Report of the 41st Meeting of the Coordination Group for Meteorological Satellites

8-12 July 2013, Tsukuba, Japan

CGMS

REPORT OF THE 41st MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS-41

Tsukuba, Japan
8-12 July 2013

Report edited on behalf of CGMS by:
CGMS Secretariat
EUMETSAT
Eumetsat Allee 1
D-64295 Darmstadt
Germany
www.eumetsat.int
CGMS MR 41

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INTRODUCTION

A OPENING SESSION

The 41st CGMS meeting was jointly organised by Japan Meteorological Agency (JMA) and Japan Aerospace Exploration Agency (JAXA)), and co-chaired by Masanori Obayashi, JMA and Alain Ratier, EUMETSAT.

The 41st plenary session of CGMS was officially opened at 9:00 on 11 July 2013 in Tsukuba, Japan. Mitsuhiko Hatori, Director-General of JMA, welcomed participants to Japan, and to the town of Tsukuba. He reflected on the achievements of CGMS since its conception, the progress in the development of meteorological satellites and the use of meteorological satellite data. Kiyoshi Higuchi, Vice-President, JAXA also welcomed participants and wished them a succesful meeting. He underlined the importance of exchanging ideas and information within the CGMS as well as outside of the group through various outreach activities.

B INTRODUCTION TO THE MEETING

The CGMS Secretariat outlined the objectives of the meeting recalling the restructuring of CGMS, the endorsement of the CGMS High Level Priority Plan at CGMS-40 and the resulting inter-sessional meetings which had been held by the CGMS Working Groups leading up to CGMS-41.

This was followed by the adoption of the agenda by the CGMS-41 plenary.

Thee CGMS Secretariat also provided a review of the outstanding plenary actions from CGMS-40 taking into account inputs provided by the Working Groups and WPs by the members, as well as by other means of correspondence, including e-mail.

In summary, the status of actions and recommendations by the end of the CGMS-41 Working Group discussions was as follows:

Type of action	Actions at CGMS-41	Closed	Comments
Actions from previous meetings (CGMS-38/-39)	10	7	3 open (new deadlines agreed)
Actions (CGMS-40)	44	29	3 open (is still expected to be closed) 12 (new deadlines agreed, or deadline later than CGMS-41)

Recommendations	46	All	Recommendations are on a best effort basis and are closed at the end of each CGMS plenary session.

The final status of the list of actions resulting from CGMS-40, updated through discussions at CGMS-41, is provided at the following link on the CGMS website: http://cgms-info.org/docs/default-source/cgms-help/here-.pdf?sfvrsn=0

C USER REQUIREMENTS

C.1 GFCS

WMO delivered an update on the Global Framework for Climate Services (GFCS) (**WMO-WP-27 PPT**). This included a presentation of the management structure of the GFCS and the draft resolution for the establishment of a management committee for the Intergovernmental Board on Climate Services (IBCS).

Three key issues for CGMS were identified:

(i) the need for CGMS members to meet the observing and monitoring needs of GFCS priority areas and therefore to contribute to the development of the architecture for climate monitoring from space;
(ii) the need to support the free and open exchange of climate-relevant space observational data and products; and
(iii) the need to assess CGMS members' future engagement in the GFCS process through the Technical Advisory Committee (TAC) and the Partner Advisory Committee (PAC).

During the discussion that followed, IOC highlighted the need for rapid access to data and suggested that a minimum time delay be considered as part of the GFCS discussions on data access.

As a result of the discussions, the following action was agreed:

CGMS-41 actions - PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	Plen C.1	41.01	WMO to report on the progress of GFCS implementation	CGMS-42	**OPEN**	HLPP #5.1.1

C.2 GCOS and WCRP

GCOS presented an update on the Global Climate Observing System (GCOS) and the World Climate Research Programme (WCRP). See also **WMO-WP-09**.

GCOS noted that a strengthened Global Climate Observing System will be important for the successful implementation of the Global Framework for Climate Services (GFCS), recognising that observations and monitoring constitute essential pillars of the GFCS. The implementation of improvements to the climate observing system will also support assessment and development of policy related to climate change.

One of the next steps of the GCOS improvement and assessment cycle will be the preparation in 2015 of the Third GCOS Adequacy Report and Progress Report on the implementation of GCOS. These reports will be based on the findings of a Workshop on Observations for Adaptation to Climate Variability and Change, on the fifth IPCC assessment process and on other workshops or symposia. The report will be developed by a writing team and the consultation process will include a public review. Progress and future needs for the development of the architecture for climate monitoring from space will be addressed in the next GCOS adequacy report and the new implementation plan that will follow for 2016. GCOS will remain engaged in the next stages of development and implementation of the architecture for climate monitoring from space.

Discussion followed on the future engagement of other user communities in the GCOS implementation plan and the challenges of the observing system's design. NASA raised the question of how the window of opportunity of the 5th IPCC assessment report might be used to set priorities on climate for space agencies. GCOS will organise a workshop for this purpose, but the WCRP/EUMETSAT Climate Symposium (see section G.3) will also be an opportunity for this discussion to take place.

The following action was agreed as a result of the discussions:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
GCOS	Plen C.2	41.02	GCOS to provide a statement documenting the importance of LEO sampling from three distributed orbits for climate observation (due 30 September 2013)	30-Sep-13	**OPEN**	HLPP #1.1.1

C.3 IOC: Ocean surface topography observations

A presentation on IOC ocean surface topography missions was given on behalf of IOC. Two examples of highly precise satellite measurements of global ocean surface topography were described: global and regional sea level variations for detection of climate and ocean weather phenomena, such as global sea level rise and upper-ocean heat content eddies, respectively. Ocean weather, which impacts the capability of the ocean to increase or decrease the intensity of tropical storms or hurricanes, is undersampled with a conventional satellite altimeter which measures ocean surface topography along the nadir direction. Even if the unlikely, but highly fortunate, situation should arise that five conventional satellite altimeters are simultaneously in complementary orbits recording ocean surface topography, the composite

dataset would be inadequate to sample a substantial portion of mesoscale motions and all submesoscale eddy motions with adequate temporal resolution. Unlike the global atmosphere, where mean motion is typically 10 times greater than eddy motion, the oceanic eddy motion is 10 times greater than the mean motion. A satellite altimetry ocean surface topography noise level of 1 cm^2/cycles per kilometer corresponds to a 3 cm s^{-1} geostrophic current error in a 10-km-diameter eddy at 45° latitude. This criterion is an objective of a wideswath satellite altimeter mission with a launch readiness date of 2020.

EUMETSAT confirmed the interest of the meteorological community in oceanography and supported the continuation of the constellation of operational classical altimetry, including SAR and interleave mode. In this context, the SWOT mission, jointly developed by NASA and CNES and referred to in the IOC presentation, should still be considered an R&D mission.

NOAA endorsed the paper and noted that ocean colour ranks high in NOAA products. The VIIRS instrument on Suomi-NPP provides ocean colour observations, and this will be continued on JPSS-1 and -2 satellites. ESA confirmed that it will continue ocean missions with Sentinel-3 and mentioned HY-2 as a potential satellite which can further cooperation on oceanography in the future. EUMETSAT noted that cross-calibration by reference missions such as Jason-type satellites is necessary to produce calibrated datasets that can be used by the modelling community.

The following action was agreed as a result of the discussions:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
IOC-UNESCO	Plen C.3	41.03	IOC to provide a paper on guidance to CGMS members on ocean colour observations	CGMS-42	**OPEN**	HLPP #3

C.4 WIGOS (including Global Cryosphere Watch and Global Atmospheric Watch matters)

The WMO Integrated Global Observing System (WIGOS) was described in **WMO-WP-10** and presented to the plenary by WMO.

The WIGOS Implementation Plan was revised following the 65th session of the WMO Executive Council (EC-65, May-June 2013). Moreover, WMO Strategic and Operational Planning for 2016-2019 further considered future strategic priorities and accorded high ranking to WIGOS.

WIGOS provides a new framework for coordination and evolution of WMO observing systems (both space-based and surface-based components), including the engagement and contributions of WMO to co-sponsored observing systems. The latest progress on WIGOS needs input and support from the space community in the following areas:

- Integration of governance and management functions through new regulatory material
- Design, planning and optimised evolution of WIGOS component observing systems (including space-based observing systems)
- Observing system operation and maintenance
- Quality management
- Standardization, system interoperability and data compatibility
- Data discovery, delivery and archival (through the WMO Information System, WIS).

As part of this process, NOAA agreed to present its requirement analysis tool at the next CGMS meeting. WMO agreed to keep CGMS informed on the status and progress of WIGOS.

The following action was agreed:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	Plen C.4	41.04	NOAA to present its requirement analysis tool at CGMS-42	CGMS-42	**OPEN**	-

C.5 Preparedness of users for new generation of satellites

A keynote speech was given by Anthony Rea of the Bureau of Meteorology, Australia, on ensuring the preparedness of users for the new generation of satellites. He referred to **WMO-WP-21** which contained the "Guideline for Ensuring User Readiness for New Generation Satellites" adopted by the WMO Commission for Basic Systems.

A side event held at the 65th session of the WMO Executive Council in May 2013 on this topic highlighted the critical importance of launching user preparedness projects on the part of CGMS operators and user organisations in all WMO regions approximately five years prior to launch. JMA, CMA, EUMETSAT and NOAA participated in this side event, along with a representative of a user organisation (Australian Bureau of Meteorology). The outcomes of this event are particularly relevant for upcoming geostationary systems (INSAT-3D, Himawari-8, FY-4A, GOES-R, MTG-I1, GEO-KOMPSAT-2A) in the period 2014-2020.

During the discussions, EUMETSAT noted that it was important to have clarity between a plan and a user guide. WMO suggested that the focus should be to promote best practices among CGMS satellite operators, and to facilitate information enabling users to access data and products and develop applications as early as possible in the programme lifecycle. JMA noted that in RA-II a website has been established to prepare users. It was suggested that WMO host an online portal, providing dynamic information which could be fed with regular information by the operational agencies. EUMETSAT supported this approach. NOAA highlighted that it is the responsibility of agencies to prepare user guides and training, but that WMO should provide

guidance on best practices. EUMETSAT noted the importance of user feedback.

The following actions were agreed as a result of the discussions:

Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	Plen C.5	41.05	CGMS space agencies to nominate focal points for a task team to share experience and prepare a dynamic WMO web-based portal on initiatives taken by satellite operators to prepare users for the next generation of GEO satellites. The structure of this portal will follow the CBS user preparedness guidelines and will link to the latest information available on space agency web sites, online resources and related projects.	15-Sep-13	**OPEN**	HLPP #4.2.1, 5.3
WMO	Plen C.5	41.06	WMO to report on the progress of the task team on the WMO web-based portal for user preparedness for next generation GEO satellites.	CGMS-42	**OPEN**	HLPP #4.2.1, 5.3

D REPORTS FROM THE SPACE AGENCIES

D.1 Reports on the status of current and future satellite systems by operational space agencies

CMA reported on the status of its current and future satellite systems in **CMA-WP-02-PPT**. CMA operates the FY geostationary and polar-orbiting systems. The polar orbit observation is carried out by FY-3A in AM orbit, and FY-3B in the PM orbit. The launch of FY-3C is planned for 23-24 September 2013. Three identical FY geostationary satellites (FY-2D/E/F) are currently in orbit. FY-2C has been retired. FY-2F was launched in early 2012. It is stored in orbit for future replacement of FY-2D (or FY-2E). CMA is currently developing FY-4, its next generation of geostationary meteorological satellites, with the launch of the first FY-4 spacecraft scheduled for 2015.

EUMETSAT reported on the status of its current and future satellite systems in **EUM-WP-02 PPT**. EUMETSAT operates a fleet of meteorological satellites, and their related ground systems, to deliver reliable and cost-efficient data, images and products. These, in turn, serve requirements for weather and climate monitoring of the national meteorological services in the 27 Member and four Cooperating States, and of global partners. The present system includes two generations of geostationary Meteosat satellites. Their global view is complemented by the detailed observations provided by the Metop polar-orbiting satellite and the marine observer, Jason-2 - a joint project of space agencies in Europe and the United States.

IMD/ISRO reported on the status of current and future Indian satellites in **IMD-WP-01**.

Two satellites are currently in operation: KALPANA-1 and INSAT-3A. With the help of these two satellites, IMD is able to monitor cyclones, western disturbances, thunderstorms and other weather events and provide early

warnings to the affected areas. The next major upgrade in observations from geostationary orbit will be the INSAT-3D satellite scheduled for launch in late July 2013. GISAT, the next generation geostationary imaging satellite, is planned in the near future .

Oceansat–2, RISAT-1 and SARAL are the Indian operational polar-orbiting space missions. In addition, Megha-Tropiques is in low inclination orbit for atmospheric and oceanic science studies. RISAT-1 (Radar Imaging Satellite), launched on 26 April 2012, provides data for flood mapping, agriculture and crop monitoring, vegetation, forestry, soil moisture, geology and sea ice and coastal processes. SARAL is a joint Indo-French satellite mission which will perform altimetric measurements designed to study ocean circulation and sea surface elevation. It was successfully launched on 25 February 2013.

JMA reported on its current and future satellite systems in **JMA-WP-02**. MTSAT-2 is currently operational over the western Pacific region with MTSAT-1R as the back-up. MTSAT-1R has continued to perform imagery dissemination and data collection services even after its imaging function was switched over to MTSAT-2 on 1 July 2010.

JMA plans to launch Himawari-8 in 2014 and commence its operations in 2015, when MTSAT-2 is scheduled to end operations. The Agency also plans to launch Himawari-9 in 2016. Himawari-8 and -9 production is currently in the build and integration phase. Himawari-8 and -9 imagery will be delivered mainly via the Internet, and JMA has also completed a feasibility study on data dissemination using a commercial telecommunication satellite. The Agency has set up a web page with information on Himawari-8 and -9 at http://mscweb.kishou.go.jp/himawari89

KMA-WP-01 summarised the current status of the KMA Communication, Ocean and Meteorological Satellite (COMS) which has been operating since 1 April 2011. KMA is responsible for Meteorological Imager operation and data distribution. The Korea Ocean Satellite Center (KOSC) is responsible for GOCI (Geostationary Ocean Colour Imager) Data Processing (GDPS) and data distribution. GOCI data can be accessed on their web site and with free access for public/research purposes. KMA reported on tentative plans for COMS follow-on missions, GEO-KOMPSAT-2A (meteorological mission) and -2B (ocean and environmental mission), which are scheduled to be launched in 2017 and 2018, respectively.

NOAA reported on the status of its current and future programmes in **NOAA-WP-02-PPT**. NOAA manages a constellation of four geostationary and eleven polar-orbiting meteorological spacecraft, including six military satellites, from the Satellite Operations Control Center (SOCC) in Suitland, Maryland. These satellites provide continuous observations of weather conditions and environmental features of the western hemisphere, monitor global climate change, verify ozone depletion and land surface change, monitor the critical space environmental parameters, and support search and rescue efforts across the globe. The WP addressed the status of the geosynchronous and low-earth-orbiting spacecraft constellations.

In **ROSH-WP-04,** ROSHYDROMET and ROSCOSMOS presented the current status of the Meteor-M №1 polar-orbiting meteorological satellite and the Electro-L №1 geostationary meteorological satellite. The future Meteor-M polar-orbiting satellite system will include three meteorological and one oceanographic satellite. The future Russian geostationary constellation will consist of three Electro-L satellites. The location of Electro-L satellites in orbit will be 14.5°W, 76°E and 166°E. The Arctica-M constellation of highly elliptical orbit satellites is now under development. The system will include two spacecraft providing continuous observations over the Arctic region. The launch is scheduled for 2015–2016.

The information provided by CGMS satellite operators in their reports above was included by WMO in the OSCAR database (http://www.wmo-sat.info/oscar/spacecapabilities). Please follow the link to find out the latest status.

D.2 Reports on the status of current and future satellite systems by R&D space agencies

CGMS was informed on the status of the Earth Observing System of CNSA in WP **CNSA-WP-01**. Currently, the on-orbit functionally operating satellites of CNSA include FY-3A, FY-3B, HY-1B, HY-2, HJ-1A, HJ-1B, HJ-1C, ZY-3, and GF-1. The FY series are operational meteorological satellites. FY-3A and -B were successfully launched on 27 May 2008 and 5 November 2010, respectively. Both satellites are running stably on orbit. The HY series includes an ocean colour satellite (HY-1) and an ocean dynamics environmental satellite (HY-2). HY-1A and -B were launched on 15 May 2002 and 11 April 2007, respectively. The HY-1A satellite stopped functioning on 30 March 2004. The HY-1B satellite is still functional in orbit. HY-2 was successfully launched on 16 August 2011, and sensor calibration and validation was performed in 2013. The ZY series satellite was developed jointly by China and Brazil with the name CBERS. Three CBERS satellites, CBERS01/02/02B, were successfully launched in 1999, 2003, and 2007. Currently, all three of these satellites have completed their missions but their measurements are still used in many application areas. The environment and disaster small satellite constellation is composed of several optical satellites and microwave SAR satellites. The first stage of the constellation, the HJ-1 programme, includes two optical satellites and one SAR satellite, for environment monitoring, ecosystem protection, and disaster detection with high spatial and temporal resolutions. HJ-1A and -B were launched on 6 September 2008, and both passed their nominal design life of three years and are experiencing ageing. HJ-1C was launched on 19 November 2012 and is currently in the on-orbit test stage. GF-1 is the first satellite of the GF high spatial resolution series for observing the Earth. It was launched on 26 April 2013 and is currently in the on-orbit test stage.

In the future, China plans to launch several satellite systems, including FY-4 (in 2015), CFOSAT (in 2014), CBERS 03/04, and HJ-1C (in 2012). FY-4 is the second generation of geostationary meteorological satellite in China, which is planned to be launched in 2015. CFOSAT is being developed jointly by China and France for dynamic ocean environmental monitoring and is expected to be

launched at the end of 2014. CBERS 03/04 is the next generation of CBERS 01/02. ZY-3 is planned to be launched at the end of 2013.

The status of the current ESA Earth observation (EO) missions was reported in **ESA-WP-01**. Two of them, MSG and Metop, are in cooperation with EUMETSAT. The Gravity field and steady-state Ocean Circulation Explorer, GOCE, the first Explorer satellite launched on 17 March 2009, completed its nominal mission in April 2011. GOCE continues to provide top-quality gravity field data. The SMOS satellite was launched on 2 November 2009. SMOS level 2 data products were released at the end of October 2010. All reprocessed level 1 and 2 data have been available from the ESA Cal/Val portal since mid-March 2012. The CryoSat-2 satellite was launched on 8 April 2010. The first CryoSat Arctic sea-ice thickness map was presented in June 2011. Release of systematic CryoSat products (level 1b and 2) to the scientific community is ongoing. The Proba-V small satellite was launched on 7 May 2013. Its coarse resolution imager continues the data acquisition of the vegetation payload on board SPOT-4 and 5. About 4,000 data user projects worldwide use data from the ESA EO missions and this number is increasing further. The total volume of ESA EO mission data exceeds 100 Terabytes per year.

CGMS was further informed of the status of the future ESA EO missions. The Living Planet Programme has three lines of implementation: Earth Explorer satellites, Earth Watch satellites plus services and applications demonstration. BIOMASS, the seventh Core Explorer, has now been selected. Progress in the preparation of the forthcoming Explorer missions ADM-AEOLUS, Swarm and EarthCARE is described. GMES represents the major new initiative of European EO efforts. GMES pre-operational services began in 2008 with the provision of the relevant data. The first GMES dedicated satellites (the “Sentinels”) will be launched in 2014. Related activities are under way at all stages within the Agency, the EC and at Member State level.

CGMS was also informed of the status of the Earthwatch Programme Element, Global Monitoring of Essential Climate Variables (also known as the ESA Climate Change Initiative or CCI). The CCI programme has continued to progress well. The 13 existing project teams have made significant progress on algorithm development and in specifying a future operational system. The programme will achieve its phase 1 objectives by end-2013 and continue in phase 2 starting in early 2014.

The status of ISRO satellite systems was covered in **IMD-WP-01** (see section D.1).

JAXA reported on its current and future satellite systems in **JAXA-WP-01**. JAXA currently operates GOSAT (Ibuki) and GCOM-W1 (Shizuku). GOSAT was launched on 23 January 2009. The data products are distributed through the GOSAT User Interface Gateway (GUIG). GCOM-W1 was launched on 18 May 2012. The initial calibration and checkout of GCOM-W1 (Shizuku), was successfully conducted. The AMSR2 products are available at the GCOM-W1 Data Providing Service website. Development of the future satellites ALOS-2, GPM/DPR, EarthCARE/CPR and GCOM-C1 are underway. Both ALOS-2 and

the GPM core satellite will be launched in 2013. EarthCARE will be launched in JFY2015. GCOM-C1 will be launched in 2016.

NASA reported on its 17 Earth science missions in **NASA-WP-01**. Although all missions were conceived as research missions, it has turned out that the efficiency of the communications and ground data handling systems has supported operational and near-real-time applications. All missions are currently producing data, but several also show signs of ageing. Except for Suomi NPP (October 2011), SAC-D/Aquarius (June 2011) and LDCM/Landsat-8 (February 2013), all missions have passed their nominal design life and are currently in extended operations. NASA's Earth Science Programme ($1.8 billion budget) is implementing a balanced and robust plan to accomplish a broad set of critical Earth observation measurements from space. 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 impact of humans. A balance of satellite measurements, science research, technology development and applications are needed to address a complex global Earth system. NASA plans the launch of 14 missions and two instruments (on a host mission) in the future.

The status of ROSCOSMOS satellite systems was covered in **ROSH-WP-04** (see section D.1).

The information provided by CGMS satellite operators in their reports above was included by WMO in the OSCAR database (http://www.wmo-sat.info/oscar/spacecapabilities). Please visit the link for the most up-to-date information.

E WORKING GROUP REPORTS

E.1 Global issues on satellite systems and telecommunication coordination (WGI)

E.1.1. Key-note - A real-time network for Suomi NPP/JPSS, POES, Metop and FY-3 satellite reception across North America and the Pacific

Liam Gumley, Space Science and Engineering Center, University of Wisconsin-Madison, provided a presentation (**GUEST-WP-03 PPT**) on the NOAA plans for implementing a real-time network for satellite reception across North America and the Pacific, a complementary service similar to RARS (Regional ATOVS Retransmission Service).

Roshydromet enquired about access to global data similar to what was provided by EUMETSAT. NOAA responded that all data are available to users but not in near-real time (NRT). Rebroadcasting had not been considered at this stage.

WMO added that it appreciated the effort made by NOAA through the University of Wisconsin-Madison but highlighted, however, the importance of

redistribution to the global community, which is an essential principle of the RARS but currently not foreseen in the project. EUMETSAT stated that the key issue is the availability for NWP, and that depending on the data volume, it might be possible to re-disseminate the data through GEONetCast. This point was confirmed to be related to the Task Team proposed to be created in WGI (see WGI report), to discuss and address topics in relation to LEO direct read-out terminals, RARS-like systems and services and associated standards. Where relevant, close coordination with WGII and WGIV would be made through a regular exchange of information between the co-chairs and rapporteurs). The Task Team will work through the planned WG inter-sessional meetings to ensure progress before the next CGMS plenary session.

This proposal was welcomed and supported by the plenary.

E.1.2 Report from WGI

The WGI rapporteur provided a summary report (**EUMETSAT-WP-20 PPT**) on the outcome of WGI discussions related to frequency management and protection, direct broadcast services, international data collection and distribution, coordination and global standards and optimisation of data collection systems, and contributions to the WIS.

One point brought to the attention of the CGMS plenary was the proposed update to the Global Specification for HRPT (CGMS Global Spec 04). The update has been technically agreed inside WGI but needed to be endorsed at plenary level. Following consultation, the CGMS plenary agreed on the proposed update of the CGMS Global Spec-04.

The actions identified in WGI were endorsed by the plenary.

It had been decided that the inter-sessional meetings by WGI will take place on
Wednesdays mid-month in October, November, December 2013, and January, February 2014.

E.2 Global data dissemination (WGIV)

E.2.1. Key-note – Status of Himawari-8/-9 data distribution/dissemination

Yoshio Shimazu, JMA, presented the status and plans of the new Himawari-8/-9 distribution and dissemination system (**JMA-WP-09 PPT**). Further information regarding the details of the Commercial Telecommunication Satellite (CTS) and receiving equipment are expected in the course of spring 2014.

JMA also informed CGMS that the first priority is to set up the system for Himawari data dissemination and assure it works, after which a possibility of an evolution of the DVB system might be envisaged.

E.2.2 Key-note – User needs/evolution of regional data dissemination requirements

Anthony Rea, Chair of WMO ET-SUP, gave a presentation on user needs related to regional dissemination requirements (**GUEST-WP-11 PPT**) and recommended that CGMS members report on their support to region-based groups maintaining satellite data access and exchange requirements as well as the creation of a new standing agenda item for Working Group IV – "Response to region-based requirements for satellite data access and exchange".

The following action was agreed as a result of the discussions:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	Plen E.2.2	41.07	CGMS members to report on their support to WMO region-based groups maintaining satellite data access and exchange requirements	CGMS-42	**OPEN**	HLPP #2.1
CGMSSEC, WGIV	WGIV (Plen E.2.2)	41.59	CGMSSEC to add a new standing agenda item in WGIV "response to region-based requirement for satellite access and exchange"	31 Mar 2014	**OPEN**	HLPP #2.1

E.2.3 Report from WGIV

The WGIV rapporteur provided a summary report on the WGIV discussions, which focused on Global DVB satellite services, coordinated dissemination services for disaster mitigation purposes, transition to new direct-readout systems, RARS, contribution to the WIS infrastructure, coordination of metadata for satellites and instruments, Internet-based services, user dialogue and interface, and long-term data preservation (**EUMETSAT-WP-21 PPT**).

The actions and recommendations identified in WGIV were endorsed by the plenary.

It had been decided that three inter-sessional meetings with WGIV will take place in mid September and October 2013, and January 2014.

E.3 Satellite data and products (WGII)

E.3.1. Scientific presentations

E.3.1.1 Volcanic ash products science and applications

Fred Prata, Norwegian Institute for Air Research, provided a presentation on volcanic ash, SEVIRI ash detection and retrieval, and related science and applications (**GUEST-WP-06 PPT**).

The presentation followed an invitation and discussions at CGMS-40. The presentation by Fred Prata not only provided a summary of the scientific and technical issues of volcanic ash retrieval but also the broader context of user needs. It was noted that the action from the preceding WGII meeting will be an important step toward consistent volcanic ash products from CGMS agencies (Ref. action WGII/8 41.26).

E.3.1.2 SCOPE-Nowcasting: Concept, objectives and pilot activities

In **WMO-WP-22**, WMO provided an update on the Sustained Coordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-Nowcasting) initiative. SCOPE-Nowcasting aims to ensure continuous and sustained provision of consistent, well-characterised satellite products for nowcasting and severe weather risk reduction. Recent discussions including at the 7th session of WMO ET-SUP resulted in an updated set of criteria and a refined set of pilot projects that should demonstrate the added value of the initiative. The updated list of pilot projects encompasses: (i) basic nowcasting products with a focus on RGBs, (ii) advanced nowcasting products with a focus on volcanic ash, (iii) precipitation, (iv) real-time ocean products, and (v) sand and dust products.

JMA, CMA, and EUMETSAT have nominated focal points for the SCOPE-Nowcasting initiative and other CGMS members were requested to nominate their focal points of contact.

The WP was complemented by a presentation by Anthony Rea, Chair of WMO ET-SUP (**WMO-WP-31 PPT)**.

The following actions were agreed as a result of the discussions:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	Plen E.3.1.2	41.08	CGMS members to nominate focal points for the SCOPE-Nowcasting (NWC) initiative as appropriate	15-Aug-13	**OPEN**	HLPP #3.3
CGMS members	Plen E.3.1.2	41.09	Feedback from CGMS members sought on the final makeup of the SCOPE-NWC pilot projects by 1 September 2013	01-Sep-13	**OPEN**	HLPP #3.3

E.3.1.3 Relevance of International Precipitation Working Group (IPWG) work to improve quality and utility of satellite-derived precipitation products

Kazumasa Aonashi, IPWG co-chair, made a presentation on the relevance of the International Precipitation Working Group (IPWG) work to improve quality and utility of satellite-derived precipitation products, including the objectives, achievements, future activities and recommendations to CGMS (**JMA-WP-11 PPT)**.

IPWG-6 had made the following recommendations to CGMS:

- To ensure the long-term continuity of conically-scanning microwave imagers, as well as space-based radars, consistent with the CGMS baseline and the WMO Vision for the Global Observing System in 2025;

- Furthermore, the coordination of satellite overpass times has to be ensured including non-sun-synchronous platforms with a minimum temporal resolution of three hours;

- CGMS members and WMO to provide adequate support to ensure active participation in international meetings and training events; and

- To ensure the optimum use of satellite-based precipitation products more training is necessary. Satellite agencies were invited to cooperate in this endeavor with IPWG experts and the WMO/CGMS VLab.

E.3.1.4 Use of satellite data in JRA-55 reanalysis and related activities

Kazutoshi Onogi, Climate Prediction Division, JMA, presented JMA's JRA-55 reanalysis project. It covers more than 50 years of 4D-var data assimilations undertaken for the period 1958-2012 as a follow-on to the JRA-25, which analysed data in the 1979-2004 period (**JMA-WP-12 PPT**). The observational data for JRA-55 showed an improvement in both quality and quantity from JRA-25 because of reprocessing of an increased quantity of satellite data and the inclusion of newly available data. Furthermore, in validating JRA-55, there is much better quality compared to JRA-25, with fewer unnatural gaps than other reanalyses. The plans for autumn 2013 are to release the JRA-55 products for research use and the data will be available from JMA, DIAS. Comprehensive reports are also under preparation. In addition, the presentation covered information on the use of satellite data in JMA's operational Climate Monitoring Services.

The plenary commended JMA for the sustained reanalysis work and specifically thanked Kazutoshi Onogi for presenting the results of JRA-55 to CGMS-41.

E.3.2 Report from WGII

The WGII rapporteurs, presented the outcome of WGII discussions on 8-9 July 2013 (**EUMETSAT-WP-22 PPT**). These discussions covered agency reports on GSICS, SCOPE-CM and SCOPE-Nowcasting; in-depth discussions on intercomparing and improving volcanic ash, atmospheric motion vector, and cloud products; ocean matters for which the ocean community is looking for guidance from CGMS on data formats and real-time access; GPM Constellation and precipitation sampling matters; updates on radio-occultation activities from the IROWG including the concerns about the decline of the radio occultation constellation and access to existing radio occultation data; updates on ESA and NASA programmes and validation activities; very encouraging cal/val results from CNSA on HY-2A instruments; the importance of orbital parameters for optimising the observing system for

ocean colour; and suggestions for support from CGMS members to the ISWGs and VLab.

The rapporteurs concluded by thanking Volker Gaertner, EUMETSAT, for his many years of dedicated service to CGMS as IPWG rapporteur.

In addition, WGII raised the issue on sustained support to the CGMS-sponsored ISWGs, and as a result, the plenary raised an action on WGII:

Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII (Plen E.3.2)	41.32	CGMS WGII chairs and rapporteurs to prepare a WP on the rationale for a structured approach to sustained support to the CGMS-sponsored ISWGs. The paper should include a description of ISWG main objectives and accomplishments, a record of past levels of support, and a proposal how to address this item at CGMS sessions. The WP should be circulated among CGMS members for comments prior to CGMS-42.	15 Dec 2013; 31 Mar 2014; CGMS-42	**OPEN**	HLPP #3.3, 4.2.4

The actions and recommendations identified in WGII were endorsed by the plenary.

It was decided that two inter-sessional meetings with WGII will take place on 26 November 2013 and 3 April 2014.

E.4 Operational continuity and contingency planning (WGIII)

E.4.1. LEO orbit coordination – follow-on to CGMS-40

E.4.1.1 Report from the Tiger Team

WMO presented the background and outcome of the Tiger Team on LEO optimisation. WMO has convened a Tiger Team to coordinate the technical evaluation of the global and regional impact of flying an FY-3 satellite in early morning orbit, in order to support CMA in the assessment process of such a potential redeployment (**WMO-WP-13, WMO-WP-13 PPT**).

There is a consensus among international experts to acknowledge that a satellite mission in an early morning orbit (around 6:00 Equatorial Crossing Time) would bring significant benefits through improved accuracy of weather forecasts, thanks to the optimum temporal distribution of sounding radiances assimilated into NWP models. Further benefits are expected from the direct use of imagery and derived products in a number of applications including tropical cyclone monitoring, fog and fire detection, air quality monitoring, climate monitoring, and solar monitoring of space weather. Moreover, early morning/late afternoon satellite observations are well timed to support the daily operational briefings held by weather services (e.g. at 8:00/20:00 local time). The FY-3 programme offers a unique opportunity for China to play this important role as one of the three major components of the global constellation besides the European programme in the mid-morning orbit and the US programme in the afternoon orbit, while complementary missions

would provide the necessary redundancy for operational robustness. The Tiger Team also stressed the need to strengthen international cooperation to maximise the benefits of the data and made the following recommendations:

- CMA to implement an FY-3 mission in an early morning orbit, with the appropriate platform and payload adaptations, and to sustain such a mission in the long term;

- WMO and CGMS to support trade-off studies (such as OSSEs) as necessary during the development phase of the FY-3 early morning mission;

- CMA and international partners to pursue strong international collaboration on data assimilation in order, as soon as possible, to maximise the benefits of future (early morning) and current FY-3 missions;

- CMA with the international community to further prepare to exploit the benefit of the early morning orbit polar satellite monitoring payload for space weather, climate monitoring, air quality and disaster monitoring; and

- WMO and CGMS to promote the use of FY-3 early morning data, contributing to a robust and efficient Global Observing System, taking advantage of the Asia-Oceania Meteorological Satellite Users Conference.

E.4.1.2 Status of investigations on using early morning orbit by FY-3 satellite

CMA reported on the status of the ongoing investigations related to early morning orbit usage of the FY-3 satellite covering the payloads, imagery usage, platform and financial implications (**CMA-WP-09 PPT**).

CMA appreciated the support provided by CGMS and WMO, in particular the Tiger Team, on the benefit assessment of the early morning orbit.

CMA is currently considering starting the procedure for redeploying FY-3 to an early morning orbit and calls on support from WMO, CGMS members and satellite operators to reach this objective. International efforts and support would be necessary during the development phase of the FY-3 early morning mission. CMA will continue to investigate the possibility of flying the mission with sounding capabilities in the early-morning orbit in order to have a better distribution of atmospheric sounding systems over the planned three orbits and to improve the global numerical weather prediction.

The plenary was informed that an action (WGIII 41.40) had been raised in WGIII for the WMO Secretary-General to send a letter to the PR of China to commend CMA on the progress made, report on the outcome of CGMS-41

discussions on FY-3 redeployment, and confirm the strong support of the international community on this endeavour.

CGMS, WMO and EUMETSAT thanked CMA for the efforts undertaken and confirmed that continued support could be expected for CMA's efforts.

E.4.2 Report from WGIII

The WGIII co-chair, provided a summary report of WGIII discussions focusing on the coordination of observing systems, advancing the architecture for climate monitoring from space, and the impact and benefit of Earth observation satellite missions (**EUMETSAT-WP-23 PPT**).

The actions and recommendations identified in WGIII were endorsed by the plenary.

It was decided that three inter-sessional meetings with WGIII will take place, on 9 October 2013, 15 January and 2 April 2014.

E.4.3 Space weather

The Chairperson of the Ad-hoc Meeting on Space Weather on 10 July 2013, reported on the outcome covering cross-cutting issues and challenges, guiding principles, setting up a team to develop the Terms of Reference for CGMS space weather activities, and collecting information on spacecraft anomalies resulting from space weather (**NOAA-WP-30 PPT**).

