Report of the 43rd Meeting of the
Coordinated Group for Meteorological Satellites

Parallel Working Group Sessions: WGII Report

WG II REPORT

The Working Group held its session as part of the CGMS-43 meeting on Monday, 18 May 2015 from 09:00-18:00 and Tuesday, 19 May 2015 from 09:00-16:00. The Group discussed 65 Working Papers and had 40 participants. Stephan Bojinski (WMO) and Toshiyuki Kurino (JMA) served as group co-chairs.

WGII/0 Objectives

Toshiyuki Kurino (JMA) expressed his thanks to NOAA NESDIS and special thanks to UCAR for providing the facility. Stephan Bojinski (WMO) stressed the role of the WG in identifying actions by CGMS operators related to satellite data and products, and for the exchange of information.

Participants identified themselves in a tour-de-table. The list of participants is provided in Annexes. Toshiyuki Kurino highlighted the necessity for CGMS cooperation in introducing the new generation of satellites, and to facilitate user uptake. Argelia Gonzalez (NOAA) assisted the session in operating the presentation laptop.

WGII/1 Review of actions and recommendations from previous meetings

WG II actions from CGMS-41 and CGMS-42 to remain open following CGMS-43							
Actionee	Action	#	Description	Action feedback/closing document	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.	JMA introduced software based on EUMETSAT approach to the testbed, and started validation activities in collaboration with Tokyo VAAC. The NOAA algorithm will also be included. CGMS-42 JMA-WP-07/ppt: VA retrieval intercomparison activity started and workshop to be organised in the framework of WMO SCOPE-Nowcasting at SSEC, Madison, on 29 June-2 July 2015 (a preparatory meeting was held on 20-23 October 2014). The JMA testbed will be useful once results from VA retrieval algorithm intercomparison are available. New deadline following discussions at CGMS-42. CGMS-43-JMA-WP-05 (Section 2) New deadline following CGMS-43 WGII discussions. WMO to report on VA Intercomparison at CGMS-44	(CGMS-41/-42/-43) **New deadlineCGMS-44**	**OPEN**	HLPP #3.2.2

WG II actions from CGMS-41 and CGMS-42 to remain open following CGMS-43							
Actionee	Action	#	Description	Action feedback/closing document	Deadline	Status	HLPP ref
CMA, EUM, JMA, NASA, NOAA, WMO	WGII/3	A42.02	The new task team on calibration events logging to identify a common set of parameters to be monitored as part of the calibration events logging and sensor performance monitoring.	1st step: Template for calibration event landing pages presented at GDAWG in March 2015. New version of OSCAR/Space allows for identification of individual instruments and thus linking to calibration event test pages, test mode of new version of OSCAR/Space continuing until 1 month before CGMS-43; 2nd step: Draft a white paper to agree on common terminology to be used on landing pages, foreseen in 2015/2016 for presentation to CGMS-44. CGMS-43 EUM-WP-10 CGMS-43-JMA-WP-03 (Section 2.4) NOAA: Work ongoing as a part of the GSICS work plan. Next steps are gathering information and agreeing on common terminology. New deadline following CGMS-43 WGII discussions.	(CGMS-43) **New deadlineCGMS-44**	**OPEN**	HLPP# 3.1
KMA	WGII/4	A42.03	KMA is invited to present a paper of different sources of soil moisture retrieval on their NWP forecasts	CGMS-43-KMA-WP-04: Test use of Metop-B/ASCAT on their global NWP system New deadline following CGMS-43 WGII discussions.	(CGMS-43) **New deadlineCGMS-44**	**OPEN**	-

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KMA	WGII/4	A42.03	KMA is invited to present a paper of different sources of soil moisture retrieval on their NWP forecasts	CGMS-43-KMA-WP-04: Test use of Metop-B/ASCAT on their global NWP system New deadline following CGMS-43 WGII discussions.	(CGMS-43) **New deadline CGMS-44**	**OPEN**	-

The final status of all CGMS-42 actions and recommendations (plenary and working groups) following CGMS-43 discussions is available here. (http://www.cgms-info.org/documents/CGMS-42_LoAandLoR_final.pdf).

WGII/2 Image processing techniques and satellite imagery for nowcasting

CGMS-43-ISRO-WP-04: Satellite image based nowcasting of severe rainfall events

Satellite based weather nowcasting is a growing field of research due to its immense application value and demand by the user community. Nowcasting models are extremely useful in predicting mesoscale and even shorter time scale weather events like thunderstorms which can cause threat to life and property. The applications of weather nowcasting range from satellite launches, aviation, transport, daily planning and disaster management. High-resolution observation networks such as Doppler Weather Radars, Automatic Weather Stations (AWS), Wind Profilers, Radiometers that monitor and provide accurate data at short spatial and temporal intervals, are the most essential component of a good nowcasting system. However presently in India there are many regions that are devoid of any ground-based observations and in such cases, satellite observations are the plausible alternatives. Data acquired from geostationary satellites are helpful in predicting the evolution of convective systems and its dynamics due to their high spatio-temporal resolution. At the Space Applications Centre, Indian Space Research organization (SAC, ISRO), the feasibility of nowcasting extreme rainfall events using satellite data has been explored and an algorithm has been developed for predicting intense convection and precipitation using half hourly INSAT-3D and Kalpana satellite data. Satellite observed thermal IR image sequence provides valuable insight into the vertical evolution of convective systems. Low Brightness Temperature (BT) values represent high clouds, and marked increases in the number of contiguous pixels having cold BT values indicate development of deep convection. The prediction of BT values thus has potential to provide nowcasting alerts for an impending disaster. Also the western Himalayan region is found to be most susceptible to extreme rainfall disasters causing loss to life and property every year. However it can be seen that Western Himalayan region is sparsely covered by ground observation stations. Thus a space-based model for Nowcasting of ExTreme orographic RAin events (NETRA) has been developed at SAC. The alerts from NETRA model are been provided for the hilly states of Uttarakhand and Himachal Pradesh and updated every half hourly though the Meteorology and Oceanography Data Archival Centre (MOSDAC) web portal.

The paper was warmly welcomed and a question was raised as to whether satellite data are also being used in short-range NWP, in addition to nowcasting. The ISRO plan is to make use of sounding data for SRNWP. It was specifically mentioned that the merging of nowcasting information with flood information (river catchment, area of flooding) is underway.

CGMS-43-NOAA-WP-13_PPT: NOAA Report on Image Processing Techniques: Applications using the VIIRS Day/Night Band

The presentation provided to the CGMS community a sampling of the emerging capabilities in nocturnal characterization enabled by the Day/Night Band (DNB) sensor on Suomi NPP, part of the Visible/Infrared Imaging Radiometer Suite (VIIRS). A growing collection of research papers are giving evidence to the DNB's utility well beyond the originally envisioned scope of 'imagery.' Quantitative applications are becoming possible with the conversion of DNB radiances to reflectance and combining with other VIIRS

spectral bands. The unexpected sensitivity to nightglow is revealing new scientific potential for the study of upper atmospheric dynamics.

The VIIRS Day/Night Band has shown capability of detecting visible light sources at night, from natural and anthropogenic sources, extraterrestrial, terrestrial, and atmospheric (e.g., fires, city lights, volcanic hotspots, fishing and industrial activity, nightglow, scattering from optically thin clouds). Progress is being made on a number of application fronts: quantitative, using calibrated radiances and converted lunar reflectance; multi-spectral imagery, leveraging the other bands on VIIRS; and other capabilities beyond the scope of those envisioned.

A DNB-like sensor is slated to fly on the 1330/0130 orbit (JPSS). The next-generation EUMETSAT program (EPS-SG) gave consideration to a Low-Light Imager initially, but is no longer considered due to low priority. Higher temporal refresh is of critical importance to operational users as well as research on the diurnal variability of essential climate data records.

The presentation encouraged CGMS to explore the new and complementary information content of the DNB for night time applications, and where appropriate, advocate for the inclusion of such measurements as a baseline requirement of future low-earth orbiting and geostationary environmental satellites.

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

CGMS-43-WMO-WP-16: GSICS Report

Peng Zhang provided a summary and highlights of GSICS, which will also be presented to Plenary under item F.1.2. Examples of the benefits of GSICS are the correction of GOES IR bias through inter-calibration with Metop/IASI and SNPP/CrIS, the adjustment of SRF of COMS/MI, and support to commissioning of Himawari-8 and characterisation of INSAT-3D calibration. Some development highlights are: IR calibration with multiple reference spectrometers, lunar calibration and GEO visible imager inter-calibration based on DCC method (to become available in 2015). An overview of the GSICS procedure for product acceptance was provided, with ISRO, KMA, and CMA preparing their submissions, and describing changes to the leadership structure after ten years of successful coordination.

Roscosmos explained the reason for the non-participation of Roshydromet in the GSICS Executive Panel meeting held on 14-15 May 2015, but emphasised that Roshydromet is interested in collaborating with CGMS operators in GSICS.

Dong Wu noted the connection of ICWG and GSICS when using DCCs for vicarious calibration. GSICS should be aware of calibration requirements coming from the ISWGs. This ties in with areas of coordination among the ISWGs.

NASA provided information on a call for proposals on work related to calibration and inter-calibration of NASA research satellites.

For the inter-calibration of geostationary infrared imagers with reference hyperspectral resolution infrared instruments, it is important there are no spectral gaps in the high spectral infrared, which would prevent the monitoring and absolute calibration of the infrared imagery channels. Therefore it is recommended that CGMS operators consider removing spectral gaps in future generation hyperspectral sounders. For example, CrIS was designed before GSICS, and the GSICS has demonstrated the importance of tying geostationary infrared sensors to polar-orbiting high spectral resolution infrared sounders.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS members	WGII/3	R43.01	CGMS members to consider removing spectral gaps from future hyperspectral sounders to support GSICS intercalibration of IR imagers.		OPEN	HLPP # 3.1
GSICS members	WGII/3	R43.02	Members to strengthen their engagement in GSICS and in particular in its GDWG.		OPEN	HLPP # 3.1

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
GSICS	WGII/3	A43.01	GSICS to establish the requirements for absolute lunar calibration and prepare a white paper describing the tentative way to meet those requirements in case they go beyond those lunar calibration capabilities.	CGMS-44	OPEN	HLPP # 3.1.2

CGMS-43-EUMETSAT-WP-09: Status report and highlights from SCOPE-CM

This document reported on the status of SCOPE-CM activities. The aim of the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) is to enable a network of facilities ensuring continuous and sustained provision of high-quality dataset for climate monitoring. The foundation of SCOPE-CM is the network of relevant space agencies and other organizations (including GSICS) with the aim to develop, extend and preserve the capabilities and skills of generating and regenerating Climate Data Records (CDR). The SCOPE-CM activity is a main contribution to the second pillar of the Architecture for Climate Monitoring from Space (climate record creation and preservation). SCOPE-CM has completed its phase-1 activity where the international collaborations network and the structure of the projects were set up. SCOPE-CM is entering the second year of its phase-2 activity. The main SCOPE-CM phase-2 objectives are to establish a systematic approach to increase the sustainability (maturity) of CDR generation capabilities and to establish the structures for sustainable generation of Fundamental and Thematic CDRs. Nine projects are active and generate both Fundamental and Thematic Climate Data Records. All projects show successes based on coordination that may result in real cost savings at the individual agency level. It is crucial for SCOPE-CM activities to be able to have

access to additional existing satellite data to close gaps in spatial coverage. The report covered the status of each project in Phase-2.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
SCOPE-CM members	WGII/3	R43.03	SCOPE-CM to invite contributions to its next call for proposals, with particular regard to the sea ice, snow cover and land surface temperature communities, and others currently not represented.	End 2015	OPEN	HLPP # 5.1

CGMS-43-EUMETSAT-WP-10: Calibration events logging status and way forward

This working paper summarized the response of EUMETSAT to CGMS action [CGMS-42: WGII/3 Action 42.01] "*EUM/NOAA/NASA/JMA/CMA/WMO and others to provide names for a task team on calibration events logging*" and CGMS action [CGMS-42: WGII/3 Action 42.02] "*The new task team on calibration events logging to identify a common set of parameters to be monitored as part of the calibration events logging and sensor performance monitoring*". The Task Team has been established after contacting the space agencies and WMO to nominate a representative [Actions 42.01]. The Task Team contributed to the GSICS action to organise their current instrument calibration information on a single landing page. The WMO modified their OSCAR web-interface, which now allows linking to one landing page per instrument per satellite. A high level design for logging calibration events and monitoring calibration information has been drafted. During the coming year the Task Team needs to draft a white paper outlining the set of parameters, the nomenclature, and the standards to be used for reporting on instrument calibration. Assessment of the nomenclature used for calibration events across space agencies revealed similarities in the types of events, but large differences in terminology. In the future, the white paper may serve as a protocol for reporting on instrument calibration across the CGMS space agencies. Once the CGMS space agencies reach consensus on a protocol they can start populating the database of calibration events for past, present and future instruments. This work should also be further discussed in the context of GSICS. Information should be included on Instrument specification (documents on instruments baseline physical basis), Calibration events (database or documents of calibration related events), Calibration monitoring (database or documents following state of the instrument) and Data outages.

