Report of the 42nd 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-42 meeting on Monday 19 May from 9:00-18:00 and on Tuesday 20 May, at 9:00-16:00. Lars Peter Riishojgaard (WMO) and Toshiyuki Kurino (JMA) served as group co-Chairs and Ajay Mehta (NOAA) and Johannes Schmetz (EUMETSAT) as rapporteurs. More than 50 participants attended the session over its two days of discussions (see list of participants in the CGMS-42 report Annex).

WG II/0 Objectives

The objectives and goals of WG II were recalled, in line with the CGMS HLPP according to the proposed agenda.

WG II/1 Review of actions and recommendations from previous meetings

The rapporteur from EUMETSAT walked through the actions resulting from previous CGMS meetings. The majority of actions had been closed or were closed with papers presented to CGMS-42. The following actions remain open: 40.18, 40.23, 41.18, and 41.19. Actions 41.21 and 41.22 will be replaced by new action and were therefore closed. Actions 41.25 and 41.26 will be discussed at IWW12 in June 2014 for reporting to CGMS-43. Action 41.28 will remain open, and its status updated after IWW12.

The final list of WG II actions and recommendations resulting from CGMS-41 following discussions at CGMS-42 is available here.

WG II/2Image processing techniques and satellite imagery for nowcasting

CGMS-42-JMA-WP-07 reported on the status of the Japan Meteorological Agency's (JMA's) activities in SCOPE-Nowcasting. The paper referred to the successfully introduced RGB composite images and it was pointed out that a web site and a user's guide will be available. Applications for data from MTSAT-2 were presented with examples dedicated to users from regions RA II and RA V as part of SWFDP and SWFDDP activities. In the discussion it was clarified that he RGB products are created according to recipes' recommended by WMO. It was also mentioned that more channels on future satellites will open the possibility for more products, pointing to major prospects for Himawari-8/-9.

CGMS-42-KMA-WP-03 described the current status of Weather Support for Nowcasting and Very Short Range Forecasting at KMA. The paper provides examples of recent activities to implement a satellite-based nowcasting system based on the software from the EUMETSAT Nowcasting SAF (Satellite Application Facility) at KMA/NMSC. In order to support severe weather forecasting, convective related products such as convective rainfall rate (CRR) and convective initiation (CI) were optimised and validated. The paper also discusses the results of a case study through comparing ground data such as lightning stroke and radar data. It was recalled that these activities were discussed with EUMETSAT experts during the 2nd KMA/NMSC-EUMETSAT workshop on NWCSAF held in 2013 during the EUMETSAT Satellite Conference in Vienna, Austria. Comparing the SAF product with radar measurements gave similar results. Regarding the convective initiation, it was stated that with COMS the onset of convection can be detected with about 15-30 minutes lead time. Responding to a question from WG II KMA explained that the satellite estimates of rainfall are quite complementary to the dense surface observations.

CGMS-42-NOAA-WP-08 entitled ”Image Processing Techniques: Image Processing and Applications from Suomi NPP VIIRS” was written in response to an action from CGMS. NOAA provided a paper on the benefits of the VIIRS Day Night Band (DNB). The low-light sensor is carried on the SNPP mission and will be on future JPSS satellites. The DNB leverages reflected moonlight to sense clouds, fog and surface features as well as artificially emitted light from cities, fires and other sources such as fishing boats. Benefits of the DNB include: The ability to observe environmental phenomena at night; better resolution than existing IR and microwave capability, thus offering more detail on applications such as sea ice analysis; provision of imagery during polar winters; and better performance than legacy capability offered on DMSP satellites (i.e., OLS) in terms of resolution, stability and accuracy. Other practical applications include detection of fog and volcanic ash to support the transportation sector, snow fields, and storm tracking. The DNB is now a critical observation and NWS has requested that it become a key performance parameter.

WG II commended NOAA on the development of the practical usage of products from DNB.

WG II/3Satellite data calibration and validation including climate related aspects

CGMS-42-CMA-WP-05 reported on the progress of CMA in GSICS-related activities since the last CGMS meeting, GPRC/CMA has applied NPP/CrIS as the new hyper-spectral reference sensor. The calibration monitoring system based on invariant targets (desert, snow) and deep convective cloud (DCC) has been established for both FY-3/MERSI and FY-2. GPRC/CMA has started monitoring CMA FY-2F and FY-3C a daily basis. The lunar calibration has also been applied to FY-3C/MERSI based on lunar observation being taken by extending the MERSI view window while viewing space.

CGMS-42-CMA-WP-06 is a summary of the project entitled inter-calibration of long-term data sets from FY-2 imager observations (IOGEO). CMA has working plans related to the SCOPE-CM project for building up FCDRs. With the inter-calibration of imager observations from time-series of geostationary satellites (IOGEO) project, the inter-calibration approach will be updated for FY-2 FCDR generation, considering nonlinear correction and diurnal variation based on GSICS reference and onboard BB observation. The radiometric normalisation coefficients of each satellite will be created separately using IASI or AIRS as references restricted to the infrared and water vapour channels of FY-2C/D/E over seven years (2005~2012) in the first phase of this plan. An onboard BB calibration model has been developed for diurnal correction. Combining GSICS inter-calibration and BB observation, hourly calibration can be realized. Overlapping observations by adjacent pairs of geostationary satellites can be compared to test the individual normalization results as well as the observation agreement between the four FY-2 satellites. The relative accuracy of the TIR channel of FY-2C/D/E is expected to be better than 1K at scene temperatures of 290K. CMA was commended by WG II for its contributions to reprocessing. During the discussion, it was explained that differences between day and night calibration of FY-2 satellites are not large. However, around midnight caution needs to be taken to address problems traceable to the imager design (as for most other instruments). It was recommended that the matter be addressed in more detail by GSICS:

CGMS-42 recommendation – WG II						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
GSICS	WG II/3	R42.01	GSICS to explore the utility of images affected by shortcomings of instruments (e.g. solar straylight) and draft a recommendation on the use of such data in the reprocessing.	(CGMS-43)	OPEN	HLPP# 3.1

CGMS-42-EUMETSAT-WP-35 presents the Calibration Event Logging and Monitoring. The working paper summarised the response of EUMETSAT to action CGMS-41: WG II/3 Action 41.22 "*CGMS agencies to provide working papers on current and future capabilities for calibration monitoring and event logs – CGMS-42*". This paper presents the event logging and calibration monitoring systems operated by EUMETSAT. The current event logging system is being designed and tested for logging a variety of events, including calibration events and/or data outages, on its operational polar orbiting (Metop and Jason) and geostationary (Meteosat) satellites. This system is called the User Notification Service (UNS). The UNS is specifically dedicated to logging events occurring on present EUMETSAT missions. Although UNS registers calibration events, it is not mainly designed for that activity. The current calibration monitoring system at EUMETSAT is available for its operational polar orbiting and geostationary satellite instruments. This system keeps track of the change in instrument performance at a quasi continuous frequency. It gives very detailed information on all parameters that may be relevant for calibration, but is a dedicated specific system that is designed more for satellite operators than for users of the satellite observations. In the future, the UNS may serve as a model for a calibration event logging system that could be used across the CGMS space agencies. The design of such a system however requires consensus on the data model to be adopted and the standardised nomenclature to be used for calibration events. Once such a design is agreed, the CGMS space agencies can start populating the database of calibration events for past, present and future instruments. This work shall be further discussed in the context of GSICS. In the discussion, WG II took note of the report. The reporting of events' impact on calibration and product quality was seen to be important and it was also noted that the need for appropriate event logging and reporting had been raised at the recent ITSC meeting. The Working Group also noted that some information that is available to the satellite operators is ITAR classified and can therefore not be shared. EUMETSAT was thanked for leading the way and sharing through the paper its operational way of logging calibration related events.