As a result of the discussions, the following actions were agreed by the plenary:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	Plen E.4.3	41.14	CGMS members to nominate a team to develop the TOR for CGMS space weather activities, taking into account the guiding principles discussed in the ad-hoc session, for consideration by CGMS-42 (Volunteers to serve on this team: CMA, NOAA, WMO, JMA [TBC], KMA [TBC])	15-Sep-13	**OPEN**	HLPP #5.2.2
CGMS members	Plen E.4.3	41.15	CGMS members to nominate points of contact to work with WMO/ICTSW in order to jointly define a procedure to improve the collection, availability, and use of satellite anomaly information (30 September 2013)	30-Sep-13	**OPEN**	HLPP #5.2.1

The minutes of the Ad-hoc Meeting on space Weather is available in the Annex.

F GEO SESSION

F.1 Status of GEO CMIN'14 preparations and GEO 2015 and beyond

The GEO Secretariat presented the progress of GEO/GEOSS and the way forward including the planned GEO ministerial summit and "GEO week" on 13-17 January 2014, as well as the development of recommendations for the post-2015 GEO/GEOSS strategy (**GUEST-WP-02 PPT**).

F.2 CGMS contribution to GEO/GEOSS – GEO Water Strategy

Toshio Koike, GEO Water Task Lead, presented the GEO Water Strategy highlighting areas for potential contributions by CGMS. The report covers primary implementation partners of the strategy; water cycle variables; water quality; data issues; water cycle integration and Interoperability; linkages; and capacity building.

The overall purpose of the report is to:

- Update and synthesise the available information about the status of water cycle observations and information systems on the basis of the IGWCO report of 2004;

- Describe a strategy for water cycle observations and information that will enable the short-term GEO objectives and the long-term community goals to be achieved;

- Provide CEOS, GEO, WMO and other agencies, including CGMS, with guidance about strategies for water cycle observations, information systems, interoperability, capacity building, etc.; and to

- Propose major initiatives to advance the overall concept.

CGMS Members were kindly requested to review the report available at ftp://ftp.earthobservations.org/TEMP/Water/ and to provide feedback by 31 August 2013 to Rick Lawford, Richard.Lawford@morgan.edu with a copy to umezawa.kazuo@jaxa.jp, yabe.shizu@jaxa.jp, and ochiai.osamu@jaxa.jp.

Concluding the discussions, the CGMS plenary warmly thanked Toshio Koike for his presentation.

G CLIMATE

G.1 Terms of Reference of proposed CEOS/CGMS Working Group on Climate

Following discussion at the 40th meeting of CGMS in Lugano on 4-8 November 2012 on the possible creation of a joint CEOS/CGMS Working Group on Climate the CGMS Secretariat (EUMETSAT) took an action: "to

explore further the possibility to coordinate Climate-related activities with CEOS in line with the work done for the preparation of the Architecture for Climate Monitoring from Space".

The secretariat reported on the positive discussions that took place with CEOS both at plenary and SIT meetings, and introduced the draft Terms of Reference for a joint CEOS/CGMS Working Group on Climate which have been developed, together with proposed transition arrangements from the existing CEOS Working Group on Climate, for endorsement by the CGMS plenary. In recognition of the complementary interests of CEOS and CGMS, the chairs will be alternately drawn from operational and R&D space agencies. CGMS members voiced strong support for the Terms of Reference. NOAA suggested that the existing badgeless team shall be a pathfinder for the working group. The Terms of Reference will be presented to the CEOS plenary in November 2013 and, assuming a positive outcome, the new joint working group will be established immediately thereafter.

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	Plen G.1.1	41.11	CGMS members to nominate members for the CEOS/CGMS joint climate working group	31-Aug-13	**OPEN**	HLPP #5.1.9
CEOS/CGMS joint climate WG	Plen G.1.1	41.12	CGMS plenary proposes that the CGMS/CEOS joint climate WG establish an inventory of FCDRs including for each one: Information on - contributing missions and instruments - calibration and cross-calibration - contributing agencies and reference to ECV/TCDRs which could be extracted. To be done in addition to and in full consistency with the existing ECV-driven inventory of TCDRs.	CGMS-42	**OPEN**	HLPP #5.1.9
CEOS/CGMS joint climate WG	Plen G.1.1	41.13	The CEOS/CGMS joint climate working group to report to each CGMS plenary session	starting with CGMS-42	**OPEN**	HLPP #5.1.9

CGMS-41 recommendations - PLENARY						
"Actionee"	**Rec**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
Joint CEOS/CGMS climate WG	Plen G.1.2 R	41.01	Space-based climate architecture: To extend the ECV product inventory to FCDRs		**OPEN**	HLPP# 5.1
Joint CEOS/CGMS climate WG	Plen G.1.2 R	41.02	Space-based climate architecture: The design phase of new sensors should include an analysis of compatibility with heritage instruments.		**OPEN**	HLPP# 5.1

G.2 Climate Monitoring Architecture – status and way forward

NOAA, on behalf of the architecture writing team, delivered a presentation on the status of the architecture for climate monitoring from space, as well as its proposed way forward. It also recalled progress since CGMS-40. The space architecture is now a key component of the GFCS Observations and Monitoring pillar.

As a contribution to the architecture, WMO provided a mapping of the satellite missions foreseen in the CGMS baseline to the essential climate variables (ECVs) product inventory. This showed that these missions supported a large part of the datasets recorded in the inventory. Moreover, these missions had the potential to provide Fundamental Climate Data Records (FCDRs) that were important for climate monitoring but were not properly captured in the ECV product inventory.

Finally, the terms of reference of the proposed joint CEOS-CGMS working group on climate have been developed.

Regarding the architecture, ongoing implementation activity is focused on the development of the ECV inventory. There is an ongoing effort to add input to this ECV inventory and CGMS members were encouraged to contribute further.

From the discussion which followed the presentation, it was recommended to extend the ECV product inventory to include FCDRs. It was also acknowledged that the CGMS baseline has a prospective dimension which is of high value for the climate monitoring architecture, but often too generic to inform on FCDRs. WMO therefore suggested that a finer categorisation of CGMS baseline missions should be used to draw a list of sustained FCDRs coordinated by CGMS. It also proposed that the design phase of new sensors should include analysis of compatibility with heritage sensors. These points were taken up by CGMS and it was agreed that they were important for future planning.

During the discussion, EUMETSAT emphasised the need to identify FCDRs that CGMS members can commit to provide on a sustained basis and to identify the CGMS priorities and where there is complementarity with CEOS. Members agreed that the current focus is on how agencies can produce the FCDRs, but in the future the inventory should also help users. Once the FCDRs are captured with tracebility to missions, instruments and possibly the ECVs, the issue of how to ensure interaction with users shall be addressed. It was agreed that a schedule should be defined and this shall be a priority of the incoming chair of the joint working group when it is created after the endorsement of the terms of reference by the CEOS plenary meeting.

G.3 Symposium on Climate Research and Earth Observation from Space

EUMETSAT announced that the Symposium on Climate Research and Earth Observation from Space, jointly organised with the World Climate Research Programme (WCRP) and supported by the European Commission, will be held in Darmstadt, Germany from 13-17 October 2014. JAXA confirmed that they will support the symposium and noted that it will be a good opportunity to promote CEOS and CGMS contributions to climate.

More details of the Symposium are available at
www.theclimatesymposium2014.com

H EDUCATION AND TRAINING

In session H on Education and Training, the keynote presentation given jointly by WMO-CGMS highlighted major achievements of the VLab over the past year, and future plans and directions (background was provided through **WMO-WP-25**). Since October 2012, VLab Training Centres of Excellence have continued offering an array of regional training opportunities and, most importantly, strengthening the global network of trainers by coordinating training delivery in various languages.

The major activities of the VLab for this period include the Event Week on Precipitation, the WMO/NOAA Train the Trainer Workshop for WMO RA III/IV, the Virtual Round Table on Competence Requirements for Aeronautical Meteorological Personnel, the Satellite Direct Readout Events, the World Weather Briefing, and progress with the Conceptual Models for the Southern Hemisphere Project. Furthermore, VLab members are developing a response to the results of the WMO 2012 Survey on the Use of Satellite Data in the "Challenges to Training" by the end of 2013.

CGMS was invited to note the important achievements of the VLab, to provide comments, and to consider the following recommendations:

- that CGMS members provide regular, annual contributions to the WMO VLab Trust Fund to ensure the continuation of the post of the VLab TSO;

- satellite operators and WMO provide the necessary resources for the translation of relevant training resources (web sites, modules and related) into other WMO languages;

- CGMS members take note of the results of the WMO 2012 Survey and support relevant actions by the VLab to further enhance the use of satellite data.

The VLab will continue to work with India (IMD and ISRO) on their contribution to the VLab, which would fill a gap in the geographical coverage of the current network.

NOAA emphasised the importance it places on training, given that levels of investments were shrinking in many countries and that resources of international importance such as the online training library UCAR/COMET was under threat due to budget issues. Additional financial support from international users and the private sector were sought. NOAA stressed that international collaboration was essential to maintain these training repositories. The COMET ESRC is recognized by the VLab.

JMA, in a joint paper with KMA, updated the plenary session on progress with the WMO RA II WIGOS Project to develop support for NMHSs in satellite data, products, and training (**JMA-WP-03, KMA-WP-03**). The project, jointly coordinated by JMA and KMA, aims to improve the dissemination and utilisation of satellite data with WMO members in RA II, with a focus on developing countries. Since it started in 2008 as a pilot project, it has undertaken user surveys, prepared quarterly newsletters, maintained a web site, supported the Asia/Oceania Meteorological Satellites Users Conferences, and organised training events jointly with the conferences. The Project Coordination Group currently has a membership of 13 countries and EUMETSAT (as an observer) and holds meetings on an annual basis.

Regarding training, KMA reported that activities in the framework of the project are aligned with the VLab. In October 2012, KMA hosted, along with the 3rd Asia/Oceania Conference, a high-profile training event with over 30 participants from the region.

EUMETSAT reported on its five-year training strategy and stressed the importance of education and training for realising the benefits of satellites. The VLab features prominently in this strategy. Document **EUMETSAT-WP-12** described the status and future plans for training in satellite meteorology provided by EUMETSAT and the Centres of Excellence (CoE) in Africa (Kenya, Niger, Morocco, South Africa), the Middle East (Oman) and Europe. The paper also provided an overview of training workshops, distance learning activities, and the development of training material by EUMETSAT.

NASA pointed out that training activities maintained in the COSPAR and CEOS WG CapD frameworks should be coordinated with VLab to provide synergies. WMO explained that the VLab had established formal working relationships with both mechanisms. The ESA delegate, Jean-Louis Fellous, informed the session in his capacity as Director of the COSPAR Secretariat that training events (on global water cycle changes, atmospheric correction) were organised with co-sponsorship by the VLab.

WMO pointed out that education and training were a strategic priority for WMO members.

It was proposed that WMO and the CGMS Secretariat write a joint letter to all CGMS members requesting regular funding for WMO-CGMS VLab technical support. The letter will explain the level of funding needed, the expected level of contribution from CGMS satellite operators, the funding mechanism provided through the WMO VLab Trust Fund, and the terms of reference of the VLab Technical Support Officer.

CGMS-41 actions - PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO/ CGMSSEC	Plen H.1	41.10	WMO and CGMSSEC to write a letter to CGMS members regarding regular contributions to the WMO VLab Trust Fund for the sustained continuation of the VLab Technical Support Officer	31-Aug-13	**OPEN**	-

I OUTREACH ACTIVITIES

A presentation was delivered by NOAA on the CGMS outreach strategy and the proposed way forward.

In response to the CGMS High Level Priority Plan and discussions at CGMS-40, NOAA agreed to develop a CGMS outreach strategy for presentation at CGMS-41. The CGMS Secretariat sent a short survey in mid-May to help inform that effort. As a result of the survey results and consultation with the CGMS Secretariat, NOAA proposed that CGMS focus on three outreach priorities: Promoting the visibility of the CGMS organisation; helping CGMS members promote the benefits of their own activities and programmes; and developing "inreach" to enhance communication among CGMS members.

Specific recommendations presented to CGMS-41 included:

- Create and display CGMS exhibit/materials at:
  - the 2013 EUMETSAT Meteorological Satellite Conference/19th AMS Satellite Conference; and
  - the 4th Asia-Oceania Meteorological Satellite Users Conference;
- Develop quarterly features for the CGMS website, highlighting a key CGMS achievement (drawing from the 40 years of achievement document);
- Develop an image gallery for the CGMS website that demonstrates the benefits of CGMS collaboration;
- Members to actively participate in the CGMS Socio-Economic Benefits Tiger Team.
- Develop regular online newsletters

CGMS members agreed to the proposed outreach strategy. NOAA agreed to work with the CGMS Secretariat to lead coordination and implementation of the recommendations. NOAA noted that successful implementation of the Outreach Strategy would require the participation and contributions of all CGMS members.

The following action was agreed as a result of the discussions:

CGMS-41 actions – PLENARY						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA/ CGMSSEC	Plen I	41.60	NOAA and CGMSSEC to lead on the coordination and implementation of the outreach and "inreach" activities proposed with the support of other CGMS members. (Create/exhibit CGMS material at relevant events, develope quarterly features on the CGMS web site, develop an image web gallery, participate in the CGMS socio-economic benefits Tiger Team, develope regular online newsletters).	Sept/Oct 2013 Jan 2014 Apr 2014 CGMS-42	**OPEN**	HLPP #4.1

J REVIEW OF CGMS-41 ACTIONS AND RECOMMENDATIONS

The CGMS Secretariat reviewed all actions and recommendations related to the plenary completing them as necessary following the discussions. A final list of actions and recommendations was achieved and circulated to the CGMS group. The Working Group actions were not reviewed in the plenary since these have been reviewed extensively within each Working Group and have been endorsed by the plenary in Session E.

In summary, the status of actions and recommendations by the end of the plenary the was as follows:

Type of action	**Actions**	**Recommenda-tions**	**Comments**
Actions from previous meetings (CGMS-38--40)	12	-	New deadlines agreed, or deadline later than CGMS-41
CGMS-41			
Plenary	13	2	
WGI	2	-	
WGII	15	10	
WGIII	14	7	
WGIV	11	3	

The list of actions and recommendations resulting from discussions at CGMS-41 is available here and is also published on the CGMS website: www.cgms-info.org.

K CGMS HIGH LEVEL PRIORITY PLAN (HLPP)

The CGMS Secretariat provided a report on the status of the CGMS High Level Priority Plan (HLPP).

The first HLPP was agreed at CGMS-40 capturing the priorities of CGMS for the period 2013-2017. The HLPP is a rolling five-year plan and therefore a living document reviewed and revised by CGMS on an annual basis. The HLPP targets are to be specific, measurable and timely for the HLPP to be the basis for demonstrating and reviewing the progress of CGMS.

The aim of the HLPP session of the CGMS plenary is to review progress in the implementation of the HLPP, confirm the overall adequacy of the HLPP and endorse specific revisions of the HLPP proposed either by the Working Groups, the CGMS Secretariat or by the plenary.

The CGMS Secretariat provided an overview (**EUM-WP-25**) of the scope and structure of the HLPP and of the role of HLPP in the new overall CGMS process, in particular emphasising the role of the HLPP in driving the priorities of the CGMS working groups, both at the plenary and throughout the inter-sessional phase. The CGMS Secretariat presented the overall status of implementation of the HLPP, noting two highlights of progress since CGMS-40, namely the early morning orbit Tiger Team conclusions on forecast impact and other benefits from the three-orbit LEO baseline configuration and the agreement on new global direct read-out specifications, endorsed by the CGMS-41 plenary.

Regarding the adequacy of the HLPP, WGs I, II, III and IV all confirmed the usefulness of the HLPP and the relevance of the HLPP priorities for driving work both at and in between plenaries, but it was also recognised that for some priority areas, the coverage of actions supporting the overall priorities can be improved, and the WGs will therefore address this aspect in their inter-sessional work plan.

It was also suggested by the Secretariat that the WGs should review relevant areas of the HLPP, and in particular assess whether all targets stated are specific and timely enough to drive the CGMS work-plan over the coming four-year period.

The four Working Groups did not present any concrete proposals for revisions to the HLPP, but the Secretariat suggested that a new cross-cutting theme would be introduced in the HLPP:

Preparation of operational users for new generation of geostationary meteorological satellites

This proposal was endorsed by the plenary, and the CGMS Secretariat will issue a new version of the HLPP following CGMS-41, reflecting the new cross-cutting area. Following CGMS-41, the status of implementation of the HLPP will be reviewed by WG chairs and rapporteurs, and will be published together with the final report.

The latest version of the HLPP is available at www.cgms-info.org.

L AOB AND CLOSING SESSION

L.1 Nominations

Nominations of co-chairs and rapporteurs of the CGMS Working Groups for CGMS-42 were made as follows:

- **Working Group I on Telecommunications** will be chaired by Marlin O Perkins, NOAA, with Joaquin Gonzalez, EUMETSAT, as rapporteur;

- **Working Group II on Satellite Products** will be co-chaired by Stephan Bojinski, WMO, and Toshiyuki Kurino, JMA, with Johannes Schmetz, EUMETSAT and Mitch Goldberg, NOAA, as rapporteurs;

- **Working Group III on CGMS Global Contingency Planning** will be chaired by Suzanne Hilding, NOAA, and Peng Zhang, CMA, with Jérôme Lafeuille, WMO, as rapporteur;

- **Working Group IV on Global Data Dissemination** will be chaired by Vasily Asmus, Roshydromet (or his nomated representative) and Jaedong Jang, KMA, with Klaus Peter Renner, EUMETSAT, as rapporteur.

L.2 Any other business

L.2.1 WMO CM-12

WMO informed the CGMS-41 plenary about the WMO Consultative Meeting on High-Level Policy on Satellite Matters (CM-12). He recalled that the WMO Space Programme was established as a result of CM-2 in 2002, and that WMO Executive Council 62 in 2010 agreed to hold the CM biennially, preferably in conjunction with the Executive Council (EC) or Congress meetings.

The meeting will focus on progress in the architecture for climate monitoring from space, GFCS and associated data policies and presentations by satellite operators and space agencies, as well as the socio-economic benefits of space programmes. The meeting will be held tentatively on 21 June 2014 on the occasion of EC 66, for which most CGMS agencies confirmed their availability.

L.2.2 CGMS plenary report

In view of CGMS's overall scope and objectives, together with efforts on reducing carbon footprint, the CGMS-41 plenary endorsed the proposal made by the CGMS Secretariat that the CGMS plenary session reports will from CGMS-41 onwards be provided in electronic format only, i.e. no paper version will be provided in future. The last paper version was made available for the 40th anniversary of CGMS in 2012.

L.3 Closing

L.3.1 Date and place of next CGMS plenary sessions

Regarding the location and date of CGMS-42, CMA informed the plenary that the request to host CGMS-42 was still under review and that a response was expected in the August/September 2013 timeframe. In case CMA is unable to host the meeting, another host will have to be found at relatively short notice.

Thereafter the plenary sessions might rotate as follows:

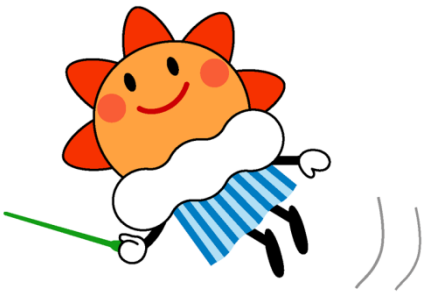
- 2015 USA
- 2016 Europe
- 2017 Korea
- 2018 India
- 2019 Russia
- 2020 WMO
- 2021 Japan

L.3.2 Closing of the meeting

The Chairperson thanked all participants for their hard work and active participation in CGMS-41, adding that there had been many interesting discussions and important developments during the Working Groups and Plenary sessions.

All participants warmly thanked JMA and JAXA for the excellent hosting and organisation of the meeting in Tsukuba, Japan.

The meeting adjourned at 17:59 on 12 July 2013.



JMA mascot "Harerun"

PARALLEL WORKING GROUP SESSIONS

WGI REPORT

Working Group I: Global Issues on Satellite Systems and Telecommunication Coordination

WGI/0 Introduction

As agreed during the plenary session of CGMS-40, Marlin O. Perkins (NOAA) and Joaquin Gonzalez (EUMETSAT) were planned to act as Chairperson and rapporteur, respectively, of Working Group I (WGI) on Global Issues on Satellite Systems and Telecommunication Coordination. Unfortunately, Marlin O. Perkins (NOAA) was unable to attend CGMS-41. Alternatives to chairmanship were discussed prior to the start of the WGI meeting and it was agreed that Charles Wooldridge (NOAA) would act as Chairperson for WGI in this CGMS-41 meeting (assuming Marlin O. Perkins will resume his chairmanship role for WGI in CGMS-42).

WGI comprised representatives of the satellite operators from CMA, CNSA, EUMETSAT, ISRO, JAXA, JMA, KARI, KMA, NOAA, ROSCOSMOS, ROSHYDROMET, WMO (see Annex for the list of participants).

WGI chairmanship difficulties resolved, the Agenda proposed by the CGMS Secretariat prior to the meeting, was discussed and adopted with the following modifications:

- Moved from agenda item I/4: International data collection and distribution and proposed under agenda item WGI/3, Direct broadcast services, the following Working Papers (WPs) were discussed in WGI/3.1 Direct read-out stations:

    - **NOAA-WP-13** Fast delivery initiatives using direct broadcast with extensions wherever possible;
    - **NOAA-WP-09** Recommendations seeking affordable receiving stations; and
    - **EUMETSAT-WP-17** (Presentation) EARS Roadmap (EUMETSAT Advanced Retransmission Service).

- Added to agenda item I/4: International **NOAA-WP-08**: Status of the International Data Collection System (IDCS)

WGI/1 Review of actions from the Previous Meeting

Actions from previous meetings were discussed at the beginning of the working group meeting as summarised below:

Action 39.21. Based on the inputs of the previous action, CGMS members to analyse potential interference issues reporting results of analysis back to CGMS WGI by next CGMS meeting. **Deadline: CGMS-40**

Status: Open. At CGMS-40 a new deadline was proposed for the end of the first quarter 2013 for a specific follow-up WGI inter-sessional e-meeting which had to be postponed to a new e-meeting in May 2013 as key inputs were missing from some of the WGI participants. The second e-meeting was also cancelled due to missing feedback. A new deadline was agreed and the discussion will be held during an inter-sessional meeting in November 2013.

Action 40.10. Interested satellite operators to inform WMO if they identify/designate a representative to be invited to the Satcom forum (WMO point of contact is Etienne Charpentier, Echarpentier@wmo.int). **Deadline: 31.12.2012**

Status: Closed. PoC details provided by NOAA and EUMETSAT.

Action 40.11. CGMS members to provide comments to the draft ToR of the Users of Satellite Data Telecommunication Systems (Satcom) Forum, included in the annex to CGMS-40-WMO-WP-02, by the end of December 2012.

Deadline: 31.12.2012

Status: Closed. EUM input provided in 2012 incorporated in current version, NOAA feedback by e-mail 6 March 2013 to be incorporated in the ToR. Agreed to copy final version of the ToR to all CGMS members (via CGMS Secretariat).

Action 40.12. CGMS members to complete and review interference assessment (in response to action 39.21) by end Q1 2013 (e-meeting).

Deadline: 31.03.2013

Status: Open. At CGMS-40 a new deadline was proposed for the end of the first quarter 2013 for a specific follow-up WGI inter-sessional e-meeting which had to be postponed to a new e-meeting in May 2013 as key inputs were missing from some of the WGI participants. The second e-meeting was also cancelled due to missing feedback. A new deadline was agreed and the discussion will be held during an inter-sessional meeting in November 2013.

Action 40.13. Round-table for reviewing the proposed update to CGMS Global Specification 04 (by end of Q1 2013 - same e-meeting as for action 40.12). **Deadline: 31.03.2013**

Status: Closed. WGI Inter-sessional meeting at end of March 2013 confirmed the support from all CGMS members to the proposed modification to CGMS-04. Discussion during the CGMS-41 meeting also confirmed the unanimous

agreement in WGI to the proposed update. To be reported to the plenary for applying the necessary change control mechanism to the update to the corresponding CGMS global spec.

WGI/2 Frequency management matters: SFCG, ITU and WRC activities

CMA-WP-03 provides supplementary Information on X-band utilisation by FY-3 satellites in response to CGMS-39 action WGI 39.20 (which was closed at CGMS-40). The updated information covered the utilisation of band 7750-7900MHz and CMA has provided X-band details on the FY-3 DB service that plans to cover the duration from 2008 to 2020 (or beyond). In addition to the global L-band AHRPT direct broadcast (DB) service, the FY-3 satellite is able of X-band MPT format direct broadcast service. At present, the FY-3 is programmed to transmit MPT format data within China to avoid interference with other facilities. Because of this, the MPT DB service open outside of China is only possible through specific bilateral arrangements.

The MPT data stream contains the raw data of MERSI instrument measurements. With this report CMA hopes to bring the attention to the utilisation of band 7750-7900MHz by FY polar-orbiting system for X-band DB service that covers the duration from 2008 to 2020 or beyond (ref.: CGMS-40-CMA-WP-02).

The FY-3 orbital parameters are:

Nominal orbit height: 836.4Km
Inclination: 98.753 deg.
Eccentricity: 0.0025
Half long-axis: 7207.63Km
Apogee: 854.42Km
Perigee: 818.38Km
Period: 101.603minutes
Daily flight circles: 14.1728
Time at descending node: 10:20 am
Shift Nodal time maintained: 10min (2 years)

Frequency and signal characteristics (as of 20 October, 2012):

Satellite	**name**	**Transmission Point**	**frequency**	(MHz)	**EIRP Polarizati**	**On**	**Modulatio**
FY-3A/-3B	MPT	7775.00	46dBw (EL=5₀)	RHC	QPSK	18.7Mbps	S-E
FY-3C	MPT	7780	46dBw (EL=5₀)	LHC	QPSK	37.4Mbps	S-E
FY-3D	MPT	7820	46dBw (EL=5₀)	RHC	QPSK	60Mbps	S-E

Supplementary information: the FY-3 afternoon orbital parameter
Nominal orbit height: 836.4Km
Inclination: 98.753deg
Eccentricity: 0.0025
Half long-axis: 7207.63Km
Apogee: 854.42Km
Perigee: 818.38Km
Period: 101.603minutes
Daily flight circles: 14.1728
Time at ascending node: 13:30 am
Shift Nodal time maintained: 10min (2 years)

This WP is provided by CMA as complementary information to CGMS-39/-40 actions WGI 39.21 and 40.12.

WGI appreciated the information update provided by CMA and WMO took the opportunity to bring to the attention of WGI members on the availability of the WMO Observing System Capability Analysis and Review Tool (OSCAR). As addressed during CGMS-40, WGI members were encouraged to provide updates and keep WMO informed on frequency information of their respective systems (present and future ones).

EUMETSAT-WP-10 provides an overview on World Radiocommunication Conference 2015 (WRC-15) related issues of relevance to EUMETSAT and MetSat systems/operators in general. WRC-15 agenda items of relevance to MetSat include agenda items 1.1, 1.6, 1.9.2, 1.10, 1.11, and 9.1.1.

Furthermore, MetSat issues not directly related to WRC-15 considered within ITU-R Working Party 7B of ITU-R Study Group 7 are summarised in this document.

WRC-15 Agenda Item 1.1

This agenda item deals with consideration of additional spectrum allocations to the mobile service and identification of additional frequency bands for International Mobile Telecommunications (IMT) and to facilitate the development of terrestrial mobile broadband applications, likely to concentrate on bands below 6 GHz.

The main frequency bands at risk for MetSat systems, the embarked instruments and related services MetSat operators use are expected to be:

- the 1695 – 1710 MHz bands used for meteorological satellite applications;
- the bands 2025 – 2110 MHz and 2200 – 2290 MHz used for earth exploration satellite and space operation (TM/TC and ranging) services. While these bands have been secured in the past by application of RR No. 5.391, the agenda item asks specifically for a review of studies conducted in the past;

- the band 3400 - 4200 MHz used for dissemination of meteorological data in the framework of GEONETCast;
- the active remote sensing band 5250-5570 MHz used for SARs, scatterometers and altimeters.

Agenda Item 1.1: 1695 – 1710 MHz

According to the fast track implementation plans for broadband mobile in the US and Canada, the band 1695 – 1710 MHz will likely be proposed by those countries for a global identification of this band for broadband mobile systems in the framework of WRC-15 agenda item 1.1.

In the framework of the European (European Conference of Postal and Telecommunications Administrations (CEPT)) preparation for WRC-15, this band is noted to be widely used by meteorological satellites systems (Space to Earth), concluding that this use represents a large number of receiving Earth Stations that would not be compatible with typical mobile deployment. In addition, this band is not considered relevant for mobile service due to the limited bandwidth available. CEPT therefore considers as preliminary position that the frequency band is not suitable.

Agenda Item 1.1: 2025 – 2110 MHz and 2200 – 2290 MHz

So far in the ITU-R responsible fora for the preparation for this agenda, namely the Joint Task Group 4-5-6-7, as well as within CEPT, these bands do not play a major/prime role in the consideration/review of candidate bands for mobile broadband systems. However, there are still proponents for these bands in the mobile broadband industry. Thus it is necessary to continue to closely monitor the developments in the discussion on these bands at ITU-R and regional level, in order to ensure that these important bands for MetSat systems are secured for long-term availability for the MetSat operators.

Agenda Item 1.1: 3400 - 4200 MHz

Considering the importance of this band for the dissemination of meteorological data, it has to be noted, that the band 3.4-3.8 GHz is one of the highest priority bands for the broadband mobile proponents. Some parties even go as far as to propose the entire C-Band (3.4-4.2 GHz) for mobile broadband identification.

In view of the incompatibility between both applications such designation of the entire band could be detrimental for the commercial satellite operators, and with this could also negatively affect the dissemination of meteorological data in the long term. With the possibility that the band 3.4-3.8 GHz could be globally designated to broadband mobile at WRC-15, at least the band 3.8-4.2 GHz should be kept available for the deployment of satellite Earth stations in the long term.

Agenda Item 1.1: 5350 – 5470 MHz

Under this agenda item the extension of the current RLAN (WiFi) spectrum (5150-5350 MHz and 5470-5725 MHz) by also allocating the gap in between (5350-5470 MHz) for RLANs is under discussion. Such additional allocation of the band 5350–5470 MHz would affect the POSEIDON altimeters on the Jason satellites and SRAL on Sentinel-3 as well as CSAR on Sentinel-1, all using the targeted frequency spectrum.

Compatibility assessments carried out so far for altimeters and SARs show the interference potential from RLAN to those instruments, where the interference to SARs constitutes the worst case. In CEPT there is still no common view on this band CGMS-41 (and more fundamentally) whether additional RLAN spectrum should at all be identified in the framework of this agenda item.

WRC-15 Agenda Item 1.6

This agenda item deals under 1.6.1 with consideration of possible additional primary allocations to the Fixed-Satellite Service (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1.

Agenda item 1.6.2 deals with consideration of possible additional primary allocations to the Fixed-Satellite Service (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz.

One of the targeted frequency bands for a possible allocation of FSS (Earth-to-space) is 13.25-13.75 GHz, which raises particular concerns with regard to the allocation of this band to EESS (active). This band is used for active remote sensing (altimeters and scatterometers) by missions such as Cryosat, Jason-2, -3, Jason-CS, Sentinel-3, and HY-2.

Studies in preparation to an earlier WRC in 1992 have already proven the incompatibility between these services with the result that the band 13.75-14 GHz got lost to the FSS and was no longer usable for EESS (active). Therefore, a new allocation to FSS (E-s) in the band 13.25-13.75 GHz despite this incompatibility would be detrimental to the long term usability of this band for active sensors.

Work is currently undertaken in the ITU-R in Study Group 7 to follow this agenda item and if necessary, to initiate sharing studies for the affected EESS (active) bands. For this purpose Working Party 7C is working on the Preliminary Draft Revision of Report ITU-R RS.2068: “Current and Future Use of the Band 13.25-13.75 GHz by Spaceborne Active Sensors”.

Within CEPT the need for additional primary allocations of 250 MHz (Earth-to-space and space-to-Earth) to the GSO FSS in frequency bands between 10 and 17 GHz in Region 1 is recognized and supported. However, an allocation can be made only if studies demonstrate the compatibility with the existing

services in these frequency bands. At this stage, based on studies provided, CEPT does not support FSS (E-s) allocation in the13.25-13.75 GHz band.

WRC-15 Agenda Item 1.9.2

This Agenda Item deals with the possibility of allocating the bands 7 375-7 750 MHz and 8 025-8 400 MHz to the Maritime-Mobile Satellite Service (MMSS) and additional regulatory measures, depending on the results of appropriate studies.

The potentially affected space science service bands under this agenda item are 7450-7550 MHz MetSat (s-E, GSO) and 8025-8400 MHz EESS (s-E). Thus, no new CGMS-41 allocations to the MMSS should be made in these frequency bands unless acceptable sharing criteria with the science services are developed.

Of particular concern is the potential interference to EESS (s-E) operations in 8025-8400 MHz at high latitudes from ships operating in closer proximity. Large exclusion zones may be needed to avoid interference to EESS earth stations. Many EESS earth stations are located near coastal areas (e.g., Svalbard, McMurdo, Maspalomas, Lannion, Wallops) and could be seriously affected by emissions from vessels navigating in the area.

ITU-R Working Party 7B at its September 2012 and April 2013 meetings considered a number of input contributions under WRC-15 Agenda Item 1.9.2, among which several sharing studies to assess the sharing and compatibility aspects under this agenda item.

All compatibility analysis on the two different sharing aspects (MMSS vs. EESS and MMSS vs. SRS) came to similar conclusions regarding the sharing difficulties with EESS and the required separation distances to protect the SRS Earth stations. To summarise the results of these compatibility analysis, ITU-R Working Party 7B developed a Preliminary Draft New Report SA.[MMSS 8-GHz] on compatibility of the possible new MMSS (E-s) allocation in the 8025-8400 MHz band with EESS and the Space Research Service (SRS).

WRC-15 Agenda Item 1.10

This Agenda Item deals with the consideration of spectrum requirements and possible additional spectrum allocations for the Mobile-Satellite Service (MSS) in the Earth-to-space and space-to-Earth directions, including the satellite component for broadband applications, within the frequency range from 22 GHz to 26 GHz.

The main frequency bands at risk for CGMS member agencies are:

- The EESS (passive) band 23.6-24 GHz (purely passive, but to be protected against unwanted emissions taking into account interference

apportionment and the levels contained in ITU Reslution 750 (rev. WRC-12)); and

- The first 500 MHz of the EESS/SRS space-to-Earth band 25.5 – 27.0 GHz.

So far the frequency bands targeted by the proponents of such new allocations to the MSS are not clear. Thus, the developments in preparation for this WRC-15 agenda item needs to be further carefully monitored.

WRC-15 Agenda Item 1.11

This Agenda Item deals with the consideration for a primary allocation for the Earth exploration-satellite service (Earth-to-space) in the 7-8 GHz range, in accordance with Resolution COM6/17 (WRC 12).

Initially proposed by ESA through CEPT, this agenda item calls for the identification of a suitable frequency band for an EESS (Earth-to-space) allocation in the 7-8 GHz range for telecommand operations in order to complement telemetry operations of EESS (space-to-Earth) in the 8 025-8 400 MHz band.

Although there is currently no MetSat system envisaged that would make use of such a new allocation, such spectrum would enlarge the potential evolutions of future MetSat systems and deployment scenarios.

WG 7B at its September 2012 and April 2013 meetings considered a number of input contributions under WRC-15 Agenda Item 1.11 and dealt with the following compatibility issues:

- Compatibility between EESS (Earth-to-space) and the space research service or the space operation service in the band 7 100-7 235 MHz;

- Compatibility between EESS (Earth-to-space) and the potential Fixed Satellite Service (under agenda 1.9.1) in the 7 100-7 235 MHz; and

- Sharing between the EESS (Earth-to-space) and the fixed service in the 7-8 GHz range.

