CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

11-16 June 2017, Jeju, South Korea

REPORT OF THE 45TH PLENARY SESSION OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS-45
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CGMS MR 45

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PLENARY SESSION

A OPENING SESSION

Dr. Yunhwa Ko, KMA Administrator, welcomed all participants to the 45th plenary session of CGMS on Jeju Island, Republic of Korea and thanked the organising committee for the excellent arrangements in preparing and running this year's meeting.

Dr. Ko's opening address is provided in the Annex I.

B APPROVAL OF AGENDA, ACTION REVIEW

B.1 Approval of the Agenda

The CGMS Secretariat presented the objectives of the plenary session and all participants approved the agenda.

B.2 Review of actions from CGMS-44

The CGMS Secretariat provided the status of the list of actions and recommendations resulting from the previous plenary (CGMS-44) with the indication that a few actions were still open pending CGMS-45 plenary discussions.

A summary list of actions and recommendations following CGMS-45 discussions is available in the Annex. You can also access the CGMS-44 actions and recommendations resulting from CGMS-45 discussions on the CGMS website under MEETINGS and CGMS-44, and the CGMS-45 actions and recommendations on the CGMS website under MEETINGS and CGMS-45.

The CGMS Secretariat invites CGMS members to provide feedback on the actions and recommendations as necessary.

C USER REQUIREMENTS (WMO AND IOC-UNESCO)

C.1 Vision 2040 WIGOS Space: Status of space/surface visions and integration plans

CGMS-45-WMO-WP-01 presented the status of the development of the Vision 2040 WIGOS Space.

WMO regularly reviews its vision of future global observing systems to support weather, climate and related environmental applications. Currently, the "Vision for WIGOS in 2040" is under preparation, with the aim of submitting it for approval to the 18th World Meteorological Congress in 2019.

The document contains three parts: An overarching "Vision for WIGOS in 2040" providing scope, context and background for the vision, together with two annexes. Annex I: "Vision for the WIGOS space-based component in 2040", and Annex II: "Vision for the WIGOS surface-based component in 2040".

Preliminary drafts of all three components are available, and these are included in the Working Paper for information. The plan is to further develop and integrate the three elements in consultation with a broad group of stakeholders, and to present a solid draft of an integrated "Vision" document for discussion at the 7th Session of the Inter-commission Coordination Group on WIGOS (ICG-WIGOS) in early 2018.

Annex I, "Vision for the WIGOS space-based component in 2040", is being developed with substantial involvement by the satellite community and the CGMS agencies, and it has undergone further modification and editing since CGMS-44.

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	C.1	A45.01	CGMS space agencies to provide comments on draft Vision for WIGOS in 2040 (Appendix I) by 31/07/2017 (CGMS-45-WMO-WP-01)	31 Jul 2017	**OPEN**	1.1

The CGMS Secretariat recalled that three contributions had been to the earlier draft of the vision (one on behalf of CGMS, and two by individual space agencies). It would be important to discuss if more consideration to carbon missions and potential architecture needs to be given in the draft vision (cf. discussion under item G). WMO highlighted that the window of opportunity to provide major inputs to the vision would be closing in spring 2018.

C.2 Shanghai NWP Impact Workshop Key Results and expected interaction with CGMS

CGMS-45-WMO-WP-02 provided a report from the 6th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction (NWP).

The 6th WMO Workshop took place on 10-13 May 2016 at the Shanghai Meteorological Service (SMS) Headquarters, hosted jointly by the China Meteorological Administration (CMA) and SMS. Some 80 participants from 14 countries including experts on data assimilation and observation impact, experts on climate change and seasonal forecasting, representatives from space agencies and from private industry, as well as managers of observing networks attended. The meeting included 43 oral presentations distributed over three sessions, and 41 poster presentations. Each oral session had allocated time for discussions where salient points from the presentations were discussed and agreed on along with recommendations for the WMO Members, the space agencies, the NWP community and other entities for recording in the final report as necessary.

Since the 5th Impact Workshop in 2012, significant progress in the use of observational data could be noted. Among the notable findings was that in spite of the steady growth in the number of available observations, especially from satellites, there is little or no evidence of saturation of impact. Adding a new observing system or a new satellite instrument to the assimilation systems thus nearly always result in a positive impact on skill. In terms of the overall contribution to forecast skill, the top five contributing observing systems were the same as they were in 2012, namely (in no ranking order): Satellite microwave

sounders, hyperspectral infrared satellite sounders, radiosondes, aircraft observations (including ascent/descent profile data), and satellite winds (AMVs).

The report from the workshop included in this CGMS working paper contains a number of formal recommendations to WMO, the NWP community and the CGMS space agencies.

In view of the 7th NWP Impact Workshop scheduled for 2020, CGMS highlighted that the scientific question on the impact of data latency from polar-orbiting satellite data from NWP needs to be raised. CGMS recognised the increased complexity in carrying out such experiments, particularly the simulation of NRT data flows with technical issues related to observations timestamping.

The impact of reduced latency from secondary missions should also be considered in future studies, noting that SNPP, JPSS-1 and eventually JPSS-2 will fly in parallel, and it will be instructive to investigate the expected benefit of low latency of parallel data streams on NWP.

IOC/UNESCO commended the increasing recognition of scatterometers in the NWP impact experiments.

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies, IROWG, IPWG, IWWG, ICWG, ITWG	C.2	A45.02	CGMS International Science Working Groups and CGMS space agency members to formulate science questions, including the impact of data latency, in view of the 7th Impact WS 2020 (ref. CGMS-45-WMO-WP-02) and provide these to lriishojgaard@wmo.int	CGMS-46	**OPEN**	1.1.2

In view of the costs associated with near real-time data provision, ISRO suggested that all CGMS operators consider providing it.

C.3 OSCAR/Space 2.0 - CGMS contribution

In September 2016 WMO released version 2 of the space-based Observing System Capability Analysis and Review tool (OSCAR/Space v2). WMO requests CGMS Members and Observers to support its efforts to maintain and update OSCAR/Space v2. It is challenging to sustain the information at its current level due to the increasing range of satellite programmes of CGMS interest (e.g. disaster monitoring and space weather).

To facilitate the input by satellite operators and to streamline the provision of input to the WMO Space Programme, WMO has created a template for adding information on the programmes, satellites and instruments. The OSCAR/Space project team will use the information provided to update and maintain

the database in the OSCAR architecture, a task which can only be achieved with the network of experts from the space agencies.

NOAA pointed out that factual information on missions and instruments is known by the agencies and they should make an effort that this is correctly reflected in OSCAR/Space by supporting the OSCAR/Space Support Team.

The maintenance and support to OSCAR/Space is organised through two teams: (i) Support Team, and (ii) Science and Technical Advisory Team (Terms of Reference are provided in CGMS-45 WMO-WP-06).

As concerns calibration events logging, web pages have been developed by the agencies participating in GSICS. WMO will refer to these landing pages in the description of instruments in OSCAR/Space.

EUMETSAT suggested aligning the reporting templates proposed by WMO, with the one used for the CEOS MIM database, at least for those parameters that are in common, in order to facilitate the reporting task at agency level. WMO accepted the suggestion to align the templates.

Concluding the discussions, the following actions were noted:

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	C.3	A45.03	WMO to, in collaboration with CEOS, to investigate the possibility of aligning the reporting templates for OSCAR/Space with those used to update the CEOS MIM database, at least for common parameters, thus facilitating the reporting task at the agency level.	CGMS-46	**OPEN**	1.1.6
CGMS	C.3	A45.04	CGMS to invite the ISWGs to nominate experts for participation in the OSCAR/Space Science and Technical Advisory Team.	End Aug 2017	**OPEN**	1.1.6

Furthermore the following actions were proposed to be addressed in WG III:

- CGMS Members and Observers to continue providing information on their satellite programmes to be recorded in OSCAR/Space, according to the recommended procedure.
- CGMS members to nominate experts for membership in the newly established OSCAR/Space Support Team.

C.4 Weather and climate extremes workshop: Populating the physical architecture for climate monitoring from space

WMO reported in **CGMS-45-WMO-WP-05** on an initiative called "Toward an Operational Space-based Monitoring of Weather and Climate Extremes" (SWCEM). WMO suggest starting the SWCEM with a "SWCEM Demonstration Project" (SEMDP) in 2018 for a period of two years. WMO also envisages involving selected WMO Regional Climate Centres (WMO RCCs) in the SEMDP and initially to confine the project to space-based monitoring of heavy precipitation events over periods of a pentad or a week up to one month. For drought events monitoring, a period of about a month is considered.

WMO requested CGMS to comment on the proposed project and to place actions on its members, the IPWG and the joint CEOS-CGMS WG Climate to support the SEMDP implementation.

The WMO working paper also showed comparisons of precipitation estimates (means, anomalies) derived from surface-based data and satellite data as well as the definition of weather/climate extremes. The working paper noted the space-time domain addressed by the proposed demonstration project (pentad to weekly up to monthly events, with focus on heavy precipitation and drought).

To address this domain, latency is important, and the benefit of operational products from satellites needs to be assessed (and possibly that of interim CDRs as far as available).

The aim of the SEMDP is to demonstrate the use of existing satellite-derived products in quasi real-time operations for two years in the 2018-2020 timeframe.

The following actions were agreed.

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	C.4	A45.05	NOAA/NESDIS to support the Space-based Monitoring of Weather and Climate Extremes project by providing satellite observations of heavy precipitation events, and land surface parameters for monitoring droughts. The observations are required with a short latency of about one day. Furthermore the project requires the creation of climate reference data sets which will be used by the RCCs to classify observations as extreme event or not (CGMS-45-WMO-WP-05)	31-Dec-17	**OPEN**	5.1

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
JAXA	C.4	A45.06	JAXA to support the Space-based Monitoring of Weather and Climate Extremes project by providing a short-term (from 5-day up to monthly) climate normal from GSMaP data archives as a reference precipitation data set for the initial SEMDP areas, i.e. East Asia and Western Pacific regions. JAXA is also requested to set-up the on-line environment to provide GSMaP data with short latency to be utilized in the SEMDP (CGMS-45-WMO-WP-05).	31-Dec-17	**OPEN**	5.1
IPWG	C.4	A45.07	IPWG co-chairs and rapporteur to provide guidance on the estimation of uncertainties and representativeness of the short-latency precipitation products related to the Space-based Monitoring of Weather and Climate Extremes project (CGMS-45-WMO-WP-05)	CGMS-46	**OPEN**	5.1
JWG CLIM	C.4	A45.08	CEOS/CGMS Working Group on Climate to provide feedback on the proposed definition for ICDR (CGMS-45-WMO-WP-05)	CGMS-46	**OPEN**	5.1

WMO recalled its role to gather user requirements globally, and to assist its Members, in particular developing countries, through pilot projects and activities such as the NWP impact workshop. WMO therefore encourages CGMS and data providers to support such activities.

C.5 Event-driven Rapid Scanning in support of DRR, Jakarta Declaration follow-up

CGMS-45-JMA-WP-06 outlines the draft protocol for Himawari-8/9 request-based rapid scanning, an activity resulting from the WMO Joint RA II/V Workshop on WIGOS for Disaster Risk Reduction held in Jakarta in October 2015. The RA II WIGOS Project on "Developing Support for NMHSs in satellite data, products and training" is advancing this task as part of its Regional WIGOS implementation plan which was approved by the RA II Session in February 2017.

JMA will respond to requests from RA II and RA V NMHSs in collaboration with Australia's Bureau of Meteorology (BoM). Although Japan's national interests will take priority in rapid-scan observation, JMA will accept requests from NMHSs in these regions as far as possible. The primary targets for the protocol are tropical cyclones and volcanic eruptions, however, other events are also eligible. JMA, BoM and other

NMHSs in the relevant regions will coordinate and discuss details toward the protocol's activation. The protocol will publicise the risk of severe phenomena to society and demonstrate the value of rapid scanning from Himawari-8 and JMA noted that the final protocol will define an anticipation time for the implementation of a request.

JMA would also welcome feedback by NMHSs on target-area observation results versus the 10-minute full disk scans.

Furthermore, JMA will report on the protocol at the 5th RA II WIGOS meeting in October 2017, and expects to activate the protocol thereafter.

C.6 Public-Private Sector Engagement

C.6.1 WMO policy framework for public-private sector engagement

CGMS-45-WMO-WP-07 presented the status of the development of a WMO policy framework for public-private sector engagement.

The relationship between the public and the private sectors of meteorology is currently undergoing very rapid change. The impact of these changes could be far-reaching on the current institutional arrangements widely accepted by WMO Members for the collection, processing, and exchange of meteorological, hydrological, climatological and other environmental data, as well as for the generation and provision of respective information and services. While the potential exists to improve the efficacy and reach of forecasts and other services within societies around the world, the concerns these changes raise include erosion of the core observational assets usually managed by National Meteorological and Hydrological Services (NMHSs), as well as their status, funding and modes of operation. Such erosion would damage sustained long-term, national observing capabilities, and thereby harm national and global climate monitoring. There could be risks to the role of NMHSs as the national authoritative voice for watches and warnings regarding high-impact weather, as well as other core governmental purposes, all of which could have negative impacts on end-users and other stakeholders of the weather enterprise.

Recognising growing concerns among the NMHSs of the WMO Members, the WMO Executive Council has decided to initiate the development of a Policy Framework for Public-Private Sector Engagement, with the aim of submitting it to the 18th World Meteorological Congress in 2019. In the text supporting its decision, WMO EC-69 also emphasised the fundamental importance of free and open data and product exchange. The roadmap for the next two years leading up to the 18th World Meteorological Congress in 2019 and reflects the intention of the Executive Council to develop this framework further. The background and the full text of the Council decision are included in this Working Paper.

CGMS is invited to note the development of such a WMO Policy Framework and to consider the implications on a free and open international exchange of meteorological satellite observations.

ISRO pointed out that as per the ISRO data policy, its essential data is provided free to other agencies for public good and non-commercial activities only. For private public enterprise where the motive is essentially profit making, sharing of the data needs to be discussed bilaterally with ISRO on a case–by-

case basis, prior to sharing of the data. Non-essential ISRO data can be shared with partners, however, only for their internal use.

CGMS-45-WMO-WP-21 presented the status of development of a WMO position on critical satellite data.

The prospect of private-sector operators of basic satellite systems has triggered attention to the issue of data access and availability for global WMO applications. To this purpose, WMO is developing a position paper establishing the types of satellite data users consider critical for applications, and the principles that should apply to these data (lead: WMO Inter-Programme Expert Team on Satellite Utilization and Products - IPET-SUP - chaired by S. English, ECMWF).

The purpose of the position paper is to:

- Guide governments/NMHS on the terms under which to receive/purchase satellite data from private operators;
- Guide data providers on the principles to apply to satellite data critical for WMO applications;

The definition of "critical satellite data" for the purpose of the paper is:

- Any satellite data that is required to underpin the 14 WMO Application Areas where a critical demand in terms of timeliness, spatial and temporal resolution to fulfill these objectives exists.

There are seven draft principles that providers of satellite data should fulfill to meet the critical data needs of the meteorological community.

This is work in progress and complements efforts to formulate a WMO-wide position on public-private sector engagement (**CGMS-45-WMO-WP-07**).

In view of the discussions, the following actions were agreed:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	C.6.1	A45.09	WMO to report to CGMS-46 on the status of the development of WMO Policy Framework for public-private sector engagement in view of the implications for free and open international exchange of meteorological satellite observations	CGMS-46	**OPEN**	1.1
CGMS	C.6.1	A45.28	CGMS members to provide a focal point of contact to WMO (sbojinski@wmo.int) for participation in the WMO Public Private Engagement discussion	15 Oct 2017	**OPEN**	1.1

C.6.2 Experience working with the private sector

In **CGMS-45-NOAA-WP-02** NOAA reported on policy development, commercial sector engagement, the NOAA Commercial Weather Data Pilot Programme, and raised key questions for further consideration. Within the framework of the U.S. National Space Policy from 2010, NOAA created a Commercial Space Policy. It sets a broad framework for use of commercial space-based approaches by NOAA. Furthermore, it:

- Defines principles that will guide NOAA in its use of commercial capabilities, including sustaining service quality, ensuring access to global observations, and upholding national and international standards for full, open, and timely data sharing calls for periodic identification of NOAA requirements that could be met by the commercial sector, and periodic canvassing of the commercial sector for available capabilities;
- States that NOAA will apply the same validation, data integrity, and security criteria to commercial data and data products as to those obtained by other means; and
- Establishes demonstration projects to test and evaluate new potential data sources and provide an avenue to operational commercial data buys.

NESDIS implementation of the NOAA Commercial Space Policy consists of the following activities:

- Review existing observing system capabilities and assess their impacts on NOAA mission objectives, and to perform analyses of gaps in our ability to meet requirements;
- Canvass the commercial sector periodically, typically every 2 to 3 years or as indicated by changing markets or technologies, by issuing general Requests for Information (RFIs);
- Issue one or more solicitations, in accordance with the Federal Acquisition Regulation, for NOAA to acquire and evaluate on-orbit observations from commercial sources; and
- Subsequent to the identification of a promising demonstration project, NESDIS may issue one or more solicitations to purchase on-orbit observations from commercial sources, for NOAA to use these data operationally.

The Commercial Weather Data Pilot serves two purposes:

- An understanding of procedures and formulate best practices that will serve as a foundation to any future commercial data demonstration projects and operational data purchases; and
- Potentially serve as a demonstration project itself, informing decisions on procurement of certain data sets operationally.

Contracts for the Commercial Weather Data Pilot (CWDP) have been awarded to Spire and GeoOptics and round 1 of the Commercial Weather Data Pilot has been completed.

The working paper raised six key questions currently under discussion by NOAA, and invited CGMS members to provide comments as necessary.

WMO commended NOAA for identifying key questions on this topic, which are useful to consider in the discussions.

In response to a question, NOAA explained that any new formulation of the U.S. Space Policy, would be expected to preserve the notion of using international partnerships in order to ensure long-term continuity of satellite assets.

C.8 Guidance to CGMS members on ocean surface wave observations

CGMS-45-IOC-UNESCO-WP-01 (Halpern, Abdalla, Bidlot and Ichikawa) discussed contributions of ocean surface wave measurements to global surface wave forecasts and global NWP products. The working paper illustrated progress of global wave model performance of forecasts of significant wave height (SWH), and the impacts of satellite altimeter and SAR measurements of SWH. Assimilation of SWH data has longer (shorter) memory in the tropics (extra-tropics) where local wind has less (more) of an influence. This is because in the tropics, swell is an important component of surface waves whereas local wind is not. Assimilation of NRT SWH data from one altimeter in the ECMWF Wave Model reduces error in initial state by 3-4 % compared to in situ buoy data. Assimilation of NRT SWH data from two to three satellite altimeters reduces error in initial state by additional 2% and 4% respectively.

ISRO asked about the scatterometer impact on the global surface wave model, as opposed to imagers and SAR, and IOC-UNESCO responded that wind measurements recorded with a scatterometer (such as QuikSCAT) and an imager (such as SSM/I) are valuable inputs to a wave model forecast system.

CGMS agreed that IOC-UNESCO provide a working paper on geostationary satellite measurements of essential ocean variables on the occasion of CGMS-46.

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	C.8	A45.10	WMO to report on the progress regarding JCOMM and satellite observations.	CGMS-46	**OPEN**	2.5
IOC-UNESCO	C.8	A45.29	IOC-UNESCO to provide a paper on guidance to CGMS members (at CGMS-46) on geostationary satellite measurements of essential ocean variables.	CGMS-46	**OPEN**	2.5

Regarding the recommendation by IOC-UNESCO raised at CGMS-44, plenary agreed to maintain it for another year:

CGMS-44 recommendation - PLENARY						
Actionee	**AGN item**	**Rec #**	**Description**	**Deadline**	**Status**	**HLPP ref**
IOC-UNESCO, CGMS members	C.7	R44.02	**On Second International Indian Ocean Expedition (IIOE-2) for enhanced data acquisition and management:** It was recommended to establish a working alliance between the IIOE-2 and the remote sensing community (CGMS) within/through the IIOE-2 Steering Committee framework and/or the IIOE-2 Joint Project Office.	(CGMS-45) **New deadline CGMS-46**	**OPEN**	2.5

D REPORTS ON NEW DEVELOPMENTS AND PROGRAMMES BY MEMBERS SINCE CGMS-44

D.1 CMA

CGMS-45-CMA-WP-01 provided a report on the latest developments of CMA's FENGYUN satellite programme.

CMA operates FENGYUN geostationary and polar-orbiting satellite systems. The current sun-synchronous polar-orbiting FY fleet has three satellites, FY-3A/-B/-C. FY-3B/-C provide X-band and L-band digital broadcast service with VIS, IR, and microwave imagery, IR and microwave sounding data. Other functions include ozone detection and space environment monitoring. FY-3D is planned for launch in September 2017 and the X-band transmission contains full information of onboard instrument measurements. Future missions include FY-3E/-F/-G/-RM. In particular, the FY-3E (2018) is under development for an early morning orbit and FY-3RM (2020) will measure rainfalls with a Ku-/Ka-band active radar.

The current FENGYUN geostationary constellation has four FY-2 satellites in orbit: FY-2D/-E/-F/-G. FY-E (86.5°E) and FY-2G (105°E) routinely transmit S-VISSR imagery, FY-2F (112°E) performs sector scanning on request and FY-2D (123.5°E) is retired. FY-2H is now planned for launch in the 2017-2018 period.

CMA launched FY-4A on 11 December 2016, positioning it at 99.5°E for the in-orbit check-out. FY-4A is a three-axis stabilised platform carrying the Advanced Geo Radiation Imager (AGRI), the Geo Interferometric Infrared Sounder(GIIRS), the Lightning Mapping Imager(LMI), and the Space Weather Package(SEP). As the first model of the FY-4 satellite series, it transmits LRIT/HRIT format data and provides DCS. The ongoing commissioning test will be completed in the course of June 2017.

D.3 EUMETSAT

CGMS-45-EUMETSAT-WP-20 presented the status of current and future EUMETSAT satellite systems.

Regarding current satellites in orbit:

In GEO orbit, the second generation Meteosat-8 was relocated to and became operational at 41.5°E on 1 February 2017 to support, on a best effort, the multi-partner service for the continuation of the Indian Ocean Data Coverage. Meteosat-7, the last of the first generation Meteosat satellites, which previously provided the IODC service, was reorbited in April 2017.

Meteosat-9, located at 9.5°E, continues to support the Rapid Scanning Service (RSS) every five minutes. Meteosat-10 continues to be the prime Meteosat satellite for the 0° service, and Meteosat-11 remains in in-orbit storage, ready for activation, if needed.

The Metop-A (secondary) and -B satellites (primary) continue to provide the LEO services. Both Metop satellites continue to perform well, although signs of ageing are present on some instruments on Metop-A. A detailed Metop-A revised lifetime extension scenario is now in place.

EUMETSAT continues to support the Jason-3 mission with product distribution, a service that was declared fully operational in November 2016.

EUMETSAT took over the responsibility of the operation of the first Copernicus ocean observation satellite, Sentinel-3A on 13 July 2016 and the Routine Operations Readiness Review is scheduled for 3 July 2017.

Regarding future satellites:

The preparation activities for the Low Earth Orbit Metop-C satellite are continuing with a launch readiness target of 1 October 2018. The launch will be on a Soyuz from Kourou.

The second Copernicus ocean observation satellite, Sentinel-3B, is planned for launch in 2017/2018.

The development phase C/D continues for the Meteosat Third Generation (MTG) satellite system. The planned launch date for the first satellite MTG-I1, carrying the FCI imager and the Lightning Imager, is now planned for the Q3 2020. The launch of the second MTG satellite, MTG-S1, carrying the

Infrared Sounder (IRS) and the UV and near-IR Sounder (UVN), is planned for Q3 2022.

The low Earth orbit EPS-SG programme is in development phase C/D with the first launches planned as follows: Metop-SG A1 in 2021 and Metop-SG B1 in 2022.

The Member States' subscription process is ongoing for the EUMETSAT Jason-CS/Sentinel-6 optional programme, including two satellites that will ensure continuity of reference ocean altimetry after Jason-3. The launch of the first Jason-CS satellite is planned for 2020.

EUMETSAT confirmed to IMD that the Meteosat-8 IODC products will be provided in BUFR format, i.e. the same set of BUFR products generated and disseminated from the EUMETSAT 0° primary mission.

In response to CMA regarding the future of EUMETCast in the context of big data and making large volumes of data available to users, EUMETSAT explained that the EUMETCast-Satellite service will continue, giving users highly reliable access to near real-time data. EUMETSAT recently added a second transponder on the EUMETCast-Europe service and additional bandwidth for the EUMETCast-Africa service. EUMETSAT plans further bandwidth enhancements in the future to cope with the large data volumes expected to be disseminated from its future satellite missions.

EUMETSAT also explained that the location and scan pattern of the MTG Sounder spacecraft which will be co-located with the MTG Imager spacecraft around 0°. The InfraRed Sounder (IRS) will take measurements in two bands, the Long-Wave InfraRed (LWIR) and the Mid-Wave InfraRed (MWIR), with a spatial resolution of 4 km. The IRS will deliver over the full disk in the LWIR (700–1210 cm-1 or 14.3–8.3 µm) 800 spectral channels and in the MWIR (1600–2175 cm-1 or 6.25–4.6 µm) 920 channels with a basic repeat cycle of 60 min. The IRS scan pattern is a set of four Local Area Coverage (LAC) "zones", interleaved together to form a scan pattern. The IRS scanning pattern provides repeated images of the same LAC zones separated by the equivalent of twice the repeat cycle duration, in order to allow wind generation over the complete Earth solid angle. The definition of the LAC zones is made by splitting the Full Disk Coverage (FDC) area into four equal areas of coverage.

The Ultraviolet, Visible and Near-Infrared Sounding (UVN) instrument will take measurements in the ultraviolet band (UV: 305–400 nm), the visible band (VIS: 400–500 nm), and the near infrared band (NIR: 755–775 nm) with a spatial resolution of better than 10 km. Its observations are restricted to the Earth area coverage, from 30 to 65° N in latitude and 30º W to 45° E in longitude. The observation repeat cycle period will be $\leq$ 60 min.

D.4 ESA

CGMS-45-ESA-WP-01 informed CGMS on the status of the current European Space Agency Earth observation missions. Two of them, MSG and MetOp are in cooperation with EUMETSAT. ESA continues to operate the SMOS, CryoSat-2, Proba-V and the Swarm constellation, launched in 2009, 2010, 2013 and 2013 respectively. Reprocessed SMOS Level 1 and 2 data are available from the ESA Cal/Val portal; CryoSat products (Level 1b and 2) continues to be released to the scientific community; the Proba-V small satellite continues the data acquisition of the vegetation payload on-board SPOT-4 and -5.

Although numbers are steadily rising, there are currently approximately 4,000 data user projects worldwide using data from the ESA Earth observation missions and data downloaded exceeds 10 Petabytes per year. The data is available to users free of charge.

ESA further informed CGMS of the status of the future European Space Agency Earth observation missions. Two of them, MTG and EPS-SG, are in cooperation with EUMETSAT. ESA's Living Planet Programme has three lines of implementation: Earth explorer satellites, Earth watch satellites, and demonstration of services and applications. The working paper also describes the progress in the preparation of the forthcoming explorer missions ADM-Aeolus, EarthCARE, BIOMASS and FLEX.

Copernicus represents the major new initiative of European efforts in Earth observation activities. As reported at CGMS-44, a series of dedicated Copernicus satellites have been launched in the 2014-2016 period, and further Sentinels will be launched in 2017 and later. The European Union and ESA are collaborating in the development of the Sentinel missions. The Sentinel-4 and -5 instruments developed by ESA will be hosted on-board the MTG-S and Metop-SG missions respectively. These missions are developed in cooperation with EUMETSAT.

ESA also informed CGMS about the status of the Earth Watch Programme Element, Global Monitoring of Essential Climate Variables (also known as the 'ESA Climate Change Initiative' or CCI) which continues to progress well. The existing project teams have made significant progress on algorithm development and on specifying a future operational system. The Programme is currently in Phase 2 and represents a strong source of ECV data sets for the Copernicus Climate Change Services. ESA's Member States have extended the programme to continue until 2024.

EUMETSAT expressed gratitude for the continued support for ADM-AEOLUS, which will give important global wind-profile observations to the user community.

D.6 IMD

CGMS-45-IMD-WP-01 reported on the status of development activities at IMD.

At present, three INSAT satellites are in operation. Kalpana–1 is a meteorological satellite, launched in September 2002 and repositioned in 2016 at 73.2° E. INSAT-A, a multipurpose geostationary satellite was launched in April 2003 was decommissioned in September 2016. INSAT-3D is India's advanced weather satellite is located at 82° E and was launched on July 26 2013, from Kourou, French Guiana. It is a dedicated meteorological satellite and carries four payloads: Imager (six channels), sounder (19 channels), Data Relay Transponder (DRT) and satellite aided search and rescue (SAS & R). INSAT-3D has the capability of providing vertical profiles of temperature and humidity, along with several products similar to Kalpana-1 and INSAT-3A but with increased resolution. The significant improvements incorporated in INSAT-3D are:

- Imaging in Middle Infrared band to provide night time pictures of low clouds and fog;
- Imaging in two Thermal Infrared bands for estimation of Sea Surface Temperature (SST) with better accuracy;
- Higher Spatial Resolution in the Visible and Thermal Infrared bands.

INSAT-3DR similar to INSAT-3D, is an advanced meteorological satellite of India configured with an imaging System and an Atmospheric Sounder was launched on 08th September 2016 from SDSC SHAR, Sriharikota using GSLV-F05 successfully and placed at 74° East.

DRT payload of INSAT-3DR has 300 kHz bandwidth to support more numbers unattended meteorological platforms (AWS) stations network. Thus, INSAT-3DR will provide service continuity to earlier meteorological missions of ISRO and further augment the capability to provide various meteorological as well as search and rescue services.

INSAT-3DR is being used in staggered mode with INSAT-3D in order to reduce temporal resolution to 15 minutes.

SCATSAT-1, launched on 26 September 2016, is a continuity of the Oceansat-2 scatterometer mission, providing wind vector data products for weather forecasting, cyclone detection and tracking services to users. The SCATSAT-1 dataset is available at: ftp://ftp.mosdac.gov.in/

India will launch INSAT-3DS third exclusive meteorological satellite of this series by 2022 and first hyper-spectral satellite GISAT-1 by 2019.

D.7 ISRO

CGMS-45-ISRO-WP-01 presented the status of current and future planned satellites systems. INSAT-3DR and SCATSAT-1 were launched in the period in support of atmospheric and oceanic sciences. INSAT-3DR, launched in September 2016, is a continuation of INSAT-3D. ISRO also informed that in this series, INSAT-3DS will also be ready in 2018 for standby services. SCATSAT-1, a Ku-band scatterometer launched in late September 2016 is providing global ocean surface winds operationally. It is also being used for various other land and polar region applications. In the continuation of Oceansat series, Oceansat-3 is scheduled to be launched in 2018 with Ocean colour Monitor, Scatterometer and Sea Surface Temperature Monitor sensors. ISRO also has web portal MOSDAC for Meteorological and oceanographic satellite data archival and dissemination.

D.8 JMA

CGMS-45-JMA-WP-01 summarises the latest status of JMA's current and future GEO satellite systems. The latest GEO satellite, Himawari-9, was successfully launched on 2 November 2016, and after the in-orbit test and since 10 March 2017, it provides the backup service for the operational Himawari-8 satellite. In case of a Himawari-8 failure, Himawari-9 will perform the operational service and the data dissemination service via HimawariCast and HimawariCloud will resume with Himawari-9. With these twin satellites, JMA is ready to provide a robust satellite observation service to the Asia Oceania regions until 2029.

D.9 JAXA

CGMS-45-JAXA-WP-01 summarised the status of the GOSAT programme.

WMO enquired about the non-linearity corrections applied to GOSAT level-1 data that have led to improved data quality and representativeness. JAXA explained that these corrections were necessary since validation sites of GOSAT retrievals were mostly located over dark surfaces, which led to biases in the product over bright surfaces (e.g. deserts).

In view of JAXA's contributions with GOSAT to greenhouse gas observations, it was also discussed under session G on carbon observations (see further below in the report).

D.10 KMA

CGMS-45-KMA-WP-01 reported on the status of current and future KMA satellites.

The COMS (128.2°E) MI is currently operational and data are distributed via landline and satellite over the Western Pacific region and the COMS GOCI over the East Asian region. The development of the GEO-KOMPSAT-2A (meteorological mission) and -2B (ocean and environmental mission) is progressing and the satellites are now scheduled for launch in November 2018 and the latter half of 2019 respectively.

D.11 NOAA

In **CGMS-45-NOAA-WP-01,** NOAA presented its new strategic plan "NOAA's National Environmental Satellite Data, and Information Service's (NESDIS) Strategic Plan" released in September 2016, and informed CGMS on the recent status of its current and future satellite systems.

The strategic plan highlights NESDIS's vision to expand the understanding of our dynamic planet as a trusted source of environmental data. NESDIS's plan to fulfil this vision rests on three pillars: Commitments, Capabilities, and Community.

NOAA also informed CGMS on its current and future satellite programmes. Since CGMS-44, NOAA successfully launched GOES-R, now GOES-16, on 19 November 2016. GOES-16 is currently undergoing an extended calibration/validation phase and will move to the GOES East location at 75°W in November 2017. Both Jason-3 and DSCOVR became the operational missions for ocean altimetry and space weather at L1 respectively in July 2016. NOAA plans to launch the first of its next generation polar orbiting satellites, JPSS-1, in 2017 and the next generation radio occultation satellites, COSMIC-2A, in 2018.

D.12 NASA

CGMS-45-NASA-WP-01 provided the NASA report on the status of current and future Earth observation satellite systems.

NASA currently supports the operations of 20 Earth science missions. Since CGMS-44 (June 2016), NASA's Earth Science programme launched one Earth Venture Mission and two instruments to the International Space Station (ISS), and continued development of several new missions. During this timeframe, the Earth Observing – 1 (EO-1) mission completed passivation, and some instruments in extended mission operations have experienced reduced capability but continue to provide valuable data. Although all NASA operated missions listed were conceived as research missions, the efficiency of the communications and ground data handling systems has supported operational and near real-time applications. NASA continues to support the development and deployment of direct operational application Earth sensing missions with the Landsat series for the USGS and the GOES and JPSS series for NOAA.

NASA's Earth Science Program is implementing a balanced and robust plan to accomplish a broad set of critical Earth observation measurements from space for advancing Earth sensing science research. The programme advances knowledge of the integrated Earth system, the global atmosphere, oceans (including sea ice), land surfaces, ecosystems, and interactions between all elements, including the impacts of humans. A balance of satellite measurements, science research, technology development and applications is needed to address a complex global Earth system. NASA's plans include the launch of 14 missions and 8 instruments (on host missions) in the future.

D.13 ROSHYDROMET/ROSCOSMOS

CGMS-45-ROSHYDROMET-WP-01 provided a report on the status of current and future Russian satellite systems. The current missions correspond to Meteor-M N2 polar orbiting meteorological satellite (launched 8n July 2014) and Electro-L N2 geostationary meteorological satellites (launched on 11 December 2015).

The future Russian geostationary meteorological constellation will consist of three Electro-L series satellites to be positioned at 14.5°W (Electro-L N2), 76°E and 166°E. The working paper presents the corresponding mission objectives, payload and ground segment details. The working paper further provides an overview of the future satellite systems encompassing the Meteor-3M and –MP missions. Meteor-3M polar-orbiting satellite system will comprise of three meteorological and one oceanographic satellite. Meteor-MP is currently planned for launch in the 2022 timeframe.

The Arctica-M constellation of highly elliptical orbit satellites, comprising two spacecraft, will be deployed in the 2019-2021 timeframe. These satellites will provide continuous observations over the Arctic region and the working paper provides an overview of the related mission objectives, payload and ground segment details.

WMO requested if the Meteor-M N2 MTVZA-GY imaging/sounding microwave radiometer data could be ingested on the WMO GTS. ROSHYDROMET responded positively, and in view of EUMETSAT already disseminating the Level 1 brightness temperatures from this instrument on EUMETCast (these data being declared essential under the EUMETSAT-ROSHYDROMET agreement), EUMETSAT agreed to ingest the corresponding data on the GTS on behalf of ROSHYDROMET.

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUMETSAT	D.13	A45.11	EUMETSAT, on behalf of ROSHYDROMET, to ingest Meteor-M N2 level 1 brightness temperatures from MTVZA-GY on the GTS for global data exchange	Q3 2017	**OPEN**	2.6

As concerns the InfraRed Fourier Spectrometer (IRFS) on Meteor-M N2, Roshydromet explained that the data from this instrument is currently under evaluation.

E WORKING GROUPS REPORTS

E.1 Satellite Data and Products (WGII)

E.1.1 Summary of highlights and request for guidance from IWWS-13

In **CGMS-45-IWWG-WP-02,** Regis Borde, co-chair of the International Winds Working Group, presented highlights of the 13th International Winds Workshop (IWWS-13) which took place in June 2016.

IWWS-13 clearly showed that new-generation GEO satellites allow for the derivation of more AMVs, with better quality due to improved spatial resolution, and spectral channels. AMV production at high latitudes from Low Earth Orbit satellites increased substantially with the addition of VIIRS, the LEO-GEO AMV product developed at CIMSS, and the Global AVHRR AMV product produced at EUMETSAT, fill the gap of AMV observations in the 50°-70° (north and south) latitude bands. All of these winds showed a neutral to positive impact when assimilated in global NWP and regional models. The IWWG has also noted a positive NWP impact for scatterometer winds (RapidSCAT, OceanSat-2 and HY-2A). The errors in pixel-based cloud height schemes need to be understood as more AMV producers are using them. Indeed, new cloud property parameters such as the median cloud optical depth and the median cloud top pressure error have shown potential to help with the assimilation of AMVs in NWP models.

The IWWG defined a plan for the next and 3rd AMV intercomparison, based on image triplets from H-8/AHI on 21 July 2016, allowing for collocation with radiosondes and with CALIPSO and MISR. Coordination of these datasets with the ICWG is underway. Producers will carry out two sets of tests (all producers using a prescribed configuration, and each producer using their own configuration). IWWG expects the results will be available by the IWW14 in April 2018. The EUMETSAT NWCSAF funds the analysis and implements it through a visiting scientist scheme. IWWG raised the problem of funding these studies going forward, and recommended that CGMS Members consider planning a budget for funding the analysis in the future. AMV intercomparison studies based on former experiences will help define the workload requirements.

The planned launch of ADM-Aeolus in January 2018 and in view of the satellite's horizontal line-of-sight (HLOS), winds are expected to have a positive impact on NWP forecasting skills. The IWWG is also working on deriving 3D wind products from the hyperspectral AIRS and IASI instruments.

Concluding the discussions, the IWWG took the following action:

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
IWWG	E.1.1	A45.12	IWWG to prepare a proposal to CGMS on how to fund the analysis of the future AMV International Intercomparison studies.	CGMS-46	**OPEN**	3.2.1

E.1.2 Summary of highlights and request for guidance from IROWG-5

CGMS-45-IROWG-WP-02

IROWG re-iterated key points discussed in WGII and brought up from the IROWG-5 workshop held in September 2016. The declining number of RO profiles from the COSMIC/FORMOSAT-3 constellation was shown, which is several years past its design life, highlighting the urgent need for a follow-on radio occultation constellation. An important accomplishment of the COSMIC constellation was the number of profiles reaching close to the surface, an outcome of improved instrument technology developed since previous RO demonstration missions. Surface observations are particularly important for observing tropospheric water vapour. Statistics were presented that more than 90% of COSMIC profiles penetrated to within 1 km of the surface. At least maintaining such performance is important for follow-on constellations, and further improvements are expected from the COSMIC-2/FORMOSAT-7 follow-on constellation currently planned for launch in 2018. Unfortunately, the only secured launch of COSMIC-2 is an equatorial constellation of six satellites. IROWG showed that very few COSMIC-2 profiles will be available beyond 40° latitude. Though RO profiles at higher latitudes are expected from MetOp and FengYun, this is far short of the 20,000 globally distributed profiles now recommended by IROWG for numerical weather prediction, backed up by EUMETSAT-funded impact studies. In addition, local time coverage from MetOp and FengYun are limited compared to what is achieved by the current and planned COSMIC/FORMOSAT constellations. IROWG showed a figure from the EUMETSAT-funded study of the positive benefit of the COSMIC-2/FORMOSAT-7 polar constellation, regarding temperature in the northern hemisphere extra-tropics. IROWG concluded their presentation by summarising these key points:

1) The importance of ensuring measurement continuity and maximising the number of high quality RO observations that can be freely exchanged;

2) A COSMIC-2/FORMOSAT-7 polar constellation, or a mission with the same high quality, is needed to maintain the impact of RO; and

3) While IROWG strongly supports the aims of the NOAA commercial data pilot study to explore alternative sources of RO profiles, it is crucial to determine the actual capabilities of the various options and not interrupt the availability of high quality, freely available data.

A final point was made that, as the number of Global Navigation Satellite Systems (GNSS) continues to increase, and instruments are being designed to take advantage of these signals, IROWG recommended that CGMS should encourage GNSS providers and agencies to distribute ICDs (Interface Control Documents) of these new signals as soon as practical.

CGMS-44 recommendation – PLENARY						
Actionee	**AGN item**	**Rec #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS agencies	E.1.2	R45.01	CGMS members to encourage GNSS providers and agencies to make ICDs (Interface Control Documents) of GLONASS and Beidou Open Service signals available as soon as possible	N/A	**OPEN**	1.1.4

E.1.3 Summary of highlights and request for guidance from IPWG-8

CGMS-45-IPWG-WP-02 presented highlights of the 8th meeting of the International Precipitation Working Group, which was held as a joint meeting with the 5th International Workshop on Space-based Snowfall Measurement (IWSSM-5) at the Consiglio Nazionale dell Ricerche (CNR) congress facility of the Institute of Atmospheric Sciences and Climate (ISAC) in Bologna, Italy on 3-7 October 2016. This was the first joint meeting between IPWG and IWSSM.

There were about 160 participants from 23 countries. Satellite training courses were also given by the IPWG members and more than 30 students took the courses. There were 5 working group (WG) sessions as in past meetings, developing internal and CGMS level actions and recommendations. The WGs include validation, research, application, data assimilation, and snow scattering WGs.

Two new co-chairs were selected; Ziad Haddad (NASA/Jet Propulsion Laboratory, USA) and Dong-Bin Shin (Yonsei University, Korea). A special issue in the Quarterly Journal of the Royal Meteorological Society has been organised by outgoing co-chair, Remy Roca and former co-chair, Chris Kidd.

Two major issues were raised by IPWG-8 for CGMS's consideration. The first one is to ensure the continuity of the current constellation of passive microwave sensors (for high quality satellite precipitation products for weather, climate and hydrological applications) through proper coordination of satellites, sensors and equatorial crossing times. The second one is that timely (< 1 hr) and free access to all geostationary visible, IR and water vapour data is required to improve global hydrological prediction.

IPWG also asked WMO to establish regular training events (likely via VLAB) on precipitation data sets and applications, for which IPWG will provide disciplinary expertise. The IPWG also recommends that CGMS members continue to pursue advanced sensors through close coordination with CGMS ISWG's including IPWG, ITWG and ICWG.

The next meetings of the IPWG and IWSSM will be held jointly in Seoul, Republic of Korea, hosted by KMA NMSC and Yonsei University during the week of 22 October 2018.

CGMS-44 recommendation - PLENARY						
Actionee	**AGN item**	**Rec #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	E.1.3	R45.02	Recognising that IPWG has considerable expertise in precipitation science and applications, IPWG requests the WMO (likely via VLAB) to establish regular training events on precipitation data sets and applications, for which IPWG will provide disciplinary expertise.	N/A	**OPEN**	3.5.3
CGMS members + IPWG, ITWG and ICWG	E.1.3	R45.03	Recognising the need for continued enhancements to the baseline precipitation observing system to a broader user community (including hydrology, NWP prediction, RTM modeling), IPWG recommends that CGMS members continue to pursue advanced sensors through close coordination with CGMS ISWG's including IPWG, ITWG and ICWG.	N/A	**OPEN**	

E.1.4 Report from Working Group II

The CGMS Working Group II on satellite data and products, met on 12-13 June 2017. The WG II Co-chair Dohyeong Kim, KMA, provided the following highlights from the deliberations (also contained in **CGMS-45-CGMS-WP-14**):

- On GSICS: GSICS is now in its operational phase and continues the development of operational tools and products. Specifically it should be noted that GSICS has now achieved a level of maturity where it will be in a position to provide to CGMS annual assessments of the performance of the CGMS space-based instrumentation, including event logging.

- On climate: SCOPE-CM Phase 2 is progressing well with nine successful ongoing projects including product maturity assessments with preparations for Phase 2+. Furthermore, the advancement of satellite data for climate applications and the response to the GCOS Implementation Plan is efficiently handled and coordinated by the CGMS/CEOS Joint Working Group on Climate.

- On Non-Meteorological Applications (NMA): The NMA related activities will now focus on three potential projects, namely aerosol/dust, fire and flood mapping.

- On International Science Working Groups: Three groups held workshops in the period since CGMS-44 and reported further progress in the exploitation of the space-based system. A specific highlight is that today Atmospheric Motion Vectors are one of the five highest contributors to the positive impact on NWP for space-based instruments. This would not have been possible without the IWWG. Similar successes were reported from other ISWGs, e.g. the NRT access to microwave sounder data from Meteor-M N2 was agreed during CGMS-45.

- On best practices: CGMS WGII plays a key role in harmonising best practices for product generation and validation, and the provision of meta-data ensuring that highest possible quality of the satellite data.

- On carbon monitoring: The Joint WGII/WGIII session on carbon monitoring confirmed the participation of CGMS to the CEOS AC-VC white paper writing team activities, particularly highlighting the benefits that CGMS can bring to the discussion on mission coordination, data access and distribution, formats and meta data as well as training and outreach.

The full report and list of participants of WGII is provided in Annex IV.

E.2 Global issues on satellite systems and telecommunication coordination - report WGI

The CGMS Working Group I (WGI) on global issues on satellite systems and telecommunications coordination, met on 12 June 2017. The WG I Chair Vanessa Griffin, NOAA, provided the following highlights from the deliberations (also contained in **CGMS-45-CGMS-WP-05**):

- The progress achieved by the different members on the preparation of WRC-19. CGMS-45 plenary concurred that protection of passive sensing bands from adjacent bands under various WRC-19 agenda items related to IMT 2020 (5G) is of paramount importance to CGMS. Consequently, it was decided that, on behalf of CGMS, the CGMS Secretariat will send the letter drafted by WGI (WGI A45.01) emphasising the need for protecting EESS and passive bands necessary for remote sensing to the ITU Secretary-General. WMO also agreed to take similar steps and informing the different members of WMO on the need of emphasising the importance of protecting the passive sensing bands.

- Similarly, CGMS-45 plenary agreed on the proposal by WGI to progress on the frequency protection aspects of Space Weather and expects regular reporting on the progress achieved under this topic.

- CGMS-45 plenary recognised the outcome of the SATCOM Forum as a significant achievement in the support to IDCS and confirmed the proposal of WGI of capitalising on the work done around the future meetings of SATCOM Forum.

- CGMS-45 confirmed the relevance and interest of pursuing a set of best practices for the representation of satellite imagery data in netCDF. CGMS shall seek to reflect the outcome of these best practices in the future evolution of the Climate and Forecast convention.

- CGMS-45 endorsed the updates proposed for the CGMS agency best practices in support to local and regional processing of LEO direct broadcast data, noting with appreciation the work done so far in the consolidation of these best practices. It also confirmed the need for the different members to report on the status of implementation of the endorsed best practices (if relevant to them).

The CGMS-45 plenary recognised, with appreciation, the increasing importance of the Space Frequency Coordination Group (SFCG) liaison in support of technical frequency management aspects for CGMS. It also noted the work done by SATCOM Forum in supporting DCS technical systems and WMO DBNet user group in the aspects related to Direct Broadcast from LEO satellites.

The CGMS-45 plenary endorsed the actions and recommendations proposed by WG I.

The WG I Chair proposed a recommendation from WGI and WGIV to plenary to establish a small task team to examine the current Terms of Reference in light of the thematic areas covered by both working groups. The team should propose additional operational topics as well as possible alternatives for realignment of the themes. Plenary agreed that this could be undertaken.

Concluding the discussions, the following actions were noted:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMSSEC	E.2	A45.13	On behalf of CGMS, CGMS SEC to send a letter to ITU Secretary-General. Letter drafted by WGI (AWGI45.01) emphasising the need for protecting EESS and passive bands necessary for remote sensing. It also agreed in tasking WMO to take similar steps and informing the different members of WMO on the need of emphasasing the importance of protecting the passive sensing bands (as per WGI discussions, CGMS-45-CGMS-WP-05)	Jun/Jul 2017	**OPEN**	1.3.1
WMO	E.2	A45.14	WMO to send a letter to ITU Secretary-General based on the CGMSSEC letter (drafted by WGI (AWGI45.01) emphasising the need for protecting EESS	mid July 2017	**OPEN**	1.3.1

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
			and passive bands necessary for remote sensing. It also agreed in tasking WMO to take similar steps and informing the different members of WMO on the need of emphasising the importance of protecting the passive sensing bands (as per WGI discussions, CGMS-45-CGMS-WP-05))			
WGI/WGIV (CGMS members)	E.2	A45.15	• WGI/WGIV to establish a small task team to examine the current Terms of Reference in light of the thematic areas covered by both working groups to address overlap and to consider adding relevant topics related to satellite and ground system operational topics not currently covered in either of the two working groups and to report to CGMS-46 • The team should propose additional operational topics as well as possible alternatives for realignment of the themes for both working groups to include the possible merger of the two working groups (including the topics discussed in the Space Weather Task Team) (Ref. CGMS-45-CGMS-WP-05)	CGMS-46	**OPEN**	

The full report and list of participants of WGI is provided in Annex IV.