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/3	A43.02	Calibration events logging task team to prepare a white paper outlining the set of parameters, the nomenclature, and the standards to be used for reporting on instrument calibration across space agencies.	CGMS-44	OPEN	HLPP # 3.1

CGMS-43-ISRO-WP-05: ISRO's GSICS Activities

This paper presented the status of ISRO's efforts towards the GSICS. ISRO has established an automated procedure to generate the GSICS correction coefficients for INSAT-3D Imager and Sounder using MetOp-A IASI. The IASI data is acquired through EUMETCAST. In view of irregular data reception through EUMETCAST an alternative procedure has been setup to receive the near real time IASI data through EUMETSAT standing data order (THREDDS server). ISRO has submitted the ATBD, GPAF and the sample GSICS products to GCC for the approval as demo-products. VIS channel calibration initiated through DCC method.

CGMS-43-JMA-WP-03: 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).

JMA began its operation of the MTSAT-1R infrared (IR) inter-calibration system on GSICS in 2008. Re-Analysis Correction (RAC) and Near-Real-Time Correction (NRTC) for the MTSAT imager IR channels in Demonstration Phase are available online. Uncertainty evaluation for MTSAT-2 GSICS Correction with reference to IASI and AIRS is currently being performed to move related products into the Pre-operational Phase. A new GSICS inter-calibration product based on data from the visible channel of the MTSAT-2 Imager with Aqua MODIS observation using deep convective cloud observations is also under development, along with visible channel calibration using lunar observation data. Existing GSICS inter-calibration methods are being implemented for the Advanced Himawari Imager (AHI) on board Himawari-8 as described in JMA-WP-09.

JMA has launched a web page for satellite event logging activities led by EUMETSAT and NOAA. The page will be linked to from the WMO Observing Systems Capability Analysis and Review (OSCAR) tool. The Agency is also considering the development of an event logging database for its past, present and future satellites.

JMA has participated in SCOPE-CM since the initiative's establishment, carrying out initial activities in a Phase 1 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 continued to lead one of the projects in phase 2 since 2014, and also contributes to other projects such as land surface albedo product.

CGMS-43-JMA-WP-09: First results and products from Himawari-8

The next-generation geostationary meteorological satellite of the Japan Meteorological Agency (JMA), Himawari-8, was successfully launched on 7 October 2014 and will start operation in July 2015. Himawari-8 features the new 16-band Advanced Himawari Imager (AHI), whose spatial resolution and observation frequency are improved over those of its predecessor MTSAT-series satellites. These

improvements will bring unprecedented levels of performance in nowcasting services and short-range weather forecasting systems. In view of the essential nature of navigation and radiometric calibration in fully leveraging the imager's potential, this working paper reports on the current status of navigation and calibration for the AHI and outlines related products.

The presentation focussed on navigation and calibration issues of Himawari-8. Image navigation accuracy is less than 0.5 pixels in 2.0 km bands; the paper also showed co-registration errors for the various bands. GSICS has made a contribution on the approach to validate AHI calibration performance.

The session congratulated JMA for its achievements shown in the paper regarding Himawari-8, which are very promising.

CGMS-43-KMA-WP-03: KMA's GSICS and SCOPE-CM Activities

This document reports on KMA's GSICS and SCOPE-CM activities.

- COMS IR inter-calibration system with LEOs (IASI-A, IASI-B, and AIRS) from April 2011 to December 2014
- COMS VI calibration using Moon with ROLO model from GSICS (GIRO) from April 2011 to December 2014 with four Earth targets (Ocean, desert, water cloud and Deep Convective Cloud)
- COMS Water Vapour channel anomaly correction using Spectral Response Function Shift
- To contribute to SCOPE-CM activity by applying GSICS correction to Sea Surface Temperature (SST) and Clear Sky Radiance (CSR)

The discussion clarified that OLR is derived for the entire disk. The session thanked KMA for a useful paper showing the downstream benefits of GSICS to products.

CGMS-43-NOAA-WP-14.PPT: NOAA Report on Satellite Data Calibration and Validation: Satellite Anomalies

This paper reported on the NOAA Integrated Calibration Validation System (ICVS) system. ICVS monitors over 400 parameters for 28 instruments on-board NOAA/METOP/SNPP satellites, SNPP spacecraft parameters, instrument performance and anomaly events (with automatic alerts), sounder SDR data quality with respect to the numerical weather prediction model (NWP) simulations, and instrument noises for their real-time applications (e.g. error covariance in data assimilation). The paper showed the current status of monitored instruments and shed light on the background of some anomalies (e.g., SNPP ATMS scan driver main motor current anomaly).

NOAA implemented a new SI-traceable NEdT using the Allan deviation (Allan, IEEE 1987; used for characterizing random noise from a time series with a variable mean), which will be discussed in the GSICS Research Working Group.

A question was asked whether this approach was reasonable since it smoothes out spikes in NEdT, since these are "normalized" by spikes in the time series.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/3	R43.04	CGMS operators to consider displaying instrument performance in a way similar to the ICVS. NOAA could share the software among CGMS operators.	CGMS-44	OPEN	HLPP # 3.1
NOAA	WGII/3	R43.05	NOAA to organize a workshop for CGMS operators on ICVS software design and development, and implementation.	CGMS-44	OPEN	HLPP # 3.1

CGMS-43-NOAA-WP-15 PPT: NOAA Report on Satellite Data Calibration and Validation: GSICS at NOAA

The paper reported on the NOAA role as the lead for the GSICS Coordination Centre, guiding products through the GSICS Procedure for Product Acceptance, hosting the GSICS products and development websites, helping to organize the 2014 User's Workshop (as a session at the AOMSUC in Shanghai) and the 2015 User's Workshop (to be held with the EUMETSAT conference in Toulouse), and producing the GSICS Quarterlies.

Current and planned activities include development of new products using the S-NPP CrIS and VIIRS, and the new Microwave (MW) and Ultraviolet (UV) subgroups which have projects to expand the application of GSICS methods and processed to include MW and UV sensors. NOAA is participating with calibration and validation comparison studies for instruments including AMSU, MSU and ATMS for the MW; and SBUV/2, OMPS, EPIC and TEMPO for the UV. NOAA supports the on-going calibration events logging activity.

The paper called for CGMS agencies to ensure that personnel receive sufficient support to continue their collaborative GSICS activities, and that designated activities to maintain, operate and improve the GSICS Coordination Center, GSICS Data Working Group and GSICS Processing and Research Centers are supported.

GSICS has some resilience by relying on a range of reference sources (DCCs, lunar target, CrIS/IASI). The mission planning of the upcoming IR sounders introduces robustness through overlap and coordination. Sub-groups have been set up to address these points.

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
GSICS	WGII/3	A43.03	GSICS to document and implement its approach to manage changes in reference instruments.	CGMS-44	OPEN	HLPP # 3.1

Dong Wu enquired about the role of ISCCP. Consistent calibration of sensors across agencies is a key mandate of GSICS, addressed through the GSICS Research Working Group. User requirements and feedback are essential to GSICS operations.

CGMS-43-CNSA-WP-02: The Calibration and Validation on HY-2 satellites

The HY-2A, launched in August 2011, is the first satellite for ocean dynamic environment measurement. The sea surface height calibration of HY-2A altimeter is performed using cross-calibration with the Jason-2 mission. Range absolute calibration activities are on-going based on the altimeter transponders. The main parameters in IGDR products are validated by in-situ NDBC buoys and Jason-2 measurements. The calibration of the HY-2A scatterometer is implemented using open sea measurements, Amazon rainforest measurements and transponders. Wind vector products are validated by NDBC buoy observations.

The key results are as follows: Crossover analysis with Jason-2 altimeter shows HY-2A altimeter total performance is close to the Jason-2. The calibration coefficients of sigma0 for scatterometer are -1.79dB for VV and -1.73dB for HH polarization using ocean calibration technique, the monitoring result of the scatterometer measurement stability by Amazon rainforest shows that the instrument system is stable, the RMS of wind speed and wind direction retrieved by scatterometer are about 1.051m/s and 16.122°.

CGMS-43-CNSA-WP-05: Geometry and radiation quality Evaluation of GF-1 and GF-2 satellite imagery

GF-1 and GF-2 are the first two satellites of China High-resolution Earth Observing System (CHEOS). Both satellites have been used in diverse application areas, such as land resource and surveying, disaster mitigation, environment protection, and so on. In this paper, the result of geometry and radiation quality evaluation of GF-1 and GF-2 satellite imagery is reported.

Generally, the geometry and radiation quality of GF-1&2 satellite imagery is fine. The geometric positioning accuracy of GF-1&2 satellite imagery can meet the requirement of high-precision image orientation. Due to no on-board calibration, the accuracy is dependent upon the in-situ measurements of field campaigns. The long-term cross calibration is necessary and on-going.

CGMS-43-ESA-WP-02: ESA Support to GCOS and Other Climate Monitoring Activities

This paper provided information on the status of the Earthwatch Programme Element, Global Monitoring of Essential Climate Variables (ECV), also known as the 'ESA Climate Change Initiative (CCI)'. The CCI program continues to proceed well and according to schedule. All thirteen ECV projects initiated in 2010 and in early 2012 have been completed. Phase 2 of this programme element was kicked-off in February 2014 and is now on-going for almost all projects. The report provides a short progress status for each individual ECV project and presents some outstanding results. The CCI is increasingly focussing on the use of ECV datasets for key applications, such as an integrated study of the sea level budget, and utilisation of CCI datasets by the community is on the rise. The CCI is also producing a Visualisation Tool as a communication aid, to showcase the ECV data products from the programme. Animations have been put together for the key variable from each project, where data is currently available, to illustrate key climate events for scientific and lay audiences.

In the discussion ESA was commended on the activities and the achievements obtained.

CGMS-43-NOAA-WP-16 PPT: NOAA Report on Satellite Data Calibration and Validation: SNPP/JPSS Cal/Val Update

The paper provides an update of the JPSS/SNPP cal/val activities and includes the overview of the 3-year performance of the SNPP instruments (ATMS, CrIS, VIIRS, OMPS), and their well characterized long-term performance. Algorithm Theoretical Basis Documents, validation plans, and validation results for a range of data records are all carefully documented and easily accessible. Definitions for JPSS product maturity (beta, provisional, validated), the product development process and the validation status are described. All SNPP instruments are performing within specifications.

CGMS-wide endorsement is recommended for a standard practice for the provision of deliverables needed to understand the science, the uncertainties and the maturity (independent validation and use) for operational and research products.

Recommended deliverables to document products were developed in the context of the WMO Product Access Guide (acceptance criteria) and QA4EO, and should be adopted by all CGMS operators.

CGMS-43-ROSHYDROMET-WP-03: Roshydromet CAL/VAL activity: progress report

The paper described the cal/val activities underway by Roshydromet to support the Meteor-M N2 polar orbiter series (Meteor-M N2 is currently in commissioning phase). Deployment of ground-based calibration/validation system for satellite L1 data and L2 products is underway. With respect to Meteor-M N2, post-launch calibration is on-going for all instruments (imaging radiometer MSU-MR, IR-sounder IKFS-2 and MW-imager/sounder MTVZA-GY), and validation of L2 products planned (e.g., vertical profiles of temperature and humidity, concentration of trace gases and aerosol, cloud cover analysis, etc). LEO-GEO intercalibration of the Meteor-M N2 imaging radiometer MSU-MR and the hyperspectral IR sounder IKFS-2 with SEVIRI is described in more detail. The inter-comparison of MSU-MR with SEVIRI reveals systematic biases of about –1.0, –1.2 K between MSU-MR channels 5, 6 and SEVIRI channels 9,10, while the std values are of 0.25 K. Validation of the hyperspectral IR sounder IKFS-2 was performed using line-by-line radiative transfer model simulations together with adequate atmospheric model (NWP data) for cloud-free scenes over sea. The IKFS-2 radiances spectra were integrated over response functions of SEVIRI channels 7-10, showing a mean difference in integrated brightness temperatures of about 0.3-0.7 K. Calibration of the temperature-humidity sounder MTVZA-GY is subject to further investigation. All instruments on board Meteor-M N2 are fully functional, except the Severjanin SAR which has a low SNR.

