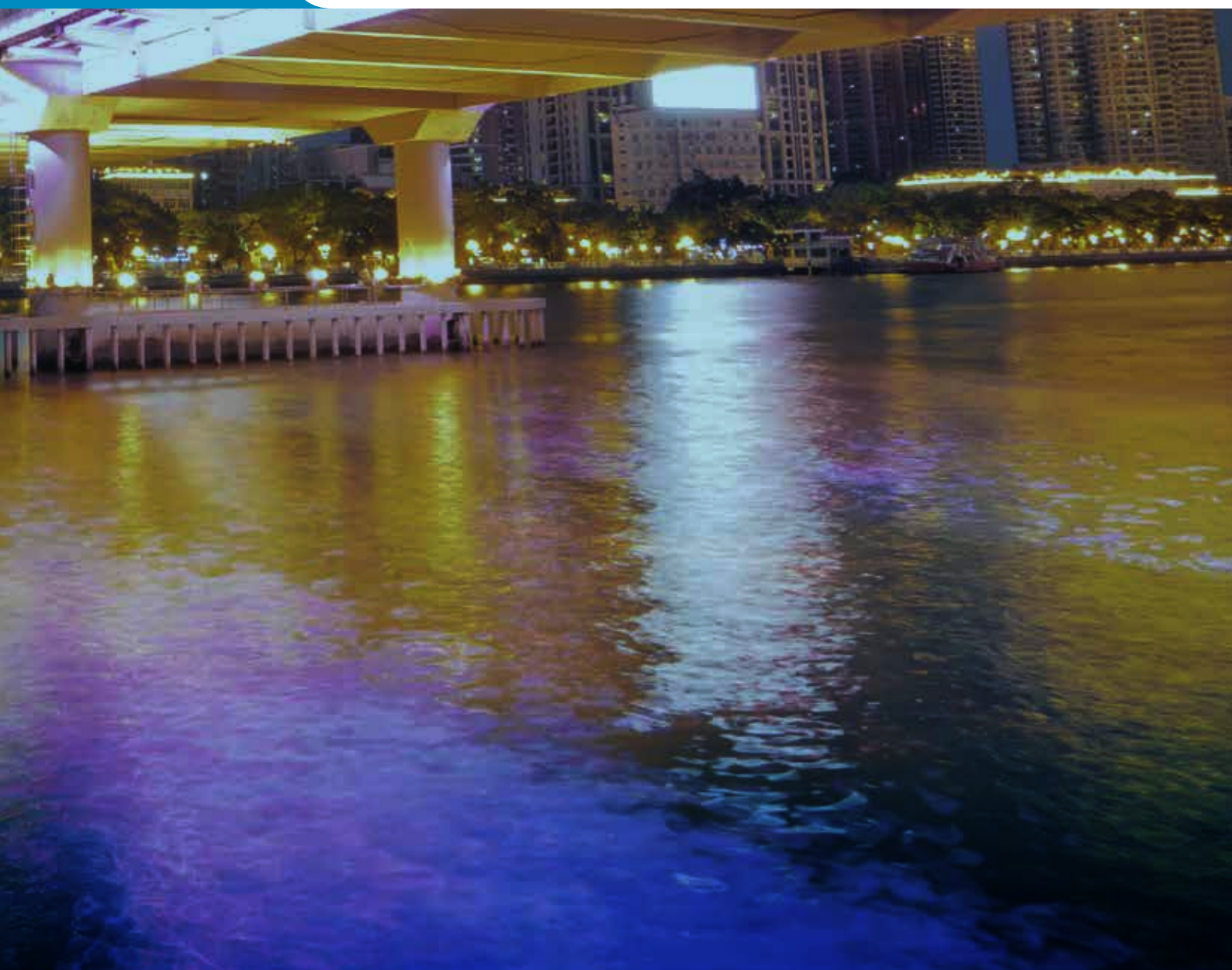




Report of the 42nd Meeting

of the Coordination Group for Meteorological Satellites

19-23 May 2014, Guangzhou, China



REPORT OF THE 42ND MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS-42
Guangzhou, China
19-23 May 2014

Report edited on behalf of CGMS by:

CGMS Secretariat

EUMETSAT

Eumetsat-Allee-1

64295 Darmstadt

Germany

www.eumetsat.int

CGMS MR 42

© EUMETSAT, 20 August 2014

TABLE OF CONTENTS

Introduction	4
A Opening session (A)	4
B Introduction to the meeting (B).....	5
C WMO user requirements (C)	5
D Reports from the space agencies (D).....	11
E Working Group reports (E)	17
F Education and training (F)	26
G Outreach (G)	28
H Cross cutting issues (H).....	28
I GEO	34
J HLPP (I).....	35
K Review of CGMS-42 actions and recommendations (J).....	35
L AOB and closing session (K).....	35
Parallel Working Group Sessions	37
WG I report.....	37
WG II report.....	73
WG III report	95
WG IV report	105
Ad-hoc meeting on space weather report.....	115
Annexes.....	121
Statements in opening ceremony.....	122
List of plenary participants.....	125
List of Working Group participants.....	128

INTRODUCTION

The 42nd plenary session of the Coordination Group for Meteorological Satellites (CGMS) was held on 22-23 May 2014 in Guangzhou, China. The meeting was hosted by China through the China Meteorological Administration (CMA) and the China National Space Administration (CNSA).

The plenary session was preceded by the four CGMS Working Groups (WG IWG I Global issues on satellite systems and telecommunication coordination, WG IWG II Satellite data and products, WG IWG III Operational continuity and contingency planning, and WG IWG IV Global data dissemination) as well as an ad-hoc meeting on space weather in the period 19-21 May 2014.

The meeting was co-chaired by Dr. Jun Yang, Director-General of the NMSC of CMA, Mr. Wenjian Zhang, Director of Space Programme, WMO, and Mr. Alain Ratier, EUMETSAT Director-General and Head of the CGMS Secretariat.

A OPENING SESSION (A)

Dr. Guoguang Zheng, Administrator, CMA, welcomed the participants to the 42nd CGMS plenary session which is the third time that China is hosting CGMS in addition to CGMS-21 in Beijing in 1993 and CGMS-34 in Shanghai in 2006. He added that CMA has been a CGMS member since 1989.

Dr. Zheng indicated that CGMS is a major international organisation coordinating Earth observation activities around the world. It facilitates international cooperation and coordination among CGMS members in a positive and pragmatic manner. He went on to say that CGMS attaches great importance to the continuity of satellite observations, coordinating different satellite systems, allowing users to have sustained and reliable access to satellite data including training on its usage. As a coordinating mechanism, CGMS has played a unique role in the use of frequencies, standardised data and product distribution, emergency response planning among others, and, in recent years, climate and space weather have been added to the portfolio.

He continued by saying that the Chinese government attaches great importance to modernising the meteorological infrastructure, and has invested huge resources in establishing China's own satellite observing and application systems. Since it began planning its satellite observing system, China has been a part of the international coordination framework. He also said that in the meantime, China has developed two series of satellite observing platforms consisting of geostationary and polar-orbiting satellites and it provides, through satellite broadcasting, satellite data, products and meteorological services directly to users in 22 countries and regions, and has become an integral part of GEONETCast and the WMO Information System. He added that in order to optimise the polar-orbiting satellite constellation and improve global Numerical Weather Prediction, CMA is currently making every effort to concretise the operation of an FY polar-orbiting satellite in the early morning orbit, urging the Chinese government to ratify the revised meteorological satellite development planning.

He concluded by wishing all participants a successful 42nd session of CGMS and a pleasant stay in Guangzhou.

Dr. Yulong Tian, Secretary-General of CNSA and co-host of CGMS-42, welcomed CGMS delegations on behalf of CNSA and its Administrator, Mr. Dazhe Xu.

He highlighted the importance of CGMS and the important role it has in the construction of the global observing system, the optimisation of space segments, and the standardisation of the global observing system and data services. He added that CGMS has been an invaluable communication platform between members and the user community, in particular WMO.

Dr. Tian stated that CNSA is committed to assure the stable transition of satellites from R&D to operations, and currently CNSA is preparing the China New generation Earth Observing System - CHEOS - one of China's major national science and technology projects. CNSA plans to promote an operational as well as an international service capability for CHEOS. He added that in future, CNSA together with CMA will work closely with CGMS and WMO in order to further enhance the capability of the global observing system.

Concluding his address, he wished all participants a successful meeting and an enjoyable stay in Guangzhou.

B INTRODUCTION TO THE MEETING (B)

The CGMS Secretariat presented the objectives of the meeting and the agenda was approved by all participants, with some changes in the order of the agenda items due to WebEx presentations.

The status of actions and recommendations resulting from CGMS-41 took were presented. At the start of the working groups of CGMS-42, 15 actions from CGMS-41 were still open, 11 of which were closed following working group discussions by the start of the plenary session. One action remained open from CGMS-40.

The final status of CGMS-41 plenary actions and recommendations resulting from CGMS-42 discussions is available [here](#).

(The status of CGMS-42 actions and recommendations is maintained on the [CGMS website](#) under CGMS-42).

C WMO USER REQUIREMENTS (C)

C.1 Use of satellite data in WMO climate assessments

CGMS-42-WMO-WP-01 described how WMO has been active in assessing global and regional climate since the initiation of the World Climate Programme in 1979. The WMO annual statement on the 'Status of the Global Climate' has been published since 1993 in the six official languages. More recently WMO published a [report](#) on the climate during the decade 2001-2010. Interest in these publications has been increasing with time, including the interest of international agencies, policy makers, governments and the general public. A need for data completeness and quality is therefore of paramount importance to maintain a high standard of these assessments.

In this regard, there is a growing need for satellite products that should complement the poorly documented areas and topics that are currently based mainly on in-situ data. It is of particular

importance for WMO to further enhance its climate assessments using long-term homogenised data sets on tropical cyclones, satellite-based data to contribute to global temperature anomalies and trends, precipitation anomalies and climatology, estimated arctic sea ice volume, monthly northern hemisphere snow cover and anomalies.

Other products such as snow depth estimate and forest fire index, based on combined in-situ and satellite data, could also be envisioned as a contribution to regional climate watch demonstration projects.

The following recommendation was made following the presentation:

CGMS-42 recommendation – PLENARY						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	Plen C.1	R42.01	CGMS Members are encouraged to support regional climate watch demonstration projects.	CGMS-43	OPEN	HLPP# 5.1.4

CGMS-42-WMO-WP-03 provided an update on the progress of the GFCS initiative. In July 2013, the first session of the Intergovernmental Board on Climate Services (IBCS-1) approved the GFCS Implementation Plan with a compendium of initial GFCS projects for immediate implementation. It also established a Partners Advisory Committee (PAC) and the IBCS Management Committee. EUMETSAT, FAO, IFRC, IUGG, UNEP, WBCSD, WFP, and WMO have formally applied to the PAC, and the EU, World Bank, and UNDP have indicated their intention to join. The first PAC session is expected before IBCS-2 in November 2014. The GFCS has now entered the implementation phase. National and regional consultations are being conducted to identify gaps in the various components of the GFCS in the four priority areas. They are also preparing the development of guidelines for frameworks for climate services at national level. There are key gaps related to inadequate gathering of high quality data including:

- Shortcomings in atmospheric observations by climate stations;
- Coverage of oceanographic observations by moored buoys;
- Uncertainties regarding the continuity of satellite monitoring with microwave sensing;
- High precision altimetry, and LIDAR and SAR coverage of sea ice parameters;
- Gaps in terrestrial observing networks, and uncertainty regarding the continuity of land cover monitoring satellite missions;
- Need for complementary biological, environmental, and socio-economic data;
- Data policies, data management, data rescue and access to historical data; and
- Need to improve monitoring systems, and perform re-analysis operationally.

The '[Executive Council Task Team on WMO Policy for International Exchange of Climate Data and Products to Support the Implementation of the GFCS](#)' developed a draft resolution complementing resolutions 40 (Cg-XII) and 25 (Cg-XIII) and identifying a set of data and products to be exchanged in a free and unrestricted manner. Data rescue activities are underway in several countries. Early efforts to showcase partnerships in the development and application of climate services are taking

place through specific activities. Various actors or stakeholders can contribute to these by: (a) contributing resources to the GFCS Trust Fund; (b) selecting activities of their interest from the implementation plan and the compendium of initial GFCS projects; and (c) designating activities they are implementing as contributing to the GFCS. The action below was raised as a result of the presentation:

CGMS-42 actions - PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	Plen C.1	A42.01	CGMS Members who are willing to contribute satellite-based products to the annual WMO climate assessment shall nominate a point of contact to liaise with the future Commission on Climatology (CCI) Task Team on the Use of Satellite Data for Climate Monitoring in order to jointly define the specifications of these products, including validation and verification issues.	15 Jun 2014	OPEN	HLPP# 5

C.2 Emergency satellite support to disaster risk reduction

The use of data and products from meteorological satellites of CGMS Members has a direct societal impact in terms of protection of life and property in disaster situations. It is also an opportunity for CGMS satellite operators to give a visible demonstration of the relevance of satellite programmes and their benefit to society. **CGMS-42-WMO-WP-04** pointed out that effort should be made to ensure that National Meteorological and Hydrological Services (NMHSs) can make the best possible use of meteorological satellite capabilities in case of disaster emergencies, including but not limited to, severe weather events such as tropical cyclones. The [International Charter Space and Major Disasters](#), which organises acquisition of Earth Observation data in emergency mode for disaster management authorities, is typically suited to the provision of high-resolution imagery products. The utilisation scenario of meteorological satellites is notably different since NMHSs generally use satellite data and products in routine operations, and most meteorological satellite data or products are systematically generated and disseminated. Therefore, provision of extraordinary support in emergency situations can be thought of in terms of “enhancing” routine operations rather than implementing totally new functions. For some disaster types such as tropical cyclones, or volcanic ash clouds, roles and responsibilities are organised at the international level, with well identified regional centres and alert procedures. It is important to maintain an active dialogue between these regional centres and the satellite community to ensure that advantage is taken of the latest satellite capabilities. For other disaster types for which no organisation is formalised at the international level, best practices should be defined to ensure that key satellite data and products are available when needed in critical situations.

The following recommendation was raised following the presentation:

CGMS-42 recommendation – PLENARY						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	Plen C.2	R42.02	CGMS Members are encouraged to <ul style="list-style-type: none"> • Support a review of meteorological satellite data use by RSMCs and other NMHSs in DRR – with DRR and Tropical Cyclone Programmes • Explore possibility to provide on-demand additional data/products in certain emergency situations – Procedures to be specified, identified points of contacts (ref CGMS-42-WMO-WP-04) 	CGMS-43	OPEN	HLPP# 2.4

C.3 Use of satellite data in emergency situations in China

In **CGMS-42-CMA-02-PPT** CMA presented the use of satellite data in emergency situations in China. Examples were given of emergency situations in which meteorological data and products were used to support the emergency response. These included Typhoon Fitow (2013), a grass land fire in Mongolia (in 2012), the flood in Heilongjiang province (2013), the mudslide in Zhouqu county in western China (in 2010), Typhoon Haiyan (2013) and the recent disappearance of Malaysian airlines flight 370 (in 2014).

Following the presentations in C.2 and C.3, it was noted that with the upcoming generations of geostationary meteorological satellites, rapid scanning observations will become standard. Users should therefore be prepared for to handle this type of data for emergency situation management.

The presentations also demonstrated that specific sets of products are needed to support emergency management. EUMETSAT indicated that WMO might help in gathering requirements for such products so space agencies can better prepare their responses. In this respect, ISRO added that regarding the [International Charter Space and Major Disasters](#), it would be beneficial to establish a feedback mechanism from users to space agencies.

JMA thanked CMA for the presentation and the support it has provided for typhoon monitoring. JMA informed CGMS that MTSAT 10-minute rapid scans incidentally captured the Kelud Volcano eruption in Indonesia, and Himawari-8/9 will provide observational 10-minute full disk scans by default. JMA also confirmed that such high-frequency full disk scanning will in the near future be a normal measure for supporting emergency situations, so that it is important to develop the usage of high-frequency data for disaster risk reduction in cooperation with Regional Specialized Meteorological Centres (RSMCs) and Volcanic Ash Advisory Centres (VAACs).

WMO added that disaster support is an important topic and the need for CGMS to support the user communities which should be addressed at future CGMS sessions.

The following two actions were raised as a result of the discussions:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
WMO	C.3	A42.02	WMO to establish a dialogue among CGMS satellite operators and the WMO Disaster Risk Reduction programme (DRR) to identify regional pilot actions for enhancing the use of satellites in support of DRR	CGMS-43	OPEN	HLPP# 2.4
CMA, JMA, KMA, BoM	C.3	A42.03	CMA, JMA, KMA and Bureau of Meteorology Australia to consider including a session on regional applications of satellites to Disaster Risk Reduction (DRR) in the programme of the 5 th Asia Oceania Meteorological Satellite Users Conference.	30 Jun 2014	OPEN	HLPP# 2.4

C.4 Benefits of Infrared Sounding Missions for Nowcasting purposes

CGMS-42-EUMETSAT-WP-02 reported on the outcome of the Workshop on Nowcasting Applications using MTG-IRS, which was held at EUMETSAT, Darmstadt, on 25-26 July 2013. The objectives of the workshop were twofold: To provide the user community information on what was planned by the Meteosat Third Generation (MTG) programme, as the MTG Infrared Sounder (IRS) is a new instrument with relatively little heritage, and to explore with users the potential use and benefits of IRS data and products. Although development has progressed very well, several key elements are still open. The discussion during the workshop provided insight on a way forward to close selected open issues. It was noted that the launch of a hyperspectral infrared sounder in geostationary orbit by EUMETSAT fulfils a longstanding wish by many users and scientists and presents a significant step forward in geostationary satellite observation techniques. CGMS members were then invited to participate in the IRS demonstration projects.

WMO stated that it looked forward to the next generation geostationary spacecraft. There are clear WMO needs of which nowcasting is the most important operational application, with the difficulty lying in how to best present the data to users (humidity temperature profiles, stability issues, atmospheric composition, cloud properties, wind profiling, convergence, etc.). SCOPE NWC might support such work and CGMS was invited to consider this.

The following recommendation was also made following the presentation:

CGMS-42 recommendation – PLENARY						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	Plen C.4	R42.03	CGMS members are invited to capitalise on the experiences from EUMETSAT's IRS workshop to provide feedback to EUMETSAT on the available case studies (ref. CGMS-42-EUM-WP-02)	CGMS-43	OPEN	HLPP# 3.6.1

C.5 Satellite User Readiness Navigator (SATURN) web portal

The new generation of geostationary meteorological satellites being launched by CMA, EUMETSAT, ISRO, JMA, KMA, NOAA and ROSHYDROMET before the end of this decade will provide unprecedented capabilities for key weather applications and for a number of developing application areas, but will also present unprecedented challenges for users worldwide. A major challenge is the order-of-magnitude increase in the amount of data and products that will be generated from the advanced imagers and sounders on-board the satellites. In addition, novel data types drive the need for advanced interpretation and assimilation techniques and implementing these new techniques into operational schemes. At CGMS-41, CGMS established the following High-Level Priority cross-cutting area: “5.3 Prepare operational users for new generation of geostationary meteorological satellites through user readiness programmes, with coordinated contributions from CGMS members” (see also CGMS-41 plenary actions 41.05 and 41.06). In response to this priority, the WMO Space Programme, with the support of CGMS member agencies, is developing the online portal SATURN (SATellite User Readiness Navigator), to provide a single point of access for all information pertinent to the global user community preparations for the new generation of satellites. The support of CGMS members to achieve this goal is essential, and therefore CGMS has established a task team of agency focal points to provide content for the portal. Access to the portal was planned to be opened in June 2014. A key element of the portal is a Reference User Readiness Project, which is intended as a “best practice” guiding CGMS members to provide content for the SATURN portal. The draft scope and timeline of this project was provided for review by CGMS satellite operators in **CGMS-42-WMO-WP-20**.

Following the presentation, ISRO stated that it would like to integrate INSAT-3D in this portal, and the WG IV rapporteur indicated that WG IV had taken an action to follow this matter up.

C.6 CGMS Baseline in the WIGOS Regulatory Material

The [Manual on the WMO Integrated Global Observing Systems](#) (WIGOS Manual) is part of the WMO Regulatory Material approved by WMO Members at Congress. It has to comply with certain drafting standards, highlighting the obligations of WMO Members (“The members shall...”) as opposed to the recommendations (“Members should...”), while background information is provided in “Notes” or “Annexes”.

Chapter 4 of the Manual is dedicated to “Common attributes specific to the space-based sub-system of WIGOS”. In order to reflect the agreement reached among CGMS satellite operators to ensure continuity of the space-based observing system, the decision was made to include the text of the CGMS Baseline as an Annex to this chapter, with the understanding that subsequent updates of the CGMS Baseline would be implemented in further updates of the WIGOS Manual as appropriate.

Chapter 4 is contained in pages 50-56 of the draft Manual on WIGOS, followed by the CGMS Baseline on pages 57-59. These pages were reproduced in **CGMS-42-WMO-WP-06** for information and comments.

Following the presentation, GEO commented that it is now working on how to tackle all high level issues and to adequately represent WIGOS in GEO post 2015.

D REPORTS FROM THE SPACE AGENCIES (D)

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

CMA reported on the status of its current and future satellite systems in **CGMS-42-CMA-WP-01** providing an overview of the current and future FY polar-orbiting and geostationary systems. Observations from polar orbit are carried out by FY-3A in an AM orbit and FY-3B in a PM orbit. FY-3C was launched in September 2013 and operations were planned to commence in June 2014. It is the first satellite in the series to carry the GNSS Radio-Occultation Sounder instrument, the first satellite in the series to do so. FY-2G will be launched in 2014 as the FY-2C and -2D services are coming to an end. FY-2F will be moved from in-orbit storage to become operational at 86.5°E. CMA is currently developing FY-4, its next generation of geostationary meteorological satellites, with the launch of the first spacecraft scheduled for 2016.

Following an enquiry from IOC-UNESCO, CMA clarified that a wind radar with two microwave frequencies very similar to a scatterometer onboard FY-3E in the 2017/2018 period is under consideration.

A summary of the status of EUMETSAT's current and future LEO and GEO satellite systems was provided in paper **CGMS-42-EUMETSAT-WP-03**. EUMETSAT operates a fleet of meteorological satellites, and their related ground systems, to deliver reliable and cost-efficient data, images and products. These, in turn, serve requirements for weather and climate monitoring of the national meteorological services in the 30 Member and one Cooperating States, and of global partners. The present system includes two generations of geostationary Meteosat satellites. Their global view is complemented by the detailed observations provided by the Metop polar-orbiting satellite and the marine observer, Jason-2 - a joint project of space agencies in Europe and the United States.

MSG-4, the last satellite in the current MSG second generation geostationary series, will be launched in 2015, with the first of the Meteosat Third Generation (MTG) series planned for launch in 2019. The last Metop-C polar-orbiting satellite will be launched in 2018. It is expected that the follow-on EPS-SG programme will be approved by the end of 2014 by EUMETSAT's Council. Jason-3 (in cooperation with NOAA, CNES and NASA) is planned for launch in 2015. EUMETSAT will also operate the Copernicus Sentinel-3 satellite commencing in 2016, following commissioning by ESA.

Following the presentation, IMD thanked EUMETSAT for the provision of the Indian Ocean Data Coverage (IODC) service and requested EUMETSAT to continue fulfilling this position after the end of Meteosat-7 (end of 2016). EUMETSAT recalled that as previously discussed in WG III, there is no replacement planned in the context of the transition to MTG. EUMETSAT will therefore continue to work with CGMS partners (IMD, CMA and ROSHYDROMET in particular) to explore the best possible approach to ensure the continuity of the IODC service based on assets of CGMS Members with a view to making image data, products and data collection services from the IODC region available to users for assessment and where appropriate operational use. A roadmap had been proposed in WG III to this purpose.

In **CGMS-42-IMD-WP-01**, IMD informed CGMS that currently three Indian meteorological satellites are in operation: KALPANA-1, INSAT-3A and INSAT-3D. With the help of these three satellites, IMD is able to monitor several phenomena like, cyclones, western disturbances, thunderstorms, etc., and provide early warnings to the affected areas. A recent major upgrade in observations from a geostationary platform is the INSAT-3D satellite. It was launched on 26 July 2013 and is an exclusive meteorological satellite carrying advanced meteorological payloads, viz. a six-channel imager and a 19-channel sounder.

The imager is a multi-spectral (optical radiometer) capable of generating the images of the Earth in six wavelength bands significant for meteorological observations, namely, visible, shortwave infrared, middle infrared, water vapour and two bands in thermal infrared regions of the Earth disk every 26 minutes. It provides information on various parameters, namely, outgoing long-wave radiation, quantitative precipitation estimation, sea surface temperature, snow cover, cloud motion winds, etc. The imager payload is an improved version of VHRR flown on the INSAT-3A and Kalpana-1 satellites, with significant improvements in spatial resolution, number of spectral channels and functionality.

The sounder provides data for the retrieval of vertical profiles of temperature and humidity over the clear sky region of the data-sparse Indian Ocean at a 10 km spatial resolution. INSAT-3D images and products are available through the dedicated web sites www.imd.gov.in and www.mosdac.gov.in on a near real-time basis.

INSAT-3DR (INSAT-3D Repeat) is planned for launch in 2015-2016 and an on-orbit spare, INSAT-3DS, is also planned. These will have similar payloads to INSAT-3D for the continuation of the operational service. The GISAT (Geo-stationary Imaging Satellite) next generation geostationary imaging satellite will provide continuous imaging of the Earth disc or regions of interest with higher spatial resolution and hyper spectral resolution. It consists of a High resolution Multi-spectral VNIR (HRMX-VNIR) <100 m resolution, Hyper spectral VNIR with less than 500 metre resolution, Hyper spectral SWIR (HySI-SWIR) with less than 300 metre resolution and a High resolution Multi-spectral (HRMX-TIR) with less than two-kilometre resolution and is planned for launch in 2017-2018.

The following three satellites, Oceansat-2 (Ocean Colour, SCAT and ROSA), RISAT-1 and SARAL-ALTIKA are Indian operational polar-orbiting space missions and Megha-Tropiques in low inclination orbit for atmospheric and oceanic science studies. Oceansat-2 is a three-axis body stabilised spacecraft placed into a near circular sun synchronous orbit, at an altitude of 720 km, with an equatorial crossing time of around 12:00 launched on 23 September 2009 at an inclination of 98.280 degrees. The Oceansat-2 scatterometer is unavailable since February 2014. The Megha-Tropiques satellite (MADRAS, SAPHIR, SCARAB and ROSA), an ISRO-CNES joint collaboration, was successfully placed into a non-sun synchronous orbit at an altitude of 867 km with an inclination of 20 degrees to the equator on 12 October 2011 with the objective of studying the water cycle and energy exchanges in the tropics. The Radar Imaging Satellite (RISAT-1), launched on 26 April 2012, placed in a polar sun-synchronous orbit of 536 km height carries a multimode C-band (5.35 GHz) Synthetic Aperture Radar (SAR) payload for wide applicability in flood mapping, agriculture and crop monitoring, generic vegetation, forestry, soil moisture, geology, sea ice and coastal processes, etc. The satellite with ARGOS and ALTIKA (SARAL) is a joint Indo-French satellite mission for

oceanographic studies. SARAL will perform altimetry measurements designed to study ocean circulation and sea surface elevation. It was successfully launched on 25 February 2013 into a 781 km sun-synchronous polar orbit at 98.538 degrees.