In conclusion the Working Group welcomed the report and placed the following actions:

CGMS-42 actions – WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CMA, EUM, JMA, NASA, NOAA, WMO	WG II/3	A42.01	EUM/NOAA/NASA/JMA/CMA/WMO and others to provide names for a task team on calibration events logging.	15 Oct 2014	OPEN	HLPP# 3.1
CMA, EUM, JMA, NASA, NOAA, WMO	WG II/3	A42.02	The new task team on calibration events logging to identify a common set of parameters to be monitored as part of the calibration events logging and sensor performance monitoring.	CGMS-43	OPEN	HLPP# 3.1

CGMS-42-CNSA-WP-06 describes the calibration infrastructure and typical applications of China land observation satellites. The report introduces the calibration facilities for China's land observation satellites, including both radiometric and geometric calibration sites. With these facilities, typical applications are performed. It was reported that eleven satellites have successfully been operated since 1999. Qinghai Lake (altitude of 3196 m) and Duanhang Gobi desert (altitude of 1229 m) are unique land sites for calibration, with the latter being of particular note for using artificial ground targets for geometric calibration.

CGMS-42-CNSA-WP-08 provides information on the geometry and radiation quality evaluation of GF-1 satellite imagery. The GF-1 satellite is the first high-resolution satellite in the Earth observation satellite system in China.

CGMS-42-ESA-WP-02 presents ESA's support to GCOS and other climate monitoring activities. CGMS Working Group II was informed on the status of the Earthwatch Program Element, Global Monitoring of Essential Climate Variables (ECV), also known as the 'ESA Climate Change Initiative (CCI). The CCI continues to proceed well and according to schedule. The three ECV projects kicked-off in early 2012 are also on track to be completed within 2014. Tender actions were performed for the next implementation steps (Phase 2) of this programme element for all 13 ECVs over the coming 3-4 years, leading to kick-off of the first ten follow-on projects in early 2014, and the remainder by the end of 2014. It was mentioned that the report provides the progress status of each individual ECV project and presents a selection of outstanding results for a subset of CCI ECV projects. EUMETSAT and WMO commended and expressed gratitude to ESA for the considerable effort put into this programme, and noted that there are similar initiatives underway in other agencies. In response to an inquiry on the continuation of the CCI beyond Phase 2, it was mentioned that two options are being considered: extension of the ESA-funded programme and/or funding through the EC Copernicus programme. The Sentinel satellite programme provides continuity of data acquisition for at least the next 15 years. It was also noted that there is good international coordination between the CCI and parallel initiatives. Attention was drawn to the fact that the CCI complies with

the EC Copernicus data policy, i.e. all data and algorithms used in the CCI are freely and openly available on the ESA CCI web site.

EUMETSAT recalled that a CCI session will be held during the Climate Symposium in Darmstadt, Germany on 13-17 October 2014. Agencies were reminded to participate in this symposium.

CGMS-42-JMA-WP-04 gives an overview of 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, and Re-Analysis Correction (RAC) and Near-Real-Time Correction (NRTC) for the MTSAT imager IR channels have now been released in a demonstration phase. To move JMA's GSICS correction activity into the pre-operational phase, uncertainty evaluation for MTSAT-2 and IASI correction products is under way. A new GSICS inter-calibration product based on data from the visible channel of the MTSAT-2 imager with Aqua MODIS observation for Deep Convective Clouds (DCC) is also under development. For the visible and NIR bands of the Advanced Himawari Imager (AHI) on board Himawari-8, a calibration method with radiative transfer (RT) simulation is being developed in collaboration with the University of Tokyo. In 2013, JMA applied this method on a trial basis to data from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) visible and NIR channels of Meteosat-9 to test its application to the NIR bands of AHIs. In response to CGMS actions, JMA will provide the URL of the MTSAT operation report page to the WMO Observing Systems Capability Analysis and Review tool (OSCAR). The Agency is also considering the development of an event log database for Himawari-8/9.

JMA has contributed to SCOPE-CM sub-projects, LAGS, IOGEO, ISCCP, and AMV/CSR. JMA continues to lead a project on AMV/CSR (SCM-10). One of the main objectives of SCM-10 is to present an AMV processing system that can be applied to all historical geostationary satellites. The project is intended to foster close interaction with the CGMS IWWG to benefit from on-going comparison activities. It was recalled that previous WGII Recommendation (CGMS-41 WG II R41.09) will also be discussed in the next CGMS IWWG.

CGMS-42-KMA-WP-04 reports on KMA's GSICS and SCOPE-CM activities. KMA began to operate GSICS using COMS as the IR inter-calibration system with LEOs (IASI) after finishing the IOT at the end of January and completed construction of an additional inter-calibration system with AIRS in 2013. KMA also performs visible channel vicarious calibration using ocean region, Australian Simpson desert region, water cloud and deep convection cloud with Seoul National University and the lunar calibration system with the USGS ROLO model. These GSICS S/Ws are for near real-time operation and the results of inter-calibration and vicarious calibration are posted on KMA/NMSC web site. KMA started initial activities on Essential Climate Variables (ECV) from satellites such as Sea Surface Temperature (SST) and Clear Sky Radiance (CSR) and will participate and contribute to the SCOPE-CM activity.

CGMS-42-NASA-WP-06 entitled "NASA Satellite Calibration Interconsistency Studies Involving Operational Satellite Instruments and the Suomi National Polar-orbiting Partnership (SNPP) Airborne Field Campaign" provides information on four research projects comparing measurements from

multiple research and operational satellite instruments to facilitate the production of long term data sets. The projects include: Constructing a consistent, cross-platform dataset of NOAA HIRS radiances building on high calibration accuracy and stability of the AIRS sensor; cross-calibration and validation of mid- and thermal infrared at-sensor data products from multiple sensors; monitoring long-term variations in upper- and mid-tropospheric water vapour from microwave satellite observations; and inter-calibration of satellites at NASA's Langley Research Center. The paper also describes the joint NASA/NOAA airborne field campaign conducted in support of calibration/validation of the ATMS, CrIS and VIIRS instruments on the SNPP satellite. The working group took note of the comprehensive work at NASA. The Chair pointed out that a related presentation will be given during the plenary.