The session congratulated Roshydromet for the achieved results regarding Meteor-M N2 instruments. The advent of a new hyperspectral sounder IKFS-2 was welcomed. WGII asked Roshydromet to pursue the new opportunities and requested more information at the next CGMS meeting.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
ROSH	WGII/3	R43.06	Roshydromet is invited to attend the next sessions of the ICWG, ITWG and the other International Science Working Groups.	CGMS-44	OPEN	-

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
ROSH	WGII/3	A43.04	Roshydromet to present an update on Meteor-M N2 data access, processing packages, and results of an intercomparison of the IKFS-2 with other hyperspectral sounders (IASI, AIRS, CrIS), to CGMS-44.	CGMS-44	OPEN	HLPP # 1.4.2

In concluding the discussions on calibration and validation matters, the following action was raised:

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/3	A43.05	CGMS operators to provide a report on their approach on cal/val, including information on dedicated campaigns and permanent sites, and potential support to cal/val infrastructure, in order to maximize benefits of satellite missions.	CGMS-44	OPEN	-

WGII/4 Infrared/Microwave sounding and ITWG matters

CGMS-43-CMA-WP-08: CMA Report on Progress in Retrieving Thermal and Humidity Profiles from Infrared and Microwave Sounders

The working paper introduced recent progress of CMA in retrieving atmospheric thermal and humidity profiles from infrared and microwave sounders. The profiles are retrieved in the context of FengYun Satellite Algorithm Testbed for Sounder (FYSAT-S) that flexibly combines data from sounders on-board a platform. By default, the products from FengYun 3 serial satellite are those derived from measurements of infrared sounders, such as the InfraRed Atmosphere sounder (IRAS) or the Highspectral IRAS (HIRAS), and measurements of microwave sounders, like the Microwave Thermal Sounder (MWTS), and the Microwave Humidity Sounder (MWHS). For FengYun 4 satellite series, the products are from infrared sounder, the Geostationary Interferometric InfraRed Sounder (GIIRS) only. A set of statistical and physical algorithms are incorporated in FYSAT-S. By now, the FYSAT-S tuned for FY-3 has been implemented in the core ground segment at NSMC/CMA, and those for FY-4 will be implemented in the core ground segment later. Besides thermal and humidity profiles, ozone profile is derived when

information from high spectral infrared sounders are used. General performances of FYSAT-S for FY-3 and FY-4 (based on simulation) are illustrated; further improvements are also addressed at the end. For FY-3C, considering two comparisons of reference types, the results from about one year show that temperature soundings can be produced under partial cloud cover with RMS errors on the order of, or better than, 2.0 K in 1-km-thick layers from the surface to 700 mb, 1-km layers from 700–300 mb, 3-km layers from 300–30 mb, and 5-km layers from 30–1 mb; and moisture profiles can be obtained with an accuracy better than 30% absolute errors in 2-km layers from the surface to nearly 300 mb. For FY-4A GIIRS, the results based on simulated data shows that temperature soundings can be produced under clear sky condition with RMS errors on the order of, or better than, 1.3 K in 1-km-thick layers from the surface to 700 hPa, 0.8 K from 700–300 hPa, and 1.5 from 300–30 hPa, and moisture profiles can be obtained with an accuracy of better than 10% absolute errors in 2-km layers from the surface to nearly 200 hPa.

WG II commended CMA on their work on preparing the use of GIIRS, and pointed out the new opportunities collaboration.

CGMS-43-ISRO-WP-06: ISRO Report on INSAT-3D Sounder

The paper presented the status of the INSAT-3D 18-channel Sounder derived atmospheric temperature and humidity profiles. A radiative transfer model dependent bias correction procedure was established using collocated INSAT-3D/RAOB observations for the period of Jan-Jun 2014. The bias correction procedure has resulted in the improved quality of humidity profiles. A procedure was also established to generate the Clear-Sky Brightness Temperature (CSBT) from Sounder channels for use in the radiances assimilation in forecast operational model. The CSBT product is now operationally assimilated in the NCMRWF model.

GSICS procedure is used to monitor Sounder radiances, which are found to be stable. Clear-sky brightness temperature retrieval, now operationally assimilated in an Indian numerical forecast model, uses GOES cloud detection procedure.

CGMS-43-KMA-WP-04: Satellite Data Application in KMA's NWP Systems

This paper reported on the current status of the satellite data application in the numerical weather prediction at Korea Meteorological Administration (KMA). The KMA global data assimilation system is based on the hybrid system, which combines 4DVAR and ensemble forecast system. KMA is also operating a 4DVAR-based 12km regional model and 3DVAR-based 1.5km local model. Satellite data streams are currently assimilated in the global and regional model; in the local model, only scatterometer data are used. At the end of 2015, Ground-based GNSS data over Korean peninsula will be assimilated into local area model and KOMPSAT-5 RO (Radio Occultation) data into the global and local area model. It is planned that Metop-B/ASCAT soil moisture data will be assimilated operationally for the global model from 2015. Tests showed positive impact of Metop-B/ASCAT soil moisture data assimilation: forecast errors were generally decreased with the introduction of Metop-B/ASCAT soil moisture. In particular, the performance over the East Asia in the fall season was greatly improved.

The impact of IASI direct readout provided by KMA/NMSC will be evaluated for the global model, and put in operation from 2015 onwards.

CGMS-43-NASA-WP-10: Twelve Years of Observations from AIRS

The Atmospheric Infrared Sounder (AIRS) instrument on the NASA Aqua satellite platform has been operating without major disruptions since becoming operational in August 2003.

The basic AIRS observation contains a single infrared spectrum in 2378 channels obtained every 0.03 seconds (2,916,000 spectra per day) at wavelengths between 3.7-15.4 µm. A subset of these spectral observations is distributed in near real time, and has been operationally assimilated since late 2003 by forecast centres around the world. Additional channels are used to generate retrieved geophysical products (e.g., on atmospheric composition such as CO, CO2, O3, CH4), and these products have supported over 700 peer-reviewed publications. The AIRS instrument remains fully functional and without significant operational issues. The expected end of mission time of the AIRS instrument is that of the Aqua spacecraft: 2022 or later, conditional on the consumption rate of spacecraft fuel needed to maintain Aqua in the NASA A-Train satellite constellation and to deorbit Aqua safely.

CGMS-43-NOAA-WP-17 PPT: NOAA Report on Infrared/Microwave Sounding and ITWG Matters

This paper provided an overview of the SNPP/JPSS CrIS/ATMS Sounding Products (NUCAPS) and their applications and to provide awareness to the CGMS community on the availability of these products. Products are generated based on the AIRS science team algorithms (version 5). NUCAPS soundings are provided to the National Weather Service (NWS) for nowcasting applications. Soundings are available from the NOAA CLASS archive, and part of the NOAA Community Satellite Processing Package (CSPP) which enables the international community with direct readout capabilities to generate sounding products from CrIS and ATMS.

Retrievals are used to check consistency across platforms; detection of polar low anomaly. Comparisons of retrievals with radiosonde soundings at ARM sites showed differences of up to 30%. Question is discussed whether retrievals could improve forecasts. They provide support to dropsonde flight campaign for validation, using NRT retrievals through DB.

CrIS, IASI have climate monitoring performance (stability, calibration accuracy) that could allow discerning climate trend from variability (<30 years or less, cross-comparisons of IASI, CrIS and AIRS). Airborne validation campaigns are conducted to assess absolute calibration of CrIS.

CGMS should recognize the importance of (NIST traceable) validation campaigns to provide absolute calibration assessments for the user community - particularly the weather and climate communities.

Dong Wu pointed out that the difference between AIRS algorithm v5 and v6 is significant regarding cloud masking; this should be considered in NUCAPS.

WGII/5 Precipitation and IPWG matters

CGMS-43-IPWG-WP-08: Summary Report of the 7th Workshop of IPWG

Working paper IPWG-WP-01 was written by the two co-chairs of the International Precipitation Working Group (IPWG), Dr. Nai-Yu Wang and Dr. Kazumasa Aonashi. The report summarized the outcome of the IPWG-7 meeting. Furthermore, it highlighted the recent achievements of IPWG and provided an outlook for the planned activities over the next two years. The report also cited specific recommendations for CGMS members and IPWG comments on the current HLPP. The IPWG-7 was held at the Tsukuba International Congress Center and hosted by the Japan Aerospace Exploration Agency (JAXA) Earth Observation Research Center (EORC), Tsukuba, Japan during 17-21 November 2014. The meeting was attended by 125 participants from over 20 countries that included 49 oral and 57 poster presentations. It consisted of nearly three full days of plenary sessions (12 oral, 3 poster), one full day of working group discussions and a final group plenary, and then closed with a special session dedicated to Dr. Arthur Hou, NASA Global Precipitation Measurement (GPM) Project Scientist, who passed away in late 2013. Additionally, a satellite training course was given, which took place in parallel to the IPWG workshop; 28 participants attended the course.

Two new co-chairs were selected; Remy Roca (CNRS, France) and Tufa Dinku (IRI, USA). IPWG-8 will be held in the fall of 2016, with an African venue being targeted, however, former co-chair Vincenzo Levizzani has offered to host the meeting at his ISAC/CNR facility in Bologna, Italy as a secondary option.

IPWG highlighted the importance of the continuity of the geostationary coverage and data access over the Indian Ocean area.

For CMA and IMD – Provide institutional support to develop IPWG validation sites over China and India.

The possibility of a WMO support letter to invite IPWG participation from these countries to access data, support sites should be discussed between WMO Secretariat and IPWG leadership.

For all CGMS Members - Continue an operational constellation of conically-scanning microwave platforms to guarantee sustained support for the current level of capability. In particular, specific plans for the following missions are requested: JAXA for the GCOM-W/AMSR-2 follow-on; NOAA for the SSMIS F20 launch plan/DMSP follow on program; NASA/potential use of GMI#2; specific plans by EUMETSAT for EPS-SG/MWI.

This is to be addressed in CGMS WG III.

For ITWG, ICWG (and other ISWG's) – To foster more close collaboration on common topics, subgroups and parallel group reports should be shared at respective subgroup meetings, as well as potential specialty meetings (i.e., emissivity, snowfall, data assimilation) and other meetings of opportunity (e.g., AGU, EGU, etc).

The session encouraged collaboration among the ISWGs.

For all CGMS Members – IPWG encourages cross-agency coordination of satellite assets into "A-train-like convoys" of instruments with sensitivities to distinct aspects of precipitation processes. IPWG requests plans for such coordination from CGMS members, specifically, plans beyond CloudSat, EarthCare and GPM, etc.

This is to be addressed in CGMS WG III.

For all CGMS Members – Provide specific plans (e.g., sensors, timelines, etc.) regarding the reprocessing of all L1 radiance data, L2/L3 derived precipitation products, and their inter-calibration (i.e., SCOPE-CM, NOAA CDR, etc.).

CGMS-43 actions - WGII

Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/5	A43.06	CGMS operators to report on their specific plans for reprocessing and associated user requirements (such information would be useful for the ISWGs).	CGMS-44	OPEN	HLPP # 5.1

For all CGMS Members – Provide free and open access to satellite and ground validation data/products to IPWG members with minimal latency.

Governed by WMO Resolution 40 and countries' data policies regarding precipitation data.

For all CGMS Members - Coordinate crossing times of precipitation relevant satellites in an effort to improve the temporal sampling of the diurnal cycle, convective system lifecycles and severe storms. This might include aging satellites that serve in a backup mode.

This is to be addressed in CGMS WG III.

For all CGMS Members – There are emerging new technologies that can enhance precipitation retrievals by improved measurement of physical properties related to precipitation, in particular, cloud properties. IPWG requests that specific plans for any news sensors (e.g., Doppler radar, cloud radars, GEO MW sensors, etc.) be made available, including those relevant to ICWG

Additionally: CGMS-43 WGII confirmed Remy Roca (CNRS, France) and Tufa Dinku (IRI, USA) as the new IPWG co-chairs and to thank the outgoing co-chairs Nai-Yu Wang from the University of Maryland (USA) and Kazumasa Aonashi from the Japan Meteorological Agency and recommended this to the CGMS-43 plenary accordingly.

CGMS-43 is requested to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG;

Guidance was provided at CGMS session.

CGMS members are requested to continue to provide financial support for the activities related to IPWG, including workshop support and associated travel for new participants (including those at any associated training activity), travel support for CGMS member participation, and support for IPWG co-chairs (or designated representatives) to participate at other relevant meetings (e.g., WMO, CEOS, etc.).

Addressed at CGMS-42

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
IPWG	WGII/5	A43.07	The session recommended a stronger application focus of IPWG (e.g. NWP, hydrology, agriculture), and asked IPWG to organize an IPWG-NWP workshop in 2015 or 2016.	CGMS-44	OPEN	HLPP # 3.6

Regarding the planned development of snowfall validation best practices, reference was made to the WMO SPICE Solid Precipitation Intercomp Experiment (SPICE).