E.3 Global data dissemination - report WGIV

The CGMS Working Group IV (WGIV) on global data dissemination, convened on 12-13 June 2017. The WG IV Co-chair Hiroshi Kunimatsu, JMA, provided the following highlights from the deliberations (also contained in **CGMS-45-CGMS-WP-06**):

WG IV highlighted two key issues:

- The IODC dissemination plan; and
- Global data exchange of next generation GEO satellites.

Regarding the first key issue, the data providers have agreed on a set of essential data for the IODC region. What remains is the ongoing task of implementing the dissemination of the identified data sets on EUMETCast and CMACast, making use of already existing interfaces between the agencies. The data providers expect to be able to conclude this activity in the course of 2018.

As concerns the second key issue, there are few high volume GEO satellites active currently (Himawari-8 and GOES-16), and the related data exchange between CGMS agencies (point to point using download services) works well considering that only reduced data volumes are exchanged. However, with increasing data volumes and increasing number of users, prioritisation of users might become important for download services.

NOAA highlighted that current CGMS users of the NOAA DDS not yet re-validated for access to the new PDA system, need to complete the data access form and send it to NESDIS.Data.Access@noaa.gov. The DDS is expected to be turned off around September, 2017.

The Co-chair also presented a brief summary of the working papers and discussions held in WGIV. This covered the status of DVB dissemination systems, the use of R&D and preoperational data, a WMO user survey on ocean satellite data needs, ongoing activities by the CGMS task force on metadata (TMFI), activities on general data access and exchange between agencies, and user readiness preparations.

The Space Weather Task Team Co-chair had also addressed the primary space weather needs relevant to WGIV, in particular the data format and near real-time data access information required for space weather data and a few WGIV actions were allocated to this purpose.

IOC-UNESCO commented after the report, that the survey for ocean satellite data needs, presented by WMO is a good starting point for further discussions.

The full report and list of participants of WGIV is provided in Annex IV.

E.4 Operational Continuity and Contingency Planning - report WGIII

The CGMS Working Group III (WGIII) on operational continuity and contingency planning, met on 13 June 2017. The WG III Co-chair Ajay Mehta, NOAA, presented the outcome of the WG III discussions (also contained in **CGMS-45-CGMS-WP-07**):

During the review of the status of implementation of satellite observing system against the CGMS baseline, WGIII noted that a more detailed risk assessment and gap analysis would be required since a few years had elapsed since the current version was prepared. WMO agreed to coordinate this task and to present its analysis to WGIII at CGMS-46.

Furthermore, the current Contingency Plan dated from 2007, predates the CGMS Baseline from 2011 with respect to the defined contingencies. Consequently, WGIII agreed to establish a Task Team to provide an update of this document. The Task Team would primarily work on the Plan as part of the WG III intersessional work. However, given the amount of time elapsed since the last update of the Plan, WMO offered to organise an ad hoc face-to-face meeting of the Task Team to restart the effort.

Concerning the CGMS Baseline itself, WGIII noted that it had been developed in response to the previous WMO "Vision" statement in 2007. Given the planned submission of a new "Vision for WIGOS in 2040" to WMO Congress in 2019, WG III decided to initiate the development of a revised CGMS Baseline with the aim of having it approved at CGMS-47 in 2019.

Following the discussion, plenary raised two actions for WG III:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	E.4	A45.16	CGMS members to nominate contributors to participate in the intersessional meetings on the CGMS contingency planning including the WMO face-to-face meeting (ref WGIII discussions, CGMS-45-CGMS-WP-07)	Jul-17	**OPEN**	1.1.7
WMO	E.4	A45.17	WMO to call for and hold a face-to face intersessional meeting on the CGMS contingency planning in the first half of 2018 (ref WGIII discussions, CGMS-45-CGMS-WP-07)	Q1 2018	**OPEN**	1.1.7

The full report and list of participants of WGIII is provided in Annex IV.

E.5 Space Weather Task Team - report SWTT

CGMS-45-CGMS-WP-08 provided a high-level status report and request for guidance from the CGMS Space Weather Task Team.

The presentation first provided a review of the SWTT's objective, to identify the methodology by which space weather can be implemented within the existing construct of CGMS in order to support the continuity and integration of space based observing capabilities for operational space weather products and services. Elsayed Talaat (NASA) and Tsutomu Nagatsuma (NICT) were unanimously nominated as new Co-Chairs of the SWTT. CGMS members and partner organisations provided updates on current and planned dedicated space weather satellite missions and on their general space weather activities and plans.

A report was provided on behalf of the Space Weather Expert Group chartered within UNCOPUOS. The current focus of the Expert Group is to prepare recommendations for the UNISPACE + 50 Initiative for an international framework for space weather services, specifically to develop a space weather roadmap for coordination and information exchange on space weather events and mitigation. It was noted that in its initial framework discussions, UNCOPUOS has recognised CGMS's role amongst the international organisations engaged in space weather activities.

WMO gave an update on its space weather activities and proposed actions for SWTT to draft a space-based observation baseline, to maintain continuity of solar measurements, solar wind and interplanetary magnetic field measurements, and heliospheric imaging, under the auspices of the WMO expert team, IPT-SWeISS. An overview was presented on CGMS observing system baseline, gap analysis and contingency planning. A discussion followed on the status and process of incorporating space weather into CGMS planning.

A discussion was also held on the status of spacecraft anomaly reporting by CGMS members and the ultimate use of this reporting. Concern was expressed by CGMS member agencies as to the consistency of analysis and level of effort required to determine if the anomaly is due to a space weather event. From the discussion, it was apparent there is still a need to better define when a spacecraft anomaly is the result from a space weather event. WMO mentioned that the IPT-SWeISS group could be a possible group that would gather and analyse these CGMS anomaly reports.

From the reported activities in this SWTT meeting that it is clear that CGMS's unique role in space weather has been successfully socialised amongst space weather international organisations and its potential role has been recognised. Discussions in the SWTT with the Working Group leads have established paths forward on many of the space weather related HLPP items and these were then presented and discussed in the Working Group meetings with the SWTT Co-Chairs.

The SWTT recommends continuing the SWTT until CGMS-46. SWTT also finds that CGMS must have an interface with the space weather community to promote space weather activities within CGMS. The status of intersessional SWTT efforts will provide a basis of recommendation as to future structure of the interface between CGMS and the space weather community going forward.

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	E.5	A45.18	WMO to send an invitation for the IPT-SWeISS to the CGMS Secretariat to secure participation by CGMS at the meeting.	Jul-17	**OPEN**	5.2.1

The full report and list of participants of the SWTT is provided in Annex IV.

F GEO AND CGMS

F.1 GEO and CGMS

CGMS-45-GEO-WP-01 presented the progress on building a GEOSS since the GEO-XIII Plenary meeting held in St. Petersburg, 9-10 November 2016. Several important decisions were made, in particular on the GEO Engagement Strategy and Priorities and the GEO Work Programme 2017-2019, for which CGMS members should consider active contributions.

The GEO-XIII Plenary approved the Engagement Priorities for the period 2017-2019:

1) 2030 Agenda for Sustainable Development;
2) Climate Change – Greenhouse Gas Monitoring;
3) Disaster Risk Reduction;
4) Resilient cities and human settlements;
5) Ecosystem accounting.

In particular, the Plenary agreed that the initial focus should be on priorities 1-3 and suggested that priorities 4-5 need more time to mature. The GEO Secretariat will prepare a detailed engagement implementation plan for the period 2017-2019 accordingly. In addition to the GEO Work Programme 2017-2019, the GEO-XIII Plenary approved 31 Community Activities, 22 Initiatives, 4 Flagships, and 10 Foundational Tasks.

The GEO Work Programme is updated annually, and is proposed by the GEO Secretariat based on input from GEO Members, participating organizations, and the greater GEO community. The Work Programme is further refined and developed in consultation with the GEO Programme Board.

The following action was agreed:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	F.1	A45.23	CGMS members to consider ideas on further contributions to the 3 GEO Engagement Priorities (SDGs, Paris Agreement, Sendai Framework of Actions) and potential interests of participation to Flagships, Initiatives and Foundational Tasks in the GEO Work Programme 2017-2019 (Areas in need of strengthening: CEOS-CGMS Joint Working Group on Climate; Non-meteorological Applications for Next Generation Geostationary Satellites (CEOS-CGMS); GEONETCast; Radio-Frequency Protection Education and Training (VLab); User Requirement (Member's studies); Carbon Observations (CEOS-CGMS))	15-Sep-17	**OPEN**	

G CARBON OBSERVATIONS

G.1 Introduction – Status and progress overview since CGMS-44 and issues at stake

In **CGMS-45-EUMETSAT-WP-21, t**he CGMS Secretariat introduced the session and presented an overview of the status and progress since CGMS-44 as well as issues at stake. The working paper recalled various reports relevant to the current discussions, in particular the reports by the National Research Council (Verifying Greenhouse Gas Emissions, 2010), GEO (GEO Carbon Strategy, 2010), CEOS (CEOS Strategy for Carbon Observations from Space, 2014) and the European Commission (Towards a European Operational Observing System to Monitor Fossil CO2 Emissions, 2015). It furthermore noted the Climate Agreement achieved at COP-21 in December 2015. It is therefore natural that the operational space agencies represented at CGMS are considering how CGMS can contribute to the space-based component of an overall carbon monitoring system. This has already been reflected in the outcome of CGMS-44 and the associated Actions (A44.13 and A44.14). The presentation furthermore highlighted the need for coordinated observations and noted that as an outcome from CGMS-44, the issues on a space agency response to the need for monitoring carbon emissions have also been discussed with CEOS. The way forward agreed with CEOS is that the CEOS Atmospheric Composition Virtual Constellation (AC-VC) will write a white paper on the overall constellation and has invited CGMS to propose participation of relevant expertise to the writing team and to identify the specific contributions CGMS can provide to such a system.

The purpose of this plenary session was to take stock of the current ongoing activities for monitoring greenhouse gases (GHG) and carbon from space and to confirm the participation and the CGMS potential contribution to the space-based component of a carbon emission monitoring system.

G.2 CGMS agency status on carbon programmes

G.2.1 CMA: Preliminary results of TanSat-1

CGMS-45-CMA-WP-02 introduced TanSat-1, the first Chinese carbon-dioxide satellite, launched on 22 December 2016. TANSAT-1 is a Chinese joint R&D mission initiated by MOST and supported by CMA and CAS. Its primary mission is to provide global atmosphere column averaged XCO2. Since January 2017 data acquisition the in-orbit post-launch activities are now ongoing. Mission data has been acquired since January 2017 with encouraging preliminary results. The commissioning phase is expected to end in August 2017, to be followed by operations in September 2018 conducted by CMA. All data are provided freely to the public over internet and a dedicated web-portal. For the future additional carbon monitoring instruments are planned to fly on FY-3D, and a grating spectrometer based instrument is under development for 2020.

G.2.2 JAXA: GOSAT programme status and plans

CGMS-45-JAXA-WP-02 presented the status of the JAXA GOSAT Programme.

(The presentation was provided earlier during Plenary due to the availability of the presenter).

GOSAT was launched on 23 January 2009. Its main mission is to observe atmospheric chemistry and specifically carbon, using a high spectral resolution FTS with a two-linear polarisation. The observations provide precise and accurate XCO2 and XCH4 measurements reducing uncertainty in the global flux. International collaboration on calibration, validation, and retrieval algorithm, in particular with the NASA OCO-2 mission, has demonstrated the effectiveness of the GHG monitoring from space. Simultaneous measurement of short-lived species such as NO2 and CO, and imaging capability, wind speed information will improve anthropogenic GHG emission estimation.

WMO enquired about the importance of the non-linearity corrections applied to GOSAT level-1 data that have led to improved data quality and representativeness. JAXA explained that these corrections were necessary since GOSAT used solar-reflected light for column CO_2 and CH_4 retrievals and the dynamic range of its spectral radiance is very wide from dark ocean surfaces to bright desert, which led to biases in the product.

JAXA is now planning the launch of the follow-on mission, GOSAT-2, in FY-2018.

G.3 WMO Integrated Global GHG Information System (I3GIS)

CGMS-45-WMO-WP-20 presented the concept and requirements from the WMO Integrated Global Greenhouse Gas Information System (IG3IS).

In December 2015, the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Paris Agreement. This is a new legal agreement for the post-2020 climate regime under the UNFCCC that addresses mitigation, adaptation and minimising loss and damage. To assist the countries in meeting their commitments under UNFCCC the World Meteorological Organization (WMO) and its partners have initiated the development of an Integrated Global Greenhouse Gas Information System (IG3IS).

The goal of I3GIS is to support the follow-on activities of COP21, specifically supporting National Inventory Preparation, City-scale Mitigation Efforts and detection and quantification of Anthropogenic Methane Emissions. The IG3IS will serve as an international coordinating mechanism to establish and propagate consistent methods and standards to help assess emission reduction actions.

The presentation specifically notes that the CGMS community can contribute through:

- Greenhouse gas monitoring using satellite remote sensing:
  - Global coverage (many regions are not covered by the surface network);
  - Improved spatial resolution (imaging @ few km^2 to quantify large local sources) with high accuracy needed (< 1ppm) for XCO2;

  - Transitioning from scientific to operational missions.

- Improvement of atmospheric transport models:
  - Models are a critical component translating mixing ratios to fluxes;
  - Accuracy of models will soon become the performance limiting factor;
  - Calls for closer collaboration between the carbon cycle and meteorological communities.

More details are provided here:

- IG3IS concept paper: http://www.wmo.int/pages/prog/arep/gaw/ghg/documents/EC_68_ConceptPaper_IG3IS_DRAFT_V14. pdf
- Draft IG3IS implementation plan (V6): http://www.wmo.int/pages/prog/arep/gaw/documents/DraftIG3IS_Implemenation_Plan_Annotated_Out line_V6.pdf

G.4 Carbon observation plans of the European Union (EU)

CGMS-45-EC-WP-01 presented the European Union (EU) carbon observations plans.

The European Union has an ambitious plan for monitoring carbon in the future, including the launch of a first possible European carbon mission delivering column CO_2 by 2025 and the deployment of an end-to-end operational system to monitor fossil CO_2 emissions around 2030. To achieve that the European Commission has put in place a Task Team with two specific objectives: i) To develop the mission requirements for a carbon mission and ii) The development of an overall architecture for carbon emission monitoring looking at all necessary components including observations (space-based, in situ/ground-based), modelling, inventories). A specific priority for the European Commission Task Team Chair is to lay the foundation for an international GHG monitoring system.

Specifically, in 2018, efforts will be made to advance this effort through the following three activities:

- Facilitate the completion of the AC-VC whitepaper on defining an optimum constellation for GHG monitoring. This includes the joint competences of CEOS and CGMS, and in the general framework of the CEOS Carbon Strategy. Support follow-on activities.

- Place the space segment in the broader context of a fully sustained system for CO_2 emission monitoring bringing together different stakeholders covering also inventories, modelling and ground/in situ observations to define best practices and synergies.

- Advance the relationship with CGMS for an operationally implemented and sustained observation capability. Consider establishing a formal working relationship between CEOS and CGMS in line with the successful ongoing relationship on systematic observations of ECVs in support of UNFCCC.

G.5 Report on the status of the CEOS AC-VC CO2 white paper

CGMS-45-CEOS-WP-02 provided the status of the CEOS AC-VC CO2 white paper preparations.

The mandate for the satellite carbon report undertaken by the CEOS AC-VC includes:

- Based on existing requirements, define the key characteristics of a global architecture for carbon (CO2, CH4) measurements from space;
- Consider observational needs for both composition and fluxes, natural and anthropogenic;
- Include known plans and considerations from space agencies worldwide in overall system architecture to ensure global consistency of design;
- Incorporate potential observations from both GEO and LEO potential missions in an optimal system, and consider optimal acquisition strategies across the system including orbits, equator crossing times, sensor characteristics etc.;
- Include instrument on-orbit calibration and geophysical validation aspects;
- Build on work already undertaken by the AC-VC in response to the CEOS Carbon Strategy; and
- Provide a reference architecture against which individual agencies can develop their plans to optimise joint implementation.

A future GHG constellation that could achieve the required coverage, resolution and precision, could incorporate:

- For complete coverage of the globe on weekly intervals, a constellation of (three or more) satellites in LEO with:
  - A broad (~200) km swath with a mean footprint size <4 km^2.
  - A single sounding random error near 0.5 ppm, and vanishing small regional scale bias (<0.1 ppm) over >80% of the sunlit hemisphere.
  - One (or more) satellites carrying ancillary sensors (CO, NO2, CO2 and/or CH4 Lidar).
- A constellation with 3 (or more) GEO satellites:
  - Monitor diurnally varying processes (e.g. rush hours, diurnal variations in the biosphere).
  - Stationed over Europe/Africa, North/South America, and East Asia.
  - One or more HEO satellites to monitor carbon cycle changes in the high Arctic.

A first draft of the report is foreseen for August 2017 to be discussed at the upcoming CEOS SIT in September 2017. A completed paper for final editing is planned for January 2018.

CGMS has been invited to contribute to the writing of this paper, bringing in the specific expertise that CGMS has to offer.

G.6 Outcome of CGMS WGII/WGIII discussions on carbon observations

CGMS-45-CGMS-WP-09 presented the outcome of the joint WG II/III session on carbon.

The joint CGMS Working Group II and III session on carbon considered the purpose of the specific carbon sessions at CGMS-45, specifically those introduced in plenary session G. The joint session further considered in detail the CEOS AC-VS activities and finally discussed the role of meteorological satellites for monitoring carbon. In conclusion, the session noted:

Regarding the CGMS/CEOS AC-VC White Paper Writing Team:

- The proposed CGMS participants to the writing team were confirmed by the session, for endorsement by Plenary:
  - CMA: Dr. Zhang Xingying, EUMETSAT: Dr. Rosemary Munro, NOAA: Dr. Chris Barnet, ROSHYDROMET: Dr. Alexey Rublev, WMO: Dr Oksana Tarasova and Dr. Stephan Bojinski
- The access to OSSEs and CTT modelling teams will be available to the writing team, to help optimise the sampling strategy and proposed constellation.
- An additional chapter on user uptake, training, outreach to be added to the White Paper for which CGMS expertise is considered important.

Regarding anticipated CGMS contributions to develop the space-based component of a carbon monitoring system, the joint WGII/III felt that the strongest contributions by CGMS will be:

- Orbit/mission coordination of carbon monitoring satellites
- Enhance capabilities of meteorological satellites
- Data distribution, exchange and formats
- Training/outreach

In addition, the joint WGII/III session proposed a new item for the HLPP:

“Provide a coordinated contribution to a future satellite-based carbon constellation and to related activities on mission coordination, data distribution, exchange, formatting, and on training and outreach.“

G.7 Discussions and overall conclusions of the session

In addition to the presentations given, NASA noted that there is a lot of research published based on data from OCO-2. Whilst funding issues are today still uncertain, NASA is still working towards launching OCO-3 on the International Space Station. Furthermore, GeoCARB, a geostationary carbon cycle observatory mission, is now under development. Finally, NASA noted that in order to complete the picture, surface observations are also crucial, and in this respect NASA is planning to launch the Global Ecosystem Dynamics Investigation Lidar (GEDI on ISS) in 2019.

During the discussion, the commitment by CGMS to support the development and operation of a space-based carbon monitoring system was re-emphasised. Plenary confirmed the CGMS contribution to the CEOS AC-VC writing team and the specific contribution CGMS can provide to a future space-based carbon monitoring system. It also noted the potential contribution that the current operational meteorological missions can provide. In addition, it was emphasised that no system can work in isolation and it is important to incorporate ground-based/in situ measurements as well. Regarding the proposed item for the HLPP, Plenary noted that in view of the current horizon of the HLPP the target at this stage should be on planning and, hence, endorsed the following HLPP item:

- "Provide a coordinated contribution to the planning of a future satellite-based carbon constellation and to related activities on mission coordination, data distribution, exchange, formatting, and on training and outreach."

Plenary further discussed the way forward to respond to CGMS-44 A44.13 on the provision of input to the WIGOS Vision 2040. As the WIGOS Vision 2040 will be finalised by the end of 2017, it is critical to provide timely inputs to that vision. To reflect this, the following HLPP item was agreed:

- "Deliver to WMO, for inclusion in WIGOS Vision 2040, a proposal for a target architecture for GHG and carbon monitoring from space."

Concluding the discussions, the below action was agreed:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	G	A45.19	CGMS to deliver proposal to WMO for inclusion in Vision 2040 for a target architecture to monitor GHG and carbon from space. (Ref. CGMS-45 plenary session G)	Oct-17	**OPEN**	5.4.2

H CLIMATE

H.1 GCOS Implementation Plan

The session started with an introductory remark by Fernando Belda (WMO Director of Observations Department) reminding CGMS Plenary on the importance of climate monitoring. WMO stated that GCOS is the climate component of GEOSS and that the new GCOS Implementation Plan (GCOS-IP) contains requirements and recommendations relevant to the COP-21 Paris Agreement and UNFCCC goals in general.

Thereafter, the GCOS AOPC Chair (Kenneth Holmlund) presented **CGMS-45-WMO-WP-04,** the 2016 GCOS Implementation Plan, on behalf of the GCOS Secretariat (Caroline Richter). He focussed on the new

elements and ECVs, the work of the GCOS observation panels and the development of a set of climate indicators to improve the communication on climate change facts.

The Global Climate Observing System (GCOS) includes surface-based, air-borne, and space-based components and constitutes, in aggregate, the climate observing component of the Global Earth Observation System of Systems (GEOSS). GCOS is a joint initiative of the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the United Nations Environment Programme (UNEP) and the International Council for Science (ICSU). These four organisations agreed to cooperate in organising and supporting GCOS based on the coordination of existing and planned operational and research observing programmes in support of all aspects of the World Climate Programme, the IPCC and the UNFCCC and relevant aspects of other climate-related global programmes.

In October 2016, the GCOS Secretariat published a new GCOS implementation Plan. It provides background in terms of requirements and recommendations for a functional and robust Global Climate Observing System. Global climate monitoring, including water and greenhouse gas fluxes, supports and serves the programmes of WMO and its Member States, especially with a view towards the United Nations Sustainable Development Goals (SDGs) and implementation of the Paris Agreement. While observations are the focus of National Meteorological and Hydrological Services (NMHSs), aspects of climate-related policy are covered by many different government departments. All these entities will benefit from the information on implementation needs described in the plan, provided by GCOS.

The final edited English version of “The Global Observing System for Climate: Implementation Needs” (GCOS-200) is available from the WMO Library (the Executive Summary and the list of actions are also available in French from gcos.wmo.int).

IOC-UNESCO commented that the presentation and the GCOS IP may have a too optimistic view in looking into some changes of the climate system. For instance, when considering the non-uniformity of global sea level change might be misleading when only a few isolated observations are available around 1870. Satellite measurements of sea level only started recently, which certainly limits the understanding of sea level change.

IOC-UNESCO also commented on the fact that sea surface temperature may not be a good indicator for ocean warming where rather the whole temperature profile to the bottom of the ocean would be needed. As sub-surface ocean temperature is not accessible by satellite measurements, statements on ocean warming are a matter of integration of different data sources including in situ data.

IOC-UNESCO suggests to GCOS to consider such points in the next update of the GCOS IP. GCOS acknowledged the importance of in situ measurements and that GCOS is also considering energy cycles where sea surface temperature is not the only important variable.

WMO seconded GCOS by stating that the indicators also contain ocean heat content and other variables. However, WMO suggested expanding the discussion on forward looking indicators that would need results from modelling.

The Chair added that the type of observing system does not matter much for the question of what is relevant for the public in terms of climate change information. The Chair suggested to GCOS to seek more active coordination with the IPCC to explore what are meaningful and robust indicators that do not easily become subject for attack from climate change sceptics.

On the indicators for extremes, the JWG Climate made the suggestion to also consider storms as an indicator because information on changes in sub-tropical and tropical storms significantly impact society. In addition, changes in the cryosphere particularly in the Arctic may impact storm tracks over the North Atlantic which has high relevance for European societies. Information on storms is also accessible from satellite data, which would allow a contribution by CGMS to this topic.

WMO stated that the GCOS paper also contains the specific recommendation that CGMS member agencies should consider the actions contained in the GCOS-IP in their respective work plans.

The Chair closed the discussion on the GCOS-IP by acknowledging that this is a complex matter that will remain and that the CGMS Secretariat will secure that this is a recurrent item on the CGMS Plenary agenda.

H.2 CEOS/CGMS Joint Working Group on Climate, inventory and gap analysis – Results since CGMS-44

The WGClimate Chair (Pascal Lecomte) introduced the progress made by the Joint WGClimate since CGMS-44 following the work plan jointly established by ESA and EUMETSAT (**CGMS-45-JWGCLIM-WP-01)**. He highlighted the major progress achieved on the ECV Inventory now allowing for a gap analysis and the derivation of coordinated actions. In particular:

- The Cycle#2 ECV Inventory was populated following a data call issued in June 2016. 11 CEOS/CGMS agencies have provided 924 (459 existing and 465 planned) ECV climate data records to the Inventory. The content of the Inventory was verified by the end of May 2017 and is now ready for the gap analysis.
- A public release of a quality-controlled version of the ECV inventory is planned for August 2017 and will appear on the joint WG Climate web page (climatemonitoring.info).
- The gap analysis has been prepared by using a semi-automated web based tool together with gap analysis support teams with the analysis currently ongoing. Presentation of the gap analysis report draft and coordinated action plan will be provided to the 8th session of the joint WG Climate on 11-12 September 2017. The final drafts require endorsement by CGMS and CEOS in October 2017.
- The planning of Cycle #3 (2018/2019) has started and contains potential addition of inventories of available FCDR and CDR Interim that provide a consistent continuation of a CDR with higher timeliness (a few days to a month).

- A dedicated response to the new GCOS Implementation Plan (GCOS-IP, 200) is under development for submission to SBSTA-47 by 6 October 2017. (The writing team has broad representation from the EC, WMO, UKSA, USGS, CNES, NASA, DLR, INPE, DWD, NOAA, EUMETSAT, JAXA and ESA).

IOC suggested that the joint WGClimate could mention the need for in situ measurements in addition to satellite measurements to achieve an integrated system. The joint WGClimate could also become more aware of GEO activities that support the ideas of integration of satellite and in-situ observations for climate.

The Chair mentioned that the integration of different measurements is part of the GCOS IP. WMO stated that the WMO Executive Council has endorsed the GCOS IP. The 16th session of the WMO Commission of Basic Systems had also considered it resulting in more than 100 recommendations related to surface-based systems.

The joint WGClimate fully acknowledged the importance of surface-based measurements and agreed to mention it in the introduction of its response to the GCOS-IP.

Finally, CGMS-45 Plenary endorsed the nomination of Dr. John Dwyer (USGS) to become the new Vice Chair of the joint WGClimate in November 2017 if also endorsed by CEOS Plenary.

The following actions were noted:

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	H.2	A45.20	CGMS to endorse the gap analysis report and the coordinated action plan in writing prior to CEOS 2017 plenary meeting, to the Joint CEOS-CGMS WG Climate (pascal.lecomte@esa.int and joerg.schulz@eumetsat.int)	15-Oct-17	**OPEN**	5.1.1
CGMS members	H.2	A45.21	CGMS to endorse the final draft of the space agency response to the new GCOS-IP in writing, prior to the submission to the SBSTA-47, to the CEOS-CGMS JWG Climate (pascal.lecomte@esa.int and joerg.schulz@eumetsat.int)	15-Oct-17	**OPEN**	5.1.3
CGMS members	H.2	A45.22	CGMS to review the Space Agency Statement to COP-23 SBSTA-47 in writing (prior internal review by the EC and submission to the SBSTA-47 by 6 October 2017), to the Joint CEOS/CGMS WG	14-Jul-17	**OPEN**	5.1.2

CGMS-45 actions – PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
			Climate (pascal.lecomte@esa.int and joerg.schulz@eumetsat.int)			

I EDUCATION AND TRAINING

I.1 Virtual Laboratory (VLab) – progress since CGMS-44

CGMS-45-WMO-WP-09 reported on activities within the WMO-CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) along with future plans. Since CGMS-44, VLab members have offered a variety of training opportunities, training more than 4600 event participants. Training highlights include user preparation for the new generation of satellites, related to Himawari-8/9, GOES-R, MTG-I and FY-4.

Future training plans include (i) Organisation of a virtual roundtable on climate monitoring from space in all WMO languages and Portuguese; (ii) Support user preparation in the Indian Ocean region, in connection with the CGMS IODC roadmap; (iii) Organise an expert workshop on RGB composites derived from multi-spectral (including new-generation) imagers.

The VLab Trust Fund received a steady level of contributions since May 2016 compared to the previous year, from NOAA, EUMETSAT, and KMA. However, a larger number of contributing CGMS agencies is required to improve its resilience. Regular financial contributions from CGMS Members are critical to maintain technical support to the VLab.

The VLab Technical Support Officer is hosted by Colorado State University and managed out of the Cooperative Institute for Research in the Atmosphere (CIRA), through a contract between WMO and the University. This contracts ends on 31 August 2018 and cannot be renewed for administrative reasons. A new hosting institution for the VLab TSO needs to be identified and a working arrangement with WMO found as of 1 September 2018.

In October 2016, ROSHYDROMET announced the resignation of Prof. Grigory Chichasov as co-chair of the VLab Management Group. In a 24 May 2017 letter to WMO, EUMETSAT nominated Dr. Mark Higgins, EUMETSAT Training Manager, as new VLab co-chair on behalf of CGMS satellite operators.

CGMS endorsed the nomination of Dr Mark Higgins (EUMETSAT) as new co-chair of the VLab on behalf of CGMS satellite operators.

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	I.1	A45.24	CGMS Members to indicate to WMO (sbojinski@wmo.int) and the CGMS	15-Sep-17	**OPEN**	4.2.3

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
			Secretariat (cgmssec@eumetsat.int) whether they would be interested in and in a position to host the VLab Technical Support Officer as of 1 September 2018.			

In October 2016, ROSHYDROMET announced the resignation of Prof. Grigory Chichasov as co-chair of the VLab Management Group. In a 24 May 2017 letter to WMO, EUMETSAT nominated Dr. Mark Higgins, EUMETSAT Training Manager, as new VLab co-chair on behalf of CGMS satellite operators.

CGMS endorsed the nomination of Dr. Mark Higgins (EUMETSAT) as new co-chair of the VLab on behalf of CGMS satellite operators.

CGMS-45-KMA-WP-02 presented a progress report on the RA II WIGOS project to develop support for NMHSs in satellite data, products and training.

The working paper outlined the aim of the RA II WIGOS Project together with detailed recent accomplishments including:

- Regular issuance of newsletters to RA II members;
- Organising the 7th Asia-Oceania Meteorological Satellite Users' Conference and VLab training event;
- The 4th Meeting of the Coordinating Group of the WMO Regional Association II (Asia) WIGOS Project which discussed:
  - Survey results of RA II/RA V training events from 2012 to 2016;
  - The KMA-KOICA training event, held from 11 October to 1 November 2016, jointly held with RA II/RA V training event on 21-22 October, with 25 participants in the RA II/RA V training event;
  - The JMA feasibility study on Himawari-8 event-driven rapid-scan which was attended by RA II Member representatives and by several RA V Member and Observers.

The project addresses preparations by NMHSs in RA II on the use of satellite data, especially in the least developed countries and other developing nations. This involves user training and guidance on upgrading processing software/hardware, information and tools. In parallel with these activities, it is also necessary to establish close coordination with the RA V Task Team on Satellite Utilization.

The 16th Session of the WMO RA II (RA II-16, Abu Dhabi, UAE, Feb 2017) approved the Regional WIGOS Implementation Plan 2017 – 2020 (R-WIP-II) including the project No. VI: Develop Support for NMHSs in Satellite Data, Products and Training.

The 5th meeting of the Coordinating Group of the RA II WIGOS Project will be held on 22 October 2017 on the occasion of AOMSUC-8.

In **CGMS-45 ROSCOSMOS-WP-02** ROSCOSMOS made an announcement and invited participants to the 8th Asia-Oceania Meteorological Satellite Users' Conference and training events, held 16-21 October 2017 in Vladivostok, Russian Federation. The conference website is available at http://aomsuc8.ntsomz.ru/; and the following deadlines can be noted: Abstract submission - 31 July 2017; and registration deadline - 30 September 2017.

CGMS-45-KMA-WP-03 provided the status of KMA'S training activities on "analysis and application of next generation satellite data".

The working paper outlines the background and mission of the Republic of Korea VLab Centre of Excellence (CoE) and also details KMA's recent training activities and plans for the preparation of next generation satellite data.

NMSC/KMA, as a Center of Excellence (CoE) of RAII and a satellite operator, is expanding the domestic and international training activities. KMA has been contributing to the WMO VLab since 2012 in terms of:

- COMS data and its application on weather forecasting "Analysis of COMS Data" (120 persons from 14 countries in RA II and RA V regions);
- GEO-KOMPSAT-2A satellite data user preparation "Analysis and Application of Next Generation Satellite Data": Three years from 2016 to 2018;
- KMA has also started participating in and holding online Regional Focus Group (RFG) weather discussion jointly with CoE-Australia since 2015.

Further accomplishments include:

- Utilisation of next generation geostationary (Geo-KOMPSAT-2A) data:
  - Improvement of Meteorological Satellite Data Analysis and Application Capacity;
  - In 2016, about 40 forecasters participated in the basic or advanced satellite meteorology course and 30 graduate or undergraduate students participate in the 4-day summer COMS satellite camp from 28 June to 1 July;
  - Training Events of the 7th Asia-Oceania Meteorological Satellite Users Conference (AOMSUC-7);
  - Online Regional Focus Group (RFG) Weather Discussion jointly with CoE-Australia.

Future plans include:

- 2017 International training course for RA II/RA V regions covering:
  - Improvement of Meteorological Satellite Data Analysis and Application Capacity.
  - Targets: RA II/RA V countries.
  - Periods: 4 weeks in November 2017 (Course Information (CI) will be available in the course of June/July 2017.

- Online Joint Regional Focus Group (RFG) meeting with CoE-Australia:

  - Quarterly joint RFG meetings will be held in the second half of 2017.
  - The recording of all RFG meeting will be available on the CoE-Australia web page (http://www.virtuallab.bom.gov.au/archive/regional-focus-group-recordings/)

J NEW GENERATION GEOSTATIONARY SATELLITES

J.1 Preliminary results

J.1.1 FY-4A

CGMS-45-CMA-WP-03 presented the preliminary results of the in-orbit testing of FY-4A.

FY-4A was successfully launched 11 December 2016. It is the only R&D satellites in the FY-4 series and it carries in addition to an advanced imager (AGRI, Advanced Geostationary Radiation Imager), a hyperspectral sounding instrument, a lightning mapper and a space environment package. With respect to non-meteorological applications (NMA) it was noted that AGRI is providing significant improvements in terms of capability as compared to the FY-2 series and is approaching the capabilities of Himawari/AHI. A wide range of products are foreseen, many of those captured in the CEOS NMA-study. The post-launch activities are ongoing and it is expected that the mission will be declared operational by the end of 2017.

In response to JAXA, CMA clarified that high spectral data will be made publicly available in line with the Chinese data policy.

ROSHYDROMET congratulated CMA on the flight of the Geostationary Interferometric Infrared Sounder (GIIRS) instrument, the first such instrument in GEO orbit, echoed by the CGMS Plenary chair on behalf of the CGMS community.

J.1.2 GOES-16

In **CGMS-45-NOAA-WP-03** NOAA presented the status of the first of its new generation of Geostationary Satellite, GOES-R, now GOES-16.

GOES-R was launched 19 November 2016 and has been renamed GOES-16. In addition to the Advanced Baseline Imager (AHI), which is very similar to Himawari/AHI, the spacecraft encompasses GLM (Geostationary Lightning Mapper) MAG (Magnetometer), SEISS (Space Environment In-Situ Suite) EXIS (Extreme Ultraviolet and X-Ray Irradiance Sensors) and SUVI (Solar Ultraviolet Imager). The in-orbit checkout is ongoing and progressing well and is also supported by Cal/Val field and aircraft campaigns. NOAA anticipates that the spacecraft will be taking over as GOES-East (75°W) by November 2017 and that the Level-2 products will be provisionally validated by December 2017 by which time the spacecraft will be declared operational.

J.2 CGMS response to CEOS on the Non Meteorological Applications Study Progress report and proposal for the way forward: Non Meteorological Applications Study

The presentation in **CGMS-45-EUMETSAT-WP-23** recalled the background for the study, a CEOS Chair 2016 initiative, and provided an update of the status of discussions since last CGMS. CGMS Members have considered the outcome of the study and identified five potential applications for collaboration. After further deliberations, considering also the relevance of geostationary satellite data, maturity of existing activities, anticipated user uptake, during CGMS-45 Working Group II discussions, three applications emerged as candidates for future collaboration – fire, aerosol, and flood mapping. Working Group II then further considered existing initiatives and explored collaboration methods, emphasising the need for synergies with polar orbiting data. In conclusion, Working Group II proposed the following activities for initiation:

- Fire
- Aerosol
- Flood mapping

The following actions were raised as a consequence:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	J.2	A45.26	CGMS members to confirm participation in the three proposed Non Meteorological Applications projects - aerosol/dust, fire, and flooding - and nominate POCs to form Task Teams reporting to WGII	Sep-17	**OPEN**	3.5.4
CGMSSEC	J.2	A45.30	Fire: CGMS SEC to approach GOFC-GOLD to explore the possibility for CGMS members to become part of the fire project.	CGMS-46	**OPEN**	3.5.4
CGMSSEC	J.2	A45.31	Aerosol: CGMSSEC to explore with AEROSAT if they pursue an activity regarding the use of new-generation GEO data.	CGMS-46	**OPEN**	3.5.4
CGMS Agencies	J.2	A45.27	CGMS Agencies to confirm interest in a flood mapping pilot project using GEO satellites, as a proposal for the SCOPE-Nowcasting executive panel meeting (18-20 Sep 2017) by 1 Sep 2017.	1 Sep 2017	**OPEN**	3.5.4

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA, CMA	J.2	A45.32	NOAA and CMA to develop a proposal to develop GEO-based flood mapping as a potential SCOPE-Nowcasting pilot project. The WMO Multi-Hazard Early Warning System (MHEWS) and the Flash Flood Guidance System (FFGS) should be invited to collaborate in this proposal.	CGMS-46	**OPEN**	3.5.4

Furthermore, Working Group II proposed a new HLPP item to this purpose:

> *"Foster the coordinated development of novel products and applications of the new generation of geostationary imagers, initially for the areas of fire, aerosols and flood-mapping."*

Discussion and Conclusions

IOC-UNESCO appreciated the presentation and requested that CGMS members operating geostationary meteorological satellites to provide IOC-UNESCO contact points covering ocean surface monitoring with geostationary satellite data. The following action was noted accordingly:

CGMS-45 actions - PLENARY						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies, CGMSSEC	J.2	A45.25	CGMS space agencies to provide the list of oceanographic products from GEO satellites to cgmssec@eumetsat.int for provision to IOC-UNESCO.	30-Sep-17	**OPEN**	2.5

EUMETSAT asked if solar flux at the ocean surface, a unique contribution from geostationary satellites, was considered. The Working Group II rapporteur noted that had been considered, but not as part of the initial set of application areas to be pursued jointly. However, this could be further discussed in upcoming meetings.

In response to an enquiry by the GEO Secretariat on the maturity of products, the rapporteur explained that for the various variables several levels of maturity have been achieved. Maturity was indeed one of the criteria considered for selecting the application areas and the proposed way forward.

NOAA noted that the incoming CEOS SIT Chair, Dr. Stephen Volz has proposed priorities for his chairmanship which include novel applications from the new non-meteorological applications. NOAA welcomes CGMS identification of initial projects and noted that CEOS would be interested in monitoring the progress of these activities.

In conclusion, Plenary approved the proposed way forward for the three application areas fire, aerosol and flood mapping as well as the proposed inclusion in the HLPP.

K HLPP

K.1 Status of HLPP implementation 2016

CGMS-45-CGMS-WP-11 presented the status of implementation of the CGMS High Level Priority Plan (2016-2020). It incorporates inputs from:

- WG I, II, III and IV chairs and rapporteurs;
- International Science Working Group chairs and rapporteurs;
- GSICS project;
- SCOPE-CM project;
- CEOS-CGMS Joint Working Group on Climate; and
- CGMS Space Weather Task Team.

CGMS plenary noted the good progress in the implementation of the HLPP and took note of the actions initiated by CGMS Working Groups to advance the implementation.

K.2 Proposed update to the CGMS High-Level Priority Plan for the period 2017-2021

CGMS-45-CGMS-WP-10 presented the proposed revision of the CGMS High-Level Priority Plan (HLPP) to cover the period 2017-2021.

WGs I, II, III, and IV considered the proposed updated set of high-level priorities, and, after making some amendments:

- confirmed that the proposed revision properly represents the high-level priorities that should guide CGMS activities for the next four-year period;
- WG I recommends one target within its area of activity to be considered achieved:
  - Coordinated participation in the activities of the International Forum of Users of Satellite Data Telecommunication Systems, to prepare the future use of the International Data Collection System (IDCS);
    - WG I considers that SATCOM is now fully integrated as part of the normal work to be performed.
- WG II recommends one target within its area of activity to be considered achieved:
  - Addressing the error characteristics of wind products at the next International Winds Workshop in 2014 and provide a set of guidelines for consideration at the operational centres);
    - WG II considers that this work was completed following IWWG-12 (2014).
- WG I, II, III and IV recommended the endorsement by the CGMS plenary of the proposal for an HLPP covering the period 2017-2021.

The CGMS plenary endorsed the final proposal for the revised CGMS High-Level Priority Plan to cover the period 2017-2020, noting that the outcome of the subsequent session on carbon observations would require a further amendment to the HLPP.
Following CGMS-45, the revised version of the updated HLPP will be published on the CGMS website.

L REVIEW OF CGMS-45 ACTIONS AND RECOMMENDATIONS

L.1 Review of summary list of actions and recommendations

Plenary reviewed the list of CGMS-45 plenary actions and recommendations and endorsed these, noting that further actions will be added as necessary following the review and editing of the final report.

The summary list of CGMS-45 actions and recommendations as well as the outcome of the CGMS-44 actions and recommendations are provided in the Annex II and will also be available on the CGMS website.

The CGMS Secretariat invites CGMS members to provide feedback to actions as necessary.

M AOB AND CLOSING SESSION

M.1 CGMS nominations and representatives at meetings

The CGMS Secretariat provided the list of nominees and representatives at meetings in **CGMS-45-CGMS-WP-03** and plenary endorsed these.

M.2 Any other business

There was no other business discussed.

M.3 Closing

M.3.1 Schedule of future CGMS plenary sessions (2018 and beyond)

CGMS plenary highly welcomed ISRO's confirmation to host CGMS-46 in Bangalore, India, and ISRO provided a taste of what is to come in **CGMS-45-ISRO-WP-07**.

Furthermore, plenary agreed to hold CGMS-46 in the period 3-8 June 2018.

The tentative plan of CGMS plenary sessions in the period 2019-2027 is:

CGMS plenary #	Year	Location
CGMS-47	2019	Russian Federation
CGMS-48	2020	WMO
CGMS-49	2021	Japan
CGMS-50	2022	China
CGMS-51	2023	North America
CGMS-52	2024	Europe
CGMS-53	2025	South Korea
CGMS-54	2026	India
CGMS-55	2027	Russian Federation

(see also **CGMS-45-CGMS-WP-02**).

M.3.2 Handover of CGMS flag

The host of CGMS-45, KMA, handed over the CGMS flag to ISRO for hosting CGMS-46.

M.3.3 Closing

Concluding the meeting, the Co-chairs declared that CGMS-45 had been a fruitful meeting recalling that a number of actions had been taken for addressing between now and the next plenary session in a year's time.

The CGMS-45 host, Dr. Park, thanked the representatives of all members and observers for their dedication and contributions to the meeting and also those who contributed to organising the meeting prior and during the meeting, namely the Working Group Chairs and rapporteurs, the CGMS Secretariat including the organising committee.

The 45th plenary session of CGMS closed at 17:00 on Friday, 16 June 2017.

CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

Working Group I: **Global issues on satellite systems and telecommunication coordination**

PARALLEL WORKING GROUP SESSIONS

WG I REPORT

Chair:

Vanessa Griffin (NOAA)

Rapporteur:

Joaquin Gonzalez Picazo (EUMETSAT)

1. Objectives

During the plenary session of CGMS-44, Mrs. Vanessa Griffin (NOAA), Mr. Sergey Uspensky (ROSHYDROMET) and Mr. Joaquin Gonzalez (EUMETSAT) were appointed as Co-Chairs and Rapporteur of Working Group I, respectively. Unfortunately, Mr. Uspensky could not attend CGMS 45.

WG I included representatives of the satellite operators from CMA, EUMETSAT, GEO Secretariat, ISRO, JMA, KMA, NOAA, ROSCOSMOS, ROSHYDROMET and WMO (see CGMS report for full list of participants). In view of the actions agreed at CGMS-44 in relation to Space Weather, the representatives of the related Task Team also participated in the meeting under dedicated agenda item 3.1.

WGI reviewed and adopted the draft agenda proposed by the CGMS Secretariat prior to the meeting with the addition, under AOB, of a proposal from NOAA to consider missing items in the agendas of WG-I and WG-IV focused on Satellite and Data Operations.

2. Review of actions and recommendations from previous meetings

Actions and recommendations from previous CGMS plenary sessions were discussed and the status following WG I discussions is summarised below with an update of the due date of the actions kept not closed.

WGI actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	WGI/6	A43.06	WMO to assess the impact of improved data latency from polar orbiters on NWP (WMO Impact Workshops) and other applications	Next WMO workshop will take place in May 2016 (China), hence there might be a verbal/preliminary report only to CGMS-44. Discussed at CGMS-45.	(CGMS-44) New deadline CGMS-46	**OPEN**	1.1.2

CGMS-44 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SFCG liaison officer (EUM)	WGI/2	A44.01	SFCG liaison officer to bring to SFCG/WMO the possibility of migrating the SFCG Remote Sensing Disaster Database (RSDD) into OSCAR from the following perspectives: • Identify the level of overlap between the two databases; • Possibility for WMO to introduce, and maintain, the delta elements of the SFCG RSDD into OSCAR; • Level of support of SFCG members to migrate the SFCG RSDD into OSCAR or preference to retain a separate database; • Arguments for retaining a stand-alone SFCG RSDD, if any.	CGMS-45 EUM-WP-24	CGMS-45	**CLOSED**	1.3

CGMS-44 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SFCG liaison officer (EUM)	WGI/2	A44.02	SFCG liaison officer to provide a report to WGI on the outcome of SFCG by Q3 2016 (as part of the CGMS-45 WPs)	CGMS-45 EUM-WP-24	30 Sep 2016	**CLOSED**	1.3.3
SFCG liaison officer (EUM)	WGI/2	A44.03	SFCG liaison officer to propose to SFCG that SFCG members will report yearly to SFCG on national regulatory changes/issue in their countries (e.g. to repurpose spectrum currently in use or planned for use by meteorological satellites (both active and passive spectrum bands)).	CGMS-45 EUM-WP-24	CGMS-45	**CLOSED**	1.3.3
SFCG liaison officer (EUM)	WGI/2	A44.04	SFCG liaison officer to report to CGMS WGI as a permanent section of his yearly SFCG outcome report to WGI updates (relevant) on proposed regulatory changes to repurpose spectrum currently in use or planned for use by meteorological satellites (both active and passive spectrum bands).	CGMS-45 EUM-WP-24	CGMS-45	**CLOSED**	1.3.3

CGMS-44 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGI/2	A44.05	CGMS agencies to provide prior to CGMS 45 a report on the space weather activities (including spacecraft and instruments) of relevance on Freq Management and freq protection topics	CGMSSEC to request SWTT representative to provide a paper to WGI to this purpose (and present it in WGI). SWTT informed by e-mail 7 April 2017. CGMS-45 NOAA-WP-04 Agency reports on frequency topics to include a dedicated chapter on space weather	(Feb 2017) CGMS-46	**OPEN**	1.3
CGMSSEC	WGI/5	A44.06	CGMS Secretariat to distribute to CGMS members (PoC for SATCOM Forum at least) the questionnaire on IDCS (included in EUM-WP-06) end June 2016	*EUMETSAT (Sean Burns) circulated an e-mail to NOAA, ISRO, CMA JMA and ROSHYDROMET on 7 June 2016*	30-Jun-16	**CLOSED**	1.2.1
CGMS space agencies	WGI/5	A44.07	CGMS agencies to reply (end of August) to the questionnaire and to confirm attendees to the splinter meeting on IDCS during the next SATCOM Forum (Sept 2016 in Madrid)	*NOAA and JMA have provided an input to EUMETSAT. To be discussed at the SATCOM Forum itself.*	31-Aug-16	**CLOSED**	1.2.1
CGMS space agencies	WGI/6.1	A44.08	CGMS agencies with satellites with DB and RO occultation sensors to assess the technical feasibility of a RARS/DBNet RO occultation service in support of the Space Weather community.	Deadline extended following CGMS-45 discussions. CGMSSEC to request IROWG representative to provide a paper to WGI to this purpose (and present it in WGI) NOAA does not have any ability to use RARS for RO data	(CGMS-45) CGMS-46	**OPEN**	1.4

CGMS-44 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGI	A44.09	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs	Deadline extended following CGMS-45 discussions. As a member, NOAA agrees that the GODEX-NWP group would be an excellent source of information on the planned types of next-gen GEO data to be disseminated and methods of data dissemination between the international NWP modeling centers. The GODEX-NWP group is also at the forefront of RARS endeavors.	(CGMS-45) CGMS-46	**OPEN**	

CGMS-44 WGI Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	WGI/6	R43.03	WMO DBNET Coordination Group to report annually to CGMS WG-I on status and progress	Discussed at WGI webex session 21 Oct 2015 (best practice proposal). WMO DBNet presentation to be circulated to WGI (NOAA, EUM, CMA and ROSH in particular - LEO satellites with direct broadcast) CGMS-44 WMO-WP-10	(CGMS-44) New deadline CGMS-45	**CLOSED**	1.4.4
CGMS space agencies	WGI/2	R44.01	CGMS agencies to inform their Freq Managers on the space weather activities to ensure the necessary protection and coordination at Freq management level	NOAA has informed their spectrum managers on space weather activities. They are actively working to identify spectrum for the SWFO as well as coordinating with other SMs on COSMIC-2 in preparation for launch. NOAA SM are also engaged in WRC Agenda Item 2.3 "relating to the technical	Long term	**OPEN**	1.3

CGMS-44 WGI Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors"			
CGMS space agencies	WGI/5	R44.02	All CGMS DCS operators to consider making all DCP messages available in the GTS.	CGMS-45 CMA-WP-xx CGMS-45 EUM-WP-28 CGMS-45 ISRO-WP-xx CGMS-45 JMA-WP-xx CGMS-45 NOAA-WP-xx CGMS-45 ROSH-WP-xx	Long term	**OPEN**	1.2
CGMS space agencies	WGI	R44.03	From CGMS-44 WGII: Agencies to explore the possibilities to develop suitable processing packages to support a direct broadcast implementation of RO processing, within the DBNet to improve timeliness for space weather applications			**OPEN**	5.2

3. Frequency Management matters

CGMS-45-EUMETSAT-WP-24, in response to CGMS-44 Working Group I actions A44.01, A44.02, A44.03 and A44.04, provides a report from the CGMS/SFCG Liaison Officer on the discussions and dispositions of SFCG from its 36th meeting (late June 2016) on all frequency management issues of mutual interest and concern.