CGMS-42-NOAA-WP-09 presents Satellite Data Calibration and Validation: NOAA Suomi NPP Cal/Val results. The NOAA Integrated Calibration and Validation System (ICVS) supports instrument scientists with information on instrument health and users with information regarding satellite data quality for product generation. This web-based system is currently being used to monitor instruments on SNPP, POES and GOES satellites as well as US instruments on Metop, and is a critical element of NOAA's long-term monitoring requirements. The WG noted the performance of the SNPP instruments which exceeded specifications and match pre-launch calibration levels. Degradations in certain AMSU-A channels were also noted. The paper also summarises significant instrument events and calibration anomalies detected and assessed with the NOAA ICVS in the past year.

CGMS-42-ROSHYDROMET-WP-07 reports on ROSHYDROMET's Cal/Val activity. ROSHYDROMET's Cal/Val system supports the post-launch calibration and characterisation of in-orbit calibration performance for current and future Russian LEO, GEO and HEO meteorological satellite instruments, as well as validation of L2 products. Several ground-based observational facilities support ROSHYDROMET's cal/val effort, including support for soundings at Peterhof and Voeikovo and aerosols at the Zotto site. The paper also addresses GEO-GEO and GEO-LEO inter-calibration techniques. WG II noted ROSHYDROMET's continued development of a Cal/Val system for satellite data and products and its first inter-calibration experiments and further noted that methods have been developed for instrument inter-calibration for future missions.

CGMS-42-WMO-WP-22 provides an update on GSICS. The paper was presented by Dr. Peng Zhang of CMA, the new Chair of the GSICS Executive Panel. GSICS, an integral part of the CGMS baseline, coordinates systematic generation of inter-calibration products for Level 1 data from satellite sensors. It facilitates greater understanding of instrument absolute calibration, supports global inter-operability, and enables better accuracy and global consistency of Level 2 environmental, climate and weather forecasting products.

The paper reported on the progress of GSICS including:

- Outcome of the last Executive Panel session,
- Status of GSICS correction products,
- On-going research and development,
- GSICS product catalogue, format and metadata developments,
- On-line plotting application and satellite event log,
- Partnership,

- Feedback from the 5th GSICS Users' Workshop (April 2013).

It was iterated that stronger representation of GSICS members is needed in the GDWG to carry out the agreed data management tasks that are necessary to reach a fully operational stage. Active engagement is also needed in the new GRWG sub-groups in order to cover the required fields of expertise. Engaging in GSICS activities is an investment that provides mutual benefits both directly, through improved instrument calibration and interoperability, and indirectly, through the capacity building resulting from the development and sharing of best practices.

Finally WG II expressed deep thanks and appreciation for the work of the outgoing Chair of the GSICS Executive Panel Dr Mitch Goldberg, NOAA, and welcomed the new Chair Dr Peng Zhang, CMA.

WG II/4Infrared/Microwave sounding and ITWG matters

CGMS-42-EUMETSAT-WP-21 provides progress in EUMETSAT hyper-spectral and microwave retrievals of atmospheric parameters. The progress being made in the exploitation of hyper-spectral soundings from the Infrared Atmospheric Interferometer (IASI) instruments on the EUMETSAT Polar System (EPS) Metop-A and Metop-B satellites is described. It reflects the improvements made in version 6 of the IASI Level 2 Product Processing Facility (PPF), which is planned to be implemented in the core ground segment at EUMETSAT. Besides IASI information, it makes use of the data measured by the Advanced Microwave Sounding Unit-A (AMSU-A) and the Microwave Humidity Sounder (MHS) instruments being flown on the same platforms. The new PPF version also includes retrievals of CO profiles, based on the FORLI algorithm developed by ULB/LATMOS in the framework of the Satellite Application Facility on Ozone and Atmospheric Chemistry (O3SAF). Further improvements are addressed at the end of the paper. In the discussion it was clarified that the development of trace gas retrieval is done in collaboration with the O3M SAF. It was also clarified that one main use of the retrieved temperature and humidity profiles is in the use of retrieving consistent trace gas information from IASI. Furthermore the product shows some utility when used to derive instability indexes, which despite being from a polar orbiting satellite could provide additional information on atmospheric stability for short range forecasting. In conclusion the Working Group congratulated EUMETSAT on the progress that has been made on the retrieval of Level-2 products using IASI in combination with microwave data.

The International TOVS Working Group (ITWG) co-Chair, Dr. Niels Bormann, presented in **CGMS-42-ITWG-WP-01** a report from the ITWG. The 19th International TOVS Study Conference, ITSC-19, was hosted by the Korea Meteorological Administration (KMA) on Jeju Island, South Korea, between 26 March and 1 April 2014. Some 196 participants from 35 organisations attended the conference, providing a wide range of scientific contributions. Fifteen countries and three international organisations were represented: Brazil, Canada, China, Taiwan, France, Germany, India, Japan, Norway, Russia, South Korea, Sweden, Switzerland, United Kingdom, United States, ECMWF, EUMETSAT, and WMO. For the fourth successive meeting the number of attendees broke the record for the highest ever attendance. The Working Groups had very productive discussions and it was again encouraging to see a large number of new, younger scientists participating. This was the first time that the ITWG met formally as a sub-group of CGMS, and the group warmly appreciated this formal recognition, while continuing the important ties with the International Radiation Commission

(IRC). The report gives an overview of the meeting, including the main conclusions and recommendations for consideration by CGMS.

The top recommendations from ITSC-19 read:

1. **To CGMS and satellite agencies:** The constellation of **at least three orbits** (early morning, morning, and afternoon), each with full sounding capabilities (IR and MW), should be maintained. The overpass times of operational satellites with sounding capability (IR and MW) should be coordinated between agencies to maximize their value.

2. **To CGMS and satellite agencies:** conduct studies to **trade off benefits of spectral, radiometric, and spatial resolutions of infra-red sounders** considering the noise floor due to atmospheric noise and current uncertainties in spectroscopy, to enable improved spatial resolution and increased number of field of views for the next generation hyperspectral infra-red sounders.

3. **To satellite agencies:** noting that absolute calibration with on-orbit SI traceability is critical for significantly reducing uncertainties in monitoring climate trends, ITWG recommends to pursue the realization of **absolute calibration missions** (such as CLARREO), including considering flight opportunities on the ISS.

4. **To CGMS:** ITWG supports **low-cost fast delivery initiatives** such as RARS, and recommends reactivating the RARS Implementation Group within WMO with a broader scope to include the NOAA Direct Broadcast Real Time Network (DBRTN) and to include CrIS, IASI, ATMS, and other sounder data.

5. **To ROSHYDROMET: pre-processing software for L0/L1 Meteor-M** data should be made available to interested users.

6. **To IRC, CGMS and satellite agencies**: **Support for line-by-line (LBL) reference model development** is of paramount importance and should be continued to ensure that users (in both operational and non-operational institutions) have access to the latest updates in LBL forward modeling.

7. **To IRC, CGMS and satellite agencies:** encourage **validation and intercomparison of LBL models/spectroscopy** to assess the impact of spectroscopic **uncertainties** and the differences between line-by-line and fast radiative transfer models.

8. **To satellite agencies: instrument characteristics should be provided as early as possible (even approximate versions)** to allow preparations for radiative transfer modelling and other evaluations. This includes in particular spectral response functions. Ultimately, detailed digitised channel system responses should be made available to allow the best-possible radiative transfer calculations.