CGMS-43-CMA-WP-09: CMA Report on Precipitation Products

The paper introduced the work at CMA that uses Microwave Radiation Imager (MWRI) sensors of FY-3 to improve the FY-2 IR-derived precipitation products. The two types of satellites are combined dynamically to trace the variability of precipitation in different areas and for different seasons. The positive effect of adding microwave precipitation products of FY-3 into products of FY-2 is demonstrated. An improved estimate of hourly rain rate is investigated and compared with in-situ gauges and the CMORPH method. The study suggests the microwave precipitation is helpful for improving IR derived products. It is planned to add more microwave data into the operational products to raise the time-space sampling in near future.

In the discussion the group asked whether this work was discussed at IPWG-7, implying that this should be done.

CGMS-43-ISRO-WP-07: Precipitation over Orographic Regions

The paper presented the status of precipitation retrieval over orographic regions using INSAT-3D measurements in the Hydro-Estimator (H-E) Technique. The H-E method implemented in the ISRO Satellite Application Centre is found to have poor performance over high orographic regions (e.g. the Himalayas). A correction to the H-E module is attempted that provides improved performance over high orographic regions. The improved module is currently under implementation for operational rain estimation.

NCEP GFS underestimates rain rate in high-elevation areas. TPW and RH values as derived from GFS fields are enhanced to be more realistic, using histogram matching. Strength of convection is determined by comparison of the temperature of convective tops from IR adjustments with that of the

Equilibrium level (level of neutral buoyancy). Tuning is applied to account for orographic effects. Weekly averaged results of the modified H-E are compared for four Indian meteorological sub-divisions with surface rain gauge observations, and results from the TRMM 3B42V7.

CGMS-43-ISRO-WP-08: Precipitation from SAPHIR – Microwave Sounder

This paper presented the status of Precipitation Retrieval from the Megha-Tropiques SAPHIR passive Microwave Sounder. The retrieval of rain from SAPHIR is required as MADRAS, the primary instrument for rain retrieval on Megha-Tropiques satellite, is non-functional. SAPHIR rain rates (mm/h) are compared with TRMM 3B42V7, GSMap, and monthly averages with results from TRMM TMI, PR, and GPCC. SAPHIR is an adequate replacement for MADRAS to fulfil the mission objectives of Megha-Tropiques, and the value of the ScaRaB thermal IR instrument is subject to further investigation.

WG II made the suggestion to look at SAPHIR and INSAT-3D –derived rainfall rates in combination.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
ISRO	WGII/5	R43.07	ISRO is encouraged to implementing a multi-sensor precipitation estimate based on SAPHIR and INSAT-3D	CGMS-45	OPEN	HLPP # 3

CGMS-43-NASA-WP-04: Update of the NASA GPM and Precipitation Products and their Availability

2014 was a keystone year for NASA precipitation missions. The GPM core satellite was launched from the Tanegashima Space Center in Japan. The TRMM satellite ran out of fuel and began its descent and end of mission period. April 8, 2015 ended the TRMM science operations after 17.5 years.
GPM radiometer data became publicly available in July 2014 which was 3 months before the planned release. Dual-frequency radar data became available in September as scheduled. The GPM core mission carries a dual-frequency precipitation radar (DPR) and a passive microwave imager (GMI).

All data is available via ftp to all users. Distribution follows the NASA free and open data access policy. While users are required to register by email to obtain the data there are no additional requirements. Data is available either through a search and query interface or via ftp so that automated scripts can be used to routinely retrieve the data. The paper provides more detail on file formats and access routes.

An important part of the GPM mission is the inter-calibration of all the radiometers in the mission to a consistent mission standard. The “at launch” standard for the inter-calibration was a well-known calibration based on the TRMM TMI and PR. This inter-calibrated brightness temperature product carries the designation of 1C. These inter-calibrated 1C brightness-temperature products are used for producing the precipitation products.

NASA indicated that there are numerous precipitation products that NASA provides in NRT. NASA is continuously upgrading its retrieval algorithms to be able to improve the time latency. NRT data is provided on a best effort basis, however, there is no official requirement on NASA to do this.

Specifically for GPM, NASA provides GMI data both L1 and L2 in 1 hour or less after data collection, and combined within 3 hours of data collection. The key to merged products is routine and consistent provision of L1 data in NRT as well as ancillary data. In addition, a listing of available GPM data products, corresponding latency information and accessibility is available on NASA's Precipitation Measurements Missions website at: http://pmm.nasa.gov/data-access/downloads/gpm.

The Plenary noted the importance of the observations from the GPM core satellite.
CGMS thanked NASA for its long-standing support to the successful TRMM mission.

CGMS-43-NOAA-WP-18 PPT: NOAA Report on Precipitation and IPWG matters

NOAA contributes to CGMS Precipitation Activities in four primary ways:

- Operating LEO and GEO satellites that make observations in the visible, IR and microwave spectrums
- Generating operational precipitation and water vapour products
- Providing ground assets to validate and compliment the satellite observations
- Making all available data sets accessible to the CGMS community

The presentation summarized NOAA's satellite assets contributing to the measurement of Precipitation, provided an update on the status of operational precipitation products, noted any contributions to HLPP, and responded to actions from IPWG-7.

Key issues raised in the paper include (i) maintaining robustness of the satellite constellation specifically for precipitation, (ii) advancing science through synergy of LEO and GEO programs, (iii) greater commitment to "routine" reprocessing of L1 radiance and L2 products

WGII/6 Atmospheric motion vectors and IWWG matters

CGMS-43-CMA-WP-06: CMA Report on Progress of AMV Long-term Reprocessing

AMVs are one of the products of CMA derived from Fengyun-2 GEO satellite data and have been archived since Jan.1, 2006. CMA started a project to reprocess the historical AMVs data in 2013. The AMVs algorithm (CMA Version 2014) has been released. By using the new algorithm, AMVs density and quality are increased. After assessment, the algorithm was realized in Fengyun-2E AMVs' operational system in Dec. 2014.

The session expressed its appreciation to CMA for starting the reprocessing FY-2 data and its potential value for reanalysis. This work could be a contribution to the SCOPE-CM AMV project (10) where JMA, EUM, CIMSS coordinate AMV reprocessing.

CGMS-43-ISRO-WP-09: ISRO Report on INSAT-3D AMV

This working paper reports on the recent status of the Atmospheric Motion Vectors (AMVs) derived from INSAT-3D at India Meteorological Department (IMD) and Indian Space Research Organization

(ISRO). INSAT-3D AMVs produced based on TIR, WV, VIS and short-wave mid-IR channels, and disseminated via the GTS in BUFR format. RMS vector differences and biases are computed for TIR, VIS, WV, and MIR AMVs at different levels, evaluated against radiosonde observations. The INSAT-3D AMVs are regularly monitoring by NCMRWF, UK Met Office and the validation statistics are displayed in the respective websites. Upon successful monitoring for several months INSAT-3D AMVS are getting assimilated regularly in operational models of NCMRWF and IMD Delhi.

WGII welcomed the progress made with INSAT AMVs. In the discussion it was also suggested to enable, and start, a regular monitoring of the AMVs by all NWP centres.

CGMS-43-IWWG-WP-01: Atmospheric Motion Vectors and IWWG Matters: Report from the IWWG

The paper summarized the outcomes of the 12th International Winds Workshop (IWW12). The workshop was hosted by the University of Copenhagen and took place in Copenhagen, Denmark from 16-20 June 2014. There was a good cross-spectrum of attendance (65 participants) from a wide range of satellite producers, NWP centers, and research centers. This paper (i) recalled recommendations from CGMS-42 to IWW12, and (ii) highlighted the outcomes and recommendations from IWW12. Among others, the paper suggested that a Third AMV Intercomparison study, optimally to take place in the 2018-2020 time frame, primarily to investigate (i) the effect of using different QI processes and different target selection processes in the different AMV algorithms, (ii) the effect of using imagery from the newest satellite series (Himawari 8/9 or GOES-R), with higher spatial resolution, higher temporal resolution, and more spectral channels in the AMV calculations. Substantial discussion was held at IWW12 on the topic of using a “Common” algorithm in reprocessing activities. The idea is valid in concept, especially given the movement by CGMS satellite operators to acquire and use more consistent instrumentation. However, it was felt that greater consultation with scientists involved in reanalysis and climate was required before embarking on this complicated and expensive process. IWW felt that higher priority should go to ensuring we have as complete a record as possible of reprocessed AMV datasets using the current framework, particularly from the earlier satellites. Main concerns are that each instrument is different and that it would not be simple to construct a single algorithm that would accommodate these differences. Also, there is currently no stand-alone algorithm to process all data, and AMV require other concurrent meteorological products (e.g., cloud properties) that may or may not be available from each provider. Some steps toward a “common” algorithm were proposed, such as working toward the use of common algorithm components, facilitated by product inter-comparisons.

Collaboration with ICWG has proven very useful (cloud top height, microphysics), there was good representation of the scatterometer community (session on boundary layer winds), and MISR winds will soon be available on GTS.

Derivation and assimilation of high-resolution AMVs aim at resolving small scale dynamics of wind field, for nowcasting, short-range NWP, and capturing of high impact events. There are a number of difficulties and there is no single-best approach in deriving and assimilating such AMVs. The new-generation imagers with high repeat cycles and higher spatial pixel resolution are enablers to progress. For tracking, 5-10 pixels are typically used which leads to a larger amount of invalid retrieved vectors,

and requires use of other techniques (correlation surface, clustering) to constrain tracking. Assimilation needs to trade correlated errors of high-resolution imagery against context if this imagery is thinned too far.

Key recommendations for consideration at CGMS are:

IWW12.1. Producers and users to discuss and agree provision of further information characterising the AMV derivation for enhanced QC and error characterisation

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
ICWG, IWWG	WGII/6 and WGII/8	R43.08	ICWG and IWWG to liaise as appropriate on the provision of further information characterising the AMV derivation for enhanced QC and error characterisation.	CGMS-45	OPEN	HLPP # 3.5.2

IWW12.2. Satellite operators to consider coordination of orbits for scatterometer instruments and to provide open and timely access to data in order to maximise independent coverage and benefits to nowcasting and NWP from assimilation of scatterometer wind data.

WGII referred the recommendation IWW12.2 to WG III to be addressed there in due course.

IWW12.3. All producers to consider, during design of future derivation systems for next generation satellites, the ability to handle existing and where possible earlier generations of satellites (with some expected code modularity to reflect the different channel availability, etc). This will remove the need to maintain more than one system, ensure improved approaches are applied to all operational satellites and will greatly simplify the approach to reprocessing.

Some items were *considered an internal IWWG matters which should be pursued there and reported to CGMS as required.*

IWW12.4. IWWG community to agree a new standard BUFR template, which when rolled out should be adopted by all producers.

IWW12.5. IWWG co-chairs to check current requirements for satellite-derived winds in the GOS [OSCAR/Requirements] and to raise with CGMS (i) how best to increase visibility of AMVs as a driver for the design and operations of future satellite systems, and (ii) how best to reflect the higher spatial and temporal resolution requirements of high resolution NWP and nowcasting.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
IWWG, IPET-OSDE	WGII/6	R43.09	IWWG to liaise with the application focal points in the WMO RRR process (on IPET-OSDE) to provide feedback on the winds-related observation requirements in the RRR database.	CGMS-44	OPEN	HLPP # 1.1

IWW12.6. Continue research into improved derivation and assimilation of high resolution winds for use in high-resolution data assimilation and nowcasting.
IWW12.7. IWWG to undertake a 3rd AMV Inter-comparison study in the 2018-2020 timeframe that will study the effect of using higher spatial, temporal, and spectral resolution imagery from the newest satellite series (Himawari 8/9 or GOES-R) on AMV derivation. The IWWG will coordinate with the ICWG in this study to gain an improved understanding of the cloud microphysics and its potential use for improving retrieved AMVs. Apply a NWP SAF analysis type approach to the results and dig deeper into differences observed by the various satellite operators in order to understand why some algorithms perform better in some situations than others.

In view of the very useful and insightful outcome of the 2nd AMV inter-comparison WGII expressed encouragement to CGMS operators to participate in the next inter-comparison and to contribute to the definition of experiments to be conducted with their experts at the next IWWG13 to be held in 2016.

IWW12.17 Encourage continued support and collaboration between AMV producers and feedback from users to help improve the quality of AMV datasets, particularly with a view to securing long-term AMV provision over the Indian Ocean region.

It was recommended to revisit wind-related requirements in OSCAR (high-res NWP, nowcasting); to confirm to what extent Wind is a driver for WIGOS (in Manual on WIGOS and otherwise).

As an important yet specific item, the session noted that revision of QC and QIs is required in view of AMV use in high-resolution NWP, since these have been defined for use in synoptic scales. This needs to be pursued as a matter of priority in view of the need of NWP for higher resolution AMV products.