Regarding CGMS 44 action A44.01 on the possibility of migrating the SFCG Remote Sensing Disaster Database (RSDD) into OSCAR from the following perspectives. In summary, the two databases are designed to serve their distinct purpose. Even if there is a certain level of overlap in the information provided, as the instruments and observing systems to a certain extent appear in both databases, however the structural design, the search functions and concepts are significantly different. This will make it difficult to retain the essence of the RSDD when migrated into the structural design of the OSCAR database. These fundamental differences provide an argument for retaining both databases separate

WGI A44.01 and SFCG Action Item 36/6 requests WMO to provide their feedback on their willingness and possibility to introduce the delta elements of the SFCG RSDD into OSCAR whilst retaining appropriately the functions and capabilities of the RSDD database.

It was concluded by SFCG that first and foremost WMO will have to provide their feedback on their willingness and possibility to introduce the delta elements of the SFCG RSDD into OSCAR whilst retaining appropriately the functions and capabilities of the RSDD database.

WMO has, in the interim, reviewed the situation of serving the SFCG Disaster Database information from OSCAR and concluded that, although it is possible to create the rules for OSCAR Space to be able to provide much of information under the SFCG Disaster Database, gaining full functionality would be beyond WMO's current capabilities to be able to develop and implement it within the current financial period (2016-2019). It is therefore recommended by WMO that no further action be taken on this issue.

In parallel to this consideration, NASA agreed to continue to maintain the database and to submit an updated database report to SFCG-37.

With this set of answers the action A44.01 is closed.

Regarding CGMS 44 action A44.03 for the SFCG liaison officer to propose to SFCG that SFCG members will report yearly to SFCG on national regulatory changes/issue in their countries (e.g. to repurpose spectrum currently in use or planned for use by meteorological satellites (both active and passive spectrum bands)).

SFCG endorsed the idea and agreed on Action Item 36/7 (Annex 2) requesting SFCG members to provide such information on potential national/regional regulatory changes/issue that could be of interest to the SFCG/CGMS community.

Details on this action are summarised in sections 4 and 5 of **CGMS-45-EUMETSAT-WP-24,** therefore covering action A44.04. The future reports to CGMS from the SFCG/CGMS liaison officer will contain a yearly update as required in A44.04.

Regarding CGMS 44 action A44.02 for the SFCG liaison officer to provide a report to WGI on the outcome of SFCG by Q3 2016 (as part of the CGMS-45 WPs), this is the core of **CGMS-45-EUMETSAT-WP-24**.

On Space weather topics, SFCG-36 confirmed the need for gathering information from its member agencies and agreed about Action Item 36/8 (Annex 3) which calls for providing to ITU-R Working Party 7C inputs on the technical and operational characteristics of systems listed in Annex 1 of document SF36-45/D as well as information on systems that may be missing in this referenced document.

In the framework of ITU-R, Working Party 7C is working on a Preliminary Draft New Recommendation ITU-R RS. [SPACE_WEATHER_SENSORS] aiming at providing information on space weather sensors.

The WMO Steering Group for Radio Frequency Coordination (SG-RFC) also considered the issue of space weather at its yearly meeting in January 2017. It noted that the timeline to complete work is the October 2017 meeting of Working Party 7C. Therefore, WMO SG-RFC agreed a number of actions (in particular issuing a survey to identified experts/entities) to ensure that the required information is gathered and can be made available in form of an input document from WMO to the October 2017 meeting of Working Party 7C.

WGI discussed the status of preparation for this WP-7C meeting in October 2017 by the different CGMS members. WGI agreed to have an inter-sessional meeting (7 September 2017) to review the information available regarding the technical and operational characteristics of space weather related systems. WGI also considered that the outcome of the WMO survey is very relevant and an action was therefore assigned to WMO to share with all CGMS members the outcome of the survey prior to the inter-sessional meeting. In order to help in preparing for the inter-sessional meeting, WGI assigned an action to the liaison officer to also share SF36-45/D with WGI participants and IPT-SWeISS members.

On WRC-19 issues of concern to CGMS

CGMS introduced in their High Level Priority Plan the following issues on the WRC-19 agenda:

- Issues with relation to DCS (1.2, 1.3 and 1.7),
- Impact of 1.13 on the band 25.5 – 27 GHz,
- Passive sensor band protection under various agenda items and
- RLAN under 1.16.

This list was communicated to SFCG-36 and taken into account by SFCG in the development of their preliminary objectives to WRC-19 agenda items of interest/concern to its member agencies as quoted below:

Agenda Item 1.2:

SFCG supports studies and analyses under Agenda Item 1.2 towards establishing appropriate in-band power limits for earth stations operating in these bands, in order to preserve on a long term basis the operation of Data Collection.

This agenda item may be impacted by activities under WRC-19 AI 1.7.

Agenda Item 1.3:

SFCG supports studies and analyses under Agenda Item 1.3 and the effort to raise the status of MetSat and EESS space-to-Earth usage. The MetSat (space-to-Earth) allocation should be upgraded from secondary to primary status and a primary EESS (space-to-Earth) allocation should be added in the frequency band 460-470 MHz. The SFCG does not support limitations on an upgraded allocation which would make the allocation effectively unusable.

Agenda Item 1.6:

SFCG supports studies to consider a review of the regulatory framework for non-GSO FSS satellites systems addressed under WRC-19 AI 1.6. However, SFCG does not support revisions to the existing regulatory framework for non-GSO FSS systems unless studies conclude the existing protection of space science services, including passive sensing, will be preserved.

Agenda Item 1.7:

SFCG supports the protection of existing space science service allocations with no specific concern on this agenda item at this time.

Agenda Item 1.13:

SFCG supports the protection of existing space science service allocations. No new allocation should be made in space science service bands unless acceptable sharing criteria and conditions are developed.

A particularly critical situation concerns the band 25.5-27 GHz which is expected to be heavily used by many future EESS and SRS satellite missions for data downlinks.

As recognized in Resolution 238 (WRC-15) for the 25.5-27 GHz band, it is fundamental for SFCG Member Agencies to be assured that EESS and SRS earth stations will continue to be able to expand in the future both in terms of number of satellites serviced and number of earth stations. Licences for these earth stations must not be refused or restricted on the basis that such action may limit IMT operational areas.

Protection of the 31.8-32.3 GHz band usage by current and future SRS deep space systems (s-E) should also be ensured.

Agenda Item 1.16:

SFCG supports a review of the RLAN spectrum, technical and operational requirements in the 5 GHz range, as requested by Resolution 239 (WRC-15) as pre-requisite to any further sharing studies in the range.

For the 5250-5350 MHz band, SFCG supports:

1) Verifying if the assumptions made in the studies leading to the mobile allocation for RLANs in that band are still valid and applicable to the current and planned use of the band by RLANs;
2) Studying the potential impact on EESS (active) systems of the possibility to authorise outdoor RLAN usage.

For the 5350-5470 MHz band, SFCG supports the consideration of new RLAN mitigation techniques proposed by the RLAN industry, provided that they are found to be effective, sufficient and enforceable. SFCG does not support reopening WRC-15 conclusion that sharing would not be feasible, as stated in recognizing a) of Resolution 239 (WRC-15).

For EESS (active) altimeters covering the entire 5250-5570 MHz band, SFCG supports studying potential RLAN mitigation techniques on the basis of invites 2 of Resolution 229 (rev. WRC-12).

Agenda Item 9.1.9:

SFCG does not support an allocation until out of band sharing studies have been completed that show the EESS (passive) is not adversely affected and any required revision to Resolution 750 (rev. WRC 15) is agreed.

SUMMARY OF NATIONAL REGULATORY ISSUE REPORTED TO SFCG

Potential Sharing of 1675-1680 MHz in the USA. Discussions are still ongoing and US regulators have made no decisions on sharing at this point.

Sharing of the Frequency Band 1695-1710 MHz with commercial broadband (AWS-3) in the USA. NOAA is currently working with the licensees to finalize the analysis methodology and assumptions for evaluating compatibility of a proposed build-out within the protection zones. Meteorological earth stations outside of the established protection zones are not protected from interference. It is expected that coordination for operations within the protection zones will commence within the next year. Detailed build-out plans and timelines have not been provided to NOAA. NOAA is deploying a radio frequency interference monitoring system (RFIMS) at each of its protected earth stations.

WGI thanked the CGMS/SFCG Liaison Officer for the detailed report provided on the frequency related topics of interested to CGMS.

CGMS WGI also wanted to re-iterate to SFCG the appreciation of CGMS on the support provided in protecting and preserving the frequency bands assigned or related to the activities of CGMS.

CGMS-45-EUMETSAT-WP-025 provides a report from EUMETSAT on frequency management related matters of mutual interest and concern to the meteorological satellite community. All of them are related to WRC-19 agenda items. At the time of CGMS-45, WRC-19 preparations are approaching halftime and the sharing and compatibility assessments and the solution finding processes are ongoing at national, regional and international (ITU-R) level. EUMETSAT is deeply involved in these processes as it is concerned with the following WRC-19 agenda items:

1.2	Introduction of power limits in the frequency band 401-403 MHz
1.3	Upgrade of the secondary allocation to the MetSat and EESS service (space-to-Earth) to primary status in the frequency band 460-470 MHz
1.6	Development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth- to-space) and 50.4-51.4 GHz (Earth-to-space)
1.7	Identification of spectrum needs for telemetry, tracking and command in the space operation service for non- GSO satellites with short duration missions, including potential new allocations in specific bands below 1 GHz
1.13	Identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis
1.15	Identification of frequency bands for use by administrations for the land- mobile and fixed services applications operating in the frequency range 275-450 GHz
1.16	Consideration of issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5150-5925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service
7	Consideration of possible changes to the satellite coordination and notification procedures
9.1.9	Possible allocation of the frequency band 51.4-52.4 GHz to the fixed- satellite service (Earth-to-space)
10	Draft Agenda for WRC-23

Not surprisingly, this list is overlapping with the issues identified by WMO SG-RFC as expressed in the preliminary position paper of WMO to WRC-19. Likewise, the positions expressed by WMO on those issues are supported by EUMETSAT.

This contribution concentrates on those WRC-19 issues identified in the CGMS High Level Priority Plan, namely:

- Issues with relation to DCS (1.2, 1.3 and 1.7),
- Impact of 1.13 on the band 25.5-27 GHz,
- Passive sensor band protection under various agenda items and
- RLAN under 1.16.

Agenda Items 1.2 and 1.7 (401-403 MHz: DCS vs. small satellites)

Both agenda items are somewhat related as the purpose of Agenda Item 1.2 is to prevent interference into the use of the band 401-403 MHz by Data Collection Systems (DCS) from other satellite systems using or planning to use this band for telecommand functions with usually higher power levels than those of DCS systems like Argos, but also DCPs to geostationary MetSat.

The challenge is now to find an appropriate set of power limits to be imposed on the EESS and MetSat service in the band 401-403 MHz. The most promising seems to be limitations based on a combination of EIRP (parameter that includes power and antenna gain) and duty cycle. Furthermore, the establishment of an appropriate set of in-band power limits has to consequently differentiate between non-geostationary and geostationary DCS systems, to ensure compatibility between existing and future non-geostationary and geostationary DCS in the 401-403 MHz frequency band.

However, such set of limits will only serve the purpose of protecting the use of the band 401-403 MHz by DCS systems if any potential new allocation to the space operation service in this band under Agenda Item 1.7 would be accompanied by a compatible set of limits to those to be established under Agenda Item 1.2.

Agenda Items 1.3 (460-470 MHz: Upgrade of EESS & MetSat to primary)

The difficulty is currently to find the appropriate power flux density (pfd) value to protect the existing terrestrial services already allocated to this band on a primary basis. This work is ongoing and the result will determine the support of the administrations for such an upgrade of the MetSat and EESS allocations to primary.

Agenda Items 1.13 (IMT above 24 GHz)

This agenda item has the potential impact on Meteorological satellites downlink of signals to their receiving ground stations (if operating in 26 GHz band) passive sensors on board the satellites using these bands.

Under this agenda item the bands 24.25-27.5 GHz, 31.8-33.4 GHz, 37-43.5 GHz, 45.5-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz have to be studied for possible 5G identification in the Radio Regulations.

The following table shows which instruments on EUMETSAT satellites would be affected by such unwanted emissions of 5G deployments.

Instrument	Satellite	EESS (passive) Band	5G IMT band
AMSU MWS, MWI AMR MWR AMR-C	Metop Metop-SG Jason-2/3 Sentinel-3 Jason-CS/Sentinel-6	23.6-24 GHz	24.25-27.5 GHz (Pioneer band in Europe)

Instrument	Satellite	EESS (passive) Band	5G IMT band
AMSU MWS, MWI	Metop Metop-SG	31.3-31.8 GHz	31.8-33.4 GHz
AMSU MWS, MWI	Metop Metop-SG	50.2-50.4 GHz	47.2-50.2 GHz & 50.4-52.6 GHz
AMSU MWS, MWI	Metop Metop-SG	52.6-54.25 GHz	50.4-52.6 GHz
AMSU, MHS MWS, MWI	Metop Metop-SG	86-92 GHz	81-86 GHz

Different to the issue of protection of EESS earth stations where the concrete protection is to be handled individually on a regional or finally on a national basis, the impact on passive sensors from unwanted emissions from 5G is a global problem and concerns all operators of passive microwave sensor on-board of their MetSat and EESS satellites and thus requires a mutual effort by CGMS members in their regional and in the ITU-R preparatory process for WRC-19 to force improvement of the unwanted emission filtering capabilities of 5G and the implementation of appropriate limits in the Radio Regulations, e.g. via Resolution 750 (Rev.WRC-15).

Agenda Items 1.6 & 9.1.9 (New commercial satellite allocations)

Likewise the issue of unwanted emissions under Agenda Item 1.13, new allocations for non-geostationary FSS under Agenda Item 1.6 and FSS under Agenda Item 9.1.9 will also require regulations for the protection of EESS (passive) in the bands 36-37 GHz, 50.2-50.4 GHz and 52.6-54.25 GHz, e.g. through appropriate unwanted emission limits in Resolution 750 (rev. WRC-15).

Agenda Items 1.15 (terrestrial fixed and mobile above 275 GHz)

Radio Regulations footnote 5.565 currently identifies those frequency bands above 275 GHz used or planned to be used for passive sensing, including two channels of the Ice Cloud Imager (ICI) on Metop-SG satellites (313-356 GHz and 439-467 GHz).

EUMETSAT presented an initial study to the CEPT preparatory process in February 2017 and to ITU-R Working Party 7C in April 2017 to highlight the potential interference from such fixed and mobile networks to passive sensors in different scanning modes (limb, conical and nadir). These initial studies have shown that sharing could be critical with nadir or conical (like ICI) scanning instruments, even without having taken into account any aggregate effects or the case of compatibility in adjacent bands (relevant in particular when considering broadband FS/MS systems). Further detailed studies are envisaged as soon as relevant information from FS/MS industry about deployment scenarios (density of equipment per km², frequency reuse pattern, pointing elevation distributions, etc.) is available.

Agenda Items 1.16 (RLAN at 5 GHz)

Two issues are of concern to EUMETSAT under this agenda item, namely:

a) the relaxation of the "predominantly" indoor restriction in the band 5250-5350 MHz (new issue compared to WRC-15) and
b) the continued designation of the band 5350-5470 MHz for RLAN use.

For a), so far there are no firm proposals for changing the regulatory conditions for this band in the Radio Regulations.

Regarding b), there are a set of first proposals in the regional (CEPT) and ITU-R (WP5A) for a "no-change" to the Radio Regulations for this band.

Considering the above there is the potential that this Agenda Item 1.16 can be positively concluded at WRC-19 with regard to the protection of active sensors in the 5 GHz range and in particular 5350 – 5470 MHz.

WG-I thanked EUMETSAT for the detailed report provided on the frequency related topics of interested to CGMS.

CGMS-45-NOAA-WP-04 presented the NOAA Use of Frequency Bands: Current and Future. NOAA described the current and future NOAA satellites (POES, S.NPP, JPSS, COSMIC, COSMIC-2, Jason-2 and -3, CDARS, GOES N-P series, GOES R series GOES-Next series, DSCOVR and SWFO) and listed the radio frequencies used/to be used by these networks. NOAA described the following spectrum recently repurposed or in consideration for repurposing.

- 1695-1710 MHz: Recently repurposed for sharing with AWS-3 (Advanced Wireless Services -3) licensees for use as LTE uplink band. Affects 27 critical federal sites and numerous other federal and non-federal sites. Operations by AWS-3 has not begun so no validation of mitigation steps.
- 1675-1680 MHz: In consideration for repurposing for use by commercial fix and mobile operations and continued shared use as a METSAT downlink band. Consideration primarily due to commercial party petition to US FCC in Proceeding RM-11681. Significant concern by NOAA on DCP downlink interference risk to GOES-R series.
- 400.15-420 and 150.05-174 MHz: WRC-19 agenda item 1.7, resolution 659, assessment of the suitability of using existing SOS allocations below 1 GHz to accommodate the TT&C requirements for NGSO satellites with short duration missions.
- 5150-5925 MHz: WRC-19 agenda item 1.16, to consider issues related to wireless access systems, including radio local area networks. May include additional spectrum allocations to the mobile service.
- 24.5-27.5 GHz: WRC-19 agenda item 1.13, to consider identification of frequency bands for the future development of IMT, including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238.

Above 24 GHz: FCC Notice of Proposed Rulemaking, "Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, GN Docket No. 14-177": Solicitation of comments on mobile use in the following bands – 27.5-28.35 GHz, 37-38.6 GHz, 38.6-40 GHz, 64-71 GHz

Other spectrum-related issues include:

- Small Sat: Extremely large growth in Small Sat deployments are being projected and observed. Spectrum use is increasing and placing pressure on established systems for coordination in UHF, S, and X bands as well as other space allocated bands. The output power levels of their TT&C (Earth-to-space) can be much higher than the power levels used by the DCS platforms. Consequently, the operation of these TT&C links to Small Sats would cause harmful interference to the DCS receivers on the EESS or MetSat satellites. For the space-to-Earth direction, the space station antennas used by Small Sats are omnidirectional antennas, which could result in significant levels of interference towards the DCS receivers on the satellite.
- Passive Bands: Various international mobile telecommunications (IMT) groups are examining spectrum above 6 GHz as part of 5G growth. Several bands in consideration are adjacent to critical passive bands used for remote sensing. Degradation in ability to use passive bands is a growing concern.
- Space Weather: In accordance with ITU Resolution 657 (WRC-15), review the results of studies, conducted for WRC-2019, relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors, with a view to providing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services.

WG-I thanked NOAA for the detailed report provided.

CGMS-45-WMO-WP-18

The WMO Steering Group on Radio Frequency Coordination prepared a preliminary position paper on the Agenda of the World Radio Communications Conference 2019 (WRC-19) in January 2017. This position paper is available online at https://wis.wmo.int/file=3379.

Among WRC-19 agenda items, thirteen items are related to frequency bands or issues of prime interest or concern for meteorology and the related fields.

Agenda item 1.1: Amateur service in the 50-54 MHz band

Agenda item 1.2: Satellite hard limits at 400 MHz

Agenda item 1.3: METSAT and EESS at 460-470 MHz

Agenda item 1.6: Non GSO FSS at 37.5-51.4 GHz

Agenda item 1.7: Small satellites

Agenda item 1.13: IMT 5G

Agenda item 1.14: HAPS

Agenda item 1.15: FS/MS above 275 GHz

Agenda item 1.16: RLAN 5 GHz

Agenda item 9.1.5: RLAN 5 GHz and reference to radar ITU-R recommendations

Agenda item 9.1.6: Wireless Power Transmission (WPT)

Agenda item 9.1.9: FSS at 51.4-52.4

Agenda item 10: Agenda for next

All might be of specific interest to CGMS members. There are also seven WRC-19 agenda items that are currently not involving specific frequency bands used for meteorological operations but that may potentially have an impact on WMO interests

Following the presentation and discussion of the different related WPs, WGI confirmed the agreement reached at CGMS 44 to continue managing the priority list of WRC-19 agenda items to be regularly reviewed by WGI. The list therefore is organised as follows (HLPP entries and WRC-19 to be considered as priorities for WG-I):

- WRC-19 Agenda Items 1.2, 1.3 and 1.7 (DCS);
- WRC-19 Agenda Items 1.13 Mobile broadband 26 GHz;
- Protection of passive sensing bands from adjacent bands under various agenda items;
- WRC-19 Agenda Item 1.16 (Radio LANs in 5 GHz).

In view of the status of preparation towards WRC-19, WGI concurred that protection of passive sensing bands from adjacent bands under various agenda items is of paramount importance to CGMS and therefore proposes that CGMS addresses the concerns associated to the different WRC-19 agenda items in relation to spectrum allocations for IMT 2020 (5G). Consequently, an action is agreed for WGI chair to draft a letter, on behalf of CGMS, to ITU Secretary-General emphasizing the need for protecting EESS and passive bands necessary for remote sensing. Beyond the agreed HLPP, WGI did not identify the need of new recommendations on this agenda item.

With all WPs on frequency topics presented and discussed, CGMS WG-I recalled that CGMS nominated the Frequency Manager of EUMETSAT as liaison officer between CGMS and SFCG. CGMS WG-I noted with appreciation the work done so far by the liaison officer.

CGMS-45 actions – WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUM	3	1	WGI chair to draft a letter, on behalf of CGMS, to ITU Secretary-General emphasizing the need for protecting EESS and passive bands necessary for remote sensing	End June 2017	**OPEN**	1.3.1

WGI also considered that the existing HLPP properly covers the related agenda item topics and see no need to assign further recommendations on the Frequency Management matters.

3.1 Report from the different agencies on the status of business on frequency related topics in support to Space Weather

CGMS-45-CMA-WP-04 provides the information of FengYun spacecraft and instruments in the area of space weather. It is provided in response to A44.05 (WGI/2). Instrument measurements without interference is considered vital for CMA to conduct space weather service. The working paper informs that FY-3D, to be launched in September 2017, will carry the Space Weather Suite that has ionospheric photometer and aurora imager. FY-3E, to be launched in 2018 will carry the solar X-ray and EUV imager. The recently launched FY-4A carries the space weather impact detectors used to assess the solar influence to the spacecraft and aboard instruments. At the end of the paper there is the feedback of CMA that has recently been returned to an ICTSW survey on radio-frequencies used for space weather, with which the report expresses the concerns about the development of the discussion on frequency management and protection for space weather observations.

CGMS-45-NOAA-WP-05 provided a report on the NOAA Space Weather Satellites; Deep Space Climate Observatory (DSCOVR), GOES-NOP and GOES-R Series, Space Weather Forward Observatory (SWFO), and COSMIC (1 & 2) Series. The NOAA DSCOVR satellite became the operational real-time solar wind spacecraft on July 27, 2016 at 1600 UTC and it continues to operate nominally – all systems are green. There are no significant issues with RF spectrum use. GOES-13 is in the East slot and operationally green. SXI and SEM are yellow (limited). GOES-15 is in the West slot and operationally green. SXI and SEM are green. GOES-14 is in on-orbit storage and green. Spectrum sharing of 1690-1710 band with AWS-3 licensees continues to be developed to protect the adjacent GOES bands. Close monitoring and discussions of other efforts to share L-band also in progress. The GOES-16 post-launch test phase is expected to complete in June, at which time the satellite will be handed over to the NOAA Office of Satellite and Product Operations. After that time, GOES-16 will undergo an additional six months of extended validation before moving to its final location in November, when the GOES-16 data will be deemed operational. During this validation period, additional testing outages may occur. Spectrum sharing of 1690-1710 band with AWS-3 licensees continues to be developed to protect the adjacent GOES bands. Close monitoring and discussions of other efforts to share L-band also in progress. For SWFO, the acquisition process is underway for the spacecraft and associated ground network. The RF spectrum work is underway to identify suitable, available, and likely-to-coordinate frequencies for program consideration.

NOAA is looking to use S-band or possibly X-band. The frequencies need to be dissimilar to DSCOVR and unique to each of the two SWFO spacecraft. COSMIC 2 proceeding towards launch in last quarter of 2017. Spectrum registration is continuing on schedule. GPS Radio Occultation is important to space weather forecasting, however the GPS navigation signal is not recognized for radio occultation. May wish to designate GNSS frequencies as space weather service in support of WRC2023 AI 2.3.

NOAA noted that space weather observations are becoming increasingly important in detecting solar activity events that could impact services critical to the economy, safety and security of administrations. Some of the sensors operate by receiving low-level natural emissions of the Sun or the Earth's atmosphere, and therefore may suffer harmful interference at levels that could be tolerated by other radio systems. No frequency bands have been documented in the Radio Regulations for space weather sensor applications. Administrations have been invited to document, in time for WRC-19, the technical and operational characteristics of space weather sensors and to determine the appropriate radio service designations for space weather sensors; RES657 – 378. Administrations have also been invited to conduct in time for WRC-23, any necessary sharing studies for incumbent systems operating in frequency bands used by space weather sensors, with the objective of determining regulatory protection that can be provided while not placing additional constraints on incumbent services. This is WRC-23 agenda item 2.3. NOAA invited the Space Weather community to help.

CMA commented on the complexity of the resolution 657 document. They asked for guidance in order to provide their input. It was agreed by WGI that the ongoing survey by WMO is helping in the consolidation of these inputs, and if necessary, some support can be provided by WMO experts running this survey. It is expected that the completion and outcome of survey will help in solving these issues.

CGMS-45 actions – WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUM	3.1	2	CGMS/SFCG liaison officer to share SF36-45/D with WGI participants, IROWG chair and IPT-SWeISS members	End June 2017	**OPEN**	1.3
WMO	3.1	3	WMO to share with all CGMS members the outcome of the survey prior to the inter-sessional meeting	August 2017	**OPEN**	1.3

WGI also considered still open Recommendation R44.01 (CGMS agencies to inform their Freq Managers on the space weather activities to ensure the necessary protection and coordination at Freq management level) and see no need to assign further recommendations on the Frequency Management matters.

4. Optimisation/harmonisation of direct readout dissemination (CGMS DB global spec)

4.1 Current systems

There were no papers presented under this agenda item.

4.2 Transition to new direct readout systems (GOES-R, JPSS, FY-3, EPS-SG...) focused on DB/formats avoiding overlap with the agency report in plenary)

CGMS-45-EUMETSAT-WP-26 reported on the progress achieved on the inter-sessional meetings on data formats and formatting agreed by WGI at CGMS 44. Since CGMS-44 there have been two WGI inter-sessional meetings on the topic of data formats and formatting standards. The primary outcome of these meeting was the consensus that inter-agency collaboration is the mechanism to ensure that the evolution of community standards for data representation such as netCDF and its CF convention reflect the requirements of the CGMS community. Therefore, In order to maximize the scope for the leveraging of downstream applications, the CGMS members producing data in netCDF are encouraged to work together in order to document a consistent set of best practices for the representation of satellite imagery data, and to endeavour to get these reflected in the future evolution of the CF convention. It is also confirmed the need of having dedicated points of contact established to pursue this topic. It is also proposed that the nominated points of contact work together to develop a set of best practices, via dedicated inter-sessional meetings for the representation of satellite imagery data in netCDF, and to endeavour to get these reflected in the future evolution of the CF convention.

WGI thanked EUMETSAT for the summary provided and, following a discussion on relevance and interest of pursuing a set of best practices, via dedicated inter-sessional meetings, for the representation of satellite imagery data in netCDF. The outcome of these best practices should also aim at getting these reflected in the future evolution of the CF convention.

In addition, WGI agreed in an action to all WGI members to nominate/confirm points of contact participating in the related inter-sessional meetings.

CGMS-45-NOAA-WP-06 described NOAA's transition to its new direct readout services. It covered the Geostationary Operational Environmental Satellite-R Series (GOES-R) and Joint Polar Satellite System (JPSS) direct readout services. NOAA requested direct readout users register in the DCS Administration and Data Distribution System (DADDS), using the link "Register for Direct Readout and Services Notifications at: https://dcs1.noaa.gov/Account/SurveyForm

GOES-R launched on November 19, 2016, and is now GOES-16., providing the GOES Rebroadcast (GRB) and High Rate Information Transmission (HRIT)/Emergency Managers Weather Information Network (EMWIN) services. The GRB provides Level 1b data products from the Advanced Baseline Imager (ABI) and the space environment and space weather instruments and Level 2 from the Geostationary Lightning Mapper (GLM). Dual polarization facilitates the 31 Mbps data rate within a frequency bandwidth of 9.8 or 10.9 MHz per polarization, using a standard downlink modulation at 1686.6 MHz (L-band). The GRB provides a full disk image in either 5 or 15 minutes, depending on the mode. To receive the data, users

can purchase the necessary equipment (antenna, receiver, computer, and software) from commercial companies for unlimited access to the GRB. GVAR users must upgrade or acquire a new antenna and acquire a GRB compatible receiver/demodulator, and acquire processing systems in order to receive the higher volume of GOES-R series data through the GRB. The GOES-R Product Definition and Users' Guide (PUG) Volume 4 is available at: http://www.goes-r.gov/users/docs/PUG-GRB-vol4.pdf. The GRB Downlink Specification is available at: http://www.goes-r.gov/users/docs/GRB_downlink.pdf

The HRIT/EMWIN service will go operational when GOES-16 becomes GOES-East. The initial offering includes watches, warnings, forecasts and graphics; GOES-DCS observations; environmental products such as tropical weather; ABI Cloud and Moisture Imagery (CMI); ABI Full Disk in Band 2, 7, 8, 9, 13, 14 and 15 (2 km spatial resolution every 30 minutes); and ABI mesoscale images in Bands 2, 7 and 13 every 15-30 minutes. The EMWIN file naming convention follows the WMO format identified in WMO Pub 386. More information is available at http://www.nws.noaa.gov/emwin/index.htm

The JPSS Direct Broadcast is the High Rated Data (HRD) and direct readout services include the Field Terminal Support (FTS) and the Community Satellite Processing Package (CSPP). The JPSS Ground Project funds FTS and the FTS web portal has been operational since March 8, 2017. The FTS node provides the software components, Mission Support Data (including ancillary data, auxiliary data, and Mission Notices), and hardware and software specifications needed for processing the broadcasts and orbital data to assist the DB community in locating the satellites of interest. Access to the FTS web portal is through a self-registration process at https://fts.jpss.noaa.gov. CSPP is a user friendly software processing system funded by the JPSS program that enables DB users to easily integrate algorithms into remote terminals. The CSPP package is available under https://cimss.ssec.wisc.edu/cspp/

CGMS WGI thanked NOAA for the detailed presentations on the plans for transitioning to GOES-R and JPSS.

Following the presentation and discussion of the different related WPs, WGI considered that the existing HLPP properly covers the related agenda item topics. Consequently WGI sees no need to assign further recommendations on the Optimisation/harmonisation of direct readout dissemination (CGMS DB Global specs) and the associated formats specs for the transition to new direct readout systems (GOES-R, JPSS, FY-3, EPS-SG,…).

CGMS-45 actions - WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WGI members	4.2	4	WGI members to nominate/confirm points of contact participating in the related inter-sessional meetings	June 17	**OPEN**	1.4

5. Data collection systems

CGMS-45-ROSHYDROMET-WP-02 addresses the current status and technical specifications of Roshydromet Data Collection System, and related future plans. The DCS was established to provide collection and distribution of meteorological data from the remote areas and to support natural hazards warning system.

WGI was reminded that the Roshydromet DCS was developed according to the international requirements of WMO and CGMS to provide transmission of the messages every 3 hours (standard synoptic hours) as well as storm warnings at any time.

Roshydromet has developed and deployed the national DCS based on Electro-L series GMS with a backup option via the Luch series communication satellites. The Roshydromet DCS system is based on the national technical equipment. The messages transmitted from DCPs to Electro-L N1/N2 and Luch-5B are relayed to the European (Moscow region), Siberian (Novosibirsk) and Far Eastern (Khabarovsk) regional centres of SRC Planeta.

The number of allocated (April, 2017 DCPs is now 585). DCPs are distributed all over the whole territory of Russia, including 114 DCPs in hard-to reach areas (Figure 4, **CGMS-45-ROSHYDROMETWP-02**). The national DCS currently has a reliability of 99.8 % based on the number of messages successfully received.

WG-I thanked Roshydromet for the detailed report and suggested they keep CGMS informed of any relevant updates.

Within **CGMS-45-EUMETSAT-WP-27**, EUMETSAT reminded WGI that the bandwidth allocated to the International Data Collection System (IDCS) was reduced from 33 to 11 channels in 2008 with 22 channels then reallocated to CGMS members for Regional/Domestic use. This paper proposes to re-examine the current and future use of the International channels. The next step proposed is to look at a future common standard or standards addressing:

- Mobile platforms. This is mainly for the IDCS and could be based on an Enhanced High Rate DCP (as described in CGMS-45-EUM-WP-29 - Future high rate DCPs - HRDCPs (ref. to ESA MTG study).
- High Rate DCPs. Both NOAA and EUMETSAT have adopted new standards for HRDCPs. NOAA – 300 and 1200bps, and EUMETSAT – 1200bps. The 1200bps standards could be used as a basis to ensure that each operator is capable of receiving the transmissions from the other CGMS DCS operators in the context of Interoperability and contingency support. This is also looking forward to the new era of Geostationary Meteorological satellites.

Noting that by adopting new transmission standards for the IDCS i.e., greater than 100bps would make better use of the available timeslots and channels available on the IDCS.

In **CGMS-45-EUMETSAT-WP-28**, EUMETSAT presents the current DCP data access mechanisms for web based retrievals and the plans for the future. The paper also proposes a way forward for a common web-based DCP message access mechanism or tool for CGMS DCS operators.

The current method provided by EUMETSAT for DCP web access is via the “DCP Public access service”. DCP user access is controlled with a user name and password. The user can visualise their DCP activity, and can also view the DCP content (as indicated in figures 1 and 2, **CGMS-45-EUMETSAT-WP-28**). Users can also download their DCP messages.

EUMETSAT is planning improvements to web access to better answer new user needs derived from DCP Operator and DCP manufacturer feedback and also taking the functionality that is provided from NOAA’s DCS web services. The following lists potential functionality that better meets the user’s needs.

1. Longer archive. The current archive is 14 days, which could easily be extended to a much larger archive. The optimal timeframe could be arrived at after discussions with the users and manufacturers. With the relatively small size of the DCP messages an archive of several months would not be unrealistic.
2. Push service. A repeated request is for push services to allow the user to be regularly supplied with the selected DCP messages. The push method is not the best solution for EUMETSAT for a number of reasons, but the users are keen to have it. This functionality could be met by providing the users with a web plug-in that would allow them to schedule regular downloads.
3. Time period selection.
4. Download selection of multiple DCP reports.
5. Allow users to update the personnel data via the web interface.
6. Allow users to view their allocation details.
7. Allocation Status. Users could generate requests for new allocations and monitor the progress of ongoing user allocation requests in pre-defined steps.
8. Manufacturers’ database. Access information about manufactures in a global manufacturer’s database.
9. Easy access to DCP supporting documentation and news items.

EUMETSAT plans to implement these features in the coming year.

In analysing the results of the feedback, but also looking towards exploiting the IDCS, and also for contingency purposes, there is a case to consider a common tool or portal that all DCS operators could use to provide access to DCP data. This would provide a familiar tool for all users and operators and only one tool to maintain.

CGMS-45-EUMETSAT-WP-29. This paper presents the work being carried out to define a standard for a future Enhanced High Rate DCPs. It is an overview of the ongoing study by ESA. Under ARTES 5.2 ESA established a study (with SCISYS GmbH) to propose an updated DCP standard that would better fulfil the user needs with special consideration for DCPs used in one of the following cases: Ocean buoy, Ship, Road, Air. These applications cover mainly platforms that can be subject to some kind of movement. Of the above the ocean buoy case is both important in terms of existing applications for DCP, and also the largest “random movement” case to study. An associated user survey was performed with feedback from both EUMETSAT and NOAA to establish the general goals for the new air interface. They included:

- Compatible with the existing FDMA channelization (3kHz for EUMETSAT, 2.25kHz for NOAA);
- Better than current High Rate DCP in terms of phase-disturbance sensitivity (e.g. for ocean buoy use and other moving platforms);
- Data integrity to match HRDCP (i.e. better than 100 Baud and GOES 300/1200);
- Power efficient operation;
- Suitable for adoption by manufacturers world-wide.

Based on discussions between SCISYS and ESA the initial design for an Enhanced Data Collection Platform (EDCP) is based on two possible options, one using traditional BPSK and the other using π/2 BPSK. Even though the proposal for EDCP is running at 1/3 of the rate of HRDCP, and 1dB closer to the theoretical FEC range, it is still achieving around the same effective C/No so the PLL performance will be roughly the same, while it is slightly more tolerant of phase noise. Basically, the computed performance of HRDCP will be matched by EDCP at 5dB less HPA output. Finally, it is worth noting this system is still 2dB better than 100 Baud in terms of EIRP, so a larger HPA than currently used for ocean buoys and other omni-directional antenna cases is not foreseen.

SCISYS and ESA confirmed that there is still work to be done in the detailed design, to identify the best use of symbol interleaving and pilot symbol insertion, to determine the real-world performance of the system with AM/PM effects, as well as considering the higher “data layer” aspects such as standardised headers.

In summary, the new design for an ECP is progressing well, with prototype demonstrations planned for 2017. The derived standard could eventually be adopted by CGMS for mobile platforms.

ROSHYDROMET thanked EUMETSAT for the summary provided and confirmed their support to 1200 bps standards for the Regional DCS.

CGMS-45-EUMETSAT-WP-30 presents the outcomes of the 2016 SATCOM Forum relevant to CGMS held alongside the CIMO Teco (Teco 2106) and the Meteorological Technology World Expo 2016 (Meteo Expo) from the 27th to the 29th September 2016 in Madrid, Spain.

The SATCOM Forum Terms of Reference were approved at CBS-15th session, and formalised at the WMO Congress in June 2015. Membership is open to all representatives of the co-sponsors stakeholders.

WGI was reminded that EUMETSAT (Sean Burns) is the appointed CGMS representative to SATCOM and is also a member of the interim Executive Committee. Information about the Data Collection Systems of CGMS members is contained in Annex II and III of **CGMS-45-EUMETSAT-WP-30**. This data will be reviewed during the WG I discussions and will be used as the CGMS input into the SATCOM Forum meetings.

Several points were emphasised regarding CGMS systems:

- CGMS operators provide access free of charge (within certain constraints);
- Data is available on the GTS – and several other dissemination mechanisms.

Additionally, the Forum would monitor the potential pros and cons of utilising small satellites as a part of future solutions and service systems. The participants also recommended that SATCOM should pay special attention to Least Developed Countries (LDC), Small Island Developing States (SIDS), etc. with an aim to facilitating their use of satcom systems.

The Forum should explore the possibility of establishing a "WMO branded disaster alerting tariff" considering hydrological community (flood warnings) as a test case and find candidate projects. Also establish contacts with networks at senior level (use WMO brand) and try to build a consensus.

CGMS WGI thanked EUMETSAT for the dedicated report and the different working papers and the proposal for consolidation of the IDCS plans in the mid-term future and the possible adoption of a new/additional standard for Enhanced Data Collection Platforms (EDCP) asking to be kept informed of the SCISYS/ESA progress on the design and development of the EDCP (action on EUMETSAT). Similarly, WGI agreed to EUMETSAT proposal to work via dedicated inter-sessional meetings for establishing use cases and then requirements for a common web-based DCP message access mechanism and agreed that an action should be placed on all WGI participants to review annex I of **CGMS-45-EUMETSAT-WP-30** and update the related information in time for the first inter-sesssional meeting.

CGMS-45-JMA-WP-01 reports on the present status of the Data Collection System (DCS) operated by the Japan Meteorological Agency and related future plans, highlighting a recent increase in the number of Data Collection Platform (DCP) stations for tidal/tsunami monitoring to be allocated to DCS regional channels.

JMA has operated the Data Collection System (DCS) since its first Geostationary Meteorological Satellite (GMS) went into operation in 1978. In July 2015, Himawari-8 entered operation and took over the DCS service from MTSAT. The system plays important roles in collecting meteorological information as well as seismic intensity and tidal/tsunami data. In March 2017, Himawari-9 entered a period of in-orbit standby as back-up to Himawari-8, and is expected to take over the service in 2022.

JMA reports an increasing number of DCPs collecting seismic intensity and tidal/tsunami data, JMA remains committed to its support of such collection using Himawari-DCS toward closer monitoring for tsunamis in the Indian Ocean and the Pacific Ocean. To this end, JMA has begun research on next generation DCP systems such as E-DCP, HRDCP and HRD for the development of successor satellites to Himawari-8 and -9 in consideration of increased demand for Himawari-DCS.

WG-I thanked JMA for the detailed report.

CGMS-45-CMA-WP-05 summarises the Chinese Data Collection System along with DCP technical descriptions. Currently the FY- 2G at 105E is operationally used for DCS. It has 433 channels, of which 400 are HDCP channels (750Hz spacing/600bps) and 33 international channels (3KHz/100bps). The Chinese DCS is established based on an approach using Frequency Division with combination of Time Division. Currently 45 HDCP are deployed within China territory.

WG-I thanked CMA for the detailed report.

CGMS-45-NOAA-WP-07 provided an update on the status of Argos and DCS. Regarding Argos (A-DCS), NOAA reported that nearly 2,000 programs/users in over 100 countries are tracking more than 20,000 platforms. NOAA anticipates the use of 399.9-400.05 MHz for non- environmental applications, beginning with the next satellite launches by ISRO & NOAA (~2018-20), with the first Argos-4 instruments. For DCS, NOAA reported that nearly 800 programs/users use DCS to receive data from more than 28,000 active platforms in the GOES footprint. This implies more than 6M observations are delivered to the global observing system daily. The associated DCS Administration and Data Distribution System (DADDS) has 1800 registered users.

NOAA reminded WGI that frequency matters remain a concern:

- Possible Auction of 1675-1695 MHz
- Petition for 1675-1680 MHz
- Use of 401-403 MHz by Microsatellites

WGI thanked NOAA for the detailed and comprehensive report covering all aspects of the DCS and A-DCS under NOAA responsibility. Regarding the frequency matters identified as of concern, WGI confirmed they are all under the frequency topics by WGI.

CGMS-45-ISRO-WP-02 covers the ISRO's contribution to the Data Collection System. ISRO Data collection systems have three major components viz. data collection platforms, data relay transponder and the data receiving stations. The data collection platforms are fitted with different types of sensors depending on the applications. ISRO's prominent DCPs are automatic weather stations, rain gauge, agro-met stations, tide gauges, tsunameters, distress alert transmitters, glacier monitoring stations, river and dam monitoring, seismic monitoring stations, ocean data buoys. The DCPs communicate at different data rates depending on the capability of the transmitters viz from 300bps to 2400bps. The downlink from satellite is in Extended C band typically in the band segment of 4500 MHz - 4520 MHz. Presently around 1400 automatic rain gauges, 1800 automatic weather stations, 600 water resource monitoring terminals and 200 other data collection platforms are deployed across the country. In addition, about 100 data collection platforms are deployed for ocean related observations. It is further expected to increase the number of platforms by about 1000 - 2000 more platform by different user agencies in the near future.

WG-I thanked ISRO for the detailed report and suggested they regularly keep CGMS informed of their continued success.

CGMS-45 actions - WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUM	5	5	EUMETSAT to report to CGMS-46 on the status of progress on future EDCP (ESA study)	CGMS 46	**OPEN**	1.2

CGMS-45 actions - WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
All	5	6	WGI participants to review annex I of **CGMS-45-EUMETSAT-WP-30** and update the related information in time for the first inter-sesssional meeting	Sept 17	**OPEN**	1.2

Following the presentation and discussion of the different related WPs, WGI considered that the existing HLPP properly covers the related agenda item topics. Consequently, WGI sees no need to assign further recommendations on the Data Collection Systems.

WGI also decided to progress in the activities related to this agenda item by specific inter-sessional meetings (x2) on DCS covering the following topics:

- User requirements on Data Access;
- Lessons learnt and feedback on certification process;
- Preparations for SATCOM Forum 2018;
- Status of progress on the EDCP design and development.

6. Best practices for operators support to LEO local processing (Direct Readout/ DBNet/RARS)

CGMS-45-NOAA-WP-08 presented the NOAA Best Local Practices in Support of Local and Regional Processing of S-NPP and JPSS Data. NOAA provided the implementation status of the CGMS best practices, contributions to the best practices in the WMO Guide to The Direct Broadcast Network (DBNet), and the status of the NOAA Direct Broadcast Real-Time Network (DBRTN).

In regards to BP.03 Two Line Elements (TLE) for DB, the NOAA NESDIS Office of Satellite and Product Operations (OSPO) Webpage provides a link to NORAD for POES TLEs. http://www.ospo.noaa.gov/Operations/POES/index.html. Also, spacecraft ephemeris and attitude information is included in the HRD broadcast from S-NPP and JPSS-1, and it is used for real-time geolocation processing in the Community Satellite Processing Package (CSPP). Although there is a use case for predictive TLE data in the event of a spacecraft manoeuvre, S-NPP and JPSS-1 do not have the ability to transmit this data to the ground. The value of TLEs in the aftermath of a manoeuvre is for precise DB antenna pointing.

In addition, the paper proposes to WGI to re-evaluate BP.04, noting that the CSPP LEO and GEO teams at CIMSS/SSEC have investigated using Docker for distribution of CSPP, and while it is technically feasible, there has not been a strong use case identified.

NOAA provided an update on the NOAA Direct Broadcast Real-Time Network (DBRTN), which is a demonstration of low latency infrared and microwave sounder data delivery to NOAA's National Weather Service and is part of the WMO DBNET Program. DBRTN adheres to the DBNET guidelines and best practices and serves as a testbed. Sounder data delivered by DBRTN is being assimilated by the National

Centers for Environmental Prediction (NCEP) to increase the percentage of polar data used in NCEP NWP models and provide backup in case of anomalies in polar global processing. Heritage ATOVS still provided through RARS, but new DBNET will soon include ATOVS. Receiving stations are located at Honolulu, HI; Gilmore Creek, AK; Madison, WI; Miami, FL; Mayaguez, PR; Monterey, CA; Guam, Marianas Islands; Corvallis, OR; Hampton, VA; and New York City, NY.