9. **To satellite agencies:** ITWG recommends **open access to new satellite data during the calibration/validation** phase (particularly for all NWP centres) to help with calibration and validation.

10. Several recommendations regarding the **dissemination of future hyperspectral infrared instruments** (esp. geostationary):

- Caution regarding loss dissemination.
- Need update strategies for Principal Component Scores products.
- Need to address user preparedness.
- Several recommendations regarding **user notifications**:
- Reliable email-based user notification services.
- Satellite/sensor status pages.
- Content of notifications.

11. **To CGMS and satellite agencies:** conduct **intercomparison studies between level 2 retrievals from hyperspectral instruments**, recognising that there are now several software packages available that utilize IASI/CrIS/AIRS data for the generation of level 2 products.

Following a discussion on climate work within ITWG, the following recommendation was given to all CGMS International Science Working Groups:

CGMS-42 recommendation - WG II						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS ISWGs	WG II/4	R42.02	All ISWGs under CGMS (IPWG, ITWG, IWWG, IROWG) to establish a formal interaction with Joint CEOS-CGMS Working Group on Climate.	CGMS-43	OPEN	HLPP# 5.1

The next meeting of ITSC-20 will take place on 28 to 3 November 2015 at Lake Geneva, Wisconsin, USA.

WG II acknowledged the contributions of Prof. H.J. Bolle, a co-founder of the ITWG, to the formation and progress of ITWG (ITSC), who passed away last year.

CGMS-42-KMA-WP-05 provides the current status of satellite data assimilation in KMA. A study was conducted determining the forecast sensitivity to various data sources. In line with many other NWP centres the largest impact per instrument is on AMSU instrument. The highest impact per platform is from Metop. The impact of soil moisture measurements is currently being studied (SMOS, GCOM-W, ASCAT). Following the announcement of further work to be conducted, KMA accepted the following action:

CGMS-42 actions - WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
KMA	WG II/4	A42.03	KMA is invited to present a paper of different sources of soil moisture retrieval on their NWP forecasts	CGMS-43	OPEN	-

WG II/5Precipitation and IPWG matters

CGMS-42-NASA-WP-4 is a White Paper describing the NASA/JAXA led Global Precipitation Measurement Mission Data Access. In response to an action from CGMS-41 NASA provided this

paper describing the data products produced by the recently launched GPM mission, which contains a US built GPM Microwave Imager (GMI) and a Japanese-built dual-frequency Precipitation Radar (DPR). Near real-time data products include radiometer products (e.g. brightness temperatures, including those from partner missions), DPR level-2 products and GMI/DPR combined level-1 products. Research products, available within 24 hours of receiving the required ancillary data, added GMI/DPR level-3 production and merged radiometer products at level-3. The data products are freely available from the NASA Precipitation Processing System; however, the partner-provided 1B data must be obtained from partner sources. Starting in March 2014, data has been available to early adopters. In June 2014, the data was scheduled to be available to Precipitation Measurement Missions (PMM) science teams and in August 2014 the data will be publicly available.

CGMS-42-NOAA-WP-12 entitled ”Precipitation and IPWG matters: Benefits of three polar orbits for precipitation forecasting” noted the benefits of three-orbit coverage, especially satellite data from an early morning orbit, for quantitative precipitation forecasts. Satellite data is assimilated in NCEP models at 00:00, 06:00, 12:00, and 18:00 UTC. Data from NOAA-18 and Metop-A provide good coverage over the continental United States at 06:00 and 18:00 UTC; however, a data void is found at 00:00 and 12:00 UTC. This data void is currently filled by NOAA-15 operating in an early morning orbit as a result of drift. Experiments conducted by NOAA concluded that adding NOAA-15 AMSU-radiance data assimilation significantly improves the 24-hour forecasts of a convective precipitation event in the central United States. The WG noted the importance of three-orbit coverage not only for NWP, but also for precipitation forecasts and noted that this is one more study which demonstrates the value of the early morning orbit and the need to ensure continuity in this orbit. SIR/AT

During the discussion, it was recalled that GPM Precipitation Processing produces products in NRT. JAXA commented that other NRT products available from JAXA will be presented in the plenary.

The positive impact of the early morning orbit on the US Gulf coast QPF demonstrates once more the value of the early morning orbit and the need to secure that orbit. CMA confirmed ongoing work on technical changes to its polar-orbiting satellite so it can fly in an early morning orbit.

WG II/6Atmospheric Motion Vectors and IWWG matters

CGMS-42-CMA-WP-07 describes progress in the reprocessing of AMVs. CMA already started a project to reprocess historical AMVs data in 2013, which will be finished at the end of 2015. This project will reprocess all Fengyun-2 IR/WV AMVs with the most recent algorithm (CMA Version 2014). The new AMV data set covers all observations from FY-2C/D/E, and it could go back to January 2006 when AMV operations started using the IR and WV channels. It was mentioned that re-navigation using the most recent navigation algorithm is critical, as is the elimination of noise in WV channel images. It was announced that an update would be presented in June at IWW12.

CGMS-42-EUMETSAT-WP-22 introduces the novel dual Metop winds. EUMETSAT has recently developed a new global Metop wind product derived from pairs of Metop-A and Metop-B images and exploiting the current configuration of two Metop satellites in tandem operations in the same orbital plane. The temporal gap between the two images used for the tracking is about 50 minutes and provides the opportunity to derive AVHRR winds for the whole globe. The global coverage of the

dual Metop wind products allows homogeneous retrieval over the whole globe, including the polar regions, and helps fill the gaps between 55° and 70° latitude north and south, where no satellite derived wind observations are currently routinely available for assimilation. It also allows a direct comparison with AMVs derived from all geostationary satellite. The paper describes the scientific concept of wind extraction using dual-Metop data and presents preliminary results of the new dual Metop wind product. The initial results show that whilst there are still some issues with the quality of the winds, with suitable quality control the winds present normalised RMS values similar to geostationary AMVs, in particular at high levels. The winds are now available for users in trial mode and operational status was anticipated for the end of May 2014. The discussion in WG II noted that this seems to have great potential to alleviate the aforementioned data gap. With respect to impact studies, it was noted that the data has not yet been available long enough for the users to explore their value for NWP. However, it is anticipated that such studies will take place. It was also noted that the use of dual Metop data provides a higher frequency of observations, leading to a higher yield of winds with better quality. It was also confirmed that the development of this product is based on close collaboration with CIMSS, which already has extensive experience in the derivation of AMVs from polar-orbiting satellites.