In addition WP 7B dealt with the determination of the spectrum requirements for a potential new EESS uplink allocation.

The different compatibility and sharing studies as well as the assessments of the bandwidth requirements (45 or 60 MHz are currently under consideration) for the potential new EESS uplink allocation came to similar conclusions. The results of those studies were summarised in corresponding ITU-R Preliminary Draft New Reports.

WRC-15 Agenda Item 9.1.1

This agenda item deals with ITU-R Resolution 205 (Rev.WRC 12) - Protection of the systems operating in the mobile-satellite service in the band 406-406.1 MHz. Cospas-Sarsat space segment providers have developed protection criteria for the search and rescue instruments of Cospas-Sarsat and local user terminals in the 406.0 - 406.1 MHz band in order to protect them against broadband out-of-band emissions and against narrow-band spurious emissions.

These protection criteria have been recognized at the ITU level through ITU-R Recommendation M.1478-1. This recommendation currently covers the protection requirements for SARP repeaters as well as repeaters on all current GSO MetSat satellites carrying SAR repeaters. However, they do not provide protection requirements for repeaters on MEO satellites and generally does not contain the protection requirements against emissions in adjacent bands which could hinder the Cospas-Sarsat system's ability to detect and/or relay signal from beacons. Thus, Cospas-Sarsat with the support of its space segment providers will need to develop the relevant protection criteria for submission to the relevant ITU-R groups and translation into an ITU-R recommendation.

ITU-R Working Party 4C is the responsible group for preparing this agenda item at which an ITU-R Preliminary Draft New Report is under development dealing with the protection of systems operating in the band 406 - 406.1 MHz. ITU-R Working Party 7B provided information on technical characteristics and the degree of deployment of EESS, MetSat and MetAids systems in this range and providing the compatibility analysis with the data collection platforms deployed within the 401-403 MHz band.

MetSat issues (unrelated to WRC-15) currently under discussion within ITU-R

Characteristics, sharing and performance criteria of EESS and MetSat

Since a number of meetings Working Party 7B is performing work towards revising and merging all ITU-R Recommendations dealing with MetSat and EESS systems in terms of characteristics, sharing and performance criteria.

This work now led to the development of the following two new Preliminary Draft New Recommendations (PDNRs):

- ITU-R SA.[EES/MET CHAR]: "Characteristics to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services and for conducting sharing studies".

With a view to reduce the characteristics for each frequency band to typical/representative sets of data for each function, ITU-R Working Party 7B maintained its strong encouragement to Administrations to contribute and

participate to this work at the forthcoming meetings of WP 7B, in particular for providing, verifying and limiting the relevant characteristics of EESS and Metsat systems.

- ITU-R SA.[EES/MET METH]: “Protection criteria for MetSat and EESS services”.

With regard to the PDNR ITU-R SA.[EES/MET METH] words of caution were raised that with the new PDNR it has to be ensured that the same level of protection would have to be ensured as provided with the current set of recommendations and that it has to be assessed carefully that all necessary elements from the existing recommendations have been carried over to the new PDNR.

Currently this PDNR SA.[EES/MET METH] only contains a procedure for determining compatibility of systems in a shared co-allocation or allocated in adjacent bands solely based on a C/N+I criteria requiring the performance of dynamic simulations.

It was agreed to complement the C/N+I criterion currently described in this PDNR by another criterion (still to be included in this PDNR), such as delta T/T, I/N or discrete values as in the current recommendations that can be used for either static or dynamic analysis.

Ones the two new recommendations are adopted, the need to retain the current recommendations will be assessed.

Data collection platforms in the 401-403 MHz band

ITU-R Working Party 7B at its September 2012 meeting agreed the following Draft New Recommendations:

- ITU-R SA.[EES/MET DCS INTERF]: “Protection criteria for non-GSO data collection platforms in the band 401-403 MHz”
- ITU-R SA.[EES/METSAT USAGE 401-403 MHz]: “Basic general partitioning and sharing conditions for the band 401-403 MHz for future long-term coordinated use of data collection systems on geostationary and nongeostationary MetSat and EESS systems”

These DNRs are subject for adoption at the next ITU-R Study Group 7 meeting in September 2013. With the adoption of the Recommendation ITU-R SA.[EES/METSAT USAGE 401-403 MHz], the basic general partitioning plan for the band 401-403 MHz, initially developed by SFCG and endorsed by CGMS, will also be ITU-R “stamped”.

WGI thanked EUMETSAT for the detailed report provided on the frequency related topics of interested to CGMS (Europe area).

EUM-WP-11 provides a summary of issues discussed at the 33rd meeting of the Space Frequency Coordination Group (SFCG), held on 25 June - 3 July 2013, which could be of potential interest to CGMS.

WRC-15 issues of mutual interest to SFCG and CGMS

SFCG refined their objectives concerning issues affecting space science services on the agenda of the World Radiocommunication Conference 2015 (WRC-15).

On WRC-15 agenda items of most common interest to SFCG and CGMS member agencies, namely agenda items 1.1, 1.6.1, 1.6.2, 1.9.2, 1.10, 9.1.1, and 10, the following SFCG objectives, as contained in the corresponding SFCG Resolution 32-1R1 (SFCG WRC-15 Objectives), are quoted below:

WRC-15 Agenda Item 1.1 (frequency spectrum for broadband mobile)

According to the SFCG objective no allocations of spectrum to support mobile broadband systems, IMT or RLAN, should be made in space science service bands unless acceptable sharing criteria and conditions are developed.

The main frequency bands of concern to SFCG member agencies are:

- the 1400-1427 MHz band used for EESS (passive) (e.g. Aquarius, SMOS, SMAP missions), whose adjacent bands 1375-1400 MHz and 1427-1452 MHz have been proposed for IMT identification. Considering current technical studies, SFCG is of the view that any decision made about identification of the bands 1375-1400 MHz and 1427-1452 MHz for broadband mobile will have to be associated with the inclusion of relevant mandatory unwanted emissions limits in the 1400-1427 MHz band in the RR;

- the 1695-1710 MHz band used for meteorological satellite applications. This band is used by all meteorological-satellite systems with Earth stations operated by almost all National Meteorological and Hydrological Services (NMHS) and many other users. This band is essential for providing operational and timecritical meteorological information to the users around the world. For this reason SFCG is opposed to an allocation/identification of the frequency band 1695–1710 MHz for terrestrial mobile broadband applications including IMT except if such allocation/identification ensures the protection of MetSat Earth station operations in that band;

- the 3400-4200 MHz band, used for Galileo Data Distribution Network and the dissemination of meteorological data via EUMETCast, CMACast and GEONETCast;

- the 5350-5470 MHz active remote sensing band used for SARs (e.g. Radarsat, GMES Sentinel-1 satellites), and altimeters (e.g. GMES

Sentinel-3 satellites, HY-2). On the basis of current technical studies, which show that RLANs cannot share the band 5350-5470 MHz with EESS (active), SFCG opposes an allocation to the MS in this band for use by terrestrial mobile broadband applications.

In addition, SFCG opposes any revisiting of the conditions set in RR No. 5.391 pertaining to the bands 2025-2110 MHz and 2200-2290 MHz used for space research, earth exploration-satellite and space operation services and therefore objects to any IMT identification in these bands under agenda item 1.1.

WRC-15 Agenda Item 1.6.1 and 1.6.2 (new frequency allocations for FSS)

SFCG supports the protection of existing space science service allocations. No additional allocation of spectrum to support Fixed Satellite Service (FSS) (E-s or s-E) should be made in space science service bands unless acceptable sharing conditions are agreed. There is particular concern with the possible allocation of FSS (Earth-to-space) in the 13.25-13.75 GHz band allocated to EESS (active). This band is used for active remote sensing (altimeters and scatterometers) by missions such as Cryosat, Jason-2, -3, Jason-CS, Sentinel-3, and HY-2. Prior studies have shown incompatibility between these services. Therefore, SFCG supports no new allocation to FSS (E-s) in the band 13.25-13.75 GHz.

WRC-15 Agenda Item 1.9.2 (new frequency allocation for MMSS)

SFCG supports the protection of existing METSAT and EESS allocations as well as the protection of SRS (s-E) (deep space) allocation from adjacent band interference. No new allocations to the Maritime Mobile Satellite Service (MMSS) should be made in these frequency bands unless acceptable sharing conditions with the science services are agreed. Particular concern is noted with regard to potential interference to EESS (s-E) operations in 8025-8400 MHz at high latitudes from ships operating in proximity.

Large exclusion zones would be needed to avoid interference to existing and future EESS and SRS earth stations.

WRC-15 Agenda Item 1.10 (new frequency allocations for MSS)

SFCG supports the protection of all the space science bands in the range 22-26 GHz considered under this AI. No new allocations to the Mobile Satellite Service (MSS) should be made unless acceptable sharing criteria with the affected space science service are developed. The main frequency bands at risk of common concern to SFCG and CGMS member agencies are:

- The EESS (passive) band 23.6-24 GHz (purely passive, but to be protected against unwanted emissions taking into account interference apportionment and the levels contained in ITU Resolution 750 (rev. WRC-12)); and

- The first 500 MHz of the EESS/SRS space-to-Earth band 25.5-27.0 GHz.

WRC-15 Agenda Item 9.1.1 (Protection of COSPAS-SARSAT)

SFCG supports the development of the studies with a view of having an adequate protection of the MSS in the band 406-406.1 MHz in order to detect and successfully process 406 MHz distress signals while not putting undue constraints to existing and planned systems in the adjacent frequency bands 390-406 MHz and 406.1-420 MHz. Regulatory provisions should be developed accordingly with their possible inclusion into a WRC Resolution.

WRC-15 Agenda Item 10 (Agenda Items for WRC-18)

CNES and EUMETSAT proposed to add to the SFCG objective for WRC-15 an agenda item for WRC-18 for upgrading the secondary allocation to the MetSat (space-to-Earth) in the band 460-470 MHz to primary in order to secure future use of the band for ARGOS-4. Such a proposal for a WRC-18 agenda item will also be introduced in the European preparation process for WRC-15.

The objective of such an agenda item for WRC-18 is to improve the regulatory status of the meteorological satellite (space-to-Earth) service in the frequency band 460-470 MHz while putting relevant constraints on this service in order to protect the existing primary (mobile, fixed) services.

NOAA voiced their support for such an agenda item WRC-18 and announced to put a similar proposal into the US preparatory process for WRC-15.

The proposed agenda item was supported by SFCG and included in the SFCG objectives Resolution SFCG 32-1R1 as an item of interest for a WRC beyond WRC-15 .

MetSat use in the band 1695 – 1710 MHz

NOAA provided an updated status of the situation in the United States regarding the repurposing of the band 1695-1710 MHz.

Legislation in the United States has authorized an auction intended for spectrum sharing in the band 1695-1710 MHz between U.S. Federal stations in the Meteorological Satellite Service (S-E) with Mobile users for broadband wireless communications.

According to this, the band 1695-1710 MHz will be auctioned still in 2013 with an expected sharing to take place within three years (2015/16).

For the protection of the most important sites at which MetSat Earth stations of federal users are located in the US, 27 coordination zones are identified

with typical coordination zone sizes of 40 km for POES, respectively 10 km for GOES reception.

Earth stations of non-federal users located outside of these zones will not be protected. In order to ensure that broadband mobile users will respect those coordination zones the mobile base stations will authorize the user terminals to operate in the band 1695-1710 MHz. In the US a potential logical pairing of this band is considered to be the band 2095-2110 MHz.

It can be expected that the band 1695-1710 MHz will be proposed by the US for a global identification of the band at WRC-15.

Contrary, CEPT already defined a preliminary position which does not support this band for broadband mobile. CMA, ISRO and EUMETSAT highlighted the importance of the band 1695-1710 MHz for their MetSat systems. Contrary to CEPT, the positions within the Asia Pacific Telecommunity (APT) and also within Russian Commonwealth in the field of Communication (RCC) are not yet determined.

In view of this support for retaining the band 1695-1710 MHz for MetSat Earth stations for providing operational and time-critical meteorological information to the users around the world, SFCG, as detailed in Resolution SFCG 32-1R1, is opposed to an allocation/identification of the frequency band 1695-1710 MHz for terrestrial mobile broadband applications including IMT except if such allocation/identification ensures the protection of MetSat Earth station operations in that band.

In view of this decision in the United States for sharing of the band 1695-1710 MHz with broadband mobile and the adjustment in the spectrum planning required for current and future NOAA geostationary and non-geostationary MetSat systems, NOAA proposed modifications to Recommendation SFCG 11-1R3 concerning the use of the band 1670-1710 MHz for meteorological-satellite services.

However, SFCG considered the proposed changes to this recommendation too premature and adopted an action item instead which asks MetSat operators to consider their present and future planned use of the band and provide recommended changes in time for SFCG-34.

MetSat use in the band 7750 - 7900 MHz

EUMETSAT provided the results of a compatibility assessment between the direct data broadcasts of EPS-SG and FY-3 in the band 7750-7900 MHz. Both systems as well as NOAA's NPP and JPSS satellites operate or plan to operate a direct data broadcast to the users in this band. Due to the bandwidth requirements of all systems planning to use this band for a data broadcast, spectrum overlap will be unavoidable.

The compatibility assessment between the direct data broadcasts of EPS-SG and FY-3 (the considered worst case) showed that there is a very low probability of interference to each other and in general limited to a scenario where both systems deploy high latitude Earth stations. It was considered useful to develop a frequency plan for this band, once the bandwidth requirements and corresponding technical characteristics of all systems planning to use this band are sufficiently mature.

In order to ensure the continued efficient use of this recently enlarged band from 7750-7850 MHz to 7750-7900 MHz at WRC-12, it was considered necessary to review SFCG Resolution 19 7R3 ("Use of the band 7750-7850 MHz by NGSO MetSat") with the view to assist in the most optimum use of this meteorological satellite service band 7750-7900 MHz, providing a guideline to the Metsat operators, which are currently in the phase of planning and developing next generation polar-orbiting systems using this band. For this purpose a corresponding action item was agreed.

Passive Sensor Filter Characteristics

In Report SFCG 32-1 information on passive sensors filter characteristics are compiled to ease the task of SFCG members in discussions pursuant to the definition of protection requirements and the resolution of interference cases with their national radiocommunication authorities.

Adopted at SFCG-32, this report provided information on filter characteristics of passive sensors of SMOS, MHS (on Metop), MWR (on ENVISAT) and AMSU (on Metop). At SFCG-33 passive sensor filter characteristics for ATMS (on NPP) and MWR (on Sentinel-3) were added to a revised SFCG Report 32-1R1.

This SFCG Report is considered to be a living document which will be updated as further information on passive sensor filter characteristics are available. Therefore, SFCG members were still invited to gather information related to their sensors in response to a corresponding agenda item for SFCG-34.

1400-1427 MHz RFI

ESA provided an updated worldwide overview of the interference environment in the 1400-1427 MHz passive band as observed by SMOS mission.

By May 2013, 570 RFI sources distributed worldwide have been detected and 45 % these interferences were suppressed thanks to the cooperation of the national spectrum management authorities. It has been found that some of the strongest RFI sources are masking other weaker RFI underneath, hence it is expected the total number of RFI detected may increase as strong ones are progressively located and switched off. Most RFIs currently active are located in Asia (49 %), and new strong RFI sources are been detected occasionally worldwide. Detecting and flagging contaminated observations and contacting

national authorities to localise and eliminate RFI sources emitting in the protected band present a continuous challenge.

As an approach to improve the situation several strategies have been put in place to improve scientific retrieval of SMOS team under the RFI scenario observed worldwide in order to make most use of the data whilst the RFI situation is attempted to be progressively improved.

This status report of the RFI situation on SMOS shows that it is essential to protect the passive band 1400-1427 MHz from both illegal and excessive unwanted emissions. While the solution of the RFI due to illegal emissions can be achieved with the cooperation of the national authorities, the solution of the excessive unwanted emissions problem requires regulatory action and compliance with the levels adopted in ITU-R Resolution 750 (WRC-07). This effort has to be continued and intensified by raising concern among the different countries and organisations about the impact of RFI in passive remote sensors.

A similar RFI situation is observed by the AQUARIUS scatterometer at 1260 MHz and the AQUARIUS radiometer at 1413 MHz as outlined the global surveys of RFI from EESS (active) sensors performed by NASA.

In view of such an unsatisfactory RFI situation in this spectrum area it was agreed to develop a Draft SFCG Report (EESS L-Band sensors RFI survey) for SFCG-34 which will gather RFI information experienced by both, active and passive remote sensors in L-Band.

Compatibility of SRDs with EESS (passive) at 122 GHz

An overview was provided on the outcomes of a work undertaken within CEPT, the European Conference of Postal and Telecommunications Administrations, leading to the recent adoption of ECC Report 190 on “Compatibility between Short-Range Devices (SRD) and EESS (passive) in the 122 to 122.25 GHz band”.

The band 122-123 GHz is identified for ISM applications as per ITU Radio Regulations Footnote 5.138 and, as most ISM bands, is hence considered for SRDs.

In 2011, the European Commission decided to include this band in its Decision on Short-Range Devices with a generic maximum e.i.r.p. of 20 dBm. ESA, EUMETSAT and EUMETNET raised concerns about the compatibility of such generic SRDs with EESS (passive) in the 122-122.25 GHz band and CEPT therefore decided to study this issue.

The ECC Report 190, recently adopted within CEPT, confirms that SRDs operated with 20 dBm maximum e.i.r.p. are not compatible with EESS (passive) sensors operating in the 122-122.25 GHz band and concludes that two additional limitations should be applied to SRDs in the 122-122.25 GHz

band, namely a maximum e.i.r.p. density of 10 dBm/250 MHz (rms) and a maximum e.i.r.p. density above 30° elevation of -48 dBm/MHz (rms).

This ECC Report 190 is considered useful to other SFCG members facing similar compatibility issue at national or regional level.

Impact of RLANs in 5350-5470 MHz

An assessment performed by ESA was presented, providing the results of analyses based on both static and dynamic methodologies to address the compatibility between radio local area networks (RLANs) and EESS (active) in the 5350-5470 MHz band.

The study demonstrates that RLANs cannot share the band 5350-5470 MHz with EESS (active) and that any introduction of RLANs into this band will endanger the operation of current and planned EESS systems, in particular narrowband SAR instruments (such as the ESA Sentinel-1 mission (3 satellites) and the Canadian missions Radarsat-2 and upcoming Radarsat-RCM (3 satellites)).

Triggered by these results and considering recent development under WRC-15 Agenda item 1.1 on possible consideration of the 5350-5470 MHz band for use by RLANs, SFCG revised Resolution 23-2 on the use of Synthetic Aperture Radars (SAR) in the band 5250-5570 MHz. Among others, it resolves that member agencies advocate within their administrations to avoid any allocation to wireless access systems (indoor or outdoor) in the band 5350-5470 MHz for the purpose of maintaining the highest reliability and availability of EESS (active) SAR measurements in this band.

The proposed revisions to the technical resolution are consistent with recent work in ITU-R Working Party 7C that led to a liaison statement to ITU-R Joint Task Group 4-5-6-7 which is the responsible group in the ITU for the preparation of WRC-15 agenda item 1.1.

Consequently, in the SFCG objectives decision 32-1R1, SFCG expresses its opposition to an allocation to the mobile service in the band 5350-5470 MHz for use by terrestrial mobile broadband applications.

WGI thanked EUMETSAT for the detailed report provided on the SFCG activities and to the efforts made, as appointed liaison to SFCG, to make available the outcome of the SFCG meeting 33 (which completed activities on 3 July 2013 (2 days before the CGMS-41 meeting).

CGMS WGI also wanted to reiterate 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.

ISRO-WP-01 provides a summary of the operational plans by ISRO regarding INSAT satellites in relation to the Data Collection System and the frequency

plans, derived by the agreements reached within CGMS and SFCG, for sharing the DCS uplink band (401-403 MHz).

ISRO has operated Meteorological satellites from 74 degE, 83 degE and 93.5 degE orbital slots for many years. Currently Kalpana and INSAT-3A satellites are operating at 74 degE and 93.5 degE orbital slots respectively. Hence the INSAT-3D satellite was planned at 83 degE. Due to operational reasons later it was decided to park INSAT-3D satellite at 82 degE. Another advanced Meteorological satellite INSAT-3DR is being built by ISRO, it was initially planned for 400 KHz of DCP band from 402.25 to 402.65 MHz. However after obtaining the responses from various Metsat operators, the band was reduced from 402.25-402.65 to 402.5-402.65 MHz, especially due to overlap with Russian GOMS satellite at 76 degE. Already letters have been written to various Administrations based on their objections to ITU filings made by Indian Administration under the filing names INSAT-MET (74E, 81.5E, 82E, 83E and 93.5E) satellite networks.

Recently coordination agreement has been received from F/ESA providing their concurrence for the completion of coordination in the 401-403 MHz. ISRO needs similar agreement/concurrence from other Metsat operators for the operation of INSAT-3D and INSAt-3DR satellites in this meeting. Because INSAT-3D will be launched in July 2013 and coordination agreement is required urgently for operating at 82 degE ISRO has requested CGMS members to provide feedback on the coordination steps to complete the notification process with ITU.

CGMS-41 actions – WGI						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGI/2	41.16	CGMS members (satellite operators) to indicate to ISRO concerns regarding the frequency and operational plans for INSAT 3D, INSAT-3DR and INSAT-future as presented in ISRO-WP-01. Namely: • 402.65-402.85 MHz for INSAT-3D which will be located at 82degE instead of the originally notified 83 degE; • 402.5-402.65 MHz for INSAT-3DR (planned in 2015); • 402.25-402.5 MHz for INSAT-future.	30-Aug-13	**OPEN**	-

NOAA-WP-06 presented the Spectrum Status and Issues from the NOAA perspective, confirming that implementation of the 2010 President's Broadband Initiative remains a U.S. government priority.

Sharing of 1695-1710 MHz:

The U.S. National Telecommunications and Information Administration (NTIA) established a government-industry working group to revalidate assumptions and conclusions in the NTIA Fast Track Report, which identified the 1695-1710 MHz band for sharing between POES, MetOp and commercial broadband providers. Industry representatives provided details about their

planned operations which are currently being analysed for impacts to exclusion zones and previously-predicted interference levels.

Interference at critical locations and at hundreds of unprotected POES and MetOp High-Resolution Picture Transmission (HRPT) direct broadcast locations outside exclusion zones remain NOAA issues that we are working with our operations personnel and customers.

NOAA presented details about polar satellite operations at command and control sites and the characteristics of HRPT reception at protected and unprotected user sites. Based on combined analysis, NOAA believes that the original sizes of exclusion zones will change because the original calculations used very conservative assumptions about industry operations characteristics. Further, NOAA is advocating creation of coordination zones outside exclusions zones. Any commercial provider proposing to operate inside a coordination zone would be required to coordinate with NOAA.

Depending upon the results of interference analysis, reasonably-priced modification such as filtering to commercially-available L-Band receivers may be possible. When available, NOAA will suggest approaches to CGMS members and worldwide customers and equipment vendors.

The working group recommendations will be used by NTIA and the Federal Communications Commission as they proceed towards an auction of the 1695-1710 MHz spectrum auction. No target date has been identified for the auction.

LightSquared Interest in 1675-1680 MHz:

LightSquared, whose proposal to operate in the spectral bands adjacent to GPS and other Positioning, Timing, and Navigation (PNT) was denied earlier in the year, continues to explore spectrum options. They have approached NOAA about sharing 1675-1680 MHz.

Systems potentially impacted if this were approved include:

- In-band interference with the GOES back-up operations at the Goddard Space Flight Center (GSFC);
- In-band interference with NOAA's radiosonde operations; and,
- Adjacent band interference with both legacy GOES and GOES-R rebroadcasts.

This discussion is in the preliminary stages and we expect that a decision will be made within 6-9 months.

Routine and Other Spectrum Management Work:

NOAA continues to coordinate domestically and internationally on numerous issues involving existing and future satellite systems. Significant work included:

- Emergency and permanent filings to permit a back-up downlink for NPP at Fairbanks in response to numerous instances of severed leased transatlantic cables carrying NPP data;

- Resolution of potential X-Band interference at Fairbanks between NPP and Landsat Data Continuity Mission. As expected the probability of interference was calculated to be less than 1/10,000; and

- Routine ITU filings for DSCOVR and Jason-3.

The world-wide commercial desire for additional spectrum is increasing and the competition is intense. NOAA and our CGMS partners must apply adequate resources to respond to new initiatives and to develop new and innovative ways of operating meteorological satellites and distributing data to users and customers. It is critical that CGMS members engage in frequent formal and informal dialogue in order to ensure continuity of operations in the future.

WGI thanked NOAA for the report provided on the frequency related topics (NOAA area) and noted the progress made on the implementation of the 2010 President's Broadband Initiative and the efforts made to ensure that operational systems and the services provided to users by these systems are not affected by the results of the Broadband initiative.

NOAA-WP-07 provides a description of current and future NOAA satellite networks as well as a list of radio frequencies used/to be used by these networks.

WMO reiterated the ready availability of the WMO Observing System Capability Analysis and Review Tool (OSCAR), encouraging WGI members to provide and maintain updated WMO with the frequency information of their systems (present and future ones).

WMO-WP-01 provides the preliminary position of WMO, as adopted by the WMO Steering Group on Radio-frequency Coordination (SGRFC) in January 2013, on the relevant agenda topics of the next World Radiocommunication Conference (WRC) 2015.

The WMO WP includes details on ten agenda items which are related to frequency bands or issues of prime interest for meteorology and related fields, and identifies a further eight agenda items that have potential impact on WMO interests. The SG-RFC collaborates closely with the Space Frequency Coordination Group on matters related to satellite operations. The output from

SFCG-32, including, SFCG Resolution 32-1 “SFCG Objectives for WRCs” formed a valuable input to the development of this preliminary position paper.

Recognising the importance of radio-frequency spectrum for WMO, the 2013 session of the WMO Executive Council stated that WMO members “should maintain close coordination with their national telecommunication authorities to register their frequencies for adequate protection, and to defend the availability of frequencies for Meteorology, Climatology and Earth observations, influencing positively the national delegations to the World Radiocommunication Conferences (WRC)”.

The Council, in its Resolution 4.4/1 (EC-65) “Preserving Radio-Frequency Spectrum for Meteorological and Related Environmental Activities at the ITU World Radiocommunication Conference 2015 (WRC-15)”2 requested “CBS to pursue an intensive preparation for WRC-15, in coordination with other technical commissions, especially the Commission for Instruments and Methods for Observation, and in collaboration with other relevant international bodies, in particular, the Coordination Group for Meteorological Satellites and the Space Frequency Coordination Group”.

The detailed positions of WMO, as adopted by its SGRFC in January 2013 are included in the annex I of **WMO-WP-01**.

WGI noted the detailed positions of WMO regarding the relevant WRC-15 agenda items and confirmed that these positions are fully in line to the ones adopted by the different CGMS members in the different regional areas in which the preparatory activities of WRC-15 are taking place.

WGI was also reiterating the need of CGMS members to closely and regularly liaise with their national frequency management/regulation authorities on the importance of the frequency bands assigned/associated to MetSats and EESS and the need to protect/preserve them. These regular activities shall ensure that adequate awareness is raised, and maintained, with the national authorities that will convey the national positions to the WRC and reminded all CGMS members on the fact that none of the CGMS members is a member of ITU with voting rights (by definition of the membership in ITU which is done at national signatory level). WMO also wanted to emphasise the need to bring the same approach to regional fora (e.g. CEPT in Europe).

WGI further noted the resolution of WMO Executive Council asking the CBS to pursue an intensive preparation for WRC-15, in collaboration with other relevant international bodies, in particular, CGMS and the Space Frequency Coordination Group.

WMO-WP-23 presented a summary of the satellite module of the Observing Systems Capability Analysis and Review Tool (OSCAR), available to the public under www.wmo.int/oscar provides information on EO satellite frequencies.

Following WGI discussions at CGMS-40 and subsequent interactions with CGMS members, the presentation format of the frequency tables has been improved (with the possibility to show or hide the expert details for each satellite) and a significant amount of information has been added. Filtering tools allow selecting specific frequency ranges, time-spans or operators, and data can be exported for offline use.

To date, OSCAR contains frequency information for 74 individual satellites in the following 21 satellite programmes:

COMS	INSAT-3
Electro	JASON
EPS	JPSS
FY-2	Kalpana
FY-3	Meteor-3M
FY-4	Meteosat 1st Generation
GOES 2nd generation	Meteosat 2nd Generation
GOES 3rd generation	Meteosat 3rd Generation
Himawari 2nd generation (MTSAT)	NOAA 5th generation / POES
Himawari 3rd generation	Sentinel-3
Suomi-NPP	

WMO invited WGI to note the availability of satellite frequency information in OSCAR and the potential use of this tool to support frequency management and planning activities. WMO asked CGMS members to continue providing WMO with updates of their respective satellite frequencies to be recorded in OSCAR, using the CGMS-agreed format. (See: http://www.wmo-sat.info/oscar/satellitefrequencies).

WGI/3 Direct broadcast services

WGI/3.1 Direct read-out stations

NOAA-WP-09. presented possible recommendations seeking affordable receiving stations. It contains the provided recommendations and background information on previous activities involving the development on the affordable user terminals and their investigation of alternative method for disseminating satellite data. The most reliable and cost effective method for disseminating satellite data is via re-broadcast. This primary method of distributing satellite data allows environment users to obtain this critical information by means of a low cost receiving terminals. In addition, this data can be exploited to meet the specific mission requirements of an organisation or satisfy needs of the users.

Future environmental satellites will produce far more data than the current satellite series. The next generation geostationary and polar-orbiting environmental satellite constellations will employ new downlink frequency allocations, larger bandwidths, and faster data rates. Environmental data

users must employ new field terminal receivers unique to that particular broadcast service. The cost of these new terminals is relatively expensive, despite the fact that costs have decreased.

To ensure a broader use of the data, alternative methods and affordable user station should be made available. In comparison, the cost of the new terminals overshadows the price of an existing receive station. Several surveys have shown that the primary reason for *not* considering the new high rate date (HRD) stations is cost. If cost was not a factor, the new systems would be in prime demand.

The old (current) systems are not compatible with the new (future) terminals. A legacy of services for more than fifty (50) years will cease with the operation of the next generation of satellites. The cost of transition is extremely high. Affordable receiving stations as well as alternative dissemination systems will promote the full use of the next generation of satellite data.

NOAA invites CGMS and the WMO to consider ways to help make acquiring this data affordable to all.

NOAA-WP-13 presented NOAA Direct Broadcast Data Initiative to Meet NWP Latency Requirements. This WP was written as NOAA's answer to CGMS-40 action 40.18 (originally raised on WGII): CGMS Agencies to support fast delivery initiatives using direct broadcast with extensions wherever possible (e.g., IASI, METOP-B, NPP), including on future polar orbiting satellites.

The volume and coverage of polar-orbiting satellite data available to NCEP's operational data assimilation systems depends on both the number of occupied orbits (orbital configuration) and the data latency. Both factors are critical issues for determining the accuracy and timing of NCEP's numerical guidance. Numerical guidance is foundational to all NOAA's forecast and warning services and future Weather Ready Nation objectives.

Data latency is critical for the use of satellite data in numerical weather prediction forecast models. The use of direct read-out over the Northern Hemisphere can improve latency of sounder data to less than 30 minutes, and as low as 15 minutes.

Direct read-out of both NPP and METOP sounder data can be implemented at a low cost since most of the stations are already available. Current North American stations are located at universities, and include Madison, Wisconsin, Fairbanks, Alaska, and Oahu, Hawaii. Additional stations are needed at Monterey/California, Miami/Florida, San Juan, Puerto Rico, Guam, and Suitland MD (or Wallops). When combined with existing stations in Japan, China, Russia, and Europe, most of the Northern Hemisphere can be covered with excellent latency.

The NOAA initiative for SNPP and Metop includes working with EUMETSAT to combine all stations to a network, which will provide data access to NCEP

and the European NWP community. Today, such a concept exists with current NOAA POES data and is called the EUMETSAT Advanced Retransmission Service (EARS). NOAA will also work with the WMO.

NOAA has approved the development of a network of direct broadcast stations which will include Suomi NPP, METOP, EOS (AIRS), and POES (AMSU), and potentially GCOM and the FY-3 satellite series. NOAA welcomes the participation of other CGMS agencies and would like to explore including for example FY-3 and Russian satellites and would encourage open access to level 0 and level 1 processing code to convert satellite data packets to calibrated sensor observations.

WMO thanked NOAA for the effort put in preparing the WP and the concepts and recommendations put forward. WMO confirm the support to the NOAA initiative for a RARS America and the intended “global” circulation of data (from regional RARS to other regions). It proposes NOAA to present a dedicated WP at the next Asia-Pacific Satellite User’s Conference in October 2013.

EUMETSAT-WP-17 PPT presented EUMETSAT current plans on the EUMETSAT Advanced Retransmission Service (EARS) Roadmap. The presentation covers

- the driving requirements for the EARS system (improving timeliness for LEO satellites data over European Region as part of the regional mission) in support of Numerical Weather Prediction (NWP) and Nowcasting (NWC);

- the timescale for the EARS services (since initial set up of the system);

- an overall EARS system overview and the principles and mechanism for data segmentation and selection (between several receiving stations);

- a summary of the current EARS supported services and the new regional SuomiNPP services the prodicts provided in both Eumetcast and GTS and the associated timeliness to these products;

- preliminary information on the plans for a RARS-Africa and the objectives of this initiative;

- preliminary information for the EPS-SG Direct Read-out (at the beginning of Phase B) focusing on the relevant characteristics of the reception station (e.g. G/T) and the aim by EUMETSAT to align, as much as possible, to the relevant parameters and characteristics of the SuomiNPP and JPSS ones; and

    - a summary of topics to be considered in the evolution of existing RARS and when planning for newer systems.

Most of the considerations provided by EUMETSAT in CGMS-41-**EUMETSAT-WP-17** are based on operational experience and derived lessons learned in the frame of implementing and operating the EARS system.

Following the presentation of the WPs, WGI discussed the proposals and concluded the following:

- It is necessary to separate the discussion topics between Direct Read-out terminals (for LEO systems) and direct broadcast and re-broadcast terminals (HRIT/LRIT like terminals for GEO systems). It is believed that the latter should be addressed specifically in WGIV with direct reference to GeonetCast related terminals. If considered necessary by WGIV, WGI can support telecommunication related discussions in WGIV regarding these systems and terminals.

For the specific case of Direct Read-out terminals, WGI is considered the adequate WG to address aspects related to affordable receiving systems (with participation of and support from WGIV as necessary).

- RARS-like systems and their evolution is an aspect to be considered in the discussions of WGI for aspects related to improvement of timeliness of LEO systems data (in support to NWP and NCW).

- WMO proposes that priority is given to sounding data (for NWP), while locally for now-casting (based on imager information) and where relevant with scatterometer (e.g. like EARS) but with due consideration of the need of tuning formats and products for adapting to available bandwidths for data circulation and repatriation/dissemination.

- WMO also expressed the importance of these RARS-related activities not only for Asia, Europe and North America but also for WMO Regions I, III, and V.

- Exchange of data (data transfers) between regions is also considered part of the RARS service implementation (timeliness requirements to be considered). Through the tour-de-table discussions it was recommended to build upon an expansion of the existing RARS infrastructure as much as possible.

- Roshydromet confirmed support to the concept of RARS in the different regions,

- KMA confirmed support to the concept of RARS in the different regions,

- ISRO and CMA/CNSA confirmed support to the concept of RARS in the different regions.

- CMA/CNSA also mentioned the need to consider not only operational systems but also pre-operational and R&D satellites. A specific point was

made on the need to consider L-Band and X-Band HRPT like solutions for the RARS systems.

- JMA also confirmed support to the concept of RARS in the different regions.