Raw data records from CrIS, ATMS, IASI, and AMSU/HSB are collected by the receive sites and then sent through FTP to NOAA- Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin. The raw data converted to "level 1B" and then put in BUFR format. The BUFR files are named according to DBNet guidelines and the BUFR data is copied to the CIMSS isolated server and then pulled by NCEP Central Operations (NCO) and EUMETSAT. NCO puts the data on to GTS (CrIS, ATMS and IASI).

WGI thanked NOAA for the status report on its implementation of CGMS best practices and for the update on DBRTN.

WGI noted that no actions have been raised under this AI. WGI also considered that the existing HLPP properly covers the related agenda item topics and see no need to assign further recommendations.

6.1 The Direct Broadcast Network (DBNet) for Near Real-time Relay of Low-Earth Orbit Data WMO paper on DBNet status report

CGMS-45-WMO-WP-10 presents the Guide to the Direct Broadcast Network for Near Real-time relay of Low Earth Orbit Data. WMO indicated to WGI that DBNet is now expanding the established RARS concept to other data types in support of a wider range of applications, integrating the newly established NOAA Direct Broadcast Real Time Network and taking into account the WMO Information System standards for encoding and discovering satellite products.

To guide the DBNet activities, a DBNet coordination Group has been established in 2015. Members of the group are regional DBNet coordinators, agencies providing software for Direct Broadcast processing, the NWP SAF. At its second meeting in 2016, the group elected Pascal Brunel from Meteo-France/NWP SAF as its new chair. The WMO Space Programme team is providing support to the group.

The DBNet coordination group defined the high priority activities for the coming years:

- Consolidate the existing network for IR/MW sounding services, solving specific local problems;
- Complete the infrastructure for Metop and S-NPP/JPSS;
- Implement consistent monitoring of DBNet part of overall latency and address specific timeliness problems;
- Extend the geographical coverage of DBNet, capitalizing on existing capabilities (e.g. Tierra del Fuego, Isla de Pasqua, NW South America, Santa Maria Madre de Dios, Guam);
- Improve the user-friendliness of release process for processing software;
- Advance the implementation of Hi-res IR services (IASI, CrIS);
- Contribute to the implementation of the new WIS metadata standard for DBNet products;

- Strengthen the dialogue with global and regional WMO groups responsible for WIS capacity planning;
- Advance the implementation of FY-3.

WGI thanked WMO for the contents of the guide and the summary provided in the corresponding WP.

CGMS-45-NOAA-WP-11 provided an update of the NOAA DBNET and its impact on short range weather forecasting (noting that results are preliminary). The paper also addressed A44.03 (Forecast impact studies). NOAA DBRTM is part of the WMO DBNET Program and adheres to the DBNET guidelines and best practices. As such, the sounder data is now assimilated by the National Centers for Environmental Prediction (NCEP) and will soon be added to GTS (CrIS, ATMS, IASI).

WGI thanked NOAA for the detailed and comprehensive reports covering the CGMS BPs (including the proposals for further consideration) and of the new NOAA DBNET and the associated preliminary results of ongoing studies regarding impact of such a network on short range weather forecasting.

In addition, CGMSSEC recalled that the Space Weather Task Team has identified the need of getting access in quasi near real-time to Radio Occultation data to lower the latency for derived ionospheric information for space weather. For achieving the related timeliness requirements the contribution of the regional RARS/DBNet systems might be fundamental.

WGI noted that no actions have been raised under this agenda item. WGI also considered that the existing HLPP properly covers the related agenda item topics and see no need to assign further recommendations.

6.2 CGMS agency best practices in support to local and regional processing of LEO direct broadcast data

In **CGMS-45-EUMETSAT-WP-31** WGI has been reminded on the purpose and scope of the CGMS agency Best Practices. This one slide paper has been considered necessary to help focusing the understanding of the different agencies when addressing the related Best Practices. The idea for this one slide paper originated on the different inter-sessional meetings on this topic between CGMS 44 and 45 noting that there was not focused understanding shared between the participants of the sessions. In summary the CGMS agency best practices:

- Expresses the commitments taken by the CGMS agencies operating DB satellites with respect to the coordination and support provided to the Direct Broadcast user community.
- The coordination and support is required by the user community to successfully establish and operate optimised DB reception and processing systems compatible with the different DB satellites.
- CGMS agencies operating DB satellites need to guide the user community towards the new capabilities of future satellites and the next generation of DB reception systems.

- By adopting the Best Practices, CGMS Agencies are also increasing users' access to data, improving timeliness of satellite data in environmental models and reducing demands on alternative data distribution systems.

In **CGMS-45-EUMETSAT-WP-32** are presented the updates of the CGMS Agency Best Practices in support to Local and Regional Processing of LEO Direct Broadcast data, first presented as CGMS-44-EUM-WP-07. The paper has been written in coordination with all CGMS members via dedicated inter-sessional meetings after CGMS 44.

Manufacturers and operators of Direct Broadcast reception stations for the polar orbiting satellites critically depend on support from the satellite operating CGMS agencies. This includes the provision of technical specification of the Direct Broadcast, TLE orbit information, software packages for product processing, auxiliary operational data for instrument processing as well as operational coordination.

To be noted that changes in the Best Practices relative to the CGMS-44 version are explained at the beginning of each section using grey italic text. This explanatory text is not part of the Best Practice. For a full change record, a separate document **CGMS-45-EUMETSAT-WP-46** has been created and will be maintained by EUMETSAT.

WG-I thanked all participants of the different related inter-sessional meetings for the efforts put in preparing the updated proposal for Best Practices and the comprehensive analysis performed.

WGI endorsed (with the following amendments) the proposed changes to or new Best Practices

- **BP-3** (update) agreed
- **BP-4** (update) agreed with the following comment: the Best practice needs further elaboration under a) to differentiate between a pre-launch **test** version of the processing package and the operational version after end of commissioning of the satellite and as soon as feasible for the related CGMS member.
- **BP-07** (new) agreed
- **BP-08** (new) agreed
- **BP-09** (new) although the idea proposed under the BP is agreed by WGI it is considered that the BP as presented needs further elaboration to subsume the purpose of a BP without unnecessary detailing and constraining technical aspects of mission specific implementations.
- All other BPs remain unchanged and WGI did not requested any modification or amendment

WGI also took note of the proposal for possible BPs under section 11 of **CGMS-45-EUMETSAT-WP-32** and agreed to work in dedicated inter-sessional meetings to prepare the related draft version for next CGMS 46 meeting and focusing on:

- CGMS operators to consider the advantages of using RHCP/LHCP as a means to minimise interference against the simplicity/affordability of the Direct Broadcast stations and to formulate a CGMS Agency Best Practice on use of Circular Polarisation for Direct Broadcast.

- CGMS to consider the advantages of orbital phasing between satellites as a measure for reducing pass scheduling conflicts and maximising the amount of instrument observation collected.

In the identified inter-sessional meetings re-elaboration of the proposed BP-09 will also take place. WGI also noted that the references to docker as the "preferred" tool for S/W delivery and installation needs to be re-assessed during the inter-sessional meetings and action is raised for that.

WGI confirmed recommending to CGMS Plenary the adoption as CGMS Agency Best Practices in support to Local and Regional Processing of LEO Direct Broadcast data (BP 1-8 as amended above).

In **CGMS-45-EUMETSAT-WP-45**, EUMETSAT presented to WGI a proposal for tracking/documenting the status (or plans) of implementation of the agreed BPs for each one of the satellites having a Direct Broadcast service. The proposal has been briefly evaluated by WGI and agreed in principle. However, an action is assigned to all CGMS members having (or planning to have) satellites with a Direct Broadcast service to further evaluate the draft template for reporting status of implementation and to address possible updates in the first of the inter-sessional meeting on DB topics identified above.

CGMS-45-EUMETSAT-WP-46 is presented by EUMETSAT as the first attempt to maintain a change record of the modifications of the BPs. WGI, in the absence of more consolidated document change control mechanisms, agreed of the proposal and suggested that this activity be reported by EUMETSAT on regularly basis (e.g. at each CGMS WGI meeting).

CGMS-45 actions – WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
All	6.2	7	WGI to re-assess during the dedicated inter-sessional meetings the aspects of S/W delivery and installation needs in BP.04 for avoiding, if considered adequate, making explicit reference to any tool or package.	CGMS 46	**OPEN**	1.4.4
All	6.2	8	CGMS member with satellites with a Direct Broadcast service to evaluate the draft template for reporting status of implementation and to address possible updates in the first of the inter-sessional meeting on DB topics identified above.	October 17	**OPEN**	1.4.4

Following the presentation and discussion of the different related WPs, WGI considered that the existing HLPP properly covers the related agenda item topics. Consequently, WGI sees no need to assign further recommendations on the CGMS Best practices in support to local and regional processing of LEO direct broadcast data.

WGI also decided to progress in the activities related to this agenda item by specific inter-sessional meetings (x3) on CGMS Best practices in support to local and regional processing of LEO direct broadcast data covering the following topics:

- Revision of BP 04 details for S/W delivery and installation needs ;
- Evaluate the draft template for reporting status of implementation of BP by each one of the agencies with satellites with a Direct Broadcast service (operational or planned);
- Re-evaluation of proposed draft BP.09;
- Evaluation and drafting of potential additional BPs (section 11 of **CGMS-45-EUMETSAT-WP-32**).

7. Review and updating of the HLPP

CGMS-45-CGMS-WP-10 and **CGMS-45-CGMS-WP-11**

Addressed the status of implementation HLPP targets under WGI and proposal for a revised HLPP set of targets for WGI for the next HLPP period.

1.2.1. is considered achieved as SATCOM Forum is an integral part of the WGI agenda and takes care of DCS

1.2.2. WIP covered by IS

1.2.3. Retained as HLPP, documenting the certification process for next CGMS and topic for IS

1.2.4. Retained as HLPP

1.2.5. Work in Progress (WIP) covered by Inter-sessional meetings

1.3.1. Proposed to close

1.3.2. Proposed to close with reference to the DB BPs

1.3.3. WIP covered by specific letter this year and dedicated IS on the topic

1.4.1. WIP covered by IS

1.4.2. Open for CGMS 46

1.4.3. WIP, BPs in place, GRB User group established.

1.4.4. WIP, BPs

1.4.5. WIP, BPs

8. Nomination and representatives at meetings

WG-I discussed nominations for CGMS-46 and agreed in proposing to plenary the following:

Co-chairs:

Vanessa Griffin (NOAA)
Sergey Uspensky (Roshydromet)

Rapporteur:

Joaquin Gonzalez Picazo (EUMETSAT)

CGMS-SFCG Liaison Officer:

Markus Dreis (EUMETSAT)

CGMS Representative at SATCOM Forum:

Sean Burns (EUMETSAT)

9. Any other business

At a joint session, Working Group 1 and 4 discussed the need to review the scope of both working groups to address overlap and to consider adding relevant topics related to satellite and ground system operational topics not currently covered in either of the two working groups.

The working groups are recommending to the CGMS plenary that a small task team be established to examine the current Terms of Reference in light of the thematic areas covered by both working groups. The team should propose additional operational topics as well as possible alternatives for realignment of the themes for both working groups to include the possible merger of the two working groups.

This study would support many of the on-going concerns of the CGMS including the integration of the topics discussed in the Space Weather Task Team into the activities of the CGMS working groups.

The two working groups identified a number of new themes/topics related to satellite and ground system operations that could be considered:

- operational decision making in response to space debris collision avoidance;
- space situational awareness and response;[1]
- space weather data formats, and protocols for data sharing;[1]
- reporting of satellite anomalies associated with space weather events;[1]
- implementation of efforts required under the CGMS contingency plan developed by Working Group 3;
- implementation of the Indian Ocean Data Continuity plan;
- CGMS preparations for the "Big Data" era;
- Information Technology security requirements for sharing data among the CGMS members.

If this recommendation is approved by the CGMS Plenary, the co-chairs and rapporteurs of Working Group I and Working Group IV will establish the task team and set the agenda for the study. The team's objective will be to make recommendations for additional CGMS Working Group themes/topics and possible alignment of the two working groups prior to the CGMS 46 meeting. The WG chairs will seek membership on the team that is representative of CGMS member agencies currently participating on either Working Group I or Working Group II along with the other CGMS working groups and task teams.

CGMS-45 actions – WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WGI and WGIV chairs and rapporteurs	9 (AOB)	A45.09	A small task team be established to examine the current Terms of Reference in light of the thematic areas covered by both working groups. The team should propose additional operational topics as well as possible alternatives for realignment of the themes for both working groups to include the possible merger of the two working groups. A dedicated WP with recommendations for additional CGMS Working Group themes/topics and possible alignment of the two working groups prior to the CGMS 46 meeting.	CGMS-46	**OPEN**	

[1] *"Operational" topics identified by the Space Weather Task Team that need to be assigned to a CGMS working Group.*

10. Date/time of inter-sessional activities/meetings in 2017-2018 [CGMS-45 -> CGMS-46]

WGI addressed the need of achieving progress in the HLPP and preparing for CGMS-46 through dedicated inter-sessional meetings and it was agreed to group them by themes as follows:

I. WGI-IS-Space Weather Frequency related topics for WRC-19. Currently only one inter-sessional meeting is agreed and proposed around the SFCG 2017 meeting (6-13 Sept). Currently the proposed date is 7 Sept 2017 (12:00 UTC).
II. WGI-IS-DCS. Theme is DCS and SATCOM Forum Direct and it is proposed to organise x2 inter-sessional meetings with the following dates:
    - 18 October 2017 (12:00 UTC)
    - 21 February 2018 (12:00 UTC)

III. WGI-IS-Formats. Theme is Data formats and Formatting standards and it is proposed to organise them every 3 months with the following dates:
    - 13 September 2017 (12:00 UTC)
    - 13 December 2017 (12:00 UTC)
    - 14 March 2018 (12:00 UTC)
IV. WGI-IS-DB. Theme is Direct Broadcast Best Practices and it is proposed to organise them quarterly with the following dates:
    - 6 September 2017 (12:00 UTC)
    - 17 January 2018 (12:00 UTC)
    - 11 April 2018 (12:00 UTC)

Frequency related topics, if necessary to be addressed in specific inter-sessional meeting will be organised around the DB and DCS related ones.

11. Review of actions/conclusions, preparation of WG report for plenary

Status of WG I CGMS-45 actions and recommendations resulting from CGMS-45 discussions:

WGI actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	WGI/6	A43.06	WMO to assess the impact of improved data latency from polar orbiters on NWP (WMO Impact Workshops) and other applications	Next WMO workshop will take place in May 2016 (China), hence there might be a verbal/preliminary report only to CGMS-44. Discussed at CGMS-45.	(CGMS-44) New deadline CGMS-45	**OPEN**	1.1.2
CGMS space agencies	WGI/2	A44.05	CGMS agencies to provide prior to CGMS 45 a report on the space weather activities (including spacecraft and instruments) of relevance on frequency management and protection topics	CGMSSEC to request SWTT representative to provide a paper to WGI to this purpose (and present it in WGI). SWTT informed by e-mail 7 April 2017. CGMS-45 NOAA-WP-04 Agency reports on Frequency topics to include a dedicated chapter on space weather	(Feb 2017) CGMS 46	**OPEN**	1.3
CGMS space agencies	WGI/6.1	A44.08	CGMS agencies with satellites with DB and RO occultation sensors to assess the technical feasibility of a RARS/DBNet RO occultation service in support of the Space Weather community.	Deadline extended following CGMS-45 discussions. CGMSSEC to request IROWG representative to provide a paper to WGI to this purpose (and present it in WGI) NOAA does not have any ability to use RARS for RO data	(CGMS-45) CGMS 46	**OPEN**	1.4
CGMS space agencies	WGI	A44.09	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs	Deadline extended following CGMS-45 discussions. As a member, NOAA agrees that the GODEX-NWP group would be an excellent source of information on the planned types of next-gen GEO data to be disseminated	(CGMS-45) CGMS 46	**OPEN**	

WGI actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				and methods of data dissemination between the international NWP modelling centres. The GODEX-NWP group is also at the forefront of RARS endeavours.			
CGMS space agencies	WGI/2	R44.01	CGMS agencies to inform their Frequency Managers on the space weather activities to ensure the necessary protection and coordination at Frequency management level		Long term	**OPEN**	1.3
CGMS space agencies	WGI	R44.03	From CGMS-44 WGII: Agencies to explore the possibilities to develop suitable processing packages to support a direct broadcast implementation of RO processing, within the DBNet to improve timeliness for space weather applications			**OPEN**	1.4

CGMS-45 actions – WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUM	3	A45.01	WGI chair to draft a letter, on behalf of CGMS, to ITU Secretary-General emphasizing the need for protecting EESS and passive bands necessary for remote sensing	End June 2017	**OPEN**	1.3.1
EUM	3.1	A45.02	CGMS/SFCG liaison officer to share SF36-45/D with WGI participants, IROWG chair and IPT-SWeISS members	End June 2017	**OPEN**	1.3
WMO	3.1	A45.03	WMO to share with all CGMS members the outcome of the survey prior to the inter-sessional meeting	August 2017	**OPEN**	1.3

CGMS-45 actions – WGI						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS WGI members	4.2	A45.04	WGI members to nominate/confirm points of contact participating in the related inter-sessional meetings	June 17	**OPEN**	1.4
EUM	5	A45.05	EUMETSAT to report to CGMS-46 on the status of progress on future EDCP (ESA study)	CGMS 46	**OPEN**	1.2
CGMS members	5	A45.06	WGI participants to review annex I of **CGMS-45-EUMETSAT-WP-30** and update the related information in time for the first inter-sesssional meeting	Sept 17	**OPEN**	1.2
CGMS members	6.2	A45.07	WGI to re-assess during the dedicated inter-sessional meetings the aspects of S/W delivery and installation needs in BP.04 for avoiding, if considered adequate, making explicit reference to any tool or package.	CGMS 46	**OPEN**	1.4.4
CGMS members	6.2	A45.08	CGMS member with satellites with a Direct Broadcast service to evaluate the draft template for reporting status of implementation and to address possible updates in the first of the inter-sessional meeting on DB topics identified above.	October 17	**OPEN**	1.4.4
WGI and WGIV chairs and rapporteurs	9 (AOB)	A45.09	A small task team be established to examine the current Terms of Reference in light of the thematic areas covered by both working groups. The team should propose additional operational topics as well as possible alternatives for realignment of the themes for both working groups to include the possible merger of the two working groups. A dedicated WP with recommendations for additional CGMS Working Group themes/topics and possible alignment of the two working groups prior to the CGMS 46 meeting.	CGMS-46	**OPEN**	

CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

Working Group II:
Satellite data and products

WG II REPORT

Co-chairs:

Stephan Bojinski (WMO)
Dohyeong Kim (KMA)

Rapporteurs:

Mitch Goldberg (NOAA), Kenneth Holmlund (EUMETSAT)

1. Objectives, CGMS survey outcome

The meeting opened on Monday 12 June 2017 at 09:00, co-chaired by and.

The list of participants is included in the Annexes of the CGMS-45 report.

WG II on Satellite Data and Products is the forum where aspects of technical and scientific nature related to instrument calibration and products from satellites are discussed. The agenda is determined by a) papers provided by the CGMS International Science Working Groups and other international initiatives (such as GSICS and SCOPE), and reports by user communities, such as in the areas of oceanography and marine meteorology, and atmospheric composition; b) papers that relate to actions and recommendations from previous meetings and c) by additional submissions of papers from delegates.

2. Review of actions and recommendations from previous meetings

The CGMS-44 actions and recommendations were reviewed and the summary status is provided in the Annex to this report.

3. Interaction between WGII and ISWGs (ref. WGII ToRs)

The Group recalled the WG II ToRs that were endorsed at CGMS-44. It was noted that the ISWGs had closely followed the guidance provided in their reports to CGMS-45.

4. Working papers on international groups/initiatives (IWWG, IPWG, ITWG, IROWG, ICWG, SCOPE-CM and GSICS EP)

CGMS-45-ICWG-WP-01

This working paper presents a summary report of ICWG activities in 2017 and recommendations to CGMS from its topical groups. The ICWG held its first meeting in Lille, France in May of 2016, and now has been reorganized as an organization that includes invariant and broad Sub-Working Groups with short-term and dynamic Topical Groups within each Sub-Working Groups. The planned Sub-Working Groups for ICWG-2 are as follows: Algorithms, Assessments, Climate Applications, Weather Applications, Software and International Issues, and Future Systems. The last Sub-Working Group would also include the linkages to other CGMS Working Groups. The Topical Groups within these Sub-Working Groups will address

specific activities. This organization will be implemented at the next ICWG, which is slated for June 2018. In response to A44.12, the ICWG has partnered with the ICARE Thematic Center based in Lille, France to collect the "Golden-Day" HIMAWARI-8 cloud product output. The two days selected for the IWWG inter-comparison are now part of this activity, as well as the comparison days selected for the SCOPE-CM IOGEO project and the GSICS project. The list of parameters remains the same as those listed in the white paper written in response A42.02. These parameters include: cloud mask (CM), cloud top temperature (CTT), cloud emissivity, effective radius (Re), and cloud optical thickness (COT). These cloud parameter retrievals are increasingly used for near-term (now-casting), short-term (weather forecasting), medium-term (regional monitoring), and decadal (climate monitoring) predictions, as well for potential improvements in the cloud and convection parameterizations adopted in weather and climate models.

The Group identified a need for inter-comparison studies from various satellite derived thunderstorm properties over the life cycle of several thunderstorms.

There are strong links to IWWG; IPWG links could be strengthened in the area of cloud microphysics and scattering libraries of hydrometeors (liquid, ice), since there are common interests in both groups.

CGMS-45 recommendations - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
ICWG	4	R45.01	ICWG to liaise with IPWG to explore common interests in the area of cloud microphysics and scattering libraries of hydrometeors (liquid, ice).		**OPEN**	3.6.3

CGMS-45-EUMETSAT-WP-47

This document reports on the status of the WMO Sustained Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) activity.

SCOPE-CM, initiated by the WMO Space Programme in 2008, is dedicated to increase the maturity, quality, and coordination of climate data record generation activities across space agencies and their associates. Since 2012, SCOPE-CM has helped steward nine CDR generation projects via the provision of best-practice guidance and monitoring. SCOPE-CM is now evolving to address additional CDR sustainment and coordination goals, including standards for research-to-operations transitions, such that the resulting virtual CDR portfolio will ultimately provide greater overall ECV coverage in a more effective manner. The SCOPE-CM Implementation is under revision to document these new thrusts.

Jeff Privette explained the role of SCOPE-CM in the path for exploiting satellites in climate monitoring. New members confirmed are KMA and ISRO. Phase 2+ focuses on transitioning research to sustained production.

Tony Mannucci asked about assessing structural uncertainty by releasing multiple versions of RO datasets. Having multiple versions of the same dataset can be valuable, but users require guidance. The SCOPE-CM project ROCLIM is coordinating six groups producing RO datasets.

ISRO asked about the criteria for a CDR: the SCOPE-CM maturity matrix should be used.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
SCOPE-CM Chair	4	A45.01	SCOPE-CM Chair to inform ISRO about the maturity matrix model, to enable its application to ISRO datasets.	15 Aug 2017	**OPEN**	3.3.2

CGMS-45-IROWG-WP-01

This report summarises the IROWG-5 meeting held on September 8-14, 2016 near Graz in Austria. It is based on the recommendations from the four IROWG subgroups: NWP, Climate, Space Weather and Receiver Technology/Innovative Occultation Techniques. The four key recommendations for CGMS, endorsed by the IROWG community at the plenary session, are summarised below. The full set of recommendations, relevant at CGMS level, at satellite operator level, and at IROWG level, is available at www.irowg.org.

For work in the immediate future CGMS-45 is invited to endorse the following four main IROWG-5 recommendations:

- Ensure that both equatorial and polar components of COSMIC-2 are fully funded and launched; this is required for Numerical Weather Prediction, Climate, and Space Weather;
- IROWG recommends targeting at least 20,000 occultations/day, to be made available to the operational and research communities of Numerical Weather Prediction, Climate, and Space Weather;
- International space agencies (in particular NASA, ESA and CNSA, where LEO-LEO and GNSS-RO&-Reflectometry proposals are pending) to support mission preparation and implementation projects towards LEO-LEO microwave occultation and GNSS-RO&-Reflectometry demonstration missions. This should include recommending new OSSEs for the LEO-LEO observations;
- IROWG recommends that CGMS should encourage GNSS providers and agencies to make ICDs of GLONASS and Beidou Open Service signals available as soon as possible, in order to allow RO instrument providers to design and develop the future receivers without uncertainties due to missing information.

Workshop minutes and this CGMS working paper from IROWG-5 are available at http://www.irowg.org, all given presentations at http://wegcwww.unigraz.at/opacirowg2016.

As key issue identified was the relationship between the new agency-led GNSS-RO missions and the commercial GNSS-RO proposals; SPIRE made a good first step, but more analysis is required; IROWG supports the aims of the NOAA commercial weather data pilot and OSSE activities.

A EUMETSAT-funded study carried out by ECMWF demonstrated the need for the COSMIC-2/ FORMOSAT-7 polar component.

The potential use of radio occultation based on Jason-CS/Sentinel-6 was raised, especially for diurnal sampling. It needs to be clarified whether FY-3F and follow-on GNOS receivers have GNSS reflectometry capability.

Rob Kursinski and Gottfried Kirchengast may be consulted for LEO-LEO RO OSSEs, but funding for such experiments is currently lacking. IROWG should come up with a detailed proposal.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
IROWG	4	A45.02	IROWG to develop a detailed proposal for OSSEs regarding LEO-LEO MW occultation and GNSS-RO&-reflectometry.	1 Nov 2017	**OPEN**	1.1.4

CGMS-45-IWWG-WP-01

Régis Borde, IWWG co-chair, presented outcomes of the 13th Int'l Winds Workshop, the status of IWW13 and CGMS recommendations, and other items of relevance to CGMS. The workshop discussed the 3rd AMV Inter-comparison study, AMV quality information from derivation, and reviewed the wind requirements in WMO-OSCAR. The working groups discussed various wind extraction methods, and data assimilation.

New-generation GEO satellites allow derivation of more AMVs, better quality due to better and spatial resolution, and spectral channels. Neutral to positive impact noted for AMVs, positive impact from scatterometer winds. Errors in pixel-based cloud schemes need to be identified. IWW defined a plan for the 3rd wind intercomparison, based on two image triplets from H-8/AHI on 21 July 2016, allowing for collocation with radiosondes and with MISR. Coordination with ICWG is underway. Producers will carry out two sets of tests (all producers using a prescribed configuration, each producer using their own configuration). Results should be available by IWW14 in April 2018. The analysis is funded by the EUMETSAT NWC-SAF through a visiting scientist contract.

IWW is compiling a report on the status of global wind processing and reprocessing, as part of a SCOPE-CM project led by JMA.

IWW also developed a new AMV BUFR format to account for new variables that are useful for assimilation, and submitted the format to WMO for review.

Launch of ADM-Aeolus is foreseen in January 2018; its HLOS winds are expected to have a positive impact on forecast skill. Work is ongoing to derive 3D wind products from the hyperspectral AIRS and IASI instruments.

The demonstration of 3D winds from AIRS over polar regions is of potential use for polar prediction/Year of Polar Prediction (YOPP); comparisons of MODIS and AIRS winds impact have been carried out.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
IWWG	4	A45.03	IWWG to liaise with the NOAA representative on PSTG (Jeff Key, jeff.key@noaa.gov) regarding the potential use of 3D winds from AIRS for Year of Polar Prediction studies.	1 Jul 2017	**OPEN**	

IWWG plans to provide updates to OSCAR/Space and OSCAR/Requirements.

CGMS-45-IPWG-WP-01

Working paper IPWG-WP-01 was written by the two co-chairs of the International Precipitation Working Group (IPWG), Dr. Ziad Haddad and Dr. Dong-Bin Shin. The report highlights the recent achievements of IPWG during the past year, including the outcome of IPWG-8/IWSSM-5 (October 2016, Bologna, Italy) and provides an outlook for the planned activities over the next two years. The report also addresses recommendations and actions from CGMS-44, as well as any IPWG items from the HLPP.

The IPWG-8 was held at the Consiglio Nazionale dell Recerche (CNR) congress facility of the Institute of Atmospheric Sciences and Climate (ISAC) in Bologna, Italy from October 3-7, 2016. It was held jointly with the 5th International Workshop on Space-based Snowfall Measurement (IWSSM-5). The meeting was attended by nearly 160 participants representing 23 countries that included 63 oral and 88 poster presentations. Additionally, a satellite training course was given, which took place in parallel to the IPWG-IWSSM workshop; 30 participants attended the three day course.

Two new co-chairs were selected; Ziad Haddad (NASA/Jet Propulsion Laboratory, USA) and Dong-Bin Shin (Yonsei University, Korea).

The workshop led to findings along the following themes: Validation, Research, Applications, Data Asssimilation, and Scattering.

Science highlighted included the dependence of precipitation on cloud types.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WG III	WGII/4		Study the continuity of the current constellation of passive microwave sensors (for high quality satellite precipitation products for weather, climate and hydrological applications) through proper coordination of satellites, sensors and equatorial crossing times.	CGMS-46	**OPEN**	1.1.6

The Group furthermore stressed the need for continuity of existing in situ precipitation observation networks, and access to those that are currently inaccessible but already in operation, and explore new sources of in situ observations.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WG IV	WGII/4		Ensure timely (< 1 hr) and free access to all geostationary visible, IR and water vapour data that is required to improve global hydrological prediction.	CGMS-46	**OPEN**	

Recognizing the need to develop synergies between IPWG and other ISWG's (most specifically ICWG and ITWG), enhanced travel assistance is needed for the IPWG and ISWG co-chairs in order to build meaningful collaborations (covered as a general point under ISWG funding).

CGMS-45 recommendations - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGII/4	R45.02	Recognizing that IPWG has considerable expertise in precipitation science and applications, IPWG requests the WMO (likely via VLAB) to establish a regular training event on precipitation data sets and applications, for which IPWG will provide disciplinary expertise.		**OPEN**	3.5.3

The detailed requirements for a VLab training event on Precipitation (e.g., an event week) need to be discussed between IPWG, the VLab and application communities (agriculture, hydrology, etc.).

CGMS-45 recommendations - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS member, WG III	4	R. 45.03	Recognizing the need for continued enhancements to the baseline precipitation observing system to a broader user community (including hydrology, NWP prediction, RTM modelling), IPWG recommends that CGMS members continue to pursue advanced sensors through close coordination with CGMS ISWG's including IPWG, ITWG and ICWG.		**OPEN**	

IPWG proposed additions to HLPP 2017-2021:

- Under **section 1.1**, *IPWG proposes that a statement be added, perhaps as an amendment of 1.1.1, as follows – "Where possible, the overpass times of the baseline LEO be staggered in a way that maximizes the sampling of the diurnal cycle."*
- Under **section 3.1**, *IPWG proposes that a statement similar to 3.1.1 and 3.1.2 be developed for passive microwave sensors.*
- Under **section 3.2**, *IPWG proposes that a statement be added – "Establish a framework for the merging of multi-sensor (e.g., Visible, IR, MW, lightning) radiances and/or precipitation retrievals that is applicable for various time scales (e.g., flash flood to climate)."*

No update was provided regarding the status of precipitation CDR generation by groups worldwide. Furthermore, the linkage of IPWG to the WCRP GEWEX scientists should be strengthened since these are an important driver of science requirements.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
IPWG	4	A45.04	IPWG to produce documentation on precipitation climate data record generation and related activities worldwide, including prospects for continuity	CGMS-46	**OPEN**	5.1

CGMS-45 recommendations - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
IPWG	4	R45.04	IPWG to maintain close relationship with GEWEX in its work, and at its next workshop (e.g. through a joint session)		**OPEN**	

CGMS-45-GSICS-WP-02

Mitch Goldberg briefed on GSICS activities. He recalled the purpose of GSICS and showed examples for the tools made available (inter-calibration of AHI and INSAT-3D against IASI). GSICS will provide a comprehensive report on the state of the global observing system with respect to instrument performance and intercomparisons with GSICS reference instruments. 9 new products were accepted into the GSICS demonstration phase. NOAA uses ICVS to monitor instrument performance. Collaboration with ISCCP is ongoing. GSICS EP is working on a guide to products and services, and best practices and guidelines on instrument performance monitoring, so that they can be considered in all satellite programmes. GSICS will support the OSCAR/Space Science and Technical Advisory Team.

The GSICS framework could successfully be used by the Space Weather Task Team. A GSICS User workshop is organised at AOMSUC-8.

CMA thanked Mitch Goldberg to accept the GSICS Executive Panel Chair role, with Kenneth Holmlund (EUMETSAT) as vice-chair. Space weather instruments and measurements are “in situ” and therefore quite different from remote sensing. Cross-benefits with GSICS are clearer for Radio Occultation measurements.

GSICS Data Working Group ToRs were approved by the GSICS Executive Panel. Masaya Takahashi (JMA) elected GDWG Chair.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
GSICS	4	A45.05	GSICS to produce annual state of the observing system report to be delivered at CGMS	CGMS-46	**OPEN**	3.1

The EUMETSAT working paper **CGMS-45-EUMETSAT-WP-33** summarizes the response of the CGMS Task Team on Calibration Events Logging to action CGMS-43: WGII/3 Action 43.01 “Calibration events logging task team to prepare a white paper outlining the set of parameters, the nomenclature, and the standards to be used for reporting on instrument calibration across space agencies.” The GSICS Data Working Group reviewed this version of the paper and has confirmed to agree with the current content. The Task Team was established further to a CGMS-42 action [CGMS-42: WGII/3 Action 42.0], and comprises representatives from the CGMS Satellite Operators and WMO. The Task Team contributed to the Global Space-based Inter-Calibration System (GSICS) action(s) asking these agencies to organise for each satellite their instrument calibration information on a single landing page. The WMO modified their WMO-OSCAR web-interface to allow linking to these landing pages. This working paper has been prepared by the Task Team and presents guidelines for reporting on instrument calibration events across the CGMS Satellite Operators, i.e., the set of parameters, the nomenclature, and the standards to be used for this reporting. The Task Team reached consensus on the guidelines proposed in this paper, and recommends CGMS to endorse the guidelines and encourage the CGMS Satellite Operators to apply these guidelines for preparing their instrument landing pages in WMO-OSCAR and for their populating databases of calibration

events for past, present (and future) satellite missions. Finally, the task team recommends that the implementation of the proposed guidelines shall be further discussed and worked out in the context of GSICS.

Agencies to assess compliance of each agency with the guidelines, and establish list of instruments to be addressed by the calibration logging system.

Routine intercomparison should be part of common set of tools for new ground systems.

Slow drifts of instruments are addressed in the guidelines.

CGMS-45 recommendations - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
GSICS	4	R45.05	Calibration events logging task team be folded under GSICS as a task team		**OPEN**	3.1
GSICS	4	R45.06	Under the task team, agencies should assess the compliance of each agency with the new guidelines on events logging, and establish a list of instruments to be addressed by the calibration logging system.	CGMS-46	**OPEN**	

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS agencies	4	A45.06	CGMS Agencies to implement Landing Pages on calibration events accessed via WMO-OSCAR.	CGMS-46	**OPEN**	3.1

5. Working papers on other international science community reports - oceans, CEOS VCs

In **CGMS-45-NOAA-WP-09,** NOAA presented on using a combination of polar-orbiting and geostationary data to support applications. The combination of relatively good spatial resolution and large cross orbital swaths make polar-orbiting weather satellites ideal for monitoring the entire planet. Most notable for their large impact on numerical weather prediction (NWP) analyses and forecasts, they have also been used in a range of environmental applications far beyond meteorology. These non-meteorological applications (NMAs) cover the gamut from floods, fires, trace gases, droughts, and many more. In this manner, these satellites are truly environmental.

Meteorological satellites operating in geostationary orbits have the advantage of very high temporal resolutions. Coupled with improvements from new geostationary imagers we envision an integration of geostationary and polar orbiting satellites for these NMAs, as well as more opportunities to cover a wider breadth of environmental applications.

NOAA promotes products with users through Proving Ground initiatives, in the area of fire, volcanic ash, flood mapping, sea ice etc.

CGMS-45-EUMETSAT-WP-23

K. Holmlund recalled the objectives of the CEOS-CGMS non-met applications report. The report was structured around the following product groups:

- Aerosol-Dust-Volcanic Ash, O3, SO2
- SST-Ice-Ocean Colour-
- Fire-LST-Snow-Inland Water/Flood – Vegetation-Epidemiology-Albedo

Focus of the study was on GEO capabilities and imagery applications; possible follow-up themes could be flood mapping, drought, aerosol and dust.

WGII in its inter-sessional meeting recommended that agencies should consider the CEOS-CGMS non-met applications report and map their ongoing and planned activities against the items identified in the report, along the lines of: (i) what is being done, (ii) what is coordinated internationally, (iii) areas where enhanced international coordination is needed. This should include a critical assessment of the added value of GEO (diurnal cycle detection, cloud-free pixels etc.) compared to dedicated missions (e.g., GOCI vs AHI).

Potential candidates for follow-up action emerged in the areas of:

- Aerosols/dust
- Drought
- Fire
- Flood mapping
- Downward shortwave radiation

The following existing community efforts were noted:

Fires:

There is an effort on the use of GEO for active fires and FRP , led by University College London (Martin Wooster) among others. A coordination mechanism exists in the form of the GOFC-GOLD Fire IT (http://gofc-fire.umd.edu/index.php) which has its next meeting in November 2017; encouragement by CEOS-CGMS would be useful.

Aerosols:

AeroSAT (www.aero-sat.org) now exists to be complementary with AeroNET and AeroCOM, and should be enlisted to be active in that area (collected information on aerosol intercomparisons, aerosol climate datasets).Linkage to the CEOS activity in support of the UN Sustainable Development Goals should be sought as well.

ISRO informed that INSAT-3D derived fire and aerosol products could be considered in int'l efforts. JMA would cooperate with JAXA in contributing to the aerosol activity through AHI. Teruyuki Nakajima (University of Tokyo) is involved in AEROSAT and should give advice.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMSSEC	5	A45.07	CGMS SEC to approach GOFC-GOLD to explore the possibility for CGMS members to become part of the fire project.	31 Jul 2017	**OPEN**	3.5.4
CGMSSEC	5	A45.08	CGMS SEC to explore with AEROSAT if they pursue an activity regarding the use of new-generation GEO data	31 Jul 2017	**OPEN**	3.5.4

KMA and CMA also agreed to join these initiatives.

NOAA and CMA to work on a proposal to develop GEO-based flood mapping as a potential SCOPE-Nowcasting pilot project. The WMO Multi-Hazard Early Warning System (MHEWS) and the Flash Flood Guidance System (FFGS) should be invited to collaborate in this proposal.

CGMS-45 actions – WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS agencies	5	A45.09	To confirm interest in a flood mapping pilot project using GEO satellites, as a proposal for the SCOPE-Nowcasting executive panel meeting (18-20 Sep 2017	1 Sep 2017	**OPEN**	3.5.4
NOAA and CMA (lead), WMO (contributing)	5	A45.10	Develop a proposal to develop GEO-based flood mapping as a potential SCOPE-Nowcasting pilot project. The WMO Multi-Hazard Early Warning System (MHEWS) and the Flash Flood Guidance System (FFGS) should be invited to collaborate in this proposal.	1 Sep 2017	**OPEN**	3.5.4

A special issue of Frontiers Scope is planned on this subject.

CGMS-45-WMO-WP-14

This paper provides an update on Polar Space Task Group (PSTG) activities and plans, including on snow product validation and intercomparison, a snow mission concept workshop tentatively scheduled for 2018, consideration of Year of Polar Prediction (YOPP) science needs for dedicated satellite data acquisitions and products, continued response by agencies to ice sheet and permafrost community needs, and addition of new members to the Group in 2016 (CONAE Argentina, ISRO India).

At its 7th session in March 2017, the WMO Executive Council Panel of Experts on Polar and High-Mountain Observations, Research and Services (EC-PHORS), the parent body of PSTG within WMO, added the focus of observing high-mountain regions to the PSTG terms of reference.

REFERENCES: 1. PSTG: http://www.wmo.int/pages/prog/sat/pstg_en.php

Related to the cryosphere, ESA is initiating the second phase of its Climate Change Initiative for snow and permafrost, in addition to ongoing ice sheets, sea ice, and glacier projects.

6. Selected topics of high priority to members [90'] (pre-selected WPs)

CGMS-45-GSICS-WP-01

The use of reference instruments is key to the inter-calibration strategy of the Global Space-based Inter-Calibration System (GSICS) – both for instrument monitoring, as well as for the generation of GSICS Corrections, which users can apply to operational Level 1 satellite data to correct its radiometric calibration to be consistent with that of the reference instrument. These corrections can be radiometric or spectral in nature and are referred to collectively as GSICS inter-calibration products.

Despite the need for reference sensors and observations, and while the required sensors and mission concepts are clearly defined, the satellite community currently lacks reference observations with adequate calibration accuracy and on-orbit traceability to SI standards, nor does it currently have definite plans for obtaining them.

This paper re-affirms GSICS's need for SI-traceable hyperspectral reference observations and endorses activities and resources needed to proceed with missions to obtain reference observations. GSICS recommends that these reference measurements be included in the WMO Integrated Global Observing System (WIGOS) in 2040 (WIGOS Space Vision 2040) which is now being formulated, but also advocates for such missions to be implemented as soon as possible.

GSICS wishes to encourage NASA to maintain its commitment to the climate observing system by continuing to consider the full CLARREO mission as a high priority, to seek ways of developing and launching this mission as soon as possible, and actively solicit international partnerships to achieve this critical objective.

"On orbit measurement reference standards for VIS/NIR, IR, MW absolute calibration" part of WIGOS 2040 Vision

Peng Zhang suggested that GRWG investigate how a SI-traceable reference instrument could be used to calibrate instruments that have lower spatial and spectral resolution. Mitch Goldberg suggested to wait with detailed investigation until the release of the next NASA Decadal Survey in November 2017. CMA and UK are exploring possibilities to fly similar instruments.

CGMS-45-JMA-WP-04

The Himawari-9 geostationary meteorological satellite of the Japan Meteorological Agency (JMA) was launched on 2 November 2016 and put into in-orbit standby as backup for Himawari-8 on 10 March 2017. Himawari-9 features the Advanced Himawari Imager (AHI), which is identical to the AHI on board Himawari-8. As accurate image navigation and radiometric calibration are essential in leveraging the imager's potential, Himawari-9/AHI Level-1 and -2 data performance was validated during the satellite's period of in-orbit test (IOT). Image navigation and registration errors determined from observation during the IOT phase were in the same order as those of Himawari-8/AHI. The validation results for Himawari-9/AHI calibration generally show close correspondence to those for Himawari-8/AHI, although larger biases are seen in several bands. Further evaluation will be performed in the near future. Quality assessment of Atmospheric Motion Vectors (AMVs) and Clear Sky Radiance (CSR) for the AHIs on board Himawari-8 and -9 was also carried out. The rawinsonde statistics for AMVs were similar for both satellites. In regard to CSR, the first-guess (FG) departure statistics for B08 and B10 were similar for both satellites, although the B09 FG departure for Himawari-9 was 0.2 K greater.

CGMS-45-JMA-WP-05

JMA/MSC will start operational generation of rapid-scan AMVs for internal use of JMA using Himawari-8's rapid-scan observation imagery in June 2017. JMA/MSC produced Himawari-8 Rapid Scan Atmospheric Motion Vectors (RS-AMVs), as trial, using operational rapid scan observation with time interval of 2.5 minutes over Japan area (defined as RS-AMV for Japan) and a small domain covering a typhoon in the western North Pacific (defined as RS-AMV for typhoon). As preparatory step about RS-AMV for typhoon, the quality of RS-AMVs for five typhoons (Soudelor, Goni, Dujuan in 2015 and Nepartak and Megi in 2016) was investigated using DOTSTAR dropsonde observations and the forecasts of the JMA's global Numerical Weather Prediction (NWP) system. The results showed that RS-AMVs wind speeds had negative bias against the sonde observations and sometimes against wind forecasts. But the accuracy of RS-AMVs was good in case of typhoon Nepartak compared with other cases. Observing System Experiments (OSEs) of RS-AMVs for typhoon in case of typhoon Nepartak were performed using the JMA's global NWP System. The OSEs revealed that typhoon track forecast impacts were neutral while forecasted typhoon intensity became weaker compared to not using RS-AMVs, and the forecast skill was degraded.

Rapid-scan based generation of AMVs can catch shorter lifetime clouds.

CGMS-45-CMA-WP-06

The Tibetan Plateau (TP) plays an important role in the interactions among land surface, boundary layer, troposphere, and stratosphere. However, owing to its complex terrains and harsh environmental conditions, the conventional observation stations in the TP are scarce, and there are far few observational data available, which has restricted the science research on the TP. Satellite remote sensing is an important way to obtain observation data in the TP. In recent years, satellite data have been widely used in the TP study. However, Due to the lack of observing data which match the satellite pixel size, the inversion accuracy of satellite products in the Tibetan Plateau (TP) is difficult to be evaluated. Under the

support of the Third Tibetan Plateau Atmospheric Scientific Experiment (TIPEX-III) project, a multi-scale automatic observatory of soil moisture and soil temperature served for satellite product validation (TIPEX-III-SMTN) were established in Tibetan Plateau. The observatory consists of two regional scale networks. Each network includes dozens of stations, which are deployed in a small region according to a predesigned pattern. At each station, soil moisture and temperature are measured by five sensors at five soil depths. One sensor is vertically inserted into 0~2 cm topsoil to measure the averaged near-surface soil moisture and temperature. This depth is comparable to the depth penetrated by passive microwave signals. Data acquired from TIPEX-III-SMTN are used to evaluate some satellite soil moisture products, including AMSR-2, SMOS, TRMM, and FY3C, and some reanalysis products, including ERAinterim and NCEP. According to the preliminary results, there are big difference between soil moisture products and observation data. Among all the soil moisture products evaluated, FY-3C, TRMM, SMOS and ERA-interim are relative better than the other products.

It was suggested to review the soil moisture validation approach proposed in this paper, using radiative transfer modelling, to make point and areal measurements comparable. There is a forthcoming paper in *Reviews of Geophysics* on validation practices in Earth observation communities.

CGMS-45-ESA-WP-02

CGMS Working Group 2 was informed about some outstanding results from the Earth Explorer missions CryoSat-2 and SMOS. Launched on 2 November 2009, SMOS is the second Earth Explorer Opportunity mission developed as part of ESA's Living Planet Programme. The data acquired from the SMOS mission will lead to better weather and extreme-event forecasting, and contribute to seasonal-climate forecasting, as demonstrated in the results presented. ESA's Earth Explorer CryoSat-2 mission, launched on 8 April 2010, is dedicated to precise monitoring of the changes in the thickness of marine ice floating in the polar oceans and variations in the thickness of the vast ice sheets that overlie Greenland and Antarctica. CGMS Working Group 2 was also informed on the status of the Earth Watch Program Element, Global Monitoring of Essential Climate Variables (ECV), also known as the 'ESA Climate Change Initiative (CCI)'. The CCI program continues to proceed well and according to schedule. All thirteen ECV projects initiated in 2010 and in early 2012 are completed. Phase 2 of this program element was kicked-off in February 2014 and is now ongoing for all projects. ECV products are being made available under an open and free data policy for uptake by the wider climate science community through the CCI Open Data Portal and are used by the Copernicus Climate Change Services. ESA's member states have extended the program to continue until 2024. The ESA Earth Watch programme encompasses the series of Sentinel satellites, which will continue and extend in the coming decades the series of environmental observations from space initiated by former ESA and other European satellite missions.

The paper also described the uptake of soil moisture, ocean salinity data in operations. The user community of Copernicus data has grown to more than 70 000. Follow-on Sentinel missions (7 to 10) are currently considered. The ESA CCI is entering its second phase (CCI+) for 2018-2026, covering additional ECVs.

7. CGMS agency reports on highlights and issues in dataset and product generation

CGMS-45-KIOST-WP-01

Ocean Colour (OC) remote sensing requires two important steps: Atmospheric correction to derive remote-sensing reflectance (Rrs) of water at sea-surface from top-of-the-atmosphere radiances, and ii) an algorithm to derive Chlorophyll from Rrs. By estimating atmospheric molecules and aerosol scattering and absorption effects, atmospheric correction algorithm converts sensor-observing radiance to water-leaving radiance. In general, two near-infrared channels (e.g. centred at 745 and 865 nm) are fundamentally used in atmospheric correction. In addition, chlorophyll algorithm generally requires two blue channels (e.g. 412 and 443 nm) and one reference channel around 555 nm, which are designed in the NASA OC satellites and Geostationary Ocean Color Imager (GOCI). Although Himawari/AHI did not have typical OC satellite channels, it is notable that one blue and one green channel with wider bandwidths enabled retrieval of chlorophyll concentration. In this working paper, we have compared retrieval of chlorophyll from GOMS/GOCI, Terra/MODIS and Himawari/AHI.

There will be an overlap period of operations of GOCI, and GOCI-II on GK-2B. Aerosol load is currently taken into account using a model, not observations. Comparison with Sentinel-3 OLCI is planned. It is unclear how the uncertainty of ocean colour retrievals changes over time (diurnal effects).

CGMS-45-ISRO-WP-03

This paper summarized the INSAT-3D/3DR satellite missions, provided examples for derived data and products (AMVs, SST), showed ISRO's GSICS activities in demonstration phase, ScatSat was launched to replace Oceansat-2 scatterometer, and validation of wind products is underway. Scatterometry has also been used to derive various other R&D products such as polar ice and large river water levels. River water levels were compared with river gauge data.