Finally, WGII confirmed the proposal to change the Co-chairmanship to Regis Borde and Steve Wunzong as of IWW-13 in Monterey CA, USA, summer 2016 and recommended this to the CGMS-43 plenary accordingly. Warm thanks were expressed to the outgoing co-chairs Mary Forsythe and Jaime Daniels for the thorough and thoughtful work and leadership.

CGMS-43-IWWG-WP-02: Summary of the second AMV intercomparison study

The Second AMV Intercomparison study furthered a line of previously completed research regarding the similarities and differences between the operational Atmospheric Motion Vector (AMV) algorithms of seven satellite-derived wind producers (NOAA, CMA, JMA, KMA, EUMETSAT, NWCSAF, CPTEC from Brazil), using a common set of MSG/SEVIRI images and ancillary data.

The current study focused on including for the first time the CMA and NWCSAF AMV algorithms in the inter-comparison, in order to quantify its performance relative to other AMV algorithms, on updating the results of the previous AMV inter-comparison studies due to the changes that had occurred since 2009, and on performing follow up studies, identified in the previous intercomparison work, to analyze particular issues in pursuance of a more complete understanding of how the different AMV algorithms compare. Four experiments were carried out, using common input datasets (Meteosat-9 imagery, and ECMWF forecast grids for 17 Sep 2012). The inter-comparison looked at: target selection, height assignment, tracking, and quality indicators.

The study found a mix of both positive and negative results. The different AMV algorithms successfully determine the horizontal and vertical displacements of the moved features, but not all centres define a consistent AMV speed and direction with these displacements. Using the IR brightness temperature (TBT) for the height assignment, the distribution of AMV heights is highly variable due to the variability of how this representative TBT is defined. When additional height assignment techniques are used, all centres except JMA improve the AMV validation statistics. Nevertheless, the improvement is limited for some of the centres because of using the improved height assignment techniques in only a small part of the data. The two centres using CCC height assignment method (EUMETSAT and NWCSAF) are in general obtaining the best validation statistics. Considering the AMV coverage, important differences occur between centres even in the case in which a similar prescribed configuration is used.

The full AMV Intercomparison Technical Report (267 pages) can be found at:
www.nwcsaf.org/HD/files/vsadoc/CIMSS_AMV_Comparison_FinalReport_04July2014.pdf

A smaller Summary (8 pages) can also be found at:
www.nwcsaf.org/HD/files/vsadoc/AMV_Intercomp_Extended_Abstract_v3.pdf

More spectral channels and higher temporal resolution allow better understanding and more precise tracking of cloud features (e.g., a “wind” tracked in a convective cloud system).

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
IWWG	WGII/6	A43.08	IWWG to define the experiments for the next intercomparison at the next IWW workshop in 2016.	CGMS-44	OPEN	HLPP # 3.2.1

CGMS-43-JMA-WP-04: JMA’s atmospheric motion vectors

This paper reports on the recent status of JMA's Atmospheric Motion Vectors (AMVs) from MTSAT-2 and MTSAT-1R, and gives an overview of Himawari-8 AMVs. Many improvements can be seen in using Himawari-8 for deriving AMVs. The paper showed radiosonde statistics for Himawari-8 and MTSAT AMVs for the period from January 24 2015 to February 23 2015. Quality is improved for upper and

middle levels over the Northern Hemisphere and tropical regions. However, increases in BIAS and RMSVD are seen for middle level over the Southern Hemisphere.

Himawari-8 gives the prospect of better depicting divergent flow in the tropics.

CGMS-43-NASA-WP-05: NASA Global Wind Measurements and Technology Development

Global wind measurements have become indispensable in numerical weather prediction (NWP), and NASA plays a vital role in improving satellite products for the atmospheric motion vector (AMV) from cloud and water vapour feature tracking and the 10-m height oceanic wind vectors from radar scatterometers. NASA continues to develop new technologies for global lidar wind profiles from space and for hurricane winds from GPS reflected signals.

The 17.6-km CMVs from NASA/JPL's MISR instrument are in good agreement with the collocated ERA-Interim winds except for a slightly slower zonal wind speed in the polar jets and a stronger tropical diverging flow in the upper-troposphere. As a MISR research product, the 4.4-km CMV provides valuable (daytime only) diagnostic to the classic Kármán vortex problem in the real atmosphere. NASA's RapidScat, newly installed on International Space Station (ISS) in September 2014, has begun to send quality scatterometer ocean wind data for operational numerical weather prediction. For decades NASA has been advancing Doppler lidar wind technologies for space-borne remote sensing, and is collaborating with ESA with airborne lidar wind validation/calibration to support the Atmospheric Dynamics Mission (ADM). NASA is currently developing an Earth Venture mission, Cyclone Global Navigation Satellite System (CYGNSS), to measure hurricane winds from reflected GPS signals with 8-satellite constellation that will be launch ready in October 2016.

Regarding cal/val plans for CYGNSS, NASA pointed out that GMAO assimilated RapidScat data, and a similar approach is envisaged for CYGNSS.

CGMS-43-NOAA-WP-19 PPT: NOAA Report on Atmospheric Motion Vectors and IWWG Matters

NOAA contributes to CGMS Satellite Wind Activities in a number of ways:

- Operating LEO and GEO satellites that make observations in the visible, IR and microwave spectrums
- Generates operational GEO and LEO Atmospheric Motion Vector (AMV) products
- Makes all available data sets accessible to the CGMS community

The paper responded to CGMS actions and recommendations CGMS-A41.28, CGMS-R41.08, and CGMS-R42.03. It provided an update to CGMS on the status of NOAA satellite wind products, and highlighted its contributions to the CGMS High Level Priority Plan (HLPP). Hourly GOES winds are now available (from 3-hourly previously), and low level wind height assignments in the presence of low level temperature inversions could be improved, with positive impacts in NWP data assimilation systems. Polar winds are now derived from the VIIRS M15 (10.76um) band.

As indicated during the calibration/validation discussions in WGII, polar region atmospheric winds using atmospheric motion vectors based on cloud and water vapour imagery have been demonstrated to be of critical importance to numerical weather prediction. The VIIRS instrument has no water vapour channel, mainly due to the development of VIIRS before water vapour polar winds were successfully demonstrated using MODIS. Without water vapour channels, the density of polar region winds are reduced by about 50% and forecasts are degraded. Therefore it is recommended that CGMS operators consider adding, if not already planned, a water vapour channel and a CO2 channel (for better cloud height estimation) for a future generation polar-orbiting imager. The addition of these channels would result in consistency with other next generation operational polar-orbiting imagers as well as next generation geostationary imagery, including the GOES-R ABI. At the same time we recognize the importance contribution of VIIRS with respect to consistent spatial resolution near the edge of scan and the Day Night Band capability.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS members	WGII/6	R43.10	CGMS members to consider include a water vapour channel and a CO2 channel to polar-orbiting imagers, to maintain accuracy and coverage of polar winds and cloud height retrievals achieved by MODIS.		OPEN	HLPP # 1.1.6

WGII/7 Radio occultation and IROWG matters

CGMS-43-IROWG-WP-13: Outcome and recommendations from the IROWG-4

Lidia Cucurull (NOAA) presented the paper on behalf of the IROWG co-chairs. The main recommendations of the fourth IROWG meeting are summarised below - only a short and concise working paper could be provided to CGMS-43 since IROWG-4 preceded CGMS-43 by about one month. The full set of recommendations, relevant at CGMS, at satellite operator, and at IROWG level will be made available at http://www.irowg.org.

For work in the immediate future CGMS-43 is invited to emphasise the following four main IROWG-4 recommendations:

- Ensure that both, **equatorial and polar components of COSMIC-2 are fully funded and launched**; this is required for Numerical Weather Prediction, Climate, and Space Weather;
- IROWG recommends **targeting at least 20,000 occultations/day to be made available to the operational and research communities** of Numerical Weather Prediction, Climate, and Space Weather;
- IROWG recommends that the **RO receiver design includes sufficient software/firmware flexibility to allow changes in the signal processing including processing of new GNSS**

signals/constellations as they become available; all receiver measurements should cover the ionosphere as well**;**

- International space/research agencies (e.g., NASA, ESA, CMA, CSA, NSF, NOAA, EUMETSAT and others) to hold an **interagency workshop to define cooperation options for implementing the next steps towards a LEO-LEO research and demonstration mission**.

All presentations, as well as minutes, from IROWG-4 are available at http://www.irowg.org.

An Ionospheric and Atmospheric Coordination Workshop was organized in Boulder CO, USA on 3 Oct 2014, to determine requirements for ionospheric products to be distributed over the WIS in NRT.

There is a common data format (based on BUFR) serving the NWP community. To serve the space weather community, further discussion is needed.

WGII asked a question about the nature of IROWG recommendations to CGMS and the science-related issues discussed at IROWG-4. WGII felt that recommendations presented were of a high-level nature and that specific science and technical matters to be addressed were missing. The presenter explained that the need to address scientific and technical objectives, which are the core remit of IROWG, will be forthcoming once the minutes from the workshop are finalized.

CGMS-43-EUMETSAT-WP-12: Status of EUMETSAT Study on Radio Occultation Saturation with Realistic Orbits

First results of a study currently running at ECMWF are presented. The study looks at saturation effects when assimilating RO observations, where RO observation positions are simulated using realistic LEO and GNSS orbits. This study is thus a refinement of an earlier study that assumed RO occultations to be randomly distributed in space and time. An Ensemble of Data Assimilation (EDA) approach, using 10 (+1) members in a 4D-Var modern NWP system, was used. Within this study, the following 3 main issues are addressed:

1. Refine the earlier, random occultation position, study with realistic future satellite orbits;
2. Assess which observation constellation is best suited to achieve the best distribution in space and time;
3. Provide guidance on RO instrument deployments on future LEO satellites.

Regarding Point 1, it has been found that although realistic orbits affect occultation positions significantly, a modern NWP system can still effectively use any observations, thus the impact of realistic orbits is small. Regarding Point 2, the more observations are available, the lower forecasting spreads are found; constellations that provide most observations at low latitudes are particularly useful, since here, per area the least occultations are available from polar orbiting RO instruments and the model errors are the largest. Regarding Point 3, it again can be concluded that the more observations, the lower the forecast spread, even if additional instruments are provided in orbits that are already populated with RO instruments.

The study itself is formally finishing by August 2015, with a final presentation at EUMETSAT about 1 month earlier. Underlying EDA runs have been run over the last year and are complete. Results, discussions and conclusions will this be included in the final report. The study results have also been presented and discussed at IROWG-4 in April 2015.

CGMS-43-NOAA-WP-20 PPT: NOAA Report on Radio Occultation and IROWG matters

The presentation provided a status report of the COSMIC-2 / FORMOSAT-7 constellation, which is a NOAA-NSPO-USAF-NASA/JPL partnership. It is a follow-on to the current COSMIC-1 satellite constellation, and its design concept meets L1RD requirements. The system will provide 10,000+ worldwide soundings per day, with all weather, uniform coverage over oceans and land with 30 min average latency. The constellation consists of 12 satellites, with 2 launches in different inclinations (6 satellites to 24 degree orbit – carrying USAF secondary payloads; and 6 satellites (+ 1 optional spare) to 72 degree orbit – carrying Taiwan secondary payloads (planned)). Details were provided on the instrument development status.

NOAA also described tracking methods that enable COSMIC-2 occultations to take measurements useful for space weather applications.

NOAA informed WGII that the full COSMIC-2 Programme (equatorial and polar) is included in the Presidential Budget for NOAA activities.

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS RO space agencies	WGII/7	A43.09	CGMS members that operate RO instruments to explore RO capabilities to support space weather applications and report on their support to space weather application to CGMS-44.	CGMS-44	OPEN	HLPP # 5.2

CGMS-43-CMA-WP-05: CMA Report on Radio Occultation Processing

FY-3C, launched on September 23rd, 2013, carries a radio occultation sounder named GNOS (Global Navigation Satellite System Occultation Sounder). Compatible with GPS and BeiDou navigation satellite systems, GNOS makes daily measurement up to 800 times which are made available through web-based data services, CMACast, and the GTS. CMA-WP-05 presents the result of a study that compares the refractivity profiles with the co-located ECMWF analyses. Bias and standard deviation being calculated as the function of altitude, the result shows that the mean bias is about 0.2% from the near-ground surface to 35km; the average standard deviation is within 2%, but for the range 5-30km where best soundings are usually made, the magnitude is about 1%. In general speaking, GNOS meets the designed requirement; it gives FY-3 a new sounding capability and users a new data option.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/7	R43.11	CGMS Members to approach Operators of GNSS systems to request them to provide a minimum level of information on the signal structure and interface control (ICD) in a timely manner to enable the use of these for future RO missions.	CGMS-44	OPEN	HLPP # 1.1.4

WGII/8 Cloud, ICWG and ash/dust related matters

CGMS-43-ICWG-WP-01: Structure International Clouds Working Group (ICWG)

Cloud parameter retrievals are increasingly used for near-term (now-casting), short-term, (weather forecasting), medium-term (regional monitoring), and decadal (climate monitoring), as well as for potential improvements in the cloud and convection parameterizations adopted in weather and climate models. These developments have led to an increasing interest of space agencies to make cloud detection and cloud parameter retrievals part of their operational services. The space agencies from the Coordination Group for Meteorological Satellites (CGMS) ask for a mechanism that facilitates access to and sharing of knowledge, commonality of approaches, requirements, and training on cloud parameter retrievals.