Following the presentation, WMO thanked IMD (and ISRO) for their comprehensive web site of data and products, an added value for data application.

JMA provided an update on the status of its current and future programmes in the paper **CGMS-42-JMA-WP-02**. JMA operates the GEO stationary MTSAT/Himawari satellite system. MTSAT-2 (145°E) is currently operational imaging over the Western Pacific region with backup from MTSAT-1R (140°E), which has continued to perform imagery dissemination and data collection services even after its imaging function was switched over to MTSAT-2 on 1 July 2010. Its Data Collection System (DCS) has functioned properly since the satellite began its operations. JMA plans to launch its next generation geostationary satellite Himawari-8 in 2014 and commence its operation in mid 2015, when MTSAT-2 is scheduled to complete its period of operation. Himawari-9 will follow in 2016. The Pre-Shipment Review (PSR) of the Advanced Himawari Imager (AHI) for Himawari-8 was successfully completed in August 2013, and Himawari-8's manufacture is now in the final test phase. The PSR of the AHI for Himawari-9 is also scheduled to take place in a few months. All Himawari-8 and -9 imagery will be delivered via an Internet cloud service, and primary sets of imagery will also be disseminated via the HimawariCast service using a communication satellite. JMA maintains updated web pages with information on Himawari-8 and -9 at <http://mscweb.kishou.go.jp/himawari89/> and <http://www.jma.go.jp/jma/jmaeng/satellite/>

CGMS-42-KMA-WP-01 provided an update on the COMS MI satellite which is currently operational at 128.2°E. Data are distributed via landline and satellite over the Western Pacific region and COMS GOCI over the East Asia region. The development of GEO-KOMPSAT-2A (meteorological mission) and -2B (ocean and environmental mission) is progressing well, and they are scheduled to be launched in May and December 2018, respectively.

In **CGMS-42-NOAA-WP-02-PPT** NOAA reported on the status of its current and future programmes. NOAA manages a constellation of three geostationary nine polar-orbiting meteorological spacecraft, including four Defense Meteorological Satellite Program (DMSP) satellites, and Jason-2 from the Satellite Operations Control Center (SOCC) in Suitland, Maryland. These satellites provide continuous observations of weather conditions and environmental features of the western hemisphere, monitor global climate change, verify ozone depletion and land surface change, monitor the critical space environmental parameters, and support search and rescue efforts across the globe. The paper included an update on the progress of preparation of GOES-R. The status of the JPSS programme was also detailed. SNPP is operating well and the next satellites in the series (JPSS-1 and -2) will be launched in 2017 and 2022. It was noted that the DISCOVER satellite (solar winds) and Jason-3 (NOAA, CNES, EUMETSAT, and NASA partnership) will both be launched in 2015. CGMS was informed on the next generation COSMIC mission, COSMIC-2, which is under preparation in collaboration with NSPO, Taiwan, to provide Global Navigation Satellite System (GNSS) Radio Occultation (RO) data. It will replace COSMIC-1 which is operating beyond the end of its mission design life.

CGMS-42-ROSHYDROMET-WP-01 addressed the current status of the Meteor-M №1 polar-orbiting meteorological satellite launched in 2009 and the Electro-L №1 geostationary meteorological satellite launched in 2011. The future Russian geostationary meteorological constellation will consist of three Electro-L satellites. The location of Electro-L satellites in orbit will be 14.5°W, 76°E and 166°E. The mission objectives, payload and ground segment details were provided in the paper. An overview was given of the future Meteor-M polar-orbiting satellite system, which will include three meteorological and one oceanographic satellite, and also the forthcoming series of Meteor-MP satellites. The Arctica-M constellation of highly elliptical orbit satellites is now under development and the system will include two spacecraft. The mission objective is to provide continuous observations over the Arctic region and the launch is scheduled for 2015–2016. An overview of the mission objectives, payload and ground segment matters were also presented.

ROSHYDROMET confirmed that it will follow the CGMS recommendation and Electro-L №2 will be positioned at 77.8°E to support IODC observations. The spacecraft is expected to be launched in December 2014.

Following the presentation, JMA highlighted that in future, DCS frequency coordination is essential in view of Himawari-8 and a future Electro-L spacecraft planned for positioning at 166°E.

At the request of WMO, ROSHYDROMET agreed to provide a point of contact for capturing the ROSHYDROMET data in the SATURN portal.

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

An update was given in **CGMS-42-CNES-WP-01-PPT** on CNES atmospheric monitoring missions: Megha-Tropiques, a CNES-ISRO collaboration, studying water and energy cycles in the tropical hemispheres; Calipso, a NASA, CNES collaboration, and Parasol (A-train) which measure the properties of clouds and aerosols; Merlin, a CNES-DLR collaboration, to measure methane and will be launched in 2019; IASI, a CNES-EUMETSAT collaboration on an infrared sounder instrument; and Microcarb which will measure CO₂ column.

CNES climate related ocean missions include: Jason-2 and -3, a EUMETSAT, NOAA, CNES, and NASA collaboration on high precision ocean altimetry; SARAL, a CNES-ISRO radar altimetry mission, launched in 2013; and CFOSAT, a CNSA-CNES collaboration on sea wave spectrum and sea surface wind. Climate related land missions include VEGETATION, a CNES, BFSPO, ASI, SNSB, and JRC cooperation on land cover data; SMOS an ESA, CNES, CDTI cooperation on soil moisture and ocean salinity measurements; and SWOT a NASA-CNES cooperation on an altimetry mission covering oceans as well as lakes and rivers.

An update was also provided on CNES's partnership with several French climate data centres and its involvement in European climate activities such as the ESA CCI programme, EUMETSAT Climate SAF and GMES core services.

Following the presentation and regarding SMOS, IMD would like to see the continuation of this R&D mission in view of it having been operated since 2009. IOC-UNESCO added it would like near real-time data to be made available through GEONETCast as far as is possible.

CGMS-42-CNSA-WP-01 provided details of China's current and future satellite systems. The presentation included an update on the FY operational satellite system and four R&D satellite systems including the HY, HJ, ZY, and GF satellite series. China plans to launch several satellite systems in the near future, including the China High-Resolution Earth Observation System – CHEOS – which was officially initiated in May 2010. The Earth Observation System and Data Center of China National Space Administration (EOSDC-CNSA) is responsible for its construction. An overview of CHEOS and its current status were also presented.

CGMS-42-CSA/EC-WP-01 outlined a mission concept to support Canadian interests in the arctic, known as the “Polar Communications and Weather Mission” (PWC). It has been developed by the Canadian Space Agency (CSA) in partnership with Environment Canada (EC) and the Department of National Defence (DND). This will cover weather imaging, space weather and civil and military communications. The concept requires government approval in order to proceed. A request for information was released to industry at the end of 2013, with around 20 respondents including several proposing end to end solutions. The next steps rely on government consideration, which is anticipated in autumn 2014. Environment Canada also confirmed the compatibility of the mission with WMO requirements for which WMO was thankful.

Following an enquiry by CMA, Environment Canada confirmed that a space weather instrument is identified as one of the core missions on PCW. However, the focus might change somewhat since there are discussions on moving away from a pure molnya orbit in view of the spacecraft lifetime. This will ultimately depend on the final configuration of the spacecraft and was still under debate by the Canadian government. CMA added that a molnya orbit would be very beneficial for GSICS activities.

CGMS was informed of the status of the current European Space Agency Earth observation missions in **CGMS-42-ESA-WP-01**. Two of them, MSG and Metop are in co-operation with EUMETSAT. The Gravity field and steady-state Ocean Circulation Explorer, GOCE, the first Explorer satellite launched on 17 March 2009, ended its mission in November 2013, exceeding its predicted lifetime. The SMOS satellite was launched on 2 November 2009. All reprocessed level 1 and 2 data have been available from the [ESA Cal/Val portal](#) since mid-March 2012. The CryoSat-2 satellite was launched on 8 April 2010. The release of systematic CryoSat products (level 1b and 2) to the scientific community is ongoing. The Proba-V small satellite was launched on 7 May 2013 and its coarse resolution imager continues the data acquisition of the vegetation payload on-board SPOT-4 and 5. The Swarm satellites were launched on 22 November 2013.

About 4,000 data user projects worldwide use data from the ESA EO missions and this number is increasing. The total volume of ESA EO mission data exceeds 100 terabytes per year.

CGMS was further informed of the status of development of future European Space Agency Earth observation missions. Two of them, MTG and EPS SG, are co-funded with EUMETSAT, and will be operated by EUMETSAT. The Living Planet Programme has three lines of implementation: Earth Explorer satellites, Earth Watch satellites plus services and applications demonstration. Progress in the preparation of the forthcoming Explorer missions ADM-Aeolus, EarthCARE and BIOMASS is described.

Copernicus (formerly GMES) represents the major new initiative of European efforts in Earth Observation. Copernicus pre-operational services started in 2008, with the provision of the relevant data. The first Copernicus dedicated satellite (Sentinel-1A) was launched on 3 April 2014, and other Sentinels will follow starting in 2015. Related activities are under way at all stages within ESA, the European Commission (EC) and at Member State level.

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

Concluding the presentation, ESA also recommended that space agencies urge the protection of C-band sensing frequencies to assure mission continuity.

ISRO presented its current and future geostationary and polar orbiting Earth observation programmes in **CGMS-42-ISRO-WP-01**. An overview of the geo-portal web services ([MOSDAC](#) and [BHUVAN](#)) was given, including provision of open data download services, weather forecasting, 2D/3D data visualisation, value added land products and climate products services. The presentation also covered the calibration and validation initiatives undertaken by ISRO with the development of many theme oriented calibration sites, and also with the participation of international calibration teams through the CEOS Working Group for Cal-Val (WGCV).

Following the presentation, EUMETSAT thanked ISRO for the provision of Oceansat-2 data and said the user community very much looks forward to the ScatSat and Oceansat-3 missions.

CGMS-42-JAXA-WP-01 provided an update on JAXA's Earth observation programmes. GPM/DPR was successfully launched from Tanegashima Space Center on 27 February 2014 and initial calibration and check out of the DPR was ongoing. The TRMM/PR is still functioning well. JAXA currently operates GOSAT, Ibuki and GCOM-W1, Shizuku. The GOSAT data products are distributed through the GOSAT User Interface Gateway (GUIG), a [web site](#) for GOSAT data distribution. The AMSR2 products are available at the GCOM-W1 Data Providing Service [web site](#).

The developments of ALOS-2, EarthCARE/CPR and GCOM-C are under way with launches planned in May 2014 for the former, and in JFY2016 for the latter two. The GOSAT-2 project was officially initiated in April 2014 as a GOSAT, Ibuki follow-on, for which the target launch date is in 2017.

WMO thanked JAXA for the presentation, and recalling the current difficult economic climate, WMO also encouraged CGMS to share and display the socio-economic benefits resulting from CGMS missions which would provide evidence for the needs of such missions.

In **CGMS-42-NASA-WP-01** NASA provided updates on the 17 Earth Science missions it currently operates. Although all missions were conceived as research missions, it has turned out that the efficiency of the communications and ground data handling systems has supported operational and near real-time applications. All missions are currently producing data, but several also show signs of ageing. Except for Suomi-NPP (October 2011), SACD/ Aquarius (June 2011), LDCM/Landsat-8

(February 2013), and GPM Core (February 2014), all missions have passed their nominal design life, and are currently in extended operations. NASA's Earth Science Program (\$1.8 billion budget) is implementing a balanced and robust plan to accomplish a broad set of critical Earth observation measurements from space. The programme advances knowledge of the integrated Earth system, the global atmosphere, oceans (including sea ice), land surfaces, ecosystems, and interactions between all elements, including the impacts of humans. A balance of satellite measurements, science research, technology development and applications is needed to address a complex global Earth system. NASA's plans include the launch of 13 missions and seven instruments (on host missions) in the future.

Concluding sessions D.1 and D.2, WMO thanked all CGMS space agencies for the positive outlook and concrete future roadmap with very comprehensive missions, data and products. As such, CGMS can contribute more to the user community and this in turn can facilitate receiving further support from users, governments and financial contributors. WMO added that it would also be beneficial to communicate these benefits at high level events.

E WORKING GROUP REPORTS (E)

E.1 Global issues on satellite systems and telecommunication (WG I)

E.1.1 Harmonisation of global Data Collection Systems (DCS)

The presentation and proposals delivered in **CGMS-42-EUMETSAT-WP-04-PPT**, on work towards harmonisation of the global Data Collection Systems (DCSs) were agreed. CGMS plenary also agreed to the proposal to support the SATCOM Forum meeting in 2015 and to prepare for it via specific inter-sessional meetings, as proposed by WG I, and to support the appointed CGMS representative, Mr. Sean Burns of EUMETSAT, by appointing dedicated points of contact from each CGMS members operating DCSs. These points of contact need to provide the necessary information to consolidate the inputs by CGMS on the existing capabilities and future requirements for the DCS. In order to achieve this, a template with the necessary information requested will be prepared by the CGMS Secretariat and submitted to all CGMS members.

Two actions were recorded during this agenda item:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	Plen E.1.1	A42.04	CGMS agencies to identify a point of contact and provide feedback on their respective Data Collection System (DCS) to sean.burns@eumetsat.int	15 Jun and 31 Jul 2014	OPEN	HLPP# 1.2.1
CGMS members	Plen E.1.1 (wrt to WG I)	A42.05	CGMS members to confirm to cgmssec@eumetsat.int the points of contact for preparation of the SATCOM forum meeting (in 2015)	15 Jun 2014	OPEN	HLPP# 1.2.1

E.1.2 Coordination of existing regional retransmission services (RARS)

CGMS-42-EUMETSAT-WP-05-PPT reported on the outcome of WG I discussions on the aspects of coordination of existing Regional Retransmission Services (RARS) to the plenary. The outcome of WG I was a series of recommendations for defining "best practices" for the implementation of RARS systems and to work by inter-sessional meetings to secure adequate WG I progress by CGMS-43.

The plenary acknowledged the recommendation by the 19th International TOVS Study Conference (ITSC-19) for the definition and implementation of community agreed operational procedures for LEO satellite data direct read-out, acquisition, and relay and the WMO decision to re-establish the Direct Readout, Acquisition and Relay of Satellite Data Implementation Group (DRARS IG). The plenary also agreed that participation in the inter-sessional meetings of WG I and participation in the WMO DRARS IG is concomitant and membership is to be ensured both by the different CGMS members participating in RARS activities and/or operating RARS related satellites.

The CGMS Secretariat also raised the point of the additional HLPP topic identified by WG I in the area of RARS for ensuring that operational processing packages for future satellite systems providing regional services are developed by the corresponding satellite operators.

The plenary agreed and endorsed all proposed recommendation for developing best practices and the proposal for the amendment of the HLPP.

E.1.3 Report by Working Group I

The summary of the outcome and conclusions/recommendation from the WG I meeting was presented to the plenary in **CGMS-42-CGMS-WP-02-PPT** by Marlin O Perkins, WG I Chair. The presentation included the consolidation of the scope of work of WG I in the area of direct broadcast and direct readout services including reference to the previous presentation made on the specific aspects of the RARS systems/services evolution.

The CGMS plenary endorsed the proposed CGMS-42 WG I actions and recommendations and the proposed WG I work plan with four inter-sessional meetings on four different themes (global specifications, RARS, DCS, user stations and frequency coordination) by CGMS-43.

During the report to the plenary, ESA highlighted the situation regarding the active remote sensing band 5350-5470 MHz used for SARs, scatterometers and altimeters and asked all CGMS members to closely and regularly liaise with their national frequency management and regulatory authorities on the importance of the frequency bands assigned and associated with CGMS systems and the need to protect and preserve them. These regular activities shall ensure that adequate awareness is raised, and maintained, with the national authorities that will convey the national positions to the WRC. On the same topic, IMD requested support from ROSHYDROMET and CMA to support the coordination of the INSAT-3 DCP frequency allocations. The Chair of WG I supported the proposal but reminded CGMS of the need to achieve the frequency coordination of space systems within the ITU framework and that CGMS can only provide a forum to facilitate preliminary discussions between CGMS members. CGMS cannot replace ITU's formal frequency notification process which is mandatory for all space systems.

Following interventions by IMD, WMO and EUMETSAT, it was agreed to assign an action to WG I Chair to draft a letter from CGMS to WMO addressing the importance of the frequency bands assigned and associated to CGMS systems and the need to protect and preserve them.

The following action was raised as a result:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
WG I Chair	Plen E.1.3 (wrt to WG I)	A42.06	WG I Chair to draft a letter from CGMS to WMO for addressing the importance of the frequency bands assigned/associated to CGMS systems and the need to protect/preserve them. The letter was drafted and endorsed during plenary. The CGMS Secretariat to send the letter to WMO following CGMS-42.	23 May 2014	CLOSED	HLPP# 1.3.3

GEO added it will also encourage its member administrations to support frequency coordination.

Additionally, the WG I Chair reported to the plenary on the adjustments in the scope of WG I and WG IV to better delimit the areas of work by both Working Groups. The plenary supported the revision of the scope of WG I and WG IV and decided that an update of the “Terms of References” of both Working Groups needs to be prepared for endorsement by CGMS-43.

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
WG I and WG IV	Plen E.1.3 (wrt WG I and WG IV)	A42.07	Following the revised scope of WG I and WG IV, the WGs to update the “Terms of Reference” of both WGs for endorsement by CGMS	CGMS-43	OPEN	-

The plenary noted the activities undertaken by WG I and endorsed the proposed new actions and recommendations. They concluded by thanking the Chair, Marlin O Perkins, NOAA, as well as the rapporteur, Joaquin Gonzalez Picazo, EUMETSAT, for their support.

E.2 Global data dissemination (WG IV)

E.2.1 Status of Himawari-8 and -9 data distribution and dissemination

CGMS-42-JMA-WP-09 described how all imagery derived from Himawari-8 and -9 will be distributed to NMHSs via an Internet cloud service. JMA also plans to start the HimawariCast service, through which primary sets of imagery will be disseminated to NMHSs via a communication satellite using DVB-S2 technology. The Internet cloud service will mainly provide Himawari standard data which will

be used to create all products related to Himawari-8/-9 as master data from all 16 bands with the finest spatial resolution. JMA plans to start test operations of the service in Q1 2015 with distribution of Himawari-8 in-orbit-test imagery. The core data of the HimawariCast service will be HRIT files which are compatible with the current MTSAT series HRIT service. These will feature five bands near the current MTSAT observation bands. Dissemination will further include meteorological data other than Himawari imagery in SATAID format. JMA plans to start the service early in 2015 while MTSAT-2 is still in operation. MTSAT-2 imagery will be disseminated through this service in parallel with direct dissemination via MTSAT-1R until Himawari-8 becomes operational in mid-2015. Himawari-8 data imagery will thereafter be disseminated via the service.

JMA also invited users (NMSs) to make delivery tests from the cloud. Interested users are invited to contact Mr. Yasushi Izumikawa, JMA Satellite Programme Division (metsat@met.kishou.go.jp).

E.2.2 Report by Working Group IV

CGMS-42-CGMS-WP-03-PPT provided the outcome of the discussions of Working Group IV, a forum for the discussion and distribution of information on satellite data dissemination, including data exchange and retransmission, and the tools to facilitate data exchange.

Further progress has been made on the deployment of DVB-based dissemination services:

- Through various projects, NOAA is planning enhancements of the GEONETCast Americas System by providing more services, in order to better support the user community's requirements; and
- JMA is implementing HimawariCast, a DVB-S2 based data dissemination system using a commercial telecommunication satellite to support the transition between the current and the next generation Himawari-8 and -9 satellites in 2015, and to serve user communities in regions with poor Internet access like the Pacific. In addition to images, products will also be disseminated on this system.

EUMETSAT regularly assesses dissemination of R&D and pre-operational mission data, and NOAA is providing global data and imagery through its LANCE facility for download in near real-time. Regarding coordinated dissemination services: NOAA is working on continued and increased participation in the [International Charter Space and Major Disasters](#) with GEONETCast Americas as an alternative dissemination method; CNSA is working on remote sensing processing technology to provide environment and disaster information quickly and accurately; and EUMETSAT was involved in the International Ocean Colour Science Meeting 2013, whose recommendations are being followed up in an action to CGMS members (CGMS-42 WG III/3 A42.10 and CGMS-42 WG IV/4.2 A42.01).

As for global data exchange from the next generation GEO satellites, ROSHYDROMET and EUMETSAT are exchanging data in the context of EARS and Electro-L №1. It is also planned to continue this activity also for Electro-L №2. JMA will provide Himawari-8 and -9 data via the Internet and HimawariCast, IMD already provides access to INSAT-3D via internet (access for users worldwide is possible after registration), and KMA is planning satellite data dissemination for GeoKOMPSAT-2A in Ultra (enhanced) HRIT and HRIT/LRIT format.

WMO presented its new Integrated Global Data Dissemination Strategy (IGDDS) with a reformulation of the vision and the strategic targets. As a result, an action was raised for CGMS members to provide comments to WMO (CGMS-42 WG IV/7 A42.03).

Data access portals and their harmonisation were also discussed as well as other user interface matters.

A clearer split of responsibilities has been achieved between WG I and WG IV and the HLPP has been updated accordingly. (See also chapter E.1.3).

Two inter-sessional meetings will be held to focus on the analysis of the LRIT/HRIT Global Specification by CGMS members' focal points and to review CGMS-42 actions and recommendations in preparation of CGMS-42.

The plenary noted the activities undertaken by WG IV, endorsed the new actions and recommendations proposed, and concluded by thanking the co-Chairs, Vasily Asmus, ROSHDYROMET, and Jae-Dong Jang, KMA, as well as Klaus-Peter Renner, EUMETSAT, for their support.

E.3 Satellite data and products (WG IWG II)

E.3.1 Scientific presentations

E.3.1.1 Summary of highlights and request for guidance from IROWG

Tony Mannucci, rapporteur for the International Radio Occultation Working Group, provided a report from the 3rd International Radio Occultation Workshop (IROWG-3), which took place on 5-11 September 2013 at Leibnitz, Austria (**CGMS-42-IROWG-WP-01-PPT**). The plenary noted that radio occultation (RO) data had a positive impact on Numerical Weather Prediction (NWP), climate monitoring, space weather, and temperature- and humidity-related atmospheric research and the need to ensure continuity of measurements. The presentation summarised the outcome of the workshop attended by more than 70 scientists. The plenary noted the desire to move towards a fully operational Global Navigation Satellite System (GNSS) RO constellation providing at least 10,000 observations per day and preferably 16,000 per day regularly distributed in time and space. The current observing systems provide approximately 3,000 soundings daily, half of which comes from research missions. The magnitude of the impact from additional RO observations appears to be nearly linear in the number of soundings up to at least 18,000 per day, making it difficult to identify an optimum number of observations needed for NWP.

The ensuing discussion centred on whether non-operational missions should be included in quantifying the number of daily observations going forward, the conclusion being that lack of continuity from research missions, and the time required to properly assimilate observations in NWP may misrepresent the robustness of the RO capability if research missions are included. The plenary noted the importance of observations not only from low- to mid-latitude observations but high-latitude observations as well. In this regard, NOAA provided an update on its efforts to extend RO coverage to high latitudes. The WMO reported on its plans to host the Sixth Impact Workshop in 2016, and reminded the plenary that this event provides an important opportunity to review and consolidate the assessment of the impact of RO observations.

The discussions led to the following action within the scope of WG II:

CGMS-42 actions – PLENARY (for WG IWG II)						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CMA	WG II/7 (from Plen E.3.1.1)	A42.10	CMA is invited to present a paper to WG II at CGMS-43 on prospects of RO measurements with future FY-3 satellites.	CGMS-43	OPEN	HLPP# 1.1.4

E.3.1.2 Status of volcanic ash test bed activities

CGMS-42-JMA-WP-07 reported on the status of JMA's activities in SCOPE-Nowcasting. The paper referred to the successfully introduced RGB composite images in this session. It was pointed out that a web site and a users' guide will be available (https://mscweb.kishou.go.jp/sat_dat/). Applications to data from MTSAT-2 were presented with examples dedicated to users from regions RA II and RA V as a part of SWFDP and SWFDDP activities. In the discussion it was clarified that the RGB products are created according to recommendations made by WMO. It was also mentioned that more channels on future satellites will open the possibilities for more products, thus indicating an important perspective for Himawari-8 and -9.

CGMS-41 invited JMA to establish an environment to be used as a test bed for inter-comparison of retrievals and Toshiyuki Kurino, JMA, provided an update on the status of volcanic ash activities. The plenary noted the impact of volcanic ash, especially on aviation, and the work of Volcanic Ash Advisory Centers (VAACs) in issuing advisories to civil aviation authorities and other decision makers. The need for advanced algorithms to advance volcanic ash retrieval was identified, particularly the development of multiple algorithms to be tested in JMA's test bed. A core organising committee has been established to plan for a future workshop related to the selection of volcanic ash cases, validation methods and their inter-comparison.

The plenary encouraged CGMS members to identify new participants for the test bed activities, especially from organisations developing volcanic ash retrieval algorithms, for the upcoming workshop in Madison, Wisconsin in October 2014.

E.3.1.3 Summary of highlights and request for guidance from ITSC-19

Niels Bormann, an International TOVS Working Group (ITWG) co-Chair, provided a report from the International TOVS Study Group-19 held on Jeju Island, South Korea, on 26 March - 1 April 2014 (**CGMS-42-ITWG-WP-01**). The conference, hosted by KMA, was attended by 196 participants from 35 organisations, which provided a wide range of scientific contributions on observing systems, data assimilation, climate application, processing systems and retrieval science topics. This was the first time that the ITWG met as a formally recognised CGMS International Science Working Group, a sub-group of CGMS, and the recognition was appreciated by the group. The plenary acknowledged China's approach to FY-3 data provision and noted the first results of the commissioning of FY-3C. Advanced hyperspectral IR instruments (e.g. AIRS, IASI and CrIS) continue to provide unprecedented scope for inter-comparisons and further advances. Further investigation is required into the efficient use of radiances, use of reconstructed radiances for level-2 retrievals and NWP and strategies for

data dissemination. The plenary noted the emerging potential use of new hyperspectral sounders such as IASI and CrIS for climate studies, due to their long-term calibration characteristics being far better than expected. Highlights of the key ITSC-19 recommendations to the CGMS plenary were:

- the requirement for at least three roughly equally spaced orbital planes (early morning, morning and afternoon) providing both IR and microwave sounding capabilities;
- studies to analyse the trade-off benefits between spectral, radiometric and spatial resolutions of IR sounders;
- low-cost, timely delivery of data to NWP centres;
- support for line-by-line reference model development;
- broader access to satellite data during the calibration/validation phase to help NWP centres; and
- inter-comparison of AIRS, IASI and CrIS level-2 products.