- In the round table discussions several concepts/ideas were put forward by the different participants in WGI like:

    - Homogeneity of products (specially L2 and formats);
    - The use of OSCAR to capture the necessary information;
    - The idea of specialising agencies by instruments.

- A Task Team was proposed to be organised (manned from the different WGI participating organisations) to work through the inter-sessional meetings to ensure progress before the next CGMS plenary session.

- WGI agreed on having dedicated bi-monthly inter-sessional e-meetings for the purpose of discussion and addressing topics in relation to LEO Direct Read-out terminals, RARS like systems and services and associated standards.

The following action was agreed as a result:

CGMS-41 actions - WGI						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGI/3.1	41.17	CGMS members to nominate representatives in the Task Team to work on RARS related aspects (before 1st IS meeting (WG-I.IS-2.1 mid October 2013)	31-Aug-13	**OPEN**	HLPP #2.10

In terms of proposed considerations:

- Use of the same core software for the centralised global instrument data processing and the local processing of the regional data has proven to be successful and ensuring consistency of products (example: Suomi NPP).

    - This requires the core software to be portable;

    - Better if defined and considered from the early programme development phases;

    - Should consider modern computer architectures (multi-core computers, cloud computing, etc) in order to optimise timeliness of product generation;

    - Timeliness oriented, including the use of clearly defined product granules for faster processing, distribution and exchange between stations and regions;

- It seems natural that each organisation is responsible for developing/releasing and supporting product processing packages for the instruments on their satellites (need for a release and change mechanism agreed at CGMS?);

- To consider the “minimum requirements” for S/W release and its associated documentation (including test data);

- Helpdesk for issues on product processors (who, how);

- Open access to mission specific details including Space To Ground ICD, data formats and instrument characteristics; and

- Harmonisation of front-end characteristics (G/T, polarisation, limiting range of alternative for modulation, FEC, etc) to achieve economical and multi-mission capable reception systems.

WGI/3.2 Coordination and Global Standards

This specific agenda point was covered in agenda point 1 when reviewing the status of WGI related actions from previous CGMS meetings (in particular action 40.13. Round table for comments review to proposed update to CGMS Global Specification 04 (by end of Q1 2013 –same e-meeting as for action 40.12). WGI considers this action closed with the outcome of the inter-sessional meeting at end March 2013 (held together with WGIV). In this meeting, the participants confirmed support to the proposed modification to CGMS-04 (as proposed in CGMS-40 EUM-WP-08). The point has been again open for comments by the WGI participants during this specific agenda topic and reconfirmed unanimously in the agreement by WGI to the proposed update.

WGI will report this to the plenary in order to apply the necessary change control mechanism to the update of the corresponding CGMS global spec (04).

WGI/4 International data collection and distribution

EUMETSAT-WP-09 presents the status of the EUMETSAT 0° and IODC Data Collection Services. The status of the High Rate Data Collection Platforms and DCP data dissemination mechanisms are also detailed in the WP.

Regional DCS (0°)

Channel utilisation

There are 223 regional channels (at 1.5 kHz spacing) available on the Meteosat-10 satellite which supports the 0° Data Collection Ser vice (DCS). Of these channels, 66 are used by 'older' DCPs, with 3 kHz spacing, (corresponding to 33,3 kHz channels), therefore 157 channels are available for 1.5 kHz DCPs. Of these channels, 42 have DCPs allocated. The upper part of the band has been set aside for HRDCP use.

There are 115 1.5 kHz Regional channels with no DCPs allocated. As older 3 kHz DCPs become obsolete, more channels will become available. The allocation is shown in Figure 1. This figure also shows the additional 11 Regional channels that were redistributed from the original 33 International Channels following the agreement at CGMS-36 i.e. I01-I11 were allocated to NOAA for regional use, I23-I33 allocated to EUMETSAT for regional use. I12-I22 remain as International channels.

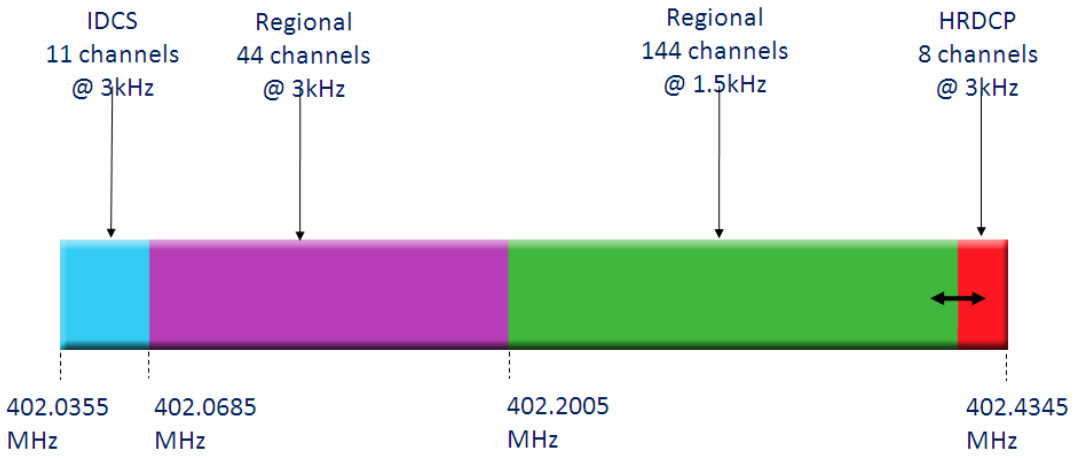


Figure 1 Allocation of International/Regional Channels of DCPs

DCPs Allocated /Active

There are 1087 DCPs allocated, of which 639 are actively transmitting. Several transmitters are seasonal in nature.

Geographical Distribution

DCPs transmitting via the 0° and IODC satellite are located in Europe, Africa and Asia. The following table and chart show the geographical distribution.

DCPs	Country	DCPs	Country	DCPs	Country	DCPs	Country
51	Algeria	1	Finland	3	Maldives	10	Tanzania
11	Angola	113	France	19	Mali	1	Thailand
2	Armenia	1	Gambia	1	Malta	2	Togo
3	Austria	44	Germany	3	Mauritania	4	Tunisia
1	Bangladesh	8	Ghana	4	Mauritius	1	Turkey
2	Belarus	1	Gibraltar	0	Morocco	48	UK
3	Benin	1	Greece	23	Mozambique	22	Ukraine
11	Botswana	11	Guinea	2	Myanmar	1	Union des Comores
1	Brazil	2	Guinea-Bissau	18	Namibia	61	USA
4	Bulgaria	19	Indonesia	23	Niger	2	Vietnam
6	Burkina Faso	2	Iran	16	Nigeria	1	Yemen
61	Cameroon	136	Iraq	10	Oman	15	Zambia
4	Cap Verde	9	Ireland	4	Pakistan	13	Zimbabwe
1	Central African Republic	96	Italy	3	Palestine		
3	Chad	3	Ivory Coast	3	Philippines		
2	Congo	0	Jordan	11	Republic of Moldova		
3	Croatia	4	Kenya	10	Republic of Seychelles		
1	Cyprus	6	Lesotho	12	Romania		
26	Democratic Republic of the Congo	11	Libya	11	Senegal		
		0	FYR Macedonia	35	South Africa		
2	Djibouti	2	Madagascar	7	Spain		
1	Egypt	8	Malawi	3	Sri Lanka		
5	Falklands	1	Malaysia	2	Swaziland		

Total = 1087 DCPs

Table 1 Geographical Distribution by Country

Note (1) Larger numbers of DCPs are highlighted with darker colours. (2) Red entries indicate countries where DCP operation has ceased, green entries where it has commenced.

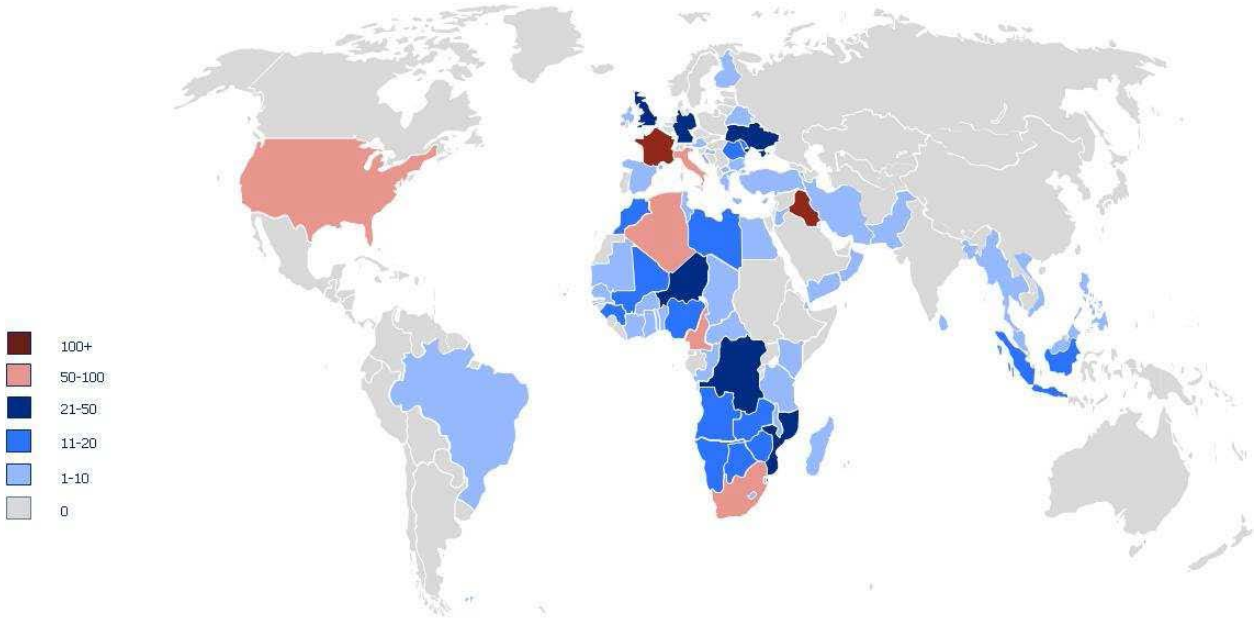


Figure 2 Geographical Distribution of DCPs

IODC (57°)

Meteosat-7 is used for the provision of the IODC service, including the DCS. The prime application is for the Indian Ocean Tsunami Warning Network (IOTWS). There are plans for DCP networks in Vietnam and other Asian countries, however further utilisation of Meteosat-7 is contingent on the use of HRDCPs due to the limited bandwidth available.

Channel utilisation

Due to interference with the 0° service, only Inter national channels have allocated for IODC use. As noted above, I01-I11 were allocated to NOAA for regional use, I23-I33 allocated to EUMETSAT for regional use. I12-I22 remain as International channels.

Agreement has been made with NOAA, that the 11 former International channels, now allocated to NOAA, can be used for IODC DCS application on a noninterference basis.

DCPs allocated

There are 37 DCPs allocated, of which 35 are actively transmitting.

Outlook

International channel usage

Only 1 DCP is allocated as an International DCP, however this DCP only transmits via the 0° spacecraft. It does not transmit via the NOAA or JMA satellites. Indeed NOAA no longer support 100 bps DCPs. It can therefore be regarded as a Regional Meteosat DCP.

It is proposed to analyse whether the remaining 11 International channels could be reallocated to Regional use, taking into account the future EUMETSAT, NOAA and JMA satellite programmes and a possible re-convergence on the DCP platform specifications.

Currently the NOAA and EUMETSAT DCP specifications are not compatible. Meteosat-7 is planned to be de-commissioned in 2017. The use of an MSG satellite over the Indian Ocean Region will only be decided following the successful launch and commissioning of MSG-4 in 2015.

HRDCP Status

EUMETSAT has recently published an updated TD16 “Meteosat Data Collection and Distribution”, mainly covering the HRDCP specification and an updated Certification process.

Several Manufacturers are actively pursuing certification of HRDCP transmitters. In addition the European Space Agency (ESA) is preparing a design for European manufacturers to be able to build HRDCP transmitters.

Data is processed and distributed to the user via these mechanisms:

- EUMETCast: Comms Satellite Multicast, which covers Europe, Africa and South America;

- LRIT Direct Dissemination: Via the prime Meteosat Satellite (Meteosat-10 LRIT);

- Global Telecommunications System (GTS) of WMO, used to transmit environmental data to meteorological services throughout the world. EUMETSA disseminate DCP bulletins the RTH in DWD Offenbach;

- Internet-manual download from the website via secure log in; and

- The first certified HRDCP is planned for the second half of 2013.

It is proposed to further analyse whether the remaining 11 International channels could be reallocated to Regional use, taking into account the future EUMETSAT, NOAA and JMA satellite programmes and a possible re-convergence on the DCP platform specifications. A joint report to be prepared and presented to the next CGMS plenary session.

WGI thanked EUMETSAT for the detailed report and the proposals made for evaluating future assignment of the identified 11 International channels, JMA confirmed support to this proposal (the IDCP ship stations allocated to these channels have not reported since 2007). NOAA is also supportive of the proposal regarding the 11 International channels.

It was agreed to have dedicated inter-sessional discussions to progress on the assessment of the potential transfer of these 11 international channels to the regional use. WGI agree in having dedicated bi-monthly inter-sessional e-meetings for the purpose of discussing this (and other WGI topics). The fist e-meeting on this topic is planned for mid-November 2013.

JMA-WP-08 reports on the present status of JMA's Data Collection System (DCS) and related future plans, highlighting a recent increase in the number of Data Collection Platform (DCP) stations at which DCS regional channels are used for better tidal/tsunami monitoring.

JMA has been operating the Data Collection System (DCS) since its first Geostationary Meteorological Satellite (GMS) was launched in 1977. As follow-on satellites to the current MTSAT-1R and MTSAT-2 spacecraft, Himawari-8 and Himawari-9 are scheduled to enter operation in 2015 and 2017, respectively. These satellites will continue to provide services for the DCS, which plays important roles in collecting meteorological information as well as earthquake and tidal/tsunami data.

After the major 2004 tsunami in the Indian Ocean, JMA began the operation of additional MTSAT-DCS channels to allow the collection and distribution of tidal/tsunami data for the Indian Ocean and western Pacific areas, thereby helping to enhance tsunami monitoring in these regions.

The use of MTSAT-DCS has increased rapidly, and JMA has received more and more requests for new Data Collection Platform (DCP) stations to support disaster prevention in these regions. The current situation suggests that DCS channels may be exhausted in the future.

Messages transmitted from DCP stations to MTSAT are relayed to JMA's Command and Data Acquisition Station (CDAS) near Tokyo before being demodulated. After format conversion, the data are distributed globally via GTS. Along with these distribution efforts, JMA provides online access to the data and an email transmission service as backup with the aim of creating redundancy in data dissemination to users. These services will also be continued on Himawari-8 and -9. Himawari-8 and -9 will use the Ka-band (up to 18 GHz) as the downlink frequency for relaying DCP data as opposed to the L-band (up to 1.6 GHz) used on the current MTSAT-DCS. To cope with the effects of rain attenuation in the Ka-band, JMA will introduce site diversity with two receiving stations in different locations so that they are unlikely to be affected by heavy rain at the same time. This is expected to guarantee 99.99% uptime in radio communication.

The conditions and required/recommended specifications for the use of MTSAT-DCS along with the relevant request form are available at http://www.jma.go.jp/jma/jma-eng/satellite/nmhs/dcp.html

Statistics on the distribution of tidal/tsunami DCP data via GTS are shown in Figure 3 of the WP, which indicates a significant increase in numbers over the last few months. In addition to this increase, more frequent collection (from every 15 minutes to every 6 minutes) is being implemented for some tidal/tsunami DCP stations in consultation with the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) for enhanced monitoring.

Among the MTSAT-DCS international channels, four are currently allocated for ship stations but have not been used since March 2007.

JMA is receiving more and more requests for the use of MTSAT-DCS. Based on the importance of disaster reduction/mitigation activities in the relevant regions and the significant role of DCS in such work, JMA has positively responded to requests for the use of MTSAT-DCS toward these ends.

Recent cases have included:

- Vietnam's plan to install more than 100 hydrometeorological DCP stations for disaster prevention along the Mekong River;
- Fiji's request for a new tidal DCP station;

- A request from France's Service Hydrographique et Océanographique de la Marine (SHOM) for new tidal DCP stations in the Indian Ocean and the western Pacific; and

- Requests from The University of Hawaii Sea Level Center (UHSLC) for developments including transition of the use of DCS from Metsat-7 to MTSAT and improvement of data collection periodicity.

MTSAT-DCS is expected to be adopted by users other than those mentioned above. However, in consideration of the need to secure backup channels in case of interference, the number of regional channels left on MTSAT-DCS is limited, even though the additional 11 channels were redistributed from the original International Channels for EUMETSAT/JMA regional use, following the agreement at CGMS-36. In light of the importance of DCS, it is desirable to find a solution to the shortage of satellite channels before they actually run out.

WGI expressed its appreciation for the dedicated report provided by JMA and the agreement and support for evaluating the future assignment of the identified 11 International channels.

ROSHYDROMET-WP-03 addresses the current status and technical specifications of Russian DCS (Electro-L №1). During Electro-L №1 exploitation DCS proved to be fully functional.

The main purpose of Russian data collection system (DCS) is to provide satellite channels for meteorological data transmission from data collection platforms (DCP). DCP signals are transmitted via Electro-L №1 dedicated channels. Main technical specifications of DCS are as follows:

- Total of 300 channels, with 33 international channels, channel spacing – 3 KHz;

- Data rate – 100 or 1200 bit/s;

- Frequency range – 401.5-402.5 MHz (Earth-space) and 1696.5-1697.5 MHz (space-Earth);

- Frequency range for international channels – 402.0-402.1 MHz (Earth-space) and 1697.0–1697.1 MHz (space-Earth);

- Message size – 5192 bit (100 bit/s channel) and 15000 bit (1200 bit/s channel); and

- Data format for 100 bit/s channel is in agreement with the European standard.

Messages received from DCPs on-board Electro-L №1 are retransmitted to the Earth at 1696.5-1697.5 MHz. Those signals are acquired in SRC Planeta, in the European (Moscow region) and Siberian (Novosibirsk) parts of Russia, via 9 meter antenna system. The deployment of the receiving system in the Russian Far East (Khabarovsk) is underway.

Now there are about 115 DCP in Roshydromet transmitting messages via Electro-L №1 channels every 3 hours (standard synoptic hours). Also it is possible to send storm warnings at any time. Russian DCS has a reliability of 99.6 % based on the number of messages successfully received.

According to the deployment plans, there should be about 800 DCP installed to the end of 2014.

Roshydromet is ready to provide WMO members with the international channels for data transmission from DCPs via Electro-L №1.

WGI thanked Roshydromet for the detailed report and the proposals made for evaluating future assignment of the identified 11 International channels

NOAA-WP-08 provides a status report on the performance of the International Data Collection System (IDCS) and NOAA's domestic DCS. NOAA's DCS Administration and Data Distribution System (DADDS, serving GOES DCS users) has almost 1000 individual users, with more than 600 organisations using the system. NOAA has continued with populating user and platform tables, registering and training users, and has now added the task of upgrading browsers, operating systems, and data base management systems. In the 4 years since the system has been in operation those features have become outdated and difficult to support. NOAA has modified the GOES DCS ground system to work with new transmitters (Version 2), which allows the use of smaller channels, has certified multiple manufacturers to this standard and has configured NOAA's receiving systems to allow those transmitters to operate. NOAA recently performed the task of updating the ground system to utilise a new filter to increase performance and now has a system that is fully capable of utilising Version 2 systems, while continuing to allow Version 1 systems to operate. The transition to high data rate (HDR) is almost complete, with approximately 400 of the 24,200 platforms that are active reporting at 100 bits/sec. NOAA plans to continue to investigate the use of two way communications to better command and control platforms but has continued to focus on higher priority items. NOAA is proceeding slowly with this project, since most resources are being committed to DADDS and to the Version 2 HDR transmitter implementation. Use of the international channels is minimal. NOAA is using the channels assigned to us for our domestic use by CGMS, and has already made assignments on all of them.

A fully redundant backup system has been located in Suitland, Maryland since 2010, and is being fully utilised by users and by developers who continue to roll out enhancements to DADDS by testing them at the Suitland site first. Use of the GOES DCS continues to flourish in the USA. The POES DCS (aka

Argos) has 21,000 active platforms, supporting 1,900 users in 115 countries. In the last year the Argos programme has supported a SARAL (Satellite with Argos and ALtika) launch by ISRO into an early morning orbit, a Metop-B launch by Eumetsat into a morning orbit, with a transition to dual-Metop operations, and preparations for a NOAA Free-Flyer into an afternoon orbit by NOAA in the 2016-2017 time frame.

Interference from "Ionospheric Scintillation" from Solar Activity

Near the end of 2011 NOAA began noticing interference to transmissions from a small number of platforms, primarily those near the North and South Poles (Canada and South America.) The data losses were not widespread, but instead seemed to be constrained to small areas, narrow time frames and specific platforms. After much investigation we concluded that the interference was coinciding with increased solar activity. This pattern seemed to be traced to a phenomenon called "Ionospheric Scintillation", an ionisation of a specific layer of the ionosphere that causes refraction and diffraction of radio waves. The pattern has also been tied to GPS interference.

Solar activity has continued to increase. While NOAA has continued to monitor this activity, and to understand it a little more, NOAA has made little progress in finding ways to mitigate it. The solar activity is expected to peak in 2013, so there is not enough time to have an impact on this cycle. NOAA will continue to study this event, with the hope that we can be prepared to respond to the next cycle, expected in about 9 years.

STATUS OF IDCS

No new assignments have been made in the last year. Current allocations include:

New International Channels	224	226	228	230	232	234	236	238	240	242	244
Channel #	01	02	03	04	05	06	07	08	09	10	11
# of PLT(s)	0	0	0	1	1	0	0	0	4	0	0

A query of the DADDS message table showed no transmissions from any of these platforms.

INTERFERENCE TO THE IDCS

Due to the current limited use of the IDCS no monitoring is performed. If the usage expands NOAA's DADDS provides tools to make it easier to monitor interference.

CONSOLIDATED LIST OF IDCS ALLOCATIONS

There have been no new allocations of IDCPs within the past year.

WGI thanked NOAA for the detailed report, including the details provided regarding interference from Ionospheric Scintillation from Solar activity and the support for evaluating future assignment of the identified 11 International channels.

WGI/4.1 Future Distribution

No papers were presented in this session.

WGI/4.2 Coordination

No papers were presented in this session.

WGI/5 Contributions to the HLPP

WGI reviewed the current version of the HLPP (v1 dated 9 November 2012).

Section 1.2, Coordination/Optimisation of data collection systems. It is considered of full relevance and applicability to WGI:

- 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):

  Considered well covered by the activities of the International Forum of Users of Satellite Telecommunication Systems and the participation of identified members of CGMS (e.g. WMO and EUMETSAT).

  It is proposed that WMO regularly reports to WGI on the progress made by this International Forum in the areas of relevance to CGMS (WGI).

- Assess Data Collection Platform (DCP) and Argos Data Collection System (A-DCS) status and evolutions including International channels, taking into account requirements of Tsunami alert systems and ocean observations (e.g. buoys):

  Considered well covered by the different WPs provided by the different WGI members (see specific and dedicated report by NOAA in NOAA-WP-08 on Argos and NOAA-WP-08, ROSHYDROMET-WP-03, JMA-WP-08 and EUMETSAT-WP-09 for the regional DCS systems and the related

IDCS activities and proposal for future adaptations). Dedicated inter-sessional meetings are identified by WGI to progress on these topics.

- Share lessons learnt and share experiences on certification of DCS platforms (especially High Rate DCPs):

  No specific WPs provided. Discussions by WGI on the identified gap confirmed the need to maintain this topic in the HLPP and the intention to address it by dedicated inter-sessional meetings to progress on these topics.

- Share information on the development of their High Rate DCPs and share lessons learned on mitigating interference between DCPs:

  Dedicated sections in specific WPs (i.e. NOAA-WP-08 on solar activities related "interferences"). Discussions by WGI on this topic confirmed its relevance and the need to maintain it in the HLPP and the intention to address it by dedicated inter-sessional meetings to progress on these topics.

- To confirm user requirements for sharing data/information delivered using DCS (outside the regional area). Data mechanisms to share DCP data.

  No specific WPs provided. Discussions by WGI on the identified gap confirmed the need to maintain this topic in the HLPP and the intention to address it by dedicated inter-sessional meetings to progress on these topics.

Section 1.3 Radio Frequency (RF) Protection. It is considered of full relevance and applicability to WGI:

- Establish a coordinated position on the future of L-band services;

  Coordination in the positions is being achieved by the progress being made in the definition of the future systems (current systems are already designed and in most cases built and therefore no modifications can be expected).

- Investigate how to mitigate Earth Exploration Satellite Service (EESS) X-band congestion and coordinate interference assessments on a regular basis and as necessary, establish coordination mechanisms for sharing and using this band (both GEO and LEO systems and inter-agencies):

No specific WPs provided, the inter-sessional meetings organised after CGMS-40 did not materialise as the necessary inputs were not ready at agency level for feeding the inter-sessional meeting and supporting the related discussions. It is considered a recurrent point to be maintained in the HLPP (or on the agenda of WGI) but CGMS members need to ensure the availability of interference studies to support discussions. It is planned to continue addressing it by dedicated inter-sessional meetings to progress on these topics. In parallel, EUMETSAT and CGMS have confirmed interference assessments results and minimum of interference at high latitude sites via SFCG dedicated reports on the topic (discussed at SFCG meeting in June 2013).

- Facilitate an effective preparation of national positions for the World Radiocommunication Conference (WRC) favourable for the CGMS-related issues:

  Considered well covered by the different WPs provided by the different WGI members. This topic needs to be kept in the HLPP for securing adequate information flow inside CGMS on national and regional level preparatory activities (as well as the dedicated report from SFCG activities provided by CGMS liaison [M. Dreis, EUMETSAT] representative in SFCG).

Section 1.3 Radio Frequency (RF) Protection. It is considered of full relevance and applicability to WGI:

Relevant bullets from Section 2 of the HLPP for WGI: DATA DISSEMINATION, DIRECT READ OUT SERVICES AND CONTRIBUTION TO THE WIS

- Maintain the CGMS Direct Broadcast Global Specifications, optimise and harmonise the approach to direct read-out dissemination, whilst investigating possible alternatives:

  Considered well covered by the different WPs provided by the different WGI members (see specific and dedicated presentations by NOAA in NOAA-WP-13 and EUMETSAT in EUM-WP-17(PPT) regarding RARS). Dedicated inter-sessional meetings are identified by WGI to progress on these topics.

- Facilitate the transition to new direct read-out systems (GOES-R, JPSS, FY-3):

Considered of full relevance to WGI. Dedicated inter-sessional meetings are identified by WGI to progress on these topics.

- Work together to define a set of recommendations seeking affordable future receiving stations or alternatives to direct read-out solutions:

  Considered well covered by the different WPs provided by the different WGI members (see specific and dedicated presentations by NOAA in NOAA-WP-09 regarding affordable receiving stations). Dedicated inter-sessional meetings are identified by WGI to progress on these topics.

- Further enhance the Regional ATOVS Retransmission Services (RARS) initiatives through their extension to advanced sounders for at least half of the globe:

  Considered of full relevance to WGI. Dedicated inter-sessional meetings are identified by WGI to progress on these topics.

WGI/6 Any other business

Nothing to report.

WGI/7 Planning of inter-sessional activities/meetings

Two groups of Inter-sessional meetings are agreed by WGI:

- WGI.IS-1.x: First group of Inter-sessional meetings will be dedicated to Section 1.2 and 1.3 of the HLPP and it is agreed to have also a bi-monthly frequency, starting mid-November 2013.

- WGI.IS-2.x. Second group of Inter-sessional meetings will be dedicated to Section 2 of the HLPP of relevance to WGI (i.e. RARS related activities) and it is agreed to have a bi-monthly frequency, starting mid-October 2013.

WGI/8 Review of actions, conclusions, preparation of WG report for the plenary

The following actions from previous CGMS meetings were given a new deadline for further discussions:

CGMS-39/-40 actions open at CGMS-41 – WGI						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGI	39.21	Action 39.21: Based on the inputs of action CGMS-39 39.20 (CGMS members to report on their plans for the utilisation of the band 7750-7850/7900 MHz for their existing and future LEO systems [including the detailed list of frequencies used in the band, associated bandwidth and signal characteristics - together with the orbital parameters]), CGMS members to analyse potential interference issues, reporting results of analysis back to CGMS WGI by next CGMS meeting.	(CGMS-40) **New deadline 15 Oct 2013**	**OPEN**	HLPP#1.3.2
CGMS members	WGI	40.12	CGMS members to complete and review interference assessment (in response to action 39.21)	31/03/2013 **New deadline 15 Oct 2013**	**OPEN**	-

Feedback related to Action 39.21:

CGMS-40: Remains open - new deadline proposed end Q1 2013 for specific follow up e-meeting of WG-I activities. Linked to HLPP: EESS X-Band congestion and interference assessments.

CGMS-41: CGMS members to analyse potential interference issues reporting results of analysis back to CGMS WGI by the next inter-sessional WGI meeting autumn 2013.

Feedback related to Action 40.12:

CGMS-40: New deadline proposed end Q1 2013 (during CGMS-40) for specific follow up Inter-Sessional e-meeting had to be postponed to a new inter-sessional (IS-1) meeting of WG-I in May 2013 as key inputs were missing on some of the WG-I participants. Second IS meeting in May 2013 had to be cancelled as inputs were still pending.

CGMS-41: CGMS members to complete and review interference assessment (in response to action 39.21) by mid November 2013 in time for the inter-sessional meeting.

The agreed list of WGI actions resulting from CGMS-41 is available here.

WGII REPORT

Working Group II: Satellite data and products

The Working Group held its session as part of the CGMS-41 meeting on Monday 8 July from 9.00-18.45 and on Tuesday 9 July from 9.00-17.30. As Group co-chairs served Stephan Bojinski (WMO) and Toshiyuki Kurino (JMA), with Johannes Schmetz (EUMETSAT) and Mitch Goldberg (NOAA) acting as rapporteurs. 60 participants attended the session over its two days of discussions (see list of participants in Annex).

WGII/0 Objectives

Objectives and goals of the WGII were recalled, in line with the CGMS HLPP and along the proposed agenda.

WGII/1 Review of actions and recommendations from previous meetings

WMO-WP-16: Status of WGII Actions and Recommendations

This paper reported the status of actions and recommendations relevant to the CGMS Working Group II. From 11 open Actions, all but three could be closed in the course of the session. The three remaining Actions concern IMD involvement in GSICS (WGII 40.18), the global GNSS-RO constellation (WGII 40.23), and IPWG sampling requirements (WGII 40.31).

WGII/2 Image processing techniques and satellite imagery for nowcasting

CMA-WP-04: CMA Activities on SCOPE-Nowcasting

Through **CMA-WP-04**, CMA responded to Action 40.28 from CGMS-40 asking for participation in a new SCOPE-Nowcasting activity. CMA participated in a break-out group at ET-SUP-7 addressing SCOPE-Nowcasting. CMA expressed the intention to be part of two activities: i) on the development of a product dissemination plan for harmonised RGBs for nowcasting from imagers on FY-2 , and ii) to carry out test studies for the future FY-4A imager on the basis of the GOES-R dust algorithm. The use of a FY-2 image processing and visualisation tool SWAP (Satellite Weather Application Platform) was also mentioned, of which an English version is under development.

WGII thanked CMA for the swift response to the request and action.

KMA-WP-06: Current Status of weather support for nowcasting and very short range forecasting

KMA-WP-06 reported on operational products including cloud analysis, such as CLA (cloud analysis), CTTP (Cloud Top Temperature & Pressure), CP (cloud phase) from the 5-channel imager on COMS (Communication, Ocean, and Meteorological Satellite). Products are derived since April 2011. The product suite also includes products related to the observations of convective cycles such as convective initiation and convective rainfall rate. Those are in a developing stage and are aimed at supporting satellite-based now-casting and very short range forecast. The paper discussed the results of a case study based on comparisons with ground data such as lightning stroke and radar observations. Finally the paper reported on recent developments to be implemented in the COMS satellite-based now-casting system in KMA/NMSC (National Meteorological Satellite Center).

WGII appreciated the report by KMA on this topic.

NOAA-WP-13: Fast delivery initiatives using direct broadcast with extensions wherever possible

This paper was prepared in response to Action 40.18: CGMS Agencies to support fast delivery initiatives using direct broadcast with extensions wherever possible (e.g., IASI, METOP-B, NPP), including on future polar orbiting satellites.

Data latency is critical for the use of satellite data in numerical weather prediction forecast models. The use of direct read-out over the Northern Hemisphere can improve latency of sounder data to less than 30 minutes, and as low as 15 minutes.

NOAA has a new funded initiative to create a network of nine direct read-out stations which provide coverage over North America and the northern Pacific ocean to support NOAA's National Weather Service (NWS) National Centers for Environmental Prediction (NCEP) global and mesoscale forecast models. The direct read-out stations will be capable of receiving sounder data from Suomi-NPP, MeTOP, AQUA, FY3, and METEOR-M.

Our NOAA initiative includes working with EUMETSAT to link to the EARS network over Europe. NOAA will also work with the WMO to contribute to the RARS network.

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/2	41.18	CGMS agencies with direct broadcast to provide access to software for converting satellite data packets to calibrated sensor observations (level 1b), and complete related information on the WMO website (http://www.wmo.int/pages/prog/sat/accessandtools_en.php). Deadline: 1 Nov 2013 to identify Point of Contact.	01-Nov-13	**OPEN**	HLPP#2.10

CGMS-41 recommendations - WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	WGII/2 R	41.03	NOAA to coordinate its new direct read-out initiative which focuses on advanced sounder data from POES, METOP, FY3, METEOR-M, Aqua/Terra with the WMO RARS programme (HLPP 2.10).	CGMS-42	**OPEN**	HLPP #2.10

WGII/3 Satellite data calibration and validation including climate related aspects

CNSA-WP-02: Calibration and Validation Results of HY-2A Scatterometer and Altimeter

The paper described quality assessment of the scatterometer and altimeter on the HY-2A satellite through calibration and validation activities. HY-2A has been operational since April 2012 and its products are available to the scientific community. A microwave radiometer is also part of the HY-2A payload.

The measurement performance monitoring of HY-2A satellite microwave scatterometer was carried out over selected geographical areas of the Amazon rainforest that had uniform spatial distribution characteristics. The monitoring results show that the measurement performance of the scatterometer is stable over time. Calibration over the oceans used an ocean surface wind vector model and observations from meteorological buoys. Speed and directional root mean square (rms) accuracies are 1.33 m/s and 20.79 respectively for wind speeds from 2-24m/s. A comparison of HY-2A scatterometer vector wind and NDBC buoys 10-m neutral stability wind has also been made. There is overall good accuracy for HY-2A scatterometer wind vectors.

Orbit determination and verification of the altimeter is based mainly on comparison with Jason-2 data. Using the DORIS positioning system and sea-level rise estimates yielded an rms accuracy of less than 3 cm compared to Jason. This was established using HY-2A altimeter data over three months in 2012. The agreement must be judged very good, while some systematic differences remain.

These results indicate that HY-2A's scatterometer and altimeter can provide data close to the accuracy of existing scatterometer and altimeter missions in orbit.