At CGMS-42 WGII the nominated ICWG representatives of the Cloud Retrieval Evaluation Working Group (CRE-WG) presented the Terms of Reference (ToR) for establishing an International Clouds Working Group within CGMS. Thereafter, the CGMS−42 plenary endorsed the formation of an International Clouds Working Group (ICWG), making CRE-WG a formal entity.

This working paper presents the response to the action assigned to the co-chairs of the ICWG at the 42nd CGMS meeting [CGMS-42: WG II/8 Action 42.06], asking the ICWG co-chairs to develop the new ICWG into a structure which is common to the existing International Science Working Group under CGMS and provide a report to CGMS-43.

CGMS-43-ICWG-WP-02: Summary report of the International Cloud Working Group Activity

The ICWG was formally known as the group in Cloud Retrieval Evaluation Workshop-4 (CREW-4). The last workshop was held on 4-7 March 2014, Grainau, Germany, and aimed at enhancing cloud parameter retrievals, assessing their associated errors, improving their use in nowcasting and forecasting activities, and improving the characterization of long-term cloud property datasets. There were 69 participants who presented their work in four sessions and eight subtopics. The main recommendations of the CREW-4 were to:

- Improve cloud models used in retrievals to more accurately reflect reality, in particular ice crystal models, vertical in-homogeneity and multiple layers;

- Explore the potential of combining different types of observation in level-2 cloud retrieval methods;
- Explore the definition of a set of essential filtering rules in level-3 aggregation methods for different cloud parameters;
- Work towards the characterisation of uncertainties in level-2 and level-3 products;
- Explore production of multi-algorithm ensembles to assess uncertainty/sensitivity;
- Explore the production of long-term datasets aimed at stability and accurate assessment of product strengths and weaknesses;
- Use of common ancillary data and validation procedures for level-2 and level-3 data;
- Establish topical groups to make progress on a variety of outstanding issues, for example multi-layered clouds, severe weather applications, and aggregation methods.

The next ICWG meeting will be held during 17-20 May 2016, in Lille, France.

ICWG has formed topical groups to address key research questions, and actions agreed by the Group or coming from CGMS. A question was asked on the potential of ICWG to address ash and aerosol retrievals in the future, given the commonalities in microphysics. ICWG has not yet addressed this.

At its next meeting, ICWG should put focus on investigating data from the new-generations instruments on Himawari-8 and GOES-R for the retrieval of cloud parameters.

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
ICWG	WGII/8	R43.12	At its next meeting (May 2015), ICWG should put focus on investigating data from the new-generations instruments on Himawari-8 and if available GOES-R for the retrieval of cloud parameters.	20 May 2016	OPEN	HLPP # 3.2.4

CGMS-43-NOAA-WP-21 PPT: NOAA Report on Cloud, ICWG and Ash/Dust Related Matters: VIIRS Aerosols and Air Quality Applications

This presentation provided the status of the current cloud, and aerosols products from NOAA/NESDIS, current applications and future capabilities. The presentation included an overview of the volcanic ash satellite retrieval algorithm inter-comparison activity currently undertaken within WMO SCOPE-Nowcasting (workshop hosted by NOAA CIMSS on 29 Jun – 2 Jul 2015). Studies on merged VIIRS/CrIS cloud retrievals are underway, as well as cloud validation efforts using CALIPSO/CALIOP, and generation of cloud CDRs. The status of VIIRS aerosol products was presented (AOD, air quality parameters), and the value of synergistic use of several sensors (e.g., VIIRS, CrIS) to derive products highlighted.

The session noted that coordination between CGMS and the European Copernicus Atmospheric Monitoring Service (CAMS), GEIA (Global Emissions InitiAtive), and CEOS (Committee on Earth Observing

Satellites) Atmospheric Composition Constellation (ACC) is needed, on a geostationary constellation for atmospheric composition and air quality monitoring (consisting of TEMPO, Sentinel-4, and GEMS).

The session further noted:

- Coordination and commonality of processing code to generate VIIRS aerosol products (HLPP 1.4, HLPP 3.2)
- Work with users to obtain feedback on experimental VIIRS/OMPS synergy products (HLPP 2.3)
- Use SNPP VIIRS fire detection, FRP, burned area products to assess societal impacts of fires (HLPP 4.1.1)
- Develop training tutorials/webinars/modules through COMET on VIIRS aerosol products and air quality applications (HLPP 4.2.2)

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
WMO	WGII/8	A43.10	WMO to provide a report on the volcanic ash intercomparison within SCOPE-Nowcasting at CGMS-44.	CGMS-44	OPEN	HLPP # 3.2.2

CGMS-43-JMA-WP-05: JMA's SCOPE-Nowcasting activities

This paper reported on the status of activities engaged in by the Japan Meteorological Agency (JMA) for SCOPE-Nowcasting pilot projects 1 (RGB composite images) in support of the WMO Severe Weather Forecasting Demonstration Project (SWFDP), 2 (volcanic ash inter-comparison and test-bed) and 4 (sand and dust monitoring). Special imagery (RGBs, heavy rainfall potential) is being made available for the SWFDP regions in Asia and the SW Pacific. The volcanic ash algorithm test-bed will be useful for exploiting the results from the inter-comparison activity (the NOAA NESDIS and EUMETSAT algorithms have been installed in the test-bed). Products from Himawari-8 are expected to contribute to all projects.

RGB composites from Himawari-8 will be made available by JMA based on the WMO/EUMETSAT recipe. Asian dust products are also being made available through ftp or other means. Cooperation between KMA and JMA on this topic continues under SCOPE-Nowcasting Pilot Project 4.

Currently no limb correction is applied to RGBs from Himawari-8, and polar imagery has been corrected for viewing angle effects.

In addition an action was placed on NASA as follows:

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
NASA	WGII/8	A43.11	NASA to report on polar-based RGB composite viewing angle corrections to CGMS-44.	CGMS-44	OPEN	-

CGMS-43-KMA-WP-05: KMA improvement in cloud amount estimation and Asian dust detection

The paper introduced the improvement of cloud amount estimation using COMS observation data to support automatic observation of cloud amount instead of visual observation and very short range forecasting in KMA. Visual observation of cloud amount is used for comparison, to overcome cloud overestimation in winter-time when BT difference between IR and WV channel becomes very small, which leads to misclassification of cloud presence. The cloud detection algorithm was then modified accordingly.

CGMS-43-KMA-WP-07: KMA progress on COMS cloud detection

This report describes the current status of COMS cloud detection by an operational algorithm and to introduce a new method for improving the algorithm. The performance of the cloud detection affects the accuracy of all of COMS meteorological products because the cloud detection plays key role as a scene analysis for retrieving the products. The operational algorithm for deriving cloud mask in KMA/NMSC adopts the conventional static thresholds method, but it has a discontinuity in the day/night transition area. To remove the discontinuity, we introduce normalized reflectance and dynamic threshold of brightness temperature difference (11 - 3.7μm). According to the case studies the new algorithm shows better results for cloud detection during twilight time. And we are now developing a cloud detection algorithm for Geo-KOMPSAT-2A/AMI based on the COMS operational one including these methods.

WGII welcomed the papers and took the opportunity to iterate the importance of consistent, well-documented cloud masks (also in view of potential generation of climate data records), and thanked KMA for its reports. Furthermore KMA was encouraged to present this work to the ICWG at their next meeting.

CGMS-43-CMA-WP-07: CMA Report on Multi-channel Processing of Aerosol

This paper is prepared in response to CGMS Action item 42.05.

Dust storm and air pollution is the most extreme aerosol event in China. NSMC/CMA use sensors aboard FY-series satellites to retrieve aerosol information. Typical sensors include VISNIR-TIR imagers, such as FY-3/MERSI/VIRR, UV mapper FY-3/TOU, and TIR observation from FY-2. Main derived products include Aerosol Optical Depth (AOD), Absorption Aerosol Index (AAI), Infrared Difference Dust Index (IDDI) using IR split-window, and dust storm quantitative parameters (dust optical depth, column dust density, and particle effective radii). The approach taken using MERSI is similar as for MODIS. These products support operational monitoring of dust storm, haze (air pollution), and volcanic ash cloud. NSMC/CMA is engaged in reprocessing the products to try to improve calibration, cloud mask method, and AOD multi-algorithms, realizing that consistency and quality of the aerosol products must be improved if they can be used for the study of climate.

WGII/9 Ocean parameters

CGMS-43-CNSA-WP-03: The Role of the HY-2 and CFOSAT satellite in the Frame of Globe Ocean Wind Vector Observation

The HY-2 satellite was successfully launched on August 16, 2011. The microwave conical scanning two-beam Ku-band scatterometer is an important payload of the HY-2 satellite. It can observe the global ocean wind vector. The CFOSAT scatterometer is a Ku-band dual-polarisation rotating fan-beam radar scatterometer for ocean surface wind vector, which will be launched in 2018. With the two scatterometers launched the temporal and spatial resolution will be better than with a single satellite. The two data source, HY-2 and CFOSAT scatterometer, will play an important role in the Frame of Global Ocean Wind Vector Observation.

CGMS-43-ESA-WP-03: Some results from the ESA Earth Explorer Missions GOCE, CryoSat-2, SMOS and SWARM

CGMS was informed about some outstanding results from the Earth Explorer (EE) missions GOCE, CryoSat-2, SMOS and Swarm. In orbit since March 2009, the Gravity field and steady-state Ocean Explorer (GOCE) has measured 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. The Swarm constellation comprising three satellites was launched on 22 November 2013. GOCE detected temporal changes in West-Antarctic ice sheet (together with GRACE); ocean circulation explorer. SMOS is performing well, the mission extended to 2017, RFI issues could be reduced; various product levels are provided including NRT (within 3h) and NRT "light", and distributed on the GTS; ocean salinity products from SMOS are critical to understand salt exchange in currents, traces of tropical instability waves, ocean acidification. CryoSat-2 data are now available within two days of acquisition, revealing unprecedented losses in both ice sheets (500 km3/year). The Swarm mission is looking at the magnetosphere.

BIOMASS has been selected as EE-8, a P-band radar mission to detect above-ground biomass and CarbonSat, FLEX selection slated for September 2015.

WGII asked whether direct broadcast was planned for any of the ESA and NASA future missions. It was explained that ESA data are partially distributed via EUMETCast and made available in NRT through ftp. However it was also recalled that direct broadcast is not necessarily part of the original planning of research missions.

CGMS-43-ISRO-WP-10 – Satellite-based ocean and polar science data products

In the view of Earth Observations applications for ocean and polar science studies, a number of satellite-based products are being generated for operational as well as research studies. INSAT-3D retrieved half-hourly SST product is available routinely from MOSDAC. 10-years of daily Net shortwave radiation estimated from Meteosat satellite over the warm pool region of the Indian Ocean has been generated. Under polar research, one such product is climatological sea-ice occurrence probability data over Antarctic region using 34-years' daily 25-km sea-ice concentration data available from NSIDC site. This product is freely available to the global scientific community from ISRO's MOSDAC (www.mosdac.gov.in) site. Coastal products like, sea surface height and significant wave height for the Indian coast using SARAL/AltiKa satellite will be available soon from the same site.

WG II thanked ISRO for the presentation.

CGMS-43-KMA-WP-08: KMA progress on multi-sensor SST composition over East Asia region

This paper describes the accuracy of COMS SST in the East Asia region through robust quality control process of in-situ SST and cloud screening, and a composition technique of multi-sensor SST from COMS and LEO (AVHRR, GCOM-W1/AMSR-2, TRMM/TMI). KMA has a plan to use the satellite SST for NWP model as a surface condition.

In the discussion it was recommended that KMA seek feedback from GHRSST on the approach taken with OSTIA, to ensure that the merged SST product is consistent.

CGMS-43-NASA-WP-02: NASA Future Ocean Satellite Missions, 2014-2020

Prior to 1978, a ship was the critical platform from which to record oceanic conditions, which severely restricted perspectives of the global ocean. Oceanographers correctly wondered why the Gulf Stream or other major oceanographic features always followed the survey ship. Then, in 1978, NASA developed a series of major science and technology breakthroughs when it launched three missions that changed the way ocean sciences were conducted and presented, for the first time, global ocean quasi-synoptic views of the near-surface phytoplankton biomass, sea ice, ocean surface topography, sea surface temperature, and surface wind speed and direction. NASA embarked on a long-term strategy to improve measurement accuracies and horizontal and temporal resolutions with each succeeding mission for advancing the science of the global integrated Earth system, including introducing new measurement capabilities such as sea surface salinity in 2011.