ITSC-20 is planned to be held on 28 October to 3 November 2015 at Lake Geneva, Wisconsin, USA, and will be hosted by the Space Science and Engineering Center.

The plenary noted the contributions of Prof. H.J. Bolle, a co-founder of the ITWG, who passed away last year.

E.3.1.4 SCOPE-Nowcasting status report

Jérôme Lafeuille, WMO, provided a status report on SCOPE-Nowcasting activities in **CGMS-42-WMO-WP-11**. The objectives of SCOPE-Nowcasting include the provision of continuous and sustained products for nowcasting in the zero to six hour range where NWP capability is limited. The goal is to allow access to satellite data by metrological/hydrological services in developing nations where facilities for processing and utilising satellite data may be limited. Four pilot projects have been identified: Harmonised product suite for Asia-Oceania; quantitative volcanic ash products, quantitative precipitation estimates, and sand dust events in Asia. The first meeting of the SCOPE-Nowcasting team was held in Geneva in November 2013 and included participation from CMA, JMA, EUMETSAT, NOAA, ESA and the Australian Bureau of Meteorology. All four pilot projects have developed 2014-2015 work plans and the formulation of an ad-hoc SCOPE-Nowcasting Steering Group is underway. The plenary noted that the continuing commitment of CGMS operators is critical.

More on SCOPE-Nowcasting is available here:

http://www.wmo.int/pages/prog/sat/scopenowcasting_en.php

E.3.2 Working Group II report

The WG II co-Chair, Lars Peter Riishojgaard, presented the outcome of WG II discussions on 19-20 May 2014 (**CGMS-42-CGMS-WP-11**). WG II considered more than 50 working papers from member organisations, including reports from all four CGMS International Science Working Groups. WG II recommended the formation of a fifth CGMS International Science Working Group - the International Clouds Working Group (ICWG) - which was endorsed by the plenary. The plenary noted the actions associated with NOAA's use of a day-night band on its Suomi NPP mission, expressed its appreciation for the work in the area of calibration and validation of the outgoing Chair of the GSICS

Executive Panel, Mitch Goldberg, and welcomed the new Chair, Peng Zhang of CMA. The plenary took note of the demonstrated qualitative benefits of an early morning orbit in the area of regional precipitation forecasts from NOAA and the ongoing work of KMA on the impact of soil moisture observations on NWP. An action inviting JAXA to explore possibilities to adjust the GCOM-C1 orbit in order to optimise the mission with Sentinel-3 was also noted. The plenary noted that the current Sentinel-3 schedule precluded consideration of changes to its orbit.

The co-Chair reported on discussions to provide sustained financial support to the conduct of the International Science Working Groups under CGMS and the conclusion of WG II was that while there were benefits to establishing a recurrent trust fund, the current approach that relies on voluntary contributions (financial or in-kind) has worked quite well and should be continued in light of the challenges of establishing a trust fund. In view of the fact that the work of the ISWGs will continue to take place based on voluntary contributions, CGMS member organisations were kindly reminded that contributions on a voluntary basis were necessary and the plenary encouraged all CGMS members to contribute resources to this work when they see opportunities to do so.

The plenary noted the progress that WG II had made on its actions and endorsed the new actions and recommendations proposed, and they concluded by thanking the two co-Chairs, Lars Peter Riishojgaard, WMO, and Toshiyuki Kurino, JMA, as well as the two rapporteurs, Ajay Mehta, NOAA, and Johannes Schmetz, EUMETSAT, for their support.

E.4 Operational continuity and contingency planning

E.4.1 Key notes

E.4.1.1 Risk assessment of operational programmes

There were no presentations or discussions under this agenda item.

E.4.1.2 Report from Socioeconomic Tiger Team (SETT) and proposed way forward

Mr. Charles Wooldridge, SETT lead, provided a status report on the activities of the CGMS Socioeconomic Benefits Tiger Team (SETT) in **CGMS-42-NOAA-WP-19-PPT**. The accomplishments of the first year of the Tiger Team include: Establishment of Membership, compilation of relevant studies and activities for review, identification of socio-economic expertise by members, and a first workshop held to identify and discuss key applications and case studies (April 2014). The CGMS Plenary was briefed on the major themes and results of the workshop and the future work plan of activities. According to the work plan, SETT will finalise the workshop report and develop a two-three page information paper to provide to CGMS members. SETT will also work to develop an example of the macro approach on weather satellites and drill down to the micro case study to demonstrate a focused concrete example of the value of information. For the longer term SETT will identify opportunities to incorporate best practices and integrate these into additional or subsequent member studies. Prior to CGMS-43, SETT will prepare a recommendation for future activities and plan a keynote on socio-economic benefits at CGMS-43. A SETT report will also be provided to the WMO Consultative Meeting on 20 June 2014. SETT plans to hold its next workshop in autumn 2014 in the Washington DC area and new members are invited to participate in SETT. Mr. Wooldridge noted the complementarities of many of the studies undertaken by CGMS members explaining that operational and research agencies can leverage each others' expertise and

experiences. In the discussion following the report, CGMS members encouraged SETT to reach outside of the normal CGMS community to ensure the necessary expertise is at the table and to capture user input. WMO noted the complementarity of this activity with what is being undertaken by the Commission on Basic Systems and expected visibility on this topic at the upcoming Executive Council and Congress meetings. Members also asked that SETT focus on users in developing countries.

E.4.2 Report by Working Group III

Suzanne Hilding, co-Chair of WG III, presented the outcome of the discussions in Working Group III on operational contingency and continuity planning in **CGMS-42-CGMS-WP-05-PPT**.

The main topics discussed were related to continuity issues and risk analysis of geostationary and polar-orbiting missions (GEO: Indian Ocean coverage, GOES-R user transition in South America; and LEO: early morning orbit, SNPP-JPSS transition, radio-occultation, ocean surface topography, scatterometry, Earth Radiation Budget); the CGMS baseline and climate architecture; the progress report by the Tiger Team on socio-economic benefits of space missions; the transition of R&D missions into operational status; the proposed update of the HLPP; and the identification of issues to be monitored at inter-sessional meetings.

Continuity issues related to the CEOS Virtual Constellations (Sea Surface Temperature, Sea Vector Winds and Ocean Colour Monitoring missions) were also presented and discussed.

The main outcomes of WG III deliberations were:

- An agreed roadmap for Indian Ocean coverage: IMD/ISRO to share data from INSAT-3D and follow-on, EUMETSAT to assist in data dissemination, CMA will consider moving FY-2F (on the understanding that FY-2G and 2H are fully functional), ROSHYDROMET will assist with Data Collection System services);
- LEO early morning orbit gap: WG III remains hopeful that CMA can confirm FY-3E on the 6:00 ECT to ensure full sounding capability in the early morning;
- On altimetry and scatterometry: Encourage SOA-EUMETSAT high-level dialogue towards agreement on an HY-2 near real-time data dissemination;
- On radio-occultation: ISRO-EUMETSAT efforts on Oceansat-3/ROSA and ScatSat, NOAA efforts towards full implementation of COSMIC-2 and optimised operation of COSMIC-1, CMA will continue RO measurements with GNOS on FY-3C and beyond.

The plenary noted the progress that WG III had made on its actions and endorsed the new actions and recommendations proposed. It concluded by thanking the two co-Chairs, Suzanne Hilding, NOAA, and Peng Zhang, CMA, as well as the rapporteur, Jérôme Lafeuille, EUMETSAT, for their support.

F EDUCATION AND TRAINING (F)

F.1 Education and training

CGMS-42-EUMETSAT-WP-10 described the current status and future plans for training in satellite meteorology provided by EUMETSAT in partnership with the Centres of Excellence (CoE) in Africa, the Middle East and Europe (in the WMO RA I, RA II and RA VI regions) and CGMS was invited to take note.

A joint JMA-KMA presentation was made outlining the background and mission of the WIGOS Project to Develop Support for RA II NMHSs in Satellite Data, Products and Training, and also detailed recent related accomplishments (**CGMS-42-JMA-WP-03** and **CGMS-42-KMA-02**).

F.1.1 Status report on CMA VLab activities (incl. FY-3 product suite)

Mr Bangzhong Wang from the China Meteorological Administration Training Centre (CMATC), a recognised WMO Centre of Excellence, presented the current state of affairs and future plans in **CGMS-42-CMA-WP-04-PPT**. This covered:

Current state of affairs:

- Eight international training classes and many domestic training classes of meteorological satellite have been held in recent years. The training sessions have covered the application of satellite imagery in weather forecasting, in environmental monitoring, and in the use of software for FY meteorological satellite data.
- On 12 March 2014, online discussions were held between CMATC and BOMTC at which cooperation on education and training was discussed and confirmed. The first educational online classes took place on 1 April and 6 May 2014 in which CMATC teachers participated.
- The teaching materials used include books, DVD, viewgraph presentations and case studies. The materials are used both in class room and distance learning training sessions.

Future prospective:

- Faculty building (training platform, teaching teams and curriculum construction);
- International training (carrying out training courses on the application of FY data and developing international distance learning);
- Information sharing (translating teaching material); and
- Holding online discussions with other WMO Centres of Excellence.

F.1.2 Status report on VLab activities

CGMS-42-WMO-WP-16 reported on activities within the WMO-CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab), along with future plans and directions. Since CGMS-41, VLab members have offered a variety of training opportunities, attracting significant interest with up to 600 online participants in a single event. The paper highlights the Virtual Round Table on Competence Requirements for Aeronautical Meteorological Personnel, Science Week 2013, Aviation Week, and the two GEONETCast Event Weeks which were presented in English and Spanish.

Furthermore, the project on “Conceptual Models for the Southern Hemisphere” was completed, involving trainers and experts from VLab Centres of Excellence.

Future plans include a series of satellite direct readout training events, including on NPP and Metop, lectures on the product suites from FY-3 and Meteor-M, and continuing collaboration with COSPAR on satellite capacity building events.

An update on the WMO VLab Trust Fund shows that although contributions to the WMO VLab Trust Fund match expenses through mid-2014, no progress has been made in the level and spread of funding by CGMS members following the call for contributions sent by CGMS and WMO Secretariats in August 2013 (plenary Action 41.10).

The following recommendation was therefore made:

CGMS-42 recommendation – PLENARY						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	Plen F.1.2	R42.04	CGMS members that are sponsors of VLab Centres of Excellence to review and where possible augment their support to these Centres, as per the “Procedure for establishing Virtual Laboratory Centres of Excellence for Training in Satellite Meteorology” (section 2.2, http://www.wmo-sat.info/vlab/wp-content/uploads/2012/02/Procedures-for-New-CoEs_LV2012.pdf)	CGMS-43	OPEN	HLPP # 4.2.3

Furthermore, in a letter to WMO, the Russian Federation has proposed as new VLab co-Chair Prof. Grigory Chichasov, Director of the WMO Regional Training Centre in the Russian Federation, assisted by Mr Eduard Podgaitskiy from the Russian State Hydrometeorological University. The proposal was endorsed by the CGMS plenary which thanked Dr. Volker Gaertner, previous VLab co-Chair, for his contributions to the VLab.

On this occasion, contributions for supporting the VLab Trust Fund (funding of the Technical Support Officer) were recalled and the following action was raised:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMSSEC/CGMS members	Plen F.1.2	A42.08	CGMS Secretariat to send a reminder to CGMS members to respond to the CGMS/WMO letter sent in August 2013 regarding call for contributions for supporting the VLab Trust Fund (funding of the Technical Support Officer)	10 Jun, 30 Sep 2014	OPEN	HLPP# 4.2.3

G OUTREACH (G)

CGMS-42-NOAA-WP-03-PPT: NOAA and EUMETSAT/CGMS Secretariat provided an update on CGMS outreach activities completed to date and those planned for the next year. The completion of the new CGMS website represents the largest accomplishment, and plans for the near future include the publication of an inreach newsletter and the development of a new CGMS brochure.

CGMS Members were asked to provide feedback on the new [CGMS website](#) and the following action was raised:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS Members	Plen G	A42.09	CGMS members to provide feedback on the CGMS web-site (http://www.cgms-info.org) to cgmssec@eumetsat.int (including any news, text, reports other content for publication, improvements, etc.)	15 Oct 2014	OPEN	HLPP# 4

H CROSS CUTTING ISSUES (H)

H.1 Space Weather

A report from the Ad-hoc meeting on Space Weather was provided in **CGMS-42-NOAA-WP-30** by Suzanne Hilding, Chair of the Ad-hoc meeting. The meeting had focussed on actions resulting from CGMS-41 which had all been completed. The following Terms of Reference of CGMS space weather activities were proposed and endorsed by the 42nd plenary session:

The overarching goal of CGMS Space Weather activities is to support the continuity and integration of space-based observing capabilities for operational Space Weather products and services. This includes:

1. Keeping abreast of major user interests for operational Space Weather products and services (e.g. for spacecraft operations, aviation, energy, disaster management) and the related **requirements for space-based observations** that can be addressed by CGMS members, in particular those space weather requirements expressed by WMO[1];
2. Evaluating existing operational space weather **products and services in support of spacecraft operations**, and recommending additional services as appropriate;
3. Encouraging **Space Weather monitoring missions** either through dedicated satellites or through hosting space weather payloads aboard weather and climate monitoring satellites as technically appropriate;

4. Supporting when relevant the **dual use of sensors** such as GNSS radio-occultation receivers that provide essential information for weather/climate monitoring and ionosphere monitoring;
5. Fostering orbit coordination, on-orbit sensor calibration and harmonisation of operational Space Weather sensors and data formats with a view to ensuring **interoperability** and data consistency;
6. Reporting on **spacecraft anomalies** and sharing the results of anomaly resolution and analyses;
7. Pursuing **global coordination** of the operational Space Weather observing constellation, with a view to helping sustain future observing capabilities, as CGMS has done successfully for terrestrial weather and climate observations, encouraging complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning;
8. Communicating on **socio-economic benefits** of space weather prediction to policy makers, the public, and the non-technical community;
9. In pursuing these objectives, CGMS recognises the complementary roles of the activities of its members and other international organisations or initiatives such as the International Space Environment Service (ISES), the Committee on Space Research (COSPAR) Panel on Space Weather.;
10. CGMS promotes partnership with these initiatives with a view to optimising overall efforts.

In terms of participation, CGMS members can invite other partners to participate in the team (e.g. NICT in the case of JMA). In future, and for the time being, space weather activities will be handled within the scope of WG III.

Following the presentation, CMA informed the plenary that space weather is considered an important topic in China, and invited other CGMS members to join the implementation team.

The following actions were raised by the plenary for WG III as a result of the discussions:

CGMS-42 actions – PLENARY (for WG IWG III)						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG III (from Plen H.1)	A42.14	CGMS Members to establish an implementation team tasked to define detailed objectives for the implementation of CGMS space weather activities as defined in the Terms of Reference	15 Oct 2014, CGMS-43	OPEN	HLPP# 5.2.2
CGMS members	WG III (from Plen H.1)	A42.15	The implementation team to propose next steps until CGMS-43 and objectives to be included in the HLPP.	15 Mar 2015, CGMS-43	OPEN	HLPP# 5.2.2

			This includes space weather observations into the WIS and implementation procedures to report on spacecraft anomalies			
--	--	--	---	--	--	--

H.2 Oceanography

H.2.1 Joint requirements by IOC-UNESCO and WMO

CGMS-42-IOC-UNESCO-WP-01 examined how the penetration of solar radiation to depths within the ocean interacts with biological and chemical constituents to generate subsequent near-surface heating and modify sea surface temperature (SST). The atmosphere and oceans are joined together over 70 % of Earth, with SST an important linkage to climate and weather phenomena. Many processes influence SST, such as wind, ocean current, solar radiation, and ocean biology.

Based on the presentation by IOC-UNESCO, there was a discussion on which aspects CGMS-coordinated observations could support the modelling of biological and chemical processes in the upper ocean, and in this regard it was proposed that IOC-UNESCO provide a presentation to CGMS-43 on sea surface salinity observations and the following action was agreed:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
IOC-UNESCO	Plen H.2.1	A42.10	IOC-UNESCO to provide a Working Paper on guidance to CGMS members on sea surface salinity observations	CGMS-43	OPEN	-

H.2.2 Status of Chinese ocean observing satellite systems

CGMS-42-CNSA-WP-03 provided the status of CFOSAT, a new satellite for ocean remote sensing and Haiyan (HY). It has two payloads, a wave spectrometer (SWIM) and a wind scatterometer (SCAT). It is designed to provide accurate information on sea state, wind and waves, to improve wind and wave forecast for marine meteorology, ocean dynamics modelling and prediction, and also to improve our knowledge of climate variability, fundamental knowledge on surface processes linked to wind and waves. In addition, CFOSAT will provide information to improve the knowledge and modelling of sea-surface processes. In the period September 2010 - September 2013, phase C of the CFOSAT satellite project was completed and phase D has started for some sub-systems. The Chinese ground segment has completed the design proposal, which consists of five sub-systems.

A complementary presentation on CFOSAT was made by Dr. Mingsen Lin, NSOAS, in **CGMS-42-CNSA-WP-03 PPT**, in which the HY-2 programme and future plans were included illustrating China's efforts in ocean observations. The data acquisition and distribution of HY-2 data were described and it was noted that data exchange with EUMETSAT had been established. There was also ongoing cooperation with EUMETSAT to review the feasibility of establishing HY-2 near real-time global data access using the FMI Sodankylä ground station in Finland. HY-2 applications were also presented (ocean disaster surveillance such as tropical cyclones, tropical fisheries, marine environment forecasting, and navigation safeguard).

As for the future, China has formulated and implemented several medium- and long-term national plans for the development of the HY programme. It is intended to establish an operational satellite development plan with CNSA and to advance the satellite application system using an R&D satellite (GF-3 satellite).

EUMETSAT thanked NSOAS for the presentation and, in view of NSOAS highly attractive satellite programmes, invited CGMS to encourage NSOAS to become a CGMS member. NSOAS indicated that this would need to be a decision taken by the China State Oceanic Administration (SOA), to which NSOAS belongs, and NSOAS would therefore continue to contribute to CGMS through CNSA for the time being.

Concluding the discussions, CGMS invited SOA/NSOAS to consider becoming a CGMS member in view of the relevance and contribution of their satellite programme to the WMO Global Observing System.

H.2.3 CGMS coordination in the ocean context

Several coordination areas are well catered for outside CGMS, in particular by the CEOS Virtual Constellations. Mr. Mikael Rattenborg, CGMS Secretariat, presented **CGMS-42-CGMS-WP-06-PPT**, with the aim of identifying a way forward for CGMS to take action, if any, in the context of oceanography which would be complementary to what is already undertaken by CEOS.

The following points were brought to the attention of the plenary for consideration:

- There are gaps in the coordination of global data exchange and NRT dissemination services for ocean, the integration of ocean-related satellite data in the WIS and in the area of contingency planning for baseline GOS missions providing ocean measurements and CGMS should therefore consider action in these areas;
- As a result, it was proposed to consider actions:
 - To encourage the CEOS Virtual Constellations to submit papers to CGMS on relevant operational matters with appropriate recommendations to CGMS;
 - CGMS Secretariat to ensure that Ocean WPs are considered in all appropriate CGMS Working Groups;
 - To strengthen the link to JCOMM, in particular the Cross cutting Task Team on Satellite Data Requirements. A dedicated report to CGMS on the Task Team activities by the IOC member and a dialogue on data dissemination requirements with CGMS WG IV would be useful;
 - To continue the dialogue with GHRST and IOCCG;
 - To explicitly include Ocean-related matters on agendas of WG III and WG IV;
 - In general to encourage members to submit ocean-related working papers for consideration by CGMS.
- Regarding the HLPP and the cross-cutting issues of CGMS, ocean is considered explicitly in climate activities and handled by the JWGClimat, and the increased capabilities of the next generation GEO satellites for ocean applications will also be addressed in this context.

It was also recalled that WG III at CGMS-42 had detailed discussions with the Virtual Constellations for Ocean Colour Radiometry, Ocean Surface Vector Winds and Sea Surface Temperature, and that WG III had proposed several CGMS actions to secure operational continuity of ocean measurements in the light of recent terminations of important ocean missions.

IOC-UNESCO expressed its appreciation to CGMS for its efforts to ensure continuity of all ocean surface vector winds measurements following the Oceansat-2 termination, iterated the need of the international ocean community for NRT OSWV data and urged every space agency flying scatterometers to make OSWV products available in near real-time. IOC-UNESCO also supported the proposal for more detailed interactions with the newly established JCOMM Task Team on Satellite Data.

ESA and other CGMS members noted the severe problems with C-band interference affecting radar ocean measurements, and urged CGMS to take necessary actions to secure the future protection of the C-band sensing frequencies.

CGMS members thanked the CGMS Secretariat for the comprehensive analysis of CGMS coordination in the ocean context and supported the proposed short- and medium-term actions of the CGMS Secretariat to optimise the contributions of CGMS to the ocean community, in particular in the areas of operational continuity, near real-time distribution of data and products and protection of ocean-relevant sensing frequencies.

H.3 Climate

H.3.1 GCOS progress report and new implementation plan

Dr. Stephen Briggs, new Chair of the Global Climate Observing System (GCOS) Steering Committee, presented a progress report and new implementation plan for GCOS (**CGMS-42-WMO-WP-02/PPT**). The GCOS programme has started the next round of its assessment cycle. The next GCOS status report on the global observing systems for climate and the future implementation plan will be highly relevant to space agencies, WMO programmes and related IOC and UNEP programmes and climate science activities, especially in light of the evolving Global Framework for Climate Services (GFCs).

Dr. Briggs noted that the GCOS programme appreciates the contributions of CGMS members to the global observing system for climate, and the specific activities undertaken by CGMS working groups and expert teams. GCOS looks to continued support in future, including by:

- assisting the GCOS programme in its assessment of progress in implementing a global climate observation system, in its assessment of adequacy of the current and foreseen observing system, and in its identification of new implementation actions;
- continuing to generate Fundamental Climate Data Records (FCDR) and ECV products, including from reprocessing past data records where needed;
- continuing its work with CEOS and the WMO Space Programme on the inventory of climate datasets; and
- promoting the intercomparison and assessment of datasets.

The creation of the new CEOS-CGMS Joint Working Group on Climate (JWGClimate) has been strongly supported by GCOS, as it provides a single mechanism through which space agencies can coordinate their response to GCOS requirements. In common with the meeting of the precursor CEOS WGClimat, the strong emphasis placed on the development of the climate monitoring architecture was a very welcome feature.

H.3.2 CEOS-CGMS Joint Working Group on Climate (JWGClimate)

Dr. John Bates, Chair of the CEOS-CGMS Joint Working Group on Climate (JWGClimate) presented the first status report of the new group (**CGMS-42-CEOS-WP-04/PPT**). The major activities covered in his report were:

- approval of revised Terms of Reference at CEOS plenary 2013;
- the first meeting of the JWGClimate;
- review of CEOS Strategy for Carbon Observations from Space; and
- reporting to the UN Framework Convention on Climate Change (UNFCCC) Subsidiary Body on Scientific and Technological Advice (SBSTA).

One area of focus during the CGMS WG III meeting discussions was the pending CGMS-41 actions for the JWGClimate regarding the production of an inventory of Fundamental Climate Data Records (FCDRs). This activity has been promoted by WMO, however, the JWGClimate did not feel that what was initially proposed by CGMS could be considered as part of the initial JWGClimate activities. In WG III discussions, it was however felt important to have some focused FCDR activity, since such a climate action helps CGMS agencies promote and encourage climate activities in their respective agencies, particularly those agencies with emerging climate activities. In particular, China (CMA) and South Korea (KMA) are both planning to join SCOPE-CM activities in re-processing their geostationary data as FCDRs. This is an important development and such activities are encouraged. Based on these developments, the CGMS-41 actions were closed and a revised action on FCDRs was raised to support these agencies promote those efforts:

CGMS-42 actions – PLENARY						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
JWGClimate	H.3.2	A42.11	Regarding the Pilot FCDR Inventory: <ul style="list-style-type: none"> • Conduct an initial analysis of available FCDRs past and current available for or planned for use in the current set of SCOPE-CM projects using CEOS, CGMS, and WMO satellite data bases; • Identify SCOPE-CM ECV projects that are or may be able to use the above FCDRs; • Assess availability of the above FCDRs for the future; 	CGMS-43, CGMS-44	OPEN	HLPP# 5

			<ul style="list-style-type: none"> • Following the first ECV gap analysis, consider FCDRs that may be useful in assessing ECV opportunities in the future ECV gap analysis. 			
--	--	--	--	--	--	--

GCOS, IOC, and other CGMS members expressed satisfaction with the progress and maturation of the JWGClimate in its first year. GCOS noted its appreciation of the coherent way forward and how GSICS, SCOPE-CM and the CGMS International Science Working Groups are integrated jointly with CGMS/CEOS. Members encouraged effective links to climatology and climate modelling work and the needs of the Global Framework for Climate Services.

Announcement: Symposium on Climate Research and Earth Observation from Space

EUMETSAT Director General Alain Ratier announced the [Symposium on Climate Research and Earth Observations from Space: Climate Information for Decision Making](#), to be held in Darmstadt, Germany, on 13-17 October 2014. The main goal of the symposium is to provide a forum for discussing the current state of climate science and climate observations in order to evaluate recent achievements, ascertain critical objectives to be achieved with satellite-based climate information, and identify gaps in the current space-based climate observing system. A major topic that will be discussed is the proposed Architecture for sustained Climate Monitoring from Space. Beyond the monitoring of the current state of the climate system, the conference will also consider how Earth observation contributes to future developments in climate prediction and climate change projection. The Symposium is being organised jointly by the World Climate Research Programme and EUMETSAT, along with several cooperating agencies and sponsors.

I GEO

In **CGMS-42-GEO-WP-01-PPT**, Mr. Osamu Ochiai, GEO Secretariat, presented GEO/GEOSS progress and post-2015 plans focusing on the following issues:

The need for:

- continued improvement of Earth observations worldwide;
- broad and open data policies and practices, essential for publically funded collections and strengthening them;
- economic value of downstream elements (value-added products and services);
- broadened stakeholder engagement, including by the private sector;
- strengthened policy linkages/mandates; and
- national, regional and international collaboration.

The presentation reconfirmed the link between CGMS and GEO in view of GEONETCast, the aim to harmonise data accessibility, radio frequency protection, climate activities and closer cooperation with WMO towards post-2015.