ISRO is considering a direct broadcast capability of future ISRO EO satellites data.

CGMS-45 recommendations – WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
ISRO	7	R45.07	ISRO to consider adding a direct broadcast capability to future satellites.		**OPEN**	1.4

CGMS-45-NASA-WP-02

Summary: With its current fleet of 20 operating missions and a vigorous program of airborne and surface-based observations that both complement and provide calibration/validation for space-based sensors, laboratory calibration facilities, and the production of model/data hybrid products through data assimilation and reanalysis, NASA provides significant knowledge about the Earth's global environment. This knowledge extends both to quantitative knowledge of Earth system parameters (many of which are not well documented through previous space-based measurement programs), and the understanding of the processes that drive Earth system behaviour. In this working paper, recent results and/or a summary

of activities from several NASA Earth science activities that are addressing questions we feel are of particular interest to CGMS members are presented. These include field campaigns (on air quality in support of GEMS and TEMPO, snow in support of 2018 PyeongChang Olympic Games, and precipitation in support of GPM) that can provide both process knowledge and relevant information for satellite missions relevant to CGMS, data products from NASA's Orbiting Carbon Observatory (OCO-2) satellite, and major reprocessing activities of previously-released data sets.

The air quality calibration/validation experiments missions form a contribution through the CEOS Atmospheric Composition Virtual Constellation (AC-VC). GRACE-FO is slated for launch in late 2017 or early 2018.

The paper also highlighted products from recently-launched missions. 2017 upcoming launches are TSIS and GRACE FO.

CGMS-45-NOAA-WP-10

NOAA reported on the status of GOES-R commissioning, the 2017 ABI/GLM validation campaign, and the status and schedule of product validation. GOES-S is scheduled for launch in March 2018.

GOES-16 L2+ products provisionally validated by December 2017.

GOES-16 international product distribution via GOES-R ReBroadcast (GRB), NOAA Product Distribution and Access (PDA) portal, HRIT/EMWIN, and GEONETCast-Americas.

There is strong user interest in ABI fire products, mostly thanks to high temporal refresh rate.

GLM will be available in netCDF as flashes, groups and flashes, small data volumes.

CGMS-45-NOAA-WP-11 (moved to WG I)

CGMS-45-NOAA-WP-12

The paper showed Observing System Simulation Experiments with Global Navigation Satellite System (GNSS) Radio Occultation – COSMIC-2.

COSMIC2-A assimilation: neutral to slight positive impact in the NH, positive impact in the SH, positive impact in tropical winds

COSMIC2-B assimilation in addition to COSMIC2-A: positive impact in the NH, further positive impact in SH

Initial results show impact of degrading COSMIC-2B to COSMIC-1 level of accuracy on global weather forecast skill is overall neutral – but additional evaluation is needed.

Two different OSSEs are used.

In conclusion, a “new” OSSE system is still being refined, not just for use with Radio Occultation, but for the full spectrum of observations.

Value of COSMIC-2A and 2B on global weather forecast skill is demonstrated, but more evaluation needs to be done to understand the difference in impact of COSMIC-1 vs. COSMIC-2 level quality.

CGMS-45-KMA-WP-04

This document is KMA report on highlights and issues in dataset and products

- Satellite data application in NWP system
- The status of KMA program on GK-2A product retrievals and applications
- KMA Implementation Plan for Climate Products
- SCOPE-CM activities
- KMA’s cal/val activities

ATMS, GroundGNSS, CrIS, MVIRI, SEVIRI and GOES CSR were newly introduced in the global model with launch of 17 km model (resolution of global model was improved from 25km to 17km). So, total 13 satellite species are being assimilated for the global model. In 1.5km local model, only one satellite observation species, Scatwind, is being used now. So, feasibility of use of other species as like Ground-GNSS, AMSU-B, IASI, and COMS (AMV, CSR) was tested.

The impact of 40 Ground-GNSS data on local model was evaluated. They showed improved results in quantitative precipitation prediction. The improvement was significant for strong precipitation at the early forecast period.

KMA/NMSC has developed the algorithms for extracting 52 meteorological and geophysical parameters which will be derived operationally from GK-2A AMI (Advanced Meteorological Imager). Preparation of user applications and ensuring user readiness creates additional demands on KMA, beyond product development. Validation has started using H-8/AHI as proxy data.

Application areas are: Nowcasting, typhoon and ocean applications, hydrology and forest applications. Some comparison of algorithms with equivalent products from H-8 AHI has occurred. CAPE/TPW results are AHI-based.

KMA implementation of climate products intends to contribute to SCOPE-CM in three areas: sea surface temperature, outgoing longwave radiation, and insolation. Both implementation plan has two steps which are Phase-I (2012~2017) and Phase-II (2018~2023). During Phase-I, focus on evaluation of effects of the Global Space-based Inter-Calibration System (GSICS) correction, data quality control/quality assurance, Climate Data Records (CDRs) algorithm development and improvement, and the inter-satellite comparison of products. During Phase-II, we will focus on the gap analysis between COMS and GeoKompsat-2A1 CDRs, continue on improvement of CDR algorithm, and the collaboration with SCOPE-CM related pilot project. Surface albedo is derived from COMS and converted to broadband albedo using a BRDF model.

KMA reported to int'l ECV inventory on its plans. There is a GEO-based spectral albedo climate dataset produced within SCOPE-CM (Lattanzio et al., BAMS). KMA are part of the IOGEO SCOPE-CM project.

COMS IR channel inter-calibration using IASI is proceeding; systematic bias of -0.84K in WV channel vs IASI, most likely due to uncertainty in SRF of MI. COMS VIS channels are calibrated using the Moon target (GIRO model).

CGMS-45-ROSHYDROMET-WP-03

The document presents an overview of operational and research activity in Roshydromet related to the derivation and application of remote sensing products from meteorological satellite data. It is focused on the results of the Meteor-M N2 and Electro-L N2 exploitation. The sample products are presented based on Meteor-M N2 and Electro-L N2.

Meteor-M N2 MSU-MR imager data used for cloud analysis, SST. IR sounder (IKFS) and MW sounder (MTVZA-GY). IKFS data not available in direct readout, MTVZA-GY data are. Comparison of MW sounder retrievals against radiosonde profiles, testing of use in assimilation scheme (comparisons against first-guess BTs calculated using RTTOV and GFS NCEP forecasts). Considerable local biases are found to remain in the post-launch radiometric calibrated data, most likely due to uncorrected instrument anomalies.

The paper also showed some results from Electro-L N2 MSU-GS: imagery and AMVs.

Meteor-M N2 data are exchanged with EUMETSAT for EUMETSAT member states.

The session commended ROSHYDROMET for the excellent results.

CGMS-45 recommendations – WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
ROSH, WG IV	7	R45.08	Roshydromet to explore steps with Working Group IV to enable global exchange of data from the MTVZA-GY instrument.	-	**OPEN**	2.6

CGMS-45-WMO-WP-08

This paper presents v1.1 of the WMO Integrated Global Observing System (WIGOS) Metadata Standard, adopted by CBS-16 as amendment to Appendix 2.4 of the Manual on the WMO Integrated Global Observing System (Annex VIII to the WMO Technical Regulations). By virtue of being in the Manual, the Standard is part of official WMO regulatory material. The reference Standard (v1.0) endorsed by WMO Congress in 2015 is available here: http://library.wmo.int/pmb_ged/wmo_1160_en.pdf

In 2015 and 2016, satellite users in the CBS Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP) provided comments on the Standard related to describing satellite-based observations. These are now reflected in the amended Standard v1.1 provided here. Although further iterations will be possible to reflect evolving needs and technology, the Standard is now considered

mature enough to be applied. In addition to all providers of observational data within WIGOS, all providers of satellite data are therefore asked to comply with the Standard.

This item was further addressed in WG IV EUMETSAT-WP-41

CGMS-45-CMA-WP-07

This paper provided highlights of the FY-4A product ground segment, the status of FY-3C GNOS data, and the status of FY-3D product ground segment. The AGRI baseline products now include AMV, but not CSR. The question was raised whether a CSR product should be produced from FY-4A AGRI as well. CMA agreed to do this.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CMA	7	A45.11	CMA to add Clear-Sky Radiance as an FY-4A baseline product	CGMS-46	**OPEN**	

GIIRS data utilization is being explored. LMI data have shown initial value. The MERSI-II imager on FY-3D combines the capabilities of MERSI-I and the VIRR visible and IR radiometer on FY-3C.

CMA participates in the ISWGs to intercompare FY-4A products within the international community.

CGMS-45-JMA-WP-03

The geostationary satellite Himawari-8 was launched on 7 October 2014 and started its operation on 7 July 2015. The Meteorological Satellite Centre of the Japan Meteorological Agency (JMA/MSC) updated the navigation process in the ground system on 16 November 2016. It significantly improved the band-to-band co-registration error about 1/10 times as before, and improved the image navigation error especially in the east-west direction. The level-2 products which includes Atmospheric Motion Vectors (AMVs), Clear Sky Radiance (CSR) and High Resolution Cloud Analysis Information (HCAI) are ongoing generated and disseminated through Global Telecommunication System (GTS) or JDDS (JMA Data Dissemination System). To provide lots of the winds in meso-scale phenomenon and around typhoons compared with operational AMV, JMA/MSC produced Himawari-8 Rapid Scan AMVs (RS-AMVs) as trial. The quality of RS-AMVs was investigated. RS-AMVs for Japan area have sufficiently superior quality for assimilation when compared with JMA's Mesoscale Analysis and upper-air observations. RS-AMVs for typhoon wind speeds had negative bias against the sonde observations. The RSMC Tokyo – Typhoon Centre and JMA/MSC have examined to utilize low level AMV of Himawari-8 to estimate sea surface winds around typhoons. The effectiveness of the estimation of sea surface winds for improving typhoon analysis has been confirmed, and JMA is now preparing for using the Himawari-8 low level AMV in the typhoon monitoring operation. With regard to volcanic ash, the results of volcanic ash retrievals are publicly available on JMA website. The AMVs and CSR also contribute SCOPE-CM activities. In SCOPE-Nowcasting, the basic imageries are on the JMA web site through the WMO Severe Weather Forecasting Demonstration Project (SWFDP) and WMO Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP)

framework. JMA/MSC is still collaborating with Australia/BOM (AuBOM) to research RGB colour composite recipes optimized for RA-II and RA-V.

CGMS-45-EUMETSAT-WP-34

The paper recalled the current fleet of EUMETSAT-operated instruments. Extended lifetime scenarios are foreseen for several satellites. Meteosat-8 has arrived over the Indian Ocean and AMVs are being derived, with improvements demonstrated vs Meteosat-7. The paper showed the status of MTG and a summary of user priorities regarding the MTG missions. EUMETSAT participates in GOES-R GLM cal/val activities. The polar-orbiting system relies on a NOAA-EUMETSAT-CMA cooperation to cover the three orbital planes. An update to the development of EPS Second Generation was provided. Co-registration is recognized as a challenge when using several instruments simultaneously.

8. Working papers responding to or raising CGMS actions

CGMS-45-ROSCOSMOS-WP-02

In response to WGII/A43.04, this WP reported on the functional features and the estimation results of the metrological characteristics of multispectral scanner MSU-MR on board the Meteor-M N2. Intercalibration between MSU-MR and AVHRR over (stable) test land polygons (for VIS), deep convective clouds (for IR channels) showed good agreement and temporal stability. SST products are derived using a NOAA algorithm. Plans are in stock to extend this production using multi-spectral scanners on other Russian spacecraft.

CGMS-45-NOAA-WP-13

In response to WGII/A44.11 to share best practices on documenting products and their quality, this paper discussed among other the NESDIS science value chain and described the various components (JPSS/GOES-R program office, STAR, NCEI), roles and responsibilities. Different terms are defined for quality (science quality, product, stewardship, service). NOAA has issued data development guidelines.to improve science maturity. “Satellite Proving Grounds” support demonstration and utilization of new capabilities by end users.

The paper proposes stronger international science collaboration in the area of product and application development. Such collaboration exists through the ISWGs and the JWGClimate, among others. Progress of agencies in following CGMS guidelines could be tracked through an agreed reporting format, in terms of maturity or a dashboard; products should eventually become part of a service, and this could be tracked more systematically.

Agencies should consider to check degree of compliance with guidelines (the paper cites examples from NOAA); this could be done regarding science and requirements management, regarding support to user readiness best practices.

A new Recommendation was made, following closure of Action WG II 44.11:

CGMS-45 recommendations - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS agencies	8	R45.09	CGMS agencies encouraged to document their products online, including ATBDs and validation reports, and link product page URLs to the WMO Product Access Guide following defined documentation criteria. (current agency focal points in WMO IPET-SUP: Sally Wannop (EUMETSAT), Natalia Donoho (NOAA), Chu-Yong Chung and Jin Woo (KMA), Xiang Fang (CMA), Shiro Ohmori (JMA))	-	**OPEN**	5.3

CGMS-45-CMA-WP-08

In April 2017, CMA/NSMC compared the FY-2E and METEOSAT-8 AMVs over the period of 2017/Feb/01 to 2017/Apr/10 which concluded that FY-2E AMV and MET- 8 AMV is basically similar, though minor difference exists. (1) The IR channel AMV comparison shows the FY-2E AMV is a bit of smaller than MET-8 on upper and middle levels; the two AMVs are close on lower level by and large (2) The WV channel AMV comparison shows the FY-2E is smaller than MET-8 on high level, and bigger than MET-8 on middle level.

9. Space weather matters: SWTT interactions with WGII

Tsutomu Nagatsuma (NICT) summarized the status of SWTT discussions related to WG II. Inter-calibration of high-energy particle sensors is of high priority, and the combination of data to get global particle flux distribution in GEO and MEO. An international framework is needed to continue on inter-calibration activity, which should include other agencies and research institutions. Expertise from GSICS would be highly welcome.

CGMS-45 actions - WGII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
SWTT	9	A45.11	SWTT members to review GSICS activities and discuss the framework for inter-calibration of high-energy particle flux measurements.	CGMS-46	**OPEN**	5.2.2
SWTT	9	A45.12	Invite a GSICS representative to the next SWTT inter-sessional meeting; and to a topical discussion meeting during the European Space Weather Week 27 Nov- 1 Dec 2017 in Oostende, Belgium.	CGMS-46	**OPEN**	5.2.2

GSICS EP discussed interaction with CGMS SW activities; Space Weather involves many activities that incorporate fields of science different from Earth observation. Many observations are based on in situ measurements and not remote sensing. GSICS EP stressed the difference of Space Weather and Earth observation, and does not recommend incorporation of Space Weather activities into GSICS. However, the benefit of interaction between GSICS and SW is recognized, and a structure similar to GSICS in the SW community could be useful (such as a research WG, a data WG etc.).

IROWG has a sub-group on space weather, since there is a natural link between radio occultation and Space Weather. How to calibrate TEC is required for radio occultation, and how the ionosphere is influencing the neutral atmosphere. Satellite altimetry is also strongly dependent on ionospheric calibration; well-organized international groups addressing this subject exist. Discussion on radio occultation physics can be arranged at ESWW or in the SWTT.

WG II concluded that the current structure of the ISWGs, GSICS, and SCOPE is currently not suitable to adequately address space weather. Expertise can however be shared. A separate international science working group or international team such as the WMO IPT-SWeISS is recommended to provide the critical mass of expertise on space weather.

10. Review and updating of the HLPP

CGMS-45-CGMS-WP-10

The status of implementation of CGMS High Level Priority Plan (2016-2020) is presented. It incorporates inputs (partial) from:

- WG – I, II, III and IV chairs and rapporteurs
- International Science Working Group chairs and rapporteurs
- GSICS project
- CEOS-CGMS Joint Working Group on Climate
- CGMS Space Weather Task Team

To guide the considerations of the working groups, the colour coding in the table indicates:

- Green: Priority is reflected in ongoing CGMS actions
- Yellow: Actions have been defined associated to the priority, but progress is limited
- Red: No actions associated with the priority can be identified or major obstacles is hindering progress

It was suggested to re-word HLPP 3.1.3: “Ensure backward compatibility when preparing for the next AMV intercomparison”. Funding issue of ISWGs should be included as well.

CGMS-45-CGMS-WP-11

As part of the agreed revision cycle for the CGMS High Level Priority Plan, this document presents a proposed HLPP covering the period 2017-2021. The plan is based on the following inter-sessional activities:

- Meetings of the International Science Working Groups IPWG, IWWG and IROWG
- Intersessional work of WG-I, -II, -III and -IV as well as SWTT

At this point in time, there are two proposals for amendments to the HLPP. Further proposals may result from the deliberations of the different Working Groups at the CGMS-45 meeting

Annex 1 – Proposed High-Level Priority Plan 2017-2021

11. Nomination and representatives at meetings

No needs for representation of WG II was identified beyond what was discussed during the session, and beyond the existing international groups and mechanisms where CGMS representation exists.

12. Any other business

13. Date/time of inter-sessional activities/meetings in 2017-2018 [CGMS-45 -> CGMS-46]

15 Nov 2017, 15 Mar 2018, at 12.00 UTC.

14. Review of actions/conclusions, preparation of WG report for plenary

The summary list of actions and recommendations from CGMS-44 and CGMS-45 are included in the Annexes to the CGMS-45 report.

CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

Working Group III: **Operational continuity and contingency planning**

WG III REPORT

Co-chairs:

Peng Zhang (CMA)
Ajay Mehta (NOAA)

Rapporteur:

Lars Peter Riishojgaard (WMO)

1. Objectives

The Co-Chairs welcomed the participants to the meeting and reminded them of the main objectives of Working Group III, per the Terms of Reference as approved by CGMS-44.

2. WG III Chairmanship

Ajay Mehta from NOAA/NESDIS was nominated and unanimously elected as the new Co-Chair to replace Suzanne Hilding, who retired from NOAA/NESDIS during the inter-sessional period. Zhang Peng from CMA continued as Co-Chair and Lars Peter Riishojgaard from the WMO Secretariat continued as Rapporteur for the Working Group.

3. Review of actions and recommendations from previous meetings

WGIII reviewed the actions from previous CGMS Sessions. The status of the actions following this review as provided in the table below. Recommendations are included in a separate table.

CGMS-44 WGIII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/	A44.01	CGMS Members: To review and react to the WIGOS Vision 2040 as it develops	*Input provided by EUM, NOAA (July 2016)*	(Aug-16) New deadline 31 Jul 2017	**OPEN**	1.1
WMO	WGIII/	A44.02	WMO Secretariat: to present the draft Vision at CEOS, GEO plenary sessions 2016.	*Not done; deferred to next plenary cycle (2017)*	New deadline: CGMS-46	**OPEN**	1.1
CGMS members	WGIII/3	A44.03	CGMS operators nominate focal points for maintaining these elements (dates, landing pages), and other elements included in OSCAR/Space (e.g., instrument characteristics).	EUM: sally.wannop @eumetsat.int NOAA: Matthew.Butler@noaa.gov Further feedback requested by WMO Secretariat	July 31 2017	**OPEN**	5.3

CGMS-44 WGIII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/2.2	R43.01	CGMS members are encouraged to consider including RO capabilities on all future polar-orbiting satellites.		Ongoing	**OPEN**	1.1.4
WMO	WGIII/	R44.02	Noting the recent conclusions of the WMO IPET-DRMM and the concurrence expressed CGMS WG III, WMO is encouraged to add the satellite identifier (from Common Code Table C5) and satellite instrument identifier (from Common Code Table C8) to OSCAR Space.		CGMS-45	**OPEN**	2.7
CGMS space agencies	WGII	R44.03	From CGMS-44 WGII: CGMS Members to continue an operational constellation of conically-scanning microwave platforms to guarantee sustained support for the current level of capability	Ref. gap analysis discussion		**OPEN**	
CGMS space agencies	WGII	R44.04	From CGMS-44 WGII: CGMS to have a special discussion on the value of formation flying similar to the A Train – especially for precipitation and other hydrological applications			**OPEN**	
CGMS space agencies	WGII	R44.05	From CGMS-44 WGII: CGMS satellite operators to consider coordination of orbits for scatterometer instruments and to provide open and timely access to data in order to maximise independent coverage and benefits to nowcasting and NWP from assimilation of scatterometer wind data.			**OPEN**	

4. Terms of Reference of WGIII

The Chairs introduced and briefly discussed the terms of reference for the Working Group, approved at CGMS-44. The chairs highlighted the importance of the CGMS baseline because of its role as a major driver of the working group. The Working Group discussed the need to update the CGMS baseline as both user requirements and space-based observing capabilities evolve over time and agreed that the update should be linked to the WMO vision for observing systems. The Working Group agreed that no update of the ToR was necessary at this time.

CGMS-45 actions – WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS	WGIII /4	A45.01	Initiate Review of CGMS Baseline, to be synchronized with development of WMO "Vision for WIGOS in 2040"	CMGS-46	OPEN	1.1

5. Status of implementation of the CGMS baseline

5.1.1 Risk assessment and gap analysis

WMO provided a brief review of the status of implementation of satellite observing system against the CGMS baseline (see table below). Since the last risk assessment and gap analysis was done a few year ago, it was noted that a more detailed risk assessment and gap analysis would be required and that different levels of priority assigned to various potential gaps should also be take into account. WMO agree to coordinate this task and to present its analysis to WGIII at CGMS-46.

GEO coverage of Indian Ocean	**Proposed to be no longer an issue.**
Transition to GOES-R in South America	**Proposed to be no longer an issue.**
Geostationary infrared sounding	JMA, NOAA and KMA to consider implementing hyperspectral sounding on the next generations of Himawari, GOES and GEO-KOMPSAT satellites.
Imagery and sounding in early morning	**Proposed to be no longer an issue.**
Radio-occultation	NOAA to bring to success the effort to implement COSMIC-2B.
Altimetry	CNES (for SWIM and KaRIN) and JAXA (for SHIOSAI) to continue and intensify their efforts on large-swath altimetry.
Active ocean surface wind	Roscosmos and ISRO to manifest their long-term plan for the follow-on of Meteor-M N3 and OceanSat-3.
Earth Radiation Budget	CMA to investigate whether it is feasible to install ERM-2 on FY- 3F. ERB instruments to be considered for future generations of GEO.
Limb sounding	Plans for limb sounding in IR and MW to be considered.

An additional item:

Spectral gaps on future hyperspectral sounders	GSICS to provide baseline specification for the inter-calibration of IR imagers

The following action was also noted:

CGMS-45 actions – WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGIII /5.1.1	A45.02	Update the risks assessment and gap analysis of implementation against the CGMS baseline; include the potential risk of gaps in the capability for passive microwave imaging in this update	CMGS-46	OPEN	1.1.7

5.1.2 WMO maintenance of the OSCAR Space database

WMO provided an update regarding the status of the WMO OSCAR/Space database. A very broad group of users from both the space agency and the satellite data user communities continue to heavily use the. The update included plans for maintaining and updating the system including IT, agency-level information about status and plans for satellite systems, and regarding resulting capabilities in terms of geophysical variables. The Working Group recognized that many CGMS agencies still have not nominated focal points responsible for reviewing and updating the information regarding their satellite systems in OSCAR, and that this may negatively impact the quality of the information. The Working Group also recognized that the system continues to be under-resourced and that the plans for keeping the system up to date are therefore at considerable risk.

CGMS-45 recommendations – WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS Agencies	WGIII /5.1.2	R45.01	Agencies to consider contributing resources (financial, in-kind, or via secondment) to the development and maintenance of OSCAR/Space		OPEN	1.1.6

5.2 Continuity issues, risk analysis

5.2.1 Operational agencies' risk assessment

5.2.1.1 NOAA's Risk Assessment Approach

In **CGMS-45-NOAA-WP-15**, NOAA provided an update on its internal approach to managing risk, which is based on a formal enterprise risk management program established in 2014. The Enterprise Risk Board leads the enterprise risk management program and is chaired by the Assistant Administrator, and its members include all program and staff office directors.

Enterprise Risk board manages three types of problems:

- Issue: An event that has already occurred
- Risk: An event that may occur in the future if mitigation efforts do not take place. Risks are assigned a likelihood of occurring and a consequence factor if the risk is realized. (*e.g.:* Risks of various coverage gaps if a satellite fails or is behind schedule)
- Concern: An event that has not yet occurred and for which the likelihood and consequences cannot be quantified

Underneath the Enterprise Risk Board, a hierarchy of Risk Boards are established at program and segment level to provide risk management at a more detailed level.

5.3 IODC roadmap implementation

In **CGMS-45-EUMETSAT-WP-35**, EUMETSAT provided an update on the status of the implementation of the roadmap for Indian Ocean Data Coverage (IODC). The IODC mission was a best effort undertaking which reflects a decision of the EUMETSAT Council to use residual Meteosat First Generation capacity a temporary data gap over the Indian Ocean. Meteosat-7, the last satellite of the Meteosat First Generation, reached its End-of-Life in March 2017 and was de-orbited in April 2017, thereby ending the EUMETSAT IODC mission. A new IODC roadmap and associated actions were agreed to by CGMS-43 answering the requirements agreed to at CGMS-42. The status of the actions is the following:

- EUMETSAT now disseminate INSAT-3D images and products via EUMETCast
- CMA has relocated FY2-E to 86.5°E and commenced an operational service
- EUMETSAT now disseminate FY2-E images and products from 86.5°E via EUMETCast
- EUMETSAT has relocated Meteosat-8 to 41.5°E and commenced a Meteosat-8 operational service including images and products via EUMETCast in February 2016
- Roshydromet have commenced an Elektro-L N2 operational service
- EUMETSAT now disseminate Elektro-L N2 images and products via EUMETCast

The meeting was briefed on the satellites currently in orbit as well as the satellites planned to be in orbit over the IODC region, and was invited to take note of the fact the implementation of the IODC Roadmap is nearing completion.

5.4 Global Contingency Planning

CGMS-45-CGMS-WP-13

The Working Group noted that the current Contingency Plan was last agreed to in2007, and that the Plan predates the 2011 CGMS Baseline. The Working Group agreed that the Plan was in urgent need of revision and update, and decided, a new process for maintaining and updating the Plan was needed. The Working Group decided to establish a Task Team under WG-III to review and update the Contingency Plan. That Task Team would do the bulk of its work during the CGMS Sessions. However, given the amount of time elapsed since the last update of the Plan, WMO offered to organize an ad hoc face-to-face meeting of the

Task Team to restart the effort. EUMETSAT, NOAA and WMO volunteered to participate in this Task Team; other agencies are invited to participate in this as well.

CGMS-45 actions - WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS	WGIII /5.4	A45.03	WMO to support one face to face Inter-sessional meeting to start off new planning effort.	CGMS-46	OPEN	1.1.7

6. Operational Agencies Future Planning

In **CGMS-45-ISRO-WP-04**, ISRO provided an update of its plans for future satellite missions. WGIII took note of the presentation and commended ISRO for a very ambitious program in Earth Observations. Beyond the already planned and approved missions, ISRO expressed their interest in implementing additional missions such as: Temperature, Humidity Sounder, Advanced Microwave Radiometer, Altimeter, Precipitation Radar, Wind Profiler, and Atmospheric Chemistry Missions. They expressed interest in potentially collaborating with international partners on these missions.

6.1 Early Morning Orbit (CMA)

The payloads and platform of FY-3E (2018 in schedule) were redesigned to meet the early morning orbit requirements. The FY-3E is under re-engineering. NWP communities from ECMWF and the UK Met Office are involved in the user readiness activities. WGIII commended CMA for taking this step to maintain the polar orbiting constellation envisaged in the CGMS Baseline.

6.2 NOAA Future Architecture Studies

WGIII took note of a study undertaken by NOAA in context of its NOAA Satellite Observing Systems Architecture (NSOSA). NOAA is examining the space segment architecture for space systems following the current Geo, Polar, Space Weather, and GNSS-RO constellations. NOAA is addressing issues such as:

- Which observation functions should be allocated to which orbits?
- Should we retain the legacy architecture or seek major change?
- Which observation functions should be improved?

The study primarily addresses NOAA operational needs for observations that result in: warnings, watches, baseline weather and space weather forecasts, as well as ocean or fisheries actions.

The scope encompasses NOAA systems, with a backdrop of partner contributions and relationships, and the intention is for this to result in program pre-formulation activities.

6.3 Other contributions

Roscosmos presented in **CGMS-45-ROSCOSMOS-WP-01** the concept development of a single Russian hydrometeorological and geophysical orbital constellation.

The GEO space sub-system “Electro-M” will provide measurements of temperature, humidity, and wind profiles of the atmosphere from geostationary orbit for the purpose of: numerical weather prediction, measurements of the radiation balance, as well as monitoring of thunderstorm activity (global scale).

The LEO space sub-system “Meteor-MP” will provide determination of additional atmospheric parameters (refraction coefficient, density, pressure, temperature, determination of electron concentration), as well as monitoring the gaseous composition of the atmosphere, aerosols, and the Earth's surface.

7. Integration of R&D missions research to operations transition

7.1 NASA (Decadal Survey and CYGNSS)

NASA’s presented on the CYGNSS (Cyclone Global Navigation Satellite System) mission, which launched on December 15, 2016. The system is now in science operating mode, and the first data were released in May 2017.

The system consists of eight satellites in a circular 520 km orbit at 35° inclination, each carrying a 4-channel bistatic radar receiver of GPS signals scattered by the Earth surface. CYGNSS also measures ocean surface wind speed in all precipitating conditions, including those experienced in the tropical cyclone (TC) eyewall as well as ocean surface wind speed in the TC inner core with sufficient frequency to resolve genesis and rapid intensification.

7.2 ESA (ADM-Aeolus)

ESA presented on the status of its pathfinder wind lidar profiling mission, which is scheduled to launch in early 2018. It was emphasized that the data will be made available in near real-time to WMO users world-wide. ESA was commended for taking steps to make this possible. CMA pointed out that the 3-dimensional wind field is still under-observed and that the NWP community strongly supports the requirement for wind observation.

8. Update on Socio-Economic Benefits Tiger Team (SETT)

CGMS-45-NOAA-WP-17

WGIII took note of the report provided by the Socio-Economic Benefits Tiger Team, and noted that the Team had conducted four Workshops and developed a Guidance Document for CGMS Members.

The following next steps were identified:

- Pilot SEB Study
  - Operational analysis (in kind)
  - Contract Economic analysis (NOAA providing contract for economist)
  - Conduct the SEB study

- Workshop #5 – Early 2018
  - Finalize SEB study
  - Develop a plan for communicating the results
- Report results to CGMS-46

Finally, the Working Group noted that SEB continues to be of high interest to the CGMS community. Discussions began at Workshop #4 hosted by CMA September 2016, on future work topics and a more formal structure in CGMS. The Team planned to present a way forward for Socio-economic Benefit studies at CGMS-46.

CGMS-45 actions - WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
SETT	WGIII /8	A45.04	Propose a way forward for guiding and coordinating socio-economic Benefit studies among the CGMS community.	CGMS-46	OPEN	4.1

9. Outcome of SWTT discussions on interaction with WGIII

The Task Team Co-Chairs provided an update on the Space Weather Task Team meeting that took place June 11, prior to the CGMS WG meetings. The recommendation from WG-III was to include a space weather element in the CGMS Baseline, and to develop this notion further via a joint inter-sessional meeting prior to CGMS-46 WGIII.

CGMS-45 actions - WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WGIII/ SWTT	WGIII /9	A45.05	WGIII and SWTT to organise a joint inter-sessional to discuss SW updates to CGMS baseline	Jul 2017	OPEN	1.1.9

10. Review and updating of the HLPP

CGMS-45-CGMS-WP-10

CGMS-45-CGMS-WP-11

A discussion on the HLPP resulted in the following conclusions:

Move this target to the SWTT section:

- Establish a coordinated approach to the reporting of space weather-related spacecraft anomalies;

Include two new targets:

- Revise the scope and framework of the CGMS contingency planning to reflect the new generations of satellite systems and to adopt a structured approach for risk assessment.
- Update the CGMS baseline to reflect the new WIGOS 2040 vision for space.

CGMS-45 actions - WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGIII /10	A45.06	Include impact of data latency among science questions posed to 7th WMO Impact Workshop	2020	OPEN	1.1.2

11. Nomination and representatives at meetings

Nothing to report.

12. Any other business

Nothing to report.

13. Date/time of inter-sessional activities/meetings in 2017-2018 [CGMS-45 -> CGMS-46]

Tentative dates for the inter-sessional meetings are proposed as follows:

- 17 October 2017, 12:00 UTC
- 23 January 2018, 12:00 UTC
- 10 April 2018, 12:00 UTC

14. Review of actions/conclusions, preparation of WG report for plenary

The summary list of actions and recommendations from CGMS-44 and CGMS-45 is included in the Annexes of the CGMS-45 report.

CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

Working Group IV: **Global data dissemination**

WG IV REPORT

Co-chairs:

Vasily Asmus (ROSHYDROMET)
Hiroshi Kunimatsu (JMA)

Rapporteur:

Klaus-Peter Renner (EUMETSAT)

1. Objectives

During the plenary session of CGMS-44, Mr. Vasily Asmus (ROSHYDROMET), Mr. Hiroshi Kunimatsu (JMA) and Mr. Klaus-Peter Renner (EUMETSAT) were appointed as Co-Chairs and Rapporteur of Working Group IV, respectively. Representatives of the following organisations attended the session: CMA, EUMETSAT, ISRO, JMA, KMA, NASA, NICT, NOAA, ROSCOSMOS, ROSHYDROMET and WMO (the full list of participants is included in the Annex).

In view of the actions agreed at CGMS-44 in relation to Space Weather, the representatives of the related Task Team also participated in the meeting under the dedicated agenda item 12.

WGIV reviewed and adopted the draft agenda proposed by the CGMS Secretariat prior to the meeting. WGIV attended the WGI session, under AOB, where a proposal from NOAA “To consider missing items in the agendas of WGI and WGIV focused on Satellite and Data Operations” was discussed.

2. Review of actions and recommendations from previous meetings

Actions and recommendations from previous CGMS plenary sessions were discussed and the status following WGIV discussions is summarised below with an update of the due date of the actions kept not closed.

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUMETSAT	(WGIII/2.) WGIV/4	A43.02	(Action transferred from WGIII) EUMETSAT to propose dissemination plan for data from Indian Ocean Data Coverage partners identified in CGMS-43-EUM-14 roadmap.	CGMS-44 EUM-WP-14 CGMS-45-EUMETSAT-WP-37 CGMS-45-ISRO-WP-05 CGMS-45: Ongoing work, deadline extended to CGMS-46	New deadline CGMS-46	**OPEN**	1.1.6 2.2
NOAA	(WGI/4) WGIV/7	A43.03	NOAA to consider including GLM products in the HRIT stream	*WG-IV IS meeting Jan 2017:* NOAA is considering putting GLM on HRIT/EMWIN. At this time, our plan is to include 5 channels of Cloud and Moisture Imagery (CMI) in Full Disk at 2 KM resolution and also 3 channels of mesoscale imagery. Under that plan, there would not be sufficient bandwidth for the predicted size of the GLM data. However, we are just receiving CMI data and will evaluate the HRIT broadcast over the next few weeks [in January 2017] prior to the public release of GOES-R data at the end of February 2017. CGMS-45: evaluation by NOAA still going on.	New deadline CGMS-46	**OPEN**	

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
TT metadata	(WGI/6) WGIV/10.1	A43.05	CGMS Task Team on metadata to define discovery metadata for DBNET	WGIV webex 9 Dec 2015: Draft DBNet guide submitted to TT, for cross-checking. To assure meta data aspects are taken into account. Expected to be endorsed as part of the final report. *CGMS-44-EUMETSAT-WP-17, ongoing work, extended deadline.* *CGMS-45: no change, extended deadline to WGIV IS meeting*	New deadline Dec 2017	**OPEN**	3.4.12.7
CGMS members		A43.06	CGMS members to provide a listing of their data access portals.	NOAA: CGMS-44-NOAA-WP-14 PPT EUMETSAT: http://navigator.eumetsat.int https://eoportal.eumetsat.int CMA http://data.cma.cn/en http://satellite.nsmc.org.cn/PortalSite/default.aspx?currentculture=en-US NASA: https://search.earthdata.nasa.gov CGMS-45-ROSCOSMOS-WP-03 due date extended to CGMS-46	(CGMS-44) New deadline CGMS-46	**OPEN**	-

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
TFMI (Task force on Metadata)	WGIV/3.1	A44.01	To submit the "Guidance Documentation on WMO Core Profile Metadata Creation For Satellite Products" to WMO IPET-MDRD and IPET-SUP.	CGMS-45-EUMETSAT-WP-41		**CLOSED**	2.7
EUMETSAT	WGIV/7	A44.02	To provide a timeline for the users preparation information for MTG, in accordance with "CGMS-44-WMO-WP-02 Best Practices for Achieving User Readiness for New Meteorological Satellites"	WG-IV IS Jan 2017 EUMETSAT: High Level information for Saturn was provided. CGMS-45: Ongoing work Deadline extended to WG-IV IS meeting.	30 Dec 2017	**OPEN**	5.3

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members (data providers)	WGIV/10	A44.03	CGMS members (data providers) to a) discuss and respond to the recommendation from CGMS-44-CEOS-WP-02: CEOS recommends the adoption of the WGISS supported standards for searching Climate Data Records (CDRs). WGISS will provide technical support to CGMS data providers providing their climate data records through the WGISS data access infrastructure (IDN, CWIC, FedEO); and b) report how far the standards WGISS developed (as described in CGMS-44-CEOS-WP-02) are supported.	WG-IV IS Jan 2017: From NASA: In response to action item # A44.03, I would like to state that EUMETSAT, NASA, ESA, CNES, USGS, JAXA, ISRO (NRSC) and CCMEO have all implemented WGISS supported standards (CEOS Opensearch Best Practices). CMA: will be implemented when appropriate CGMS-45: Sufficiently answered, can be closed.	CGMS-45	**CLOSED**	5.1

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
JCOMM task team	WGIV/6.2	A44.04	The JCOMM Task Team To work together with the International Wind Working Group and the CEOS "Ocean Surface Vector Wind Virtual Constellation" (OSVW-VC) at developing a project on Surface Vector Winds, using the well-known and highly successful GHRSST Project as a model for the adoption of globally-agreed standards for the production and distribution of global, integrated, surface vector winds and associated products.	CGMS-45: no response expected from JCOMM task team. User requirements addressed by CGMS-45-WMO-WP-16. Proposed to close.	CGMS-45	**CLOSED**	2.5
CGMS members	WGII	A44.05	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs.	CGMS-45: GODEX-NWP not yet ready to provide feedback.	CGMS-46	**OPEN**	
ROSH	WGII	A44.06	From CGMS-44 WGII: ROSHYDROMET to explore the possibilities to implement an operational NRT service for the hyperspectral infrared sounder IKFS-2 on Meteor-M N	CGMS-45-ROSHYDROMET-WP-04 Access via ftp download Proposed to close	CGMS-45	**CLOSED**	

CGMS-44 WGIV Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGIV/7	R42.01	Satellite operators to provide WIS Discovery Metadata Records, compliant to WIS requirements and following the guidance to be provided by the CGMS-WMO Task Force on metadata implementation, in order to facilitate satellite information discovery and access	NOAA: Related to metadata, the best reference is NGDC metadata provided here the URL: http://www.ngdc.noaa.gov/metadata/ *WGIV CGMS-43 discussions: Ongoing and routine activity. Recommendation maintained until CGMS-44* *WGIV webex 9 Dec 2015: To be taken up at the TT on Meta Data meeting the week of 14 Dec 2015.* *See CGMS-44-EUMETSAT-WP-17.* *Recommendation still valid, to be retained.*	(CGMS-43) New deadline **CGMS-45**	**OPEN**	2.7
CGMS members	WGIV/3.2	R44.01	CGMS members to contribute to the implementation of the Best Practices for User Readiness for meteorological satellite systems under development, both GEO and LEO	Closed for NOAA. *Recommendation still valid, to be retained.*	CGMS-45	**OPEN**	5.3
CGMS members	WGIV/3.2	R44.02	CGMS members to continue the provision of up-to-date User Readiness information in the SATURN portal	*Recommendation still valid, to be retained.*	CGMS-45	**OPEN**	5.3

CGMS-44 WGIV Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUM and NOAA	WGIV/11.1	R44.03	NOAA (and EUMETSAT, as appropriate) to continue their strong engagement in the WMO Coordination Group on Satellite Data Requirements for Region III and IV (Americas) and to provide support to Region-based access to satellite data, including from GOES-R and JPSS, according to user needs.	Strong engagement continues, now considered normal work. Proposed to close	CGMS-45	**Closed**	2.1
CGMS-44 plenary	WGIV/3.1	R44.04	WG-IV recommends to CGMS plenary to endorse the extension of the CGMS TFMI activity to assess the WIGOS Metadata OGC Observations and Measurements mapping and to report its findings/recommendations to WMO IPET-MDRD	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	2.7
CGMS-44 plenary	WGIV/3.2	R44.05	WG-IV recommends to CGMS plenary to adopt "CGMS-44-WMO-WP-02 Best Practices for Achieving User Readiness for New Meteorological Satellites", as far as it applies to satellite operators, as CGMS Best Practice.	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	5.3

CGMS-44 WGIV Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS-44 plenary	WGIV/3.3	R44.06	In the context of IODC data access, WG-IV supports the definition of essential data first and, once defined, recommends the distribution of these data via the established dissemination means by the CGMS agencies in the region (CMA, EUMETSAT, ISRO, ROSHYDROMET).	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	1.1.6

3. WGIV key issues

3.1 IODC data dissemination plan (CMA, EUMETSAT, ISRO, ROSH)

CGMS-45-EUMETSAT-WP-37 EUMETSAT presented: EUMETSAT'S contribution to the IODC data dissemination plan.

The paper presents the latest status of the list of essential data and products and EUMETSAT's activities related to the enhancement of IODC service since CGMS-44.

Meteosat-8 has been relocated to the 41.5° geostationary position. The identified essential data and products from Meteosat-8 and FY-2E are being disseminated on EUMETCast Europe, Africa and on CMACast.

The dissemination of the essential data and products identified in the IODC dissemination baseline from INSAT-3D is being considered, once the data access is fully established. The implementation of dissemination of Elektro-L N2 data is in progress.

It is planned to use the existing interfaces between EUMETSAT and CMA for transfer of INSAT-3D and Elektro-L N2 data and products to CMA, in order to support the dissemination on CMACast.

CGMS-45-ISRO-WP-05 ISRO presented: ISRO's contribution for IODC data dissemination plan.

MOSDAC is the main ISRO data centre for dissemination of meteorological data over Indian Ocean.

The MOSDAC provides online access via internet to a wide set of meteorological and oceanographic data, and to information services from MOSDAC. Information dissemination is also being implemented by using MOSDAC Android Mobile App.

ISRO data is disseminated on GTS using the IMD network and on EUMETCast through ftp fetch by EUMETSAT.

A new ISROCast service is in conceptualization and prototype demonstration phase. Once fully operational, it will be able to provide real-time data to end users, using multicast and unicast protocols on terrestrial networks and broadcast over satellite networks.

The working group acknowledged the progress on this key item.

3.2 Global data exchange from next generation GEO satellites

CGMS-45-EUMETSAT-WP-38 EUMETSAT presented: Status of next generation GEO satellite data exchange with EUMETSAT.

This paper describes the exchange of GEO satellite data between EUMETSAT and partner organisations with the focus on next or newest generation satellites from each agency.

Data exchange is active for INSAT-3D from ISRO, Himawari-8 from JMA and GOES-16 from NOAA. The implementation of Elektro-L N2 data from Roshydromet is in progress. The exchanged data is a sub selection of the full available data set at 2 to 4 km resolution and 30 min frequency.

It is planned to also include FY4 from CMA, once the data is available.

In addition, the data exchanges for the current generation GEO satellites FY2E/G from CMA and GOES-13/15 from NOAA are still in effect.

CGMS-45-NOAA-WP-18 NOAA presented: Status on the Product Distribution and Access (PDA) System.

The Product Distribution and Access (PDA) will become the main distribution system for near real-time data. McIDAS products from legacy satellites (i.e., only GOES-13, -14 & -15) will remain on GEODIST. The PDA started with provision of GOES-16 data and now legacy data streams are being added on a weekly basis.

An overview over operational, technical and management aspects was provided, including the links to policy and data access information.

NOAA noted that current CGMS users of the DDS who were not yet re-validated for access to new PDA system need to complete the data access form to NESDIS.Data.Access@noaa.gov. The DDS is expected to be turned off around September, 2017.

EUMETSAT thanked NOAA for the presentation and expressed its satisfaction with the PDA performance. Initially only GOES-16 data was retrieved, but now EUMETSAT is in the process of migrating the retrieval of all remaining near real-time data flows to the PDA, in line with NOAA's schedule of replacing the legacy systems.

4. Implementation of sustained and coordinated communication satellite broadcast systems

CGMS-45-NOAA-WP-19 NOAA presented: Report on Status and Future Plans for GEONETCast Americas.

GEONETCast-Americas (GNC-A) is a regional contribution to the global GEONETCast system. GNC-A serves much of North America, the Caribbean Basin, and all of Central and South America. GEONETCast Americas forms part of the "global" GEONETCast environmental data dissemination systems in Europe, Africa, and Asia.

The GNC-A service has made significant progress since CGMS-44. The bandwidth has been increased from 2 Mbps to 12 Mbps in order to support data and products for GOES-16 and upcoming satellite missions and to support Hydro-Met services and other users in the region.

NOAA continues to work closely with regional partners to support the GEOSS Societal Benefit Areas and to address the requirements of the Coordination Group on Satellite Data requirements for RA III and RA IV where appropriate.

GNC-A supports capacity building through assisting the efforts of countries to add receive stations and develop national networks like those in Brazil, El Salvador, Costa Rica, Colombia, and Mexico. Additionally,

GNC-A supports capacity building through collaboration with the WMO Virtual Laboratory for Training and Education in Satellite Meteorology (VLab) and promoting participation in the GEONETCast Americas Coordination Group. GEONETCast also participates in training events, including a GOES-R focused training session held concurrent with the WMO Region III / IV Satellite Data Requirements meeting in Curacao on September 5–9, 2016.

GEONETCast Americas Capacity Building Plan includes the following events:

- July 15-16, 2017: a two day VLab Train-the-Trainer event prior to NOAA Satellite Conference 2017 in New York, NY.
- August 1-4, 2017: a four day AmeriGEOSS Week training event at the National University of Costa Rica.
- October 16-19, 2017: a workshop on GOES-R and Earth Observations for Disaster Preparedness and Response in Mexico City.
- January-February, 2018: an AmeriGEOSS University Seminar at the National University of Colombia

NOAA continues to support the users and providers, the user requirements process and capacity building in the region. A capacity building plan was presented and the involvement in the INPE SIGMACast project.

NOAA responded to a question about content providers in the region.

CGMS-45-EUMETSAT-WP-39 EUMETSAT presented the status of EUMETSAT NRT data dissemination systems.

The current EUMETSAT near-real-time dissemination systems are composed of broadcast via EUMETCast Satellite and EUMETCast Terrestrial, point-to-point file based dissemination to WMO members and other organisations via RMDCN, point-to-point file based dissemination to organisations via Internet and also downloads initiated from users via Internet and research networks.

The baseline dissemination systems are EUMETCast Europe for users in RA-VI, EUMETCast Africa for users in RA-I and RMDCN for the global WMO community. These NRT dissemination services are complemented by EUMETCast Terrestrial and point to point download services using research networks or the Internet.

EUMETCast Europe is currently feeding two Ku band transponders and will significantly grow in transponder capacity with the implementation of the next generation GEO and LEO satellites. A less pronounced growth will take place on EUMETCast Africa.

As part of the Copernicus S3 ground segment the data access portal CODA has been established providing a download service for all S3 data, including NRT products.

In the context of the EUMETSAT Data Services Roadmap it is planned to further enhance the EUMETCast Terrestrial push service from a Demo service into an operational service up to Gbps and to set up a new Online Data Service to provide end users an easy method for downloading NRT data, also for high data volumes.

NOAA asked how EUMETSAT is handling the challenge of many users using a download service in parallel. EUMETSAT explained that for the currently implemented CODA service for S3 data prioritisation is not used and users have to accept the delays if downloading large data sets. Users with timeliness requirements are requested to use EUMETCast where the end-to-end timeliness is guaranteed by the service. The use of prioritisation may be considered in future if needed.

On an enquiry from WMO regarding the access to EUMETCast Terrestrial, EUMETSAT replied that for practical reasons users within Europe can get access if their research network provider's data policy allows this. For users outside Europe the access will be handed on a case by case basis, in the context of a cooperation agreement. The removal of these restrictions is part of the planned enhancement of EUMETCast Terrestrial.

WMO appreciated the progress of the GEONETCast broadcasts consisting of GEONETCast Americas, EUMETCast (Europe and Africa) and CMACast, and pointed out that GEONETCast still has a gap in the Asia/Pacific region, which could be closed with a system such as HimawariCast. A discussion followed about the feasibility of this proposal.

As a first step, in order to assess the additional dissemination needs in the RA II/V region, the working group agreed to raise the following action:

CGMS-45 actions – WGIV						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
JMA, KMA	WGIV/4	A45.01	JMA/KMA to coordinate a regional user survey in RA II/V based on the WMO 2016 global survey (CGMS-45 WMO-WP-15) in collaboration with BOM and WMO, taking into consideration current and future data dissemination systems available in the regions.	CGMS-46	**OPEN**	2.1, 2.2

5. Incorporation and dissemination of R&D and pre-operational mission data

CGMS-45-EUMETSAT-WP-40 EUMETSAT presented: EUMETSAT third-party data services.