The paper reviewed NASA's planned constellation of ocean missions, demonstrating NASA's commitment to pioneer new technology to advance ocean sciences as an essential component of global integrated Earth system science and how these missions will continue to extend the legacy initiated in 1978 (RapidScat, Jason-3 with main responsibility with NOAA and EUMETSAT, ICESat-2, SWOT, PACE).

WMO noted that ocean observations are critical for weather and climate services, and appreciated the NASA contribution. On the issue of continuity of proven research-based instrumentation, NASA referred

to the NRC Decadal Survey mechanism used for deciding on follow-on missions. Discussion in the U.S. is on-going on how NASA can support sustained missions for the oceans and climate.

CGMS-43-NOAA-WP-22 PPT: NOAA Report on Ocean Parameters: SST

The paper provided an update of the new SST that is now available from VIIRS onboard S-NPP (launched in 2011), and follow-on J1 (2017) and J2 (2022). VIIRS spatial resolution, radiometric performance, image quality, and wide swath are enabling new unprecedented SST remote sensing capabilities. The product highlighted is SST derived from VIIRS, and access to product, its accuracy, and application activities promoting its use are discussed.

CGMS-43-NOAA-WP-23 PPT: NOAA Report on Ocean Parameters: Ocean Color

The paper provided an overview of the ocean colour products that are now available from VIIRS, including a couple of new products. VIIRS spatial resolution and swath is enabling new ocean colour remote sensing capabilities. Products highlighted are the ocean colour suite (examples of global and regional) that is now available from NOAA/STAR (Wang et al., 2013; 2014). The presentation included a description of the STAR end-to-end ocean colour data processing capability (including in situ data for Cal/Val activities), data access/accuracy of these products, and application activities promoting the use of these products.

NOAA supports the Marine Optical Buoy (MOBY) programme, for validation purposes. A VIIRS cal/val cruise has been undertaken with international participation. Parameters of interest included nLw, chl-a, PAR. The NOAA processor can be used to ingest other sensor data, such as from Sentinel-3, GCOM-C. Reprocessing of the entire VIIRS record is planned.

EUMETSAT on behalf of the European Copernicus Marine service expressed appreciation for the NOAA ocean colour products. EUMETSAT is re-distributing these products in Europe through EUMETCast.

CGMS-43-NOAA-WP-24 PPT: NOAA Report on Ocean Parameters: Coral Reef Watch

The Coral Reef Watch mission is to utilize remote sensing and in situ tools for near-real time and long term monitoring, modelling and reporting of physical environmental conditions of coral reef ecosystems. Primarily, Coral Reef Watch uses satellite data to provide current reef environmental conditions to quickly identify areas at risk for coral bleaching around the world. The presentation provided an overview of the Coral Reef Watch program, which uses SST anomalies blended from VIIRS, AVHRR, and GOES. Value of blended data (at 5-km resolution) lies in better coverage, using polar data for global coverage, and geostationary imagery to fill gaps caused by clouds.

An unresolved issue is in-situ verification of near-shore SST data since in-situ SST data coverage is poor in developing nations, and reporting of coral bleaching is even more limited.

CGMS-43-NOAA-WP-26 PPT: NOAA Use of Scatterometry Products

This paper reported on the use of scatterometry products from EUMETSAT (ASCAT) and NASA (RapidScat, used now in AWIPS) by NOAA. Satellite scatterometer data provides critical information that supports short term weather analysis, forecasting and warning and longer-term monitoring and characterization of the environment. Proper temporal and spatial sampling require coordination among satellite agencies and a commitment of open and timely data access.

NOAA looks into possibility for reprocessed ocean colour and SST datasets.

IOC/UNESCO stressed the necessity of sustaining key missions in support of oceanography and marine meteorology. WMO clarified that the CGMS Baseline for the Operational Contribution to the WMO Global Observing System (GOS) includes satellite missions performed or to be performed on an operational/sustained basis.

WGII/10 Other parameters and products

CGMS-43-EUMETSAT-WP-11: Utilisation of Geostationary Satellite Data for Short-range NWP - A Questionnaire

This paper addressed the utilisation of new geostationary satellite data in Short-Range NWP (SRNWP) models. CGMS members are kindly requested to discuss the questions with their SRNWP experts as applicable and to provide responses to GCMS-44. With this paper EUMETSAT intends to establish a broader view among CGMS members on the needs and evolution of SRNWP for satellite observations. The responses will lay out pertinent research and development work on the part of satellite operators and SRNWP, respectively.

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS members	WGII/10	A43.12	CGMS members to provide responses to the questionnaire on use of satellite data for SRNWP from experts (in their organization) and provide a compilation of responses to CGMS-44.	CGMS-44	OPEN	-

A follow-on activity in 2016-2017 could be an expert workshop on this topic. The scope of satellite data is broad. E.g. it includes polar orbiters and is not limited to geostationary imagers. An important question is what scale a particular product represents.

CGMS-43-CNSA-WP-04: The Productions Distribution and Application about HY-2 satellite

HY-2 is an ocean dynamic environment satellite which was launched in August 2011 to obtain global marine dynamic environment parameters including sea surface height, significant wave height, ocean wind vectors, etc. Ocean observation data provided by HY-2 have been widely used by both domestic

and international users in extensive areas such as ocean disaster prevention and reduction, marine environment forecast, ocean resource development and management, ocean investigations and scientific research, etc.

The session acknowledged the contribution by CNSA in support of ocean applications through HY-2A.

CGMS-43-IMD-WP-03 PPT: Web based Satellite data Analysis tool "RAPID"

Real time Analysis of Products & Information Dissemination called RAPID is a web based quick visualization and analysis tool for satellite data on a real-time basis. This presentation introduced Next Generation Weather Data Access & Advanced Visualization Application ranging from weather events to atmospheric phenomenon to agricultural production. The fog presence over railway track and highways can be visualized, as well as the position of clouds, fog and visibility by a pilot along the entire route in real time and interactively.

The tool has a latency of 30 minutes. It allows visualization not only in NRT but also retrospectively. Quantitative information is provided per pixel.

In the discussion, ISRO agreed to enquire whether the software tool can be made available more broadly.

CGMS-43-IMD-WP-04 PPT: INSAT-3D New Products & their use in Operational Forecasting

The presentation provided an overview of the INSAT-3D payload (Imager, Sounder) derived products and their use. Full disk mode of the Imager takes 26 min, and rapid scan of specific sectors 6 min. Day/night-time microphysics RGB examples were shown, e.g., for dust detection. Surface insulation (irradiance) and land surface temperature products are also derived.

WGII asked whether the adopted visualisation of RGBs is based on the widely accepted standards developed by WMO/EUMETSAT. ISRO confirmed that this is the case.

CGMS-43-NASA-WP-03: Suomi National Polar-orbiting Partnership (SNPP): Continuing NASA Research and Applications

Following the 2011 launch of SNPP, spacecraft commissioning, and instrument activation, the NASA SNPP Science Team evaluated the operational RDRs, SDRs, and EDRs produced by the NOAA ADS and IDPS. A key part in that evaluation was the NASA Science Team's independent processing of operational RDRs and SDRs to EDRs using the latest NASA science algorithms. The NASA science evaluation was completed in the December 2012 to April 2014 timeframe with the release of a series of NASA Science Team Discipline Reports.

In summary, these reports indicated that the RDRs produced by the SNPP instruments were of sufficiently high quality to be used to create data products suitable for NASA Earth system science and applications.

However, the quality of the SDRs and EDRs were found to vary greatly when considering suitability for NASA science. The need for improvements in operational algorithms, adoption of different algorithmic approaches, greater monitoring of on-orbit instrument calibration, greater attention to data product validation, and data reprocessing were prominent findings in the reports. In response to these findings, NASA, in late 2013, directed the NASA SNPP Science Team to use SNPP instrument data to develop data products of sufficiently high quality to enable the continuation of EOS time series data records and to develop innovative, practical applications of SNPP data.

In 2014, NASA held the Second Suomi NPP Applications Workshop to brief application users on upcoming data products and to exchange information between application developers, the NASA Science Team, and the new Science Investigator-led Processing Systems (SIPS) community. The workshop provided updated information on instrument performance, data characteristics, and ways to access the data, a review of current SNPP applications in use by end users and opportunities for the user community to provide feedback to NASA and the science team, and the effort to identify current barriers to the integration of SNPP data into other existing and developing applications. Much of the interaction was conducted in breakout sessions aligned with the four focus areas of Public Health and Air Quality, Water Resources, Ecological Forecasting, and Disasters.

CGMS-43-NASA-WP-06: Use satellite observations in NASA reanalyses: MERRA-2 and future plans

Nearing completion, the MERRA-2 atmospheric reanalysis of the modern satellite era (1979-onward) is being produced at the Global Modeling and Assimilation Office at NASA Goddard Space Flight Center. The system is incorporating a number of advances in observation utilization, data assimilation methodology, and model development to produce a follow-on to the original MERRA project that both improves on the original and provides many value-added features. Many of these new features include the incorporation of a global aerosol modelling and analysis system, improved use of ozone and temperature observations in the stratosphere and lower mesosphere (notably during the NASA Aura period), and the incorporation of new satellite observations of temperature and water vapour in the most recent periods (2005-onward).

The paper aims to introduce MERRA-2 and to demonstrate the consistency of the analysis through the investigation of its observations. The system will serve as the basis for future reanalysis projects coupling the atmosphere, land, and ocean model and analysis components. Fundamental to the advancement of reanalysis is the further understanding and exploitation of both historical and future observations.

Observation feedback is important to link observation and analysis communities, and the use CORE-CLIMAX output is proposed. The session enquired as to what extent a facility for systematic collection of user feedback has been established within MERRA.

CGMS-43-NASA-WP-07: NASA's 7-km GEOS-5 Nature Run: A resource for satellite mission planning

The Global Modeling and Assimilation Office (GMAO) has produced a two-year 7-km resolution non-hydrostatic global mesoscale simulation with the Goddard Earth Observing System (GEOS-5)

atmospheric general circulation model. The simulation was produced as a Nature Run for conducting observing system simulation experiments (OSSEs). Generation of the GEOS-5 Nature Run (G5NR) was motivated in part by the desire of the OSSE community for an improved high-resolution sequel to an existing Nature Run produced by the European Centre for Medium-Range Weather Forecasts (ECMWF), which has served the community for several years. The intended use of the G5NR in this context is for generating simulated observations to test proposed observing system designs regarding new instruments and their deployments. Because NASA's interest in OSSEs extends beyond traditional weather forecasting applications, the G5NR includes, in addition to standard meteorological components, a suite of aerosol types and several trace gas concentrations, with emissions downscaled to 10 km using ancillary information such as power plant location, population density and night-light information.

To optimally support global modelling, CGMS operators should consider involving modellers early in the definition of future mission concepts.

CGMS-43-NASA-WP-08: Surface Pressure and other Meteorological Properties Measured by the NASA Orbiting Carbon Observatory-2 (OCO-2)

The Orbiting Carbon Observatory-2 (OCO-2) is the first NASA mission designed to measure atmospheric carbon dioxide (CO2) with the precision, accuracy, resolution, and coverage needed to quantify the processes emitting CO2 into the atmosphere and absorbing it at the surface on regional scales over the globe. OCO-2 was successfully launched from Vandenberg Air Force Base on 2 July 2014. After completing a series of spacecraft checkout activities and orbit raising manoeuvres, OCO-2 was inserted into lead position of the 705 km Afternoon Constellation (A-Train) on August 3, 2014. Its 3-channel, imaging grating spectrometer was then cooled to its operating temperatures and a series of calibration and validation activities was initiated. In early October, OCO-2 started routinely collecting almost one million soundings each day over the sunlit hemisphere. Preliminary results from the cloud screening algorithm indicate that around 25% of these soundings (250,000/day) are sufficiently cloud free to yield full column estimates of the column averaged CO2 dry air mole fraction, XCO2 with precisions of ~0.25% (one part per million (ppm) out of the ambient ~400 ppm background). While XCO2 is the primary product of the OCO-2 mission, its measurements also yield a number of other geophysical quantities that might be of use to the meteorological community, including the first space based estimates of surface pressure with precisions near 1 hecto-Pascal (hPa). Estimates of other meteorological variables, including near-surface wind speed over the ocean, aerosol optical depths, near-surface atmospheric temperature, and relative humidity profiles are also routinely retrieved, and are currently being validated against available standards. Once validated, the next step will be to assimilate these surface pressure measurements into a numerical weather prediction reanalysis model to assess their impact on weather forecasts.