J HLPP (I)

As part of the agreed revision cycle for the CGMS High Level Priority Plan (HLPP), the CGMS Secretariat presented a proposed update in **CGMS-42-CGMS-WP-07**. 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 CGMS WG IWG II;
- Recommendations from ITWG - Refinement of split of responsibilities between CGMS WG I and WG IV;
- Establishment of a four-year work plan for climate by the JWGClimate; and
- Other revisions identified by CGMS WG Chairs and co-Chairs, Annex 1 – Status of implementation of HLPP 2014-2018 (Version 2), Annex 2 – Proposed updated High-Level Priority Plan 2014-2018 (Version 3, incl. track changes).

Following the discussions, a further few updates were proposed and made, and the HLPP was endorsed by the plenary. The final version will be concluded and published by the CGMS Secretariat following CGMS-42.

K REVIEW OF CGMS-42 ACTIONS AND RECOMMENDATIONS (J)

CGMS Secretariat reviewed the list of actions and recommendations in the plenary which was endorsed by the plenary. The final list of CGMS plenary actions and recommendations resulting from CGMS-42 deliberations is available [here](#).

L AOB AND CLOSING SESSION (K)

K.1 Nominations

It was agreed that the CGMS Secretariat will represent CGMS at the WMO EC-66 in Geneva, Switzerland, in June 2014 and at the GEO-XI plenary in Libreville, Gabon, in November 2014.

The plenary also endorsed the following CGMS Working Group Chairs and rapporteurs as follows:

- WG I: Marlin Perkins, NOAA, Lars-Peter Riishojgaard, WMO (co-Chairs)
Joaquin Gonzalez, EUMETSAT (rapporteur)
- WG II: Toshiyuki Kurino, JMA, and Stephan Bojinski, WMO (co-Chairs)
Johannes Schmetz, EUMETSAT, and Mitch Goldberg, NOAA (rapporteurs)
- WG III: Suzanne Hilding, NOAA, Peng Zhang, CMA (co-Chairs)
Jérôme Lafeuille, WMO (rapporteur)
- WG IV: Vasily Asmus, ROSHYDROMET, and Jae-Dong Jang, KMA (co-Chairs)
Klaus-Peter Renner, EUMETSAT (rapporteur)

K.2 Any other business

ISRO announced its intention to become a CGMS member. In view of ISRO's contribution of its Earth observation missions to the WMO Global Observing System and its fulfilment of the requirements of the CGMS Charter, the plenary very much welcomed this.

It was agreed that the CGMS Secretariat and ISRO interact on the next steps with the objective of ISRO becoming a full CGMS member by CGMS-43.

K.3 Closing

K3.1 Date and Place of next meeting

NOAA confirmed that it will host the 43rd plenary session of CGMS on 18-22 May 2015, in Boulder, Colorado, USA.

In view of CGMS-42 being the last CGMS plenary session attended by Ms. Mary Kicza's of NOAA, WMO, CMA, EUMETSAT and the CGMS plenary thanked her for her contributions over the years, on both a multi-lateral and bilateral partner level, as well as for the contributions to the WMO user community through NOAA's environmental polar satellite programme during a difficult period coloured by the hardship of the global financial crisis.

Mary Kicza thanked all CGMS colleagues for the kind words. She said that it had been a privilege to work and serve in the CGMS arena. Recalling that it had not been just her achievement, but the result of team work, she also expressed her thanks for the support of her close colleagues and team over the years.

Afterwards, CMA handed the CGMS flag over to NOAA.

K3.2 Closing remarks

Concluding the meeting, Dr Jun Yang, CMA, firstly declared that CGMS-42 had been a successful and fruitful meeting.

He thanked the representatives of all members and observers for their dedication, which ensured that the meeting had been a success. Dr. Yang also thanked the co-Chairs for supporting him during the meeting.

Secondly, over the two days of the plenary, all agenda items had been handled with encouraging results. He said the discussions on the proposal and updates of the High Level Priority Plan (HLPP) will guide CGMS on the way forward over the next five years. He added that the outcomes in terms of actions and recommendations will be collated by the CGMS Secretariat and circulated to all participants after the meeting.

Thirdly, he thanked all those who contributed to organising the meeting so successfully, namely the outstanding work by the Working Group Chairs and rapporteurs, the support provided by the CGMS Secretariat before and during the meeting, and the support of the local organising committee.

Finally, he hoped to see everyone at the 43rd CGMS plenary session in Colorado in 2015.

The 42nd plenary session of CGMS was closed at 16:45 on Friday 23 May 2014.

PARALLEL WORKING GROUP SESSIONS

WG I REPORT

WG I/0 Objectives

As agreed during the plenary session of CGMS-41, Mr. Marlin O. Perkins (NOAA) and Mr. Joaquin Gonzalez (EUMETSAT) acted as Chair and Rapporteur respectively, of Working Group I (WG I) on Global Issues on Satellite Systems and Telecommunication Coordination.

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

The Agenda proposed by the CGMS Secretariat prior to the meeting, was discussed and adopted and the Working Group agreed that a number of WebEx-based presentations would be given during predefined time-slots during the meeting and, when necessary, the sequencing of the presentations would need to be adapted to these slots. However, during the WG I meeting, a modification was included in agenda item WG I/4 (Data Collection System) as EUM-WP-20 (PPT) regarding a proposal from EUMETSAT for the harmonisation of global Data Collection Systems which was considered to be more focused after all agencies have provided their dedicated report on the status of their regional Data Collection Systems (including EUMETSAT in CGMS-42-EUM-WP-19) with the following modifications:

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

CGMS-41-NOAA-WP-13 Fast delivery initiatives using direct broadcast with extensions wherever possible

CGMS-41-NOAA-WP-09 Recommendations seeking affordable receiving stations

CGMS-41-EUMETSAT-WP-17 (Presentation) EARS Roadmap (EUMETSAT Advanced Retransmission Service)

Added to agenda item I/4: International **CGMS-41 NOAA-WP-08**: Status of the International Data Collection System (IDCS)

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

The final status of the list of WG I actions and recommendations resulting from CGMS-41, following CGMS-42 deliberations is available [here](#).

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

EUMETSAT-WP-16 on frequency management topics provides an overview on World Radiocommunication Conference 2015 (WRC-15) related issues of relevance to EUMETSAT and

MetSat systems/operators in general. WRC-15 agenda items of most relevance to MetSat include agenda items 1.1, 1.6, 1.9.2, 1.10, 1.11, 9.1.1 and 10.

Furthermore, MetSat issues not directly related to WRC-15 considered within ITU-R Working Party 7B of ITU-R Study Group 7 as well as within the framework of the SFCG are summarized in this document.

WRC-15 Agenda Item 1.1

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

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

- the 1695 – 1710 MHz bands used for meteorological satellite applications;
- the 2025 – 2110 MHz and 2200 – 2290 MHz bands used for earth exploration satellite and space operation (TM/TC and ranging) services;
- the 3400 - 4200 MHz band used for dissemination of meteorological data in the framework of GEONETCast;
- the 5350-5470 MHz active remote sensing band used for SARs,
- scatterometers and altimeters.

Agenda Item 1.1: 1695 – 1710 MHz

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

This triggered consideration of the suitability of this band for broadband mobile implementation in the relevant ITU preparatory group for this Agenda Item, namely the ITU-R Joint Task Group 4-5-6-7.

Meanwhile the sharing studies in the framework of JTG 4-5-6-7 are completed for this band. The results are summarized in Draft New Report ITU-R SA.[METSAT 1.7 GHz] (Sharing assessment between meteorological satellite systems and IMT stations in the 1 695-1 710 MHz frequency band) which is based on three sets of studies from China, the USA and EUMETSAT.

The report shows that the required protection area around MetSat stations from which potential IMT base stations in the 1 695-1 710 MHz frequency band would be up to several hundred kilometres. Therefore, sharing between IMT base stations and MetSat stations in the 1 695-1 710 MHz frequency band is not feasible.

Regarding the assessments of protection areas around MetSat stations from which IMT mobile terminals in the 1 695-1 710 MHz frequency band would have to be excluded, this report provides diverging results depending on the assumptions, parameters, and methodologies used.

Two of the three studies (Annexes A and B) depict required separation distances from 46 kilometres (GSO case) and 60 kilometres (NGSO case) up to more than 120 kilometres (NGSO case), even considering low rural deployment and conclude that sharing is not feasible between IMT mobile terminals and MetSat stations in the 1 695-1 710 MHz band. The study in Annex C provides an example calculation resulting in separation distances ranging from 32 to 46 kilometres (NGSO case) and concludes that sharing between IMT mobile terminals and MetSat stations is feasible.

In the discussions in JTG 4-5-6-7 on this issue there were only a very limited number of administrations present in the consideration of this band with no representatives from mobile operators or mobile equipment manufacturers. Currently there is only one country actively supporting this band, drawing a positive conclusion on the sharing between IMT mobile terminals and MetSat stations. It can be expected that this situation will not change significantly towards WRC-15.

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

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

Although these bands do not seem to play a major role in the global identification of additional spectrum for broadband mobile systems, there are still some proponents for these bands (or parts of) in the mobile industry and by some individual countries. Thanks to NASA, which provided sharing studies between IMT systems and data relay satellite (DRS) forward and return links operating in the 2 025-2 110 MHz and 2 200-2 290 MHz frequency bands, a negative conclusion on the sharing capabilities was drawn within ITU-R JTG 4-5-6-7, resulting in Draft New REPORT ITU-R SA.[2 025 - 2290 MHz] (Feasibility assessment for accommodation of mobile broadband IMT systems in the 2 025-2 110 MHz and 2 200-2 290 MHz frequency bands). With this new study earlier ITU-R studies as summarized in Recommendation ITU-R SA.1154 are reaffirmed that resulted in the adoption of RR No. 5.391 at WRC-97, which prohibits high-density mobile systems from operation within these frequency bands.

Although, all attempts to identify these bands for broadband mobile have been successfully countered so far, there is still the probability that individual countries will propose parts of these bands for broadband mobile systems on the basis of band segmentation in preparation for or as input to WRC-15. Thus, it is necessary to continue to closely monitor the developments in the

discussion on these bands at ITU-R and regional level, in order to ensure that these important bands for MetSat systems are secured for long-term availability for the MetSat operators. According to the preliminary CEPT position, these bands are not considered suitable for a broadband mobile identification.

Agenda Item 1.1: 3400 - 4200 MHz

This frequency range is one of the prime targets of the mobile industry to cover their broadband spectrum requirements. Some parties even go as far as to propose the entire C-band (3400 – 4200 MHz) for a mobile broadband identification. However, there is also very strong opposition by all commercial satellite operators and a number of countries around the world against identifying further spectrum in this frequency range. Note: Already at WRC-12 the 3400-3600 MHz band was allocated to the mobile service and identified for International Mobile Telecommunications (IMT) in a number of countries by footnotes RR No. 5.430A, 5.431A, 5.432A, 5.432B and 5.433A to the Radio Regulations. From the sharing studies performed in ITU-R JTG 4-5-6-7 it is concluded that co-frequency sharing between Fixed-Satellite Service (FSS) earth stations and IMT macro-cell or small-cell outdoor networks would not be feasible in the same geographical area when the FSS earth stations and/or IMT stations are deployed in a ubiquitous manner and/or with no individual licensing of earth stations, since no minimum separation can be guaranteed.

In view of the incompatibility between IMT systems and Earth stations in the FSS a designation of the entire 3400 – 4200 MHz band for mobile broadband would be detrimental for the commercial satellite operators, and thus the service providers supporting the dissemination of meteorological data via GEONETCast in the long term.

However, identification of the entire C-band mobile broadband system is very unlikely, given the strong opposition from various sides. A more probable scenario would be that parts of the 3400 – 4200 MHz band would be globally identified for mobile broadband systems implementation, thus still retaining spectrum available for FSS systems that could continue to be used for the dissemination of meteorological data.

For example the preliminary position of CEPT currently is that the 3400 – 3800 MHz band could be globally designated to broadband mobile at WRC-15 and the 3800 – 4200 MHz band should be kept available for the FSS for the deployment of satellite Earth stations in the long term.

Agenda Item 1.1: 5350 – 5470 MHz

Under this agenda item the extension of the current RLAN (WiFi) spectrum (5150-5350 MHz and 5470-5725 MHz) by also allocating the gap in between (5350-5470 MHz) for RLANs was also under discussion.

The additional allocation of the 5350-5470 MHz band would affect SARs such as CSAR on Sentinel-1 or RadarSat most severely. Less sensitive to RLAN interference but also potentially affected in the

long term by such an RLAN introduction in the 5350 – 5470 MHz band could be scatterometers and altimeters.

All studies performed so far in ITU-R JTG 4-5-6-7 agreed that, with the current RLAN parameters, compatibility cannot be achieved, even if the RLAN systems are limited to indoor use only. Thus, there is a need to see if additional mitigation techniques could give compatibility. One study indicates that an eirp mask imposed on RLAN would do so. Another study proposes using an orbit avoidance concept, based on the knowledge by the RLAN devices of the EESS satellites orbital positions and their channel usage avoidance during the satellites visibility periods. Other studies indicate that none of these two methods (or other methods previously considered) would work for multiple reasons associated with insufficient mitigation, technical problems with the implementation, and the impossibility for administrations to enforce and verify these mitigations on unlicensed mass-market devices, or a combination of the above reasons.

A final conclusion on the compatibility with EESS (active) instruments and the effectiveness of the necessary mitigation measures will need to be drawn at ITU-R level at the last meeting of JTG -4-5-6-7 in July 2014.

It is important to note that the last JTG meeting in February 2014, also received a number of sharing studies which show incompatibility of RLANs with terrestrial and aeronautical radars operating in the 5350 – 5470 MHz band.

With those additional elements, the incompatibility with active sensors is no longer considered to be the only sharing problem. Now the full extent of the sharing problems with the incumbent services is on the table and can be assessed by administrations when they develop their position on whether to support or oppose an introduction of RLANs in the 5350 – 5470 MHz band.

There is still no common view in CEPT on this band.

WRC-15 Agenda Item 1.6

This agenda item, under 1.6.1, dealt with consideration of possible additional primary allocations to the fixed-satellite service (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1.

Agenda item 1.6.2 dealt with consideration of possible additional primary allocations to the fixed-satellite service (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the 13-17 GHz range.

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

Sharing studies between EESS (active) and FSS (space-to-Earth) performed so far show compatibility between both services.

Regarding sharing between EESS (active) and FSS (Earth-to-space) studies performed so far still show diverging results. Studies from the US, ESA, and CNES show limited compatibility between EESS (active) and FSS (Earth-to-space) while studies from Luxembourg indicate large degrees of compatibility. Thus, a negative impact of an allocation to FSS (Earth-to-space) could currently not be excluded and therefore such a new allocation to FSS in the uplink direction should be opposed. In parallel, work is being undertaken in the ITU-R in Study Group 7 to support sharing studies in the affected EESS (active) bands. For this purpose Working Party 7C is working on the Preliminary Draft Revision of Report ITU-R RS.2068: Current and Future Use of the Band 13.25-13.75 GHz by Spaceborne Active Sensors”.

The need for additional primary allocations of 250 MHz (Earth-to-space and space-to-Earth) to the GSO FSS in frequency bands between 10 and 17 GHz in Region 1 is recognized and supported within CEPT. However, an allocation can be made only if studies demonstrate compatibility with the existing services in these frequency bands. At this stage, based on studies provided, CEPT does not support FSS (Earth-to-space) allocation in the 13.25-13.75 GHz band, but identifies the 13.4-13.65 GHz band as a possible frequency band for a new primary allocation of 250 MHz to GSO FSS (space-to-Earth) subject to development of possible mitigation technique if required.

WRC-15 Agenda Item 1.9.2

This Agenda Item dealt with the possibility of allocating the 7375-7750 MHz and 8025-8400 MHz bands to the maritime-mobile satellite service (MMSS) and additional regulatory measures, depending on the results of appropriate studies. The potentially affected space science service bands under this agenda item are 7450 - 7550 MHz MetSat (space-to-Earth, GSO) and 8025 - 8400 MHz EESS (space-to-Earth). Thus, no new allocations to the MMSS should be made in these frequency bands unless acceptable criteria for sharing with the science services are developed.

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

All compatibility analysis on the two different sharing aspects (MMSS vs. EESS and MMSS vs. the space research service (SRS)) came to similar conclusions regarding the sharing difficulties with EESS and the required separation distances to protect the SRS Earth stations. To summarise the results of this compatibility analysis, Preliminary Draft New Report SA.[MMSS 8-GHz] was developed in the framework of ITU-R WP 7B.

Furthermore, the issue of the large number of exclusion zones and the regulatory mechanisms for implementing and keeping up-to-date the necessary exclusions zones makes such an allocation to

the MMSS impracticable. Consequently, CEPT does not support an allocation for MMSS in the 8025-8400 MHz band without acceptable and practicable regulatory methods.

WRC-15 Agenda Item 1.10

This agenda item dealt with the consideration of spectrum requirements and possible additional spectrum allocations for the mobile-satellite service (MSS) in the Earth-to-space and space-to-Earth directions, including the satellite component for broadband applications, within the frequency range from 22 GHz to 26 GHz.

The main frequency bands at risk for CGMS member agencies could be:

- The EESS (passive) band 23.6-24 GHz (purely passive, but to be protected against unwanted emissions taking into account interference apportionment and the levels contained in ITU-R Resolution 750 (rev. WRC-12));
- The first 500 MHz of the EESS/SRS space-to-Earth band 25.5-27.0 GHz.

The frequency band 25.5 – 27 GHz is allocated to the EESS (space-to-Earth) and is used for data links for EESS payloads. Relevant sharing criteria for this service are given in Recommendation ITU-R SA.1027.

Studies have been performed with SRS receiving Earth stations tracking non-GSO SRS satellites. These studies, using protection criteria given in Recommendation ITU-R SA.609, show no compatibility between MSS downlink and SRS. Since the sharing criteria in Recommendation ITU-R SA.1027 are globally more stringent than the protection criteria in Recommendation ITU-R SA.609, it is expected that similar conclusions would apply to the EESS (space to-Earth). With regard to MSS uplinks, it has been shown that separation distances greater than 330 km would be required for SRS. These distances would be even be greater when considering EESS.

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

CEPT does not support any such additional allocations to the MSS under this agenda item.

WRC-15 Agenda Item 1.11

This agenda item dealt with the consideration of a primary allocation for the Earth exploration-satellite service (Earth-to-space) in the 7-8 GHz range. Initially proposed by ESA through CEPT, this agenda item called for the identification of a suitable frequency band for an EESS (Earth-to-space) allocation in the 7-8 GHz range for telecommand operations to complement telemetry operations of EESS (space-to-Earth) in the 8025 - 8400 MHz band.

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

- Compatibility between EESS (Earth-to-space) and the space research service or the space operation service in the 7100- 7235 MHz band (Preliminary Draft New Report ITU-R SA.[EESS 7-8 GHz_SHARING-SPACE]);
- Compatibility between EESS (Earth-to-space) and the potential Fixed Satellite Service (under agenda 1.9.1) in the 7100-7235 MHz band (Preliminary Draft New Report ITU-R SA.[1.9.1VS1.11-7GHz]);
- Sharing between the EESS (Earth-to-space) and the fixed service in the 7-8 GHz range (Draft new Report ITU-R SA.[EESS-FS-7GHz]).

In addition ITU-R WP 7B dealt with the determination of the spectrum requirements for a potential new EESS uplink allocation. A bandwidth of 60 MHz was considered appropriate to cover the spectrum requirements for this new EESS uplink allocation.

CEPT supports such an allocation on a primary basis to the EESS (Earth-to-space) in the 7190-7250 MHz frequency band, recognizing that sharing with SRS (deep space) in the 7145-7190 MHz band is considered not feasible.

WRC-15 Agenda Item 9.1.1

This agenda item dealt with Resolution 205 (REV.WRC 12) - Protection of the systems operating in the mobile-satellite service in the band 406-406.1 MHz.

Cospas-Sarsat space segment providers have developed protection criteria for the Cospas-Sarsat search and rescue instruments and local user terminals in the 406.0-406.1 MHz band in order to protect them against broadband out-of-band emissions and against narrow-band spurious emissions. These protection criteria have been recognized at the ITU-R level through ITU-R M.1478-1. However, they do not provide protection against emissions in adjacent bands which could hinder the Cospas-Sarsat system's ability to detect and/or relay signals from beacons.

Several noise measurements have been conducted using all three space components. The measurements of the 406 - 406.1 MHz band must be carefully examined, as Cospas-Sarsat has a general concern about the reception and processing of weak distress signals, in certain areas, caused by an increase in noise in Europe and Asia.

Current analysis of observations show that over certain years, this noise (measured in the 406 - 406.1 MHz band) has increased by 15 to 20 dB above the interference level in some areas. Measurements performed at 406 MHz have shown that the noise level is especially high over Europe and also confirm concerns about parts of Asia. This noise issue in the UHF band addresses the

possibility that the frequency range between 390 MHz and 420 MHz might be caused by the operation of terrestrial systems deployed in many countries.

Thus, Cospas-Sarsat with the support of its space segment providers will need to develop the relevant protection criteria for submission to the relevant ITU-R groups and translation into an ITU-R recommendation.

In this context, the potential impact from EESS, MetSat and MetAids systems in the 401-406 MHz range also had to be assessed. Preliminary analysis has shown that for data collection platforms in operation within the frequency 401- 403 MHz band, the aggregate transmitter power does not exceed the broadband interference threshold, assuming a maximum load of the Earth exploration-satellite systems. Operation of radiosondes in the meteorological aids service will also not exceed the broadband measured sensitivity levels of the search-and-rescue receivers for LEO, MEO or GEO satellites.

In order to ensure adequate protection of MSS systems in the 406- 406.1 MHz frequency band, the revision of Resolution 205 is required introducing further mitigation measures. These would also include design and implementation of improved filters at the LEOSAR, GEOSAR and MEOSAR systems' space receivers, which are already planned for future generations of satellites.

CEPT supports a revision of Resolution 205 (REV.WRC 12) to contain appropriate mitigation measures, however, without unduly constraining duly authorised existing stations/systems operating in adjacent frequency bands.

2.7 WRC-15 Agenda Item 10

Agenda Item 10 of WRC-15 calls for proposals for possible agenda items for WRC-18. CNES and EUMETSAT, supported by France and Germany, proposed to CEPT an agenda item for WRC-18 to upgrade the secondary allocations to the MetSat (space-to-Earth) and the EESS (space-to-Earth) in the 460- 470 MHz band to primary in order to secure future use of the band for ARGOS-4.

The objective of such an agenda item for WRC-18 is to improve the regulatory status of the MetSat (space-to-Earth) and the EESS (space-to-Earth) services in the 460- 470 MHz frequency band while putting relevant constraints on these services in order to protect the existing primary (mobile, fixed) services. This proposal was added to the CEPT "shopping list" for WRC-18 agenda items for further consideration.

NOAA voiced its support at last year's SFCG-33 meeting for such an agenda item for WRC-18 and announced that a similar proposal would be put into the US preparatory process for WRC-15.

The proposed agenda item was also included in the SFCG WRC-15 objectives as given in Resolution SFCG 32-1R1.

3 WRC-15 unrelated MetSat issues currently under discussion within ITU-R

3.1 Characteristics, sharing and performance criteria of EESS and MetSat

ITU-R WP 7B performed work at its last meetings towards revising and potentially merging existing ITU-R Recommendations dealing with MetSat and EESS systems in terms of characteristics, sharing and performance criteria, leading to the following two new Preliminary Draft New Recommendations:

- ITU-R SA.[EES/MET CHAR]: “Characteristics to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services and for conducting sharing studies”;
- ITU-R SA.[EES/MET METH]: “Protection criteria for MetSat and EESS services”.

At the meeting of WP 7B in September 2013, rather than proceeding with these two new PDNRs, WP 7B agreed to review the existing ITU-R Recommendations providing protection criteria for MetSat and EESS services, here in particular Recommendations ITU-R SA.1026 and SA.1027. It was concluded that the work on the complementary criteria as contained in ITU-R SA.[EES/MET METH] should rather be progressed in the SFCG in the framework of inter-agency coordination.

Regarding the PDNR ITU-R SA.[EES/MET CHAR], as this PDNR is closely related to PDNR ITU-R SA.[EES/MET METH], the work on this PDNR will also be progressed in the framework of the SFCG.

Therefore, work on these PDNRs will not be progressed in the framework of WP 7B for the time being.

3.2 Data collection platforms in the 401 - 403 MHz band

Two new ITU-R Recommendations have been in force since December 2013 for the 401-403 MHz band:

- ITU-R SA.2044 “Protection criteria for non-GSO data collection platforms in the band 401 - 403 MHz”;
- ITU-R SA.2045 “Basic general partitioning and sharing conditions for the 401- 403 MHz band for future long-term coordinated use of data collection systems on geostationary and non-geostationary MetSat and EESS systems”.

This basic general partitioning plan for the 401- 403 MHz band, initially developed by SFCG and endorsed by CGMS, is now also published as an ITU-R Recommendation

4 WRC-15 unrelated MetSat issues currently under discussion within SFCG

4.1 MetSat use in the 1670 – 1710 MHz band

Changes in the use of the 1670 - 1710 band for various MetSat services, such as expanded data dissemination by GOES and the use of emergency weather information distribution systems, showed a need to review Recommendation SFCG 11-1R3 (adopted in 2005) to ensure its accuracy and that it continues to assist in the most optimum use of this meteorological satellite service band 1670 – 1710 MHz.

Therefore, SFCG-33 agreed action item 33/4 which requests SFCG members to review Recommendation SFCG 11-1R3 considering their present and future planned use of the band and propose recommended changes. These proposed changes will be gathered, summarised by a dedicated responsible person (in this case from NOAA) and presented to SFCG-34 (3 – 11 June 2014) with the aim of updating this recommendation dealing with the use of the 1670- 1710 MHz band.

4.2 MetSat use in the 7750 – 7900 MHz band

In order to ensure the continued efficient use of this recently enlarged band from 7750-7850 MHz to 7750-7900 MHz at WRC-12, it was considered necessary to review Resolution SFCG 19-7R3 with a view to assisting in the most optimum use of this MetSat band 7750-7900 MHz, providing a guideline to MetSat operators, which are currently in the phase of planning and developing next generation polar orbiting systems using this band.

For this purpose SFCG action item 33/5 was agreed to review Resolution SFCG 19-7R3 considering their present and future planned use of the band and propose recommended changes. These proposed changes will be gathered, summarised by a dedicated responsible person (in this case from EUMETSAT) and presented to SFCG-34 with the aim of updating this recommendation dealing with the use of the 7750-7900 MHz band.

WG I thanked EUMETSAT for the detailed report provided on the frequency related topics of interest to CGMS (European area).

CGMS WG I also wanted to reiterate to SFCG the appreciation of CGMS for the support provided in protecting and preserving the frequency bands assigned or related to the activities of CGMS.