This document summarises ongoing activities at EUMETSAT in the area of Third-Party Data Services, including dissemination of operational, pre-operational and R&D mission data. The document is structured in two parts – an assessment of the Third-Party Data Services under consideration, and a summary of the status of currently ongoing Third-Party Data Service implementation activities, excluding those implemented at the request of Copernicus.

WMO noticed that most of the data is provided to a restricted user community (EUMETSAT NMHs, ECMWF) and asked if that is intentional. EUMETSAT responded that the implemented data access is fulfilling the request and a wider or open user access is normally not attempted. In some cases there are indeed data policy restrictions.

CGMS-45-ISRO-WP-06 ISRO presented: Incorporation and dissemination of R&D and pre-operational mission data.

This paper gives an overview of preoperational and R&D products related to the following satellites INSAT-3D, INSAT-3DR, SARAL and SCATSAT-1. The products are presented together with use cases and examples.

6. Coordinated dissemination services for additional user communities:

6.1 Disaster mitigation purposes

There was no paper presented under this topic, however the paper CGMS-44-NOAA-WP-19 contains relevant activities by NOAA. EUMETSAT is observing the activities by NOAA and will follow up.

6.2 Ocean user community

CGMS-45-WMO-WP-16 WOM presented: Ocean Satellite Data Needs of WMO Global Producing Centres.

In February-March 2017, WMO Secretariat sought an indication of requirements by WMO-recognized Global Producing Centres for Long-range Forecasts (GPCs; i.e., leading NWP centres), and by a subset of Regional Specialized Meteorological Centres (RSMCs) and Warning Centres for Tropical Cyclones, for near real-time (NRT) access to satellite data and products characterizing the oceans.

This survey responded to an action by the WMO CBS Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP), and informs the CGMS high-level priority to “Investigate the feasibility of introducing a coordinated dissemination service for information in support of the ocean user community”. The document summarizes the 11 responses received.

WMO indicated that this paper is for information and no action is proposed at this time. This will be followed up later, once the future of the JCOMM TT-SAT (cross-cutting task Team on Satellite Data Requirements) is clear.

7. Development of efficient standardised data handling for high-resolution imaging and hyper-spectral instruments

No paper was presented. This topic has been moved to WGI, as agreed in CGMS-44, and the agenda item will be removed.

8. Use of the WMO Information System (WIS) infrastructure for data provision and discovery

8.1 WMO Satellite Data Dissemination Strategy

No paper was presented. This is not a permanent topic; therefore the agenda item will be removed.

9. Coordination of metadata for satellites and instruments

CGMS-45-EUMETSAT-WP-41 EUMETSAT presented: CGMS-45-Progress Report and Outcomes from the TF on Metadata Implementation.

The CGMS-WMO Task Force on Metadata implementation has been created after CGMS 42 to provide a consolidated view regarding the WMO Information System (WIS) discovery metadata definition for satellite data products, accelerate the adoption of WIS by satellite data providers and represent the satellite data users' point of view within the WIS.

The Task force has continued to work on its prime task: publishing guidance documentation on WIS metadata creation for satellite data products. The document presents the work performed by the Task Force during year three: the finalisation of the guidance documentation on metadata creation, the participation of the Task Force to the creation of the WIS metadata official documentation and the review of the WIGOS metadata standard.

This report details also the future work to be performed by the Task Force and is asking the CGMS to endorse the assessment by CGMS TFMI of the WIGOS metadata OGC Observations and Measurements mapping to insure that WIGOS is covering the most common use-cases for satellite observations.

The working agreed to the extension of the task, noted that CGMS-44 plenary has endorsed this activity, and created the following action:

CGMS-45 actions - WGIV						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
TFMI	WGIV/9	A45.02	TFMI to work on the WIGOS metadata standard, in particular to assess the WIGOS Metadata OGC Observations and Measurements standard, and recommend possible adjustments for satellite observations to the WMO WIGOS team.	CGMS-46	**OPEN**	2.7

10. Evolution and promoting harmonisation of data access portals

CGMS-45-ROSCOSMOS-WP-03 ROSCOSMOS presented: ERS open data portal of ROSCOSMOS: promoting access to open data.

The portal provides online GIS access to open Resurs-P and Meteor-M data, in the form of raw data, cloud processing services and integrated and thematic services. Use cases for flood monitoring, fire monitoring and ice situation monitoring are included.

On a question about prioritisation from EUMETSAT, ROSCOSMOS responded that there is currently no performance issue and prioritisation of users is not implemented.

11. User dialogue and interface

11.1 Response to region-based requirements for satellite data access and exchange

CGMS-45-ROSHYDROMET-WP-04 ROSHYDROMET presented: Satellite Data Exchange in ROSHYDROMET.

The document presents an overview of satellite data exchange mechanisms between ROSHYDROMET and EUMETSAT, including participation in the EUMETSAT Advanced Retransmission Service (EARS). ROSHYDROMET has an operational access to EUMETSAT data distributed via EUMETCast, and data from ROSHYDROMET is available to EUMETSAT vie ftp download.

Data provided from ROSHYDROMET includes regional data from NOAA, Metop and SNPP, microwave sounder MTVZA data and Electro-L N2 data. In addition, data from IR sounder IRFS-2 is also available in test mode.

CGMS-45-WMO-WP-12 WMO presented: Update on Data Requirements of the WMO Coordination Group on Satellite Data Requirements for Region III and IV.

Formulating Region-based requirements for satellite data access and exchange has been recognized by WMO as a priority (see WMO Executive Council Resolution 12 (EC-65, 2013)). The last face-to-face meeting of the Coordination Group on Satellite Data Requirements in Region III and Region IV (RA-3-4-SDR) was held in Curacao in September 2016, leading to major accomplishments regarding user preparation for GOES-R and data dissemination to the Region using GEONETCast-Americas. The Group regularly organizes teleconferences and plans its next meeting on the margins of the NOAA Satellite Conference 2017 in New York, USA.

This document describes recent initiatives and actions taken. Finally, it discuss the agenda for the next face to face meeting in the NOAA Satellite Conference.

The working group took note of the achievements and further plans.

11.2 User readiness preparations for new satellites

CGMS-45-WMO-WP-15 WMO presented: WMO 2016 Survey on the Use of Satellite Data.

The World Meteorological Organization (WMO) commissioned the WMO 2016 Survey on the Use of Satellite Data to collect information on the availability and use of satellite data and products for meteorological and related environmental applications by users globally, and to identify obstacles and areas for improvement. WMO carries out this global Survey every four years. It consisted of 25 questions, structured along three major topics: (i) accessing and using geostationary satellite data, (ii) accessing and using low-Earth orbiting satellite data, (iii) satellite applications and training. The Survey also enquired on user access and gaps to satellite-derived information on soil moisture, lightning, sea-surface salinity, greenhouse gases, and inland water bodies, all of which were identified as emerging priorities in the 2012 survey.

The total number of valid, complete responses received was 215 (originating from 106 WMO Member countries) of which 148 (69%) were provided by NMHSs, 17 (8%) from other operational governmental agencies, and 40 (19%) from institutions with a research/academic mandate. Four responses (2%) were received from regional or international organizations. From the majority of Member countries, multiple responses were provided. The total number of responses (215) remained stable compared to 2012 when 218 valid responses were analysed. The country base of the Survey increased to 106 countries compared to 2012 when responses from 95 countries were recorded.

Overall, the Survey shows that satellite data are increasing in importance in many global, regional and local applications such as nowcasting, numerical weather prediction, marine services, climate monitoring, and climate prediction. Preparing users for the new generation of satellites is a major challenge, and Survey results will help target assistance and remedial action to address issues by satellite operators and WMO.

This WP contains the draft report from the 2016 WMO Survey (dated 7 June 2017, to be finalized by the end of June 2017).

CGMS-45-NOAA-WP-20 NOAA presented: Status of populating WMO SATURN with JPSS Information.

This presentation summarizes the status of JPSS contributions to the WMO SATellite User Readiness Navigator (SATURN) portal for the Next generation of meteorological satellites.

The portal provides a single point of access with up-to-date information supporting user-readiness. (http://www.wmo-sat.info/satelliteuser-readiness/). Initial content focused on GEO satellites including Himawari-8, FY-4A, and GOES-R. Content from LEO satellites such as JPSS is now included. New sensors and data types are driving the development of more advanced techniques for interpretation and assimilation of the data and products generated are inspiring new research.

JPSS is committed to contributing information content to the WMO SATURN portal to serve the needs of user groups of polar satellite products.

WMO thanked NOAA for this contribution, and also CMA, EUMETSAT, ISRO, JMA, KMA, ROSHYDROMET for their contributions and population of SATURN.

CGMS-45-JMA-WP-08/KMA-WP-02 JMA presented the joint KMA / JMA paper: Progress Report on the RA II WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training.

This paper outlines the mission of the WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training, and also details recent related accomplishments.

The project was established to support self-help efforts by NMHSs toward improved utilization of satellite-related information. The major focus of the initiative involves facilitating the timely provision of satellite data by satellite operators to users (i.e., NMHSs in RA II), especially in least-developed countries (LDCs) and other developing nations. It is necessary to create synergies with the Virtual Laboratory (VL) initiative and other ongoing projects in order to maximize benefit from the project and avoid duplication of work.

The paper lists the detailed accomplishments and future plans.

The working group took note of the activities.

12. Space weather matters

The SWTT chair presented verbally the needs for data access to the working group. Consequently, two actions were formulated under the following agenda items.

12.1 Current data formats for space weather observations

CGMS-45 actions - WGIV						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/ 12.1	A45.03	CGMS members to provide documentation on the data formats for space weather observations, and to forward related space weather metadata to the WIS.	CGMS-46	**OPEN**	2.9

12.2 Near-real-time access to and global exchange of space weather data from instruments hosted on meteorological satellites

CGMS-45 actions - WGIV						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/ 12.2	A45.04	CGMS members to report on the status of near real-time access to space weather data from instruments hosted on meteorological satellites. This includes data from space environment monitor suites, solar X-ray/EUV sensors, and radio occultation instruments on any orbiting satellite. Members are asked to detail product level definitions including near real-time availability of each level and user access required to obtain each level of data.	CGMS-46	**OPEN**	2.10

12.3 Outcome of SWTT discussions on interaction with WGIV

Apart from the issues on data access there were no further items identified with relevance to the WGIV.

13. Review and updating of the HLPP

CGMS-45-CGMS-WP-11, **CGMS-45-CGMS-WP-10** CGMS Secretariat presented: Status of implementation of CGMS High Level Priority Plan (2016-2020).

The status of implementation of CGMS High Level Priority Plan (2016-2020) as relevant for WGIV presented. It incorporates inputs (partial) from WG IV chairs and rapporteur.

To guide the considerations of the working groups, the colour coding in the table indicates:

Green: Priority is reflected in ongoing CGMS actions
Yellow: Actions have been defined associated to the priority, but progress is limited
Red: No actions associated with the priority can be identified or major obstacles is hindering progress

No targets overseen by WG IV are proposed to be considered achieved, therefore all HLPP items remain valid. Proposed updates in the formulation of targets were agreed by WGIV as follows:

> 2.2 Support the coordination of the operational Digital Video Broadcast (DVB) satellite services for the Americas, Africa, Europe and the Asia Pacific regions;
>
> 2.4 Demonstrate the feasibility of utilizing existing dissemination systems for providing meteorological and other information in support to disaster mitigation;
>
> 2.5 Increase operational access to data and products in support to the ocean user community;

14. Nomination and representatives at meetings

WGIV discussed nominations for CGMS-46 and agreed in proposing to plenary the following:

Co-chairs:

Vasily Asmus (ROSHYDROMET)
Hiroshi Kunimatsu (JMA)

Rapporteur:

Klaus-Peter Renner (EUMETSAT)

15. Any other business

At a joint session, Working Group 1 and 4 discussed the need to review the scope of both working groups to address overlap and to consider adding relevant topics related to satellite and ground system operational topics not currently covered in either of the two working groups.

The discussion and outcome is detailed in the WGI report, and the results are agreed by both working groups.

16. Date/time of inter-sessional activities/meetings in 2017-2018 [CGMS-45 -> CGMS-46]

Tentative dates for the inter-sessional meetings are proposed as follows:

- 11 October 2017, 12:00 UTC:
  WG-IV intersessional meeting: main topic is IODC dissemination coordination
- 6 December 2017, 12:00 UTC:
  WG-IV intersessional meeting: main topic is status of actions/recommendations
- 24 January2018, 12:00 UTC:
  WG-IV intersessional meeting: preparation/agenda for CGMS-46.

17. Review of actions/conclusions, preparation of WG report for plenary

The summary list of actions and recommendations from CGMS-44 and CGMS-45 is included in the Annexes of the CGMS-45 report.

CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

Space Weather Task Team

SWTT REPORT

Co-chairs:

Elsayeed Taalat (NASA)
Tsutomu Nagatsuma (NICT)

Rapporteur:

Elsayeed Taalat (NASA)

1. Objectives and Chairmanship

The Space Weather Task Team began with a review of the SWTT's objective, to identify the methodology to implement space weather within the existing construct of CGMS in order to support the continuity and integration of space-based observing capabilities for operational space weather products and services.

2. SWTT Chairmanship

2.1 Presentation by nominated candidates for two Co-chairs of SWTT

CGMSSEC noted that the previous Chair of the SWTT retired at the end of last year. Since then, the SWTT Rapporteur, Elsayed Talaat (NASA), has been an acting Co-chair. Additionally, last year, JMA nominated Tsutomu Nagatsuma (NICT) as SWTT Co-chair.

2.2 Election of CGMS SWTT Co-chairs

Elsayed Talaat (NASA) and Tsutomu Nagatsuma (NICT) were unanimously nominated as new Co-Chairs of the SWTT.

3. Review of actions and recommendations from previous meeting

CGMS-44 SWTT actions resulting from CGMS-45							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SWTT		A44.01	SWTT to conduct a workshop with leadership from the various space weather communities that will benefit from CGMS coordination of space-based space weather observing systems.	CGMS-45: CGMS presentation and discussions have occurred at European Space Weather Week (ESWW) and UNCOPUOS. Discussions have been held with leadership of ISWI, COSPAR, and ISES. CGMS SWTT organized electron inter-calibration mini-workshop at US Space Weather Workshop CGMS space weather role is included in draft UNCOPUOS framework for space weather services. Planned: Dedicated CGMS ESWW topical discussion meeting ("Space Weather Activities in the Coordination Group for Meteorological Satellites.") - Nov 2017 Presentation of CGMS at UN/US ISWI workshop - Jul/Aug 2017	30 Nov 2017, CGMS-46	**OPEN**	5.2.1

CGMS-44 SWTT actions resulting from CGMS-45							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SWTT members		A44.02	Members of SWTT review the current WIGOS 2040 vision to ensure inclusion of necessary space weather observations.	NOAA: Input sent 27 Jul 2016. Webex 22 Mar 2017: WMO to circulate version WIGOS 2040 1.1 for further review by SWTT by CGMS-45 to be reflected in the SWTT agenda at CGMS-45. NASA submitted comments after CGMS-45 SWTT meeting. Closed following CGMS-45 discussions.	15 Dec 2016	**CLOSED**	1.1.7
SWTT		A44.03	(From WGIII): SWTT members wishing to participate in the SETT activities are invited to participate in the SETT activities, and should provide their contact information to the SETT accordingly (Charles.wooldridge@noaa.gov).	Next SETT WS in autumn 2017. Inputs requested for the next SETT case study to be undertaken (e.g. impact of severe space weather, ...). A SETT WS will be held on 1 May 2017 prior to the US space weather WS 2017. Contact information has been sent to SETT. Closed following discussions at CGMS-45.	1 Jul 2016	**CLOSED**	4.1.1

CGMS-44 SWTT Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS-44 plenary		R44.01	**On Space Weather Task Team:** Sustain the SWTT for another year in order to enable CGMS space weather integration.	Endorsed by CGMS-44 plenary.	9 Jun 2016	**OPEN**	5.2

4. Updates by CGMS members and partner organisations on current and planned dedicated space weather satellite missions

Mark Gibbs (UK Met Office) discussed the recent "L5 in Tandem with L1: Future Space-Weather Missions Workshop" that took place in London, UK, 06-09 March 2017 (**CGMS-45-GUEST-WP-01)**. Issues discussed at the workshop included: socio-economic benefits and forecaster requirements; an update on ESA and NOAA mission plans; ground segment requirements and complementary ground based monitoring; modelling capabilities and gaps; in situ and remote-sensing observational requirements; mission options and payload priorities; and maximising complementarity of L1 and L5 missions. The workshop outcomes confirmed that there was enormous support for L5 as the 'next' mission. The experts gathered at the workshop agreed that an L5 mission would provide significant benefit to the space weather observing infrastructure but there are insufficient papers have been published that demonstrate this quantitatively. Additionally, consensus is converging on the complement of required and desired instrumentation on an L5 mission.

Matt Butler (NOAA/NESDIS) presented the status of the DSCOVR satellite and NOAA's plan for Space Weather Forward Observatory (**CGMS-45- NOAA-WP- 21**). NOAA presented on their two key satellites on the sun-earth line: GOES-16 and DSCOVR. GOES-16 space weather instruments are undergoing an extended cal/val checkout, but they are currently receiving science data. DSCOVR was launched on 11 Feb 2015 and became the primary operational satellite at L1 on July 26, 2016. The DSCOVR magnetometer is operating nominally and the Faraday Cup collects accurate readings in large solar wind events but relies on ACE during times of lower solar wind output. Products are being developed at the NOAA Space Weather Prediction Center (SPWC) and will be available on-line and archived at the NOAA Center for Environmental Information (NCEI). NOAA presented on its plans for a Space Weather Forward Observatory (SWFO) mission and a possible coronagraph gap filler. The purpose of SWFO is to continue to maintain space weather measurement requirements at L1 and a coronagraph gap filler would replace the reliance on an aging SOHO mission.

Elsayed Talaat (NASA) updated the SWTT on the NASA activities in space weather (**CGMS-45-NASA-WP-03)**. NASA operates 32 spacecraft for heliophysics observations and implements a research program that includes data analysis, theory and model, instrumentation technology development, suborbital flights, and the development of space weather empirical and first principles modelling.

Nana Higashio (JAXA) presented the Space Environment & Effects System (SEES) developed by the Research and Development Directorate of JAXA (**CGMS-45-JAXA-WP-03)**. SEES provides real-time and quasi-real-time data on its site (http://sees.tksc.jaxa.jp). The ETS-V (Kiku-V) was the first JAXA satellite in geostationary Earth orbit (GEO) to measure electrons, protons, and heavy ions. Over fifteen satellites have measured the space environment and the SEES site also provides space weather data (quasi-real-time graph/txt data) of the Arase satellite that was launched on December 20, 2016. Currently, SEES users can get real-time data and quasi-real-time data from eight satellites.

Hyesook Lee (KMA) reported on major advances in the development of KMA's KSEM and its associated data processing subsystem development including other space weather programs led by KASI (**CGMS-45-KMA-WP-05)**. KSEM (Korean Space wEather Monitor) is Korea's first space weather instrument suite for Geo-KOMPSAT-2A (GK2A). KSEM is in the final stage of flight model development and will be

integrated into the satellite by the end of August 2017. KMA has been building KSEM with the extensive cooperation of KARI, KHU, SatrecI Inc., U.C. Berkeley and ESA. ESA has developed a magnetometer (SOSMAG) as CFI. The suite of KSEM instruments consists of 1) medium energy Particle Detector, 2) Magnetometer and 3) satellite charging monitor. KSEM data processing subsystem consists of the data receiving, processing, disseminating, and extracting the 2nd level of space weather information. KMA plans to continue space weather mission for GEO and to establish new space weather program for LEO. Two space weather missions which are led by KASI were also introduced; 1) SNIPE mission, which consists of 4 nanosatellites with formation flying in polar orbit and is in SDR phase and is scheduled to launch 2020. Its science target is to identify temporal and spatial variation of small scale plasma structures in ionosphere and magnetosphere. 2) KASI in cooperation with NASA has kicked off the coronagraph project flying on ISS.

Juha-Pekka Luntama (ESA) presented the ESA Report on Lagrange Mission Preparation (**CGMS-45-ESA-WP-03)**. The current status of the ESA Space Situational Awareness (SSA) space weather segment (SWE) system was updated. SSA SWE strategic objectives are to reinforce and mature the SWE system, reduce dependence on non-European systems, and begin transition towards an operational system. The SWE enhanced space segment includes the Lagrange mission, which is based on 2015/2016 Phase 0 studies of L1 and L5 dedicated space weather missions. The start of mission Phase A/B study has been mandated and funded by ESA Member States participating in the ESA SSA Programme. The development is proceeding for an L5 mission to complement the planned L1 Space Weather Forward Observatory (SWFO) and other space weather observations on the Sun-Earth line. However, ESA is proceeding with an option to revert the mission goal back to L1 in case other plans to implement the necessary measurements on the Sun-Earth line fail.

Konstantin Litovchenko (ROSHYDROMET) presented Russian space weather monitoring carried out on board the sun-synchronous METEOR-M and geostationary ELECTRO-L satellites (**CGMS-45-ROSHYDROMETWP-05**). Both platforms carry spectrometers that measure electron and proton fluxes at various energies. ELECTRO also carries a magnetometer and X-ray flux and sun flux constant sensor. In addition to future launches in the METEOR-M and ELECTRO-L series, Russia plans to include space weather monitoring onboard the “Zond” and “Ionosphera” spacecraft, planned with LEO orbits, and the “Arctica” mission, planned with a Molniya (high-latitude inclination, highly elliptical) orbit.

5. Updates by CGMS members and partner organisations on their space weather activities and plans

Joseph Pica (NOAA) reported NOAA's space weather activities (**CGMS-45-NOAA-WP-22**). NOAA’s role is to provide forecasts, warnings, and alerts to protect critical infrastructure, society, and economic vitality. User’s demand for space weather services are increasing. NOAA presented on its new space weather modelling effort and its new regional geomagnetic activity prediction capability from its global MHD model that became operational in April 2017. NOAA is working closely with the US National Space Weather Strategy and Action Plan as well its international partners through international organizations like ISES, WMO, UNCOPUOS, and ICAO.

Kenneth Holmlund (EUMETSAT) reported the status of EUMESAT activities and plans (**CGMS-45-EUMETSAT-WP-44**). The Metop satellites fly the Space Environment Sensor (SEM) supplied by NOAA,

and the radio occultation instrument. EUMETSAT uses Space weather services as a satellite operator. EUMETSAT is accessing the suitability of solar event warning information to be integrated into the operational processes. Space weather monitoring continues in the future with the next generation LEO and GEO satellites. Responding to user interest, a Total Electron Content (TEC) data product is also under development. EUMETSAT also reported impact on Meteosat and Metop satellites due to space weather as an annex of the working paper.

Hyesook Lee (KMA) reported major advances in KMA space weather activities since CGMS-44 (**CGMS-45-KMA-WP-06**). KMA has developed Korean Radiation Exposure Assessment model (KREAM) to support the space weather information on the aviation route dose. KREAM is now in the transition phase to operation. For this, KMA has verified and improved the model. KREAM validation results based on in situ measurement in the route between ICN to JKF was presented. It shows model results are well matched when both of GCR and SEP were used as input. Another advancement was made in the local K measurement. Estimation of local K index at Cheongyang geomagnetic observatory has been done and KMA is going to provide the estimated local K index to the public in near real-time.

Hiroshi Kunimatsu (JMA) reported space-based space weather activities in Japan (**CGMS-45-JMA-WP-02**). JMA began monitoring the high-energy-particle environment in geostationary orbit at around 140 degrees east in 1978 using the space environment monitor (SEM) on board its first geostationary meteorological satellite, Himawari. With the launch of Himawari-8, monitoring was resumed in Nov. 2014 after a hiatus using the on-board Space Environment Data Acquisition (SEDA) unit. Himawari-9 was launched in November 2016 and carries a SEDA unit. SEDA data are provided to NICT in parallel for work relating to space weather monitoring and forecasting. JMA's continued support for NICT's space weather activities is expected to promote programs for space weather monitoring/forecasting.

Juha-Pekka Luntama (ESA) reported on distributed SWE sensor system (D3S) planning (**CGMS-45-ESA-WP-04**). Near-Earth space is critical for monitoring of SWE impacts. The main target of measurements includes energetic particles, plasma environment, earth magnetic field, Thermosphere (electron and neutral density, neutral winds, auroral particles) and Troposphere/stratosphere (charged particle radiation). Because the most needed instruments are small, hosted payload missions are possible. Several specifications of the sensor and its orbit for each region in the magnetosphere are proposed. ESA proceeds with several precursor missions, such as Next Generation Radiation Monitor (NGRM) and Service Oriented Spacecraft Magnetometer (SOSMAG). ESA started in 2016 a phase 0 study for dedicated SWE smallsat mission to enhance ESA's space weather nowcasting capabilities through cost-effective and reliable networking of sensors collecting spatially and temporally correlated data in the proximity of Earth,. He also suggested that CGMS could be a forum for the coordination of hosted payload missions and exchange of space weather data to achieve the near-Earth space observation objectives.

Tsutomu Nagatsuma (NICT) reported on inter-calibration of high energy electron sensor onboard Himawari (**CGMS-45-NICT-WP-01**). To utilize Himawari/SEDA data for the quantitative monitoring and forecasting of high-energy electron flux/fluence, and to examine the variations of the global distribution of high-energy electrons in GEO using space environment data obtained from many space-based observations, the inter-calibration of high-energy electron sensors is essential. Inter-calibration work has been done using Himawari-8 and -9 data, and Himawari-8 and GOES 15 data. They are

planning to provide the product of the estimated high-energy electron flux distribution along GEO in near real-time using a near-real-time data stream from Himawari, DSCOVR, and GOES.

Xiang Fang (CMA) reported on updates of space weather activities in CMA (**CGMS-45-NICT-WP-01**). The CMA space weather observing facilities were discussed including the spaced-based payloads onboard FY satellites, the ground-based instruments for monitoring the upper atmospheric, ionospheric and solar activities, as well as the GPS/MET network. The FY satellites in LEO and GEO have become the ideal platform to monitor the space weather, including charged particles, geomagnetic field, ionospheric, and solar activities, as well as space weather effects in geospace. New capabilities for space weather on CMA's satellites were also introduced. Observed data from FY satellites are available for global cooperation.

Anthony Mannucci (IROWG) reported an update of the space weather subgroup of the Ionospheric Radio Occultation Working Group (IROWG) (**CGMS-45-IROWG-WP-01**). Based on the recommendation from IROWG-5 in 2016, they recommend that future RO missions will enable 95% of the measurements be available for use in operational models within 30 minutes or less, and near real-time data latency would be optimal. This should be a goal for future missions when possible. Further considerations in the context for space weather RO were also presented.

6. UN COPUOS Update

A report was provided on behalf of the Space Weather Expert Group chartered within the United Nations (UN) Committee on Peaceful Uses of Outer Space (COPUOS) (**CGMS-45-NASA-WP-04**). The current focus of the Expert Group is to prepare recommendations for the UNISPACE + 50 Initiative, commemorated in 2018. UNISPACE+50 celebrates the 50th anniversary of UNCOPUOS and will serve as a blueprint for shaping the "Space 2030" agenda. Within the seven Thematic Priorities identified for UNISPACE+50, Priority 4 - International framework for space weather services – seeks to develop a space weather roadmap for coordination and information exchange on space weather events and mitigation. It was noted that in its initial framework discussions, UNCOPUOS has recognized CGMS's role among many international organisations engaged in space weather activities. The Space Weather Expert Group will develop recommendations for an international framework for space weather services, including governance and cooperation. Further discussions will occur at UN/US Workshop on the International Space Weather Initiative, July 31-August 3, 2017, at Boston College. Continuing discussions will occur at COPUOS Science Technology Science Committee meeting in February 2018. The final roadmap will be submitted to COPUOS in June 2018.

7. WMO Update on 4 Year Plan

Toshiyuki Kurino (WMO) reported WMO's space weather activities updates (**CGMS-45-WMO-WP-17**). The International Civil Aviation Organization (ICAO) Meteorology Panel (METP) noted an update to a concept of operations for space weather. This included revisions to performance and functional requirements for near-realtime and forecast space weather information, that would enable an operational global space weather information service for aviation in the 2018 timeframe and guidance on the space weather information provider designation process. One of the key components in the realisation of an operational, global space weather information service for aviation before the end of 2018 is site assessments and audits of prospective space weather information providers by WMO at

ICAO's request. He proposed actions about SWTT to draft a space-based observation baseline, to maintain continuity of solar measurements, solar wind and interplanetary magnetic field measurements, and heliospheric imaging under the auspices of the WMO expert team, IPT-SWeISS (Due date: December 2017).

CGMS-45 actions - WGIII						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS	SWTT/7	A45.01	SWTT members to identify initial baseline for space-based space weather measurements and hold intercessional with WGIII to plan forward analyses. This will be finalized in the first inter-sessional to be held on 14 September 2017.	30 Sep 2017	**OPEN**	1.1.9

8. Review of space weather component of WIGOS 2040 version 1.1 and feedback by CGMS Members

The SWTT discussed agency responses to the WIGOS 2040 vision. Previously, NOAA submitted its comments in 2016. SWTT members were asked to discuss any additional comments with WMO during this agenda item. NASA discussed comments and submitted them to WMO.

Mikael Rattenborg (CGMSSEC) presented observing system baseline, gap analysis and contingency planning (**CGMS-45-CGMS-WP-12**) during Section 8 of the SWTT. The Contingency Plan was initially established by CGMS to consolidate the conclusions of: numerous contingency related discussions, guidance received from WMO bodies, and the lessons of experience. The current plan aims to serve as a reference for CGMS satellite operators in the planning and implementation of satellite missions. To support the development of this Contingency Plan, WMO conducted a gap analysis and reviewed this during WGIII. Additionally, WGIII also discussed the plan's scope of maintaining continuity of critical operations as well as using traditional risk framework to capture updates to this plan. He also touched upon how international collaboration must be maintained to ensure positioning and launching of assets upholds data continuity. Further coordination is necessary with WGII to determine what products need to be maintained and with WGIV to determine possible improvements for accessing near-real-time data from research and development satellites. He suggests CGMS to update the plan as well as establishing a tiger-team to perform these updates.

9. Review and updating of the HLPP

Mikael Rattenborg (CGMSSEC) reviewed the status of implementation of CGMS High Level Priority Plan (2016-2020) (**CGMS-45-CGMS-WP-10**) and the Proposed CGMS High Level Priority Plan (HLPP) for the period 2017-2021 (**CGMS-45-CGMS-WP-11**). Out of the discussion, the HLPP item 1.1.8 "Establish a coordinated approach to the reporting of space weather-related spacecraft anomalies" was recommended to move from the WGIII into the SWTT section.

10. Review status of the SWTT and plan for integration of SWTT topics into the other CGMS WGs (WGI - WGIV)

Representatives from all the working groups attended the SWTT and engaged with the SWTT in planning next steps to address space weather relevant HLPP items.

WG I – Review of the space weather-relevant HLPP targets and the WG I agenda and papers for CGMS-45 showed that WG I is successfully integrating SWTT topics into their activities.

WG II – Discussion focused on two HLPP targets relevant to space weather, 3.1.3 and 3.6.4. For 3.1.3, it was noted that inter-calibration of high-energy particle sensors is of high priority, and the combination of data to get global particle flux distribution in GEO and MEO. An international framework is needed to continue on inter-calibration activity, which should include other agencies and research institutions. Expertise from GSICS would be highly welcome. As a result, SWTT proposed Action A45.02 for SWTT members to review GSICS activities and deliver recommendations for its use as a model for space weather sensor inter-calibration activities. Additionally, SWTT proposed Action A45.03 for SWTT to invite a GSICS representative to the next SWTT inter-sessional meeting and to a topical discussion meeting during the European Space Weather Week Nov 27-Dec 01, 2017 in Oostende, Belgium.

In the discussion of how to progress towards HLPP target 3.6.4, SWTT noted that it is unclear if preventive measures by CGMS operators result from space weather alerts and warnings. The SWTT proposed that a survey be provided to CGMS member operators regarding if and how actions are undertaken by satellite operators in response to space weather threats and/or conditions via Action 45.07. Additionally, SWTT noted that training is needed for operators to understand how to use the predictive space weather information effectively. This will be revisited after completion of Action A45.07.

CGMS-45 actions - SWTT						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS	SWTT/10	A45.02	SWTT members review GSICS activities and deliver recommendations for its use as a framework for space weather sensor inter-calibration activities.	30 Dec 2017	**OPEN**	5.2.2
SWTT Co-Chairs	SWTT/10	A45.03	Invite a GSICS representative to the next SWTT inter-sessional meeting; and to a topical discussion during the European Space Weather Week Nov-Dec 2017 in Oostende, Belgium	30 Dec 2017	**OPEN**	5.2.2
SWTT Co-Chairs	SWTT/10	A45.04	Survey CGMS member operators regarding if and how actions are taking by satellite operators in response to space weather threats and/or conditions	30 Dec 2017	**OPEN**	5.2.3

WG IV - Discussion centred on the WGIV HLPP targets relevant to space weather, 2.8 and 2.9. SWTT noted that both of these targets were agenda items in the WGIV session on Tuesday but no papers

were submitted under the items. SWTT recommended that the SWTT Co-Chair attend WGIV and propose two actions within WG IV as first steps to addressing the two HLPP targets. WG IV agreed and two WG IV actions ask CGMS members to report on current data formats for space-based space weather observations (2.8) and the status of near real-time access of space weather data from instruments hosted on meteorological satellite (2.9).

SWTT – SWTT discussed the status of HLPP target 5.2.1. Reports were provided on the interactions between SWTT representatives and the space weather community at various forums to socialize the CGMS space weather role. In particular, CGMS presented at European Space Weather Week 2016 and at the UNCOPUOS Space Weather Expert Group meeting. Also, CGMS SWTT organized an electron inter-calibration mini-workshop at US Space Weather Workshop. It was noted that the UN COPUOS presentation from Section 6 discussed a pentagon shape with several organization as the foundation for this framework that featured CGMS in its unique role along with ISES, WMO, UNCOPUOS, and ICAO. Once CGMS agrees to this framework it needs further socialization throughout the community at various meetings, European Space Weather Week, SES, ISWI, COSPAR, IPT-SWeISS.

The SWTT noted that the WMO should extend an invitation for a member of CGMS to join IPT-SWeISS and represent the CGMS interests and overall role. In the meantime, the SWTT Co-Chair will participate in the IPT-SWeISS meeting next week via telecom to encourage the incorporation of anomaly collection, analysis, reporting, and resolution processes into their work plan.

CGMS-45 actions - SWTT						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
SWTT Co-Chairs	SWTT/10	A45.05	Engage ISES as an observer for CGMS plenary meeting and/or include with SWTT inter-sessional activities.	30 Dec 2017	**New**	5.2.1

11. Anomaly reporting and database discussion

A discussion was held on the status of spacecraft anomaly reporting by CGMS members (**CGMS-45-NASA-WP-06**), relevant to HLPP target 1.1.8. Three agencies, NOAA, EUMETSAT, and KMA, have reported their spacecraft anomalies using the WMO template provided to CGMS in 2012. CGMS member agencies expressed concern on the consistency of analysis and level of effort required to determine if the anomaly is due to a space weather event. Also, members were interested in what the ultimate disposition of this reporting is and whether it is or will be used. Currently, the SWTT members are not using other agencies anomaly databases. WMO mentioned that the IPT-SWeISS group could be a possible group that would gather and analyse these CGMS anomaly reports. Action 45.05 directs SWTT to engage the IPT-SWeISS to encourage analysis of anomaly collection, reporting, and resolution processes into their work plan.

From the discussion, it was apparent there is still a need to better define when a spacecraft anomaly is the result from a space weather event. To provide this clarification, Action 45.04: SWTT members report on procedures to determine if an anomaly results from a space weather event including what thresholds are used was created.

CGMS-45 actions - SWTT						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	SWTT/11	A45.06	CGMS operators report on internal procedures to determine if an anomaly results from a space weather event including what thresholds are used.	30 Dec 2017	**OPEN**	5.2.3
SWTT Co-Chairs	SWTT/11	A45.07	CGMS to engage WMO IPT-SWeISS to encourage incorporation of an analysis of anomaly collection, reporting, and resolution processes into their work plan.	30 Dec 2017	**OPEN**	5.2.3

12. Nomination and representatives at meetings

7/31/17-8/4/17: UN/US Workshop on the International Space Weather Initiative @ Boston College in Chestnut Hill, MA

- NASA planning to participate; will present on CGMS space weather role

9/18-22/17: 3rd COSPAR Symposium in Jeju Island, South Korea

- KMA will be participating for one-day; can also represent CGMS SWTT interests

9/21-27/17: Cosmic - IROWG 2017 @ The Stanley Hotel in Estes Park, CO

- NASA and NOAA planning to participate; can also represent CGMS SWTT interests

Fall Workshop: CGMS Socio-economics Benefits Tiger Team

- NASA and NOAA planning to participate pending location and date release; can also represent CGMS SWTT interests
- Additional POCs are encouraged to participate

11/27/17-12/1/17: 14th European Space Weather Week

- EUMETSAT, NASA, NICT, and NOAA planning to participate and hold a topical discussion meeting to discuss CGMS space weather role

13. Any other business

No other business discussed.

14. Next meetings 2017-2018 period

The SWTT identified four inter-sessional meeting dates:

- 14 September 2017 – finalize baseline architecture for operational space weather observations; GSICS representative to brief and discuss compatibility of GSICS and space weather
- 12 October 2017 – to address ESWW agenda
- 7 December 2017
- 15 March 2018

SWTT in conjunction with WGIII is requesting that CGMS conduct a survey (doodle poll) to schedule their joint inter-sessional meeting.

15. Review of actions/conclusions, preparation of WG report for plenary

It is clear from the reported activities in this SWTT meeting that CGMS's unique role in space weather has been successfully socialized amongst space weather international organizations and its potential role has been recognized. Discussions in the SWTT with the Working Group leads have established paths forward on many of the space weather related HLPP items and these were then presented and discussed in the Working Group meetings by the SWTT Co-Chairs.

In conclusion, the SWTT recommendation is to continue the SWTT until CGMS-46. Currently, some actions do not have a home in the Working Groups and the SWTT needs to continue addressing these. At CGMS-45, the internal efforts to incorporate HLPP targets within the Working Groups have been initiated and paths forward defined for each HLPP target relevant to space weather. Currently, we have several actions planned as joint efforts between the SWTT and the Working Groups. We recommend the SWTT continue to aid in maturation of these efforts into the Working Group structures.

CGMS-45 actions - SWTT						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
SWTT	SWTT/15	A45.08	CGMS operators report on internal procedures to determine if an anomaly results from a space weather event including what thresholds are used.	CGMS-46	**OPEN**	5.2.3

Finally, the SWTT finds that CGMS must have an interface with the space weather community to effectively advance space weather relevant HLPP targets. This will be accomplished by assessing the extent to which the identified CGMS space weather priority items have been successfully translated into the Working Groups through work in the inter-sessionals, and how much activity is still outside of the current Working Group infrastructure. The status of these SWTT efforts will provide a basis of recommendation as to future structure of the interface between CGMS and the space weather community going forward. This recommendation will be proposed at CGMS-46.

Status of SWTT CGMS-45 actions and recommendations resulting from CGMS-45 discussions:

CGMS-45 actions – SWTT						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS	SWTT/7	A45.01	SWTT members to identify initial baseline for space-based space weather measurements and hold intercessional with WGIII to plan forward analyses. This will be finalized in the first inter-sessional to be held on 14 September 2017.	30 Sep 2017	**OPEN**	1.1.9

CGMS-45 actions – SWTT						
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**	**HLPP ref**
SWTT members	SWTT/10	A45.02	SWTT members review GSICS activities and deliver recommendations for its use as a framework for space weather sensor inter-calibration activities.	30 Dec 2017	**OPEN**	5.2.2
SWTT Co-Chairs	SWTT/10	A45.03	Invite a GSICS representative to the next SWTT inter-sessional meeting; and to a topical discussion during the European Space Weather Week Nov-Dec 2017 in Oostende, Belgium	30 Dec 2017	**OPEN**	5.2.2
CGMS	SWTT/10	A45.04	CGMS operators report on internal procedures to determine if an anomaly results from a space weather event including what thresholds are used.	30 Dec 2017	**OPEN**	5.2.3
SWTT Co-Chairs	SWTT/10	A45.05	CGMS to engage WMO IPT-SWeISS to encourage incorporation of an analysis of anomaly collection, reporting, and resolution processes into their work plan.	30 Dec 2017	**OPEN**	5.2.3
SWTT Co-Chairs	SWTT/11	A45.06	Engage ISES as an observer for CGMS plenary meeting and/or include with SWTT inter-sessional activities.	30 Dec 2017	**OPEN**	5.2.1
SWTT Co-Chairs	SWTT/11	A45.07	Survey CGMS member operators regarding if and how actions are taking by satellite operators in response to space weather threats and/or conditions	30 March 2017	**OPEN**	5.2.3
SWTT	SWTT/15	A45.08	SWTT develops recommendation as to future structure of the interface between CGMS and the space weather community going forward.	CGMS-46	**OPEN**	5.2.1

CGMS-45 recommendations – SWTT							
Actionee	**AGN item**	**Action #**	**Description**		**Deadline**	**Status**	**HLPP ref**
SWTT		R44.01	**On Space Weather Task Team:** Sustain the SWTT for another year in order to enable CGMS space weather integration into existing Working Groups.	CGMS-45 discussions: Sustain the SWTT for another year in order to enable CGMS space weather integration into existing Working Groups until CGMS-46. CGMS-45: CGMS presentation and discussions have occurred at European Space Weather Week (ESWW) and UNCOPUOS. Discussions have been held with leadership of ISWI, COSPAR, and ISES. CGMS SWTT organised electron inter-calibration mini-workshop at US Space Weather Workshop CGMS space weather role is included in draft UNCOPUOS framework for space weather services. Planned: Dedicated CGMS ESWW topical discussion meeting ("Space Weather Activities in the Coordination Group for Meteorological Satellites.") - Nov 2017 Presentation of CGMS at UN/US ISWI workshop - Jul/Aug 2017 CGMS-44: Recommendation endorsed by CGMS-44 plenary.	Jun 2018	**OPEN**	5.2

CGMS

Report of the 45th Meeting of the Coordination Group for Meteorological Satellites

Annexes

ANNEXES

CGMS Agenda and Working Papers

The agenda and Working Papers (WPs) are available at http://www.cgms-info.org/agendas/Default.aspx

CGMS List Servers

There are currently six CGMS list servers for plenary, WGs I-IV and SWTT respectively. Information on points of contact and list servers is available upon request from the CGMS Secretariat at CGMSSec@eumetsat.int.

CGMS Charter, Members and Observers

Other information such as the CGMS Charter and the current list of Members and Observers are available at http://www.cgms-info.org/index_.php/cgms/page?cat=ABOUT&page=INDEX.

General enquiries

Please contact the CGMS Secretariat at CGMSSec@eumetsat.int in case of any enquiries related to CGMS.

ANNEX I: OPENING ADDRESS BY DR. YUNHWA KO, KMA ADMINISTRATOR

Dr. Alain Ratier,
Members from the WMO,
Distinguished guests and participants,

I would like to welcome all of you to the 45th Meeting of the Coordination Group for Meteorological Satellites. It is my great honour to have the 2nd chance to host the CGMS meeting since the first one in 2009.

I am very pleased that I've been allowed to have several opportunities to meet a lot of great satellite experts by hosting international meetings in the field of meteorological satellite. I believe such opportunities have made me feel closer to you than ever before, and I hope you also feel the same way.

KMA became the member of the CGMS at the 33rd meeting in 2005, and then hosted the 37th meeting in 2009, which was one year before the launch of COMS. And today, hosting the 45th CGMS meeting is all the more meaningful and significant because almost a year from now on, KMA will launch GK2A.

The history of the CGMS has reminded me of two Greek mythological characters, (not meteorological characters). One is Polyphemus and the other is Argus. As you know, Polyphemus was a monster with a single eye, whereas Argus was a giant with one hundred eyes. Polyphemus was able to see the world with one point of view, but Argus could see with one hundred points of views. Furthermore, since Argus slept with his only 2 eyes closed and other 98 eyes awake, Argus was able to watch the world for 24 hours a day and 365 days a year.

I came to realize that the CGMS has something in common with Argus because since its establishment in 1972, the CGMS has coordinated various viewpoints of different nations and organizations to fill the observation gaps for the continuous monitoring of the Earth by moving their own satellite to cover the other region and to cooperate each other for the development of meteorological satellite technologies.

I believe that the way members of the CGMS mutually understand and collaborate is exactly what we need as a new way of work and management for the sustainable development of the Earth. Just like Polyphemus, I also have my own point of view to see the world, but meetings with those in the meteorological satellite community have provided me with a new perspective to view the world.
You have developed inter-calibration technologies for various instruments and are now sharing the data, data processing and its utilization technologies to provide constant and stable observation information, not only for the current users but also for our next generation. In this sense, I think you are like Argus with one hundred eyes, who are contributing to the sustainable development of the Earth.

I am sure that your endeavour will serve as a priceless asset for our next generation. I believe the outcomes from this CGMS meeting will lay a solid foundation for the advancement of meteorological

satellites. And I hope you will achieve desired results in terms of satellite development, planning, operation, and utilization.

Lastly, I again would like to extend my warmest welcome to all of you, and I'd like to thank the CGMS Secretariat and staff members of the NMSC for their efforts in organizing this meeting.

Thank you.