CGMS-42-IWWG-WP-01 gives an overview of the preparations for the 12th Workshop of the International Winds Working Group (IWW12) in Copenhagen, Denmark, on 16-20 June 2014. The biennial international winds workshops are the fora used by the International Winds Working Group (IWWG) for cooperation in the operational and research community, and have contributed greatly to the improvement in the quality of derived wind fields. The paper summarises the activities and relevant discussion items of the IWWG in advance of IWW12. The IWWG co-Chairs are finalising the IWW12 workshop and had worked these items into the agenda through dedicated sessions and the plenary discussion periods. CGMS-42 WG II is invited to discuss and provide advice on the topics addressed in this working paper and other related IWWG topics as submitted to CGMS-42 by other CGMS operators. This paper was written by the two IWWG co-Chairs, Jaime Daniels (NOAA) and Mary Forsythe (Met Office) and the IWWG rapporteur (Johannes Schmetz, EUMETSAT). The IWWG rapporteur and co-Chairs acknowledged and thanked Regis Borde (EUMETSAT) for serving as interim IWWG co-Chair during Mary Forsythe's absence. The brief discussion resulted in the following recommendation for consideration by IWW12:

CGMS-42 recommendations - WG II						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	WG II/6	R42.03	CGMS recommends to CGMS members performing a reprocessing of AMVs to pursue future AMV reprocessing with their own algorithm and in addition with a common algorithm. IWW12 is invited to discuss the implications and derive guidance on the practical implementations.	CGMS-43	OPEN	HLPP# 3.2.1

It was recalled that this is an important requirement from SCOPE-CM.

CGMS-42-JMA-WP-05 reports on JMA's atmospheric motion vectors describing recent status of its Atmospheric Motion Vectors (AMVs) from MTSAT-2 and MTSAT-1R, and on the status of Himawari-8 AMV development. It is confirmed that AMVs based on the algorithm for Himawari-8 are spatially more uniform and denser than the current ones.

CGMS-42-KMA-WP-06 gives a short update on the current status of AMVs at KMA. COMS AMVs are produced hourly from three consecutive images with an interval time of 15 minutes and are used in NWP model at KMA. In addition, the COMS AMV has been evaluated for its impact on NWP performance. The paper introduces the current status of the COMS AMV in terms of variation of accuracy and compares the operational COMS AMVs and HRW/NWC SAF in terms of statistical accuracy and AMV estimation characteristics.

CGMS-42-NASA-WP-7 is a paper on Cloud Motion Winds from the NASA Terra/MISR and Near Real-Time Product and is in response to an action. NASA provided a report on the use of Terra's Multiangle Imaging SpectroRadiometer (MISR) to produce global cloud-tracked wind (CTW) measurements on a daily basis. The winds products are validated against those produced by GOES. The new third generation CTW algorithm shows improved sampling and a reduction of along-track bias. NASA expected to release a near real-time CTW product in May 2014 available from the Langley Research Center with a three-hour latency (from sensing). Although the product is expected to produce less coverage no significant degradation in accuracy is expected. Preliminary studies indicate a positive impact on NWP from CTW. More studies are being undertaken and further improvements on MISR CTW quality control and assimilation procedures are needed.

WG II/7Radio occultation and IROWG matters

CGMS-42-EUMETSAT-WP-34 presents the status of a EUMETSAT study on radio occultation/saturation. The paper describes the status of a study recently initiated at EUMETSAT to further detail the saturation level for radio-occultation in NWP assimilation, with particular emphasis on using realistic orbits foreseen in the future. The study builds on experience gained in a previous study performed by ECMWF on behalf of ESA, "Estimating the optimal number of GNSS radio occultation measurements for Numerical Weather Prediction and climate reanalysis applications". This study led to recommendations at IROWG and WMO workshops aiming at constellations to make 10,000 to 16,000 GNSS-RO observations operationally available per day. However as the initial study assumed a random distribution of occultations EUMETSAT initiated a study "Impact of different Radio Occultation Constellations on NWP and Climate Monitoring" in 2013. A proposal received from ECMWF was selected and the study was kicked-off in March 2014. The study addresses various CGMS Actions/Recommendations (plenary IV.4 A40.06, WG III/2.2 A41.36, WG II A40.23, and WG III/2.1 R41.14). As the study will last until the end of 2015, only preliminary results are available, demonstrating that even with 18,000 occultations per day, the saturation level has not yet been achieved, with only a modest improvement in terms of error reduction. This initial study demonstrates that:

- a full COSMIC-2 (equatorial and polar) constellation gives the highest temperature improvements; and
- COSMIC-2 Equator plus RO sensors on all the three operational polar orbits would give a bit less than half of the improvement of having the full COSMIC-2 constellation.

In its discussions, the Working Group took note of the presentation and thanked EUMETSAT for conducting this important study. NOAA queried about the schedule of the study and noted that it would be valuable to have a more complete picture of the impact of the COSMIC-2 polar mission as soon as possible. EUMETSAT responded that this is well understood and confirmed that this will be looked at.

The rapporteur of the International Radio-occultation Working Group, Dr. Tony Manucci of NASA/JPL, presented via WebEx the paper **CGMS-42-IROWG-WP-01, a** report from the 3rd International Radio Occultation Workshop (IROWG-3). This paper summarises the outcome of the workshop. The main organiser of the workshop was the Wegener Center for Climate and Global Change at the University of Graz, Austria. The meeting was held at Seggau Castle, in Leibnitz, Austria, on 5-11 September 2013. Radio occultation (RO) data has a major positive impact on Numerical Weather Prediction (NWP), climate monitoring, space weather, and on temperature- and humidity-related atmospheric research. The meeting was attended by more than 70 scientists. All global assimilation centres use RO data to derive information on stratospheric temperature, and tropospheric temperature and humidity. In addition, the bias free nature of RO data anchors assimilation models to the true atmospheric state. Recent NWP studies have shown substantial forecasting improvements with an increased number of available occultations. Climate, research users also benefit from more data. The current observing system provides about 3,000 occultations daily, relying however for more than half of the data on research type missions.

The main IROWG-3 recommendations to CGMS are:

1. Develop a detailed GNSS-RO Continuity Plan
2. Move towards a fully operational GNSS RO constellation providing at least 10,000 observations per day
3. Ensure the continuity of RO measurements
4. Avoid an impending observation gap at mid- and high latitudes
5. Fund the FORMOSAT-7/COSMIC-2 polar mission
6. Missions should enable receiver firmware updates to maximize receiver performance
7. Hold an interagency workshop to define cooperation options for LEO-LEO occultation research

The discussion led to the following action:

CGMS-42 actions - WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CMA	WG II/7	A42.04	CMA is invited to present a paper to CGMS-43 on prospects of RO measurements with future FY-3 satellites.	CGMS-43	OPEN	HLPP# 1.1.4

The IROWG Rapporteur continued the WebEx session by presenting **CGMS-42-NASA-WP-09**: Update on Radio Occultation Activities at NASA. NASA maintains an active radio occultation programme that

supports the operational and climate communities. This Working Paper provides an update of NASA's instrument development and research activities related to radio occultation using the Global Navigation Satellite Systems (GNSS). NASA has completed development of the Trig radio occultation instrument engineering model. A NASA centre (JPL) is currently working with the United States Air Force to develop flight models for the COSMIC-2/FORMOSAT-7 follow on mission, planned for launch in 2016. NASA actively participates in activities of the International Radio Working Group, a scientific working group of CGMS, supporting the operational, climate, space weather, and payload technology sub-groups. NASA supports numerous research activities to advance radio occultation use in climate, meteorology and atmospheric process research. Continued progress in these areas is expected over the coming years.