CGMS-42-WMO-WP-07 reported on the outcome of the WMO Steering Group on Radio-Frequency Coordination (SG-RFC), which had updated, at its last meeting in March 2014, the preliminary WMO position on the agenda items of the 2015 World Radiocommunication Conference related to frequency bands or issues of interest or concern for meteorology and related fields. This document was provided to WG I for consideration and feedback, with a view to building strong support along those lines in forthcoming ITU Study Group discussions and ultimately at WRC 2015.

This document reflects the preliminary position of the World Meteorological Organisation (WMO) on the agenda of World Radiocommunication Conference 2015 (WRC-15). Ten WRC-15 Agenda items are related to frequency bands or issues of prime interest or concern for meteorology and related fields. There are also eight WRC-15 Agenda items that may potentially have an impact on WMO interests, either due to their wide open scope in terms of frequency ranges under study or in relation to a potential general interest.

Agenda item 1.1

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the 1675-1710 MHz, 2 025-2 110 MHz and 2 200-2 290 MHz frequency bands.

WMO is also opposed to any mobile allocation in 2700-2900 MHz which would impose any sort of constraints on meteorological radars operations and design (such as modification of radar equipment).

WMO is also extremely concerned about and opposed to an allocation/identification for RLAN in the 5350-5470 MHz band, since it will in particular endanger the operation of current and planned EESS systems. WMO is of the view that any of the current mitigation techniques proposed so far is impracticable to implement and maintain. In particular, the introduction of a data base/orbit avoidance of EESS (active) systems cannot be seen as a potential solution to enable compatibility. Furthermore, the protection of all meteorological radar use of the band must be ensured.

WMO opposes any allocation in the 1 400-1 427 MHz frequency band, covered by RR No. 5.340, and also requires that protection of sensors in this band be ensured against unwanted emissions of terrestrial mobile broadband applications including IMT if proposed in the adjacent bands. In such a case, WMO would strongly request the adoption of mandatory limits in the Radio Regulations consistent with current ITU-R studies. In addition, WMO states its requirement to maintain relevant fixed satellite service capacity and availability in the 3 400-4 200 MHz frequency band.

Agenda item 1.6 (including both 1.6.1 and 1.6.2):

WMO opposes a new allocation to FSS (Earth-to-Space) in the 13.25-13.75 GHz frequency band. If this band was proposed for a new allocation to FSS (Space-to- Earth), then relevant protection of EESS (active) sensors in that band would have to be ensured.

WMO also opposes any allocation in the 10.6-10.7 GHz frequency band. WMO requires that protection of EESS (passive) sensors in the 10.6-10.7 GHz band be ensured against unwanted emissions of FSS systems.

Agenda item 1.9

WMO is concerned with regard to potential interference to EESS (space-to-Earth) operations in 8 025-8 400 MHz from ships operating in proximity and considers it impracticable to implement separation distances of several hundred kilometres from MMSS stations to a large number of EESS Earth stations. WMO is therefore opposed to a new allocation to MMSS (Earth-to-space) in the 8025-8400 MHz frequency band.

Agenda item 1.10

WMO opposes new MSS allocations in the 23.6-24 GHz and 25.5-26.0 GHz frequency ranges. Allocations to MSS in other portions of the 22-26 GHz frequency range will have to be associated with the adequate protection of EESS applications from emissions of MSS systems.

Agenda item 1.11

WMO supports a new EESS (Earth-to-space) allocation in the 7-8 GHz frequency band, provided that compatibility with meteorological-satellite systems operating in the 7450-7550 MHz and 7750-7900 MHz bands is ensured.

Agenda item 1.12

WMO urgently calls for a new EESS (Earth-to-space) allocation in the 9 GHz frequency range to ensure adequate protection of meteorological applications, in particular, meteorological radars in the 9300-9500 MHz frequency band and passive sensors in the 10.6-10.7 GHz frequency band.

Agenda item 1.17

WMO opposes the use of the 2700-2900 MHz and 5350-5460 MHz frequency bands for WAIC based on the approved ITU-R studies which conclude that sharing between meteorological radars and WAIC is not feasible in these bands.

If other frequency bands were to be considered for WAIC (e.g. the 13.25-13.4 GHz frequency band or frequency bands above 15.7 GHz), compatibility with meteorological and Earth observation applications would need to be assessed and adequate protection ensured.

Agenda item 9.1.1

WMO supports studies and regulatory measures towards ensuring the adequate protection of Cospas-Sarsat receivers against emissions from adjacent bands, noting that, to a large extent, these receivers are implemented on meteorological satellites.

Agenda item 9.1.5

WMO states its requirement to maintain relevant fixed-satellite service capacity and availability in the 3 400-4 200 MHz frequency band.

WMO supports technical and regulatory actions to protect the FSS operations in the 3400-4200 MHz band for the dissemination of meteorological data in Region 1 and would support a revision of Resolution 154 (WRC-12) calling for relevant administrations in Region 1 to use special care in the coordination, assignment, and management of frequencies.

Other WRC-15 Agenda items that may potentially have an impact on WMO interests are agenda items 1.3, 1.5, 1.9.1, 1.18, 7, 9.1.2, 9.1.6, and 9.1.8. WMO will monitor developments under these Agenda items and react accordingly in order to protect meteorological interests.

Detailed justifications of the WMO positions are given in **CGMS-42-WMO-WP-07**.

CGMS satellite operators are invited to communicate and take into account these views in addressing WRC-2015 preparation at their respective national levels.

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

WG I also reiterated the need of CGMS members to closely and regularly liaise with their national frequency management/regulation authorities on the importance of the frequency bands assigned/associated to MetSats and EESS and the need to protect/preserve them. These regular activities shall ensure that adequate awareness is raised, and maintained, with the national authorities that will convey national positions to the WRC and reminded all CGMS members that no CGMS member is a member of ITU with voting rights (according to the definition of ITU membership which is done at national signatory level). WMO therefore also emphasized the need to bring the same approach to the regional level (e.g. CEPT in Europe).

WG I also noted the resolution of the WMO Executive Council asking its CBS to pursue intensive preparations for WRC-15, in collaboration with other relevant international bodies, in particular, the Coordination Group for Meteorological Satellites and the Space Frequency Coordination Group.

Following the discussions, one action and one recommendation were raised:

CGMS-42 actions – WG I						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG I/2	A42.01	CGMS members to provide feedback to WMO (David Thomas, Dthomas@wmo.int) on the updated preliminary WMO position on frequency protection for WRC-2015.	30 June 2014	OPEN	HLPP# 1.3.3

CGMS-42 recommendations – WG I						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WG I/2	R42.0	CGMS satellite operators are invited to communicate and take into account the WMO position on frequency protection when addressing WRC-2015 preparation at the national level.	CGMS-43	OPEN	HLPP# 1.3.3

CGMS-42-NOAA-WP-05 reported on the implementation of the 2010 President's Broadband Initiative, which remains a U.S. government priority. The date and criteria for auction of the 1695-1710 MHz band resulting in sharing between POES, Metop and commercial broadband providers have been defined. There are other spectrum sharing ideas originating with U.S. industry that have required technical analysis and coordination domestically and abroad.

LightSquared, LLC, has performed technical analyses leading to a decision to share the 1675-1680 MHz band with current GOES back-up operations and NOAA radiosondes.

Finally, NOAA spectrum specialists have continued to work on routine domestic and ITU filings for current and future NOAA spacecraft.

Sharing of 1695-1710 MHz:

NOAA continues preparations to share the 1695-1710 MHz band with commercial broadband providers. US law requires the band to be auctioned as early as September 2014, with a winner announced late in 2014. NOAA estimates that the earliest a company would be in a position to start using the band would be about three years after the winner is certified. NOAA submitted the required Transition Plan to the National Telecommunications and Information Administration (NTIA) in January 2014. Key features of the Transition Plan include:

- Use of an existing on-line design portal in which commercial vendors could design their deployed systems near NOAA facilities. NOAA will verify that the proposed design does not cause harmful interference;
- Design and deployment of a spectrum monitoring system at each of the 27 documented critical sites. This system would be capable of quickly identifying the location and strength of signals causing interference to NOAA operations;
- Relocation of the National Weather Service radiosonde broadcasts to approximately 406 MHz; and,
- Full reimbursement of all costs including several years of operations.

NOAA stated in the Plan that full funding must be in place before work begins. NOAA committed to a 39-month deployment schedule, following receipt of funding, for the monitoring system.

LightSquared Interest in 1675-1680 MHz:

LightSquared, LLC, desires to combine 5 MHz of spectrum between 1670-1675 MHz, which it already occupies, with the adjacent 1675-1680 MHz band, which NOAA occupies, to give it the continuous 10 MHz it requires to begin operating its terrestrial broadband system. Lightsquared contracted with a NOAA contractor and signed an MoU with NOAA to conduct a feasibility analysis for sharing the 1675-1680 MHz band. The study was in two phases:

- Phase 1 was a study to determine the feasibility of moving the NWS radiosondes from 1675-1683 MHz to 406 MHz. This phase was completed in the autumn of 2013 and concluded that it was feasible for the radiosonde move. Funding for this move was requested in the 1695-1710 MHz Transition Plan.
- Phase 2 was a study to determine if Lightsquared could operate without harmful interference to GOES and GOES-R operations in the adjacent 1675-1695 MHz band. Preliminary results show that large exclusion zones would be required around critical NOAA

sites. This phase is not yet completed because the GOES-R ground system installation is not yet complete.

If the study shows that sharing is possible, Lightsquared would still be required to comply with the Federal Communications Commission (FCC) decision concerning Lightsquared's proposal before sharing begins. The decision space for the FCC includes granting Lightsquared's request in its present form, deciding to hold an auction for the spectrum among Lightsquared and its competitors, or simply denying Lightsquared's proposal. In addition, there are several unresolved bankruptcy court proceedings and ongoing civil lawsuits, in which Lightsquared is either the defendant or the complainant, which will have a major bearing upon Lightsquared's viability as a company.

Routine and Other Spectrum Management Work:

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

- Overcrowding of S-band: Recent problems finding frequencies for DSCOVR and COSMIC-2 point to problems with overcrowding of the S-band frequencies allocated for satellites: 2220-2290 MHz. NOAA has found a large discrepancy between the International Telecommunications Union (ITU) and the Space Frequency Coordination Group (SFCG) databases for systems registered in this band. During several sessions of the 2013 SFCG meeting, it was clear that countries and space agencies are not being diligent updating the database. Inaccurate data bases significantly hamper the ability to perform analyses and defend those portions of the spectrum which an incumbent either "owns" or shares. NOAA has requested that the SFCG perform an end-to-end review of all of its data bases.
- Routine ITU and NTIA filings for JPSS and Jason-3.
- GOES-R Stage III filing approved in December 2013.
- The activation and increased use of the new Virginia Spaceport at Wallops, Virginia, U.S.A., resulted in numerous short deadline interactions with NASA and commercial launch companies to coordinate frequency use during space launches from the new Wallops launch site, which is only several kilometres from NOAA's Wallops Command & Data Acquisition Station.

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

For further details on any satellite radio frequency issue, NOAA encourages CGMS members to consult with their SFCG counterparts or to review information found at: <http://www.sfcgonline.org>.

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

CGMS-42-NOAA-WP-06 provided a description of current and future NOAA satellite networks as well as a list of radio frequencies used/to be used by these networks.

WMO reiterated the ready availability of the WMO Observing System Capability Analysis and Review Tool (OSCAR), encouraging WG I members to provide and keep WMO updated with the frequency information of their present and future Systems.

Note: CGMS-41-WMO-WP-23 presented a summary of the satellite module of the Observing Systems Capability Analysis and Review Tool (OSCAR), available to the public at www.wmo.int/oscar, which provides information on EO satellite frequencies (<http://www.wmo-sat.info/oscar/satellitefrequencies>).

Comment on summary report and SFCG approach

CGMS WG I wanted to re-iterate to SFCG the appreciation of CGMS for the support provided in protecting and preserving the frequency bands assigned or related to CGMS activities. CGMS WG I recalled that at CGMS-40, CGMS nominated the Frequency Manager of EUMETSAT as the liaison officer between CGMS and SFCG. CGMS WG I noted with appreciation the work done so far by the liaison officer.

CGMS WG I noted the efforts identified in the different Working Papers to concentrate the discussions on frequency coordination and management topics in the framework of SFCG. Discussing how to better use the time and resources of both SFCG and CGMS WG I, it was proposed to use the identified liaison officer to also report back from SFCG on the topics of relevance to CGMS to allow all frequency management and coordination issues between CGMS members (but also members of SFCG) to be addressed in an expert forum as it is in SFCG.

To ensure that CGMS is informed of any issue needing dedicated attention within CGMS WG I, the following recommendation and related action were agreed:

CGMS-42 recommendation – WG I						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS members	WG I/2	R42.02	CGMS WG I, understanding the complexity of the issues to be covered in the area of frequency management and coordination (including interference assessments) for the existing and future space systems under the responsibility of the different CGMS members, and also recognising the efforts, already in place by most of the CGMS members, to concentrate these discussion in the frame of SFCG, recommends CGMS members to continue bringing all frequency management and coordination issues under the expert forum of SFCG and actions the liaison officer (from CGMS to SFCG) to report to CGMS WG I all aspects of SFCG discussions considered of relevance to CGMS.	(CGMS-43)	OPEN	HLPP# 1.3

CGMS-42 action – WG I						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
EUM (CGMS liaison officer)	WG I/2	A42.02	CGMS Liaison officer to SFCG to report to CGMS WG I on the discussions and disposition of SFCG on all topics of interest to the different CGMS members. For achieving that a dedicated CGMS Secretariat WG I working paper will be prepared by EUMETSAT Frequency Manager (in the role of liaison officer from CGMS to SFCG) and will be released to the participants of WG I before end of Q1 of the corresponding year. Based on the contents, CGMS members will decide the level of information they will include in their specific reports to CGMS for the corresponding WG I meeting.	30 Mar 2015	OPEN	HLPP# 1.3

WG I/3 Direct Broadcast Services

WG I/3.1 Direct read-out stations

There were no papers presented under this agenda item during CGMS-42. Nevertheless, the need to maintain this agenda topic was discussed (and confirmed) under the revision of the HLPP (parts relevant to WG I).

WG I/3.2 Coordination and global standards

WG I/3.2.1 Optimisation/harmonisation of direct readout dissemination (CGMS DB global spec)

CGMS-42 NASA-WP-05 highlighted NASA's Direct Readout program. The prime objective is to enable real-time data access of Earth remote sensing data. Through the use of Direct Broadcast (DB) on EOS and Suomi NPP satellites, real-time environmental data is made available on a continuous basis world-wide. Having regional data access, three additional elements are necessary to render DB data useful by the general application user: instrument specific algorithms along with data processing tools to handle a live data stream, data product formatting or data transport tools and, product distribution mechanisms for decision support systems. This paper addresses these elements and their availability to the public as NASA's contribution to enabling the use of space-borne remote sensing data for real-time applications.

The ultimate goal of the direct broadcast or network-based remote sensing data user is to arrive at an understanding of its regional environment dynamics and derive information for decision support. The extent of DB's utility is therefore directly proportional to the ability of the user to provide the derived information to a decision-making infrastructure; whether it is a large farmer assessing a fungal infestation or the federal government assessing the extent of damage caused by a tornado. Both require a mechanism or path for real-time DB products to reach appropriate decision-making bodies.

NASA, as a science research organisation, has developed space-borne remote sensing instruments and corresponding science algorithms to measure and quantify geophysical parameters for use in understanding and quantifying climate change. Many of these algorithms, although for use on a global and longer temporal scale, are applicable for real-time regional applications. The Direct Readout programme, in order to bridge the gap between NASA science and the end-user application, has developed support technologies and ported science algorithms, as described, to function in a Direct Readout environment for direct use by such application users. These are freely available for download at <http://directreadout.sci.gsfc.nasa.gov>.

CGMS-42 NOAA-WP-23 provided an update on the development of the direct readout service on the Joint Polar-orbiting Satellite System (JPSS) and the GOES-R satellites. It is planned that JPSS carry an X-band service similar to the NASA EOS and NOAA Suomi NPP spacecraft. The HRD service will transmit a full complement of instrument data. GOES-R will make available an HRIT/EMWIN service which will be a combination of the LRIT and NWS' Emergency Managers Weather and Information Network (EMWIN) services. The GOES Re-Broadcast (GRB) service will replace the GVAR transmission on the current GOES spacecraft. NOAA's current direct broadcast services will change dramatically in data rate, data content, and frequency allocation, driving changes to field terminal configurations. Direct readout data users must employ new field terminal receivers unique to each particular broadcast service.

WMO asked about the possibility of using GEONETCast to support data delivery in the pre-operational phase as a risk reduction measure (at user level) for GRB readiness. WG I identified this

point to be addressed through recommendation CGMS-41 WG IV 41.20: NOAA to consider the provision of an LRIT like subset of GOES-R or GOES-S data over GNC-A, at least on a transitional basis to support operational users in RA III and RA IV with limited technical infrastructure. In **CGMS-42-NOAA-WP-20** NOAA responds that it will assess the possibilities of including a subset of the GOS-R/S in GNC-A. NOAA must consider the best options for the data format and data content. CGMS members and the WMO Space Programme will be kept abreast of any considerations for including GOES-R/S data in GNC-A broadcast. However, the CGMS Secretariat recalled to WG I that the HLPP contains a dedicated entry regarding support to users (in the 2014-2018 timeframe) and this HLPP objective is not limited to NOAA and GOES-R but applies to all CGMS members and the future systems that are to be deployed in the 2014-2018 timeframe (e.g. GOES-R and JPSS, MTG, Himawari 8, FY-3E/F, FY-4, etc.) and therefore agreed the following actions:

CGMS-42 action – WG I						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG I/3.2.1	A42.03	CGMS members to regularly report to WG I their plans on the user preparation for their future systems (in areas aspects relevant to the WG I).	CGMS-43	OPEN	HLPP# 1.4.2
CGMS members	WG I/3.2.1	A42.04	CGMS members to gather responses from manufacturers of receiving stations about experiences and lessons learnt for both LEO and GEO systems. Due date: September 2014 and provided answers to be assessed in dedicated Inter-Sessional meeting in November 2014	15 Sep 2014, 15 Nov 2014	OPEN	HLPP# 1.4.3

CGMS-42 NOAA-WP-29 provided a simplified description of the steps required to decode the NOAA GOES LRIT mission specific data transmissions into LRIT application files. This document is primarily intended for developers to allow implementation of NOAA LRIT specific processes such as Rice decompression of image files. It is important to note how this document is organized. Examples of the usage of this code are included in the main body of this paper with more specific examples in the WP Appendix. It is important to note that the data flow diagrams (figures 1 and 3) are simplified examples and the reader must refer to the NOAA LRIT Receiver Specification and CGMS 03 HRIT/LRIT Global Specification for the specifics on processing the various data layers.

The intent of this document is to provide terminal software developers a visualisation of the data flow as it progresses through the various layers defined by the LRIT system specification(s) and a guideline for the implementation of the HRIT/EMWIN service for GOES-R/S. NOAA plans to reduce the user impact when transitioning from LRIT to HRIT/EMWIN. The new system will be capable of receiving the current GOES broadcasts as well as the new GOES-R/S services. This document serves as the basis for the development of the HRIT/EMWIN service that will be available on the GOES-R series of satellites.

WG I thanked NOAA for the report provided on the LRIT Mission Specific Data for GOES and the transition from LRIT to HRIT/EMWIN.

In view of the plans of the different CGMS members to deploy more advanced systems and instruments in the next two to six years, WG I debated the suitability of the existing CGMS Global specification for GEO systems (Global Specification 03) to efficiently format and disseminate L1 and L2 products and therefore agreed an action to assess its suitability and decide on additional steps accordingly (if possible even in inter-sessional meetings before CGMS-43).

CGMS-42 action – WG I						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG I/3.2.1	A42.05	CGMS members to nominate focal points to support, via inter-sessional meetings, the analysis of the LRIT/HRIT Global Specification for its usefulness for next generation GEO satellite data dissemination, and propose an update taking into account the availability of new file format standards and dissemination means. Initial coordination to be done by EUMETSAT (as book captain of the document). Due date 30 June 2014	30 Jun 2014	OPEN	HLPP# 2.6

WG I/4 Data collection systems

CGMS-42-EUM-WP-19 presents the status of the EUMETSAT 0° and IODC Data Collection Services. The status of the High Rate Data Collection Platforms and DCP data dissemination mechanisms are also detailed.

Regional DCS (0°)

Channel utilisation

There are **223** regional channels (at 1.5 kHz spacing) available on the Meteosat-10 satellite, which supports the 0° Data Collection Service (DCS). Of these channels, **66** are used by 'older' DCPs, with 3 kHz spacing, (corresponding to 33.3 kHz channels). Therefore, **157** channels are available for 1.5 kHz DCPs. Of these channels, **47** have DCPs allocated. The upper part of the band has been set aside for HRDCP use. There are **110** 1.5 kHz Regional channels with no DCPs allocated. As older 3 kHz DCPs become obsolete, more channels will become available. The allocation is shown in Figure 1. This figure also shows the additional 11 Regional channels that were redistributed from the original 33 international channels following the agreement at CGMS-36, i.e. I01-I11 were allocated to NOAA for regional use, I23-I33 allocated to EUMETSAT for regional use. I12-I22 remain as international channels.

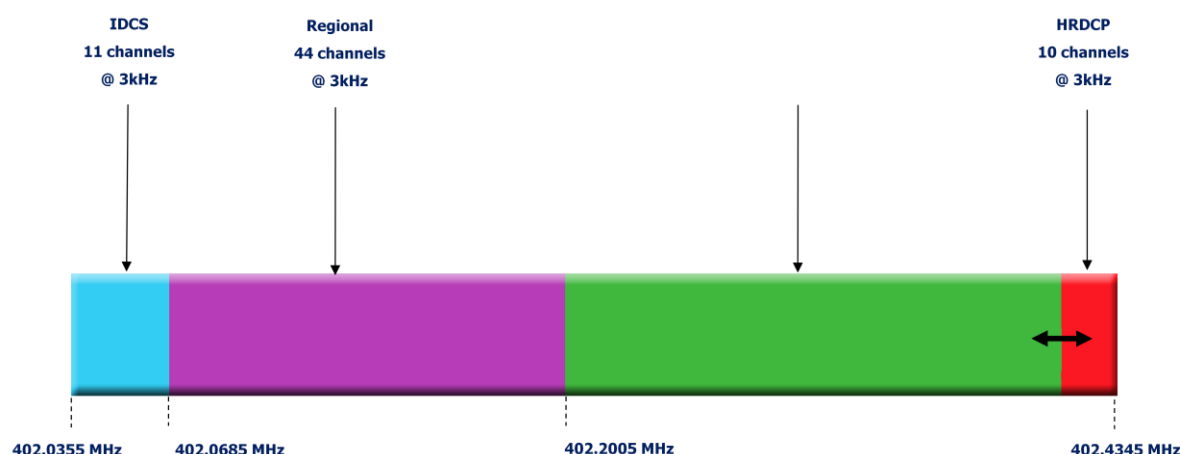


Figure 1 Allocation of International/Regional Channels of DCPs

Allocated/active DCPs

There are **1146** allocated DCPs, of which **762** are actively transmitting. Several transmitters are seasonal in nature.

Geographical distribution

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

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

Total = 1087 DCPs

Table 1: Geographical distribution by country

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

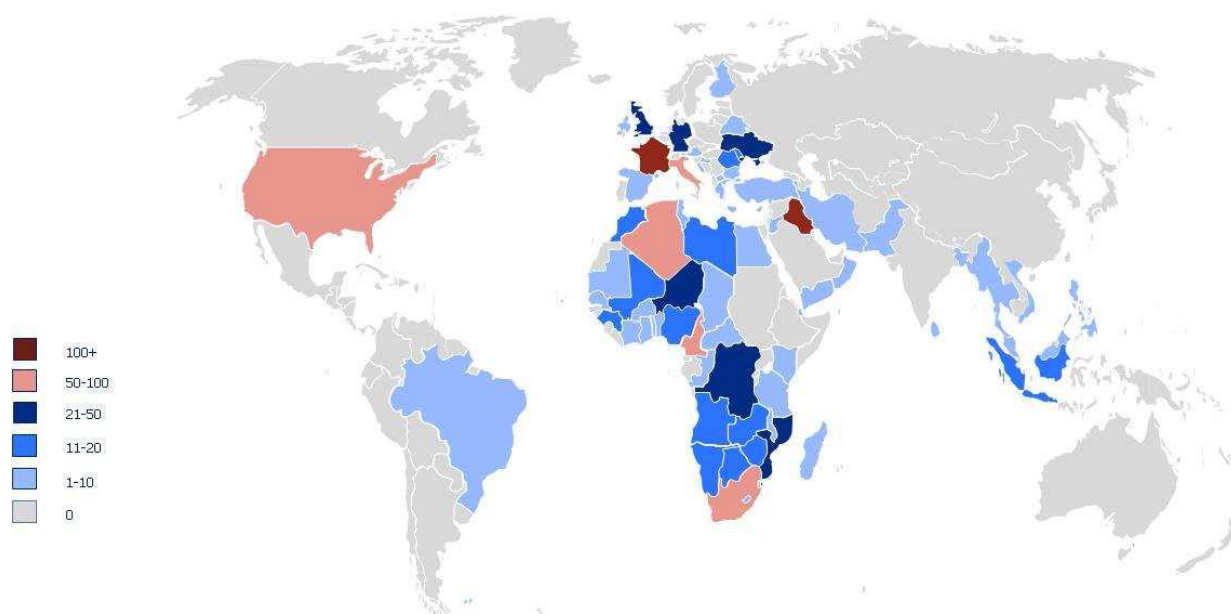


Figure 2: Geographical distribution of DCPs

IODC (57°)

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

Channel utilisation

Due to interference with the 0° service, only the remaining 11 international channels have allocated for IODC use. As noted above, I01 – I11 were allocated to NOAA for regional use and I23-I33 to EUMETSAT for regional use. I12-I22 remain as international channels.

It has been agreed with NOAA that the 11 former international channels, now allocated to NOAA, can be used for IODC DCS applications on a non-interference basis.

Allocated DCPs

There are **60** allocated DCPs, of which **39** are actively transmitting. This is a 30% increase over 2013.

Outlook

International channel usage

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

Referring to **CGMS-42 EUM-WP-26** - Roadmap for the future provision of Indian Ocean Data Coverage (IODC) services - it is clear that the remaining international channels utilised by Meteosat-7 should remain in place until an alternative to the DCS provided by Meteosat-7 is in place.

The international channels bandwidth is the only bandwidth currently available for 'non-regional' users, i.e. outside the CGMS members' bandwidth that is reserved in most cases for regional use only.

This topic should be revisited at each CGMS meeting, until a long-term alternative to the current Meteosat-7 DCS is decided.

HRDCP Status

EUMETSAT has recently published an updated TD16 – Meteosat Data Collection and Distribution, mainly covering the HRDCP specification and an updated certification process. Several manufacturers are actively pursuing certification of HRDCP transmitters. In addition the European Space Agency (ESA) is preparing a design for European manufacturers to be able to build HRDCP transmitters. The first certified HRDCP is now planned for mid-2014.