ANNEX II: SUMMARY LIST OF ACTIONS AND RECOMMENDATIONS RESULTING FROM CGMS-45 DELIBERATIONS

CGMS list of CGMS-45 actions and recommendations (plenary, WGs I-IV, SWTT):

CGMS-45 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/ closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	C.1	A45.01	CGMS space agencies to provide comments on draft Vision for WIGOS in 2040 (Appendix I) by 31/07/2017 (CGMS-45-WMO-WP-01)		31 Jul 2017	**OPEN**	1.1
CGMS space agencies, IROWG, IPWG, IWWG, ICWG, ITWG	C.2	A45.02	CGMS International Science Working Groups and CGMS space agency members to formulate science questions, including the impact of data latency, in view of the 7th Impact WS 2020 (ref. CGMS-45-WMO-WP-02) and provide these to lriishojgaard@wmo.int		CGMS-46	**OPEN**	1.1.2
WMO	C.3	A45.03	WMO to, in collaboration with CEOS, to investigate the possibility of aligning the reporting templates for OSCAR/Space with those used to update the CEOS MIM database, at least for common parameters, thus facilitating the reporting task at the agency level.		CGMS-46	**OPEN**	1.1.6
CGMS	C.3	A45.04	CGMS to invite the ISWGs to nominate experts for participation in the OSCAR/Space Science and Technical Advisory Team.		End Aug 2017	**OPEN**	1.1.6
NOAA	C.4	A45.05	NOAA/NESDIS to support the Space-based Monitoring of Weather and Climate Extremes project by providing satellite observations of heavy precipitation events, and land surface parameters for monitoring droughts. The observations are required with a short latency of about one day. Furthermore the project requires the creation of climate reference data sets which will be used by the RCCs to classify observations as extreme event or not (CGMS-45-WMO-WP-05)		31-Dec-17	**OPEN**	5.1

CGMS-45 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/ closing document**	**Deadline**	**Status**	**HLPP ref**
JAXA	C.4	A45.06	JAXA to support the Space-based Monitoring of Weather and Climate Extremes project by providing a short-term (from 5-day up to monthly) climate normal from GSMaP data archives as a reference precipitation data set for the initial SEMDP areas, i.e. East Asia and Western Pacific regions. JAXA is also requested to set-up the on-line environment to provide GSMaP data with short latency to be utilized in the SEMDP (CGMS-45-WMO-WP-05).		31-Dec-17	**OPEN**	5.1
IPWG	C.4	A45.07	IPWG co-chairs and rapporteur to provide guidance on the estimation of uncertainties and representativeness of the short-latency precipitation products related to the Space-based Monitoring of Weather and Climate Extremes project (CGMS-45-WMO-WP-05)		CGMS-46	**OPEN**	5.1
JWG CLIM	C.4	A45.08	CEOS/CGMS Working Group on Climate to provide feedback on the proposed definition for ICDR (CGMS-45-WMO-WP-05)		CGMS-46	**OPEN**	5.1
WMO	C.6.1	A45.09	WMO to report to CGMS-46 on the status of the development of WMO Policy Framework for public-private sector engagement in view of the implications for free and open international exchange of meteorological satellite observations		CGMS-46	**OPEN**	1.1
WMO	C.6.1	A45.28	CGMS members to provide a focal point of contact to WMO (sbojinski@wmo.int) for participation in the WMO Public Private Engagement discussion		15-Oct-17	**OPEN**	1.1
IOC-UNESCO	C.8	A45.29	IOC-UNESCO to provide a paper on guidance to CGMS members (at CGMS-46) on geostationary satellite measurements of essential ocean variables.		15-Apr-18	**OPEN**	2.5
WMO	C.8	A45.10	WMO to report on the progress regarding JCOMM and satellite observations.		CGMS-46	**OPEN**	2.5

CGMS-45 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/ closing document**	**Deadline**	**Status**	**HLPP ref**
EUMETSAT	D.13	A45.11	EUMETSAT, on behalf of ROSHYDROMET, to ingest Meteor-M N2 level 1 brightness temperatures from MTVZA-GY on the GTS for global data exchange		Q3 2017	**OPEN**	2.6
IWWG	E.1.1.1	A45.12	IWWG to prepare a proposal to CGMS on how to fund the analysis of the future AMV International Intercomparison studies.		CGMS-46	**OPEN**	3.2.1
CGMSSEC	E.2	A45.13	On behalf of CGMS, CGMS SEC to send a letter to ITU Secretary-General. Letter drafted by WGI (AWGI45.01) emphasising the need for protecting EESS and passive bands necessary for remote sensing. It also agreed in tasking WMO to take similar steps and informing the different members of WMO on the need of emphasising the importance of protecting the passive sensing bands (as per WGI discussions, CGMS-45-CGMS-WP-05)		Jun/Jul 2017	**OPEN**	1.3.1
WMO	E.2	A45.14	WMO to send a letter to ITU Secretary-General based on the CGMSSEC letter (drafted by WGI (AWGI45.01) emphasising the need for protecting EESS and passive bands necessary for remote sensing. It also agreed in tasking WMO to take similar steps and informing the different members of WMO on the need of emphasising the importance of protecting the passive sensing bands (as per WGI discussions, CGMS-45-CGMS-WP-05))		mid July 2017	**OPEN**	1.3.1
WGI/WGIV (CGMS members)	E.2	A45.15	• WGI/WGIV to establish a small task team to examine the current Terms of Reference in light of the thematic areas covered by both working groups to address overlap and to consider adding relevant topics related to satellite and ground system operational topics not currently covered in either of the two working groups and to report to CGMS-46		CGMS-46	**OPEN**	

CGMS-45 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/ closing document**	**Deadline**	**Status**	**HLPP ref**
			• The team should propose additional operational topics as well as possible alternatives for realignment of the themes for both working groups to include the possible merger of the two working groups (including the topics discussed in the Space Weather Task Team) (Ref. CGMS-45-CGMS-WP-05)				
CGMS members	E.4	A45.16	CGMS members to nominate contributors to participate in the intersessional meetings on the CGMS contingency planning including the WMO face-to-face meeting (ref WGIII discussions, CGMS-45-CGMS-WP-07)		Jul-17	**OPEN**	1.1.7
WMO	E.4	A45.17	WMO to call for and hold a face-to face intersessional meeting on the CGMS contingency planning in the second half of 2017 (ref WGIII discussions, CGMS-45-CGMS-WP-07)		Q3/Q4 2017	**OPEN**	1.1.7
WMO	E.5	A45.18	WMO to send an invitation for the IPT-SWeISS to the CGMS Secretariat to secure participation by CGMS at the meeting.		Jul-17	**OPEN**	5.2.1
CGMS members	G	A45.19	CGMS to deliver proposal to WMO for inclusion in Vision 2040 for a target architecture to monitor GHG and carbon from space. (Ref. CGMS-45 plenary session G)		Oct-17	**OPEN**	5.4.2
CGMS members	H.2	A45.20	CGMS to endorse the gap analysis report and the coordinated action plan in writing prior to CEOS 2017 plenary meeting, to the Joint CEOS-CGMS WG Climate (pascal.lecomte@esa.int and joerg.schulz@eumetsat.int)		15-Oct-17	**OPEN**	5.1.1
CGMS members	H.2	A45.21	CGMS to endorse the final draft of the space agency response to the new GCOS-IP in writing, prior to the submission to the SBSTA-47, to the CEOS-CGMS JWG Climate (pascal.lecomte@esa.int and joerg.schulz@eumetsat.int)		15-Oct-17	**OPEN**	5.1.3

CGMS-45 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/ closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	H.2	A45.22	CGMS to review the Space Agency Statement to COP-23 SBSTA-47 in writing (prior internal review by the EC and submission to the SBSTA-47 by 6 October 2017), to the Joint CEOS/CGMS WG Climate (pascal.lecomte@esa.int and joerg.schulz@eumetsat.int)		14-Jul-17	**OPEN**	5.1.2
CGMS members	F.1	A45.23	CGMS members to consider ideas on further contributions to the 3 GEO Engagement Priorities (SDGs, Paris Agreement, Sendai Framework of Actions) and potential interests of participation to Flagships, Initiatives and Foundational Tasks in the GEO Work Programme 2017-2019 (Areas in need of strengthening: CEOS-CGMS Joint Working Group on Climate; Non-meteorological Applications for Next Generation Geostationary Satellites (CEOS-CGMS); GEONETCast; Radio-Frequency Protection Education and Training (VLab); User Requirement (Member's studies); Carbon Observations (CEOS-CGMS))		15-Sep-17	**OPEN**	
CGMS members	I.1	A45.24	CGMS Members to indicate to WMO (sbojinski@wmo.int) and the CGMS Secretariat (cgmssec@eumetsat.int) whether they would be interested in and in a position to host the VLab Technical Support Officer as of 1 September 2018.		15-Sep-17	**OPEN**	4.2.3
CGMS space agencies, CGMSSEC	J.2	A45.25	CGMS space agencies to provide the list of oceanographic products from GEO satellites to cgmssec@eumetsat.int for provision to IOC-UNESCO.		30-Sep-17	**OPEN**	2.5
CGMS members	J.2	A45.26	CGMS members to confirm participation in the 3 proposed Non Meteorological Applications projects - aerosol/dust, fire, and flooding - and nominate POCs to form Task Teams reporting to WGII		Sep-17	**OPEN**	3.5.4

CGMS-45 plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/ closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	J.2	A45.27	CGMS members to confirm interest in a flood mapping pilot project using GEO satellites, as a proposal for the SCOPE-Nowcasting Executive Panel meeting on Sept 18-20, 2017		01-Sep-17	**OPEN**	3.5.4
CGMSSEC	J.2	A45.30	Fire: CGMS SEC to approach GOFC-GOLD to explore the possibility for CGMS members to become part of the fire project		CGMS-46	**OPEN**	3.5.4
CGMSSEC	J.2	A45.31	Aerosol: CGMS SEC to explore with AEROSAT if they pursue an activity regarding the use of new-generation GEO data.		CGMS-46	**OPEN**	3.5.4
CMA, NOAA	J.2	A45.32	NOAA and CMA to develop a proposal to develop GEO-based flood mapping as a potential SCOPE-Nowcasting pilot project. The WMO Multi-Hazard Early System (MHEWS) and the Flash Flood Guidance System (FFGS) should be invited to collaborate in this proposal.		CGMS-46	**OPEN**	3.5.4

CGMS-45 plenary recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS agencies	E.1.2	R45.01	IROWG recommends CGMS to encourage GNSS providers and agencies to make ICDs (Interface Control Documents) of GLONASS and Beidou Open Service signals available as soon as possible		N/A	**OPEN**	1.1.4
WMO	E.1.3	R45.02	Recognising that IPWG has considerable expertise in precipitation science and applications, IPWG requests the WMO (likely via VLAB) to establish regular training events on precipitation data sets and applications, for which IPWG will provide disciplinary expertise.		N/A	**OPEN**	3.5.3

CGMS-45 plenary recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members + IPWG, ITWG and ICWG	E.1.3	R45.03	Recognising the need for continued enhancements to the baseline precipitation observing system to a broader user community (including hydrology, NWP prediction, RTM modelling), IPWG recommends that CGMS members continue to pursue advanced sensors through close coordination with CGMS ISWG's including IPWG, ITWG and ICWG.		N/A	**OPEN**	
IOC-UNESCO, CGMS members	C.7	R44.02	**On Second International Indian Ocean Expedition (IIOE-2) for enhanced data acquisition and management:** It was recommended to establish a working alliance between the IIOE-2 and the remote sensing community (CGMS) within/through the IIOE-2 Steering Committee framework and/or the IIOE-2 Joint Project Office.	There was no feedback by CGMS-45 and the recommendation remains open.	(CGMS-45) **CGMS-46**	**OPEN**	2.5

WGI actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	WGI/6	A43.06	WMO to assess the impact of improved data latency from polar orbiters on NWP (WMO Impact Workshops) and other applications	Next WMO workshop will take place in May 2016 (China), hence there might be a verbal/preliminary report only to CGMS-44. Discussed at CGMS-45.	(CGMS-44) New deadline CGMS-46	**OPEN**	1.1.2
CGMS space agencies	WGI/2	A44.05	CGMS agencies to provide prior to CGMS 45 a report on the space weather activities (including spacecraft and instruments) of relevance on frequency	CGMSSEC to request SWTT representative to provide a paper to WGI to this purpose (and present it in WGI). SWTT informed by e-mail 7 April 2017.	(Feb 2017) CGMS-46	**OPEN**	1.3

WGI actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
			management and frequency protection topics	CGMS-45 NOAA-WP-04 Agency reports on Frequency topics to include a dedicated chapter on space weather.			
CGMS space agencies	WGI/6.1	A44.08	CGMS agencies with satellites with DB and RO occultation sensors to assess the technical feasibility of a RARS/DBNet RO occultation service in support of the Space Weather community.	*Deadline extended following CGMS-45 discussions.* CGMSSEC to request IROWG representative to provide a paper to WGI to this purpose (and present it in WGI) NOAA does not have any ability to use RARS for RO data	(CGMS-45) CGMS-46	**OPEN**	1.4
CGMS space agencies	WGI	A44.09	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs	*Deadline extended following CGMS-45 discussions.* *As a member, NOAA agrees that the GODEX-NWP group would be an excellent source of information on the planned types of next-gen GEO data to be disseminated and methods of data dissemination between the international NWP modelling centres. The GODEX-NWP group is also at the forefront of RARS endeavours.*	(CGMS-45) CGMS-46	**OPEN**	

CGMS-45 WGI actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUM	3	A45.01	WGI chair to draft a letter, on behalf of CGMS, to ITU Secretary-General emphasizing the need for protecting EESS and passive bands necessary for remote sensing		End June 2017	**OPEN**	1.3.1
EUM	3.1	A45.02	CGMS/SFCG liaison officer to share SF36-45/D with WGI participants, IROWG chair and IPT-SWeISS members		End June 2017	**OPEN**	1.3
WMO	3.1	A45.03	WMO to share with all CGMS members the outcome of the survey prior to the inter-sessional meeting		Aug 2017	**OPEN**	1.3
CGMS WGI members	4.2	A45.04	WGI members to nominate/confirm points of contact participating in the related inter-sessional meetings		Jun 2017	**OPEN**	1.4
EUM	5	A45.05	EUMETSAT to report to CGMS-46 on the status of progress on future EDCP (ESA study)		CGMS-46	**OPEN**	1.2
CGMS members	5	A45.06	WGI participants to review annex I of CGMS-45-EUMETSAT-WP-30 and update the related information in time for the first inter-sesssional meeting		Sep 2017	**OPEN**	1.2
CGMS members	6.2	A45.07	WGI to re-assess during the dedicated inter-sessional meetings the aspects of S/W delivery and installation needs in BP.04 for avoiding, if considered adequate, making explicit reference to any tool or package.		CGMS-46	**OPEN**	1.4.4

CGMS-45 WGI actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	6.2	A45.08	CGMS member with satellites with a Direct Broadcast service to evaluate the draft template for reporting status of implementation and to address possible updates in the first of the inter-sessional meeting on DB topics identified above.		Oct 2017	**OPEN**	1.4.4
WGI and WGIV chairs and rapporteurs	9 (AOB)	A45.09	A small task team be established to examine the current Terms of Reference in light of the thematic areas covered by both working groups. The team should propose additional operational topics as well as possible alternatives for realignment of the themes for both working groups to include the possible merger of the two working groups.		CGMS-46	**OPEN**	

CGMS-45 WGI recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGI/2	R44.01	CGMS agencies to inform their Freq Managers on the space weather activities to ensure the necessary protection and coordination at Freq management level	NOAA has informed their spectrum managers on space weather activities. They are actively working to identify spectrum for the SWFO as well as coordinating with other SMs on COSMIC-2 in preparation for launch. NOAA SM are also engaged in WRC Agenda Item 2.3 "relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors"	Long term	**OPEN**	1.3
CGMS space agencies	WGI/5	R44.02	All CGMS DCS operators to consider making all DCP messages available on the GTS.	CGMS-45 CMA-WP-xx; CGMS-45 EUM-WP-28; CGMS-45 ISRO-WP-xx; CGMS-45 JMA-WP-xx; NOAA currently does this CGMS-45 NOAA-WP-xx; CGMS-45 ROSH-WP-xx	Long term	**OPEN**	1.2
CGMS space agencies	WGI	R44.03	From CGMS-44 WGII: Agencies to explore the possibilities to develop suitable processing packages to support a direct broadcast implementation of RO processing, within the DBNet to improve timeliness for space weather applications			**OPEN**	5.2

WGII actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/4	A44.02	CGMS members to submit data to the ICWG intercomparison: full-disk data at 10 minute temporal resolution, 2 km spatial resolution in the native AHI projection is preferred. The data should be submitted by 1 September 2016.	ICWG plans underway (see above Action); communicate new Golden Day(s) to CGMS members as soon as decided; CGMS-45: remains open since some submissions missing or forthcoming	New: CGMS-46 (1 Sept 2016)	**OPEN**	3.2.3
IMD	WGII/6	A44.08	IMD to provide more information (documentation, availability details, URL) about the RAPID tool , for inclusion in the WMO webpage on Visualization Tools to CGMSSEC	Documentation to be provided by Virendra Singh to WMO ; CGMS-45: Details to be provided by ISRO	1 Oct 2016	**OPEN**	
IROWG	WGII/8	A44.13	IROWG to define the requirements on timeliness for RO observations	CGMS-45: IROWG-WP-01: We recommend that future RO missions include communications infrastructure that will enable 95 % of the measurements to be available for use in operational models within 30 minutes or less. Data older than 30 minutes is of lower value for current models. Near-real time data latency would be optimal, but is not always practical, and should be considered to be a useful goal for future missions when possible. In the specific case of COSMIC-2 Polar, south polar ground stations (e.g., McMurdo, Troll) should be deployed to reduce data latency IROWG to look at the implications of the requirement on ionospheric processing. IROWG rapporteur to check status (space weather-related); state-of-the-art to be reported out through IROWG	New deadline: CGMS-46 (CGMS-45)	**OPEN**	1.1.4

CGMS-45 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SCOPE-CM Chair	4	A45.01	SCOPE-CM Chair to inform ISRO about the maturity matrix model, to enable its application to ISRO datasets.		15 Aug 2017	**OPEN**	3.3.2
IROWG	4	A45.02	IROWG to develop a detailed proposal for OSSEs regarding LEO-LEO MW occultation and GNSS-RO&-reflectometry.		01-Nov-17	**OPEN**	1.1.4
IWWG	4	A45.03	IWWG to liaise with the NOAA representative on PSTG (Jeff Key, jeff.key@noaa.gov) regarding the potential use of 3D winds from AIRS for Year of Polar Prediction studies.		01-Jul-17	**OPEN**	
IPWG	4	A45.04	IPWG to produce documentation on precipitation climate data record generation and related activities worldwide, including prospects for continuity		CGMS-46	**OPEN**	5.1
GSICS	4	A45.05	GSICS to produce annual state of the observing system report to be delivered at CGMS		CGMS-46	**OPEN**	3.1
CGMS agencies	4	A45.06	CGMS Agencies to implement Landing Pages on calibration events accessed via WMO-OSCAR.		CGMS-46	**OPEN**	3.1
CGMSSEC	5	A45.07	CGMS SEC to approach GOFC-GOLD to explore the possibility for CGMS members to become part of the fire project.		CGMS-46		3.5.4

CGMS-45 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMSSEC	5	A45.08	CGMS SEC to explore with AEROSAT if they pursue an activity regarding the use of new-generation GEO data		31 Jul 2017	**OPEN**	3.5.4
CGMS agencies	5	A45.09	To confirm interest in a flood mapping pilot project using GEO satellites, as a proposal for the SCOPE-Nowcasting executive panel meeting (18-20 Sep 2017		01-Sep-17	**OPEN**	3.5.4
NOAA and CMA (lead), WMO (contributing)	5	A45.10	Develop a proposal to develop GEO-based flood mapping as a potential SCOPE-Nowcasting pilot project. The WMO Multi-Hazard Early Warning System (MHEWS) and the Flash Flood Guidance System (FFGS) should be invited to collaborate in this proposal.		01-Sep-17	**OPEN**	3.5.4
CMA	7	A45.11	CMA to add Clear-Sky Radiance as a FY-4A baseline product		CGMS-46	**OPEN**	

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
ICWG	4	R45.01	ICWG to liaise with IPWG to explore common interests in the area of cloud microphysics and scattering libraries of hydrometeors (liquid, ice).			**OPEN**	3.6.2, 3.6.3

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	4	R45.02	Recognizing that IPWG has considerable expertise in precipitation science and applications, IPWG requests the WMO (likely via VLAB) to establish a regular training event on precipitation data sets and applications, for which IPWG will provide disciplinary expertise.			**OPEN**	3.5.3
CGMS member, WG III	4	R. 45.03	Recognizing the need for continued enhancements to the baseline precipitation observing system to a broader user community (including hydrology, NWP prediction, RTM modeling), IPWG recommends that CGMS members continue to pursue advanced sensors through close coordination with CGMS ISWG's including IPWG, ITWG and ICWG.			**OPEN**	
IPWG	4	R45.04	IPWG to maintain close relationship with GEWEX in its work, and at its next workshop (e.g. through a joint session)			**OPEN**	
GSICS	4	R45.05	Calibration events logging task team be folded under GSICS as a task team			**OPEN**	3.1
GSICS	4	R45.06	Under the task team, agencies should assess the compliance of each agency with the new guidelines on events logging, and establish a list of instruments to be addressed by the calibration logging system.		CGMS-46	**OPEN**	3.1

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
ISRO	7	R45.07	ISRO to consider adding a direct broadcast capability to future satellites.			**OPEN**	1.4
ROSH, WG IV	7	R45.08	Roshydromet to explore steps with Working Group IV to enable global exchange of data from the MTVZA-GY instrument.			**OPEN**	2.5
CGMS agencies	8	R45.09	CGMS agencies encouraged to document their products online, including ATBDs and validation reports, and link product page URLs to the WMO Product Access Guide following defined documentation criteria. (current agency focal points in WMO IPET-SUP: Sally Wannop (EUMETSAT), Natalia Donoho (NOAA), Chu-Yong Chung and Jin Woo (KMA), Xiang Fang (CMA), Shiro Ohmori (JMA))			**OPEN**	5.3
CMA		R45.10	CMA to add Clear-Sky Radiance as a FY-4A baseline product.			**OPEN**	
SCOPE-CM members	WGII/3	R43.01	SCOPE-CM to invite contributions to its next call for proposals, with particular regard to the sea ice, snow cover and land surface temperature communities, and others currently not represented.	SCOPE-CM executive panel in Sep 2016 to decide on approach regarding next call for proposals; check draft SEP-11 report		**OPEN**	3.3.2

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGII/3	R43.02	CGMS members to consider removing spectral gaps from future hyperspectral sounders to support GSICS intercalibration of IR imagers.	To be discussed at second WGII inter-sessional meeting after CGMS-44. (For WG III to consider)		**OPEN**	3.1.1
CGMS members	WGII/6	R43.03	CGMS members to consider include a water vapour channel and a CO2 channel to polar-orbiting imagers, to maintain accuracy and coverage of polar winds and cloud height retrievals achieved by MODIS.	To be discussed at a second WGII inter-sessional meeting after CGMS-44. (For WG III to consider)		**OPEN**	1.1.6
CGMS space agencies	WGII/10	R43.07	CGMS agencies to make available a non real-time cache of satellite level 1 data over the previous 2-3 months, similar to the NOAA CLASS system.	CGMS-44 IMD: At present there are no such plans (until a new data centre is installed).		**OPEN**	
ISRO	WGII/5	R43.10	ISRO is encouraged to implementing a multi-sensor precipitation estimate based on SAPHIR and INSAT-3D	CGMS-45: ISRO/IMD have plans		**OPEN**	
IWWG, IPET-OSDE	WGII/6	R43.12	IWWG to liaise with the application focal points in the WMO RRR process (on IPET-OSDE) to provide feedback on the winds-related observation requirements in the RRR database.	CGMS-45: IWWG addressed this for capabilities, need to follow up regarding requirements		**OPEN**	
CGMS space agencies	WGII/7	R43.13	CGMS Members to approach Operators of GNSS systems to request them to provide a minimum level of information on the signal structure and interface control (ICD) in a timely manner to enable the use of these for future RO missions.	To be discussed at the second WGII inter-sessional meeting after CGMS-44. CGMS-45: IROWG discussed this and made recommendations		**OPEN**	1.1.4

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
GSICS	WGII/4	R44.02	GSICS to report to SCOPE-CM projects on its plan to intercalibrate the geostationary ring using hyperspectral IR sounders as transfer function	*done, occurring in IOGEO*		**OPEN**	3.1
GSICS	WGII/4	R44.03	GSICS member agencies to identify roles and responsibilities and funding needs to support the geostationary ring GSICS corrections including the processing of retrospective data going back to NASA EOS AIRS (2002).	CGMS-45: Partially addressed; GRWG encouraged agencies to inter-calibrate past data		**OPEN**	3.1.1
CGMS space agencies	WGII/4	R44.04	CGMS agencies should employ the GSICS Correction as part of their operational procedures	Should be part of agencies		**CLOSED**	3.1.1
CGMS members	WGII/4	R44.05	CGMS members to budget a baseline funding for the cloud intercomparison study, given its importance and impacts on global cloud products.	CGMS-45: ICWG-WP-01: Currently, ICWG helps to facilitate the collection of data used for assessments (e.g., level-2 retrieval assessment in TG “Assessment of level-2 retrievals” or level-3 climate data records in TG “Assessment of cloud parameter data records for climate studies”), but many teams carried out the efforts on a volunteer basis. Lack of funding has limited the scope and prohibited a definitive analysis of the new HIMAWARI-8 data set.		**OPEN**	3.2.3
IROWG, IPWG, IWWG, ITWG	WGII/4	R44.06	To enhance coordination, ISWGs to discuss with ICWG co-chairs key items for collaboration.			**OPEN**	

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS R&D agencies	WGII/4	R44.07	Research agencies to consider continuing space-borne lidar for ice/liquid water since they have proven very valuable to validate retrievals from passive sensors			**OPEN**	1.1.3
CGMS space agencies	WGII/4	R44.08	All operators of next-generation GEO imagers to consider the implementation of routine full-disc 10-min (or better) scanning for Nowcasting	CGMS-45: NOAA consider this for GOES-16		**OPEN**	3.2.4
CGMS space agencies	WGII/4	R44.09	CGMS Members to continue an operational constellation of conically-scanning microwave platforms to guarantee sustained support for the current level of capability.	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45. CGMS-45: Questions of resolution, frequency need to be resolved, not just high-level mission continuity		**OPEN**	1.1.6
CGMS members	WGII/4	R44.10	At the request of IPWG, CGMS to improve cross-agency coordination of satellite assets into A-train-like convoys of instruments with sensitivities to distinct aspects of precipitation processes (e.g., CloudSat, EarthCare, GPM, etc.).	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45.		**OPEN**	
NOAA	WGII/4	R44.11	NOAA is strongly encouraged to fully fund and launch both equatorial and polar components of COSMIC-2.			**OPEN**	1.1.4

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGII/4	R44.12	CGMS agencies to target at least 20,000 occultations/day, at appropriate global distribution, to be made available to the operational and research communities, based on recent impact studies (NWP, climate and space weather)			**OPEN**	1.1.4
CGMS members	WGII/4	R44.13	CGMS agencies to ensure that the RO receiver design includes sufficient software/firmware flexibility to allow changes in the signal processing including processing of new GNSS signals/constellations, including ionospheric measurements			**OPEN**	1.1.4
CGMS space agencies	WGII/4	R44.14	CGMS agencies to maintain the constellation of at least three polar orbits (early morning, morning, and afternoon), each with full sounding capabilities (IR and MW). The overpass times of operational satellites with sounding capability (IR and MW) should be coordinated between agencies to maximize their value.	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45.		**OPEN**	1.1.1
CGMS space agencies	WGII/4	R44.15	Future satellite programmes should include the provision of high temporal frequency MW humidity sounding radiances (alongside cloud and precipitation sensitive observations).	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45. CGMS-45: NASA Cubesat mission Tropics underway		**OPEN**	1.1.1

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
ROSH	WGII/4	R44.16	Roscosmos to develop and release a direct broadcast processing package (for level 1 data) for the MTVZA-GY microwave imager. Roshydromet to provide dissemination of this package to interested users.			**OPEN**	1.1.5
CGMS space agencies	WGII/4	R44.17	CGMS agencies to identify the resources required to support the 3rd intercomparison of satellite-derived winds.	Reference is made to recommendation for ICWG.		**OPEN**	3.2.1
space agencies	WGII/4	R44.18	CGMS satellite operators to consider coordination of orbits for scatterometer instruments and to provide open and timely access to data in order to maximise independent coverage and benefits to nowcasting and NWP from assimilation of scatterometer wind data.	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45.		**OPEN**	1.1.6
CGMS space agencies	WGII/4	R44.19	CGMS agencies to explore possibilities to derive winds from new upcoming satellites and opportunities.			**OPEN**	

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGII/4	R44.20	CGMS members to continue to support SCOPE-Nowcasting and its transition to pre-operational phase, in particular to consider financial support the finalization of the satellite-based volcanic ash retrieval algorithm intercomparison activitiy (Pilot Project 2) over the next 12-18 months.	*Deadline for indication of support to volcanic ash activity)* *No indication of support to VA intercomparison so far received by WMO. WMO has identified resources to engage consultant for 2.5 months FTE to support SCOPE-Nowcasting.* *CGMS-45: Funds earmarked by EUMETSAT for 2018*		**OPEN**	3.2.2
CGMS space agencies	WGII/6	R44.21	Operators to take into account in the planning of their data distribution systems the emerging stringent requirements on data latency from SRNWP			**OPEN**	2
CMA	WGII/7	R44.22	CMA to make available data from FY-3D HIRAS and FY-4A GIIRS early in commissioning			**OPEN**	
CGMS space agencies	WGII/7	R44.23	CGMS agencies with operational direct broadcast needs are encouraged to attend the next ITWG sponsored Direct Broadcast Users Meeting in March 2017 hosted by CONAE, Argentina.	CGMS-45: Last week of June 2017, Madison WI, USA		**OPEN**	
CGMS space agencies	WGII/7	R44.24	CGMS agencies to provide key documentation related to the quality of their products, to allow for informed uptake by users. These documents should include ATBDs, cal/val plans, and regular validation reports	CGMS-44 WGII: Part of WGII action to develop best practices CGMS-45 NOAA-WP-13		**OPEN**	5.3

CGMS-45 WGII Recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/7	R44.25	For monitoring the Polar Regions, the Group stressed the importance of the deployment of HEO missions	*Link to WGIII required*		**OPEN**	1.1
CGMS space agencies	WGII/8	R44.26	Satellite operating agencies should support proposals and programs to acquire high-accuracy characterization measurements of the Moon, to develop a new, high accuracy, SI-traceable lunar reference standard for reflected solar wavelengths.	CGMS-45: GSICS discussed this issue		**OPEN**	3.1.2
CGMS space agencies	WGII/8	R44.27	Long-term continuity of absolute solar spectral irradiance measurement with SI-traceable accuracy should be ensured.			**OPEN**	3.2.1
CGMS space agencies	WGII/8	R44.28	Agencies to explore the possibilities to develop suitable processing packages to support a direct broadcast implementation of RO processing, within the DBNet to improve timeliness for space weather applications			**OPEN**	
WGII	WGIII/6	R44.29	From WGIII to WGII: WGII to study this issue and provide guidance on the potential impact of temporal a gap in the PMW SST products.	CGMS-45: 6.9MHz currently used, in future only GCOM-W will provide this capability for the time being.		**OPEN**	

WGIII actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/	A44.01	CGMS Members: To review and react to the WIGOS Vision 2040 as it develops	Input provided by EUM, NOAA (July 2016)	(Aug 2016) CGMS-46	**OPEN**	1.1
WMO	WGIII/	A44.02	WMO Secretariat to present the draft Vision at CEOS, GEO plenary sessions 2016.	Deferred to next plenary cycle (2017)	(End 2016) CGMS-46	**OPEN**	1.1
CGMS members	WGIII/3	A44.03	CGMS operators nominate focal points for maintaining these elements (dates, landing pages), and other elements included in OSCAR/Space (e.g., instrument characteristics).	EUM: sally.wannop @eumetsat.int NOAA: Matthew.Butler@noaa.gov	31 Jul 2017	**OPEN**	5.3

CGMS-45 WGIII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS	WGIII/4	A45.01	Initiate review of CGMS Baseline, to be synchronised with development of WMO "Vision for WIGOS in 2040"		CGMS-46	**OPEN**	1.1.8
WMO	WGIII/ 5.1.1	A45.02	Update the risks assessment and gap analysis of implementation against the CGMS baseline; include the potential risk of gaps in the capability for passive microwave imaging in this update		CGMS-46	**OPEN**	1.1.6
CGMS	WGIII/5.4	A45.03	WMO to support one face to face Inter-sessional meeting to start off new planning effort.		CGMS-46	**OPEN**	1.1.7

CGMS-45 WGIII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SETT	WGIII/8	A45.04	Propose a way forward for guiding and coordinating socio-economic Benefit studies among the CGMS community.		CGMS-46	**OPEN**	4.1
WGIII and SWTT	WGIII/9	A45.05	WGIII and SWTT to organise joint inter-sessional to discuss SW updates to CGMS baseline		Jul 2017	**OPEN**	1.1.9
WMO	WGIII/10	A45.06	Include impact of data latency among science questions posed to 7th WMO Impact Workshop		2020	**OPEN**	1.1.2
WGIII	WGII/4	A45.07	**Action from WGII:** Study the continuity of the current constellation of passive microwave sensors (for high quality satellite precipitation products for weather, climate and hydrological applications) through proper coordination of satellites, sensors and equatorial crossing times.		CGMS-46	**OPEN**	1.1.6

CGMS-45 WGIII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS Agencies	WGIII/5.1.2	R45.01	Agencies to consider contributing resources (financial, in-kind, or via secondment) to the development and maintenance of OSCAR/Space			**OPEN**	
WMO	WGIII/	R44.02	Noting the recent conclusions of the WMO IPET-DRMM and the concurrence expressed CGMS WG III, WMO is encouraged to add the satellite identifier (from Common Code Table		CGMS-45	**OPEN**	2.7

CGMS-45 WGIII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
			C5) and satellite instrument identifier (from Common Code Table C8) to OSCAR Space.				
CGMS space agencies	WGII	R44.03	From CGMS-44 WGII: CGMS Members to continue an operational constellation of conically-scanning microwave platforms to guarantee sustained support for the current level of capability	Ref. gap analysis discussion		**OPEN**	
CGMS space agencies	WGII	R44.04	From CGMS-44 WGII: CGMS to have a special discussion on the value of formation flying similar to the A Train – especially for precipitation and other hydrological applications			**OPEN**	
CGMS space agencies	WGII	R44.05	From CGMS-44 WGII: CGMS satellite operators to consider coordination of orbits for scatterometer instruments and to provide open and timely access to data in order to maximise independent coverage and benefits to nowcasting and NWP from assimilation of scatterometer wind data.			**OPEN**	
CGMS members	WGIII/2.2	R43.01	CGMS members are encouraged to consider including RO capabilities on all future polar-orbiting satellites.	CGMS-44 discussions:	Ongoing	**OPEN**	1.1.4

WGIV Actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUMETSAT	WGIII/2	A43.02	(Action transferred from WGIII) EUMETSAT to propose dissemination plan for data from Indian Ocean Data Coverage partners identified in CGMS-43-EUM-14 roadmap.	Status at CGMS-45: CGMS-45-EUMETSAT-WP-37 CGMS-45-ISRO-WP-05 Ongoing work, deadline extended. WGIV webex 9 Dec 2015: WMO seeking to assure that the dissemination to users will be equivalent to the current one (EUMETSAT, CMA, ROSH and ISRO to collaborate and clarify this in view of CGMS-44. EUMETSAT makes FY-2E data available through EUMETCast. EUM expects its Council to take a decision on moving Meteosat-8 to ca 40° E in June 2016. CGMS-44 EUM-WP-14 WG-IV WEBEX and communication 18 Jan 2017: Status of IODC Service by CMA: The CMA FY-2E at 86.5E is undertaking IODC service. CMA shall keep continuity of IODC service at 86.5E, on assumption: - FY-2G, launched 31 December 2014, currently operating at 105E; - Launch of FY-2H is planned for the end of 2017 or early 2018.	(CGMS-44, -45) ***New deadline CGMS-46***	**OPEN**	1.1.6

WGIV Actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
NOAA	(WGI/4) WGIV/7	A43.03	NOAA to consider including GLM products in the HRIT stream	CGMS-45: evaluation by NOAA still going on. WG-IV WEBEX 18 Jan 2017 and communication: NOAA is considering putting GLM on HRIT/EMWIN. At this time, our plan is to include 5 channels of Cloud and Moisture Imagery (CMI) in Full Disk at 2 KM resolution and also 3 channels of mesoscale imagery. Under that plan, there would not be sufficient bandwidth for the predicted size of the GLM data. However, we are just receiving CMI data and will evaluate the HRIT broadcast over the next few weeks [in January 2017] prior to the public release of GOES-R data at the end of February 2017. Webex 21 Oct 2015 discussion: NOAA is working on it, and final product list planned for 2016.	(CGMS-44, 45) ***New deadline CGMS-46***	**OPEN**	

WGIV Actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
TT metadata	(WGI/6) WGIV/10.1	A43.05	CGMS Task Team on metadata to define discovery metadata for DBNET	NOAA: CGMS-44-NOAA-WP-14 PPT EUM: http://navigator.eumetsat.int https://eoportal.eumetsat.int CGMS-44-EUMETSAT-WP-17, ongoing work, extended deadline. CGMS-45: no change, extended deadline to WGIV IS meeting WG-IV WEBEX 18 Jan 2017 and communication: CMA http://data.cma.cn/en http://satellite.nsmc.org.cn/PortalSite/default.aspx?currentculture=en-US NASA: https://search.earthdata.nasa.gov CGMS-45-ROSCOSMOS-WP-03 Still not complete, extend due date to CGMS-46	(CGMS-44, -45) ***New deadline Dec 2017***	**OPEN**	2.7

WGIV Actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members		A43.06	CGMS members to provide a listing of their data access portals.	CGMS-44-NOAA-WP-14 PPT EUM: http://navigator.eumetsat.int https://eoportal.eumetsat.int WG-IV WEBEX 18 Jan 2017 and communication: CMA: http://data.cma.cn/en http://satellite.nsmc.org.cn/PortalSite/default.aspx?currentculture=en-US NASA: https://search.earthdata.nasa.gov CGMS-45-ROSCOSMOS-WP-03 Still not complete, extend due date to CGMS-46	(CGMS-44) **New deadline CGMS-46**	**OPEN**	
EUMETSAT	WGIV/7	A44.02	To provide a timeline for the users preparation information for MTG, in accordance with "CGMS-44-WMO-WP-02 Best Practices for Achieving User Readiness for New Meteorological Satellites"	WG-IV WEBEX 18 Jan 2017 EUMETSAT: High Level information for Saturn was provided. CGMS-45: Ongoing work, keep open until more mature. Extend deadline to WG-IV IS meeting.	(30 Dec 2016) ***New deadline Dec 2017***	**OPEN**	5.3

WGIV Actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGII	A44.05	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs.	WG-IV WEBEX 18 Jan 2017: WMO: GODEX-NWP scheduled May 2017, needs will be addressed there, WMO will provide feedback. CGMS-45: GODEX-NWP not yet ready to provide feedback.	(CGMS-45) ***New deadline CGMS-46***	**OPEN**	

CGMS-45 WGIV actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
JMA/KMA	WGIV /4	A45.01	JMA/KMA to coordinate a regional user survey in RA II/V based on the WMO 2016 global survey (CGMS-45 WMO-WP-15) in collaboration with BOM and WMO, taking into consideration the communication satellite broadcast systems available in the regions.		CGMS-45	**OPEN**	2.1, 2.2
TFMI	WGIV /9	A45.02	TFMI to work on the WIGOS metadata standard, in particular to assess the WIGOS Metadata OGC Observations and Measurements standard, and recommend possible adjustments for satellite observations to the WMO WIGOS team.		CGMS-46	**OPEN**	2.7

CGMS-45 WGIV actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS satellite operators	WGIV /12.1	A45.03	CGMS satellite operators to provide documentation on the data formats for space weather observations, and to forward related space weather metadata to the WIS.		CGMS-46	**OPEN**	2.9
CGMS satellite operators	WGIV /12.2	A45.04	CCGMS members to report on the status of near real-time access to space weather data from instruments hosted on meteorological satellites. This includes data from space environment monitor suites, solar X-ray/EUV sensors, and radio occultation instruments on any orbiting satellite. Members are asked to detail product level definitions including near real-time availability of each level and user access required to obtain each level of data.		CGMS-46	**OPEN**	2.10
WG IV	WGII/ 4	A45.05	**Action from WGII:** Ensure timely (< 1 hr) and free access to all geostationary visible, IR and water vapour data that is required to improve global hydrological prediction.		CGMS-46	**OPEN**	

CGMS-45 WGIV recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGIV /7	R42.01	Satellite operators to provide WIS Discovery Metadata Records, compliant to WIS requirements and following the guidance to be provided by the CGMS-WMO Task Force on metadata implementation, in order to facilitate satellite information discovery and access	*CGMS-45: Recommendation still valid, to be retained.* NOAA: Related to metadata, the best reference is NGDC metadata provided here the URL: http://www.ngdc.noaa.gov/metadata/ WGIV CGMS-43 discussions: Ongoing and routine activity. Recommendation maintained until CGMS-44 WGIV webex 9 Dec 2015: To be taken up at the TT on Meta Data meeting the week of 14 Dec 2015. See CGMS-44-EUMETSAT-WP-17. Recommendation still valid, to be retained.	(CGMS-43, -45) ***New deadline CGMS-46***	**OPEN**	2.7
CGMS members	WGIV /3.2	R44.01	CGMS members to contribute to the implementation of the Best Practices for User Readiness for meteorological satellite systems under development, both GEO and LEO	CGMS-45: Recommendation still valid, to be retained. Closed for NOAA.	(CGMS-45) ***New deadline CGMS-46***	**OPEN**	5.3
CGMS members	WGIV /3.2	R44.02	CGMS members to continue the provision of up-to-date User Readiness information in the SATURN portal	CGMS-45: Recommendation still valid, to be retained.	CGMS-45	**OPEN**	5.3

SWTT actions open from previous plenary sessions (at CGMS-45)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SWTT		A44.01	SWTT to conduct a workshop with leadership from the various space weather communities that will benefit from CGMS coordination of space-based space weather observing systems.	CGMS-45: CGMS presentation and discussions have occurred at European Space Weather Week (ESWW) and UNCOPUOS. Discussions have been held with leadership of ISWI, COSPAR, and ISES. CGMS SWTT organized electron inter-calibration mini-workshop at US Space Weather Workshop CGMS space weather role is included in draft UNCOPUOS framework for space weather services. Planned: Dedicated CGMS ESWW topical discussion meeting ("Space Weather Activities in the Coordination Group for Meteorological Satellites.") - Nov 2017 Presentation of CGMS at UN/US ISWI workshop - Jul/Aug 2017 CGMS-44: Endorsed by CGMS-44 plenary	(15 Dec 2016) New: 30 Nov 2017, CGMS-46	**OPEN**	5.2.1

CGMS-45 SWTT actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	SWTT/7	A45.01	SWTT members to identify initial baseline for space-based space weather measurements and hold intercessional with WGIII to plan forward analyses. This will be finalized in the first inter-sessional to be held on 14 September 2017.		30 Sep 2017	**OPEN**	1.1.9

CGMS-45 SWTT actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	SWTT/10 (WGII/9)	A45.02	SWTT members review GSICS activities and deliver recommendations for its use as a framework for space weather sensor inter-calibration activities.		30 Dec 2017	**OPEN**	5.2.2
SWTT Co-Chairs	SWTT/10 (WGII/9)	A45.03	Invite a GSICS representative to the next SWTT inter-sessional meeting; and to a topical discussion during the European Space Weather Week Nov-Dec 2017 in Oostende, Belgium		30 Dec 2017	**OPEN**	5.2.2
SWTT Co-Chairs	SWTT/10	A45.04	Survey CGMS member operators regarding if and how actions are taking by satellite operators in response to space weather threats and/or conditions		30 Dec 2017	**OPEN**	5.2.3
SWTT Co-Chairs	SWTT/10	A45.05	Engage ISES as an observer for CGMS plenary meeting and/or include with SWTT inter-sessional activities.		30 Dec 2017	**OPEN**	5.2.1
CGMS space agencies	SWTT/11	A45.06	CGMS operators report on internal procedures to determine if an anomaly results from a space weather event including what thresholds are used.		30 Dec 2017	**OPEN**	5.2.3
SWTT Co-Chairs	SWTT/11	A45.07	CGMS to engage WMO IPT-SWeISS to encourage incorporation of an analysis of anomaly collection, reporting, and resolution processes into their work plan.		30 Dec 2017	**OPEN**	5.2.3
SWTT	SWTT/15	A45.08	CGMS operators report on internal procedures to determine if an anomaly results from a space weather event including what thresholds are used.		CGMS-46	**OPEN**	5.2.3

CGMS-45 SWTT recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
		R44.01	**On Space Weather Task Team:** Sustain the SWTT for another year in order to enable CGMS space weather integration.	CGMS-45 discussions: Sustain the SWTT for another year in order to enable CGMS space weather integration into existing Working Groups until CGMS-46. CGMS-45: CGMS presentation and discussions have occurred at European Space Weather Week (ESWW) and UNCOPUOS. Discussions have been held with leadership of ISWI, COSPAR, and ISES. CGMS SWTT organised electron inter-calibration mini-workshop at US Space Weather Workshop CGMS space weather role is included in draft UNCOPUOS framework for space weather services. Planned: Dedicated CGMS ESWW topical discussion meeting ("Space Weather Activities in the Coordination Group for Meteorological Satellites.") - Nov 2017 Presentation of CGMS at UN/US ISWI workshop - Jul/Aug 2017 CGMS-44: Recommendation endorsed by CGMS-44 plenary.	(9 Jun 2016) Jun 2018	**OPEN**	5.2

ANNEX III: STATUS OF CGMS-44 ACTIONS AND RECOMMENDATIONS RESULTING FROM CGMS-45 DELIBERATIONS

Note that any open actions/recommendations have been included in the list of CGMS-45 actions and recommendations.