The histogram of the differences between the retrieved surface pressure and the ECMWF prior model state, shows an overall positive bias of ~0.78 hPa and a standard deviation of 3.5 hPa. The bias may be associated with known uncertainties in the absorption cross sections of the O2 A-band or small errors in the instrument calibration.

While the nominal downlink and data processing strategy precludes meeting the NRT latency requirement (less than 3 hours), this strategy could be modified to meet this latency requirement. The agreement between GOSAT and OCO-2 is at the level of 2ppm, using the TCCON network as ground-based reference, and the aim is to achieve a level of 1ppm.

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
NASA	WGII/10	A43.13	NASA to report on progress in testing the use of surface pressure retrievals from OCO-2 by NWP centres, with a view to report on results at the WMO Impact workshop in May 2016 (and to CGMS-44).	May 2016 and CGMS-44	OPEN	-

CGMS-43-NOAA-WP-25 PPT: NOAA Use of Soil Moisture Products

The presentation described the NASA Soil Moisture Active/Passive (SMAP) mission launched on 31 Jan 2015. Benefits are expected to be realized in the NESDIS Soil Moisture Operational Product System (SMOPS), developed for timely (in near real-time) consistent processing of these data products for use in NOAA operations (NWP) and research. The System already uses soil moisture data products from ASCAT, SMOS, WindSat, and AMSR2.

CGMS should encourage collaboration between different research and operation groups for a globally consistent soil moisture data set.

Satellite continuity may need attention from operational agencies for development and application of consistent soil moisture data products.

NOAA has projects underway to demonstrate the impact of soil moisture retrievals on forecasting. Consistency in products with precipitation, vegetation, and snow cover require attention.

CGMS-43-NOAA-WP-27 PPT: NOAA Land Products

The purpose of this presentation was to provide an update on selected new land products that are now available from VIIRS. Products highlighted are green vegetation fraction, land surface temperature, and fire locations/fire radiative power. Product continuity of heritage sensors such as AVHRR is also covered. Some products are available through web mapping services, such as on active fire for early responders.

The presentation included access/accuracy of these products, and examples of application activities promoting the use of these products.

CGMS to consider:

- Consistent global multi-sensor products (LEO, LEO-GEO)
- Coordination of global land monitoring constellation (CEOS LSI dysfunctional)

NASA noted that work is underway to develop an all-sky land surface temperature product from AIRS.

Concerning the availability of datasets, the following recommendation was made:

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/10	R43.13	CGMS agencies to make available a non real-time cache of satellite level 1 data over the previous 2-3 months, similar to the NOAA CLASS system.	CGMS-44	OPEN	HLPP # 2

CGMS-43-ROSHYDROMET-WP-04: Meteorological and environmental satellite data and products in Roshydromet – new development

The document presented an overview of operational and research activity in Roshydromet related to the derivation and application of remote sensing products from weather and environmental satellite data. It is focused mainly on the results of the Meteor-M N2 commissioning phase and further exploitation. The sample products are presented based on Meteor-M N2 and other satellite data. MSU-MR is used for deriving cloud images and analyses, precipitation intensity, SST; the KMSS instrument used for fire monitoring, flood mapping, sea ice cover). The X-band SAR sensor BRLK Severjanin can provide input to ice monitoring, but has low SNR and is therefore only used as a supplementary data source. Atmospheric sounding products are derived from the IR sounder IKFS-2 and the MW imager/sounder MTVZA-GY. During commissioning phase, all the main characteristics of IKFS-2 were confirmed, and a processing package for T,u retrievals is now being finalised. A comparison of MTVZA-GY that has been performed with similar AMSU/NOAA-, ATMS/SNPP- and SSMIS/DMSP-based products has shown good resemblance of both estimates. This can be treated as an indirect proof of reliability of the presented products.

WGII commended Roshydromet on their development and encouraged a wide access to the products by the CGMS user community.

In concluding the discussions, it was noted that the following action had been transferred from WGIV to WGII:

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS members	WGII/10	A43.14	(Action transferred from WGIV) CGMS members that have not yet done so to nominate focal points that would work with the WMO Secretariat in populating the WMO Product Access Guide. • ESA: Jean-Louis Fellous jfellous@noos.fr • EUM: Sally Wannop, Sally.Wannop@eumetsat.int • JMA: Daisaku Uesawa, satellite@ml.kishou.go.jp • NOAA: Tony Mostek, anthony.mostek@noaa.gov • ROSH: Dr. Sergey Uspensky, Head of Department, SRC "PLANETA" uspenskys@planet.iitp.ru • CMA: Xu Zhe, xuzhe@cma.gov.cn KMA: Nomination of a KMA focal point is pending.	30 July 2015	OPEN	-

WGII/11 Review and updating of the HLPP

CGMS-43-CGMS-WP-29: Proposed CGMS High Level Priority Plan (HLPP) 2015-2019

As part of the agreed revision cycle for the CGMS High Level Priority Plan, this document presented a proposed HLPP covering the period 2015-2019. The update is based on the following inter-sessional activities:

- IWWG and IPWG meetings in 2014
- Other revisions identified by WG chairs and co-chairs

Annex 1 – Status of implementation of HLPP 2014-2018

Annex 2 – Proposed High-Level Priority Plan 2015-2019

WG II provided comments on the status of implementation of HLPP, and on the proposal for revision of HLPP 2015-2019 to the CGMS Secretariat in due course.

WGII/12 Any other business

WGII reconfirmed the WGII co-chairmanship of Toshiyuki Kurino and Stephan Bojinski, as well as Mitch Goldberg and Kenneth Holmlund as WGII rapporteurs to be presented to CGMS-43 plenary accordingly.

WGII/13 Inter-sessional activities/meetings in 2015-2016 [CGMS-43 -> CGMS-44]

Tentative dates agreed: 12 Nov 2015, 17 Feb 2016

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

CGMS-42 actions and recommendations:

The final status of all CGMS-42 actions and recommendations (plenary and working groups) following CGMS-43 discussions is available here.

(http://www.cgms-info.org/documents/CGMS-42_LoAandLoR_final.pdf

The session reviewed and agreed on actions and recommendations from Working Group II.

Summary list of WGII actions

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
GSICS	WGII/3	A43.01	GSICS to establish the requirements for absolute lunar calibration and prepare a white paper describing the tentative way to meet those requirements in case they go beyond those lunar calibration capabilities.	CGMS-44	OPEN	HLPP # 3.1.2
CGMS space agencies	WGII/3	A43.02	Calibration events logging task team to prepare a white paper outlining the set of parameters, the nomenclature, and the standards to be used for reporting on instrument calibration across space agencies.	CGMS-44	OPEN	HLPP # 3.1
GSICS	WGII/3	A43.03	GSICS to document and implement its approach to manage changes in reference instruments.	CGMS-44	OPEN	HLPP # 3.1
ROSH	WGII/3	A43.04	Roshydromet to present an update on Meteor-M N2 data access, processing packages, and results of an intercomparison of the IKFS-2 with other hyperspectral sounders (IASI, AIRS, CrIS), to CGMS-44.	CGMS-44	OPEN	HLPP # 1.4.2
CGMS space agencies	WGII/3	A43.05	CGMS operators to provide a report on their approach on cal/val, including information on dedicated campaigns and permanent sites, and potential support to cal/val infrastructure, in order to maximize benefits of satellite missions.	CGMS-44	OPEN	-
CGMS space agencies	WGII/5	A43.06	CGMS operators to report on their specific plans for reprocessing and associated user requirements (such information would be useful for the ISWGs).	CGMS-44	OPEN	HLPP # 5.1
IPWG	WGII/5	A43.07	The session recommended a stronger application focus of IPWG (e.g, NWP, hydrology, agriculture), and asked IPWG to organize a IPWG-NWP workshop in 2015 or 2016.	CGMS-44	OPEN	HLPP #3.6
IWWG	WGII/6	A43.08	IWWG to define the experiments for the next intercomparison at the next IWW workshop in 2016.	CGMS-44	OPEN	HLPP # 3.2.1
CGMS RO space agencies	WGII/7	A43.09	CGMS members that operate RO instruments to explore RO capabilities to support space weather applications and report on their support to space weather application to CGMS-44.	CGMS-44	OPEN	HLPP # 5.2

CGMS-43 actions - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
WMO	WGII/8	A43.10	WMO to provide a report on the volcanic ash intercomparison within SCOPE-Nowcasting at CGMS-44.	CGMS-44	OPEN	HLPP # 3.2.2
NASA	WGII/8	A43.11	NASA to report on polar-based RGB composite viewing angle corrections to CGMS-44.	CGMS-44	OPEN	-
CGMS members	WGII/10	A43.12	CGMS members to provide responses to the questionnaire on use of satellite data for SRNWP from experts (in their organization) and provide a compilation of responses to CGMS-44.	CGMS-44	OPEN	-
NASA	WGII/10	A43.13	NASA to report on progress in testing the use of surface pressure retrievals from OCO-2 by NWP centres, with a view to report on results at the WMO Impact workshop in May 2016 (and to CGMS-44).	May 2016 and CGMS-44	OPEN	-
CGMS members	WGII/10	A43.14	(Action transferred from WGIV) CGMS members that have not yet done so to nominate focal points that would work with the WMO Secretariat in populating the WMO Product Access Guide. • ESA: Jean-Louis Fellous jfellous@noos.fr • EUM: Sally Wannop, Sally.Wannop@eumetsat.int • JMA: Daisaku Uesawa, satellite@ml.kishou.go.jp • NOAA: Tony Mostek, anthony.mostek@noaa.gov • ROSH: Dr. Sergey Uspensky, Head of Department, SRC "PLANETA" uspenskys@planet.iitp.ru • CMA: Xu Zhe, xuzhe@cma.gov.cn KMA: Nomination of a KMA focal point is pending.	30 July 2015	OPEN	-

Summary list of WGII Recommendations

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS members	WGII/3	R43.01	CGMS members to consider removing spectral gaps from future hyperspectral sounders to support GSICS intercalibration of IR imagers.		OPEN	HLPP # 3.1
GSICS members	WGII/3	R43.02	Members to strengthen their engagement in GSICS and in particular in its GDWG.		OPEN	HLPP # 3.1
SCOPE-CM members	WGII/3	R43.03	SCOPE-CM to invite contributions to its next call for proposals, with particular regard to the sea ice, snow cover and land surface temperature communities, and others currently not represented.	End 2015	OPEN	HLPP # 5.1
CGMS space agencies	WGII/3	R43.04	CGMS operators to consider displaying instrument performance in a way similar to the ICVS. NOAA could share the software among CGMS operators.	CGMS-44	OPEN	HLPP # 3.1
NOAA	WGII/3	R43.05	NOAA to organize a workshop for CGMS operators on ICVS software design and development, and implementation.	CGMS-44	OPEN	HLPP # 3.1
ROSH	WGII/4 and WGII/8	R43.06	Roshydromet is invited to attend the next sessions of the ICWG, ITWG and the other Int'l Science Working Groups.	CGMS-44	OPEN	-
ISRO	WGII/5	R43.07	ISRO is encouraged to implementing a multi-sensor precipitation estimate based on SAPHIR and INSAT-3D	CGMS-45	OPEN	-
ICWG, IWWG	WGII/6 and WGII/8	R43.08	ICWG and IWWG to liaise as appropriate on the provision of further information characterising the AMV derivation for enhanced QC and error characterisation.	CGMS-45	OPEN	HLPP # 3.5.2
IWWG, IPET-OSDE	WGII/6	R43.09	IWWG to liaise with the application focal points in the WMO RRR process (on IPET-OSDE) to provide feedback on the winds-related observation requirements in the RRR database.	CGMS-44	OPEN	HLPP # 1.1
CGMS members	WGII/6	R43.10	CGMS members to consider include a water vapour channel and a CO2 channel to polar-orbiting imagers, to maintain accuracy and coverage of polar winds and cloud height retrievals achieved by MODIS.		OPEN	HLPP # 1.1.6

CGMS-43 recommendations - WGII						
Actionee	AGN item	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WGII/7	R43.11	CGMS Members to approach Operators of GNSS systems to request them to provide a minimum level of information on the signal structure and interface control (ICD) in a timely manner to enable the use of these for future RO missions.	CGMS-44	OPEN	HLPP # 1.1.4
ICWG	WGII/8	R43.12	At its next meeting (May 2015), ICWG should put focus on investigating data from the new-generations instruments on Himawari-8 and if available GOES-R for the retrieval of cloud parameters.	20 May 2016	OPEN	HLPP # 3.2.4
CGMS space agencies	WGII/10	R43.13	CGMS agencies to make available a non real-time cache of satellite level 1 data over the previous 2-3 months, similar to the NOAA CLASS system.	CGMS-44	OPEN	HLPP # 2

The status of CGMS-43 actions and recommendations will be maintained on the CGMS website under MEETINGS and CGMS-43.