CGMS-42-JMA-WP-08 reports on the present status of JMA's Data Collection System (DCS) and related future plans, highlighting a recent increase in the number of Data Collection Platform (DCP) stations at which DCS regional channels are used for better tidal/tsunami monitoring.

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

In 2014, JMA will revise the related technical requirements to support efficient regional channel usage. The name MTSAT-DCS will also be changed to Himawari-DCS with the operational satellite switch-over in 2015.

JMA has reviewed the technical requirements to support regional channel expansion and effective channel usage at 300 bps.

The Agency plans to allocate its assigned international channels I23-I33 as regional channels, and to narrow down the occupied frequency bandwidth of 300 bps as well as increasing its effective isotropic radiated power (EIRP). The radio frequency channel, EIRP and bandwidth to be used are as follows:

- Radio frequency channel 402.0685-402.4 MHz (100 bps) 402.1-402.4 MHz (300 bps)
- EIRP 43-46 dBm (100 bps) 45 dBm-48 dBm (300 bps)

- Radio signal bandwidth 1.8 kHz (100 bps and 300 bps)

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

The use of tidal/tsunami DCPs on MTSAT-DCS regional channels has expanded. Statistics on the distribution of tidal/tsunami DCP data via GTS indicates an increasing trend in numbers. In addition to this increase, more frequent collection (from every 15 minutes to every 6 minutes) is being implemented for some tidal/tsunami DCP stations in consultation with the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) to support enhanced monitoring.

In 2014, Padang DCP and Sibolga DCP in Indonesia began operation, and the country's Ambon DCP and Saumlaki DCP have shortened the collection time from every 15 minutes to every 6 minutes.

JMA is receiving more and more requests regarding the use of its MTSAT DCS. Based on the importance of disaster reduction/mitigation activities in the relevant regions and the significant role of the DCS in such work, JMA has responded positively to such requests. Recent instances have been related to:

- Vietnam's plan to install more than 100 hydrometeorological DCP stations for disaster prevention along the Mekong River;
- Fiji's request for a new tidal DCP station;
- A request from France's Service Hydrographique et Océanographique de la Marine (SHOM) for new tidal DCP stations in the Indian Ocean and the western Pacific;
- Requests from the University of Hawaii Sea Level Center (UHSLC) for developments including transition of the use of DCS from Metsat-7 to MTSAT and enhanced data collection periodicity;
- Myanmar's request for a new tidal DCP station

Himawari-8 and -9 will use the Ka band (up to 18 GHz) as the downlink frequency for relaying DCP data, as opposed to the L-band (up to 1.6 GHz) used on the current MTSAT-DCS. To cope with the effects of rain attenuation in the Ka-band, JMA will introduce site diversity with two receiving stations in Tokyo and Hokkaido. As these stations are more than 1,000 km apart, they are unlikely to be affected by heavy rain at the same time. This is expected to guarantee 99.99% uptime in radio communication.

Data transmitted from DCP stations to Himawari-8 are relayed to the Tokyo station and the Hokkaido station before being demodulated. The qualities of data at both stations are compared, and the set with fewer errors is chosen for use. After format conversion, the data are distributed globally via GTS. Along with these distribution efforts, JMA provides online access to the data and an email transmission service as back-up with the aim of creating redundancy in data distribution to users.

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

CGMS-41-ROSHYDROMET-WP-03 addresses the current status and technical specifications of Russian DCS (Electro-L №1). During Electro-L №1 exploitation, DCS proved to be fully functional.

The Russian DCS was established to provide satellite channels for meteorological data transmission from DCPs via meteorological satellites (back-up option – via Luch communication satellites).

The DCS was developed according to the international requirements of WMO and CGMS and has to provide transmission of the messages every 3 hours (standard synoptic hours), and also storm warnings at any time.

The development of the national DCS was started in SRC Planeta in the 1990s. In the absence of national geostationary meteorological satellites (GMS) until 2011 the initial testing and experimental operation of DCS was based on the Meteosat satellite (under the bilateral agreement between ROSHYDROMET and EUMETSAT).

DCP signals are transmitted via dedicated satellite channels at frequency ranges of 401.5-402.5 MHz (uplink) and 1696.5-1697.5 MHz (downlink) with a transmission rate of 100 or 1200 bps. The message size is up to 15 000 bit. The transmission time is synchronised with GLONASS/GPS signals.

System capacity allows data transmission from 300 DCPs simultaneously that provides throughput of 3000 DCPs in 10 minutes.

Russian DCS is developed for data transmission via meteorological satellites: the Electro-L GMS series (constellation of three spacecraft to be located at 76°E, 14.5°W and 166°E), series of Meteor polar-orbiting satellite series (constellation of three spacecraft), Arctica highly elliptical orbit satellite series (constellation of two spacecraft), and Luch geostationary communication satellite series.

The Electro-L GMS constellation (with Luch communication satellites as the back-up option) provides coverage of the territory from about 75°S to about 75°N, the highly elliptical orbit satellites will provide coverage of high Arctic latitudes, and polar-orbiting satellites will cover the regions outside the area mentioned above, but less frequently.

Presently the national DCS is in experimental operation in SRC Planeta based on Electro-L №1 GMS. Messages transmitted from the DCP station to Electro-L №1 are relayed to the European (Moscow region) and Siberian (Novosibirsk) regional centres of SRC Planeta. The deployment of the receiving system in the Far Eastern (Khabarovsk) regional centre is planned for 2015. Then the data will be distributed globally via GTS. In addition, ROSHYDROMET provides an email transmission service for some regional users (regional hydrometeorological administrations).

The number of DCPs has increased significantly over the last two years. Now there are about 420 DCPs allocated (April 2014) transmitting messages via Electro-L №1. DCPs are distributed over the entire territory of Russia, including the remote areas and northern regions with extremely low elevation angles (about 3 degrees) According to the deployment plans, there should be about 800 DCPs installed by the end of 2014. The national DCS currently has a reliability of 99.8 % based on the number of messages successfully received.

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

CGMS-42-NOAA-WP-07 provides a status report on the performance of the International Data Collection System (IDCS) and NOAA's domestic DCS. NOAA's DCS Administration and Data Distribution System (DADDS, serving GOES DCS users) now has almost 1500 individual users, with more than 780 organisations using the system. NOAA has continued to populate user and platform tables, registering and training users, and has now added the task of upgrading browsers. In the past year, it has upgraded operating systems and data base management systems. In the five years since the system has been in operation those features have become outdated and difficult to support. NOAA is contemplating adding a framework system to make browsers easier to maintain and NOAA has begun implementation of new Version 2 transmitters. Implementation of 300 baud transmitters was fairly simple as they could be placed on existing 300 baud channels. However, the 1200 baud channels do not line up with existing channels, and rolling out new channels is more difficult. NOAA recently borrowed a channel from EUMETSAT to accommodate an emergency deployment of new 1200 baud transmitters. The ultimate goal is to relocate the 1200 baud channels to the lower end of the spectrum, where channels have almost been vacated by 100 baud transmitters. The transition to high data rate (HDR) is officially complete with approximately 100 of the 24,800 platforms that are active reporting at 100 bits/sec. NOAA has communicated with owners of the platforms still operating to arrange termination.

NOAA plans to continue to investigate the use of two way communications to better command and control platforms but has continued to focus on higher priority items. NOAA is proceeding slowly with this project, since most resources are being committed to DADDS and Version 2 HDR transmitter implementation. Use of the international channels is minimal.

NOAA is using the channels assigned to us for our domestic use by CGMS, and has already made assignments on all of them. A fully redundant back-up system has been located in Suitland, Maryland, since 2010, and is being fully utilised by users and by developers who continue to roll out enhancements to DADDS by testing them at the Suitland site first. Use of the GOES DCS continues to flourish in the US. The POES DCS (aka Argos) has 21000 active platforms, supporting 1900 users in 118 countries. The Argos space segment currently consists of NOAA-15/16/18/19, Metop-A/B, and SARAL. Future launches include Metop-C (2018) and Metop-SG-B1 (2022) by EUMETSAT, with additional launches by NOAA also planned – but pending Congressional appropriations.

Interference from “Ionospheric Scintillation” from Solar Activity

Near the end of 2011 NOAA began noticing interference with transmissions from a small number of platforms, primarily those near the North and South Poles (Canada and South America.) The data losses were not widespread, but instead seemed to be constrained to small areas, narrow time frames and specific platforms. After much investigation it was concluded that the interference coincided with increased solar activity. This pattern seemed to be traced to a phenomenon called “ionospheric scintillation”, an ionisation of a specific layer of the ionosphere that causes refraction and diffraction of radio waves. The pattern has also been tied to GPS interference. Solar activity has continued to increase. While NOAA has continued to monitor this activity, and to understand it a little more, we have made little progress in finding ways to mitigate it. The solar activity is expected to peak in early 2014, so there is not enough time to have an impact on this cycle. There appears to be less impact, and it is hoped this peak is diminishing. NOAA will continue to study this event, with the aim to be prepared to respond to the next cycle, expected in about nine years.

STATUS OF IDCS

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

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

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

INTERFERENCE TO THE IDCS

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

CONSOLIDATED LIST OF IDCS ALLOCATIONS

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

Status of the Argos Data Collection System

The Argos Data Collection and Location System (DCS) provides global coverage and platform location for government and non-profit agencies with system use agreements (which are reviewed and approved by CNES and NOAA), and for non-government organizations with a vested government interest. The Argos programme is administered under a joint agreement between the National Oceanic and Atmospheric Administration (NOAA) and the French Space Agency, Centre National d’Etudes Spatiales (CNES). Additional partners include EUMETSAT and the Indian Space Research Organisation (ISRO).

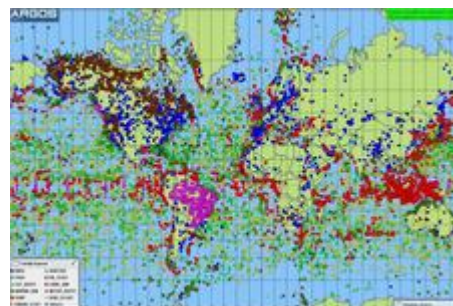
The system consists of in-situ data collection platforms equipped with sensors and transmitters and Argos instruments aboard NOAA, EUMETSAT, and ISRO polar-orbiting satellites. The global environmental data sets are collected at telemetry ground stations in Alaska, Virginia, Norway and Antarctica; and pre-processed by the National Environmental Satellite, Data, and Information Service (NESDIS) in Suitland, Maryland. Regional data sets are collected via a global network of HRPT stations. Two CNES subsidiary companies, Collecte Localisation Satellites (CLS) in France and CLS America in Maryland process the data and deliver it to users (and for met-ocean



data, post it to the GTS).

Flying the Argos system aboard polar-orbiting satellites provides worldwide coverage. Additionally, incorporating the Argos instrument on a moving satellite allows a platform to be located using Doppler shift calculations. This positioning capability permits applications such as monitoring drifting ocean buoys, wildlife migrations, and commercial fishing vessels, among many others.

There are currently more than 21,000 active Argos Platforms being tracked by over 1,900 users in 118 countries. Argos use has steadily risen since its inception over 30 years ago, and especially in the last decade (subject to seasonal variation). The data latency requirement for the system is 60-minutes, with 30-minutes strongly preferred. This is achieved by a robust spacecraft constellation and ground system.



Frequency uses include: Platforms to spacecraft – 401.65 MHz; spacecraft to platforms (for Metop-A and SARAL with operational Argos-3 instruments) – 465.9875 MHz; and spacecraft to ground stations – 1695-1710 MHz. Future use of 399.9-400.05 MHz is anticipated for a small number of non-environmental applications, beginning with NOAA's next Argos mission (TBD), with the first Argos-4 instrument.

CGMS-42-EUM-WP-20 presented an overview of the work performed on behalf of CGMS in the SATCOM Forum in the context of Data Collection Systems. The meeting discussed WMO/IOC user requirements for remote automatic weather stations, hydrological stations, polar observations, drifting buoys, ship-based observations, sea-level observations, ARGO profilers and animal trackers.

Overall there was agreement that such a Forum would benefit the existing user community, but could also provide a 'one-stop-shop' for new users who wish to collect data from remote sites. The information about the Data Collection Systems of CGMS members will be collected and made available to existing and potential end users via the SATCOM Forum.

In addition to the usual information provided by agencies at each CGMS meeting, the ad-hoc meeting also proposed the following useful Satcom criteria and draft metrics:

This list of criteria which may be described in tables published by the Satcom Forum gives the specifications of satellite operators or requirements of users:

- Transmission Frequency - Determines size and type of antenna;
- Type of service (packet or streaming) - Some platforms perform better when using packet systems;
- Packet size and repetition rate, or streaming data rates - Care should be taken to understand actual data rates;
- Timeliness: Getting data onto GTS not automatic with Iridium;
- Availability, are satellites available. Not a problem with geostationary satellites if you are within view of a satellite and not in the polar regions. Not a problem with big LEO systems;
- Performance in different environments, such as extreme temperatures, rough oceans;
- Power consumption - This is very important on some platforms;
- Inherent Positions - Positions calculated inherently through the signal transmitted by platforms without the need for a GPS receiver can reduce power consumption significantly;
- Long Term Viability of Satellite System - Users and manufacturers both need long term stability in order to optimize planning of instrument production and deployment;
- Availability - Not simply telemetry coverage, but including regional governmental restrictions and frequency interference;
- Technical Support.

The first SATCOM Forum is planned for 2015.

It was proposed to collate all the current CGMS DCS information, and gather further information, as outlined above, in a single 'manual' in preparation for the next Satcom Forum meeting.

This information will be gathered during the CGMS-42 meeting and in subsequent bilateral discussions with CGMS partners.

CGMS-42 action – WG I						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
EUM	WG I/4	A42.06	EUMETSAT to provide template to report DCP system characteristics by the different DCP operators of CGMS	30 Jun 2014	OPEN	HLPP# 1.2
CGMS DCP operators	WG I/4	A42.07	CGMS DCP operators to provide DCP system characteristics (in the template form provided by EUMETSAT in previous action) in support of the preparation activities for the Satcom Forum in 2015	30 Sep 2014	OPEN	HLPP# 1.2.1

WG I/5 Regional Retransmission Services (RARS) including support for NPP and Metop

CGMS-42-EUM-WP-17 presents an overview of the elements of Regional Services for the polar orbiting satellites, summarises experiences gained throughout the operation and development of

Regional Services at EUMETSAT and NOAA, and discusses elements that could be considered for coordination through CGMS.

The aim is to achieve a coordinated and consistent set of Regional Services, while leaving room for diversity in the regional implementations, operations concepts and set of services offered.

The availability of mature and well supported product processing software is essential for providing Regional Services of a high operational quality, and this software shall be provided by the agencies operating polar-orbiting satellites, together with appropriate user support functions.

While different internal architectures of Regional Services may exist, CGMS is encouraged to evaluate and document commonalities and best practices in the organisation and architecture of Regional Services.

To facilitate the setup of new Regional Services and to promote the exchange of data between multiple Regional Services, it is recommended that the interfaces between the different elements are standardised, specifically:

- The interface between the direct broadcast reception station and the Regional Service;
- The interface for retrieving auxiliary data required for product processing;
- The interface and product formats for distributing products to users;
- The inter-regional interface for exchanging products, scheduling and monitoring data between the Regional Services.

Additionally, consistent and comprehensive documentation for the space to ground interface is essential for the success of establishing direct broadcast reception stations.

CGMS-42 recommendation – WG I						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS space agencies (with LEO spacecraft)	WG I/5	R42.03	<p>All agencies operating polar orbiting satellites to provide, whenever relevant for operational meteorology, a package based on the core software from the global processing for use in local and regional product processing, in particular level-1 processing; considering that:</p> <ul style="list-style-type: none"> • the software is executable on a standard computer platform, typically Linux/x86-64; • the software uses parallelisation techniques making efficient use of modern multi-core computers for the sake of timeliness; • updates to the software and its configuration data are provided via 	(CGMS-43)	OPEN	HLPP# 1.4.4

			the Internet for maintaining consistency with the global products throughout the lifetime of the mission; <ul style="list-style-type: none"> complete and comprehensive user documentation is supplied. 			
CGMS members	WG I/5	R42.04	Each agency providing product processing packages to implement a user support function supporting the software release process, the software installation and anomaly resolution.	(CGMS-43)	OPEN	HLPP# 1.4.4
CGMS members	WG I/5	R42.05	CGMS to consider further actions to evaluate and document commonalities and best practices in organisation and architecture of Regional Services.	(CGMS-43)	OPEN	HLPP# 1.4.5
CGMS members	WG I/5	R42.06	Agencies to provide a complete and comprehensive Space to Ground Interface Control Document for each satellite family, defining the radio frequency encoding and data layout of the direct broadcast downlink.	(CGMS-43)	OPEN	HLPP# 1.4.2
CGMS members	WG I/5	R42.07	CGMS to promote standardisation of the data interface between the direct broadcast reception station and the product processing software.	(CGMS-43)	OPEN	HLPP# 1.4.5
CGMS members	WG I/5	R42.08	CGMS to promote standardisation of the pass scheduling interface between the Regional Service and the direct broadcast reception station.	(CGMS-43)	OPEN	HLPP# 1.4.5
CGMS space agencies (with LEO spacecraft)	WG I/5	R42.09	All agencies operating polar orbiting satellites to provide product processing auxiliary data via the Internet.	(CGMS-43)	OPEN	HLPP# 1.4.5
CGMS members	WG I/5	R42.10	CGMS to consider further actions on standardising the interregional interfaces for exchange of products, pass scheduling, monitoring and other information.	(CGMS-43)	OPEN	HLPP# 1.4.5

CGMS-42-EUMETSAT-WP-18 presents the approach taken by EUMETSAT for developing a Regional Advanced Retransmission Service (RARS) in Africa. The document provides a brief summary of the overall RARS status and discusses the rationale for developing a RARS network in Africa. In addition, this working paper provides an explanation of the concept which is currently being discussed with the partners in Africa, and the potential donors. EUMETSAT defined an approach aiming at implementing several RARS stations in Africa that would ensure full coverage of the region.

This approach includes:

1. a preliminary design of an African RARS network that would be operated independently of the EUMETSAT RARS (EARS) network; and
2. interactions with potential donors (mainly the European Commission) to mobilise funds to support the implementation of such a project.

In parallel to the technical discussions, EUMETSAT and the WMO approached the European Commission to mobilise funding, through the European Development Fund, to support the implementation of the proposed RARS network.

The tentative schedule for the implementation of this activity is as follows:

- consolidation of the approach with African partners by mid-2014;
- confirmation of availability of funding by autumn 2014; and
- start of implementation of the RARS Africa project in 2015 for a 4-year period.

CGMS-42-WMO-WP-19 provides an update on the Regional ATOVS Retransmission Services (RARS) concept, the RARS network status, and the procedures – including for example pre-processing software harmonisation, quality monitoring, and coding convention – adopted to ensure consistency of RARS products. Several new RARS stations are being included in the RARS/ATOVs network, namely in Tahiti, Chennai, and New Delhi, with plans for Easter Island, which will significantly improve coverage over the Pacific Ocean in particular. RARS is increasingly recognised as a valuable model for near real-time access to LEO data.

RARS is evolving into a new system, named “Direct Readout, Acquisition and Relay of Satellite Data” (DRARS), with two major developments: the inclusion of data products from advanced sounders such as CrIS and IASI, and convergence with the NOAA Direct Broadcast Real Time Network (DBRTN) for NPP and JPSS. These major developments will be reflected in a new Guide on DRARS to be developed as part of the WMO Information System (WIS) documentation, replacing the current RARS Operators Standards.

The 19th International TOVS Study Conference (ITSC-19) expressed strong support for these developments from a user viewpoint. It invited WMO to reactivate the CGMS-WMO RARS Implementation Group and recommended “that the Space Science Engineering Centre (Univ. Wisconsin), NOAA, EUMETSAT, and WMO coordinate on data formats, software versions, and latency requirements and come up with a plan to include the DBRTN products in RARS”.

The following action was therefore raised:

CGMS-42 recommendation – WG I						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS space agencies (with LEO spacecraft)	WG I/5	R42.11	CGMS Satellite operators to support the definition and implementation of community agreed operational procedures for LEO satellite data direct read-out, acquisition, and relay in the context of the DRARS Implementation Group.	(CGMS-43)	OPEN	HLPP# 1.4.5

All these aspects are considered by WG I to fall under the assigned responsibilities of this specific CGMS WG and the revision of the HLPP shall ensure that the proposals made by the different working papers submitted to CGMS-42 on this specific subject are properly taken care of and adequately handled via dedicated inter-sessional meetings.

However, in order to achieve that, it is necessary to recall that CGMS-41 WG I action 41.17 “*CGMS members to nominate representatives in the Task Team to work on RARS related aspects*” is still open and a new date was proposed (15 June 2014) to allow adequate representation in the Inter-Sessional meetings to work on the identification and consolidation of best practices for Regional Services (RARS based) using LEO satellites. The participants identified in the WG I Inter-Sessional meetings are also expected to be part of the requested WMO DRARS Implementation Group.

WG I/6 Review and updating of the HLPP

The WG considered the status of implementation of the High-Level Priority Plan (HLPP), and while appreciating the overall progress, did not identify priorities within its area of focus that can be considered achieved at this point in time.

Following detailed discussions on the planned evolution of the RARS systems, the WG proposed the following priority for inclusion in the new version of the HLPP: Make available pre-processing S/W packages for generation of L1 products from LEO Direct Broadcast

With this amendment, the WG recommended to the CGMS plenary the proposal for an updated High-Level Priority Plan.

WG I/7 Any other business

There was no other business discussed.

WG I/8 Planning of inter-sessional activities/meetings [CGMS-42 - CGMS-43]

Four groups of Inter-sessional meetings were agreed by WG I:

- WG I.IS-1: The first group of inter-sessional meetings will be dedicated to Section 2.6 (Global Specs) of the HLPP and will be held on a quarterly basis, starting in mid-September 2014;
- WG I.IS-2: The second group of inter-sessional meetings will be dedicated to Section 1.4.5 (RARS) of the HLPP of relevance to WG I (i.e. RARS related activities) and will be held on a quarterly basis, starting mid-August 2014;

- WG I.IS-3: The third group of inter-sessional meetings will be dedicated to Section 1.2 (DCS) of the HLPP and will also meet on a quarterly basis, starting in early October 2014; and
- WG I.IS-4: The fourth group of inter-sessional meetings will be dedicated to Sections 1.4.3 (user stations) and 1.3 (frequency coordination topics) of the HLPP and will also meet on a quarterly basis, starting in early September 2014.

WG I/9 Review of actions, conclusions, preparation of WG report for the plenary

The final list of WG I actions and recommendations resulting from CGMS-42 deliberations is available [here](#).

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/2 Image 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 the 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/5 Precipitation 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/6 Atmospheric 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/7 Radio 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/8 Cloud 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 Cumulus 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/9 Ocean parameters

CGMS-42-CMA-WP-08 responds to action 41.10 and provides feedback on the GHR SST 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 GHR SST 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 JWGClimat 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 cgmsec@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.

WG III REPORT

Co-Chairs: Suzanne Hilding (NOAA), Peng Zhang (CMA)

Rapporteur: Jérôme Lafeuille (WMO)

WG III/0 Objectives

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

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

The meeting reviewed the status of actions from previous meetings. It noted that all seventeen actions were completed and closed, with the following exceptions:

- Action 38.40, related to atmospheric composition requirements, is in progress with the establishment of a dedicated task team by the Global Atmospheric Watch programme;
- Action 41.42, related to reformulation of the CGMS baseline, is underway with the contribution provided by **CGMS-42-WMO-WP-08**;
- Action 41.48, regarding the long term planning of active precipitation measurement, will be postponed to 2015 in order to best take into account the recent progress of the GPM-Core and CMA's plans for FY-3RM.

The Co-Chairs underlined the excellent progress made by the Working Group during the intersession period in completing these actions.

The meeting also reviewed the recommendations and agreed the following:

- Recommendation 41.14 on potential gaps should be closed and replaced by a new recommendation reflecting an updated risk assessment in light of the discussion of item III/2.2 ;
- Recommendations 41.16 and 41.17 can be closed, given the very good response received through the Early Morning Tiger Team;
- Recommendation 41.18 is addressed by an action in the HLPP and can be closed as a Recommendation.

The final status of the list of WG III actions and recommendations resulting from CGMS-41, following CGMS-42 deliberations is available [here](#).

WG III/2 Status of implementation of the CGMS baseline

WG III/2.1 Mapping of planned missions against the baseline

CGMS-42 WMO-WP-08 reports on a study performed by WMO with the aim of providing a draft list of FCDRs that CGMS members could commit to provide (in response to CGMS Action 41.43) as a step towards the inventory of FCDRs requested by CGMS-41 (WG III Action 41.12) and a subsequent gap analysis at the FCDR level. The outcome of the study is two-fold:

- (i) For each ECV, to produce a list of the FCDRs that can be generated from past, present and future satellite missions, with particular emphasis on CGMS baseline missions.

- (ii) This list should include basic characteristics, and periods of availability of individual satellite missions which have the potential to produce these FCDRs, based on the programmatic and technical information recorded by WMO in OSCAR.

The potential to deliver FCDRs from past, present, and future missions is evaluated on the basis of sensor and orbit characteristics and mission launch and end dates. It was stressed, however, that sensor availability and adequacy are necessary but not sufficient conditions to deliver FCDRs. The availability of the FCDRs should be stated by the agencies responsible for ensuring data availability and overall maturity of the data records. Quality evaluation should take into account the compatibility with relevant heritage instruments. The report was completed in consultation with the Expert Team on Satellite Systems (ET-SAT) and presented at the first meeting of the CEOS-CGMS Joint Working Group on Climate (Darmstadt, Germany, 5-7 March 2014).

The Chairman of the Joint CEOS-CGMS Working Group on Climate (JWGClimate) explained the information flow and the processes involved in the processing of satellite measurements into climate data records, which sets the scene for the work of the JWGC. The JWGC is currently focusing on the inventory of ECV products and intends to perform a gap analysis from the user end.

It was realised that the JWGClimate and Working Group III were pursuing a common goal – to identify the gaps and provide guidance to strengthen the climate monitoring system –with two complementary perspectives, however: while the JWGC is focusing on the ECV product processing chain the Working Group III is putting emphasis on the long term planning of sensor missions. Both approaches have merits and drawbacks. There was consensus on the point that the approaches could feed each other and help focus the attention on missions or products that pose the most critical challenges in terms of continuity.

WG III/2.2 Continuity issues, risk analysis

CGMS-42 WMO-WP-13 contains a review of the status of critical missions identified at CGMS-41 in the implementation of the CGMS baseline, as well as other potential gaps identified by different user communities. This was used as a guideline by WG III to update its assessment of risks and gaps. It was agreed that continuity was deemed to be ensured when a mission was operating successfully with planned follow-on (or firmly planned with a mature technology, for future missions), and the data were available in near-real time.