The NASA Trig, next-generation GNSS RO, has been successfully developed. It is capable of receiving GPS signals from future GPS missions such as Galileo. During the discussion, it was clarified that TGRS (Trig GNSS Occultation System) could also receive signals from Chinese GNSS systems. In addition to instrument delivery and research activities, NASA actively participates in the International Radio Occultation Working Group.

WG II/8Cloud and ash/dust related matters including proposal for a new CGMS International Science Working Group (CREW)

CGMS-42-EUMETSAT-WP-24 presents the development and Implementation of aerosol products at EUMETSAT. The paper provides a short summary of the development and implementation plans for aerosol products to be produced from instruments on the EUMETSAT Polar System (EPS/Metop), Meteosat Second Generation (MSG) and EPS-Second Generation (EPS-SG/Metop-SG) satellites, with the aim of providing support to emerging operational air quality and climate applications, as well as numerical weather prediction. Other operational satellite operators are also actively engaged in similar activities. In addition, there are parallel initiatives, pursued jointly within the framework of CGMS, targeting the production of volcanic ash related products. On the EPS/Metop series of satellites, the focus is on the development of a multi-instrument, with a single platform aerosol retrieval algorithm referred to as PMAp (Polar Multi-sensor Aerosol properties), initially based on the use of data from the EPS/Metop GOME-2 and AVHRR instruments and later also IASI data. IASI is already technically integrated into the product processing facility and is planned for use in further releases. Also in focus is the development of an MSG aerosol product based on an algorithm theoretical basis document and prototype processor developed by Météo-France. Finally, new missions planned to be flown on the EPS/Metop-SG series of satellites will offer new opportunities for the development of operational aerosol products. The Multi-spectral, Multi-polarisation, Multi-angle Imager (3MI) based on PARASOL/POLDER heritage is also expected to deliver a range of aerosol products in the future, with further possibilities for synergistic aerosol product development by taking advantage of the Visible/Infra-red Imager (VII), the Nadir-viewing Ultraviolet, Visible, Near-infra-red, Shortwave-infra-red sounder (UVNS or Sentinel-5), and the Infra-red Atmospheric Sounder (IAS). In the discussion CMA explained that it is pursuing similar approach and accepted an action:

CGMS-42 actions - WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CMA	WG II/8	A42.05	CMA to present a paper on their approach toward multi-sensor aerosol products.	CGMS-43	OPEN	-

CGMS-42-EUMETSAT-WP-25 is a proposal for the creation of a new CGMS International Science Working Group (ISWG) called the International Cloud Working Group (ICWG). It was recalled that 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 parameterisations adopted in weather and climate models. These developments have led to increasing interest by space agencies to make cloud detection and cloud parameter retrievals part of their operational services. There is a need at CGMS space agencies for a mechanism that facilitates access to and sharing of knowledge, commonality of approaches, requirements, and training on cloud parameter retrievals. The Terms of Reference (ToRs) of the ICWG that are presented in this Working Paper aim to provide such a mechanism. The proposed CGMS-ICWG intends to provide a forum for space agencies to seek coherent progress in science and applications and also to act as a bridge between space agencies and the cloud research community. The ICWG plans to serve as a forum to exchange and enhance knowledge on state-of-art cloud parameter retrievals algorithms, to stimulate support for training on cloud parameters, and to encourage space agencies and the cloud research community to use and share commonality algorithms. The ICWG plans to prepare recommendations to guide the direction of future research, for example on observing severe weather events or on process studies, and to influence relevant programmes of WMO, WCRP, GCOS and the space agencies. The working paper presents the response to the action assigned to the Cloud Retrieval Evaluation Working Group (CRE-WG) at the 41st CGMS meeting (CGMS-41: WG II/8 Action 41.27), asking the CRE-WG co-Chairs to draft the terms of reference for an ICWG.

The paper responds to CGMS-41 action 41.27, in which the co-Chairs of the Cloud Retrieval Evaluation Working Group (CRE-WG) are invited to draft the Terms of Reference for a CGMS Working Group on operational cloud parameter retrievals, jointly with the nominated points of contact from CGMS agencies.

As the suggestion was already made at CGMS-40 and the co-Chairs and the members of a task force drafted very satisfactory Terms of Reference, the discussion was relatively brief. WG II at CGMS-42 concurred with the proposal to create a 5th CGMS International Science Working Group under CGMS and formulated the following recommendation to the plenary for decision:

WG II decided to recommend the following to the 42nd CGMS plenary:

CGMS-42 plenary is invited to accept the formation of an International Clouds Working Group (ICWG) under CGMS on the basis of the Terms of References presented to and confirmed by WG II of CGMS-42.

The following action was based on the assumption that this is accepted by the plenary:

CGMS-42 actions – WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
ICWG co-Chairs	WG II/8	A42.06	Co-Chairs of the International Cloud Working Group (ICWG) 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	OPEN	HLPP# 3.2.3

CGMS-42-JMA-WP-06 reports on the status of developments regarding the Japan Meteorological Agency (JMA)'s Himawari-8/-9 cloud products. JMA is developing two types of cloud microphysics products for Himawari-8 by "empirical" and "physical" (Optimal Cloud Analysis (OCA), developed by EUMETSAT) approaches. Based on the review by the Cloud Retrieval Evaluation Workshop (CREW), the empirical approach will produce Himawari-8 cloud product operationally. Future transition of the retrieval algorithm into the OCA approach was considered. JMA has also commenced development of an advanced nowcasting of precipitation and severe rainfall product, Rapid Developing Cumulous Area (RDCA), using simulated satellite imagery for convective cloud monitoring. A data base of ground surface characteristics is being developed for improved derivation of cloud masks and will be introduced into operations. JMA elaborated the diagnostic database, which is intended to improve cloud mask accuracy based on accumulation of satellite observation.

CGMS-42-JMA-WP-07 was on Japan Meteorological Agency (JMA) activities in SCOPE-Nowcasting and reports on the status of activities related to volcanic ash/dust products. JMA plans to establish the test bed for the inter-comparison of multiple volcanic ash retrieval algorithms to contribute to the activities of SCOPE-Nowcasting. JMA introduced two volcanic ash retrieval algorithms provided from EUMETSAT and NOAA/NESDIS. JMA has shown an outline of the test bed and has performed preliminary inter-comparison of the retrieved ash cloud height from these two pieces of software. The detail of the test bed will be discussed in a workshop in October 2014 in Madison.

JMA has developed a prototype algorithm to retrieve dust parameters from visible channel. Further improvements will be made after the launch of Himawari-8. JMA is working on validation for the current dust product against a number of case studies. An action plan for dust intercomparison was presented. Requirements for dust product are being explored jointly with RA II satellite data users.