CGMS-44 Plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	C.1	A44.01	**Vision for the WIGOS space-based component in 2040:** CGMS operators are invited to provide comments on draft v0.2 of the Vision for the WIGOS space-based components in 2040, to sbojinski@wmo.int, by 8 July 2016.	CGMS-44 WMO-WP-01: http://www.eumetsat.int/website/wcm/idc/idcplg?IdcService=GET_FILE&RevisionSelectionMethod=LatestReleased&Rendition=Web&dDocName=CWPT_1666 *EUM, NOAA feedback provided to WMO July 2016*	8 Jul 2016	**CLOSED**	1.1
CMA, JMA, KMA	C.2	A44.02	CGMS operators to publicise the rapid scan capabilities of current and future geostationary satellite among the user community in RA II and V, and build the necessary capacity (on the occasion of 7th AOMSUC).	*Closed following discussions and presentations at the AOMSUC-7 and 4th RA II WIGOS coordination group meeting*	30 Oct 2016	**CLOSED**	1.1
CGMS members	C.6	A44.03	**On NWP and impact on forecasting skills:** **(**Ref. CGMS-44 WMO-WP-04) CGMS Members to formulate their requests (if any) for additional impact assessment work and transmit them to the WMO Secretariat (lriishojgaard@eumetsat.int).	NOAA provided feedback to WMO on 2 Nov 2016	30 Oct 2016	**CLOSED**	1.1.2

CGMS-44 Plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	C.6	A44.04	**On NWP and impact on forecasting skills:** WMO to brief CGMS-45 on the Final Report from the Sixth WMO Impact Workshop, with a particular focus on those recommendations that are directed to the CGMS Members and CGMS Working Groups.	Report will be provided at CGMS-45 under plenary agenda C.2: CGMS-45 WMO-WP-02 Next impact workshop will take place in 2020.	CGMS-45	**CLOSED**	1.1.2
IOC-UNESCO	C.8	A44.05	IOC-UNESCO to provide guidance to CGMS on ocean surface wave observations at CGMS-45.	*Agenda item foreseen in CGMS-45 plenary in the user session.*	CGMS-45	**CLOSED**	1.1.6
CGMSSEC	C.8	A44.06	**On sea ice:** Consistent with the discussions held at CGMS-44, CGMS Secretariat to liaise with CEOS SIT Chair on the suggestion that CEOS develop a Virtual Constellation for Sea Ice - following its established process for this purpose, and in coordination with the activities of the WMO PSTG. An initial discussion will be held at 2016 CEOS SIT Technical Workshop (September 2016).	*23 Feb 2017: CEOS SIT Chair letter of 28 Nov 2016 to WMO PSTG was circulated in February 2017 by CGMSSEC closing the action. It was considered by the WMO PSTG that it currently addresses the needs sufficiently.* *The issue was then discussed among CEOS Agencies at the SIT Technical Workshop in September 2016 and at CEOS Plenary in November. It was agreed at the 2016 CEOS SIT Technical Workshop on 14th-15th September 2016 in Oxford, UK that the WMO Polar Space Task Group (PSTG) covers polar sea-ice observations well, but that an increase in SAR observation coordination may be of benefit.*	01-Sep-16	**CLOSED**	1.1.6

CGMS-44 Plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				CEOS considered that the PSTG represented a competent body for the coordination of polar space observations and that the creation of a Virtual Constellation or similar body within CEOS to conduct the same function would be an unnecessary duplication. The view was that indeed the PSTG was already functioning very well in this task, that no further body was necessary and the PSTG was reconfirmed as the primary body for this work. A significant number of PSTG Space Agency Members are represented on the Committee of Earth Observing Satellites (CEOS). Since there is no other group responsible for coordinating satellite observations in the polar regions and cryosphere, and in order to encourage information flow, PSTG periodically will continue to periodically submit reports to the CEOS Strategic Implementation Team (SIT) meetings.			
CGMSSEC	C.8	A44.07	CGMSSEC to write a letter on behalf of CGMS to Japan recommending that JAXA consider continuing the GCOM-W series in particular in support of precipitation and sea-ice measurements.	*CGMSSEC letter (CGMS/LET/16/862312 of 29 June 2016) circulated to L-CGMS on 11 July 2016. Action will be closed once CGMS-44 report is published.*	30-Jun-16	**CLOSED**	1.1.6
CMA, EUM, ISRO, ROSH	E.2.1	A44.08	**On IODC** (ref. WGIV/3.3)**:** CGMS agencies in the IODC region (CMA, EUMETSAT, ISRO, ROSHYDROMET) to support the distribution of essential data to IODC users via their existing dissemination methods (CMACast, EUMETCast, GTS, Internet, etc).	*Originating from WGIV and endorsed by CGMS-44 plenary on 9 June 2016.*	CGMS-45	**CLOSED**	1.1.6
CGMSSEC EUMETSAT CMA, ISRO, ROSH	E.3.3	A44.09	**On IODC:** CGMSSEC with EUMETSAT to coordinate with CMA, ISRO and ROSH and update the table on IODC essential data and products (essential as per WMO Res. 40)	*CGMSSEC letter EUM/CGMS/LET/16/861620 of 29 June 2016. Circulated to WGIII on 20 June and to L-CGMS on 22 Aug 2016.*	15-Jun-16	**CLOSED**	1.1.6

CGMS-44 Plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMSSEC EUMETSAT (CMA, ISRO, ROSH)	E.3.3	A44.10	**On IODC:** CGMSSEC EUMETSAT to prepare a letter (on behalf of EUM, CMA, ISRO and ROSH) to WMO confirming the baseline for the future multi-partner IODC service essential data and product baseline.	*CGMSSEC letter EUM/CGMS/LET/16/861620 of 29 June 2016. Circulated to WGIII on 20 June and to L-CGMS on 22 Aug 2016.*	31-Jul-16	**CLOSED**	1.1.6
IWWG	E.5.4	A44.11	**On IWWG matters:** IWWG to develop a detailed plan for the 3rd wind intercomparison, including concept and deliverables, and an estimate of the required resources.	The preparation of the intercomparison study is concluded. Ref. CGMS-45 IWWG-WP-01/01.ppt and -02.ppt	CGMS-45	**CLOSED**	3.2.1
ICWG	E.5.4	A44.12	**On ICWG matters:** ICWG to develop a detailed plan for the cloud intercomparison activity, including concept, deliverables, and an estimate of the required resources.	CGMS-45: Discussed in and transferred to WGII and therefore closed for plenary. CGMS-45 ICWG-WP-01/01.ppt The intercomparison studies are ongoing. 10 min sampling from GEO sensors by GOES-16 is under discussion. Both items will be discussed at the ICWG-2.	CGMS-45	**CLOSED**	3.2.3

CGMS-44 Plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMSSEC	G.2	A44.13	**On carbon observation programmes:** Consistent with the discussions held at CGMS-44, CGMS Secretariat to request CEOS SIT Chair to organise a discussion at the CEOS SIT Technical Workshop (September 2016) on developing a suitable mechanism involving both CGMS and CEOS agencies to review how planned carbon observation missions might be better coordinated in response to the GCOS Implementation Plan and to develop a coherent contribution to the WMO Vision for WIGOS 2040.	CGMS-45: Closed following discussions at CGMS-45 and plenary session G. Dedicated carbon sessions will be held between WGII/WGIII as well as in plenary at CGMS-45. CGMSSEC plans a carbon observation session for CGMS-45 plenary to this purpose covering the overall mapping of the various activities within the CEOS ACC, CGMS, Copernicus Task Forces A&B, noting the GCOS IP and corresponding response as well as WIGOS 2040. Discussions took place at CEOS SIT Sept 2016: It was agreed that the ACC-VC should be the basis for the CEOS response, with a formal and open invitation for participation extended to interested additional CGMS participants, and it should be pursued in conjunction with the climate workshop 2017.	Sep-16	**CLOSED**	
CGMSSEC	G.2	A44.14	**On carbon observation programmes:** CGMS Secretariat to include a standing agenda item on carbon observation programmes at future CGMS plenary sessions.	Agenda item foreseen in CGMS-45 plenary as well as a joint WGII/WGIII session.	CGMS-45	**CLOSED**	

CGMS-44 Plenary actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
JWG CLIM (CGMS members)	H.3	A44.15	**On GCOS Implementation Plan:** CGMS - through the CEOS-CGMS JWG Climate (pascal.lecomte@esa.int, joerg.schulz@eumetsat.int) - to contribute to the public review of the draft GCOS Implementation Plan (http://www.wmo.int/pages/prog/gcos/)	GCOS IP is now finalised and has been endorsed by the GCOS Committee. (Input provided by NOAA 6 Sep 2016)	25 July-5 Sept 2016	**CLOSED**	5.1
JWG CLIM (CGMS members)	I.1	A44.16	**On training/VLab:** For the scoping of training activities on climate datasets: CGMS - through CEOS-CGMS JWG Climate - to inform the VLab TSO (luveeck@gmail.com) about access to the ECV inventory once available.	Will be made publicly available (close to the CGMS-45 meeting). Inventory is published and available (June 2017). See CGMS-45 JWGCLIM-WP-01.	CGMS-45	**CLOSED**	5.1

CGMS-44 Plenary recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
KMA, KARI, CMA, CNSA, JMA, JAXA	C.2	R44.01	**On disaster risk reduction:** The "Jakarta Declaration" recommends to CGMS that the satellite operators provide the necessary support to the Joint RA II/V WIGOS project on Satellite Data. The declaration encourages the satellite operators of the Republic of Korea, China, and Japan to make digital data at the full resolution available to all Members involved in the "Satellite Data project" and to support the project in any way they can.	CGMS-45: The recommendation is included in the new WIGOS 4-year plan, and since several cgms actions and recommendations cover similar purposes it was agreed to close the recommendation at plenary level of CGMS at this point in time. JMA leads an effort defining a protocol for event-driven rapid scanning Himawari-8, in collaboration with BOM Australia contributing to the efforts.	CGMS-45	**CLOSED**	1.1
IOC-UNESCO, CGMS members	C.7	R44.02	**On Second International Indian Ocean Expedition (IIOE-2) for enhanced data acquisition and management:** It was recommended to establish a working alliance between the IIOE-2 and the remote sensing community (CGMS) within/through the IIOE-2 Steering Committee framework and/or the IIOE-2 Joint Project Office.	There was no feedback by CGMS-45 and the recommendation remains open.	CGMS-45	**OPEN**	2.5

CGMS-44 Plenary recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS agencies	C.8	R44.03	CGMS agencies to promote sustainability of satellite passive microwave sea ice measurements begun in 1978.	Closed on the occasion of CGMS-45: This will be referenced in the JWG CLIM action plan (ECV Inventory and Gap Analysis) Following the Gap Analysis, it is expected that the following actions/recommendations will arise: • promote sustainability of satellite passive microwave sea ice measurements, • promote the implementation of sustained satellite scatterometer sea ice observations, • promote sustainability of satellite frequent high-¬spatial marginal ice zone measurements, • promote the implementation of sustained satellite measurements of Arctic Ocean sea ice thickness	Long term	**CLOSED**	1.1.6
CGMS agencies	C.8	R44.04	CGMS agencies to promote the implementation of sustained satellite scatterometer sea ice observations with scatterometer to provide an independent source of information concerning climate change impacts on the marine cryosphere.	Closed on the occasion of CGMS-45: This will be referenced in the JWG CLIM action plan (ECV Inventory and Gap Analysis)	Long term	**CLOSED**	5.1
CGMS agencies	C.8	R44.05	CGMS agencies to promote sustainability of satellite frequent high-spatial marginal ice zone measurements for navigation and other near real-time applications.	Closed on the occasion of CGMS-45 since it is addressed by agencies in the Int'l Ice Charting Working Group, and in PSTG. PSTG reports to WG II.	Long term	**CLOSED**	1.1
CGMS agencies	C.8	R44.06	CGMS agencies to promote the implementation of sustained satellite measurements of Arctic Ocean sea ice thickness.	Closed on the occasion of CGMS-45: This will be referenced in the JWG CLIM action plan (ECV Inventory and Gap Analysis)	Long term	**CLOSED**	1.1

CGMS-44 Plenary recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CMA, EUM, NOAA	F.1	R44.07	The GEONETCast operators to actively follow-up the commitment made at the side event at the GEO Mexico City summit.	CMA, EUM and NOAA reconfirmed their contributions to GEONETCAST on the occasion of the GEO Plenary in St Petersburgh in Nov 2016		**CLOSED**	
CGMS members	G.1.3	R44.08	**On SCOPE-NWC:** CGMS members to continue to support SCOPE-Nowcasting and its transition to preoperational phase, in particular to financially support the finalisation of the satellite-based volcanic ash retrieval algorithm intercomparison activity (Pilot Project 2) over the next 12-18 months. (Ref. CGMS-44-WMO-WP-15).	CLOSED on the occasion of CGMS-45 EUMETSAT has earmarked resources to financially support completion of the volcanic ash algorithm intercomparison in 2018. WMO has identified resources to engage consultant for 2.5 months FTE to support SCOPE-Nowcasting.	30 Dec 2017	**CLOSED**	3.2.4
CGMS members	I.1	R44.09	**On training/VLab:** CGMS members are invited to share product information, dissemination information and training resources with the CoEs in Kenya, South Africa, Russian Federation, China, and Oman, and with users, to support VLab training activities in the Indian Ocean region.	Closed on the occasion of CGMS-45. CoEs will remind CGMS members of this Recommendation in the preparation phase for these training activities	Long term	**CLOSED**	4.2.1

CGMS-44 Plenary recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	I.1	R44.10	**On training/VLab:** CGMS operators to make available training resources in all official languages as defined by the satellite operator's charter. Translation of training resources should be considered as a continuous, ongoing effort. Satellite operators without multiple official languages should consider coordinating the translation of their training resources through in-kind contributions by user institutions.	Closed on the occasion of CGMS-45. (Will reach out to VLab community to seek comments)	Long term	**CLOSED**	4.2.1
CGMS members	I.1	R44.11	**On training/VLab:** CGMS to join efforts with VLab to investigate ways to fund the continuation of the Project "Conceptual Models for the Southern Hemisphere" (CM4SH) and also extend the initiative to prepare case studies related to the new generation of satellites.	Closed on the occasion of CGMS-45. (Will reach out to VLab community to seek comments)	Long term	**CLOSED**	4.2

WGI actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	WGI/6	A43.06	WMO to assess the impact of improved data latency from polar orbiters on NWP (WMO Impact Workshops) and other applications	Next WMO workshop will take place in May 2016 (China), hence there might be a verbal/preliminary report only to CGMS-44.	(CGMS-44) New deadline CGMS-46	**OPEN**	1.1.2

CGMS-44 WGI actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SFCG liaison officer (EUM)	WGI/2	A44.01	SFCG liaison officer to bring to SFCG/WMO the possibility of migrating the SFCG Remote Sensing Disaster Database (RSDD) into OSCAR from the following perspectives: • Identify the level of overlap between the two databases; • Possibility for WMO to introduce, and maintain, the delta elements of the SFCG RSDD into OSCAR; • Level of support of SFCG members to migrate the SFCG RSDD into OSCAR or preference to retain a separate database; • Arguments for retaining a stand-alone SFCG RSDD, if any.	CGMS-45 EUM-WP-24	CGMS-45	**CLOSED**	1.3
SFCG liaison officer (EUM)	WGI/2	A44.02	SFCG liaison officer to provide a report to WGI on the outcome of SFCG by Q3 2016 (as part of the CGMS-45 WPs)	CGMS-45 EUM-WP-24	30 Sep 2016	**CLOSED**	1.3.3

CGMS-44 WGI actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SFCG liaison officer (EUM)	WGI/2	A44.03	SFCG liaison officer to propose to SFCG that SFCG members will report yearly to SFCG on national regulatory changes/issue in their countries (e.g. to repurpose spectrum currently in use or planned for use by meteorological satellites (both active and passive spectrum bands)).	CGMS-45 EUM-WP-24	CGMS-45	**CLOSED**	1.3.3
SFCG liaison officer (EUM)	WGI/2	A44.04	SFCG liaison officer to report to CGMS WGI as a permanent section of his yearly SFCG outcome report to WGI updates (relevant) on proposed regulatory changes to repurpose spectrum currently in use or planned for use by meteorological satellites (both active and passive spectrum bands).	CGMS-45 EUM-WP-24	CGMS-45	**CLOSED**	1.3.3
CGMS space agencies	WGI/2	A44.05	CGMS agencies to provide prior to CGMS 45 a report on the space weather activities (including spacecraft and instruments) of relevance on Freq Management and freq protection topics	CGMSSEC to request SWTT representative to provide a paper to WGI to this purpose (and present it in WGI). SWTT informed by e-mail 7 April 2017. Agency reports on Frequency topics to include a dedicated chapter on space weather.	(Feb 2017) CGMS-46	**OPEN**	1.3
CGMSSEC	WGI/5	A44.06	CGMS Secretariat to distribute to CGMS members (PoC for SATCOM Forum at least) the questionnaire on IDCS (included in EUM-WP-06) end June 2016	*EUMETSAT (Sean Burns) circulated an e-mail to NOAA, ISRO, CMA JMA and ROSHYDROMET on 7 June 2016*	30-Jun-16	**CLOSED**	1.2.1

CGMS-44 WGI actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGI/5	A44.07	CGMS agencies to reply (end of August) to the questionnaire and to confirm attendees to the splinter meeting on IDCS during the next SATCOM Forum (Sept 2016 in Madrid)	*NOAA and JMA have provided an input to EUMETSAT. To be discussed at the SATCOM Forum itself.*	31-Aug-16	**CLOSED**	1.2.1
CGMS space agencies	WGI/6.1	A44.08	CGMS agencies with satellites with DB and RO occultation sensors to assess the technical feasibility of a RARS/DBNet RO occultation service in support of the Space Weather community.	*Deadline extended following CGMS-45 discussions.* CGMSSEC to request IROWG representative to provide a paper to WGI to this purpose (and present it in WGI)	(CGMS-45) CGMS-46	**OPEN**	5.2
CGMS space agencies	WGI	A44.09	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs	*Deadline extended following CGMS-45 discussions.*	(CGMS-45) CGMS-46	**OPEN**	

CGMS-44 WGI recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
WMO	WGI/6	R43.03	WMO DBNET Coordination Group to report annually to CGMS WG-I on status and progress	Discussed at WGI webex session 21 Oct 2015 (best practice proposal). WMO DBNet presentation to be circulated to WGI (NOAA, EUM, CMA and ROSH in particular - LEO satellites with direct broadcast) CGMS-44 WMO-WP-10	(CGMS-44) New deadline CGMS-45	**CLOSED**	1.4.4
CGMS space agencies	WGI/2	R44.01	CGMS agencies to inform their Freq Managers on the space weather activities to ensure the necessary protection and coordination at Freq management level		Long term	**OPEN**	1.3
CGMS space agencies	WGI/5	R44.02	All CGMS DCS operators to consider making all DCP messages available in the GTS.	CGMS-45 CMA-WP-xx CGMS-45 EUM-WP-xx CGMS-45 ISRO-WP-xx CGMS-45 JMA-WP-xx CGMS-45 NOAA-WP-xx CGMS-45 ROSH-WP-xx	Long term	**OPEN**	1.2
CGMS space agencies	WGI	R44.03	From CGMS-44 WGII: Agencies to explore the possibilities to develop suitable processing packages to support a direct broadcast implementation of RO processing, within the DBNet to improve timeliness for space weather applications		Long term	**OPEN**	5.2

WGII actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CMA, EUM, JMA, NASA, NOAA, WMO	WGII/3	A42.02	The new task team on calibration events logging to identify a common set of parameters to be monitored as part of the calibration events logging and sensor performance monitoring.	*CGMS-45 EUM-WP-33* *It was suggested to integrate the activity into GSICS and was therefore closed.* Nov 2016: EUM to report by end 2016 on the way forward CGMS-44: Delays incurred - new deadline proposed. EUMETSAT to check status. Nov 2015: Co-chair R Roebling, drafting white paper to be circulated within ICWG by end 2015 in preparation of CGMS-44. To be included in the GSICS paper following the new WGII agenda (possibly EUMETSAT's paper - TBD). 1st step: Template for calibration event landing pages presented at GDAWG in March 2015. New version of OSCAR/Space allows for identification of individual instruments and thus linking to calibration event test pages, test mode of new version of OSCAR/Space continuing until 1 month before CGMS-43; 2nd step: Draft a white paper to agree on common terminology to be used on landing pages, foreseen in 2015/2016 for presentation to CGMS-44.	(CGMS-43) **New deadline: CGMS-45**	**CLOSED**	3.1

WGII actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				CGMS-43 EUM-WP-10 CGMS-43-JMA-WP-03 (Section 2.4) NOAA: Work ongoing as a part of the GSICS work plan. Next steps are gathering information and agreeing on common terminology. New deadline following CGMS-43 WGII discussions.			
KMA	WGII/4	A42.03	KMA is invited to present a paper of different sources of soil moisture retrieval on their NWP forecasts	*New deadline following CGMS-44 WGII discussions - KMA NWP centre have not yet concluded analyses. KMA has no plans. Ken and Dohyeong to follow up.* CGMS-43-KMA-WP-04: Test use of Metop-B/ASCAT on their global NWP system. *The inclusion of soil moisture in the KMA NWP model is part of the long-term planning. And in near future, however, there is no plan due to lack of experts and their amount of tasks. Suggest closing this Action. (D. Kim, 24 Jan 2017)*	(CGMS-43) **New deadline: CGMS-45**	**CLOSED**	-
CGMS space agencies	WGII/3	A43.01	Calibration events logging task team to prepare a white paper outlining the set of parameters, the nomenclature, and the standards to be used for reporting on instrument calibration across space agencies.	*CGMS-44: Work in progress, new deadline proposed. See Action 42.02* Nov '2015: Part of/related to CGMS-42 action 42.02. CGMS-45 EUM-WP-33	(CGMS-44) New deadline CGMS-45	**CLOSED**	3.1

WGII actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
ROSH	WGII/3	A43.03	Roshydromet to present an update on Meteor-M N2 data access, processing packages, and results of an intercomparison of the IKFS-2 with other hyperspectral sounders (IASI, AIRS, CrIS), to CGMS-44.	*CGMS-44: No progress reported at CGMS-44 - proposed new deadline.* EUM has received Meteor-M N2 sample data of the MTVZA-GY Imaging/Sounding Microwave Radiometer (29 channels) and dissemination through EUMETCast is expected in Q1 2016 pending EUM Council approval in Dec 2015. mtg. ROSH will deliver a L1 pre-processing software to EUMETSAT early 2016. Nov 2015: ECMWF has looked at microwave instruments which were reported on at the recent ITSC. ITWG and CGMS welcomes the sharing of data by ROSH, and further collaboration is expected. CGMS-45 ROSC-WP-03	(CGMS-44) New deadline CGMS-45	**CLOSED**	1.4.5
CGMS space agencies	WGII/3	A43.04	CGMS operators to provide a report on their approach on cal/val, including information on dedicated campaigns and permanent sites, and potential support to cal/val infrastructure, in order to maximize benefits of satellite missions.	*3 agencies responded (JMA; NOAA; NASA); keep open as action for CGMS-45 for remaining agencies.* Nov 2015: Feedback is expected as part of the general agency report or in a dedicated WP for the proposed new WGII agenda item 4 (CGMS-44 WG II item 8). CGMS-45 ROSHYDROMET-WP-02, KMA-WP-04	(CGMS-44) New deadline CGMS-45	**CLOSED**	-
CGMS space agencies	WGII/3	A43.05	CGMS operators to report on their specific plans for reprocessing and associated user requirements (such information would be useful for the ISWGs).	*Keep open as action for CGMS-45 for remaining agencies.* Item 8 - NASA, and NOAA responded (WP-09)	(CGMS-44) New deadline CGMS-45	**CLOSED**	5.1

WGII actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				CGMS-45: No WPs Action on IPWG to document activities			
CMA	(Plenary F.1.5.3) for WGII	A43.11	From CGMS-43 plenary: IROWG encouraged CMA to provide NRT GNOS data on the GTS, and CMA agreed to investigate this further	*Nov 2016: CMA is trying to change the data format of GNOS to buffer format. The work will be finished in the beginning of 2017.* Oct 2016: WGII IS#1 - no progress - ask CMA directly. Jun 2016: CGMSSEC recommends this to be discussed in WGII and reported to plenary through WGII CGMS-45: To date, CMA focussed on generating an operational processor; data exchange to follow (CMA-WP-07)	(CGMS-44) New deadline CGMS-45	**CLOSED**	1.1.4

CGMS-44 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SCOPE-CM Executive Panel	WGII/4	A44.01	SCOPE-CM should review its IP, Terms of Reference, and prepare for the next phase including a possible call for proposals.	Action taken at Sep 2016 11th meeting of SCOPE-CM executive panel CGMS-45 EUM-WP-47	CGMS-45	**CLOSED**	5.1

CGMS-44 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/4	A44.02	CGMS members to submit data to the ICWG intercomparison: full-disk data at 10 minute temporal resolution, 2 km spatial resolution in the native AHI projection is preferred. The data should be submitted by 1 September 2016.	ICWG plans underway (see above Action); communicate new Golden Day(s) to CGMS members as soon as decided; CGMS-45: remains open since some submissions missing or forthcoming	New deadline: CGMS-46 (1 Sept 2016)	**OPEN**	3.2.3
IPWG, IMD	WGII/4	A44.03	IPWG Rapporteur to liaise with IMD (AK Sharma) on the development of precipitation validation sites over India.	*Nov 2016: Dr. S.K.Peshin, Head(SatMet)/Scientist-G sunil.peshin@gmail.com (replaces A K Sharma, retired)* Contact made at IPWG-8 (Raj Ramasenkaran, KJ Ramesh); WMO request letter to IMD needed to pursue; new focal point to be conveyed by IMD; CGMS-45: Contact established	CGMS-45	**CLOSED**	3.3.1
GSICS members, GSICS EP	WGII/4	A44.04	GSICS to review the GDWG Terms of Reference and associated indicated levels of effort of the members	No progress. To be discussed at March 2017 meeting of GDWG-GRWG; Part of GSICS report Closed at CGMS-45 following discussions in WGII	CGMS-45	**CLOSED**	3.1.1
GRWG	WGII/4	A44.05	GRWG to dicuss with ISCCP (SCOPE-CM Project 9) a detailed project proposal for the use of GSICS methodologies to produce a GSICS-compliant ISCCP dataset for evaluation	Discussion on subset of ISCCP to be identified; ISCCP representative to be invited to next meeting of GRWG CGMS-45: Discussed, follow-up action agreed at GRWG meeting in March 2017 ("GCC to coordinate provision of GSICS Corrected test data from the 0.6µm and 11µm channels of all available GEO imagers during Dec 2009 to Ken Knapp to assess the impact of the corrections on ISCCP products." see http://gsics.atmos.umd.edu/pub/Development/201	CGMS-45	**CLOSED**	5.1

CGMS-44 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				70320/GSICS-GRWG-GDWG-2017_Final-Report.pdf) Suggest closing			
CMA	WGII/6	A44.07	CMA to provide more information (documentation, availability details, URL) about the 3D-ADVP tool , for inclusion in the WMO webpage on Visualization Tools to CGMSSEC.	*Nov 2016: WMO to provide CMA with the necessary documentation facilitating the comletion of the action.* Oct 2016: WGII IS#1 - Contact CMA directly CGMS-45: Tool currently only for CMA-internal use (Tang Shihao, 7 Jun 2017) and no firm plan to produce int'l version; CMA suggest closing action	1 Oct 2016	**CLOSED**	
IMD	WGII/6	A44.08	IMD to provide more information (documentation, availability details, URL) about the RAPID tool , for inclusion in the WMO webpage on Visualization Tools to CGMSSEC	Documentation to be provided by Virendra Singh to WMO ; CGMS-45: Details to be provided by ISRO	1 Oct 2016	**OPEN**	

CGMS-44 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/6	A44.09	CGMS operators and WMO to work with NAEDEX-APSDEU to explore options for optimal data exchange of advanced data from next-gen GEOs	CGMS-45: Not discussed at 2017 GODEX-NWP meeting (GODEX-NWP includes limited expertise on capacity planning). Action transferred to WGIV and hence closed in WGII.	CGMS-45	**CLOSED**	2
IWWG	WGII/7	A44.10	IWWG to pursue intercomparisons of Meteosat-8 and FY-2/4 winds over the IODC region. During the transition phase also Meteosat-7 should be considered.	Discussion with European NWP centres to perform such intercomparisons, report back to IWWG; inform IWWG co-chairs (Ken) CGMS-45 CMA-WP-08: CMA made comparisons between Meteosat-8 and FY-2 AMVs over IODC; good agreement, FY-2E AMVs are a bit slower than METEOSAT-8 AMVs at High and middle levels for IR channel, and at High Levels for WV channel.	CGMS-45 (for update)	**CLOSED**	3.2.1
CGMS members	WGII/7	A44.11	CGMS to develop best practices for documenting products and their quality.	CGMS-45 NOAA-WP-13 Suggest closing, new Recommendation: CGMS agencies encouraged to document their products online, including ATBDs and validation reports, and link product page URLs to the WMO Product Access Guide following defined documentation criteria. (Current list of existing CGMS agency focal points to be added here)	CGMS-45 (for update)	**CLOSED**	3
ROSH	WGII/7	A44.12	ROSHYDROMENT to explore the possibilities to implement an operational NRT service for the hyperspectral infrared sounder IKFS-2 on Meteor-M N2	CGMS-45: No direct readout available (ROSC-WP-03), NRT data available through EUMETSAT.	CGMS-45	**CLOSED**	1.4.5
IROWG	WGII/8	A44.13	IROWG to define the requirements on timeliness for RO observations	CGMS-45: IROWG-WP-01: We recommend that future RO missions include communications infrastructure that will	***New deadline: CGMS-46***	**OPEN**	1.1.4

CGMS-44 WGII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
				enable 95 % of the measurements to be available for use in operational models within 30 minutes or less. Data older than 30 minutes is of lower value for current models. Near-real time data latency would be optimal, but is not always practical, and should be considered to be a useful goal for future missions when possible. In the specific case of COSMIC-2 Polar, south polar ground stations (e.g., McMurdo, Troll) should be deployed to reduce data latency IROWG to look at the implications of the requirement on ionospheric processing. IROWG rapporteur to check status (space weather-related); state-of-the-art to be reported out through IROWG	(CGMS-45)		
WGII	SWTT	A44.14	From CGMS-44 SWTT: WGII to determine how to implement the planning and development of Space Weather research and data management activities within the auspices of WGII.	US space weather workshop in May 2017, with meeting on CGMS support to space weather (action on SWTT) ; CGMS-45: addressed under item WGII/9	CGMS-45	**CLOSED**	

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SCOPE-CM members	WGII/ 3	R43.01	SCOPE-CM to invite contributions to its next call for proposals, with particular regard to the sea ice, snow cover and land surface temperature communities, and others currently not represented.	SCOPE-CM executive panl in Sep 2016 to decide on approach regarding next call for proposals; check draft SEP-11 report		**OPEN**	3.3.2
CGMS members	WGII/ 3	R43.02	CGMS members to consider removing spectral gaps from future hyperspectral sounders to support GSICS intercalibration of IR imagers.	To be discussed at ~~a~~ second WGII inter-sessional meeting after CGMS-44. (For WG III to consider)		**OPEN**	3.1.1
CGMS members	WGII/ 6	R43.03	CGMS members to consider include a water vapour channel and a CO2 channel to polar-orbiting imagers, to maintain accuracy and coverage of polar winds and cloud height retrievals achieved by MODIS.	To be discussed at a second WGII inter-sessional meeting after CGMS-44. (For WG III to consider)		**OPEN**	1.1.6
CGMS space agencies	WGII/ 10	R43.07	CGMS agencies to make available a non real-time cache of satellite level 1 data over the previous 2-3 months, similar to the NOAA CLASS system.	CGMS-44 IMD: At present there are no such plans (until a new data centre is installed).	CGMS-44	**OPEN**	2
ISRO	WGII/ 5	R43.10	ISRO is encouraged to implementing a multi-sensor precipitation estimate based on SAPHIR and INSAT-3D	CGMS-45: ISRO/IMD have plans	CGMS-45	**OPEN**	HLPP # 3
IWWG, IPET-OSDE	WGII/ 6	R43.12	IWWG to liaise with the application focal points in the WMO RRR process (on IPET-OSDE) to provide feedback on the winds-related observation requirements in the RRR database.	CGMS-45: IWWG addressed this for capabilities, need to follow up regarding requirements	CGMS-44	**OPEN**	HLPP # 1.1

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/ 7	R43.13	CGMS Members to approach Operators of GNSS systems to request them to provide a minimum level of information on the signal structure and interface control (ICD) in a timely manner to enable the use of these for future RO missions.	To be discussed at ~~first~~ second WGII inter-sessional meeting after CGMS-44. CGMS-45: IROWG discussed this and made recommendations	CGMS-45	**OPEN**	HLPP # 1.1.3
CGMS plenary	WGII/ 3	R44.01	CGMS to endorse the proposed Terms of Reference for WGII including the following updates: Ø A 2-yearly rotation scheme for one of its co-chairs, with KMA starting after the end of CGMS-44 [Dohyeong Kim (KMA) to become the WG II co-chair, replacing Toshiyuki Kurino (JMA)]. Subsequently, co-chairs from CMA, JMA, ROSHYDROMET and IMD will follow. Ø WMO to provide the second co-chair Ø NOAA and EUMETSAT to provide the rapporteurs	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	
GSICS	WGII/ 4	R44.02	GSICS to report to SCOPE-CM projects on its plan to intercalibrate the geostationary ring using hyperspectral IR sounders as transfer function	*done, occurring in IOGEO*	15 Sep 2016	**OPEN**	3.3.2

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
GSICS	WGII/4	R44.03	GSICS member agencies to identify roles and responsibilities and funding needs to support the geostationary ring GSICS corrections including the processing of retrospective data going back to NASA EOS AIRS (2002).	CGMS-45: Partially addressed; GRWG encouraged agencies to inter-calibrate past data	CGMS-45	**OPEN**	3.1.1
CGMS space agencies	WGII/4	R44.04	CGMS agencies should employ the GSICS Correction as part of their operational procedures	Should be part of agencies		**CLOSED**	3.1.1
CGMS members	WGII/4	R44.05	CGMS members to budget a baseline funding for the cloud intercomparison study, given its importance and impacts on global cloud products.	CGMS-45: ICWG-WP-01: Currently, ICWG helps to facilitate the collection of data used for assessments (e.g., level-2 retrieval assessment in TG "Assessment of level-2 retrievals" or level-3 climate data records in TG "Assessment of cloud parameter data records for climate studies"), but many teams carried out the efforts on a volunteer basis. Lack of funding has limited the scope and prohibited a definitive analysis of the new HIMAWARI-8 data set.	1 Nov 2016	**OPEN**	3.2.3
IROWG, IPWG, IWWG, ITWG	WGII/4	R44.06	To enhance coordination, ISWGs to discuss with ICWG co-chairs key items for collaboration.		1 Sep 2016	**OPEN**	
CGMS R&D agencies	WGII/4	R44.07	Research agencies to consider continuing space-borne lidar for ice/liquid water since they have proven very valuable to validate retrievals from passive sensors			**OPEN**	1.1.3

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/ 4	R44.08	All operators of next-generation GEO imagers to consider the implementation of routine full-disc 10-min (or better) scanning for nowcasting	CGMS-45: NOAA consider this for GOES-16	CGMS-45 (for update)	**OPEN**	3.2.4
CGMS space agencies	WGII/ 4	R44.09	CGMS Members to continue an operational constellation of conically-scanning microwave platforms to guarantee sustained support for the current level of capability.	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45. CGMS-45: Questions of resolution, frequency need to be resolved, not just high-level mission continuity		**OPEN**	1.1.6
CGMS members	WGII/ 4	R44.10	At the request of IPWG, CGMS to improve cross-agency coordination of satellite assets into A-train-like convoys of instruments with sensitivities to distinct aspects of precipitation processes (e.g., CloudSat, EarthCare, GPM, etc.).	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45.		**OPEN**	
NOAA	WGII/ 4	R44.11	NOAA is strongly encouraged to fully fund and launch both equatorial and polar components of COSMIC-2.		CGMS-45 (for update)	**OPEN**	1.1.4
CGMS members	WGII/ 4	R44.12	CGMS agencies to target at least 20,000 occultations/day, at appropriate global distribution, to be made available to the operational and research communities, based on recent impact studies (NWP, climate and space weather)			**OPEN**	1.1.4

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGII/ 4	R44.13	CGMS agencies to ensure that the RO receiver design includes sufficient software/firmware flexibility to allow changes in the signal processing including processing of new GNSS signals/constellations, including ionospheric measurements			**OPEN**	1.1.4
CGMS space agencies	WGII/ 4	R44.14	CGMS agencies to maintain the constellation of at least three polar orbits (early morning, morning, and afternoon), each with full sounding capabilities (IR and MW). The overpass times of operational satellites with sounding capability (IR and MW) should be coordinated between agencies to maximize their value.	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45.		**OPEN**	1.1.1
CGMS space agencies	WGII/ 4	R44.15	Future satellite programmes should include the provision of high temporal frequency MW humidity sounding radiances (alongside cloud and precipitation sensitive observations).	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45. CGMS-45: NASA Cubesat mission Tropics underway		**OPEN**	1.1.1
ROSH	WGII/ 4	R44.16	Roshydromet to develop and release a direct broadcast processing package for the Meteor-M N2 series, including level 1 processing for the MTVZA-GY microwave imager.		CGMS-45 (for update)	**OPEN**	1.1.5

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/ 4	R44.17	CGMS agencies to identify the resources required to support the 3rd intercomparison of satellite-derived winds.	Reference is made to recommendation for ICWG.	1 Nov 2016	**OPEN**	3.2.1
CGMS space agencies	WGII/ 4	R44.18	CGMS satellite operators to consider coordination of orbits for scatterometer instruments and to provide open and timely access to data in order to maximise independent coverage and benefits to nowcasting and NWP from assimilation of scatterometer wind data.	CGMS-44 WGII - For reference: WG III should discuss this and come up with results at CGMS-45.		**OPEN**	1.1.6
CGMS space agencies	WGII/ 4	R44.19	CGMS agencies to explore possibilites to derive winds from new upcoming satellites and opportunities.		CGMS-45 (for update)	**OPEN**	
CGMS members	WGII/ 4	R44.20	CGMS members to continue to support SCOPE-Nowcasting and its transition to pre-operational phase, in particular to consider financial support the finalization of the satellite-based volcanic ash retrieval algorithm intercomparison activitiy (Pilot Project 2) over the next 12-18 months.	*Deadline for indication of support to volcanic ash activity)* *No indication of support to VA intercomparison so far received by WMO. WMO has identified resources to engage consultant for 2.5 months FTE to support SCOPE-Nowcasting.* *CGMS-45: Funds earmarked by EUMETSAT for 2018*	1 Nov 2016	**OPEN**	3.2.2
CGMS space agencies	WGII/ 6	R44.21	Operators to take into account in the planning of their data distribution systems the emerging stringent requirements on data latency from SRNWP		CGMS-45 (for update)	**OPEN**	2

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CMA	WGII/7	R44.22	CMA to make available data from FY-3D HIRAS and FY-4A GIIRS early in commissioning		CGMS-45 (for update)	**OPEN**	
CGMS space agencies	WGII/7	R44.23	CGMS agencies with operational direct broadcast needs are encouraged to attend the next ITWG sponsored Direct Broadcast Users Meeting in March 2017 hosted by CONAE, Argentina.	CGMS-45: Last week of June 2017, Madison WI, USA	Mar 2017	**OPEN**	
CGMS space agencies	WGII/7	R44.24	CGMS agencies to provide key documentation related to the quality of their products, to allow for informed uptake by users. These documents should include ATBDs, cal/val plans, and regular validation reports		CGMS-45	**OPEN**	5.3
CGMS space agencies	WGII/7	R44.25	For monitoring the Polar Regions, the Group stressed the importance of the deployment of HEO missions	*Link to WGIII required? Yes*		**OPEN**	1.1
CGMS space agencies	WGII/8	R44.26	Satellite operating agencies should support proposals and programs to acquire high-accuracy characterization measurements of the Moon, to develop a new, high accuracy, SI-traceable lunar reference standard for reflected solar wavelengths.	CGMS-44 WGII: Part of WGII action to develop best practices CGMS-45 NOAA-WP-13		**OPEN**	3.1.2
CGMS space agencies	WGII/8	R44.27	Long-term continuity of absolute solar spectral irradiance measurement with SI-traceable accuracy should be ensured.			**OPEN**	3.2.1

CGMS-44 WGII recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/ 8	R44.28	Agencies to explore the possibilities to develop suitable processing packages to support a direct broadcast implementation of RO processing, within the DBNet to improve timeliness for space weather applications		CGMS-45 (for update)	**OPEN**	
WGII	WGIII/ 6	R44.29	From WGIII to WGII: WGII to study this issue and provide guidance on the potential impact of temporal a gap in the PMW SST products.	CGMS-45: 6.9MHz currently used, in future only GCOM-W will provide this capability for the time being.	CGMS-45	**OPEN**	
WGII	WGIII/ 6	R44.29	From WGIII to WGII: WGII to study this issue and provide guidance on the potential impact of temporal a gap in the PMW SST products.	CGMS-45: 6.9MHz currently used, in future only GCOM-W will provide this capability for the time being.	CGMS-45	**OPEN**	

WGIII actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
ISRO	WGIII/2.2	A42.05	ISRO to report at CGMS-43 on its progress on radio-occultation processing of ROSA on Oceansat-2 and Megha-Tropiques, and on the possibility of near real-time access to ROSA data acquired at a high latitude station such as Svalbard.	CGMS-43 ISRO-WP-03 partially closed. NRT access to ROSA data remains open.	(CGMS-43) New deadline CGMS-45	**CLOSED**	1.1.4

CGMS-44 WGIII actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/	A44.01	CGMS Members: To review and react to the WIGOS Vision 2040 as it develops	*Input provided by EUM, NOAA (July 2016)*	(Aug 2016) CGMS-46	**OPEN**	1.1
WMO	WGIII/	A44.02	WMO Secretariat to present the draft Vision at CEOS, GEO plenary sessions 2016.		(End 2016) CGMS-46	**OPEN**	1.1
CGMS members	WGIII/3	A44.03	CGMS operators nominate focal points for maintaining these elements (dates, landing pages), and other elements included in OSCAR/Space (e.g., instrument characteristics).	EUM: sally.wannop @eumetsat.int NOAA: Matthew.Butler@noaa.gov	31-Jul-17	**OPEN**	5.3

CGMS-44 WGIII recommendations							
"Actionee "	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/2.2	R43.01	CGMS members are encouraged to consider including RO capabilities on all future polar-orbiting satellites.	CGMS-44 discussions:	Ongoing	**OPEN**	1.1.4
CGMS members	WGIII/	R44.01	CGMS Members are invited to comment on NOAA Commercial Space Policy and/or associated RFI by June 13, providing inputs per directions at the link: https://www.fbo.gov/index?s=opportunity&mode=form&id=09512e960853e562024b6bd2f631ee6b&tab=core&_cview=0		13 Jun 2016	**CLOSED**	
WMO	WGIII/	R44.02	Noting the recent conclusions of the WMO IPET-DRMM and the concurrence expressed CGMS WG III, WMO is encouraged to add the satellite identifier (from Common Code Table C5) and satellite instrument identifier (from Common Code Table C8) to OSCAR Space.		CGMS-45	**OPEN**	2.7
CGMS space agencies	WGII	R44.03	From CGMS-44 WGII: CGMS Members to continue an operational constellation of conically-scanning microwave platforms to guarantee sustained support for the current level of capability	Ref. gap analysis discussion		**OPEN**	1.1.6
CGMS space agencies	WGII	R44.04	From CGMS-44 WGII: CGMS to have a special discussion on the value of formation flying similar to the A Train – especially for precipitation and other hydrological applications			**OPEN**	
CGMS space agencies	WGII	R44.05	From CGMS-44 WGII: CGMS satellite operators to consider coordination of orbits for scatterometer instruments and to provide open and timely access to data in order to maximise independent coverage and benefits to nowcasting and NWP from assimilation of scatterometer wind data.			**OPEN**	1.1.1

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUM	WGIII/ 2	A43.02	(Action transferred from WGIII) EUMETSAT to propose dissemination plan for data from Indian Ocean Data Coverage partners identified in CGMS-43-EUM-14 roadmap.	Status at CGMS-45: CGMS-45-EUMETSAT-WP-37 CGMS-45-ISRO-WP-05 Ongoing work , extend deadline to cgms-46 WGIV webex 9 Dec 2015: WMO seeking to assure that the dissemination to users will be equivalent to the current one (EUMETSAT, CMA, ROSH and ISRO to collaborate and clarify this in view of CGMS-44. EUMETSAT makes FY-2E data available through EUMETCast. EUM expects its Council to take a decision on moving Meteosat-8 to ca 40° E in June 2016. CGMS-44 EUM-WP-14 WG-IV WEBEX and communication 18 Jan 2017: Status of IODC Service by CMA: The CMA FY-2E at 86.5E is undertaking IODC service. CMA shall keep continuity of IODC service at 86.5E, on assumption: - FY-2G, launched 31 December 2014, currently operating at 105E; - Launch of FY-2H is planned for the end of 2017 or early 2018.	(CGMS-44, -45) ***New deadline CGMS-46***	**OPEN**	1.1.6

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
NOAA	(WGI/4) WGIV/7	A43.03	NOAA to consider including GLM products in the HRIT stream	CGMS-45: evaluation by NOAA still going on. WG-IV WEBEX 18 Jan 2017 and communication: NOAA is considering putting GLM on HRIT/EMWIN. At this time, our plan is to include 5 channels of Cloud and Moisture Imagery (CMI) in Full Disk at 2 KM resolution and also 3 channels of mesoscale imagery. Under that plan, there would not be sufficient bandwidth for the predicted size of the GLM data. However, we are just receiving CMI data and will evaluate the HRIT broadcast over the next few weeks [in January 2017] prior to the public release of GOES-R data at the end of February 2017. Webex 21 Oct 2015 discussion: NOAA is working on it, and final product list planned for 2016.	(CGMS-44, 45) ***New deadline CGMS-46***	**OPEN**	

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
TT metadata	(WGI/6) WGIV/10.1	A43.05	CGMS Task Team on metadata to define discovery metadata for DBNET	NOAA: CGMS-44-NOAA-WP-14 PPT EUM: http://navigator.eumetsat.int https://eoportal.eumetsat.int CGMS-44-EUMETSAT-WP-17, ongoing work, extended deadline. CGMS-45: no change, extended deadline to WGIV IS meeting WG-IV WEBEX 18 Jan 2017 and communication: CMA http://data.cma.cn/en http://satellite.nsmc.org.cn/PortalSite/default.aspx?currentculture=en-US NASA: https://search.earthdata.nasa.gov CGMS-45-ROSCOSMOS-WP-03 Still not complete, extend due date to CGMS-46	(CGMS-44, -45) ***New deadline Dec 2017***	**OPEN**	2.7

WGIV Actions open from previous plenary sessions (at CGMS-44)							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS members		A43.06	CGMS members to provide a listing of their data access portals.	CGMS-44-NOAA-WP-14 PPT EUM: http://navigator.eumetsat.int https://eoportal.eumetsat.int WG-IV WEBEX 18 Jan 2017 and communication: CMA: http://data.cma.cn/en http://satellite.nsmc.org.cn/PortalSite/default.aspx?currentculture=en-US NASA: https://search.earthdata.nasa.gov CGMS-45-ROSCOSMOS-WP-03 Still not complete, extend due date to CGMS-46	(CGMS-44) **New deadline CGMS-46**	**OPEN**	-

CGMS-44 WGIV actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
TFMI (task force on Metadata)	WGIV/ 3.1	A44.01	To submit the “Guidance Documentation on WMO Core Profile Metadata Creation For Satellite Products” to WMO IPET-MDRD and IPET-SUP.	CGMS-45-EUMETSAT-WP-41	30 Dec 2016	**CLOSED**	2.7

CGMS-44 WGIV actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUM	WGIV/ 7	A44.02	To provide a timeline for the users preparation information for MTG, in accordance with "CGMS-44-WMO-WP-02 Best Practices for Achieving User Readiness for New Meteorological Satellites"	WG-IV WEBEX 18 Jan 2017 EUMETSAT: High Level information for Saturn was provided. CGMS-45: Ongoing work, keep open until more mature. Extend deadline to WG-IV IS meeting.	(30 Dec 2016) ***New deadline Dec 2017***	**OPEN**	5.3
CGMS members (data providers)	WGIV/ 10	A44.03	CGMS members (data providers) to a) discuss and respond to the recommendation from CGMS-44-CEOS-WP-02: CEOS recommends the adoption of the WGISS supported standards for searching Climate Data Records (CDRs). WGISS will provide technical support to CGMS data providers providing their climate data records through the WGISS data access infrastructure (IDN, CWIC, FedEO); and b) report how far the standards WGISS developed (as described in CGMS-44-CEOS-WP-02) are supported.	WG-IV IS Jan 2017: From NASA: In response to action item # A44.03, I would like to state that EUMETSAT, NASA, ESA, CNES, USGS, JAXA, ISRO (NRSC) and CCMEO have all implemented WGISS supported standards (CEOS Opensearch Best Practices). CMA: will be implemented when appropriate CGMS-45: Sufficiently answered, can be closed.	CGMS-45	**CLOSED**	5.1

CGMS-44 WGIV actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
JCOMM task team	WGIV/ 6.2	A44.04	The JCOMM Task Team To work together with the International Wind Working Group and the CEOS "Ocean Surface Vector Wind Virtual Constellation" (OSVW-VC) at developing a project on Surface Vector Winds, using the well-known and highly successful GHRSST Project as a model for the adoption of globally-agreed standards for the production and distribution of global, integrated, surface vector winds and associated products.	Proposed closure following CGMS-45 discussions. JCOMM to approach CGMS as necessary.	CGMS-45	**CLOSED**	2.5
CGMS members	WGII	A44.05	From CGMS-44 WGII: CGMS operators and WMO to work with GODEX-NWP to explore options for optimal data exchange of advanced data from next-gen GEOs.	WG-IV WEBEX 18 Jan 2017: WMO: GODEX-NWP scheduled May 2017, needs will be addressed there, WMO will provide feedback. CGMS-45: GODEX-NWP not yet ready to provide feedback.	(CGMS-45) *New deadline CGMS-46*	**OPEN**	
ROSH	WGII	A44.06	From CGMS-44 WGII: ROSHYDROMET to explore the possibilities to implement an operational NRT service for the hyperspectral infrared sounder IKFS-2 on Meteor-M N		CGMS-45	**CLOSED**	

CGMS-44 WGIV recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGIV/ 7	R42.01	Satellite operators to provide WIS Discovery Metadata Records, compliant to WIS requirements and following the guidance to be provided by the CGMS-WMO Task Force on metadata implementation, in order to facilitate satellite information discovery and access	*CGMS-45: Recommendation still valid, to be retained.* NOAA: Related to metadata, the best reference is NGDC metadata provided here the URL: http://www.ngdc.noaa.gov/metadata/ WGIV CGMS-43 discussions: Ongoing and routine activity. Recommendation maintained until CGMS-44 WGIV webex 9 Dec 2015: To be taken up at the TT on Meta Data meeting the week of 14 Dec 2015. See CGMS-44-EUMETSAT-WP-17. Recommendation still valid, to be retained.	(CGMS-43, -45) ***New deadline CGMS-46***	**OPEN**	2.7
CGMS members	WGIV/ 3.2	R44.01	CGMS members to contribute to the implementation of the Best Practices for User Readiness for meteorological satellite systems under development, both GEO and LEO	*CGMS-45: Recommendation still valid, to be retained.* Closed for NOAA.	(CGMS-45) ***New deadline CGMS-46***	**OPEN**	5.3
CGMS members	WGIV/ 3.2	R44.02	CGMS members to continue the provision of up-to-date User Readiness information in the SATURN portal	*CGMS-45: Recommendation still valid, to be retained.*	CGMS-45	**OPEN**	5.3

CGMS-44 WGIV recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
EUM and NOAA	WGIV/ 11.1	R44.03	NOAA (and EUMETSAT, as appropriate) to continue their strong engagement in the WMO Coordination Group on Satellite Data Requirements for Region III and IV (Americas) and to provide support to Region-based access to satellite data, including from GOES-R and JPSS, according to user needs.	Closed following discussions at CGMS-45 Strong engagement continues, now considered normal work.	CGMS-45	**CLOSED**	2.1
CGMS-44 plenary	WGIV/ 3.1	R44.04	WG-IV recommends to CGMS plenary to endorse the extension of the CGMS TFMI activity to assess the WIGOS Metadata OGC Observations and Measurements mapping and to report its findings/recommendations to WMO IPET-MDRD	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	2.7
CGMS-44 plenary	WGIV/ 3.2	R44.05	WG-IV recommends to CGMS plenary to adopt "CGMS-44-WMO-WP-02 Best Practices for Achieving User Readiness for New Meteorological Satellites", as far as it applies to satellite operators, as CGMS Best Practice.	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	5.3
CGMS-44 plenary	WGIV/ 3.3	R44.06	In the context of IODC data access, WG-IV supports the definition of essential data first and, once defined, recommends the distribution of these data via the established dissemination means by the CGMS agencies in the region (CMA, EUMETSAT, ISRO, ROSHYDROMET).	Endorsed by CGMS-44 plenary	9 Jun 2016	**CLOSED**	1.1.6

CGMS-44 SWTT actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SWTT		A44.01	SWTT to conduct a workshop with leadership from the various space weather communities that will benefit from CGMS coordination of space-based space weather observing systems.	CGMS presentation and discussions have occurred at European Space Weather Week (ESWW) and UNCOPUOS. Discussions have been held with leadership of ISWI, COSPAR, and ISES. CGMS SWTT organized electron inter-calibration mini-workshop at US Space Weather Workshop CGMS space weather role is included in draft UNCOPUOS framework for space weather services. Planned: Dedicated CGMS ESWW topical discussion meeting ("Space Weather Activities in the Coordination Group for Meteorological Satellites.") Presentation of CGMS at UN/US ISWI workshop	30 Nov 2017	**OPEN**	5.2.1
SWTT members		A44.02	Members of SWTT review the current WIGOS 2040 vision to ensure inclusion of necessary space weather observations.	NOAA: Input sent 27 Jul 2016. Webex 22 Mar 2017: WMO to circulate version WIGOS 2040 1.1 for further review by SWTT by CGMS-45 to be reflected in the SWTT agenda at CGMS-45. NASA submitted comments after CGMS-45 SWTT meeting.		**CLOSED**	1.1.7

CGMS-44 SWTT actions							
Actionee	**AGN item**	**Action #**	**Description**	**Action feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
SWTT		A44.03	(From WGIII): SWTT members wishing to participate in the SETT activities are invited to participate in the SETT activities, and should provide their contact information to the SETT accordingly (Charles.wooldridge@noaa.gov).	Contact information has been sent to SETT	1 Jul 2016	**CLOSED**	4.1.1

CGMS-44 SWTT recommendations							
"Actionee"	**AGN item**	**Rec #**	**Description**	**Recommendation feedback/closing document**	**Deadline**	**Status**	**HLPP ref**
CGMS-44 plenary		R44.01	**On Space Weather Task Team:** Sustain the SWTT for another year in order to enable CGMS space weather integration into existing Working Groups.	Endorsed by CGMS-44 plenary. CGMS-45: Integration activities ongoing.	(9 Jun 2016) Jun 2018	**OPEN**	5.2

ANNEX IV: LIST OF PARTICIPANTS

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