(a) Geostationary coverage over Indian Ocean

The current and planned missions of IMD/ISRO, ROSHYDROMET and CMA together have the potential to ensure robust coverage of the Indian Ocean. There is, however, a need to analyse how these plans supplement each other, what contingency arrangements can be established, what is the actual status of the missions, and to confirm that full resolution data are or will actually be available in near real-time. This was the reason for CGMS Action 41.38 calling for a medium-term strategy for ensuring Indian Ocean coverage with advanced geostationary imagery.

CGMS-42 CMA-WP-03 provided an update on Indian Ocean data coverage by Fengyun geostationary satellites. The Working Group noted the commitment of CMA to share openly all “essential data” with reference to WMO Resolution 40 (Cg-12) and discussed which data should be considered

“essential”. It recalled that Resolution 40 sees as essential “Those data and products from operational meteorological satellites that are agreed between WMO and satellite operators. (These should include data and products necessary for operations regarding severe weather warnings and tropical cyclone warnings)”. WMO was asked to provide guidance in this respect.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
WMO, CMA, EUM, ROSH, ISRO	WG III/2.2	A42.01	WMO to initiate a dialogue with Indian Ocean satellite operators and clarify which data are essential in the sense of Resolution 40, in view of the meteorological requirements in the region.	CGMS-43	OPEN	HLPP# 1.1.6

CGMS-42 ROSHYDROMET-WP-04 presents the status of Electro-L satellites for Indian Ocean coverage. Electro-L N1 is currently not fully functional. Electro-L N2 is planned for launch at the end of 2014 and will be located at 77.8°E.

CGMS-42 IMD-WP-01 presents the status of INSAT-3D, clarifying that the spacecraft was designed for five years of operation and that the plans included a follow-on.

CGMS-42 EUMETSAT-WP-26 presents a synthesis of the satellite capabilities available and planned in the near to medium-term and proposes a roadmap for the future provision of IODC (India Ocean Data Coverage) services. IMD confirmed its agreement to share the full resolution data from INSAT-3D and make them openly available via FTP in near-real time, but needs assistance for onward dissemination to the users. IMD therefore required the assistance of EUMETSAT to ensure dissemination. EUMETSAT agreed to work with IMD towards ensuring dissemination to EUMETCast users, which would be a significant first step. CMA indicated its readiness to relocate a spare FY-2 satellite (i.e. FY-2E) westwards after the successful launch and commissioning of FY-2G. It was further agreed that ROSHYDROMET could contribute to the regional capabilities supporting the DCS system.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
EUM, ISRO	WG III/2.2	A42.02	EUMETSAT and ISRO will address the technical issues to accommodate high-resolution half-hourly data from INSAT-3D on dissemination means.	CGMS-43	OPEN	HLPP# 1.1.6
WMO	WG III/2.2	A42.03	WMO to consider sending a request to CMA for moving FY-2D over the Indian Ocean after successful launch and commissioning of FY-2G.	CGMS-43	OPEN	HLPP# 1.1.6

(b) Geostationary coverage of Central and South America

The Working Group noted with appreciation that, in response to Action 41.39, NOAA had implemented an optimized scanning pattern on GOES-East as of May 2014, after consultation of the regional user community, as described in WMO-WP-09. During rapid scan events over the Continental United States, the optimised scanning pattern allowed two 2-minute windows to be accommodated every hour, covering most of the South American continent. Thanks to this mitigation scenario, the risk resulting from the termination of GOES-South America was considered closed. WMO thanked NOAA for its efforts to offer the best possible response to user needs.

(c) Transition to GOES-R in South America

WMO reported that users in South America were unlikely to be equipped with GRB stations in time given the uncertainties regarding the location (GOES-West or GOES-East) and the date (after storage or not) of the operational start of GOES-R. Users may not be able to plan an heavy investments without knowing when it will be required. There is thus a risk that the switch to GOES-R or GOES-S will result in a temporary disruption of the operational service for these users, instead of being a big step forward. WMO therefore invited NOAA to consider disseminating a subset of GOES-R data by a different means such as GEONETCast-America as a risk reduction measure for the users. (Note: this was also addressed in WG IV)

WMO also underlined NOAA's "Proving Ground" project as a remarkable initiative to prepare the use of a new generation satellite well ahead of its launch. WMO however echoed the concern of users about the possibility that the new GOES-R be put in storage after its commissioning, thus delaying significantly the realization of the benefits of this new system. It was therefore suggested that the acquisition of images and the dissemination of some data on a pre-operational basis be considered during an extended check-out period after commissioning, until the satellite is put in operation. The RA-III/RA-IV Coordination Group on Satellite Data Requirements could advise on the most relevant subset of data to be transmitted.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
NOAA	WG III/2.2	A42.04	NOAA to report at the first WG III Intersession meeting on its plans regarding the possibility of pre-operational dissemination of GOES-R data via e.g. GEONETCast-Americas both as a risk reduction measure and as a way to reap the earliest benefit of the new system.	30 Nov 2014	OPEN	HLPP# 1.1.6

(d) Geostationary infrared hyper-spectral sounding

There have been promising simulations of the use of geostationary hyper-spectral data for nowcasting. Some simulation experiments of NWP impact are also planned. However, there will be a

stronger case for the operational benefit of such novel sensors once FY-4A/GIIRS and MTG/IRS are demonstrated. Following the planned demonstration of hyper-spectral sensors on FY-4 and MTG-S, the implementation of such sensors remains an objective for the other geostationary sectors.

(e) Imagery and sounding on early morning orbit

CMA confirmed that substantial progress had been made to establish the feasibility to fly FY-3E and follow-on spacecraft on a 6:00 ECT orbit, tentatively in 2017, with a comprehensive sounding package. The decision for such a deployment of the FY-3 programme cannot be confirmed yet. Working Group III remained hopeful about this development which would be a major achievement towards a global, robust constellation of core meteorological missions

(f) Continuity of afternoon orbit primary missions

Continuity is normally ensured by NOAA on the afternoon orbit with the Suomi NPP mission, to be followed by JPSS-1/-2 on a 13:30 ECT orbit. NOAA indicated at earlier CGMS meetings a risk of a gap in transitioning from Suomi NPP to JPSS, and is investigating mitigation scenarios which include extending as much as possible the lifetime of Suomi NPP to avoid a gap and launching DMSP-20 on an afternoon orbit. The Working Group also recalled that CMA operates FY-3B, to be followed by other FY-3 spacecraft, nominally on a 14:00 orbit.

The Working Group agreed that the situation should be closely monitored to ensure a seamless transition.

(g) Radio-occultation

CGMS-42 EUMETSAT-WP-34 reports on the preliminary results of a study being performed by EUMETSAT through ECMWF on radio occultation/saturation. It was noted that it would be a significant benefit to NWP to ensure at least 16,000 globally distributed, occultations per day.

ISRO noted that a ROSA instrument is flying on Megha-Tropiques and Oceansat-2. It was also noted that issues with ROSA data processing were being addressed.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
ISRO	WG III/2.2	A42.05	ISRO to report at CGMS-43 on its progress on radio-occultation processing of ROSA on Oceansat-2 and Megha-Tropiques, and on the possibility of near-real time access to ROSA data acquired at a high latitude station such as Svalbard.	CGMS-43	OPEN	HLPP# 1.1.4
EUM	WG III/2.2	A42.06	EUMETSAT to review the schedule of its ECMWF radio-occultation study with the aim to deliver advanced results on the specific impact of the high-latitude COSMIC-2 constellation.	CGMS-43	OPEN	HLPP# 1.1.4

(h) Altimetry

As concerns the reference mission on high-precision orbit, Jason-2 will be followed by Jason-3 is planned for launch in March or April 2015. Sentinel-3A (22:00 ECT) is also planned for launch in 2015, followed by Sentinel-3B. The ISRO-CNES research mission Altika is operating successfully. When considering also the HY-2 series (6:00 ECT) of China's State Oceanic Administration (SOA), an operational constellation would be nominal as planned in the CGMS baseline, provided that HY-2 data can be globally available in near-real time.

Working Group III invited NOAA to give an update on the launch date of Jason-3 at the next inter-session meeting. It also encouraged EUMETSAT and SOA to pursue their high level dialogue to collaborate on the near real-time dissemination of HY-2 data. (See action in section (i) below).

(i) Active ocean surface wind measurement

CGMS-42-CEOS-WP-01 reviews the status of the scatterometer constellation, with a focus on sustainability of observations and timely access to data. It recalls the successful operation of OSCAT on Oceansat-2 until early 2014 and the great benefit to the user community of OSCAT data being available in near real-time through collaboration between ISRO and EUMETSAT. It however highlights that, following the loss of OSCAT, only ASCAT data from Metop-A and -B are currently available in near real-time. Since both Metop satellites are on the same orbit, there is now a lack of scatterometer data on a well separated orbital plane.

ISRO indicated that a fast-track project had been set up to launch a gap filler scatterometer named ScatSat.

CMA recalled that FY-3E (tentatively foreseen in 2017 on a 06:00 orbit) and FY-3F (tentatively foreseen in 2018 on an afternoon orbit) will fly a scatterometer.

EUMETSAT also recalled the ongoing high-level dialogue between EUMETSAT and SOA towards collaboration on the near real-time availability of HY-2 data, including scatterometer data.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CNSA, EUM	WG III/2.2	A42.07	EUMETSAT and CNSA to report at CGMS-43 on the progress of EUMETSAT-SOA collaboration on the dissemination of HY-2 data in near real time.	CGMS-43	OPEN	HLPP# 1.1.3
EUM, ISRO	WG III/2.2	A42.08	ISRO and EUMETSAT to report at CGMS-43 on their discussions on data dissemination collaboration for SCATSAT data.	CGMS-43	OPEN	HLPP# 1.1.3

(j) Active global precipitation measurement

Working Group III commended NASA and JAXA for the successful launch and early in-orbit testing of the GPM-core observatory. It also looked forward to the Fengyun-3 Rain Monitoring (FY-3 RM) mission planned by CMA. With these developments in mind, active precipitation measurement could be considered as a possible candidate for the CGMS Baseline in the future.

The Working Group agreed to **maintain Action 41.18** (WG III to investigate the long-term planning of space based observation for global precipitation measurements and liaise as appropriate with the CEOS Precipitation Constellation) with a new deadline set for CGMS-43.

(k) Earth Radiation Budget

The Working Group noted the progress of ERB measurement missions within the Suomi NPP, JPSS, FY-3, Megha-Tropiques and Electro-L/-M programmes. It supported the view that a detailed review would be needed to confirm the comparability of planned sensors (for both broadband upward component and solar irradiance) with heritage sensors.

(l) Limb sounding

The need was identified in previous meetings of limb sounding missions to provide high-vertical resolution of temperature, humidity, wind, aerosol, ozone and other trace gas observations in the stratosphere and mesosphere. A gap is anticipated with the unavoidable termination of several R&D missions (EOS/AURA, SCISAT, TIMED, ODIN) in the coming years. OMPS-limb is on Suomi NPP and foreseen on JPSS-2 but not JPSS-1.

A future objective should be to implement and maintain limb sounding missions in various spectral bands (UV, VIS, IR, MW). The newly created task team on atmospheric composition requirements is expected to provide guidance in this respect.

Concluding the discussions of agenda item WG III/2.2, it was decided to amend CGMS-41 Recommendation 41.14 as follows:

CGMS-42 recommendations - WG III						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS satellite operators	(WG III/2.1 CGMS-41) WG III/2.2	R41.14	CGMS Satellite Operators to address the anticipated or potential gaps identified by WG III, in particular: <ul style="list-style-type: none"> • infrared and microwave sounding on the early morning orbit, • geostationary coverage of Indian Ocean • hyperspectral sounding missing in some geostationary sectors • ocean surface wind by scatterometry • long-term follow-on of radio-occultation constellation, • global precipitation measurement 	(CGMS-43)	OPEN	HLPP#1.1

			precipitation radar follow-on mission, • long-term Earth Radiation Budget monitoring • limb sounding for high-vertical resolution observations in the stratosphere and mesosphere (of temperature, humidity, wind, aerosol, ozone and other trace gases).			
--	--	--	---	--	--	--

WG III/3 Space-based observing system review and optimisation

In response to an action from CGMS-41, NOAA provided the CGMS-41-NOAA-WP-27 paper on the benefits of the VIIRS Day Night Band (DNB). The low-light sensor is carried on the Suomi NPP 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. The benefits of the DNB include the ability to observe environmental phenomena at night; obtain 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.

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

In a remote presentation of **CGMS-42-CEOS-WP-02**, Gary Corlett, Coordinator of the Group for High Resolution Sea Surface Temperature (GHRSSST), provided a status report on the SST constellation. He pointed out that observing capabilities should be strengthened in particular as concerns microwave imagery (only provided by GCOM-W/AMSR-2 in the low frequency band) and multi-angle viewing infrared radiometry (following the loss of ENVISAT/AATSR). He also stressed the requirement of the GHRSSST community to adopt netcdf CF convention formats for Level 2 SST data and invited actual or potential providers of such data to join the Working Groups where this is discussed.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CMA, ROSH	WG III/3	A42.09	CMA and ROSHYDROMET to provide points of contact for possible participation in GHRSSST.	31 Aug 2014	OPEN	-

In a remote presentation of **CGMS-42-CEOS-WP-03**, Stewart Bernard, Chair of the International Ocean Colour Coordinating Group (IOCCG), provided a report on the Ocean Colour Radiometry Virtual Constellation (OCR-VC). He emphasised that the IOCCG was aiming at ocean colour measurement continuity, consistency and at the development of operational services.

Working Group III noted that the CGMS baseline did not specify in detail what capabilities should be maintained to monitor ocean colour. Therefore the needs raised by the OCR-VC are therefore not identified as a gap in implementing the baseline, but should rather be considered as an input for a possible update of this baseline.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CEOS OCR-VC	WG III/3	A42.10	OCR-VC Chair to provide feedback on the CGMS Baseline, and suggest more specific provisions addressing the needs of ocean colour monitoring, if relevant, for consideration by CGMS.	CGMS-43	OPEN	HLPP# 1.1.6

WG III/4 Integration of R&D missions (research to operations transition)

In **CGMS-42-NOAA-WP-28**, NOAA responds to the request from CGMS-41 to report on its activities towards transitioning mature R&D missions to an operational status. NOAA summarises the operational and research satellites used by NOAA in Numerical Weather Prediction models. NOAA uses the Joint Center for Satellite Data Assimilation as its primary test bed for developing new science for taking advantage of new research satellite data. In addition to preparing for the latest advancements in NOAA satellites, the Joint Center is preparing to take advantage of the latest research satellite capabilities expected to have a major impact on Numerical Weather Prediction. NOAA highlights its highest priorities for research satellite data and then touches on the hurdles to overcome when new types of data are assimilated into weather models. Lastly NOAA is incorporating new research data into weather models, warnings and forecasts to benefit society through reduced loss of life and property, improved understanding of short-term and long-term climate change and contributions to better planning and decision making.

Working Group III acknowledged that promoting the operational use of advanced sensor data, and communicating on the operational benefit of such new missions, was an important aspect of the transition phase from R&D to operations.

WG III/5 Socio-economic benefits of space missions

In **CGMS-42-NOAA-WP-19**, Charles Wooldridge of NOAA provides a status report on the activities of the CGMS Socioeconomic Benefits Tiger Team (SETT). In the first year of the Tiger Team, three of the seven milestones/activities in its Terms of Reference were fully completed (*Tiger Team has been established; relevant studies and activities compiled; expertise identified and a first workshop held to identify and discuss key applications and case studies*). WG III was briefed on the results of the April 2014 workshop and the future work plan of activities. According to the work plan, SETT will finalise the workshop report and develop a 2-to-3 page information paper to provide to CGMS members. SETT will also work to develop an example of the macro approach on weather satellites and drill down to the micro case study to demonstrate a focused concrete example of the value of information. For the longer term, SETT will identify opportunities to incorporate best practices and integrate these into additional or subsequent member studies. Finally, prior to CGMS-43 SETT will prepare a recommendation for future activities and plan a keynote on Socio-economic benefits at

CGMS-43. Mr. Wooldridge noted that he will give a report on SETT to the June 21 2014 WMO Consultative Meeting on High-level Policy on Satellite Matters. SETT plans to hold its next workshop in autumn 2014 in the Washington DC area.

CGMS-42 actions - WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
NOAA	WG III/5	A42.11	NOAA to communicate to WG III the link to the information material collected by the Tiger Team.	31 Aug 2014	OPEN	HLPP# 4.1.1
NOAA	WG III/5	A42.12	NOAA to report at the first inter-session web meeting of WG III on the progress of the SETT.	30 Nov 2014	OPEN	HLPP# 4.1.1
NOAA	WG III/5	A42.13	NOAA to circulate to WG III the 2-3 page report on socio-economic benefit to be produced by the SETT.	30 Apr 2015	OPEN	HLPP# 4.1.1

WG III/6 Review and updating of the HLPP

With respect to **CGMS-42-CGMS-WP-07**, Working Group III agreed on a rewording of the first objective of the CGMS High Level Priority Plan 2014-2018, with the aim of giving greater visibility to the three-orbit core meteorological constellation.

WG III/7 Any other business

No other business was raised.

WG III/8 Planning of inter-sessional activities/meetings

The Working Group agreed to schedule two inter-sessional web meetings at dates still to be determined:

- Q4 2014
- Q1 2015

It was strongly recommended that all CGMS members nominate a representative who will participate in the inter-sessional working group meetings.

WG III/9 Review of actions, conclusions, preparation of WG report for the plenary

The final list of WG III actions and recommendations resulting from CGMS-42 deliberations is available [here](#).

WG IV REPORT

Working Group IV (WG IV) on Global Data Dissemination held its session on Monday, 19 May 2014, at 14:40-18:30 and on Tuesday, 20 May, at 08:30-09:00. Vasily Asmus, ROSHYDROMET and Jae-Dong Jang, KMA served as co-Chairs and Klaus-Peter Renner from EUMETSAT as rapporteur.

Representatives of the following organisations attended the session: CMA, CNSA, EUMETSAT, IMD, ISRO, JMA, KMA, NOAA, ROSCOSMOS, ROSHYDROMET and WMO, and from Environment Canada, GEO and KARI as Observers (the list of participants is included in the Annex).

The agenda proposed by the CGMS Secretariat was adopted with the following modifications:

The working paper “CGMS-42-EUMETSAT-WP-30” was moved to agenda item WG IV/6. The working paper “CGMS-42-JMA-WP-09” planned for E.2.1 was also presented under WG IV/5.

Two presentations were provided online using WEBEX and were therefore scheduled at fixed times. The sequence of the agenda was therefore interrupted at the times of these WEBEX sessions and resumed afterwards.

WG IV/0 Objectives

The objectives of WG IV were recalled, with the agenda following closely the relevant CGMS HLPP sections.

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

Actions: After CGMS-41, a total of 17 Actions were open, 10 closed, and seven remain open.

The final status of the list of WG IV actions and recommendations resulting from CGMS-41, following CGMS-42 deliberations is available [here](#).

WG IV/2 Global DVB satellite services

CGMS-42 NOAA-WP-20 NOAA presents future enhancements of the GEONETCast Americas system. The plans for the future include:

- Expansion of the GEONETCast Americas product suite to Include provision of spatial data format imagery files;
- Dissemination of products to support the WMO Coordination Group on Satellite Data Requirements (SDR) for RAIII and RA IV;
- Continued and increased participation in the [International Charter Space and Major Disasters](#) as an Alternative Dissemination Method;
- GEONETCast Americas An Alternative Dissemination Method for the ISCS RA-IV RMTN GIFS system;
- Increased use of the training channel and partnership with the VLab; and
- Continued discussion with INPE on increased GEONETCast Americas bandwidth

WMO inquired about user support during the transition to GOES-R using GEONETCast Americas. NOAA explained that it will assess the possibility of including a subset of the GOS-R/S in GNC-A but

must consider the best options or the data format versus the data content. (See also response to WG IV/2 Recommendation 41.2 above).

WG IV/3 Incorporation and dissemination of R&D and pre-operational mission data

CGMS-42-EUM-WP-28 EUMETSAT presented a summary of ongoing activities in the area of Third-Party Data Services. The document is structured in two parts – an assessment of the Third-Party Data Services under consideration, and a summary of the status of currently ongoing Third-Party Data Service implementation activities, excluding those implemented on the request of Copernicus.

ROSHYDROMET recalled that the position of Electro-L №2 will be 77.8° E.

The correction was noted.

CGMS-42 NASA-WP-03 NASA's Land Atmosphere Near real-time Capability for EOS (Earth Observing System) (LANCE) provides global data and imagery from the Atmospheric Infrared Sounder (AIRS), Microwave Limb Sounder (MLS), Moderate Resolution Imaging Spectroradiometer (MODIS) and Ozone Monitoring Instrument (OMI) instruments in less than three hours from satellite observation to meet the needs of the near real-time (NRT) applications community. On an average day, over 2 TB of NRT products (data and imagery) are downloaded from LANCE. Demand for these products comes from applications users, operational agencies and scientists to support NRT research and applications in weather prediction, monitoring of natural hazards, agriculture, air quality, disaster relief and homeland security.

The working paper could not be presented in person due to the absence of NASA participants. Further discussion did not take place.

WG IV/4 Coordinated dissemination services

WG IV/4.1 Disaster mitigation purposes

In **CGMS-42 CNSA-WP-07**, CNSA presented a multi-satellite integrated remote sensing application system. The remote sensing technology is used to produce environment and disaster information quickly and accurately. The report introduces data fusing and subdivision technologies, the processing and analysis system, and particular applications of the remote sensing system.

The working group took note of the presentation.

WG IV/4.2 Ocean user community

In **CGMS-42-EUM-WP-29**, EUMETSAT presented a report on the International Ocean Colour Science Meeting 2013 which was held in Darmstadt, Germany, on 6-8 May 2013. The meeting was convened by the International Ocean Colour Coordinating Group (IOCCG), and sponsored by EUMETSAT, NASA, ESA and CNES. During the meeting, a splinter session on "Satellite Data File Formats and Tools for Easy Science Exploitation" was held. This paper presents a summary of the discussions and recommendations formulated for each of the themes covered. It was already presented at CGMS-41 as paper CGMS-41 EUM-WP-14 to WG II. The working group broadly endorsed the conclusions and recommended that the topic be addressed at CGMS-42 in WG IV.

Following the recommendation from the paper, an action was proposed by the working group:

CGMS-42 actions – WG IV						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG IV/4.2	42.01	CGMS members producing ocean colour products to comment on the 2 recommendations given in CGMS-42-EUM-WP-29: <ul style="list-style-type: none"> - to adopt netCDF4/CF for their ocean colour data; - to support large volume, batch data access and download (e.g., through established means such as ftp/http), as well as more targeted access through protocols such as REDDS/OpenDAP 	CGMS-43	OPEN	HLPP#2.5

WG IV/5 Global data exchange from next generation GEO satellites

CGMS-42 ROSHYDROMET-WP-05 ROSHYDROMET presented an overview of satellite data exchange mechanisms in ROSHYDROMET, including participation in the EUMETSAT Advanced Retransmission Service (EARS) and FTP access to near real-time Electro-L data.

ROSHYDROMET informed the working group that the nominal operation of Electro-L №1 was suspended earlier this year due to satellite problems. It is at the moment unclear when operations can be resumed.

In addition to the agenda, the following presentations were made under this session:

CGMS-42-JMA-WP-9 JMA presented an update on Himawari-8/9. All imagery derived from Himawari-8/9 will be distributed to NMHSs via an Internet cloud service. JMA also plans to start the HimawariCast service, which will disseminate primary sets of imagery to NMHSs via a communication satellite using DVB-S2 technology.

The Internet cloud service will mainly provide Himawari Standard Data which will be used to create all products related to Himawari-8/9 as master data from all 16 bands with the finest spatial resolution. JMA plans to start test operation of the service in Q1 of 2015 with distribution of Himawari-8 in-orbit-test imagery.

The core data of the HimawariCast service will be HRIT files which are compatible with the current MTSAT series HRIT service. These will feature five bands near the current MTSAT observation bands. Dissemination will further include meteorological data other than Himawari imagery in SATAID format. JMA plans to start the service in early 2015 when MTSAT-2 is still in operation. MTSAT-2 imagery will be disseminated through this service in parallel with direct dissemination via MTSAT-1R until Himawari-8 becomes operational in the middle of 2015, after which Himawari-8 data imagery will be disseminated via the service.

An online presentation of the INSAT 3D WEB Portal available at <http://www.imd.gov.in/section/satmet/dynamic/insat.htm> was given by IMD, showing the complete set of products available from the Internet. Access for users worldwide is possible after registration.

Extract of **CGMS-42-KMA-WP-01** KMA presented the dissemination aspects of Geo KOMPSAT-2A. The baseline data broadcast policy for GeoKOMPSAT-2A is to disseminate from all 16 channels data of meteorological observations in Ultra HRIT (tentatively named UHRIT) and to maintain H/LRIT broadcast corresponding to COMS' five channels. Downlink frequencies in L-band, S-band and X-band are proposed at the moment.

Responding to WMO's question about which data would be available by what downlink, KMA explained that this will be decided later depending on the response by ITU on the frequency selection.

WG IV/6 Development of coordinated approach for compression of data, incl. geographical location, from high-resolution imaging instruments

CGMS-42-EUM-WP-30 EUMETSAT presented a paper to accommodate efficient compression of regional LEO satellite data. During the implementation of the EUMETSAT provided VIIRS regional service a need was identified to develop a Compact VIIRS SDR product format (Level 1) to achieve a cost efficient distribution of the VIIRS data via EUMETCast, EUMETSAT's satellite-based data distribution system.

The main use case is expected to be that VIIRS data distributed via EUMETCast in the compact SDR format is converted back to the original VIIRS SDR format for further processing and visualisation by the service users.

However, tools are currently under development by third parties for visualising and utilising the data directly from the compact VIIRS SDR format without first reconstructing the original VIIRS SDR format. The size of the resulting compact VIIRS SDR product is a third of the original VIIRS SDR product, making the real-time dissemination via EUMETCast affordable.

This paper provides an overview of the Compact VIIRS SDR Product Format and proposes that it be generalised to serve as a compact format for all advanced imagers of current and planned polar-orbiting satellites.

ROSHYDROMET proposed applying the same approach to geostationary data. EUMETSAT replied that the compression characteristics are typical for these instruments and one needed to be cautious before generalising the result, adding that such an approach would need to be analysed.

The following action was proposed by the working group:

CGMS-42 actions – WG IV						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG IV/6	A42.02	CGMS members are invited to comment on the work done in the context of the EUMETSAT provided VIIRS Regional	CGMS-43	OPEN	HLPP#2.7

			Service, and to provide feedback on the proposal to define a standardised compact product format, generalised to cover the advanced imagers of the current and planned polar orbiting satellites.			
--	--	--	---	--	--	--

WG IV/7 Contribution to the WIS infrastructure incl. RMDCN

CGMS-42 WMO-WP-18 WMO presented a paper on the WIS. Seven centres are registered in the WIS as specialist satellite centres. Satellite operators, not registered as separate WIS centres, are expected to register the information they publish through, for example, National Meteorological and Hydrological Services.