CGMS-42-NOAA-WP-15 presents the Multisensor Cloud Algorithm for weather and climate applications – CLAVR-x. NOAA's Cloud from AVHRR Extended Processing System (CLAVR-x) is used to generate real-time cloud products from operational imagers on the POES and GOES satellites as well as generate Pathfinder Atmospheres Extended (PATMOS-x) climate data sets. CLAVR-x has been modified to process sensor data from MODIS and MSG to gain experience with channels absent from POES and GOES imagers and currently processes data from COMS, MTSAT and SNPP as well. The multi-sensor design of CLAVR-x helps ensure consistent results and is an example of NOAA's move to enterprise algorithms that can support multiple missions; thereby reducing life-cycle costs to

generate, maintain and validate data products and improving performance by facilitating the generation of merged products. Examples were shown of cloud optical thickness from PATMOS-x run on MODIS on Aqua, GOES-11 and AVHRR on NOAA-18. The main conclusion is that results are consistent using that retrieval technique. The importance of this to CREW, or the new International Cloud Working Group (ICWG), was pointed out.

WG II/9Ocean parameters

CGMS-42-CMA-WP-08 responds to action 41.10 and provides feedback on the GHRSST data specification. CMA reported that global Sea Surface Temperature (SST) products are derived operationally from the Visible and Infrared Radiometer (VIRR) on the FY-3 meteorological satellite in the National Satellite Meteorological Center of the China Meteorological Administration (NSMC/CMA). The processing levels include Level 2 and Level 3. This paper introduces CMA SST data products specification and file naming convention components. CMA SST products specification is crosschecked with GHRSST data specification (GDS). CMA recommendations to IOC on GDS2.0 were presented.

CGMS-42-CNSA-WP-04 and -05 summarise ocean observations from the HY-2 satellite. In 2011 and 2014, the HY-2 satellite has been operating normally. HY-2A 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-2A have been widely used by both domestic and international users in areas such as ocean environment protection, ocean disaster prevention and reduction, marine environment forecasting, ocean resource development and management, ocean investigations and scientific research, etc. Current users of the data include EUMETSAT, NOAA, CNES and the Australian Bureau of Meteorology. In a question it was pointed out that the number of potential users is likely to be much larger.

CGMS-42-ESA-WP-03 presents some outstanding results from the ESA Earth Explorer 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. The in-orbit commissioning phase is ending. The first results were scheduled to be presented in June 2014.

WMO expressed its appreciation for the richness and interest of the results presented. Questions were raised about possible GOCE follow-on missions, operational use of SMOS and CryoSat-2 data and the launch date of EarthCARE.

CGMS-42-NASA-WP-02 presents "GCOM-C1 Optimization with Sentinel-3". Written in response to CGMS action 41.30, NASA, on behalf of the CEOS Systems Engineering Office, the paper provides an analysis of the coverage capabilities of a virtual satellite constellation consisting of the GCOM-C1 and Sentinel-3A mission and identifies realistic steps which could be taken to improve the daily coverage available for ocean colour imaging. The 2014 analysis updates results obtained in 2013 based on a qualitative review. The updated 2014 analysis calculates the quantitative impact of orbit coordination and concludes that the non-optimised orbits achieved 45%-87% of global coverage (with an average of 66%) while the optimised orbits achieved 85-87% global coverage – an improvement of more than 40% over the worst case orbit alignment. The WG thanked NASA for the report. During the discussion, JAXA offered to take an action:

CGMS-42 actions – WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
JAXA	WG II/9	A42.07	JAXA is invited to explore possibilities to adjust to GCOM-C1 orbit in order to optimise the mission with Sentinel-3 (reference is CGMS-42-NASA-WP-02). Due date CGMS-43	CGMS-43	OPEN	HLPP# 1.1.6

CGMS-42-NOAA-WP-16 presents "Ocean Parameters: Report on NOAA VIIRS Ocean Color Product Accuracy and Preparations for User Readiness – update report including utilization by NOS and NMFS". The focus of the presentation is the evaluation of different algorithms in the US that produced an ocean colour product. WG II noted the operational users within NOAA that used the product including the National Ocean Service and the National Marine Fisheries Service. The evolution of ocean colour product generation from the NPOESS programme to the current JPSS program was described and results of four different algorithms (Interface Data Processing Segment (IDPS), NASA's L2GEN on VIIRS data, Multi-Sensor Level1 to Level2 (MSL12), and NASA L2GEN on MODIS data) producing chlorophyll-a products were presented. The results indicated that the IDPS results were clearly out-of-family compared to the other three data sets. NOAA is completing an analysis of alternatives to replace the IDPS algorithm with the MSL12 algorithm.

CGMS-42-WMO-WP-05 describes a new marine task of GEO (Oceans & Society: Blue Planet). The paper was submitted jointly by the WMO Secretariat and the Partnership for Observation of the Global Oceans (POGO). Oceans & Society: Blue Planet is the recently established marine task of the work of the Group on Earth Observations (GEO) and the Global Observation System of Systems (GEOSS), formulated through its kick-off symposium in November 2012. Understanding that oceans affect all the societal-benefit areas of GEO, and are key to climate and weather forecasting, Blue Planet seeks through the mobilisation of expert knowledge to raise public awareness of the role of the oceans in the Earth system, of their impacts (good and bad) on humankind, and of the societal benefits of ocean observations. As ocean issues are involved in, and influence, various cross-cutting initiatives in GEO, such as system architecture and capacity building, Blue Planet also aims to coordinate the various marine initiatives within GEO, to develop synergies between them; in particular to advocate and advance the establishment and maintenance of a global observing

network for the oceans, which acknowledges the value of ocean observations and their contribution to helping alleviate societal issues in multiple areas.

The Working Group took note.

WG II/10 Other parameters and products

CGMS-42-CNSA-WP-05 gives an overview of the application of moderate and high resolution satellites in China for Environmental Protection. Since 2009, aiming at the requirements of environmental protection and management, the Satellite Environment Center, Ministry of Environmental Protection (SEC) has been exploring and promoting the application of remote sensing in environmental protection, depending on moderate and high spatial resolution satellite data, such as HJ-1 A/B satellite data, the TERRA/AQUA MODIS (Moderate Resolution Imaging Spectroradiometer) data, and the China GF-1 satellite data. With the application development of environment remote sensing, it has entered into the key fields of environment management, including environment monitoring, environment law enforcement, environment emergency, ecological protection, and nuclear safety, offering strong technology support and information service for the monitoring and management of the Ministry of Environmental Protection. The paper also announces the future launches of more satellites of the civilian GF series, notably GF-5 and GF-6, which will improve the capability to monitor air pollution. The working group was impressed by the work conducted with GF-1, HJ-1 A/B and MODIS.

CGMS-42-CNSA-WP-09 describes the retrieval of Aerosol Optical Depth from Multi-spectral Camera Data of GF-1 Satellite. GF-1 is the first high-resolution satellite in the Chinese Earth observation satellite system. The paper explored the potential for aerosol optical depth retrieval by using GF-1 satellite imagery. It describes the method using multi-channel look-up tables. Accuracy is somewhat inferior to the MODIS product because of the smaller number of spectral channels (four).

CGMS-42-KMA-WP-07 is a brief viewgraph presentation on the current status of typhoon analysis using satellite observations at KMA. An operational sea surface wind speed retrieval algorithm with high accuracy at the sea surface is developed, which can be applied to a variety of spaceborne passive microwave radiometers. This recognises the fact that surface wind speed plays a key role in the air-sea interaction and the corresponding surface fluxes. It was explained that microwave sensing can be applied in rainy situations. During the discussion KMA was commended for the paper, which again demonstrated the power of microwave observations.