WGII appreciated the report by CNSA on this subject matter and agreed on the following action:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CNSA	WGII/9	41.20	CNSA is requested to provide a summary paper on how to access HY-2A data for CGMS-42.	CGMS-42	**OPEN**	HLPP #2.3

ESA-WP-02: ESA support to GCOS and other climate monitoring activities

ESA-WP-02 described the current support to GCOS and other climate monitoring activities. Working Group 2 was informed on the status of the Earthwatch Programme Element and ESA's contribution to the Global Monitoring of Essential Climate Variables (ECV), also known as the 'ESA Climate Change Initiative (CCI)'.The CCI programme continues to proceed well and according to schedule. The ten ECV projects initiated in 2010 are on track and will be completed in 2013. The three ECV projects kicked-off in early 2012 are also on track to get completed in 2014. Currently tender actions are underway for the next implementation steps (Phase 2) of the CCI for all 13 ECVs over the coming 3-4 years. It is expected that the follow-on projects will be kicked off in early 2014. Furthermore, the ESA paper provided a progress status for each individual ECV project and presents some outstanding results. ESA confirmed that the datasets generated in the CCI would be openly available. Upon a question by WGII on long-term perspectives of the CCI, ESA indicated their intention to continue the CCI Programme, together with European partners, as a permanent activity after its termination in the 2016 timeframe, subject to the decision by ESA member states. Various members of WGII expressed recognition to the ongoing work of ESA as a major contribution to climate monitoring from satellites.

EUMETSAT-WP-16: EUMETSAT's SCOPE-CM activities

EUMETSAT-WP-16 reported on the results of the first phase of the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) initiative 2008-2012, and the current status of projects submitted to the SCOPE-CM Executive Panel for phase 2 in response to a Call for Proposals issued in January 2013.

The first phase of SCOPE-CM 2008-2012 had five pilot projects with different partnerships. These were:

i) AVHRR based data set of cloud and aerosol properties NOAA (proposal coordinator) + EUMETSAT (CM-SAF);

ii) SSM/I: Total column water vapour, precipitation, liquid water path NOAA + EUMETSAT (CM-SAF) (proposal coordinator) + CMA (precipitation);

iii) Surface albedo, clouds + aerosols from geostationary satellites JMA + EUMETSAT (Central Facilities (proposal coordinator) + CM SAF + NOAA + CMA;

iv) Atmospheric Motion Vectors (AMV) + clear sky radiance JMA (proposal coordinator) + EUMETSAT (Central Facilities) + NOAA + CMA;

v) Upper tropospheric humidity JMA + EUMETSAT (CF + CM SAF) + NOAA (proposal coordinator) + CMA.

For the second phase a total of 10 proposals was received, and evaluated by the SCOPE-CM Executive Panel. The Panel requested clarifications and updates for a number of proposals. The current status is given in **EUM-WP-16**. It is planned to finally endorse projects as contributing to SCOPE-CM phase 2 by June 2013. The first set of progress reports from the projects is expected to be available by April 2014.

One recommendation was raised following the discussions:

CGMS-41 recommendations – WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGII/3 R	41.05	CGMS members to consider participation in approved SCOPE-CM phase 2 projects.	CGMS-42	**OPEN**	HLPP #3.3

JMA-WP-04: JMA's GSICS and SCOPE-CM activities

This paper reported on the activities of the Japan Meteorological Agency (JMA) regarding the Global Space-based Inter-Calibration System (GSICS) and the Sustained, COordinated Processing of Environmental satellite data for Climate Monitoring (SCOPE-CM).

In 2008, JMA began operation of the MTSAT-1R infrared (IR) inter-calibration system on GSICS. Re-Analysis Correction (RAC) and Near Real Time Correction (NRTC) for the MTSAT IR channels were released in a demonstration phase. To move GSICS correction into the pre-operational phase, uncertainty evaluation of GSICS MTSAT-IASI correction product is underway. The visible channels of GMS-5, MTSAT-1R and MTSAT-2 have been re-calibrated in collaboration with The University of Tokyo.

JMA has participated in SCOPE-CM since the initiative's establishment, carrying out initial activities in a pilot project related to historical Atmospheric Motion Vectors (AMVs) and Clear Sky Radiance (CSR) products to be provided for use in global and potentially regional Numerical Weather Prediction (NWP) model-based re-analysis. The Agency has also contributed to another pilot project regarding land surface albedo products in Phase 1. In Phase 2, JMA will continue to lead a project on AMVs and CSR/All Sky Radiance (ASR) as well as participating in three other projects.

With regard to vicarious calibration for visible channel, a question was raised that simulated radiances were higher than observations (also in **KMA-WP-04**). It reflects aging degradation of a sensor. It was also questioned which aerosol parameter is more reliable between climatological value and retrieval from MODIS. Although MODIS aerosol parameter provides accurate calibration results, developments of alternative calibration methods without MODIS will contribute to a generation of homogeneous climate data record before the MODIS observation period. As for visible channel calibration, use of in-situ observations such as AERONET was suggested by WGII.

These activities will be continued not only in the GSICS framework, but also in the SCOPE-CM IOGEO subproject.

WGII expressed its appreciation to JMA for continuing strong engagement in phase 2 of SCOPE-CM.

KMA-WP-04: KMA's GSICS Activities

This document reported on KMA's GSICS activities. KMA-WP-04 announced that they began to operate GSICS inter-calibrations for COMS thermal IR channels with LEOs reference observations (IASI) after finalising the IOT at the end of January 2013. KMA also performs visible channel vicarious calibration using Australian Simpson desert region, water cloud and deep convection cloud as targets. The work is performed in cooperation with Seoul National University (SNU). The related GSICS results are used for near real-time operation and the results of inter-calibration are posted on the KMA/NMSC website. The WP raised some specific question on scene dependent differences in relation to the reference observation. KMA accepted the following action for the next CGMS meeting:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
KMA	WGII/3	41.23	KMA to provide paper on their contribution to SCOPE-CM to the next CGMS session.	CGMS-42	**OPEN**	HLPP #3.3, 5.1.3

CMA-WP-05: CMA Activities on GSICS

CMA-WP-05 informed CGMS on progress of the CMA GSICS Processing Research Centre over the last year in the geostationary imagery calibration monitoring based on operational GEO-LEO IR inter-calibration for FY-2D/2E/2F satellites, besides providing calibration correction, GSICS plays a key role in monitoring the onboard blackbody calibration, which has recently become operational. Lunar observations have also been included in the process. LEO-LEO inter-calibration evaluation for FY-3A/B IR bands using AIRS and IASI shows a calibration bias and non-linearity of the optical sensors (MERSI/VIRR/IRAS). Calibration tracking and inter-calibration of solar channels based on Deep Convective Cloud (DCC) are being

implemented for FY-3A/MERSI and FY-2/VISSR. The instrument performance monitoring for the FY sensors is being established based on telemetry and engineering data and displayed near real-time on the CMA GSICS website (http://gsics.nsmc.cma.gov.cn).

In the discussion Working Group II commended CMA on the progress and on the achievement to have their GSICS work fully integrated in the operational system.

NASA-WP-03: Calibration/validation of Operational Instruments at NASA Langley Research Center, NASA Goddard Space Flight Center and the University of Wisconsin

Over the past 8 months, NASA Langley Research Center, NASA Goddard Research Center, and the University of Wisconsin have performed research in the calibration and validation research of a number of operational satellite instruments. NASA Langley, having advanced its use of Deep Convective Clouds (DCCs) as stable, uniform, on-orbit calibration targets, is currently implementing its DCC calibration methodology across all Geostationary Earth Observation (GEO) Global Space-based Inter-calibration System (GSICS) Processing Research Centers (GPRCs). NASA Langley is also using DCCs and well characterised desert scenes to calibrate the long-term Advanced Very High Resolution Radiometer visible radiance record.

NASA Langley, in coordination with the Japan Meteorological Agency (JMA), successfully used coincident MTSAT-2 commissioning images to improve the MTSAT-1R image quality, followed by intercalibration with MODIS Aqua to improve the MTSAT-1R derived broadband fluxes and cloud properties. The University of Wisconsin utilised Simultaneous Nadir Overpass (SNO) views to intercalibrate the infrared bands of the Suomi NPP Cross-track Infrared Sounder (CrIS) with the EOS Aqua Atmospheric Infrared Sounder (AIRS), the Metop-A Infrared Atmospheric Sounding Interferometer (IASI), and the Suomi NPP Visible Infrared Imager Radiometer Suite (VIIRS).

Lastly, the VIIRS Characterization Support Team (VCST) at the NASA Goddard Space Flight Center continues to trend the on-orbit performance of the visible, near infrared and shortwave infrared bands using the on-board solar diffuser/solar diffuser stability monitor and near monthly views of the Moon. This work has proven to be invaluable in the accurate trending and prediction of the near infrared reflectance degradation of the VIIRS rotating telescope assembly mirrors.

JMA expressed appreciation for the NASA work in correcting MTSAT Point Spread Functions. NASA provided explanations for the degradation of the VIIRS instrument, which recently has been flattening, and stressed that the instrument was still operating within specifications.

NOAA-WP-10: Satellite Data Calibration and Validation: NOAA SUOMI NPP Cal/Val Results

The Suomi NPP (SNPP) satellite was launched successfully on 28 October 2011 and is a pathfinder for the future US Joint Polar Satellite System (JPSS) operational satellite series. The primary objectives of the SNPP mission provide a continuation of the group of Earth system observations initiated by the Earth Observing System Terra, Aqua, and Aura missions, and prepare the operational forecasting community with pre-operational risk reduction, demonstration, and validation for selected JPSS instruments and ground processing data systems. The SNPP satellite is now flying with the following five instruments: Visible/Infrared Imager/Radiometer Suite (VIIRS), Cross-track Infrared Sounder (CrIS), Advanced Technology Microwave Sounder (ATMS, Ozone Mapping and Profiler Suite (OMPS) and Cloud and Earth Radiant Energy System (CERES).

The SNPP instruments are now undergoing a period of intensive cal/val and the instrument on-orbit performances are stable and the post-launch results all meet or exceed the specifications. The SNPP SDR products have reached the provisional version level at which users can order the data from NOAA archival and perform in-depth scientific research. Also, ATMS and CRIS data have been operationally assimilated into global and regional forecast models and a suite of EDR products are generated from the NPP ground system and NOAA processing system. During the intensive cal/val, the SDR teams have developed many innovative techniques for characterising the instrument performance and improving the bias corrections. JPSS SDR and EDR teams led by STAR have completed critical SNPP cal/val tasks and the most recent SNPP cal/val results will be reported in the JGR-Atmospheres Special Issues. NASA Langley is responsible for the cal/val of the CERES instrument. Recently NOAA sponsored a NASA-led validation airborne campaign to support the absolute calibration of CrIS, ATMS and VIIRS.

NOAA-WP-11: Satellite Data Calibration and Validation: NOAA Report on Satellite Calibration Anomalies and Instrument Performance Monitoring

NOAA Integrated Calibration and Validation System (ICVS) continues to evolve for the monitoring of instrument performance and radiance quality of the NOAA operational satellite instruments. It continues playing a key role in detecting the calibration anomaly, diagnosing the root cause and assessing the impacts of anomalous events. The WP summarises the significant instrument events and calibration anomalies detected and assessed with the NOAA ICVS over the past year.

EUMETSAT-WP-06: Calibration Event Working Group

EUMETSAT-WP-06 summarised the response of EUMETSAT and NOAA to an action from CGMS-40 (Action 40.15) requesting: "*EUMETSAT and NOAA to present a consensus concept and realisation of calibrations events logging system with emphasis on issues and lessons learnt*". In response to this

action, a first assessment of some calibration event logging systems operated by space agencies was made. Based on the outcome of the first assessment, steps were taken towards the definition of standard calibration event types. In collaboration with NOAA, EUMETSAT further modified the high level concept of the satellite calibration event logging system that was presented at CGMS-40. Moreover, EUMETSAT introduced a consensus data model that was developed at NOAA. The robustness of this model was tested with calibration event reports taken from the existing systems in a pilot project. Finally, the WP summarised the issues and lessons learned.

WGII noted that historical event information should be archived along with the datasets themselves, as part of metadata, to enable traceability of the impact of calibration events on the data record and agreed to the following actions:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
GSICS	WGII/3	41.21	GSICS to take on calibration event monitoring activities following the recent work on calibration event monitoring. Such information should be included in the next update of the WMO OSCAR database.	CGMS-42	**OPEN**	HLPP #3.1

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/3	41.22	CGMS agencies to provide WPs on current and future capabilities for calibration monitoring and event logs – CGMS-42.	CGMS-42	**OPEN**	HLPP #3.1

NOAA-WP-12: Consensus concept and realization of a calibration events logging system with emphasis on issues and lessons learned

At recent CGMS meetings, NOAA presented WPs on near-real-time instrument monitoring known as the Integrated Calibration Validation System (ICVS).

The ICVS is accessible to users from its NOAA website, and enable users to access daily assessments of instrument performance. In addition to ICVS, NOAA Office of Satellite Operations (OSO) provides an event log through its websites when a change in status of a satellite and/or instrument occurs. This website informs the public of major changes in the performance of an instrument. ICVS often shows trends that may lead to an event, which would warrant an update to the event log.

The WP illustrates the OSO event log via the POES and GOES Health Status and is also in response to Action 40.15: NOAA and EUMETSAT are invited to present a consensus concept and realisation of calibrations events logging system with emphasis on issues and lessons learned due at CGMS-41.

WGII recommended that historical event information should be archived along with datasets themselves, as part of metadata.

ROSHYDROMET-WP-02: New satellite information products and ground-based validation of space hydrometeorological data

In this document, Roshydromet presented an overview of satellite data and products provided by Roshydromet/SRC Planeta. The objective of operational and research activities in Roshydromet is to use satellite data and products for numerous applications, including operational meteorology, NWP, hydrology, agrometeorology, hazards, water pollution monitoring, and climate research. Examples of products generated by SRC Planeta were shown, including:

- Cloud imagery and analyses (using geostationary imagery from Electro-L, Meteosat and GOES satellites)
- Flood mapping (using data from Meteor-M, Aqua/Terra and POES)
- Forest fire detection (based on data from Meteor-M, Aqua/Terra and POES)
- Sea ice cover mapping in the Russian Arctic sector and Okhotsk Sea (using Kanopus-V No-1)
- Climate studies of sea ice and snow cover (using Okean series and several scatterometer and passive microwave datasets)

The Roshydromet project on calibration/validation system development and implementation was presented, highlighting the priority that Roshydromet places on full quality assessment of its satellite hydrometeorological datasets, especially for the next generation of LEO, GEO and HEO meteorological satellites. The calibration/validation system includes sites providing a range of near-surface and atmospheric sounding measurements (such as Peterhof, Voeikovo, Zotino tall tower facility) and aircraft.

In the framework of GSICS, intercalibration of IR channels of the MSU-GS instrument on Elektro-L with AIRS was realised, showing overall positive results.

WGII enquired on access mechanisms to Meteor-M data through Direct Broadcast, and related pre-processing tools. WGII enquired on access mechanisms to Meteor-M data through Direct Broadcast, and related pre-processing tools. Action 41.18 was agreed, requesting CGMS agencies to provide Direct Read-out-related information (see above).

WMO-WP-25: GSICS progress report

GSICS, an integral part of the CGMS baseline, coordinates systematic generation of inter-calibration products for Level 1 data from satellite sensors. It facilitates greater understanding of instrument absolute calibration, supports global inter-operability, and enables better accuracy and global consistency of Level 2 environmental, climate and weather forecasting products.

In this WP, the Chairperson of the GSICS Executive Panel reported on the progress of GSICS including:

- Outcome of the last Executive Panel session
- Status of GSICS correction products
- On-going research and development
- GSICS product catalogue, format and metadata developments
- On-line plotting application for GSICS products
- Satellite event logging system
- Partnership
- Feedback from the 5th GSICS Users' Workshop (April 2013)

High level priorities for GSICS are:

- GSICS Correction for Current Infrared Channels
- GSICS corrections for heritage instruments
- GSICS Correction for Visible Channels
- Microwave activities (in collaboration with GPM Intersatellite Calibration team)
- General Methodology and infrastructure

Stronger representation of GSICS members is needed in the GSICS Data Working Group (GDWG) to carry out the agreed data management tasks that are necessary to reach a fully operational stage. Active engagement is also needed in the new GSICS Research Working Group (GRWG) sub-groups in order to cover the required fields of expertise.

It was noted that relevant GSICS resources (such as the website) should be registered in the WMO Information System. WGII also emphasised that GSICS, GRUAN and CLARREO were three pillars for generating stable, accurate and SI-traceable upper-air satellite data records. The Working Group noted the uncertainty associated with the realisation of the CLARREO mission and reiterated its importance.

Engaging in GSICS activities is an investment that provides mutual benefits both directly, through improved instrument calibration and interoperability, and indirectly, through the capacity building resulting of the development and sharing of best practices.

CGMS members that are not currently members of GSICS or do not yet actively participate in GSICS are encouraged to take an active role in its future progress through their involvement in GSICS technical activities and governance.

WGII/4 Infrared/MicroWave sounding and ITWG matters

KMA-WP-07: Current status of the satellite data assimilation in KMA

KMA-WP-07 reported on the current status of the satellite data assimilation in the numerical weather prediction at Korea Meteorological Administration (KMA). KMA has been operating the UK Met Office's Unified Model (UM) and data assimilation (4D-VAR) system since May 2010, and now runs forecasts at the same resolution as the Met Office (N512L70. vn7.9). COMS satellite products became available in April 2011, and KMA developed modules to make use of the observations over East Asia. COMS clear-sky radiances (CSR) are now being assimilated operationally, and assimilation of COMS snow cover data is being tested. Furthermore, radio-occultation data (GPS-RO from GRAS on Metop, Grace-A), AMV (COMS) and soil moisture products (ASCAT) are also assimilated. The discussion addressed inter alia the assimilation scheme for soil moisture and snow-cover.

NASA-WP-06: Atmospheric Sounding Product Development and Cal/Val Activities at NASA using AIRS/AMSU on Aqua, CrIMSS on SNPP, and NAST-I on NASA High-altitude Aircraft Platforms

Atmospheric sounding at NASA is a broad based effort to measure, characterise and understand the Earth's atmosphere from ground, airborne and spaceborne platforms. This paper covers recent activities at NASA's JPL, GSFC and LaRC centers in support of the AIRS, CrIS, IASI and NAST-I instruments. The AIRS and AMSU instruments on the EOS Aqua Spacecraft continue to operate well, however loss of channels has been seen. In AIRS, the impact is minimal, and over 50 channels were recovered using redundant detectors.

AMSU loss of channel 5 severely impacted the AIRS/AMSU Level 2 Version 5 products, but the Version 6 mitigates this and other problems and was released in February of 2013 at the GES/DISC. The NASA teams have demonstrated Level 2 retrievals from the CrIS/ATMS (CrIMSS) instruments on the Suomi NPP satellite and have concluded the instrument is of high value to the scientific community.

Comparisons of AIRS, CrIS and IASI have shown excellent radiometric agreement under normal conditions but differences do exist that are being carefully examined. The NAST-I aircraft sounder continues to provide excellent validation of the spaceborne sounders. New retrieval methodologies are being developed and utilised to improve computational speed, accuracy and error estimation. These new retrievals run on all three IR sounder instruments and will form the basis for a next generation retrieval for Version 7. Scientific interest in the sounding instruments remains high with over 100 peer reviewed publications released in 2012 using AIRS data and numerous more with the other sounder instruments.

WGII showed interest in the means for independent validation of AIRS and IASI using aircraft sounders.

WGII/5 Precipitation and IPWG matters

NASA-WP-10-PPT GPM Constellation Coverage and Sampling

NASA provided a short presentation showing the status of plans for the baseline GPM constellation schedule, and a map of temporal sampling (average time interval between overflights) globally by all the contributing missions. It shows that the GPM constellation in 2015 would enable more than 50% of observations being less than 1 hour apart at all latitudes, and that in most regions, observations would be less than 3 hours apart (70% of observations in mid-latitudes, 80% in tropics, 90% in polar regions).

Ad-hoc presentation by Kazumasa Aonashi (IPWG co-chair):

In an ad-hoc presentation to WGII, Kazumasa Aonashi (Meteorological Research Institute, JMA, and IPWG co-chair) expanded on the rationale behind the IPWG-related Action 40.31 ("CGMS members to evaluate the requirement by IPWG for 3-hourly global temporal sampling of satellites including non sun-synchronous platforms"). He pointed out that for the current constellation of precipitation related instruments (MW imagers, conical scanners) included ageing instruments and that there was a risk of future gaps. 3-hourly sampling globally was needed for resolving the diurnal cycle in rainfall events. Correlation between MW imager observation and verification of precipitation decreases rapidly beyond 90 minutes offset.

NASA indicated their readiness to work with IPWG in investigating the impact of a potentially degraded precipitation constellation over the next decade.

EUMETSAT asked whether near-real time data access arrangement were in place for precipitation-related datasets. The Working Group pointed out that CGMS operators should provide improved access to precipitation datasets.

The following actions were agreed:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
IPWG	WGII/5	41.19	IPWG to collect the details of data access arrangements for all GPM constellation contributions, and to document these on the IPWG website. Deadline: CGMS-42	CGMS-42	**OPEN**	HLPP #2.3

WGII/6 Atmospheric Motion Vectors and IWWG matters

EUMETSAT-WP-07: Report from the International Winds Working Group (IWWG): Status of the 2nd Atmospheric Motion Vector (AMV) Inter-comparison study

EUMETSAT-WP-07 provided a report from the International Winds Working Group (IWWG) on the Status of the 2nd Atmospheric Motion Vector (AMV) Inter-comparison study. The WP had been put together by the IWWG co-chairs. The paper summarised the latest status on the progress of the second AMV inter-comparison study being undertaken by the IWWG. A key goal of the study is to learn and understand similarities and differences in AMVs produced at different operational centers, and ultimately, to improve the quality and consistency of the AMV products. Work on this second AMV inter-comparison is well underway. EUMETSAT has successfully prepared the test datasets and the study participants have all successfully generated AMVs from each of the datasets. The analysis effort of the AMV datasets has just started. A final report of the findings will be prepared and presented at IWW12.

EUMETSAT-WP-08: Preparing for the 12th International Winds Workshop

EUMETSAT-WP-08 addressed the preparation for the 12th International Winds Workshop. The biennial International Winds Workshops are the fora used by the International Winds Working Group (IWWG) for co-operation in the operational and research community, and have strongly contributed to the improvement in the quality of the derived wind fields and have enabled the convergence by satellite wind providers toward consistent AMV derivation algorithms based on shared science.

The WP announced the 12th Workshop of the International Winds Working Group (IWW12) to be held in Copenhagen, Denmark from 16-20 June 2014. The workshop will be hosted by the University of Copenhagen.

The WP provides a coherent and continuous perspective by recalling the background of relevant activities as discussed and put into action at earlier CGMS meetings and Wind Workshops. Furthermore, the WP puts forward additional topics for discussion at CGMS-41 in WGII with the suggestion to consider those topics for further elaboration at IWW12.

CGMS-41 was invited to:

i) Discuss in WGII the topics addressed in the WP and other related topics as submitted to CGMS-40 by other CGMS operators;
ii) Advise on priority topics to be addressed at the 12th IWWG; and
iii) Provide support to the next IWW12 meeting by approving participation of scientists and operational staff working on the utilisation and derivation of satellite winds and, if possible to provide some funding to support travel of relevant scientists from the research community.

Following the discussions, the following actions and recommendations were agreed:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
IWWG	WGII/6	41.24	Co-chairs of IWWG to provide a summary paper and lessons learnt to CGMS-42 from the second AMV derivation inter-comparison project.	CGMS-42	**OPEN**	HLPP #3.3

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
IWWG	WGII/6	41.25	IWWG co-chairs to i) organise a dedicated session at IWW-12 on research, operational applications and benefits of high resolution AMVs and ii) to provide a corresponding report to the next CGMS meeting.	IWWG-12 (6 June 2014) CGMS-42	**OPEN**	HLPP #3.3

CGMS-41 recommendations – WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
IWWG	WGII/6 R	41.06	The IWWG-12 is requested to discuss progress on spatially enhanced AMV products using combinations of data from polar orbiting satellites (including sounders).	CGMS-42	**OPEN**	HLPP #3.3
IWWG	WGII/6 R	41.09	The International Wind Working Group (IWWG) to support SCOPE-CM toward the possible development of a unified algorithm for consistent reprocessing of AMVs from geostationary meteorological satellites.	CGMS-42	**OPEN**	HLPP #5.1.3

CMA-WP-06: CMA Progress on AMV Inter-comparison Study

The WP described CMA's participation in and contribution to the AMV inter-comparison study. In accordance with the requirements of the study, the data provided were utilised and the AMVs were derived using CMA's AMV algorithm. The results were submitted in January 2013.

NOAA-WP-27 NOAA's Participation in the 2nd Atmospheric Intercomparison Study

This WP summarised NOAA's participation in the second AMV inter-comparison study being undertaken by the IWWG. NOAA has generated the required AMV datasets using its latest algorithm developed for GOES-R, and looks forward to the analysis of the results at the next IWWG.

Following the discussions, the below action was agreed:

CGMS-41 recommendations – WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	WGII/6 R	41.08	NOAA is invited to consider sustained support to future reprocessing work on GOES and polar AMVs for the benefit of future reanalyses.	CGMS-42	**OPEN**	HLPP #3.3

EUMETSAT-WP-18 Reprocessing of GOES Atmospheric Motion Vectors (AMVs) from 1995 Onwards for NWP Reanalysis Efforts (1/2)

EUMETSAT-WP-18 provided a short power point presentation on the reprocessing of GOES Atmospheric Motion Vectors (AMVs) from 1995

onwards for NWP Reanalysis Efforts performed by the University of Wisconson/CIMSS in Madison under the lead of Chris Velden and Dave Santek. The primary task will involve the reprocessing of GOES imagery from 1995 onward (Phase 1) into AMVs using the latest NOAA/NESDIS operational algorithms. A 2nd phase should soon follow and will include the entire GOES archive period, as well as using the new processing algorithms being developed for GOES-R. Funding for the 2nd phase will be required and will be proposed to NOAA/NESDIS. Echoing the very positive responses that had been obtained already by various international entities, WGII expressed appreciation for this work and noted that the earlier reprocessing of AMVs from GMS/MTSAT and Meteosat have a very positive impact on climate re-analyses.

CGMS-41 Working Group II commended and thanked the University of Wisconsin and the Space Science and Engineering Center (SSEC) for their initiative to perform the first reprocessing of GOES AMVs. This activity does complement the reprocessing work at JMA and EUMETSAT and is highly welcomed by centres conducting global reanalyses for climate applications. WGII stated that such activities need to be recurrent and require a sustained reprocessing framework in the future.

NOAA also agreed to the following action:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	WGII/6	41.28	NOAA to ensure that CIMSS/SSEC AMV reprocessing activity should be embedded into SCOPE-CM AMV project by a communication to the SCOPE-CM Secretariat.	30-Dec-13	**OPEN**	HLPP #5.1.3

JMA-WP-05 JMA's Atmospheric Motion Vectors

JMA-WP-05 reported on the recent status of JMA's AMVs from MTSAT-2 and MTSAT-1R, and outlined responses to CGMS-40 Recommendation 40.22. In accordance with WMO CBS-XIII Recommendation 4 Amendments to the Manual on Codes (WMO-No. 306) Volume I.2, JMA/MSC began disseminating MTSAT-AMVs in the new BUFR Ver. 4 format at 01 UTC on 31 October 2012. In response to CGMS-40 Recommendation 40.22, JMA/MSC computed Meteosat-9 AMVs retrieved using JMA AMV software for the second intercomparison study. The computed AMV dataset was sent to AEMET and is currently under evaluation. JMA/MSC is now developing AMV software for Japan's Himawari-8/9 follow-on satellites. Recent development activities have included the improvement of cloud height assignment based on optimal estimation using three or more channels at the same time. An AMV retrieval experiment based on this method has been performed for a winter season. The results show that IR negative wind speed bias is lower around jet streams but higher over tropical regions. The cause of this erroneous increase for the tropics is under investigation.

With regard to cloud physics for height assignment scheme, a question was raised for its improvement. JMA is considering implementing the detailed

cloud physics model based on 16-channel observations from Himawari-8/9. The discussion also addressed difficulties to assess the effectiveness of the height assignment scheme and tracking scheme for the mitigation of errors.

KMA-WP-05 Current status of Atmospheric Motion Vector at KMA

KMA-WP-05 described the current status of Atmospheric Motion Vector (AMV) at KMA AMVs from COMS images are produced with a target box of 24x24 pixels (T24) and used in NWP data assimilation operationally since December 2011. Currently a tracking method using a Target box of 16x16 pixel (T16) and the nested tracking method developed by NOAA were introduced aiming at a reduction of the slow bias in high level AMVs. As the number of low-level AMV derived with the T24 target box are not enough to modify the NWP field, a new tracking method is required in order to increase the number of low level AMV which is known to make a potentially important contribution in regional NWP models.

The WP also addressed a comparison between the operational AMVs and AMVs derived with a smaller target box aiming at the reduction of slow biases at high altitudes. KMA has started to derive HRW (High Resolution Wind) with a software using the NWC SAF HRW module (NWC SAF: Nowcasting Satellite Application Facility of EUMETSAT). Cloud information at pixel level is needed for the height assignment (CCC height assignment).

In the discussion KMA confirmed their participation in the 2nd International AMV Intercomparison.

NASA-WP-05 Global Wind Measurements from Earth Orbit: AMVs and Development of Doppler Lidar Systems

Atmospheric motion vector (AMV) measurements have become indispensable in numerical weather prediction (NWP), and NASA continues to play a vital role in improving global wind products and developing new observing capabilities. From the joint NASA/NOAA GOES project to the advanced MODIS and MISR instruments on NASA's EOS satellites, the coverage of AMVs from cloud and water vapor features continues to improve from GOES AMVs at low-and-middle latitudes to MODIS polar winds. MISR employs a novel stereoscopic technique to derive global cloud motion vectors (CMVs) at a vertical resolution better than other AMVs. A recent study shows that the assimilation of NASA/JPL MISR CMVs on the NRL Global Atmospheric Prediction System produces a significant positive impact. The MISR CMV rank 7th on a per-observation basis in terms of global tropospheric moist total energy error norm. In addition, NASA has been developing spaceborne Doppler lidar technologies to enable wind remote sensing from space. The Doppler lidar would provide one or more wind vertical profile "sheets" per orbit that would cover surface to lower stratosphere. The data product would be horizontal vector wind, wind turbulence, and relative aerosol backscatter. The status of this development is reviewed.

NASA noted that increasing recognition of the importance of reprocessing MISR winds within NASA has enabled this activity and encouragement by the IWWG helped facilitating this.

Following the discussions a recommendation was raised:

CGMS-41 recommendations – WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NASA	WGII/6 R	41.07	NASA is requested to provide a summary paper to CGMS-42 on Cloud-Motion Winds from MISR. The paper should include the potential of the product for NRT application in NWP and also describe efforts to provide the product for re-analyses.	CGMS-42	**OPEN**	HLPP #3.3

Based on an intervention by IOC/UNESCO, the Working Group recommended that the IWW address ocean surface vector winds matters at its next workshop. The IOC delegate (David Halpern) volunteered to assist in this effort. It was recognised that the CEOS Ocean Surface Vector Winds constellation and the International Ocean Winds Working Group provide platforms for discussing this subject.

WGII/7 Radio occultation and IROWG matters

Anthony Manucci (NASA, IROWG rapporteur) provided a short report on issues related to the GNSS-RO constellation and data access. He briefed on three CGMS-40 Actions pertinent to IROWG: Actions 40.6 (on GNSS-RO impact studies); 40.23 (on GNSS-RO constellation and liaison with CEOS agencies); and 40.41 on the use of GNSS-RO-based data for ionospheric monitoring. EUMETSAT informed WGII that they look into funding a study in 2014 to update and refine user requirements for GNSS radio-occultation-based datasets (e.g. number of occultations/day, distribution in space). There would be an opportunity to liaise with CEOS agencies at the CEOS plenary in late 2014. Information on international participation and objectives of the upcoming IROWG-3 workshop (5-11 September 2013, near Graz, Austria) was also provided. The use of GNSS-RO for for ionospheric monitoring will be discussed in an IROWG sub-group during the workshop, addressing CGMS-41 Action 40.41.

Regarding the GNSS-RO constellation timeline, he highlighted the imminent data gap in ROs in high latitudes, and data gap filling opportunities offered by the ROSA instrument and planned commercial and research satellites. The liaison with CEOS agencies would provide potential opportunities in regard to data access. A project on RO-CLIM has been submitted for the second phase of SCOPE-CM.

CMA noted that the FY-3 series will have RO instrument on board from FY-3C (September 2013) onwards. WGII encouraged participation in IROWG-3 of representatives from China, India and Russia.

WGII/8 Cloud and ash/dust related matters

EUMETSAT-WP-05: Cloud Retrieval Evaluation Working Group

EUMETSAT-WP-05 addressed the work of the Cloud Retrieval Evaluation Working Group (CRE WG). With a view to consider the CRE WG as a future International Science WG under CGMS it was recalled that cloud parameter retrievals are used increasingly in data assimilation for Numerical Weather Prediction (NWP), regional now-casting especially for severe weather forecasting, cloud-chemistry modelling, climate monitoring and more. These developments have led to an increasing interest of space agencies to make cloud detection and cloud parameter retrievals part of their operational services.

There is a need at CGMS space agencies for a mechanism that facilitates access to and sharing of knowledge, commonality of approaches, requirements, and training on cloud parameter retrievals. The International Cloud Working Group within CGMS that is presented in this WP aims to provide such a mechanism.The proposal for a new WG intends to provide a forum for space agencies to seek coherent progress in science and applications and also to act as bridge between the space agencies and the cloud research community.

In line with the established of the four CGMS International Science WGs the CRE WG plans to serve as a forum: i) to exchanges and enhance the knowledge on state-of-art cloud parameter retrievals algorithms; ii) to stimulate support to trainings on cloud parameters; and iii) to encourage space agencies and the cloud research community to use and share commonality algorithms. The paper also informed that the 4th Cloud Retrieval Evaluation Workshop will be held in Grainau, Germany from 4-7 March 2014. The members of CGMS are cordially invited to attend this workshop.

WGII noted that an important component of these CREW workshops was the comparison of passive imager cloud parameter retrievals by the various teams and their validation against active sensor measurements.

Comparison of different cloud mask algorithms show significant differences (up to 30%). Although user demand for cloud products is dependent on applications, comparability is desirable. Lessons learned from the ESA Cloud_cci project across other ECV_cci project needs for cloud retrievals should be taken on board by the CREW.

The following actions was agreed as a consequence:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CREW	WGII/8	41.27	Co-chairs of CRE WG are invited to draft the ToR for a CGMS Working Group on operational cloud parameter retrievals, jointly with the nominated points of contact from CGMS agencies. Due date CGMS-42.	CGMS-42	**OPEN**	HLPP #3.3

EUMETSAT-WP-19-PPT: Status of Volcanic Ash Product Activities at EUMETSAT

EUMETSAT-WP-19 presented the ''Status of Volcanic Ash Product Activities at EUMETSAT" in respons to Action 40.24: EUMETSAT, JMA and NOAA are invited to report on their development toward common and consistent volcanic ash products from Meteosat and MTSAT-2 and GOES, respectively. EUMETSAT has procured through a study a simple 'two-channel algorithm' for quantitative applications (method by F. Prata). This two-channel algorithm is currently operational. It is clear that the current EUMETSAT operational product can and will be enhanced using the full capability of MSG. This is a step toward realising the future perspective when most CGMS agencies will fly similar (or the same) multi-channel imagers on their near-future geostationary satellites. This presents another opportunity to develop consistent products from different geostationary satellites for the benefit of the global user community. Furthermore, complementary activities on ash cloud retrievals from polar orbiting satellites were recalled.

JMA-WP-06: Cloud, volcanic ash, yellow dust products for Himawari-8/9

This three-part report describes JMA products related to cloud and aerosols. The first section covers JMA's development of cloud mask, cloud type and cloud top height data as fundamental products for its next-generation Himawari- 8/9 satellites. These will be based on the NWC-SAF algorithm for MSG with different threshold values. Partial introduction of the NOAA/NESDIS algorithm into JMA's algorithm is also expected. The Agency plans to use these products both in weather analysis and in the computation of other products.