CGMS-42-KMA-WP-09 informed WG II about the status of an Instability Index for Geo-KOMPSAT-2A. The paper provides a description of the instability index algorithm for the Geo-KOMPSAT-2A/AMI. KMA/NMSC is developing an algorithm for deriving instability index through an artificial neural network method as well as through a conventional retrieval method using temperature and humidity profiles. The work shows that a neural network technique can be applied to derive an instability index such as CAPE with computational effectiveness when high temporal and spatial satellite data are obtained from Geo-KOMPSAT-2A/AMI. Currently, validation is being pursued with radiosondes, NWP data and other satellite instability indices such as the Global Instability index (GII) from MSG/SEVIRI. Furthermore, a conventional algorithm of an instability index using vertical

temperature and humidity profiles is being developed and an intercomparison between the two methods will be performed.

CGMS-42-NOAA-WP-17 describes results from the SNPP Aircraft Campaign. The WG noted that detailed validation has demonstrated that both CrIS and IASI have achieved a high level climate monitoring performance capability, thereby minimising the time it takes to detect a real climate trend from natural variability. Validation includes airborne campaigns on board the NASA ER-S aircraft equipped with a Scanning-High resolution Interferometer Sounder (S-HIS). The WG noted that total uncertainty extended the number of years to detect a trend and that, even with perfect observations, it would take 20 years to detect a trend of 0.1K/decade. The specifications for CrIS and IASI would imply that they are not suitable for monitoring trends; however, actual performance significantly exceeds specification and achieves an absolute accuracy between 0.1C and 0.2C. This allows CrIS and IASI to support applications other than NWP.

CGMS-42-ROSHYDROMET-WP-03 on 'Weather and environmental satellite data products in ROSHYDROMET" provides an overview of its primary objectives of hydro-meteorology and geophysical monitoring, disaster monitoring, global climate change and Earth monitoring, and pollution monitoring; as well as the data products that support these objectives. The data products include cloud cover, winds and precipitation, floods and fire, sea and land surface temperatures, snow and ice cover, environmental monitoring, atmospheric soundings, and time series data. Regional ground segment centres in Moscow, Novosibirsk, and Khabarovsk support more than 350 data products for hundreds of users. The objective of operational and research activity in ROSHYDROMET is to use satellite data and products for numerous applications, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods), water pollution monitoring and climate research. Examples of some products retrieved by SRC Planeta were shown as well as the global mosaics of geostationary satellite data, including from Electro-L. Some excellent examples were presented of tropical cyclone monitoring, Amur flooding monitoring, ice cover monitoring, and sea water pollution using a multi-satellite approach. Furthermore examples of climate parameters were presented such as the multi-year ice cover dynamics for Antarctica and snow cover monitoring over the European part of Russia. WG II noted Russia's extensive support of meteorological and climate services and its use of the broad constellation of Earth observing satellites.

CGMS-42-WMO-WP-12 reviews observation requirements and satellite needs for atmospheric composition. The document reports on progress forming the Global Atmospheric Watch (GAW) Task Team on Observational Requirements and Satellite Needs. The Task Team, with its members already nominated, will update the IGACO observation requirements and assess the needs for satellite observations. The first meeting of this task team was planned for mid-June or early July 2014 in Geneva. The process is embedded in the rolling review of requirements, in which requirements are formulated in terms of application domains, for instance spatial, temporal resolution and expected accuracy. The discussion led to the below action:

CGMS-42 actions - WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
WMO	WG II/10	A42.08	WMO is invited to provide a report to CGMS-43 on the outcome of the work of the Global Atmospheric Watch (GAW) Task Team on Observational Requirements	CGMS-43	OPEN	-

WG II/11 Review and updating of the HLPP

CGMS-42-CGMS-WP-07 proposes an update to the CGMS High Level Priority Plan 2014-2018 as part of the agreed revision cycle. The update is based on the following inter-sessional activities:

- Revision of the priorities for part 3: "Enhance the quality of satellite-derived
- Data and products" as elaborated by the co-Chairs and rapporteurs of WG II.
- Recommendations from ITWG
- Refinement of split of responsibilities between WG I and WG IV.
- Establishment by the JWGClimate of a four-year work plan for climate
- Other revisions identified by WG Chairs and co-Chairs

Following the example of ITWG, the following action was included in the upcoming meetings of International Science Working Groups of CGMS:

CGMS-42 actions - WG II						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
IWWG, IPWG	WG II/11	A42.09	IWW12 and IPWG7 to respond to the updated HLPP and to provide feedback to cgmssec@eumetsat.int within 3 months after the working group meeting	1 Oct 2014, 1 Feb 2015	OPEN	-

WG II/12 Any other business

CGMS-42-WMO-WP-23 analyses the resourcing of CGMS sponsored International Science Working Groups (ISWGs). It is clear that these provide an essential mechanism to discuss and advance core scientific and operational satellite meteorology issues. They organise workshops every 18-24 months to review the scientific state-of-the-art, discussing applications and the utilisation of satellite products, and formulating recommendations to CGMS. The workshops also offer an opportunity to respond to actions CGMS has tasked the ISWGs with. In the past, sponsoring ISWG meetings generally has not followed any defined, common structure, e.g. through regular financial contributions by CGMS members or any other standing sponsorship mechanism. On average, two meetings are held per year, with sponsorship identified by the organisers and hosts on a case-by-case basis. The need to provide financial support is regularly iterated in specific recommendations related to ISWG meetings. A more structured approach for securing the resources needed for ISWG meetings, e.g. through a trust fund, may therefore be warranted. Three options were proposed for discussion. Following an in-depth discussion, it is recommended that:

CGMS-42 recommendations - WG II						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	WG II/12	R42.04	Working Group II at CGMS-42 discussed options to provide sustained financial support to the conduct of the International Science Working Groups under CGMS. Although the benefit of establishing a recurrent trust fund was acknowledged, it was concluded that the current approach that relies on voluntary contributions (money or in kind) has worked quite well and should be continued. CGMS members are kindly reminded that contributions on a voluntary basis are necessary and encouraged.	(CGMS-43)	OPEN	-

WG II/13 Planning of inter-sessional activities/meetings

It was briefly summarised that the need for inter-sessional meetings between co-Chairs and rapporteurs of ISWGs should be triggered by specific events such as the conduct of a meeting of an ISWG. Furthermore, the status of relevant actions and related activities should be discussed via WebEx between CGMS meetings.

WG II plans to hold 2-3 inter-sessional meetings until CGMS-43.All CGMS members are strongly recommended to nominate a representative who will participate in the inter-sessional working group meetings.

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

All actions and recommendations were reviewed by walking through the actions and recommendations displayed for discussion. Some actions and recommendations were, as a group effort, elaborated and finally agreed for presentation to the plenary.

The final list of WG II actions and recommendations resulting from CGMS-42 deliberations is available here.

The WG II meeting was closed at around 16:30 on Tuesday, 20 May 2014.