The second section reports on the development of volcanic ash products for MTSAT and Himawari-8/9 in response to Action 40.24. JMA/MSC plans to introduce two different volcanic ash algorithms from EUMETSAT/MSG and NOAA/NESDIS/GOES-R, and to provide both of them to the VAAC in Tokyo. At the end of 2012, JMA introduced a look-up table (LUT) from EUMETSAT by which brightness temperature difference data are converted to indicate physical quantities of volcanic ash, and developed a programme to apply the LUT to data from MTSAT. The algorithm used was adjusted using MTSAT-2 data when volcanic ash was emitted from Mt. Shinmoe in January 2011. The programme is now running in pre-operation mode.

The third section details the development of Aeolian dust products for Himawari-8/-9. To support the monitoring of this phenomenon, JMA generates

two products using visible and infrared data from MTSAT. The Agency has also developed an algorithm as a follow-on from the current one for visible data based on a NOAA/NESDIS/GOES-R algorithm. As an algorithm for infrared data, JMA is preparing to introduce the NOAA/NESDIS/GOES-R volcanic ash algorithm, which is applicable to Aeolian dust with coefficients recalculated for dust.

It is recognised that relative comparison of volcanic ash retrievals from multi-algorithms to be operated in VAAC will be useful to share in science communities, because there is little observation to validate volcanic ash products from satellite. CGMS agencies should compare each retrieval result from incidents of volcanic ash eruption with each algorithm in the framework of SCOPE-Nowcasting. It is also recognised that the importance of sharing the in-situ and surface remote sensing data for ash cloud monitoring for the validation among related countries.

The development of cloud products and volcanic ash products for Himawari-8 and FY-4A is underway and should be subject to discussions within SCOPE-Nowcasting.

As a consequence, JMA agreed to the following action:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
JMA	WGII/8	41.26	JMA to establish an environment to implement multiple algorithms to retrieve quantitative ash cloud parameters from operational satellites. This will serve as a test bed for the intercomparison of retrievals on an operational basis in the framework of SCOPE-Nowcasting. JMA is invited to perform an intercomparison based on historical data and report on this to CGMS-42.	CGMS-42	**OPEN**	HLPP #3.3

KMA-WP-09: Volcanic ash product using COMS data

KMA-WP-09 reported on the volcanic ash product from COMS. The WP provided a description of volcanic ash product which is derived from the COMS imager Infrared channels. WGII was informed that KMA/NMSC not only developed their own volcanic ash algorithm but also introduced a similar algorithm from EUMETSAT based on a method devised by Fred Prata. In order to optimise the volcanic ash algorithm from EUMETSAT as well as the KMA/NMSC algorithm, KMA/NMSC will cooperate with EUMETSAT. The current methods are evaluated on the Shinmoedake case. Tests of spatial consistency are performed to remove false signals and to evaluate optical depth and mass loading as well as the height of the volcanic ash plume.

As for the future KMA stated that a volcanic ash product is included in the plan for the data processing system of Geo-KOMPSAT-2A. WGII discussions touched upon the use of various volcanic ash retrieval methods and their strengths and weaknesses. The SCOPE-Nowcasting initiative serves as an international framework for intercomparison of such methods among CGMS operators, including product comparison and error characterisation. NILU

indicated its willingness to share validation data obtained from ground-based sites, lidar and aircraft.

NOAA-WP-17: Cloud and Ash/Dust related Matters: VIIRS Cloud Products and Performance

Clouds are the dominant feature of the Earth when viewed from space at most frequencies in the visible through the infrared spectrum. Knowledge of the properties of clouds is critical to understanding the transfer of energy through the atmosphere and provides insight into precipitation, convection and many dynamical processes. The Suomi National Polar Orbiting Partnership (S-NPP) represents the next generation of American polar orbiting meteorological satellites. The prime instrument for the observation of clouds on S-NPP is the Visible Infrared Imaging Radiometer Suite (VIIRS).

In the second year of operation, the JPSS cloud group has made progress in several of the cloud algorithms. First, the VIIRS cloud mask has achieved Provisional Status in early 2013 and updates are continuing to flow into the system. The major deficiencies in the Daytime Cloud Optical Properties Algorithm (COP) have been solved by substituting the original lookup with one generated by NOAA. In addition, several bugs and code improvements were implemented into the IDPS cloud height routine. Cloud phase thresholds were also updated in April 2013 for the first time. The cloud products achieved Beta status in June 2013. In addition, NOAA is developing independent cloud algorithms based on its GOES-R research and these products will be available operationally late 2014.

In connection with volcanic ash products, the discussion highlights the complementary value of tailored cloud masks. SCOPE-Nowcasting serves as a WMO-sponsored framework for the intercomparison of satellite-derived volcanic ash products, this has been recognised as a pilot project within SCOPE-Nowcasting. The first meeting of SCOPE-Nowcasting is planned for November 2013 in Geneva, Switzerland.

NOAA-WP-18: NOAA Activities: Volcanic Ash Report
Towards full utilization of the space-based observing system for volcanic ash cloud monitoring

No single satellite sensor (past, current, or future) has the optimal spectral, spatial, and temporal attributes to effectively detect and characterise all types of volcanic ash clouds. In addition, traditional “split-window” ash remote sensing techniques are prone to numerous false alarms (especially when applied globally). They can not detect all ash clouds that can be manually identified in multi-spectral imagery (without further increasing the false alarm rate); not be applied to the current GOES imaging sensors; and do not provide information on the spatial pattern of ash cloud height. In an effort to address some of the major limitations of current ash cloud remote sensing techniques, NOAA is developing a fully automated, globally applicable, integrated system for detecting and characterising clouds that contain

volcanic ash (running in prototype mode since May 2013). The NOAA system aims to utilise the full spectral, spatial, and temporal capabilities of every individual low Earth orbit and geostationary meteorological satellite sensor and, optionally, integrate information from multiple satellite sensors. Thus far, NOAA has demonstrated that an approach that more heavily leverages the full capabilities of meteorological satellite sensors adds considerable value (e.g. previously unnoticed ash clouds were identified with very few false alarms) and can be applied to near real-time low Earth orbit and geostationary satellite data with global coverage. Currently the NOAA team at the University of Wisconsin provides automated email alerts to subscribers on potential volcanic eruptions.

WMO-WP-07: WMO and ICAO Activities on Volcanic Ash

This WP reports on WMO and ICAO activities related to volcanic ash, and more specifically on anticipated data requirements for international civil aviation operations in volcanic ash-affected airspace. The WP includes a description of (i) recent developments in the International Airways Volcano Watch, and scientific workshops on volcanic ash and aviation, and (ii) expected emerging requirements for providers of data on atmospheric aerosols and ash content.

The WP was submitted to the CGMS secretariat on 17 April 2013 in response to CGMS Recommendation 40.25.

In summary, the following milestones apply:

- Current ICAO Annex 3 Requirements in Amendment 76 stress the need for better ash detection and forecasts;

- The 10-15 March 2013 WMO/IUGG Volcanic Ash Scientific workshop provided an opportunity for the science community to compare and align methodologies and processes employed by different groups;

- The 2nd WMO/IAVCEI Workshop to be held 18-20 November 2013 in Geneva on Volcanic Ash detection and modeling aims at further refinement of volcanic ash detection and forecasting techniques;

- Following the planned engine ash sensitivity tests in 2014, the operational establishment of quantitative detection and prediction methods will likely be required;

- The ICAO Annex 3 Requirements are expected to include quantitative ash load products as of November 2016.

WGII noted that ash mass loading (“dosage”) was a key parameter of interest for aviation since it is the result of integrating ash concentration over the path length an engine propagates in ash-contaminated airspace.

WGII/9 Ocean parameters

GUEST-WP-01: Towards a sustainable high-resolution SST measurement system

WGII for High Resolution Sea Surface Temperature (GHRSST) is the international expert group for the provision and application of satellite-derived SST data, and offers a suite of global high-resolution SST products, operationally in near-real-time, on a daily basis, to support operational forecast systems and the broader scientific community.

GHRSST SST products rely on a combination of low-Earth orbit infrared and microwave imagery, geostationary orbit infrared imagery, as well as in situ data from moored and drifting buoys. Many of the satellite instruments providing data for GHRSST are meteorological satellites coordinated by CGMS.

As part of its user requirements review, GHRSST has identified gaps in SST measurement capability that need urgent attention if a sustained high resolution SST measurement system is to be provided in order to support the user needs. This report for the CGMS briefly summarises the views of GHRSST on what is needed to ensure a sustainable high resolution SST measurement system for operational forecast systems.

JAXA, on behalf of the GHRSST Science Team, introduced their activities, summarised their views on what is needed to ensure a sustainable high resolution SST measurement system for operational forecast systems, and indicated the willingness to collaborate with the CGMS agencies in the preparation for the white paper “Sea Surface Temperature Constellation: Vision for 2025”.

WGII discussed the GHRSST data format based on netCDF and the CF metadata convention. CGMS members generating SST datasets should consider adopting the GHRSST data format since it represents a well-accepted community standard. The necessity to understand error characteristics of SST datasets was also highlighted.

WMO pointed out that development of the white paper should be coordinated with the planning process of the Vision for the Global Observing System in 2025.

In concluding the discussions the following recommendation was made:

CGMS-41 recommendations - WGII					
“Actionee”	**Action**	**#**	**Description**	**Deadline**	**Status**
CGMS space agencies	WGII/9 R	41.10	CGMS agencies to assess the GHRSST data specification (GDS, https://www.ghrsst.org/files/download.php?m=documents&f=121009233443-GDS20r5.pdf) for applying to SST data, and to report to CGMS-42.	CGMS-42	**OPEN**

CMA-WP-07: Validation of FY-3B Sea Surface Temperature Product

CMA-WP-07 reported on the validation of the FY-3B Sea Surface Temperature Product. The National Satellite Meteorological Center (NSMC) currently uses the Nonlinear Sea Surface Temperature (NLSST) algorithms to estimate the sea surface temperature (SST) with the FY-3B satellite Visible and Infrared Radiometer (VIRR) data. Based on the match-up database (MDB), the standard deviation between the FY-3B VIRR SST and the in-situ is 0.5° C or less. Comparing with Daily OISST, the standard deviation is about 1.5° C.

ESA-WP-03: Some results from the ESA Earth Explorer Missions GOCE, CryoSat-2 and SMOS

ESA-WP-03 informed CGMS about some outstanding results from the Earth Explorer missions GOCE, CryoSat-2 and SMOS. In orbit since March 2009, the Gravity field and steady-state Ocean Explorer (GOCE) is measuring Earth's gravity field with unprecedented detail to advance our understanding of ocean circulation, sea-level change and Earth-interior processes. Launched on 2 November 2009, SMOS is the second Earth Explorer Opportunity mission to be 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.

WGII briefly discussed the issue related to transitioning research capabilities, such as SMOS, into a continued service. ESA noted that the Sentinel and Jason missions were successful examples for such transitions.

WMO noted the excellent Satellite Soil Moisture Validation and Applications Workshop, co-sponsored by ESA, EUMETSAT, WMO, GEWEX and GCOS and held at ESA ESRIN on 1-3 July 2013, providing an overview of the state-of-the-art in observing and applying soil moisture information using satellite and in-situ systems, and modelling frameworks. A follow-up workshop is planned for 11-12 July 2014 at the University of Amsterdam, Netherlands.

It was noted that COSPAR has supported training events related to soil moisture.

EUMETSAT-WP-14: Ocean Colour community requirements for data format and utilisation as captured at the IOCS meeting

EUMETSAT-WP-14 addressed requirements from the Ocean Colour community for data format and utilisation as captured at the recent

International Ocean Colour Science Meeting 2013 held in Darmstadt, Germany 6-8 May 2013. The meeting was convened by the International Ocean Colour Coordinating Group (IOCCG), and sponsored by EUMETSAT, NASA, ESA and CNES. During the meeting a splinter session on "Satellite Data File Formats and Tools for Easy Science Exploitation" was held. The WP presented a summary of the discussions and recommendations formulated. Discussions in WGII led to the following recommendation:

CGMS-41 recommendations – WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS space agencies	WGII/9 R	41.11	CGMS agencies to support the ocean colour community by adopting netCDF4/CF for representing ocean colour data; and further support data analysis tools (such as SeaDAS, BEAM and ODESA), and optimise the dissemination of ocean colour datasets for research and operational applications.	CGMS-42	**OPEN**	HLPP #3.4

NASA-WP-02: An Optimization Analysis of the GCOM-C1 and Sentinel-3A Missions for Improved Ocean colour Imaging Coverage

The Committee on Earth Observation Satellites (CEOS) System Engineering Office (SEO) was asked to examine the coverage capabilities of a virtual satellite constellation consisting of Global Change Observation Mission - Climate (GCOM-C1) and Sentinel-3A and to determine what realistic steps could be taken to improve the daily coverage available for ocean colour imaging. The design orbits of the satellites appear to be well matched but the difference in orbit repeat cycle causes significant periods of complete overlapping coverage to appear. With minor adjustments to the planned orbit of GCOM-C1 (4 km altitude, 2 minutes in Local Time of Descending Node), the constellation can maximise the daily coverage potential and remove the oscillations in relative spacing between adjacent swaths that create periods of poor coverage. However, both creating and maintaining the enhanced coverage pattern will require launch and orbit insertion coordination between GCOM-C1 and Sentinel-3A as well as tighter orbit maintenance than either mission team is currently planning. With the addition of Sentinel-3B, a further optimisation can be applied to the constellation to provide full, daily global coverage or GCOM-C1 can return to its original design orbit as most of the benefit of the formation flying would be lost.

The COVE tool maintained by the NASA System Engineering Office http://www.ceos-cove.org was used for this analysis.

WGII discussed with interest the utility of this tool for optimising ocean colour mission planning, and more generally, for CGMS contingency planning. NASA SEO should make available background information on the COVE tool.

The following action was agreed:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NASA	WGII/9	41.30	NASA is invited to pursue the analyses of optimising the orbits of GCOM-C1 and Sentinel-3A, including trade-offs to be made for different scenarios. Due date CGMS-42	CGMS-42	**OPEN**	HLPP #1.1.6

NASA-WP-04: NASA Global Ocean General Circulation Model Activities

An important aspect of NASA's comprehensive approach to generate new knowledge about weather and climate of the integrated global Earth system is assimilation of satellite and in-situ observations into global ocean general circulation models (OGCMs). Accurate description of ocean conditions is especially challenging because the ocean is undersampled. No single OGCM and data assimilation scheme would adequately achieve all NASA tasks. At the Jet Propulsion Laboratory (JPL), the focus is on optimal statistical state estimation of oceanic conditions since 1992. The Goddard Space Flight Center (GSFC) emphasises ocean reanalysis for seasonal and decadal prediction of coupled ocean-atmosphere phenomena and the Goddard Institute for Space Studies (GISS) motivation is centennial-millennial predictions of the global integrated Earth system in response to changes in key climate drivers, such as greenhouse gases. Amount of data assimilated varied from none (GISS) to some (GSFC) to almost everything (JPL). An example of complementarity is illustrated with tropical currents in the Pacific Ocean.

Global ocean general circulation modeling combined with assimilation of satellite and in-situ measurements is a valuable instrument for weather and climate applications, and requires support of Coordination Group for Meteorological Satellites (CGMS) members for increased computing capacity and capabilities and reprocessing of ocean and atmosphere weather datasets for climate quality accuracy and precision.

NASA's approach has four elements: i) developing new techniques for assimilation of satellite and in-situ measurements into an OGCM; ii) improving the representation of physical processes in OGCMs and their interactions with chemistry and biology; iii) enhancing computational numerical recipes; and iv) analysing results.

NOAA-WP14: Understanding the carbon cycle continue to coordinate infrastructure development to calibrate and validate the Suomi NPP ocean colour satellite observations

Between 2012 and 2014 NOAA CoastWatch is providing independent validation and access of VIIRS ocean colour data for NOAA's operational product and services. CoastWatch is focusing on the following four components.

a. Independent Quality Assessment: Work was completed in initiating and completing a user driven independent quality assessment according to

protocols established in consultation with NOAA's operational users. The CoastWatch Team provided a recommendation in April 2013 to utilise the IDPS based production system for open waters. However IDPS based chlorophyll-a data retrieved from coastal waters, specifically in the Gulf of Mexico, are still uncertain and will be evaluated again in spring 2014 after vicarious calibration using MOBY is applied in the operational IDPS product generation system. Meanwhile CoastWatch is providing ocean colour products in coastal region using NASA's L2GEN algorithm, which uses MOBY derived vicarious calibration.

b. Expand NOAA Operational Use/Users: Significant expanded use of ocean colour data in at least the following areas: NMFS/fisheries management models, input to NWS/NCEP models, and production of HAB products for NWS/OPC (all U.S. coastal areas) has begun. Use of VIIRS ocean colour for hazards management (oil spills, etc) will be pursued in over the next year.

c. Develop/deploy Next Generation VIIRS Distribution Portal: Develop and deploy a next generation community consensus data portal including expanded data search and retrieval features and (human) user support.

d. Develop/Deploy User Requested Ocean colour Products: The national and international ocean colour community has come to expect the routine availability of a large array of time and geographically binned products. NOAA will develop these products and prototype their distribution via NOAASTAR access assets.

WGII/10 Other parameters and products

CNSA-WP-03: Summary of application for the environment and disaster small satellite constellation in environmental protection

Since CNSA has launched the HJ-1 satellite series, they have played an important role in environmental and civil protection applications. The payload involves wide cover and multispectral sensors and an infrared camera. The series is operated in support of the China Ministry of Environmental Protection. Applications include monitoring of forest fires, air pollution and haze, urban heat island effects, water pollution, and earthquake emergency response. In some applications, data from other satellites (e.g. MODIS) has been used.

Regarding targeted data acquisition in case of disasters (e.g. SAR imagery), WGII noted the mechanism provided by the International Charter for Space and Major Disasters, to which many CGMS members are signatory parties.

On the question of responsibility for providing air quality information in China, CNSA and CMA pointed out their different but complementary responsibilities

and noted that the China State Council had established a data sharing and information mechanism.

WGII also noted that deriving ocean colour at 30 m horizontal resolution from the HJ-1 multispectral CCD may be impacted by a low signal to noise ratio.

CNSA-WP-04: Application capability assessment of the CNSA satellite systems and future requirement

This WP described how the China National Space Administration (CNSA) used the WMO OSCAR database as a starting point to assess the observation capability of the CNSA Earth observing systems, as well as the degree to which they meet user application requirements. This is in response to user demand in the areas of land, natural disaster monitoring and evaluation, macroscale resource and environment investigation, land and resource protection, agriculture, and ecosystem environment. Categories of requirements that define temporal and spatial resolution are: Resource investigation, dynamic monitoring, and fast response. Sensor characteristics are defined along spectral, spatial, radiometric, calibration, observation, and other features. Variable-based analyses are planned.

The following recommendation was placed:

CGMS-41 recommendations – WGII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CNSA	WGII/3 R	41.04	CNSA to participate in GSICS in recognition of their framework to map sensor performance to application requirements.	CGMS-42	**OPEN**	HLPP #3.1

NASA-WP-08: A Report on NASA Activities That Strengthen Capacity to Use and Apply Earth Science Data and Products for Submission to the 41st Meeting of the Coordinated Group for Meteorological Satellites

This WP summarises activities within the National Aeronautics and Space Administration (NASA) Earth science division that are intended to strengthen the capacity of partners and end-users to use and apply Earth science data and products. One of the aims of the WP was to stimulate discussion on potential points of synergy between NASA and Coordination Group for Meteorological Satellites capacity building activities. NASA's Earth science division sponsors programmes and projects that strengthen the ability of decision makers, community leaders, scientists, and resource managers in the United States and abroad to access and apply Earth observations. More information about each project can be found in the WP.

NASA stressed that synergy should be exploited between its various capacity building activities and the WMO/CGMS Virtual Laboratory for Education and Training in Satellite Meteorology. Identification of a focal point with NASA would be useful.

NASA-WP-09: The Terrestrial Reference Frame

The terrestrial reference frame (TRF) is the foundation for virtually all space-based, airborne and ground-based Earth observations. Positions of objects are determined within an underlying TRF and the accuracy with which objects can be positioned ultimately depends on the accuracy of the reference frame. The TRF also allows different spatial information, such as imagery from different space and airborne platforms, to be geo-referenced and aligned with each other. Providing an accurate, stable, homogeneous, and maintainable terrestrial reference frame to support numerous scientific and societal applications is one of the essential goals of the International Association of Geodesy's (IAG's) Global Geodetic Observing System (GGOS) and of NASA's contribution to it, the Space Geodesy Project.

This WP discusses the importance of geodetic measurements and the reference systems determined from them to satellite observations of the climate system. Uncertainty in the terrestrial reference frame had no impact on weather applications, but was significant when estimating climate trends, for example sea-level rise.

It was asserted that the accuracy and stability of the terrestrial reference frame needs to dramatically improve in order to fully realise the measurement potential of the current and future generation of Earth observing satellites.

WGII noted that CGMS-39 had agreed on the Recommendation that "CGMS satellite operators [..] adopt the World Geodetic System (WGS84) and Earth Geodetic Model (EGM-96) geographical reference systems for the normalised geostationary projections in all future geostationary systems and related products, and inform the users accordingly" (CGMS-39 Recommendation 39.34).

More generally, WGII recognised that CGMS operators were relying in many respects to a range of (mostly in-situ) supporting networks without having direct control over these systems. These include the Global Geodetic Observing System (in this case), the Global Atmosphere Watch networks, the ground-based Global Observing System, and the GCOS Reference Upper-Air Network. For the institutions supporting these systems, it is important that CGMS member manifests their support.

ROSCOSMOS-WP-02: Special-purpose equipment hydrometeorological and Oceanographic maintenance of Space complexes "Meteor - 3м" and "Meteor-MP"

In this WP, Roscosmos provided an overview of the planned Russian polar-orbiting hydrometeorological and oceanographic satellite system consisting of the Meteor-M No2, 2-1, 2-2, Meteor-MP No 1, 2 and the oceanographic Meteor-M3 satellites. It also included the suite of planned instruments on these satellites.

WGII appreciated the presentation by ROSCOSMOS and noted that the WMO OSCAR database provided a comprehensive community information resource on satellite systems. Some discrepancies between content in OSCAR and the presentation were noted.

As a consequence of the discussions, Roscosmos and Rosydromet agreed on the following action:

CGMS-41 actions – WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
ROSH/ROSC	WGII/12	41.31	ROSCOSMOS/ROSHYDROMET to verify information on its Meteor-M missions in WMO OSCAR database (http://www.wmo.int/oscar). Deadline: 1 Sep 2013	01-Sep-13	**OPEN**	-

ROSCOSMOS-WP-01: Systematisation urgency of the radio waves reflection features for various types of terrestrial sites and their contrasts

This paper described the need for reference information on radar wave reflection characteristics for different types of natural terrestrial sites. Roscosmos and other SAR instrument operators experience a lack for updated and representative reference data. This poses challenges to the qualitative classification of imagery, negatively impacting the final product. In short, reference information for validating SAR missions is required.

This is in the context of the Severyanin-M SAR instrument on Meteor-M, used for monitoring ice conditions and forest monitoring.

WMO-WP-11: PSTG Update

During 2012 and 2013, the Polar Space Task Group (PSTG) and its SAR Coordination Working Group developed and initiated a coordinated space agency response to observation requirements expressed by the ice sheet science community. Following a detailed 2013-2016 acquisition plan developed by WGII, coordinated SAR imagery using multiple space agency sensors covering Antarctica, Greenland, Svalbard and the Canadian Ice Caps is being recorded. The goal of the campaign is to achieve full interferometric coverage of these areas (or a large portion) for at least three consecutive years. Data acquisitions continue and currently involve CSA, ASI, DLR, with the perspective to also use upcoming ESA and JAXA sensors.

Quasi-continuous time series are especially needed in regions of rapid change such as the West Antarctic Ice Sheet and the fast-flowing glaciers in coastal regions of Greenland. NASA and ESA are supporting projects to provide continent-wide geophysical products based on the SAR data. ASI has invited a science call for Italian SAR data through ESA, and ice sheet related proposals are being submitted.

The dataset is expected to provide a significant improvement in monitoring and understanding ice sheet dynamics and mass balance, to contribute to further understanding interannual variability in ice sheet mass and its impact on sea level.

Needs of other polar and cryosphere-related users were considered for agency action by PSTG at its third session in May 2013 (snow, permafrost, WWRP polar prediction project).

WMO-WP-12: The WMO 2012 Survey on the Use of Satellite Data

The World Meteorological Organization (WMO) has undertaken the 2012 WMO Survey on the Use of Satellite Data to collect information on the availability and use of satellite data and products by users globally, and to identify any areas for improvement and remedial action.

The total number of valid responses received was 227 (originating from 95 WMO members) provided by National Meteorological and Hydrological Services (NMHS), other operational governmental institutions, and from institutions with a research/academic mandate.

Target audience of the survey were users in NMHSs of the 189 WMO member states and territories (at time of Survey), as well as other satellite users worldwide active in the fields of meteorology, climate, hydrology, disaster risk reduction and related environmental applications.

Key results from the survey include:

- Increasing utilisation of satellite data in member countries;
- Increasing relevance of satellite data recognised for a wide range of applications (nowcasting, aviation, atmospheric composition);
- Importance of satellite data for climate applications is perceived as equally important as for weather applications;
- Users increasingly demand high-resolution data and products;
- Overall improved access to data, facilitated by data policies and the enhanced role of the internet as a data dissemination mechanism;
- The key relevance of data from research/demonstration missions for operational purposes has been confirmed;
- There is increasing availability and use of commercial data;
- Easier access and guidance should be provided to satellite products

- Satellite data formats should be harmonised and simplified, for platform-independent use;

- Many users are insufficiently prepared for the new generation of operational satellites planned for 2014-2020;

- Targeted and continuous training is required to build and maintain human capacity;

- Future surveys should be conducted by Region on a 2-3 year basis, complemented by WMO-led global surveys on a 4-5 year basis;

Full Report: http://www.wmo.int/pages/prog/sat/documents/SAT-PUB_SP-9-Survey-Report-2012.pdf

WGII appreciated the availability of the survey.

WMO-WP-20: Satellite applications for agriculture

One of the main activities of the WMO Agricultural Meteorology Programme (AGMP) is to provide coordination and training for WMO members including on remote sensing applications for agriculture and drought. Recently there have been several training and project activities related to satellite products and their use, such as:

- WMO/EUMETSAT/GMA Land SAF/Satellite Products Training Course on the Use of Satellite Products for Agrometeorological Applications in Accra, Ghana, 10-14 June 2013;

- Agricultural Meteorology and Soil Moisture Applications Pilot Projects in Africa - based on MODIS products;

- Participation in the IIASA/ZAMG project “Farm Support: Demonstrating the Potential of EO-derived Soil Moisture and Weather Forecasts in Farmer Decision Support and Crop Modeling”; and

- Participation in the G20 GEO Global Agriculture Monitoring Initiative (GEO -GLAM).

Furthermore, WMO along with the United Nations Convention to Combat Desertification and FAO organised the High Level Meeting on National Drought Policies (HMNDP) in Geneva, Switzerland on 11-15 March 2013 with 414 participants from 87 countries.

The HMNDP approved the Final Declaration which stated the need to enhance global observation networks and delivery systems for drought monitoring. The Integrated Drought Management Programme (IDMP) was established at the meeting. Therefore, satellite and remote sensing

applications will be an important component of drought information delivery systems which include monitoring and early warning systems.

ECV Inventory

Mitch Goldberg briefed WGII on the ongoing work by CGMS members on a comprehensive inventory of ECV datasets and related Fundamental Climate Data Records. The inventory is an important element in the Architecture for Climate Monitoring from Space.

It was noted that collection of information on long time series of satellite datasets was continuing, and that it was too early for a comprehensive assessment of metadata quality in the inventory, and overall maturity of the products. CGMS operators are encouraged to enter relevant information, as per CGMS-40 recommendation 40.17. The inventory is available at www.ecv-inventory.com. Data entering arrangements for CGMS members need clarification on the part of the NASA System Engineering Office who built the online inventory on behalf of the task team on the Architecture for Climate Monitoring from Space.

WGII/11 Review and updating of the HLPP

The co-chairs recalled the 2013-2017 CGMS High-Level Priority Plan and briefly introduced key tasks relevant to the work of WGII and invited WGII to provide comments on the Plan. It was suggested that WGII review these tasks on a regular basis, and provide guidance to CGMS at the plenary level.

WGII/12 Any other business

WGII recommended that at future CGMS sessions, CGMS members should include references to ATBDs, scientific papers or other sources of information providing background to their generation in all WPs describing datasets and products.

Volker Gärtner announced his retirement as rapporteur on the IPWG to CGMS. WGII expressed its appreciation for his service to CGMS. Hence, a new rapporteur needs to be identified, and the Co-chairs of the IPWG will nominate someone for this function.

WGII/13 Planning of inter-sessional activities/meetings

Inter-sessional meetings for reviewing the status of WGII-related actions, recommendations and for discussing topics for consideration at CGMS-42 were agreed for the following dates:

26 November 2013, 13.00 UTC

3 April 2014, 13.00 UTC

These meeting are held remotely via telephone and online conference tools; invitations shall follow by e-mail in due course. All CGMS members are invited to participate.

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

WGII reviewed the actions and recommendations drafted by the co-chairs and rapporteurs, which were subsequently forwarded to the CGMS Secretariat. The full list of WGII actions and recommendations are available here.

The session closed at 17.30 on Tuesday 9 July 2013.

WGIII REPORT

Working Group III: Operational Continuity and Contingency Planning

WGIII/0 Introduction and objectives

The CGMS Working Group on Operational Continuity and Contingency Planning (WGIII) was convened on 8 July 2013 with Suzanne Hilding (NOAA) and Peng Zhang (CMA) as co-chairs and Jérôme Lafeuille (WMO) as rapporteur. The participants included representatives of CMA, CNSA, EUMETSAT, JMA, KARI, NOAA, ROSCOSMOS, WMO and the International Radio-occultation Working Group (IROWG) (the list of participants is available in the Annex).

The co-chairs recalled the main objectives of the meeting which were to:

- review the overall status of implementation of the space-based observing system, with a view to address potential gaps;
- advise on coordination and optimisation of plans;
- advance the contribution of CGMS to the architecture for climate monitoring from space; and
- initiate a CGMS effort to promote the socio-economic benefits of space missions.

WGIII/1 Review of actions and recommendations from previous meetings

Actions

38.40	WMO in collaboration with the atmospheric composition community and satellite experts to further refine the requirements for atmospheric composition requirements and the optimal way to address these in the revised baseline.	ON-GOING. It was agreed by the Joint Steering Committee of the Open Programme Area Group on Environmental Pollution and Atmospheric Chemistry (GAW JSC OPAG-EPAC) in March 2013 that the ad-hoc Task Team be established before the end of 2013.
40.02	WMO Secretary General to send a letter to CMA inviting them to consider redeploying the FY-3 to an early morning orbit and offering international support to reach this objective.	COMPLETED. An exchange of letters occurred between WMO SG and the PR of China. This was followed by a Tiger Team seminar in

		Beijing, and an important statement by the PR of China at the WMO Executive Council in May 2013.
40.03	WMO to convene a CGMS tiger team to coordinate the technical evaluation of the global and regional impact of flying a FY-3 satellite in early morning orbit, in order to support CMA in the assessment process.	COMPLETED. The Tiger Team involved seven NWP centres from Europe, Asia and the United States, and actively pursued its evaluation, as reported in WMO-WP-13
40.04	WGIII to establish a CGMS tiger team on assessing the impact and socio-economic benefits of satellite missions who would collaborate with e.g. the WMO CBS and other partners and would report at CGMS-41.	Finally CLOSED after discussion of item III/6, The Terms of Reference of this team were agreed by WGIII as reported under III/6. The nominations to the team will be done within a new action.
40.32	NOAA, in consultation with South America users and WMO, to investigate options for a follow-on to GOES-12 mission for South America, in order to develop a transition plan, involving GOES or other geostationary satellites, until the availability of the GOES next generation, which is expected to provide full coverage of both North and South America.	COMPLETED. NOAA-WP-20 reports that GOES-12 will have to be decommissioned in August 2013. A new action to review the GOES-East scanning schedule was agreed as reported under III/2.2.
40.33	EUMETSAT to report at CGMS-41 on its plans for Indian Ocean coverage beyond 2013.	COMPLETED. EUMETSAT-WP-15 reported that IODC is extended to the end of 2016.
40.34	All CGMS members to review and update their contribution to the mapping of CGMS mission plans against the CGMS baseline, and inform WMO accordingly. (5 December 2012)	CLOSED. Replaced by two new actions.
40.35	CGMS members to consider opportunities for partnership with NOAA on COSMIC-2 ground segment and DSCOVR follow-on mission and report to CGMS-41. (July 2013)	CLOSED. The context has changed and the action as it stands is no longer relevant.
40.36	CGMS satellite operators to inform the ICTSW via the WMO Secretariat (jlafeuille@wmo.int) on their needs for space weather data and warning products.	Action directed to the ad-hoc meeting on space weather.

Recommendations

40.35	R & D or operational satellite operators should consider the provision of some high-accuracy and stable reference instruments as anchors for operational instruments, in particular, for climate purposes.	ON-GOING. METOP-A/IASI is used by GSICS as the primary reference for IR sensor calibration. Excellent consistency is observed with AQUA/AIRS, SNPP/CrIS, and METOP-B/IASI. The proposed NASA CLARREO mission concept would provide SI traceability.
40.36	CGMS Satellite Operators to address the anticipated or potential gaps identified in the WMO Gap Analysis, in particular: • infrared and microwave sounding on the early morning orbit, • hyperspectral sounding missing in some geostationary sectors, • long-term follow-on of radio-occultation constellation, • global precipitation measurement precipitation radar follow-on mission, • long-term Earth Radiation Budget monitoring • limb sounding for high-vertical resolution observations in the stratosphere and mesosphere (of temperature, humidity, wind, aerosol, ozone and other trace gases).	ON-GOING. Was discussed at CGMS-41 WGIII
40.37	All CGMS members to provide updates on satellite programmes to be included in OSCAR, through their annual reports to CGMS and by other means as appropriate.	ON-GOING.
40.38	CGMS satellite operators to support NWP centres to perform Observing System Experiments (OSEs) on the regional impact of a potential gap of sounding from the early morning orbit.	ON-GOING. Tiger Team activities have been very effective.
40.39	CGMS members to support CMA in further investigations of the benefit and technical consequences of potential move of a mid morning mission to an early morning mission.	ON-GOING. Tiger Team activities have been pretty effective. See WMO-WP-13

40.40	CGMS members, through WGIII, to evaluate the CGMS baseline in the light of the architecture strategy with a view to populate the space segment part of the initial physical view of the architecture and identify gaps and scenarios to address them.	ON-GOING. Addressed under III/4,

WGIII/2 Status of implementation of the baseline

WGIII/2.1 Updated mapping of actual/planned missions against the baseline

In order to play its role in monitoring possible risks or continuity issues, as foreseen by the High-level Priority Plan (HLPP), it is essential for WGIII to maintain a comparison between the nominal plans and the current or actually planned missions. For this purpose, the CGMS and WMO Secretariats had circulated a draft mapping of the planned missions against the CGMS baseline but little response was received. This tentative mapping will be further updated by WMO with the reports from satellite operators to CGMS. The updated mapping will be sent to CGMS members for review, in advance of the first WGIII inter-sessional meeting.

The following actions and recommendations were taken:

CGMS-41 actions – WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGIII/2.1	41.33	WMO to circulate an updated mapping of CGMS members' missions to the CGMS baseline for operational/sustained missions, for review by CGMS members (31 August 2013).	31-Aug-13	**OPEN**	HLPP #1.1.1
CGMS space agencies	WGIII/2.1	41.34	All CGMS members to provide feedback on the updated mapping of satellite plans with the CGMS baseline (30 September 2013).	30-Sep-13	**OPEN**	HLPP #1.1.1

CGMS-41 recommendations – WGIII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/2.1	41.13 (Ref WGIII R40.35)	CGMS members to consider opportunities for partnership with NOAA on COSMIC-2 ground segment and DSCOVR follow-on mission and report to CGMS-41. WGIII discussions at CGMS-41: Ongoing. Metop-IASI is used by GSICS as the primary reference for IR sensor calibration. Excellent consistency is observed with AQUA/AIRS, SNPP/CrIS, and Metop-B/IASI. The proposed NASA CLARREO mission concept would provide SI traceability.	CGMS-42	**OPEN**	HLPP#1.1
CGMS satellite operators	WGIII/2.1 R	41.14 (Ref. WGIII R40.36)	CGMS Satellite Operators to address the anticipated or potential gaps identified in the WMO Gap Analysis, in particular: • infrared and microwave sounding on the early morning orbit, • hyperspectral sounding missing in some geostationary sectors, • long-term follow-on of radio-occultation constellation, • global precipitation measurement precipitation radar follow-on mission, • long-term Earth Radiation Budget monitoring • limb sounding for high-vertical resolution observations in	CGMS-42	**OPEN**	HLPP#1.1

			the stratosphere and mesosphere (of temperature, humidity, wind, aerosol, ozone and other trace gases).			
CGMS members	WGIII/2.1 R	41.15 (Ref. WGIII R40.37)	All CGMS members to provide updates on satellite programmes to be included in OSCAR, through their annual reports to CGMS and by other means as appropriate.	CGMS-42	**OPEN**	HLPP#1.1

WGIII/2.2 Continuity issues and risk analysis

WMO-WP-14 reported that, based on earlier outcomes of CGMS plenary sessions and WMO CBS, the WMO Executive Council adopted a Resolution on "Avoiding gaps in Essential Space-based Observations" inviting the CGMS to monitor the plans and coordinate efforts, in view of the risks of gaps in the following missions:

- early morning orbit imagery and sounding
- afternoon orbit continuity between SNPP and JPSS-1
- geostationary coverage of South America
- geostationary hyperspectral sounding
- operational follow-on of the R&D GPM mission
- Earth Radiation Budget measurement
- limb sounding observations of atmospheric composition
- space weather

The preliminary gap analysis presented by WMO emphasised the first three issues (early morning and afternoon orbits, geostationary coverage), which are related to core components of the meteorological constellations. In addition, it highlighted risks recently arisen on the funding of the US contribution to the COSMIC-2 radio-occultation programme, a joint undertaking of the United States and NSPO of Taiwan, China. WGIII discussed the risks affecting these missions and agreed related actions.

Radio-occultation:

The International Radio-occultation Working Group (IROWG) representative explained that the COSMIC-2 programme included two components: An equatorial constellation of 6 low-inclination (24°) satellites to be launched in 2015/2016, and a polar constellation of 6 high-inclination (72°) satellites to be launched nominally in 2018. The current funding uncertainties are putting at risk this latter component, which would dramatically reduce the number of occultations per day, and bias the observations towards the lower latitudes. This would have a major impact on the global observation system since COSMIC-2 alone is expected to represent about 80% of the future global radio-occultation capability.

Following WGIII discussions, EUMETSAT informed the WG co-chairs that in response to discussions which took place at CGMS-40, EUMETSAT has planned to start a study in 2014 on optimisation of RO constellations in the future, considering missions planned to fly on different orbital planes. This study will be closely coordinated with the IROWG. EUMETSAT will be pleased to report on progress at CGMS-42.

Following the discussions, the following actions were agreed:

CGMS-41 actions - WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
IROWG	WGIII/2.2	41.35	IROWG to update its assessment of the planned availability of radio-occultation data taking into account the risks on the funding of the US part of the COSMIC-2 polar constellation, and to report at the IROWG workshop to be held in Graz, Austria on 5-11 September 2013. (September 2013)	15-Sep-13	**OPEN**	HLPP #1.1.4
EUM	WGIII/2.2	41.36	EUMETSAT to report on its study on RO constellation optimisation at CGMS-42.	CGMS-42	**OPEN**	HLPP #1.1.4
WMO	WGIII/2.2	41.37	WMO to send a letter to the United States (appropriate authority t.b.d.) recalling the demonstrated impact of radio-occultation observations on NWP and their use in climate monitoring and space weather, highlighting the major role expected to be played by the COSMIC-2 programme in the global observing system, and stressing the concerns of the global community about the risks on the funding of the US contribution, which would dramatically affect the implementation of this programme. (Mid October 2013)	15-Oct-13	**OPEN**	HLPP #1.1.4

Geostationary constellation:

EUM-WP-15 informed WGIII that EUMETSAT had agreed to extend the Indian Ocean coverage on a best-effort basis until the end of life of Meteosat-7, expected to occur around the end of 2016. Different options are being considered for the deployment of the MSG satellites and there is no guarantee that EUMETSAT would have a spare capacity for Indian Ocean coverage with an MSG satellite. However, EUMETSAT is willing to collaborate with other regional satellite operators including ISRO, ROSHYDROMET and CMA to investigate a medium-term strategy ensuring coverage of the Indian Ocean region with advanced geostationary imagery. The following action was agreed as a consequence:

CGMS-41 actions – WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUM	WGIII/2.2	41.38	EUMETSAT to initiate the dialogue with ISRO, ROSHYDROMET, CMA, and other interested partners to investigate a medium-term strategy for ensuring coverage of the Indian Ocean coverage with advanced geostationary imagery. (15 January 2014)	15-Jan-14	**OPEN**	HLPP #

Roscosmos/Roshydromet indicated that the implementation of the Electro-L programme had been reviewed in line with CGMS-40 WGIII discussions, with the objective to secure geostationary observations at 76°E as the primary position under responsibility of the Russian Federation. WGIII expressed its appreciation to Roscosmos/Roshydromet for this global coordination effort.

The future plans for Indian Ocean coverage should be monitored and discussed by WGIII in inter-sessional meetings and at CGMS-42.

As regards South America coverage, **NOAA-WP-20** reported that GOES-12, which has largely exceeded its end of life, had to be decommissioned mid August 2013 for safety reasons. The user community was informed of this

process during the April 2013 NOAA Satellite Conference. As a mitigation action for South America users, NOAA is studying the feasibility of optimising the GOES-East scan schedule in order to preserve a sufficient refresh cycle of South America imagery even in case of North America rapid scan in severe weather conditions.

In view of this, NOAA agreed to the following action:

CGMS-41 actions – WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	WGIII/2.2	41.39	NOAA to provide update on the study to optimise the GOES-E scanning mode with a view to ensure a sufficient number of South America scans during North America rapid scan periods.	15-Jan-13	**OPEN**	HLPP #1.1.6

Afternoon orbit transition:

As concerns the transition from SNPP to JPSS, NOAA indicated that the JPSS programme schedule was unchanged. WGIII agreed that this critical transition should continue to be monitored at future meetings.

WGIII/3 Tiger Team on LEO optimisation

WMO-WP-13 reported on the outcome of the Tiger team convened by WMO, in response to CGMS-40 Action 40.03, in order to support CMA in the assessment process of the potential redeployment of a FY-3 satellite in early morning orbit. Seven NWP centres (ECMWF, Met Office, DWD, JMA, KMA, CMA/NWPC and JCSDA) conducted and shared the results of Observing System Experiments to assess the impact of optimised polar-orbit observations on global and regional NWP. These results were discussed at a Tiger Team seminar hosted by CMA in April 2013. There is a consensus among international experts to acknowledge that a satellite mission in an early morning orbit (around 6:00 Equatorial Crossing Time) would bring significant benefits through improved accuracy of weather forecast, thanks to the optimum temporal distribution of sounding radiances assimilated into NWP models. Further benefits are expected from the direct use of imagery and derived products in a number of applications including tropical cyclone monitoring, fog and fire detection, air quality monitoring, climate monitoring, and solar monitoring for space weather. Moreover, early morning/late afternoon satellite observations are well timed to support the daily operational briefings held by weather services (e.g. 8:00/20:00 local time). With the FY-3 programme, China could provide one of the three main components of the global constellation besides Europe and the USA. Additional missions would complement this backbone constellation, contributing to the overall operational robustness of the observing system.

The Tiger Team had recommended to:

- CMA to implement a FY-3 mission in an early morning orbit, with the appropriate platform and payload adaptations, and to sustain such mission in the long term.

- WMO and CGMS to support trade-off studies (including e.g. OSSEs) as necessary in the course of the development phase of the FY-3 early morning mission;

- CMA and international partners to pursue strong international collaboration on data assimilation in order, as soon as possible, to maximise the benefits of future (early morning) and current FY-3 missions;

- CMA with the international community to further prepare to exploit the benefit of the early morning orbit polar satellite monitoring payload for space weather, climate monitoring, air quality and disaster monitoring;

- WMO and CGMS to promote the use of FY-3 early morning data, contributing to a robust and efficient Global Observing System, taking advantage of the Asia-Oceania Meteorological Satellite Users Conference.

Following this Tiger Team seminar, the PR of China informed the WMO Executive Council that CMA was exploring the procedures related to the adjustment of China's Meteorological Satellite Development Plan for the period from 2011 to 2020 in order to include a series of FY-3 early-morning orbit satellites, which will contribute significantly to improvement of Earth observation and regional and global numerical weather predictions. The Council applauded this statement, considering that such a decision by China would be a major accomplishment for the space-based global observing system.

WGIII noted that EUMETSAT had formally reaffirmed its commitment to ensuring access to and use of mid-morning satellite data and products by CMA.

In **CMA-WP-09**, CMA presented the progress of technical studies performed by CMA and CNSA for the adaptation of an FY-3 satellite to a 6:00 ECT early morning orbit. The earliest possibility would be to reconfigure FY-3E, currently planned for launch in 2016 on an A.M. orbit. Whilst there was no major issue for the platform, the payload definition would be reviewed. The priority payload configuration for the FY-3 early morning orbit tentatively includes a low-light level imager, microwave temperature and humidity sounders (MWTS, MWHS), a dual band scatterometer (WindRAD), infrared spectrometer (HIRAS), a radio-occultation receiver (GNOS) and a Space Environment Suite. The day-night imager would be a new sensor, the specifications of which should be defined by the end of 2013. CMA is calling upon international collaboration at various levels to facilitate such a challenging programme redefinition: Support to trade-off studies through e.g. OSSEs in the course of the development phase, stronger collaboration on data assimilation in order to maximise the benefits of future (early morning)

and current FY-3 missions, support on other applications such as space weather, climate monitoring, air quality and disaster monitoring.

WGIII commended CMA for actively pursuing this programme redefinition and the following actions and recommendations were agreed as a result of the discussions:

CGMS-41 actions – WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGIII/3	41.40	WMO Secretary-General to send a letter to the PR of China to commend CMA on progress made, report on the outcome of CGMS-41 discussions on FY-3 redeployment, and confirm the strong support of the international community on this endeavour.	15-Sep-13	**OPEN**	HLPP #1.1.1
NOAA	WGIII/3	41.41	NOAA to provide a report on the benefit of Day-Night imagery (e.g. as experience with SNPP/VIIRS) at CGMS-42 in order to assist CMA in refining its requirements for an imager for the early morning orbit mission.	CGMS-42	**OPEN**	HLPP #1.1.1

CGMS-41 recommendations – WGIII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/3 R	41.16 (Ref. R40.38)	CGMS satellite operators to support NWP centres to perform Observing System Experiments (OSEs) on the regional impact of a potential gap of sounding from the early morning orbit.	CGMS-42	**OPEN**	HLPP#1.1
CGMS members	WGIII/3 R	41.17 (Ref. R40.39)	CGMS members to support CMA in further investigations of the benefit and technical consequences of potential move of a mid morning mission to an early morning mission.	CGMS-42	**OPEN**	HLPP#1.1

WGIII/4 Architecture for Climate Monitoring From Space

In response to WGIII Action 40.07, **EUM-WP-04** presented the draft Terms of Reference of a Joint CEOS-CGMS working group on climate that would combine the contributions of CEOS and CGMS to the development of the climate monitoring architecture. WGIII supported the principle of this joint entity and the proposed description of tasks. WMO strongly supported the proposed establishment of the joint group and recalled that the WMO Executive Council (EC-65) had highlighted the role that the WMO Space Programme should continue to play in facilitating the future development of the physical and operational structure; to promote the synergy and integration between in-situ and space-based observing systems for validating the space observations and products; and to ensure the engagement of the broader user communities for utilising the deliverables and realising the benefits of the Architecture.

In an advanced presentation of **NOAA-WP-04**, NOAA summarised the status and way forward for the development of the architecture for climate monitoring from space, which CGMS has agreed to contribute to as part of its HLPP (Section 5.1). Since CGMS-40, the report on the strategy for the architecture has been published, the first results of the ECV Product Inventory have been analysed, and a Climate and Space week was organised in Geneva in February 2013 with in particular a joint meeting of the CEOS-CGMS-WMO

architecture definition team and of the CEOS Working group on Climate. Several actions were discussed: Consistency check of the ECV Product Inventory; mapping of the CGMS baseline with the ECVs; user requirements analysis on case studies; and the merging of CEOS and CGMS efforts in a joint structure for the climate architecture.

WMO-WP-15 presented a tentative mapping of the current contents of the ECV product Inventory against the CGMS baseline as foreseen in the HLPP. This illustrates that most of the registered ECV products with a known satellite source are based on mission types listed in the CGMS baseline. In particular 105 of these products are based on FCDRs from core operational missions of the CGMS baseline, or precursors of such missions: Geostationary imagery, polar-orbiting VIS/IR and MW imagery, polar-orbiting IR and MW sounding. Since these missions will be sustained, they have the potential to support long-term climate data sets and products in the future.

Comparing the CGMS baseline with the ECV product inventory led to the following comments for the development of the climate monitoring architecture:

- FCDRs are important deliverables that should be documented as such in the inventory, since some FCDRs, e.g. radiances, support several TCDRs or are used directly in climate models without being processed into TCDRs;

- Moreover, there is a better visibility on future FCDRs than TCDRs. As a matter of fact, the ECV product inventory contains few entries related to future capabilities and the development of an architecture requires a forward-looking approach;

- Thanks to the prospective nature of the CGMS baseline, and subject to a slightly more precise characterisation of the missions, CGMS could, on this basis, commit on the long-term provision of FCDRs, which would be a tangible step in the development of the architecture; and

- As technology progresses and instrument designs evolve, high attention shall be paid to the compatibility with the FCDRs of relevant heritage instruments.

WGIII considered that the architecture will benefit from GSICS activities to support the generation of FCDRs for instruments in its field of expertise. As concerns TCDRs, it expected that the WGII would play a role e.g. in promoting product intercomparisons with the contribution of science groups (e.g. with IWWG for wind vectors, or IPWG for precipitation estimates).

These findings should be reported to the plenary. The following actions were agreed:

CGMS-41 actions - WGII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGIII/4	41.42	WGIII (actionee TBD) to review the categorisation of missions in the CGMS baseline and refine it as appropriate in order to support a high-level mapping with FCDRs.	15-Dec-13	**OPEN**	HLPP #5.1.2
WGIII members	WGIII/4	41.43	WGIII (actionee TBD) to define a first list of FCDRs that CGMS members can commit to provide on a sustained basis as a contribution to the architecture for climate monitoring from space, building on the CGMS baseline, and to communicate this contribution to the future CEOS-CGMS working group on climate.	15-Feb-14	**OPEN**	HLPP #5.1.6

It was also recommended to extend the ECV product inventory to FCDRs and the design phase of new sensors should include an analysis of compatibility with heritage instruments.

CGMS-41 recommendations - WGIII						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/4 R	41.18 (Ref. R40.40)	CGMS members, through WGIII, to evaluate the CGMS baseline in the light of the climate architecture strategy with a view to populate the space segment part of the initial physical view of the architecture and identify gaps and scenarios to address them.	CGMS-42	**OPEN**	HLPP#5.1

WGIII/5 Integration of R&D missions (RTO)

No WP was presented under this agenda item, but this topic being part of the HLPP should be kept on the regular agenda of WGIII. NOAA volunteered the following action:

CGMS-41 actions – WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	WGIII/4	41.44	NOAA to report at CGMS-42 on its activities towards transitioning mature R&D missions to an operational status.	CGMS-42	**OPEN**	HLPP #1.1.3

WGIII/6 Socio-economic benefits

Responding to WGIII Action 40.04, **NOAA-WP-29** proposed the terms of reference and suggestions for the membership of a Tiger Team on assessing the impact and socio-economic benefits of space missions. The purpose would be i) to develop a credible methodology and common terminology for articulating the socio-economic benefit of satellite observing systems, and ii) to explore most effective ways to communicate this information to desired stakeholders.

WGIII endorsed the proposed scope and list of tasks of this new team and recommended to ensure broad participation and an immediate start of activities. Roshydromet and CMA agreed to join the team, and WMO designated L. P. Riishojgaard to link the Tiger Team effort with related CBS activities. During the discussion, it was recognised that assessing socio-

economic benefits of satellite missions is not an easy tasks and should involve experts external from space agencies. An important and immediate starting point of such an activity should be to share among CGMS members existing studies on the matter.

The following actions were agreed.

CGMS-41 actions – WGIII						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIII/6	41.45	CGMS members to nominate participants in the Tiger Team on socio-economic benefits of space missions.	15-Sep-13	**OPEN**	HLPP #4.1.1
NOAA	WGIII/6	41.46	NOAA, as the initiator of the Tiger Team on socio-economic benefits, to request inputs from all CGMS members on available socio-economic benefit studies and case studies in order to allow the Tiger Team to compile the existing information as soon as members are nominated.	15-Sep-13	**OPEN**	HLPP #4.1.1
NOAA/CMA/WMO	WGIII/6	41.47	WGIII co-chairs to plan addressing the Tiger Team on Socio-economic Benefits actions at the first WGIII intersession meeting.	09-Oct-13	**OPEN**	HLPP #4.1.1

Action WGIII 40.04, being superseded by these new actions, was then closed.

WGIII/7 Any other business

No other business was discussed.

WGIII/8 Future intersessional meetings

Three inter-sessional web meetings were planned, with the following topics to be discussed:

9 October 2013:

- Updated mapping of the agencies' plans to the CGMS baseline
- Status of the letter to CMA on the progress of the LEO Tiger Team
- Status of the letter to the USA on US funding situation for COSMIC-2
- Outcome of the IROWG workshop on assessment of RO constellation
- Implementation of the Tiger Team on Socio-economic benefits

15 January 2014:

- Update on Indian Ocean coverage strategy
- Update on GOES-East scan mode optimization
- Update on SNPP-JPSS transition and COSMIC-2 funding
- Mapping of the current/future constellations to the climate architecture model

2 April 2014:

- Status of EUMETSAT/CMA dialogue and FY-3 data assimilation
- Preparation of CGMS-42

WGIII/9 Review of actions and contributions to the HLPP

WGIII reviewed Sections 1.1 (Coordination of observing systems) and 5.1 (Advancing the architecture for climate monitoring from space) of the HLPP and confirmed its relevance. All the actions of Section 1.1 have been addressed with the exception of "*Identifying partnership opportunities on space and ground segments and establish CGMS coordinated mechanisms for hosted payloads, e.g. for solar wind monitoring*". All the actions of Section 5.1 within the scope of WGIII have been addressed, noting that other actions of Section 5.1 are more relevant to WGII (e.g. GSICS and SCOPE-CM, long-term dataset analysis, decadal ECV product priorities) or to WGIV (integrated access to CDRs, long-term data preservation). In addition, WGIII addressed Section 4.1 of the HLPP (4.1 Impact and benefit of EO satellite missions).

The full list of WGIII actions and recommendations is available here.

The co-chairs thanked the participants and closed the meeting at 14:30.

WGIV REPORT

WGIV/0 Introduction

Working Group IV (WGIV) on Global Data Dissemination was convened on Monday 8 July 2013 at 15:00. Due to unavailability of the previously elected Chairperson and co-chair, Jerome Lafeuille from WMO was acting Chairperson of WGIV, with Klaus-Peter Renner from EUMETSAT, serving as rapporteur. WGIV was comprised of representatives of the following satellite operators: CMA, CNSA, EUMETSAT, ISRO, JMA, NOAA, ROSCOSMOS, ROSHYDROMET and WMO, and from KARI as an Observer (the list of participants is included in the Annex).

The agenda proposed by the CGMS Secretariat was adopted with the following modifications:

Agenda item WGIV/11 “Election of WGIV co-chair” was briefly addressed at the beginning in order to prepare the finding of a Chairperson and co-chair for WGIV.

WGIV/1 Review of actions and recommendations from previous meetings

Action 39.46: EUMETSAT to re-assess the European user requirement for a L-band service from its LEO satellites, bearing in mind the ongoing broader consultation process of WMO, and report to CGMS accordingly.
EUMETSAT: Following decision by EUMETSAT's 78th Council meeting (June 2013), there will be no L-band provision on the future LEO (EPS-SG) due to cost issues.

Status: **Closed** by response.

Action 39.49: CGMS members to nominate Points of Contact who can assist WMO with the development of common guidelines for long term data preservation. WMO to prepare a report on the guidelines to be presented to CGMS-40.

Status: **Closed** with **WMO-WP-05**. Discussed in WGIV/8.

Action 39.51: All CGMS members to propose using interoperability standards for providing and sharing of climate data records and report on their efforts at the next meeting of CGMS Deadline: CGMS-40

EUMETSAT: No further developments since CGMS-39. EUMETSAT is prepared to revisit this following an input from other CGMS members. NOAA provided inputs which were circulated via the CGMS list server on 02/11/12. Other CGMS members to provide their input.

WGIV commented that a more standardised solution is needed. Further discussion could take place at the EUMETSAT-WCRP Symposium on climate research and Earth observation from space planned for October 2014 if not completed earlier.

Status: **Open**.

Action 39.53: WMO to further refine the web-based Product Access Guide for satellite products, within the WMO Space Programme website, in collaboration with CGMS satellite operators.

Status: **Closed** by **WMO-WP-06**. Discussed in WGIV/9.

Action 40.37: CGMS satellite operators to report about the implementation of the World Geodetic System (WGS84) and Earth Geodetic Model (EGM-96) geographical reference systems.

EUMETSAT has updated the standard and reported that it will implement the new standard starting with the next generation of satellites.

Status: **Open** (for other satellite operators).

Action 40.38: ROSHYDROMET to report at CGMS-41 on the technical modalities for the near-real time provision of Meteor-M global data sets and associated ancillary information, as needed to fully contribute to the GOS.

This action was previously WGII 40.29. Following the CGMS-40 debriefing on 9 November 2012 it was decided to allocate it to WGIV. The second satellite of Meteor-M series is to be launched in 2013. After the commissioning phase ROSHYDROMET will review the technical modalities for the near real time provision of Meteor-M data and associated ancillary information.

Status: **Open**.

Action 40.39: CMA and NOAA to review the draft revised Global Specification 04 and provide comments by April 2013, with the goal to provide a revised version for CGMS-41.

This action is complementary to action 40.13 of WGI. It was adopted in WGI and WGIV fully supports this decision.

Status: **Closed**.

Action 40.40: WMO and NOAA to discuss future possibility of NOAA disseminating via GEONETCast-Americas certain environmental data to users in Central and South America.

Status: **Closed** with **NOAA-WP-26**. Discussed in WGIV/2.

Action 40.41: CGMS members to propose experts for a CGMS-WMO Task Force on Metadata implementation, for the purpose of interfacing with the WMO IPET-MDRD in the context of the revision of the WMO core metadata profile.

Status: **Open**. Discussed in WGIV/8.

Action 40.42: The CGMS Secretariat to draft, in consultation with the WMO secretariat and the co-chair of the IPET-MDRD, the terms of reference for the CGMS-WMO Task Force on meta data implementation.

Status: **Closed** with **EUM-WP-03**. Discussed in WGIV/8.

Action 40.43: JMA, CMA, KMA, NOAA and other CGMS agencies, as appropriate, to nominate focal points to the Task Team on Satellite User Requirements recently established in RA V (South-West Pacific) (Lead: Russell Stringer, Bureau of Meteorology Australia, r.stringer@bom.gov.au).

CMA: ZHANG Peng (zhangp@cma.gov.cn)
JMA: Yukihiro Kumagai, Satellite Program Division
(metsat@met.kishou.go.jp)
KMA: Hyun-Jong OH, Researcher, Satellite Operation Division, KMA/NMSC:
(hyunjong.oh@korea.kr)
NOAA: Paul Seymour (Paul.Seymour@noaa.gov)

Status: **Closed**.

Action 40.44: CGMS members to support the RA V Task Team in organising a workshop in late 2013 to advance its work plan, in conjunction with the 4th Asia/Oceania Meteorological Satellites Users' Conference in Australia.

Status: **Open**.

Recommendation 40.44: CGMS satellite operators to actively support user readiness projects as part of the implementation of their new generation satellite systems, following best practices recommended in the "CBS Guideline for Ensuring User Readiness for New Generation Satellites".

Status: **Ongoing**. Related WPs are CGMS-41: EUMETSAT-WP-13, JMA-WP-09, NOAA-WP-09, NOAA-WP-25.

Recommendation 40.45: CGMS members are highly encouraged to utilise the operational infrastructure of WIS in particular for the description, inclusion and provision of their satellite meta data to WIS GISCs such that satellite data becomes discoverable within WIS and also consider using WIS in the context of provision of their satellite data.

Status: **Ongoing**. Related WPs are CGMS-41: CMA-WP-10, WMO-WP-02, EUMETSAT-WP-03.

Recommendation 40.46: CGMS members are encouraged to support the expansion of RARS to advanced sounder data and the broader IGDDS initiatives in order to further expand the access to and use of satellite data and products.

Status: **Ongoing**. Related WPs are WMO-WP-04, NOAA-WP-13 and EUMETSAT-WP-17 (both presented in WGI)

In summary, following actions remain open:

Actions open from CGMS-39 and -40 (at CGMS-41)							
Actionee	**Action**	**#**	**Description**	**Action feedback**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV	39.51	Action 39.51: All CGMS members to propose using interoperability standards for providing and sharing of climate data records and report on their efforts at the next meeting of CGMS Deadline: CGMS-40	EUMETSAT: No further developments since CGMS-39. EUMETSAT is prepared to revisit this following an input from other CGMS members. NOAA provided inputs which were circulated via the CGMS list server on 02/11/12. Other CGMS members to provide their input. CGMS-41 WGIV commented that a more standardised solution is needed. Further discussion could take place at the EUMETSAT-WCRP Symposium on climate research and Earth observation from space planned for October 2014 if not completed earlier	(CGMS-40) **New deadline 30 October 2014**	**OPEN**	HLPP#5.1.7
CGMS satellite operators	WGIV	40.37	CGMS satellite operators to report about the implementation of the World Geodetic System (WGS84) and Earth Geodetic Model (EGM-96) geographical reference systems.	EUMETSAT has updated the standard and reported that it will implement the new standard starting with the next generation of satellites (closed for EUM). Other agencies are asked to report back.	(CGMS-41) **New deadline CGMS-42**	**OPEN**	HLPP #3.2

ROSH	WGIV	40.38	ROSHYDROMET to report at CGMS-41 on the technical modalities for the near-real time provision of Meteor-M global data sets and associated ancillary information, as needed to fully contribute to the GOS.	This action was previously WGII 40.29. Following the CGMS-40 debriefing on 9 November 2012 it was decided to allocate it to WGIV. A new satellit of Meteor-M series is to be launched in 2013. After the commissioning phase ROSH will review the technial modalities for the near real time provision of Meteor-M data and associated anscillary information.	(CGMS-41) **New deadline 15 Dec 2013**	**OPEN**	HLPP#2.8
CGMS members	WGIV	40.41	CGMS members to propose experts for a CGMS-WMO Task Force on Metadata implementation, for the purpose of interfacing with the WMO IPET-MDRD in the context of the revision of the WMO core metadata profile.	CGMS-41 WGIV discussions: To be confirmed in the inter-sessional meeting planned in Sep 2013	(CGMS-41) **New deadline 30 Sept 2013**	**OPEN**	HLPP#2.12
CGMS Secretariat and WMO	WGIV	40.42	The CGMS Secretariat to draft, in consultation with the WMO secretariat and the co-chair of the IPET-MDRD, the terms of reference for the CGMS-WMO Task Force on meta data implementation.	ToR drafted. Review ongoing (Feb 2013). Circulation to 'csr' expected in Mar '13 for CGMS to nominate Task Force participants. Draft ToR and request for nominations to be circulated in the course of April 2013. Closed with CGMS-41 EUM-WP-03, pending update of task 3 as in the WFG report	(31/12/2012) **New deadline 15 Aug 2013**	**OPEN**	HLPP#2.12
CGMS members	WGIV	40.44	CGMS members to support the RA V Task Team in organising a workshop in late 2013 to advance its work plan, in conjunction with the 4th Asia/Oceania Meteorological Satellites Users' Conference in Australia.		30-Sep-13	**OPEN**	HLPP#2.1

WGIV/2 Global DVB satellite services

CMA-WP-10 informs CGMS that the GISC Beijing maintains over 200,000 metadata records for meteorological observations and products, and supports the data discovery and subscription service for GTS data, CMA's NWP products and the satellite data of FY-2D/E, FY-3A/B, etc. CMACast is operated by GISC Beijing, as a complement to the GTS and AMDCN, for sharing time-critical and operation-critical data with users. By mid June 2013, CMACast had 2,649 user registrations including 24 international users. To improve the interoperability between CMACast and EUMETCast and to provide better service to both data providers and users, CMA and EUMETSAT have implemented a data exchange and re-dissemination service, including metadata exchange, and provided each other with a remote management tool for user registration, data access control and service monitoring. Partner user stations are also exchanged to allow for user problem investigations. CMA plans to optimise the CMACast user registration and data access procedures to provide an improved service to users in the Asia-Pacific region.

EUMETSAT-WP-13 presents technical aspects of the new DVB-S2 based EUMETCast Europe Broadcast System. The main outcome of a trade-off analysis made by EUMETSAT is that a DVB-S2 based satellite dissemination system remains the most cost-effective way of providing most data to EUMETSAT users. The WP provides the technical details and the benefit of the planned upgrade of EUMETCast Europe to the DVB-S2 standard. The DVB-S2 standard is more efficient at using the satellite resources and allows considerably higher throughput on the transponders compared to DVB-S. The achievable data rates depend on the reception antenna sizes where larger antenna sizes can support higher data rates. This is made by the proper selection of the so called MODCODs (MODulation and CODing). EUMETSAT intends to provide two services via DVB-S2, the Basic Service and the High Volume Service. The Basic Service is proposed as the continuation of the current EUMETCast Europe Service. On the user side only the DVB reception device must be replaced with a compatible DVB-S2 device. The High Volume Service will be optimised for higher data rates, roughly to the factor of 1.5 over the Basic Service. Users wanting to receive data from this service with sufficient weather margin will need larger antenna sizes compared to the Basic Service, roughly to the factor of 1.8 of what is required for the Basic Service. This system will provide sufficient flexible capacity on one or two transponders to accommodate the MTG mission and future third party data streams.

Following a question from WMO, EUMETSAT clarified that both services, Basic and High Volume, will be running in parallel, i.e. while new products requiring high bandwidth will be introduced on the High Volume service other products will be available on the Basic Service.

WMO emphasised the importance of MTG data for RA I and inquired about the plans for disseminating MTG data to RA I. It was recalled that a joint

EUMETSAT-WMO regional expert group (RAIDEG) was in charge of maintaining the regional user requirements for satellite data access.

The following action was created:

CGMS-41 actions – WGIV						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
EUMETSAT	WGIV/2	41.49	EUMETSAT to present the MTG dissemination baseline for RA-I (Africa).	CGMS-42	**OPEN**	HLPP#5.3

JMA-WP-09 gives a presentation of the status of Himawari-8/-9 data distribution/dissemination system. It consists of an Internet-based distribution system for the full resolution and reduced resolution data, and of a satellite based DVB dissemination system. On the satellite system MTSAT like HRIT/LRIT products will be disseminated to users in the region with limited or no internet capability. An overview of products, interval and channels including data volume for each distribution system is described. The necessary receiving equipment for the satellite distribution system including estimated costs is presented and the schedule for transition to the new satellite generation.

The WP will also be presented in the plenary session under E.2.1.

WMO welcomed the dissemination scheme presented by JMA, which offered a range of services suited to different user categories. WMO asked JMA to provide more details about the telecommunications satellite in order to include such information in the WMO Space Programme report to the RA V session, by mid March 2014, even if it is preliminary or planning information.

The following action was created:

CGMS-41 actions – WGIV						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
JMA	WGIV/2	41.50	JMA to provide details of the telecommunication satellite used for DVB rebroadcast, to be included in the WMO space programme report to Regional Association V session before mid March 2014, even if it is preliminary or planning information.	15-Mar-14	**OPEN**	HLPP#5.3

NOAA-WP-22 describes the current status and short term plans (2011-2015) of the GEONETCast Americas Service, in response to CGMS-41 Action 40.40. GEONETCast Americas (GNC-A) is a regional contribution to the global GEONETCast system. GNC-A provides a satellite-based system to deliver near-real time, environmental products and data in support of the Global Earth Observation System of Systems societal benefit areas (agriculture, energy, health, climate, weather, disaster mitigation, biodiversity, water resources, and ecosystems). GEONETCast Americas serves much of North America and the Caribbean Basin and all of Central, and South

America. GEONETCast Americas has links with GEONETCast regional environmental data dissemination systems deployed in Europe, Africa and Asia. GEONETCast Americas broadcasts to inexpensive satellite receiver stations based on Digital Video Broadcasting - Satellite (DVB-S) Standards that are in the geographic footprint of the commercial satellite (currently Intelsat-21). NOAA indicated that GNC-A was evolving towards a truly regional service since Brazil, through INPE, indicated readiness to contribute to funding the service in addition to providing products. NOAA also indicated that compatibility between GNC-A and EUMETCast-America was being investigated.

WMO encouraged NOAA and EUMETSAT to further investigate the EUMETCast/GEONETCast Americas compatibility and, if possible, integration. Recalling the presentation by JMA, WMO expressed the expectation of RA III and RA IV users that GNC-A be used at least on a transition basis, to support the provision of GOES-R data. This may be addressed at the CBS session to be hosted in South America in September 2014. NOAA explained that GEONETCast Americas is not intended to duplicate the satellite data dissemination, but for selected satellite products.
WMO therefore recommended considering LRIT-like satellite products (e.g. reduced channel sets) that would provide a safety net for operational users who cannot afford and maintain a complex GRB stations or will not be ready in time for either GOES-R or GOES-S direct reception.

The following recommendation was created:

CGMS-41 recommendations – WGIV						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
NOAA	WGIV/2 R	41.2 0	NOAA to consider the provision of an LRIT like subset of GOES-R or GOES-S data over GNC-A, at least on a transition basis to support operational users in RA III and RA IV having limited technical infrastructure	CGMS-42	**OPEN**	HLPP# 2

WGIV/3 Incorporation and dissemination of R&D and pre-operational mission data

There were no papers presented for this agenda item.

WGIV/4 Coordinated dissemination services

WGIV/4.1 Disaster mitigation purposes

As explained in the short term plans in **NOAA-WP-22** (see agenda item WGIV/2) GEONETCast and thus GEONETCast Americas is an alternative dissemination method for International Disaster Charter information.

GEONETCast Americas is working on integration into the International Charter system.

EUMETSAT has already joined the International Charter system as data provider and as provider of the GEONETCast/EUMETCast capacity.

WGIV/4.2 Ocean user community

There were no papers presented for this agenda item.

WGIV/5 Optimisation/harmonisation of direct readout dissemination (CGMS DB global spec)

WGIV/5.1 Current systems

NOAA-WP-23 provides a status of NOAA's geostationary and polar-orbiting satellite constellations.

The current geostationary configuration takes in to account the changes in the geostationary operations in the Pacific region and the continuous operation of GOES-12 to support the Caribbean and South America at 60°W. The current polar-orbiting spacecrafts continue to function and provide support for the direct read-out communities. The launch schedules for the future geostationary and polar-orbiting constellations have been revised to reflect a more robust support and implementation plan.

This WP will also be presented under plenary session D.1. The WG took note.

WGIV/5.2 Transition to new direct readout systems (GOES-R, JPSS, FY-3, EPS-SG,...)

NOAA-WP-09 provides recommendations on seeking affordable receiving stations.

NOAA-WP-25 presents a summary of the direct read-out plans for future NOAA environmental spacecraft. The transition of the NOAA direct read-out services is taking place across several spacecraft constellations. This will encompass many years of development, coordination and implementation. In 2005, replacement of the analogue Weather Facsimile (WEFAX) with the new digital LRIT started a transition period that will culminate with the implementation of the High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN) service combined with the transition from today's GOES Variable (GVAR) retransmission format to the GOES Re-Broadcast (GRB) service on the GOES-R spacecraft constellation. NOAA's current direct broadcast services will change dramatically in data rate, data content, and frequency allocation, and drives changes to field terminal configurations. The geostationary and polar-orbiting environmental satellite constellations will employ higher data rates, larger

bandwidths, and new downlink frequency allocations. Environmental data users must employ new field terminal receivers unique to each particular broadcast service.

Both NOAA WPs were also presented in WGI.

Some concerns were expressed by EUMETSAT and JMA addressing a possible inconsistency between the data formats used for the different next generation GEO satellites. One aspect that requires confirmation is the compatibility with the HRIT/LRIT Global Specification, especially when dealing with novel sensors such as hyperspectral sounders. Another aspect is the difference in the Mission Specific Implementation for different satellites, which is in line with the Global Specification, but may create problems when integrating data from different satellites for the same region. The possible differences between HRIT/LRIT direct broadcast data and HRIT/LRIT formats disseminated by rebroadcasting or Internet should also be clarified.

The following actions/recommendations were created:

CGMS-41 actions – WGIV						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/5.2	41.51	CGMS members to share information for HRIT/LRIT mission specific implementation for both direct broadcast and rebroadcast data for next generation GEO satellites	CGMS-42	**OPEN**	HLPP#5.3
CGMS members	WGIV/5.2	41.52	CGMS members to assess compatibility of the HRIT/LRIT global specification with the next generation GEO satellite broadcast	CGMS-42	**OPEN**	HLPP#5.3

CGMS-41 recommendations – WGIV						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/5.2 R	41.19	CGMS members are encouraged to seek (as much as possible) convergence in the Mission Specific Implementation of the HRIT/LRIT data for the next generation GEO satellites	CGMS-42	**OPEN**	HLPP#2

WGIV/6 Regional ATOVS Retransmission Services (RARS) incl. support for NPP and Metop

WMO-WP-04 provides an update on the Regional ATOVS Retransmission Service (RARS). Two main objectives are currently pursued within the RARS project:

- Further expanding the network to fill the main gaps, especially over oceanic areas, for the retransmission of ATOVS data from NOAA/POES and METOP-A/B satellites or equivalent FY-3 sounding data;

- Preparing the retransmission of advanced sounder data from METOP-A/B and SNPP spacecraft.

Three new stations have been proposed by IMD (Delhi, Guwahati and Chennai), which could improve the RARS coverage for ATOVS data from NOAA/POES and METOP. The possible inclusion of stations in Africa and on the Easter Island, South-eastern Pacific, is under investigation. As regards the retransmission of advanced sounder data, EUMETSAT has already included such data in its EARS network. The RARS Implementation Group has agreed a way forward to implement this development at the global level. A critical issue is the accommodation of large data volumes in the GTS, unless alternative data dissemination capabilities can be used. This issue was discussed at the last NAEDEX-APSDEU meeting and needs further discussion.

WMO recalled the presentation of **NOAA-WP-13** in WGI. This paper presented the NOAA Direct Broadcast Data Initiative to Meet NWP Latency Requirements which is very similar to RARS (if data can be redistributed globally). WGIV discussed the relation of this initiative to RARS, and how RARS can take advantage of this project.

The following actions were created:

CGMS-41 actions – WGIV						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/6	41.53	WGIV to support WGI in the Task Team to work on RARS related aspects.	15 Oct 2013	**OPEN**	HLPP#2.10
NOAA and WMO	WGIV/6	41.54	NOAA and WMO to discuss the relation of the Direct Broadcast Data Initiative (see NOAA-WP-13) to RARS, and how RARS can take advantage of this initiative	CGMS-42	**OPEN**	HLPP#2.10

WGIV/7 Contribution to the WIS infrastructure incl. RMDCN

WMO-WP-02 presents the status of the WMO Information System (WIS). The WIS has entered its operational phase, with already seven operational Global Information System Centres (GISC) and a total of 360 centres (National Centres, Data Collection or Production Centres or GISC) already identified. It is essential that datasets be registered with a GISC, using WIS-discovery metadata, to enable data discovery and take full benefit of the open accessibility of the system by diverse user communities. An example is given in the Annex of the WP to illustrate the interoperability as a result of the provision of WIS-compliant discovery metadata.

WGIV noted the progress made in the operational use of the WIS and agreed to the recommendation made that CGMS members register their data and products in WIS. This is already expressed in the existing WGIV Recommendation 40.45.

WGIV/8 Coordination of metadata for satellites and instruments

EUMETSAT-WP-03 presents the CGMS-WMO Terms of Reference for the Task Force on Metadata Implementation, in response to CGMS-40 action 40.42. During CGMS-40, CGMS-40-EUM-WP-15 “Facilitation of satellite data exchange under WMO WIS” recommended an increased involvement from the satellite data providers in the WMO Information System (WIS). As a resulting action, it was decided to create a CGMS-WMO Task Force on Metadata implementation allowing satellite providers to provide consolidated views on metadata definition. The main mission of that Task Force is to address and coordinate the development of relevant WIS metadata records authorising users to efficiently discover satellite products in the WIS catalogues. EUMETSAT-WP-03 presents the Terms of Reference of the CGMS-WMO Task Force as well as its relation with its WMO counter-part: the Inter-Programme Expert Team on Metadata and Data Representation Development (IPET-MDRD).

WMO commented that task 3 should involve users to achieve its goal and recommended to update task 3 to: “3. To improve the user search experience regarding satellite data products on WMO WIS catalogues, based on user feedback. “

With this modification to the document, WGIV agreed to the Terms of Reference for the Task Force on Metadata Implementation.

It is proposed to start immediately and use an inter-sessional meeting not later than September 2013 to confirm task team participants (action 40.41).

WMO-WP-05 reports about the development of common guidelines for long-term-data preservation. In response to action 39.49 and recommendation 40.17, a task team with members from ESA, EUMETSAT, KMA and WMO have investigated the development of common CGMS guidelines for Long Term Data Preservation (LTDP). A first attempt to develop a common approach has been made in Europe in 2009, with the European Long Term Data preservation Guidelines. These guidelines have subsequently also been adopted as GEO LTDP guidelines by the Group on Earth Observation (GEO). The European guidelines are based on solid data system standards and have been reviewed by a number of bodies. They comply with identified WMO programme and user requirements. The task team felt that they were appropriate for other CGMS members and recommended that each CGMS member evaluates their applicability.

WMO clarified that the European version and the GEO version were identical in substance, but GEO and ESA had indicated that ultimately only the GEO version of the LTDP may be maintained. Therefore, the GEO version of these guidelines should be reviewed by the CGMS members. WMO will ensure proper consultation with the CCL (Commission for CLimatology) working groups. Any proposal for further update of the guidelines should preferably be considered as part of the ongoing GEO Task IN-02 Component C1 of the

GEO Work plan 2012-2015 with a view to consolidate GEO and CGMS requirements in a single version.

The following actions were created:

CGMS-41 actions - WGIV						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
WMO	WGIV/8	41.55	WMO to distribute the GEO LTDP guidelines by the Group on Earth Observations (Distributed via e-mail to WG-IV participants on 10-July 2013)	15 Sep 2013	**CLOSED**	HLPP#5. 1.8
CGMS members	WGIV/8	41.56	Each CGMS member to review the GEO version of the Long Term Data Preservation Guidelines (GEO LTDP) and provide feedback on the applicability of each single guideline to its own organization by creating a compatibility table for the organisation	CGMS-42	**OPEN**	HLPP#5. 1.8
WMO	WGIV/8	41.57	WMO to provide feedback from CCL (Commission for Climatology) regarding the GEO LTDP.	CGMS-42	**OPEN**	HLPP#5. 1.8

WGIV/9 User dialogue and interface

ROSHYDROMET-WP-04 reports on the Internet-based Services in the State Research Center "PLANETA". The document presents an overview of internet-based services in SRC Planeta/Roshydromet, including participation in Eumetsat Advanced Retransmission Service (EARS) and FTP access to real-time Electro-L data.

EUMETSAT and WMO appreciate the availability of Electro L1 for retransmission on EUMETCast which provides a potential backup for the Indian Ocean Data Coverage. Although the satellite experienced some instrument anomalies, the WV channel is broken and the IR channels are degraded but still usable, Electro L1 still provides meteorological useful data.

WMO-WP-03 reports on the establishment of the Coordination Group on Satellite Data Requirements for WMO RA III and RA IV. At its 16th session in April 2013, WMO Regional Association IV (North and Central America, and the Caribbean) endorsed the establishment of a Regional Coordination Group on Satellite Data Requirements as a joint initiative of RA III and RA IV. Formulating region-based requirements for satellite data access and exchange is one of the important steps of the Integrated Global Data Dissemination Strategy (IGDDS) Implementation Plan and recognised by WMO as a priority. The Group is currently composed of members from seven countries (Argentina, Brazil Canada, Colombia, Chile, Trinidad and Tobago, Venezuela), from four satellite operators (EUMETSAT, NOAA NESDIS, CONAE, INPE), and WMO. It held a preparatory meeting in April 2013 hosted by NOAA where it discussed its composition, working arrangements, support structure, and preliminary milestones for its activities. It was recognised that a set of well-defined Region-based requirements for satellite data access and exchange maintained by the Group would provide a driver for data services

provided by CGMS members, including the further evolution of data dissemination systems such as GEONETCast-Americas and EUMETCast-Americas. Leadership from users in the region is a prerequisite for the Coordination Group to be effective. Support from CGMS operators including technical expertise and financial assistance for meetings is equally important.

There were no comments received from WGIV on the scope and work plan. WGIV agreed to the recommendation proposed in the WP.

The following recommendation was created:

CGMS-41 recommendations – WGIV						
"Actionee"	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/9 R	41.21	CGMS members to support the Coordination Group on Satellite Data Requirements for WMO RA III and RA IV in advancing its proposed work plan, as appropriate	CGMS-42	**OPEN**	HLPP#2

WMO-WP-06 describes an improved concept of the web-based WMO Product Access Guide (PAG) to guide users to quality-controlled selections of (satellite) products. The new concept introduces a multi-dimensional classification system for uniquely identifiable product collections (using "tags") allowing flexibility on the provider side, as well as different presentation options and search possibilities for the user interface.

WMO gave a live demonstration of the online mockup user interface of the PAG.

The following action was created:

CGMS-41 actions – WGIV						
Actionee	**Action**	**#**	**Description**	**Deadline**	**Status**	**HLPP ref**
CGMS members	WGIV/9	41.58	CGMS members to provide feedback on the improved concept of the WMO Product Access Guide, in particular on the feasibility with respect to their organization's product catalogues	CGMS-42	**OPEN**	HLPP#5.3

WGIV/10 Review and updating of the HLPP

No changes are proposed to the HLPP, all topics are active.

WGIV/11 Election of WGIV co-chair

KMA confirmed to be available for WGIV co-chair and Vasily V. Asmus from Roshydromet/SRC Planeta confirmed that he or his deputy will be available for the role of WGIV Chairperson for the next CGMS meeting.

WGIV/12 Any other business

There were no contributions under this item.

WGIV/13 Planning of inter-sessional activities/meetings

Three inter-sessional activities are planned:

IS-1 18 September 2013, topic: CGMS-WMO Task Force
IS-2 (shared with WGI) 16 October 2013, topics RARS
IS-3 Wed mid Jan 2014, topics: general and CGMS-WMO Task Force

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

New actions and recommendations as included in the report were reviewed and accepted. The summary list of actions and recommendations is available here.

The Chairperson thanked the participants for their contributions and the WGIV session was closed at 18:35 on Monday 8 July 2012.

ANNEXES

1. **Statements in opening ceremony**

2. **List of Plenary participants**

3. **List of Working Group participants**

4. **Minutes of the Ad-hoc Meeting on Space Weather on 10 July 2013**

Annotated Agenda and WPs can be found at http://www.cgms-info.org/working-papers

Points of contact information and list servers can be requested from the CGMS Secretariat CGMSSec@eumetsat.int.

ANNEX 1 STATEMENTS IN OPENING CEREMONY

Dr. Mitsuhiko Hatori, Director-General of JMA

Distinguished guests, ladies and gentlemen, welcome to Japan, welcome to Tsukuba.

It is my pleasure to see you all here for the 41st meeting of the Coordination Group for Meteorological Satellites, or CGMS. It is a great honor for me to have a chance to deliver a welcome address as one of the meeting hosts.

CGMS, as you are all aware, came into being in 1972, when representatives of the European Space Research Organisation, Japan, the United States of America, observers from WMO and the Global Atmosphere Research Programme met in Washington to discuss questions of compatibility among geostationary meteorological satellites. Over the past 4 decades, the scope of CGMS has been expanded to polar meteorological satellites, and many satellite operators including research and development organizations have joined CGMS. I believe we can say that the progress of CGMS reflects the progress of meteorological satellites. I am proud of its glorious path as one of the satellite operators.

Nowadays, meteorological satellite data are being used not only for real-time monitoring of weather conditions, but also for assimilation into global and regional numerical prediction models effectively. Meteorological satellites, therefore, play a critical role in the operations of National Meteorological Hydrological Services, especially those for disaster risk reduction. In addition, because of its observation capability across the earth and accumulation of the data over many years, climate monitoring is also becoming the important target of meteorological satellites. CGMS is expected to take its utmost effort to strengthen the related activities.

JMA has stably operated Himawari-series of geostationary meteorological satellites over 35 years around 140 degrees east, as part of WMO's Global Observing System, which is currently one of the essential components of WIGOS. To continue and enhance this key mission, JMA is preparing to launch the first satellite of the next generation, Himawari-8, in 2014. I am sure that its multi-channel, high-frequent and high-resolution data will contribute to the improvement of the weather and climate monitoring capabilities in the East Asia and Western Pacific regions.

In closing, I would like to thank all the participants for your great contribution to the meeting, and I am convinced that this meeting will be very successful and fruitful. I hope all of you have a pleasant stay here, enjoying Japanese cool culture and hot summer.

Thank you very much for your kind attention.

Kiyoshi Higuchi, Vice-President, JAXA

Distinguished guests, Ladies and Gentleman,

Good morning. Welcome to tropical Japan. We have very extraordinary climate in Japan this summer. Usually it would be rainy season in the middle of July. I hope all of you, the coordinating Group for Meteorological Satellites, contribute to understand the reason why we have so unusual weather recently.

As one of the co-hosting agencies, JAXA is very honored to host the 41st meeting of Coordinating Group for Meteorological Satellites. I would like to express my gratitude to all of you who are contributing and participating in this very important meeting.

JAXA has been making much effort to develop, launch and operate the many meteorological and earth observation satellites since the first Geostationary Meteorological Satellite " HIMAWARI" was launched in 1977. Because one of the important roles of JAXA is to promote and enhance the satellite application. Recently we successfully launched and are operating GCOM-W1(Global Change Observation Mission or Shizuku) and GOSAT (Greenhouse gases Observing Satellite or Ibuki) . They are observing the Earth and producing very valuable data for weather and climate phenomena.

Regarding the international cooperation, now we are cooperatively developing new satellites with US and Europe partners. GPM (Global Precipitation Measurement) with NASA will be launched in the beginning of the next year and Earthcare (Earth Clouds, Aerosols and Radiation Explore) with ESA will be ready to launch within 2 years. JAXA is willing to continue these activities.

However, on the other hand, we are facing very challenging financial status. Japanese government has recently announced the new space policy. But, unfortunately, it does not put the priority on the environment monitoring satellites, such as JAXA's GCOM series, nor global climate change issues.

I believe that the CGMS has a long history to coordinate meteorological satellite programs in the world, and is regarded as a major user group of the satellite data for meteorology and climate applications. Then it should be very important for us to share the idea about the importance of the earth environment monitoring by satellites not only in this community but also outside of this community. I expect the CGMS to appeal its activity to the outside of this community. It will help us and make it easier for JAXA to continue the earth environment monitoring missions.

I hope that we will have variable information exchanges and fruitful discussions and get fruitful results in this meeting. And enjoy staying at Tsukuba.

Thank you very much for your attention.

ANNEX 2 LIST OF PLENARY PARTICIPANTS

CMA
Feng Lu
Dongfeng Luo
Chunfang Wang
Xuebao Wu
Peng Zhang

CNSA
Jun Gao
Zhao Shaohua
Yong Xie
Qingjun Zhang

Embassy of India
Sivaji Chadaram

ESA
Jean-Louis Fellous

EUMETSAT
Rowanna Comerford
Paul Counet
Simon Elliott
Volker Gaertner
Joaquin Gonzalez
Livio Mastroddi,
Alain Ratier
Mikael Rattenborg
Klaus-Peter Renner
Robert Roebeling
Johannes Schmetz
Anne Taube
Lothar Wolf

GEO
Osamu Ochiai
Toshio Koike

ISRO
Kamaraju

IOC/UNESCO

David Halpern

JAXA

Toru Fukuda
Azusa Fukuki
Yukio Haruyama
Kiyoshi Higuchi
Keiji Imaoka
Chu Ishida
Misako Kachi
Masatoshi Kamei
Takayuki Kawai
Riko Oki
Arata Okuyama
Kazuo Umezawa
Shizuo Yamamoto

JMA

Kazumasa Aonashi
Mitsuhiko Hatori
Yasushi Izumikawa
Yukihiro Kumagai
Hiroshi Kunimatsu
Toshiyuki Kurino
Toshihiro Manda
Toshimasa Marui
Yasutaka Murakami
Masashi Nagata
Yoji Nagata
Naoki Nanrin
Masanori Obayashi
Tomoo Ohno
Nozomu Okawara
Kazutoshi Onogi
Yoshiaki Sato
Yoshio Shimazu
Yasuhiko Sumida
Kunio Takase
Shougo Tanaka
Hiroaki Tsuchiyama
Tetsuyuki Ueyama
Keiko Yamamoto
Akifumi Yamashita
Hironobu Yokota
Masahiro Yoshida

KARI
Koon-Ho Yang

KMA
Cha Eun Jeong
Dohyeong Kim
Tae-Sun Kwon

NASA
Jack Kaye
Brian Killough
Anthony Mannucci

NILU
Fred Prata

NOAA
Mitch Goldberg
Suzanne Hilding
Charles Wooldridge

ROSHYDROMET
Zoya Andreeva
Vasily Asmus
Liubov Kramareva
Alexey Rublev
Alexander Uspenskiy

ROSCOSMOS
Anton Baliev
Kirill Borisov
Yury Golovin
Harun Karchaev
Alexander Karelin
Dmitry Kozlov
Fedor Lyubchenko
Mikhail Novikov
Vyacheslav Pastarnak
Stanislav Smirnov,
Alexander Tkachenko

University of Wisconsin-Madison

Liam, Gumley

WMO

Stephan Bojinski
Jerome Lafeuille
Anthony Rea
Lars Peter Riishojgaard
Adrian Simmons
Wenjian Zhang

ANNEX 3 LIST OF WORKING GROUP PARTICIPANTS

List of participants in WGI

Feng Lu	CMA
Chunfang Wang	CMA
Xuebao Wu	CMA
Jun Gao	CNSA
Sivaji Chadaram	Embassy of India
Simon Elliott	EUMETSAT
Joaquin Gonzalez	EUMETSAT
Livio Mastroddi	EUMETSAT
Mikael Rattenborg	EUMETSAT
Klaus-Peter Renner	EUMETSAT
Kamaraju	ISRO
Yukio Haruyama	JAXA
Hidekazu Inoue	JMA
Yasushi Izumikawa	JMA
Yukihiro Kumagai	JMA
Masanori Obayashi	JMA
Tomoo Ohno	JMA
Yoshio Shimazu	JMA
Hiroshi Tomita	JMA
Keiko Yamamoto	JMA
Hironobu Yokota	JMA
Koon-ho YANG	KARI
Mitch Goldberg	NOAA
Suzanne Hilding	NOAA
Charles Wooldridge	NOAA
Zoya Andreeva	ROSHYDROMET
Liubov Kramareva	ROSHYDROMET
Alexander Tkachenko	ROSCOSMOS
Wenjian Zhang	WMO

List of participants in WGII

Feng Lu	CMA
Peng Zhang	CMA
Zhao Shaohua	CNSA
Simon Elliott	EUMETSAT
Volker Gaertner	EUMETSAT
Robert Roebeling	EUMETSAT
Johannes Schmetz	EUMETSAT
David Halpern	IOC-UNESCO

Misako Kachi	JAXA
Takayuki Kawai	JAXA
Arata Okuyama	JAXA
Kazuo Umezawa	JAXA
Akiyoshi Ando	JMA
Kotaro Bessho	JMA
Kenji Date	JMA
Ryo Dojo	JMA
Masahiro Hayashi	JMA
Keita Hosaka	JMA
Takahito Imai	JMA
Shiro Ishizaki	JMA
Toshiharu Izumi	JMA
Tsutomu Jomura	JMA
Hiroshi Kunimatsu	JMA
Yukio Kurihara	JMA
Toshiyuki Kurino	JMA
Koki Mori	JMA
Hidehiko Murata	JMA
Ryuichiro Nakayama	JMA
Masanori Obayashi	JMA
Kozo Okamoto	JMA
Takeshi Otomo	JMA
Kazuki Shimoji	JMA
Yasuhiko Sumida	JMA
Masaya Takahashi	JMA
Kunio Takase	JMA
Ayako Takeuchi	JMA
Hidetaka Taniguchi	JMA
Hiroaki Tsuchiyama	JMA
Satoru Tsunomura	JMA
Yoshito Yoshizaki	JMA
Eun-Jong Cha	KMA
Dohyeong Kim	KMA
Tae-Sun Kwon	KMA
Jack Kaye	NASA
Brian Killough	NASA
Anthony Mannucci	NASA
Mitch Goldberg	NOAA
Fred Prata	NILU
Alexey Rublev	ROSHYDROMET
Alexander Uspenskiy	ROSHYDROMET
Zoya Andreeva	ROSHYDROMET
Liubov Kramareva	ROSHYDROMET
Vasily Asmus	ROSHYDROMET

Anton Baliev	ROSCOSMOS
Fedor Lyubchenko	ROSCOSMOS
Vyacheslav Pastarnak	ROSCOSMOS
Stanislav Smirnov	ROSCOSMOS
Jean Louis Fellous	ESA
Stephan Bojinski	WMO
Anthony Rea	WMO

List of participants in WGIII

Dongfeng Luo	CMA
Peng Zhang	CMA
Jun Gao	CNSA
Sivaji Chadaram	Embassy of India
Joaquin Gonzalez	EUMETSAT
Mikael Rattenborg	EUMETSAT
Anne Taube	EUMETSAT
Osamu Ochiai	JAXA
Kamaraju	ISRO
Takayuki Kawai	JAXA
Yasushi Izumikawa	JMA
Tomoo Ohno	JMA
Yoshiaki Sato	JMA
Yoshio Shimazu	JMA
Keiko Yamamoto	JMA
Hironobu Yokota	JMA
Yukihiro, Kumagai	JMA
Koon-Ho Yang	KARI
Tae-Sun Kwon	KMA
Suzanne Hilding	NOAA
Charles Wooldridge	NOAA
Kirill Borisov	ROSCOSMOS
Yury Golovin,	ROSCOSMOS
Harun Karchaev	ROSCOSMOS
Alexander Karelin	ROSCOSMOS
Dmitry Kozlov,	ROSCOSMOS
Fedor Lyubchenko	ROSCOSMOS
Mikhail Novikov	ROSCOSMOS
Vyacheslav Pastarnak	ROSCOSMOS
Alexander Tkachenko	ROSCOSMOS
Jerome Lafeuille	WMO
Lars Peter Riishojgaard	WMO
Wenjian Zhang	WMO

List of participants in WGIV:

Dongfeng Luo	CMA
Chunfang Wang	CMA
Xuebao Wu	CMA
Jun Gao	CNSA
Sivaji Chadaram	Embassy of India
Simon Elliott	EUMETSAT
Joaquin Gonzalez	EUMETSAT
Livio Mastroddi	EUMETSAT
Klaus-Peter Renner	EUMETSAT
Kamaraju	ISRO
Hidekazu Inoue	JMA
Yasushi Izumikawa	JMA
Kumagai Yukihiro	JMA
Masanori Obayashi	JMA
Tomoo Ohno	JMA
Yoshio Shimazu	JMA
Shougo Tanaka,	JMA
Hiroshi Tomita	JMA
Keiko Yamamoto	JMA
Hironobu Yokota	JMA
Koon-Ho Yang	KARI
Suzanne Hilding	NOAA
Charles Wooldridge	NOAA
Zoya Andreeva	ROSHYDROMET
Alexey Rublev	ROSHYDROMET
Alexander Tkachenko	ROSCOSMOS
Jerome Lafeuille	WMO
Wenjian Zhang	WMO

ANNEX 4 MINUTES OF THE AD-HOC MEETING ON SPACE WEATHER ON 10 JULY 2013

FINAL REPORT OF THE AD-HOC MEETING ON SPACE WEATHER

CGMS-41, Japan, 10 July 2013

1. Introduction and background

The meeting was convened on Wednesday, 10 July 2013 at 11h00, with Ms Suzanne Hilding (NOAA) as Chair and Mr Jérôme Lafeuille (WMO) as Rapporteur. The participants included in total 24 representatives of CGMS members and observers: CMA, CNSA, ESA, EUMETSAT, ISRO, JMA, KARI, KMA, NASA, NOAA, ROSCOSMOS, WMO, GCOS, IROWG, NICT, CGMS Secretariat. (See list in Annex)

The Chair highlighted the relevance of Space Weather for CGMS members since space weather events were regularly the cause of anomalies on spacecraft and, furthermore, many of these spacecraft were carrying a space weather payload. Therefore, CGMS members had the potential to play an important role in support of space weather activities, and to take benefit of such activities.

She recalled Recommendations 40.34, 40.36, 40.41, 40.42 and 40.43 of the last meeting and underlined that the CGMS High-Level Priority Plan (HLPP) identified Space Weather as one of the “Cross-cutting issues and new challenges” with two objectives:

- Establish a coordinated approach to the monitoring of space weather and the reporting of space weather-related spacecraft anomalies;
- Assess how CGMS is organized to address space weather matters.

WMO indicated that Space Weather coordination had been recognized by the WMO Congress (Cg-16, May 2011) as one of the activities of the WMO Space Programme and that an Inter-Programme Coordination Team on Space Weather (ICTSW) had been established. The ICTSW has started its work by reviewing the requirements for space weather information and the observing capabilities supporting these requirements, which has led to a “Statement of Guidance on Space Weather Observations” containing recommendations for improving current ground and space-based observations for Space Weather. Recognizing both the valuable contribution of individual CGMS Members and the lack of a coordinated approach for space weather observations from space, it has invited the CGMS to consider its active involvement in the coordination of satellite activities in support of space weather.

2. Reports from CGMS members

The **NOAA-WP-21** report on Anomalies from Solar Events provided examples of new space weather products under development, the progression and prediction of the solar cycle, a summary of recent significant space weather events, and a discussion about the

growth of space weather services and international cooperation. The Spacecraft Environmental Anomalies Expert System – Real Time (SEAESRT) at the Space Weather Prediction Center will provide geosynchronous satellite operators with information about space weather hazard levels from energetic particles in the space environment. This information, along with other tools developed at the National Geophysical Data Center, will be used to support satellite anomaly investigation. NOAA is also partnering with the international community to strengthen the world's satellite fleet through better design standards. Predictions are given for the time and magnitude of Solar Cycle 24 maximum. The consensus prediction that the new cycle will be smaller than recent cycles is consistent with current observations; however solar maximum, based on a running 13-month average of sunspot numbers, may be later than the predicted May 2013. Although the solar cycle may be small, we note that historically some of the largest geomagnetic storms have occurred during small solar cycles. An update was provided on the levels of recent space weather activity based on solar and near-Earth observations. NOAA finally noted the increasing international interest in space weather and related international coordination.

CMA-WP-08 provided an overview of recent activities of CMA relating to the space weather. The meeting noted that CMA had standardized its operational methodology for quantitative space weather forecast. Besides the routine space weather monitoring, forecasting and services, the CMA activities related to space weather also include several project-supported R&D, conferences, and educational initiatives to increase the public awareness of the space weather.

NASA-WP-07 summarized the NASA Space Weather activities, referred to in the NASA structure bas " Applied Heliophysics". The goals are to provide space weather relevant data to NASA assets and other governmental agencies; to transition Heliophysics science to operational space weather knowledge and products; and to support NASA missions with relevant tools and understanding. These activities can be broadly grouped into three areas: space weather observing systems and services, space weather research, Inter & Intra- Agency Coordination. An update was given on the current and future satellite missions of NASA supporting space weather activities.

NOAA-WP-15 provided a report on ground and space-based observations, which are at the heart of space weather forecasting and specification. These observations extend from the Sun to interplanetary space, to the magnetosphere, ionosphere and upper atmosphere, and are used to support a growing and diverse user community. Space weather observations are used as situational awareness, as input to drive models that can provide spatial and temporal forecasts, in assimilative models, to validate model performance, and for research that may ultimately lead to improved space weather applications. NOAA supports both ground and space-based observations (e.g. from GOES and POES) that provide continuous measurements of the vast space environment.
Also critical for supporting space weather operations are data from NASA, NSF, the USAF, the USGS, and international partners. The report described many of the space weather observing systems in use, and planned for, at the NOAA Space Weather Prediction Center and how these observations support space weather services.

In another presentation, **NOAA-WP-28**, NOAA gave an overview of the products and services delivered by its space weather prediction centre. NOAA suggested different activities for CGMS in the area of space weather: to contribute to the availability and coordination of space weather observations – including traditional measurements (solar, energetic particles, magnetic field, GNSS radio occultation) and non-traditional measurements (coronagraph, solar wind); to assist with defining user requirements and evaluating space weather products ; to collect space weather driven spacecraft anomaly information and encourage its availability and use; and to contribute to a strategy for the long-term continuity of space weather observations.

KMA-WP-08 described the status of KMA Space Weather Service. KMA initiated the delivery of space weather services to the public in April, 2012 with three main targets: 1) support to satellite operation, 2) support to aviation, and 3) ionospheric dynamics. KMA proceeds with tree major projects to build the infrastructure supporting space weather operations, which are focusing respectively on: building the observation system (ground-based GNSS receivers, and plans for a Geo-Kompsat-2A space weather payload), developing the prediction system (modeling the solar and interplanetary region and the magnetosphere-ionosphere-atmosphere region), and delivering space weather services (for aviation, spacecraft operations, and telecommunications).

The meeting was pleased to note the important activities reported by the members, ranging across the whole end-to-end chain from observation, to modeling, prediction methods, delivery of services, outreach and education. It also pointed out the scope for greater integration, in particular as concerns observation means.

3. Report from ICTSW

The **WMO-WP-18** report provided by the WMO/ICTSW suggested that WMO and CGMS had complementary interests in space weather and, among the international organizations engaged in space weather, were uniquely focused on operational service aspects. The purpose of ICTSW is to support space weather observations, data exchange, product and service delivery, and operational applications. CGMS provides a substantial contribution to space weather in operating space environment monitors and solar instruments on meteorological satellites, and CGMS has an interest in mitigating the impacts of space weather on satellites.

CGMS members were thus encouraged to develop a strategy for involvement in space weather and were invited to coordinate with the WMO/ICTSW. It is envisioned that CGMS could contribute in numerous areas, including the utilization of satellite anomaly information, the acquisition of space weather observations, the development of a plan for long-term continuity of observations, and the solicitation of space weather product requirements.

4. Outcome of the discussion

The Chair then opened a discussion on the possible role of CGMS with respect to Space Weather in expressing the view that CGMS had the potential to play a role in the coordination of the space weather observing constellation, similar to the role played regarding weather and climate observation satellites. The IROWG representative reinforced and illustrated this view in reporting the need for improved coordination of the radio-

occultation constellation and a better understanding of which radio-occultation missions have also the capability to monitor the ionosphere.

WMO stressed the need for CGMS to remain focused on an operational perspective. CGMS activities should be driven by user requirements derived from user needs for products and services. An effort should thus be undertaken to clearly identify the user basis (e.g. through a survey to participating countries, or compiling results of existing surveys). There was scope for developing a synergy between space weather services and meteorological services to certain users (e.g. aviation, telecommunications, energy, disasters)

The meeting agreed that, beyond the historical role to report on spacecraft anomalies and to host space weather payload, CGMS could assist in global coordination of satellite aspects. It should however keep a clear focus on operational needs, to support provision of products and services.

This would facilitate integration of observing capabilities across space weather communities. In defining a baseline and fostering integration of the current suite of observations, CGMS would help to sustain future observing capabilities.

CGMS should recognize other international partners with complementary roles, e.g. : the Committee on Space Research (COSPAR) has a Panel on Space Weather and is developing a roadmap, the International Space Environment Service (ISES) coordinates operational space weather warnings. The meeting also recognized the need to communicate the socio-economic benefits of space weather prediction with policy makers, public, non technical community.

5. Actions taken

The meeting identified two actions: a short-term action regarding the collection of spacecraft anomaly information in response to WMO/ICTSW, and a broader action of strategic nature to develop the Terms of Reference of future CGMS activities in Space Weather.

- CGMS Members to nominate points of contact to work with WMO/ICTSW in order to define jointly a procedure to improve the collection, availability, and use of satellite anomaly information (Due date: **30/09/2013)**
- CGMS Members to nominate a team to develop the TOR for CGMS space weather activities, taking into account the guiding principles discussed in the ad-hoc session, for consideration by CGMS-42 (Due date: **30/09/2013)**

During the meeting, the following organizations already volunteered to serve on this team: CMA, NOAA, WMO, JMA (to be confirmed), KMA (to be confirmed).

Annex: List of participants at the Ad-hoc Meeting on Space Weather on 10 July 2013

NAME	Organization
COUNET, Paul	CGMS Secretariat
LU, Feng	CMA
WU, Xuebao	CMA
ZHANG, Peng	CMA
GAO, Jun	CNSA
FELLOUS, Jean-Louis	ESA
GAERTNER, Volker	EUMETSAT
RATTENBORG, Mikael	EUMETSAT
SIMMONS, Adrian	GCOS
CHADARAM, Sivaji	Indian Embassy
MANNUCCI, Anthony	IROWG
KAMARAJU	ISRO
IZUMIKAWA, Yasushi	JMA
KUMAGAI, Yukihiro	JMA
MURAKAMI, Yasutaka	JMA
YAMAMOTO, Keiko	JMA
YANG, Koon-Ho	KARI
KIM, Dohyeong	KMA
ISHII, Mamoru	NICT
HILDING, Suzanne (Chair)	NOAA
BOJINSKI, Stephan	WMO
LAFEUILLE, Jérôme (Rapporteur)	WMO
REA, Anthony	WMO
ZHANG, Wenjian	WMO

Report edited on behalf of CGMS by:
CGMS Secretariat
EUMETSAT
Eumetsat-Allee 1
D-64295 Darmstadt
Germany
www.eumetsat.int

CGMS MR 41