WIS relies on WIS Discovery Metadata records for users to discover, access, and retrieve information, and for managers of the WIS system to handle information correctly. Although there are over 3,500 satellite-related WIS Discovery Metadata records available through the WIS, the overwhelming majority are still associated with Global Telecommunications Systems bulletins. Satellite operators are therefore strongly encouraged to provide WIS metadata records for the information they provide to users.

WIS, unlike the Global Telecommunications System, is not limited to near real-time exchange of products to fixed distribution lists. WIS also allows data providers to publish details of information that is delivered directly from the data providers' systems, such as interactive downloads or through web services.

The working group recognised the need for and agreed to the recommendation made in the paper:

CGMS-42 recommendations – WG IV						
Actionee	Rec	#	Description	Deadline	Status	HLPP ref
CGMS space agencies	WG IV/7	R42.01	Satellite operators to provide WIS Discovery Metadata Records, compliant to WIS requirements and following the guidance to be provided by the CGMS-WMO Task Force on metadata implementation, in order to facilitate satellite information discovery and access	(CGMS-43)	OPEN	HLPP#2.9

WMO presented a new Integrated Global Data Dissemination Strategy (**CGMS-42-WMO-WP-21**). A comprehensive overview of the following topics was given:

- IGDDS background and expected benefits to WMO members
- Challenges and opportunities
- IGDDS reformulation (vision and strategic targets)
- IGDDS strategic activities, status and proposed actions

- IGDDS oversight and role of CGMS

Following the recommendation given in the paper, an action was proposed by the working group:

CGMS-42 actions – WG IV						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG IV/7	A42.03	CGMS members to comment on the IGDDS vision, and to provide feedback to WMO (jlafeuille@wmo.int)	CGMS-43	OPEN	HLPP#2.8

WG IV/8 Coordination of metadata for satellites and instruments

WG IV/8.1 Task force on metadata

In **CGMS-42 EUM-WP-32**, EUMETSAT presented the background and planned activities for the task force on metadata. During CGMS 40, EUM-WP-15 “Facilitation of satellite data exchange under WMO WIS” recommended an increased involvement by satellite data providers in the WMO Information System (WIS).

As a resulting action, it was decided to create a CGMS-WMO Task Force on Metadata implementation allowing satellite providers to provide consolidated views on metadata definition. The main mission of the Task Force is to address and coordinate the development of relevant WIS metadata records authorising users to efficiently discover satellite products in the WIS catalogues.

This document presents the Terms of Reference of the CGMS-WMO Task Force as well as its relation with its WMO counter-part, the Inter-Program Expert Team on Metadata and Data Representation Development (IPET-MDRD).

As proposed in the presentation and to allow the immediate start of the task team, the working group elected the co-Chairs, Virendra Singh, IMD, as Chair and Guillaume Aubert, EUMETSAT, as co-Chair.

WG IV/9 Data access portals, harmonisation between different portals

CGMS-42 WMO-WP-10 provides an update on the development of the WMO Product Access Guide (PAG), an online resource maintained by WMO:

- to facilitate access by users to satellite-based geophysical products,
- to enhance the visibility of products, and
- to provide guidance on these products where possible.

A refined PAG concept (v1.0) was endorsed by the WMO Expert Team on Satellite Utilization and Products (ET-SUP) in April 2014. The PAG data model (“tag tree”) now also accommodates products from non-satellite sources, such as from ground-based radar and aircraft. This is in line with the WIGOS objective (WIGOS IP Action 7.2.2). The PAG will be registered as a resource in the WIS.

A new online implementation of the PAG, finalised in late 2013, is now available (<https://www.wmo-sat.info/product-access-guide>) and was shown during the session.

As per Action 41.58, feedback by CGMS is particularly necessary on the criteria stipulated in the PAG concept for online product collections maintained by CGMS members to be visible in the PAG: These require stable URLs pointing to variable-specific product collections, and a minimum set of information (metadata) provided to guide users.

ET-SUP recommended that when fully populating the PAG the CGMS operators should be the first choice to be considered. The overall success of the PAG is dependent on the ability, willingness and technical means of providers (i.e. CGMS operators) to comply with the functional requirements, and to make changes if necessary to achieve such compliance.

A new action was proposed by the working group to support the population of the PAG:

CGMS-42 actions – WG IV						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG IV/9	A42.04	CGMS members to nominate focal points that would work with the WMO Secretariat in populating the PAG, initially for one year; such nomination could take into account current membership of the WMO Expert Team on Satellite Utilization and Products (ET-SUP). WMO: Stefan Bojinski bojinski@wmo.int	15 Jul 2015	OPEN	HLPP#5.3

CGMS-42 WMO-WP-20 WMO presented a paper on a new Satellite User Readiness Navigator online portal. The new generation of meteorological geostationary satellites being launched by CMA, EUMETSAT, ISRO, JMA, KMA, NOAA and ROSHYDROMET before the end of this decade will provide unprecedented capabilities for key weather applications and for a number of developing application areas, but will also present unprecedented challenges for users worldwide. A major challenge is the order-of-magnitude increase in the amount of data and products that will be generated from the advanced imagers and sounders on-board the satellites. In addition, novel data types drive the need for advanced interpretation and assimilation techniques and implementing these new techniques into operational schemes.

At CGMS-41, CGMS established the following high-level priority cross-cutting area: “5.3 Prepare operational users for new generation of geostationary meteorological satellites through user readiness programmes, with coordinated contributions from CGMS members”

In response to this priority, the WMO Space Programme, with the support of CGMS member agencies, is developing the online portal SATURN (SATellite User Readiness Navigator) to provide a single point of access for all information pertinent to global user community preparations for the new generation of satellites. The support of CGMS members to achieve this goal is essential, and therefore CGMS has established a task team of agency focal points to provide content for the portal. Access to the portal is planned to be opened in June 2014.

A key element of the portal is a Reference User Readiness Project, which is intended as a “best practice” guiding CGMS members to provide content for the SATURN portal. The draft scope and timeline of this project was provided for review by CGMS satellite operators.

The working group acknowledged the effort for a “one stop shop” for users regarding the new generation of satellites and proposed the following action:

CGMS-42 actions – WG IV						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
CGMS members	WG IV/9	A42.05	CGMS Members to provide detailed comments on the Reference User Readiness Project to WMO (sbojinski@wmo.int)	CGMS-43	OPEN	HLPP#5.3

WG IV/10 User dialogue and interface

WG IV/10.1 Response to region-based requirements for satellite data access and exchange

CGMS-42 EUM-WP-33 EUMETSAT presented its activities on region-based requirements for satellite data access and exchange in WMO RA I, RA II and RA VI. In line with its strategic objective to “Extend the user base for EUMETSAT data, products and services in EUMETSAT Member and Cooperating States and in WMO Members”, EUMETSAT undertakes activities related to data access in various WMO regions, in particular WMO RA I and RA VI and to a lesser extent in RA II, RA III and RA IV.

The region-based requirements for these regions are usually discussed through dedicated groups or events. For example, the WMO RA I Dissemination Expert Group plays a key role determining data access requirements within the region. Its recommendations are presented at the biennial EUMETSAT User Forum in Africa, reported on in WMO meetings and taken into account in various collaboration projects. In WMO RA VI (for countries which are not EUMETSAT Member or Cooperating States), requirements are discussed during information days. The requirements gathered are channelled into the user feedback management process.

A number of the activities developed to promote operational data access are implemented through projects, e.g. EU funded AMESD and MESA for WMO RA I and EUMETSAT and partner funded DAWBEE for WMO RA VI and SADCA for the WMO RA II. These projects can encompass infrastructure deployment or maintenance and training activities.

CGMS-42 JMA-WP-03 JMA presented the progress in the RA II WIGOS project to develop support for NMHSs in satellite data, products and training. This paper outlines the background and mission of the WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training, and also details related recent accomplishments.

CGMS-42 WMO-WP-09 The Coordination Group on Satellite Data Requirements in Region III (South America) and Region IV (North America, Central America and the Caribbean) has made progress in:

- providing consolidated feedback to NOAA on implementing an optimised imager scanning schedule for GOES-13 (GOES-East), mitigating the loss of the decommissioned GOES-South

America; NOAA plans to implement the optimised GOES-13 schedule, ensuring at least hourly temporal geostationary coverage of most of South America, on 6 May 2014 at 16.00 UTC;

- identifying detailed user requirements for data access and exchange and related challenges in the region through a user survey.

Formal endorsement of the group by the WMO RA III, which meets in September 2014, is pending. RA IV endorsed the Group at its 16th session in 2013.

NOAA and EUMETSAT support of the work of this group has been critical and should continue.

WG IV took note and appreciated the progress on the responses to region-based requirements for satellite data access and exchange.

WG IV/11 Review and updating of the HLPP

In **CGMS-42 CGMS-WP-07**, the CGMS Secretariat presented the status and a proposed update of the CGMS High Level Priority Plan (HLPP) as part of the agreed revision cycle of the HLPP. 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 of a four-year work plan for climate by the JWGClimate;
- Other revisions identified by WG Chairs and co-Chairs.

The Status of implementation of HLPP 2014-2018 (Version 2) and the proposed updated High-Level Priority Plan 2014-2018 (Version 3, including track changes) are provided as an Annex to the paper.

After discussion the working group concluded that all HLPP items covered by WG IV are still considered relevant and important (none of them are obsolete or complete). The working group also agreed to the updated HLPP.

WG IV/12 Any other business

There were no items.

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

Two inter-sessional meetings are planned:

Q4 2014: Joint WG I/IV inter-sessional meeting on the analysis of the LRIT/HRIT Global Specification by CGMS members’ focal points.

Q1 2015: WG IV inter-sessional meeting to review actions and to prepare the CGMS-43 agenda.

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

The final list of WG IV actions and recommendations resulting from CGMS-42 deliberations is available [here](#).

The co-Chairs thanked the participants and the WG IV session was closed at 09:00 on Tuesday, 20 May 2014.

AD-HOC MEETING ON SPACE WEATHER REPORT

Chair: Suzanne Hilding (NOAA)

Rapporteur: Jérôme Lafeuille (WMO)

The ad-hoc meeting on Space Weather convened on Wednesday, 21 May 2014.

The ad-hoc group (see list of participants in the CGMS-42 report Annex) reviewed the proposed Terms of Reference for CGMS Space Weather Activities (see below) and recommended their endorsement by the CGMS-42 plenary. The ad-hoc group further recommended that, at CGMS-43, space weather activities be addressed within Working Group III, Global Continuity and Contingency Planning.

Proposed Action: CGMS Members to establish an implementation team with the task of defining detailed objectives for the implementation of CGMS space weather activities as defined in the ToR. In particular, the implementation team should propose objectives to be included in the HLPP, for instance:

- i. Include space-based observation data space weather in WIS.
- ii. Define and implement a procedure for reporting on spacecraft anomalies caused by space weather.

As per CGMS Action 41.15, CGMS Members have nominated “points of contact to work with WMO/ICTSW in order to define jointly a procedure to improve the collection, availability, and use of satellite anomaly information.” The points of contacts are: "Xiaoxin Zhang and Jianguang Guo (CMA); Mike Williams (EUMETSAT); Yasushi Izumikawa (JMA); Inchul Shin (KMA); Elsayed R. Talaat (NASA); Jérôme Lafeuille (WMO). Since this joint work between satellite operators and space weather centres has not yet started, it is still time to nominate points of contact. It was therefore agreed that a reminder for Action 41.15 be resent by the CGMS Secretariat with a new due date of 30 September 2014, to allow CGMS satellite operators to join this team, or to validate or update their participation. (The action has been included in the list of CGMS-42 WG III actions and recommendations).

The following action was assigned to these points of contact for satellite anomaly information, in collaboration with WMO/ICTSW, to jointly define a procedure for reporting on spacecraft anomalies attributed to space weather, taking into account the guidance from the ad-hoc meeting on space weather (see below), in particular as concerns the content of information to be shared, the frequency of reporting, the practicality of information collection, and the use of this information.

In order to facilitate communication and collaboration, the following actions were agreed:

CGMS-42 actions – Ad hoc Space Weather for WG III						
Actionee	Action	#	Description	Deadline	Status	HLPP ref
WMO	Ad hoc space weather for WG III	A42.16	WMO to establish an e-mail list server for CGMS Space Weather activities (including CGMS members and associated organisations)	30 Sep 2014	OPEN	HLPP# 5.2.1
CGMS members	Ad hoc space weather for WG III	A42.17	CGMS Members interested in space weather activities to indicate to the CGMS Secretariat their points of contact for inclusion into the e-mailing list.	30 Sep 2014	OPEN	HLPP# 5.2.1

TERMS OF REFERENCE FOR CGMS SPACE WEATHER ACTIVITIES

Background

Considering the significant impact of Space Weather events on the integrity of spacecraft;

Recognizing the contribution of CGMS Members to Space Weather observation, e.g. in operating space environment monitors, solar imagers, and GNSS radio-occultation sensors;

Noting that the WMO Congress has recognized Space Weather as one area of activity of the WMO Space Programme;

Noting that the WMO Executive Council has highlighted the need for coordination to maintain the continuity of satellite-based solar, solar wind and other space weather measurements;

Noting that in spite of several international initiatives there is no established mechanism to coordinate global efforts for space-based Space Weather observation;

Recalling the CGMS High Level Priority Plan to “Establish a coordinated approach to the monitoring of space weather and the reporting of space weather-related spacecraft anomalies”;

The CGMS agreed at its 41st meeting to develop the Terms of Reference for future CGMS Space Weather activities.

CGMS objectives for Space Weather

The overarching goal of CGMS Space Weather activities is to support the continuity and integration of space-based observing capabilities for operational Space Weather products and services.

This includes:

1. Keeping abreast of major user interests in operational Space Weather products and services (e.g. for spacecraft operations, aviation, energy, disaster management) and the related

requirements for space-based observations that can be addressed by CGMS Members, in particular those space weather requirements expressed by WMO¹;

2. Evaluating existing operational space weather products and services in support of spacecraft operations, and recommending additional services as appropriate;
3. Encouraging Space Weather monitoring missions either through dedicated satellites or through hosting space weather payloads aboard weather and climate monitoring satellites as technically appropriate;
4. Supporting when relevant the dual use of sensors such as GNSS radio-occultation receivers that provide essential information for weather/climate monitoring and ionosphere monitoring;
5. Fostering orbit coordination, on-orbit sensor calibration and harmonisation of operational Space Weather sensors and data formats with a view to ensure interoperability and data consistency;
6. Reporting on spacecraft anomalies and sharing the results of anomaly resolution and analyses;
7. Pursuing global coordination of the operational Space Weather observing constellation, with a view to help sustain future observing capabilities as CGMS has done successfully for terrestrial weather and climate observations, encouraging complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning,
8. Communicating on socio-economic benefits of space weather prediction with policy makers, the public, and the non-technical community.

Partnership

In pursuing these objectives, CGMS recognises the complementary roles of the activities of its members and other international organisations or initiatives such as the International Space Environment Service (ISES), and the Committee on Space Research (COSPAR) Panel on Space Weather. It promotes partnership with these initiatives with a view to optimize overall efforts.

¹ Currently ICTSW, established by CBS and CAeM

COLLECTION OF INFORMATION ON SPACECRAFT ANOMALIES CAUSED BY SPACE WEATHER

- **What is the purpose of sharing this information within CGMS?**

The main purpose of sharing spacecraft anomaly information is to provide feedback to space weather centres on the context and the extent of spacecraft anomalies, for verification of space weather forecasts, and to document climatology of space weather impacts on spacecraft.

Although detailed feedback on spacecraft anomalies is also essential for industry to understand spacecraft behaviour, and to improve spacecraft design and protection, this is not the driving requirement. Spacecraft anomalies are generally very satellite specific, and their technical details are best addressed either bilaterally between satellite operators and industry, or within IEEE in the context of the development of industry standards.

- **Detailed information is required in the CGMS-ICTSW template: Is all that information relevant for space weather analysts? Is such a level of detail necessary?**

It is recommended to keep the information simple. There is no evidence that the details on, for example, spacecraft coordinates and velocity are relevant for space weather forecasters. The template should be reviewed and simplified in discussion among space weather centres and CGMS satellite operators.

- **Is there any difficulty in sharing this information and making it public?**

CMA has no issue with the unrestricted sharing of information on its spacecraft anomalies.

JMA wishes to clarify that the scope of information to be shared is only those anomalies that are assumed to be caused by space weather events. Furthermore, this should only be considered after completion of the in-orbit testing phase.

NOAA has no issue with sharing information on its spacecraft anomalies.

KMA indicates that information on anomalies is collected by KARI, which is responsible for controlling the spacecraft, so it will consult KARI to check what information can be shared.

ROSCOSMOS confirms that spacecraft anomaly information is important and interesting for many parties. However, detailed information on spacecraft status and location is classified and thus cannot be shared.

- **How is the information going to be used? By whom?**

Clarification is required on whether it is sufficient to provide an annual report, or more frequent updates are necessary. On the one hand, it may take several months to analyse an anomaly and confirm that it is caused by space weather, but such a delay may be acceptable for climatology purposes. On the other hand, quick feedback on anomalies would be useful for forecasters for forecast validation purposes, and for operators to support operational response to anomalies. It is suggested to share the information with space weather centres as soon as the origin of the space weather is confirmed.

- **What will be the benefit for satellite operators?**

As a verification loop, providing feedback on space weather related anomalies would contribute to better confidence in the forecasts.

As concerns the detailed impact on spacecraft, there is little interest in anomalies occurring on satellites of other operators, unless they are correlated with anomalies on their own satellites. The main benefit is in helping to understand the status of the spacecraft. Satellite operators might not take operational decisions on the basis of space weather forecasts (as their reliability is not yet demonstrated with a sufficient level of confidence), but use space weather information to analyse anomalies a posteriori, identify the root cause and determine possible responses.

ANNEXES

Statements during the opening ceremony	122
List of plenary participants.....	125
List of Working Group participants.....	128

The annotated agenda and Working Papers (WPs) can be found at

<http://cwpt.eumetsat.int/CWPT/views/agendaext.jsf>

Information on points of contact and list servers can be requested from the CGMS Secretariat

CGMSSec@eumetsat.int

Other information such as the CGMS Charter, and the current list of Members and Observers are available at <http://cgms-info.org>

STATEMENTS IN OPENING CEREMONY

Dr ZHENG Guoguang, Administrator, CMA

Distinguished Mr. Alain Ratier, Head of CGMS Secretariat,

Distinguished representatives,

Ladies and gentlemen,

First of all, I would like to welcome you to participate in the forty-second plenary session of CGMS in Guangzhou. This is the third CGMS plenary hosted by China, following the 1993 21st session in Beijing and the 2006 34th session in Shanghai.

It is a known fact that satellite observation has become the largest data source for numerical weather prediction. The combination of accurate and timely satellite observations and forecast modelling maximizes the possibility of providing accurate weather forecasts to the public. Satellite observation, in particular, makes an indispensable atmospheric and environmental data source for the areas lacking of surface observation.

CGMS is a major international organization coordinating Earth observation activities around the world. It facilitates international cooperation and coordination among members of the organization in a positive and pragmatic manner. CGMS attaches great importance to the continuity of satellite observation, coordinating different satellite systems, and allowing users to have a sustained and reliable access to satellite data. As a coordinating mechanism, CGMS has played a unique role in the use of frequency, standardized data and products distribution, emergency response planning among others.

Thanks to the booming development of satellite applications, CGMS' activities have reached non-conventional areas, such as climate and space weather. In addition, it supports the use of various techniques, including virtual laboratories, to sponsor user training events, in an attempt to enhance users' knowledge and understanding of new products. We think highly of the work done by CGMS, and appreciate the important role played by CGMS in coordinating national satellite planning, optimizing the global meteorological satellite observing system, in improving meteorological services, and in disaster prevention and preparedness.

As head of a meteorological service that takes care of the world's most populous country, I would like to share with you that the Chinese government attaches great importance to the drive of meteorological modernization, and has invested huge resources in establishing China's own satellite observing and application systems. CMA became a member of CGMS in 1989. Right from the beginning of planning a satellite observing system, China has been a part of the international coordination framework. In the past 40 years, CMA has become increasingly involved in CGMS activities and in international meteorological activities as well. China has developed two series satellite observing platforms consisting of geostationary and polar-orbiting satellites. China provides, through satellite broadcasting, satellite data, products and meteorological services directly to the users in 22 countries and regions, and became an important part of GEONETCast and WMO

Information System. To optimize the polar-orbiting satellite constellation and improve global numerical weather prediction, CMA works hard to make early morning orbit part of the operation of FY polar-orbiting satellites, urging the Chinese government to ratify the revised meteorological satellite development planning.

CMA has been greatly benefited from satellite observing system, and expects more from it. In response to global climate change and the increased occurrences of extreme weather, climate events and atmospheric pollution, I, being one of the user group representatives, appeal for further enhanced cooperation between satellite operators and meteorological agencies, making concrete efforts to improve meteorological satellite data and products, and to provide more and better services to different users around the world.

I am pleased to see that at this meeting, CMA will report the role played by Chinese meteorological satellites in emergency response. Hopefully, the discussions made at this meeting will draw more attention to the regional cooperation in emergency response. We should, through a proper demonstration mechanism, establish sound intercommunications between satellite users and service providers, dealing with unexpected regional weather disasters using our joint efforts.

Distinguished Mr. Alain Ratier,

Ladies and gentlemen,

I believe with your hard work, this CGMS plenary will produce fruitful results from the upcoming discussions. I would also like to thank the staffs making this meeting a successful event.

In concluding, I wish a complete success of CGMS-42 plenary! Wish you a pleasant stay in Guangzhou!

Thank you.

Dr TIAN Yulong, Secretary-General, CNSA

Distinguished Mr. Alain Ratier, Administrator Dr. Zheng, ladies and gentlemen,

Good Morning!

It is a great honor for CNSA and CMA to help holding CGMS-42. On behalf of CNSA and Administrator, Mr. Xu Dazhe, I would like to congratulate CGMS-42 has been going well!

CGMS plays a key role in the construction of global observing system, the optimization of space segment, and the standardization of global observing system and data services. Contributions from CGMS and WMO in coordination of space resource, data receiving and sharing, especially analysis of space-based gap are incredibly important, and instructive for all members, in organizing the satellite projects and constructing the space system. CGMS has been an invaluable communication platform for members.

Both CNSA and CMA are committing to construct of FY series satellites, which guarantee the stable transit satellites from R&D satellite to operational satellite and global serving capability of FY-2 and FY-3, and propel the development of FY-4 new satellite. CNSA now is organizing the China New generation Earth Observing System-CHEOS which is one of the major national science and technology projects. The objective of CHEOS is the observation and scientific exploration of land, ocean, atmosphere, and their interaction. Nowadays, the new system has achieved preliminary results from GF-1. CNSA is attempting to promote the operational service of CHEOS and offer the international serving capability.

In the future, CNSA with CMA together will keep closely cooperating with CGMS and WMO to optimize the space-based system, push forward the satellites technology and its professional services, and boost the capability of global observing system together.

At last, I wish this meeting a complete success, and everyone enjoy your stay in Guangzhou!

Thank you very much for your attention!

LIST OF PLENARY PARTICIPANTS

PLENARY List of Participants - CGMS-42				
First name	Last name	Organisation	Country	Email
Xiang	Fang	CMA	China	fangxiang@cma.gov.cn
Ling	Gao	CMA	China	gaoling@cma.gov.cn
Qiang	Guo	CMA	China	guoqiang@cma.gov.cn
Guan	Hong	CMA	China	-
Mi	Liao	CMA	China	-
Jian	Liu	CMA	China	-
Feng	Lu	CMA	China	lufeng@cma.gov.cn
Dongfeng	Luo	CMA	China	luodf@cma.gov.cn
Ning	Niu	CMA	China	niuning1980@126.com
Chunfang	Wang	CMA	China	-
Bangzhong	Wang	CMA	China	wangbz@cma.gov.cn
Xuebao	Wu	CMA	China	wuxb@cma.gov.cn
Jun	Yang	CMA	China	junyang@cma.gov.cn
Xiaoxin	Zhang	CMA	China	-
Peng	Zhang	CMA	China	zhangp@cma.gov.cn
Zhiqing	Zhang	CMA	China	zqzhang@cma.gov.cn
Xiaoxin	Zhang	CMA	China	xxzhang@cma.gov.cn
Guoguang	Zheng	CMA	China	yi@cma.gov.cn
Heng	Zou	CMA	China	-
Jun	Gao	CNSA	China	gaojun8858@sina.com
Li	Liu	CNSA	China	liulicugb@126.com
Sihan	Liu	CNSA	China	-
Ying	Luo	CNSA	China	luoying@dfhsat.com
Yulong	Tian	CNSA	China	xiey@irsa.ac.cn
Chengwen	Wang	CNSA	China	zhaony@irsa.ac.cn
Zheng	Wei	CNSA	China	weizheng@radi.ac.cn
Yong	Xie	CNSA	China	xieyong@radi.ac.cn
Hongliang	Xu	CNSA	China	-
Qi	Yu	CNSA	China	yuqi@radi.ac.cn
Mingsen	Lin	CNSA (NSOAS)	China	mshin@mail.nsoas.gov.cn
Michael	Manore	Environment Canada	Canada	Mike.Manore@ec.gc.ca
Jean-Louis	Fellous	ESA	France	jfellous@noos.fr
Rowanna	Comerford	EUMETSAT	Germany	rowanna.comerford@eumetsat.int
Joaquin	Gonzalez Picazo	EUMETSAT	Germany	joaquin.gonzalez@eumetsat.int
Kenneth	Holmlund	EUMETSAT	Germany	kenneth.holmlund@eumetsat.int
Livio	Mastroddi	EUMETSAT	Germany	zeynep.dinsi@eumetsat.int
Alain	Ratier	EUMETSAT	Germany	alain.ratier@eumetsat.int
Klaus Peter	Renner	EUMETSAT	Germany	klauspeter.renner@eumetsat.int
Anne	Taube	EUMETSAT	Germany	anne.taube@eumetsat.int
Paul	Counet	EUMETSAT	Germany	paul.counet@eumetsat.int

Stephen	Briggs	GCOS	United Kingdom	stephen.briggs@esa.int
Osamu	Ochiai	GEO	Switzerland	oochiai@geosec.org
Virendra	Singh	IMD	India	vsvsingh69@gmail.com
David	Halpern	IOC/UNESCO	USA	david.halpern@jpl.nasa.gov
Rajagopalan	Ramakrishnan	ISRO	India	rama@sac.isro.gov.in
Arumugam	Senthil Kumar	ISRO	India	senthilkumar_a@nrs.gov.in
Niels	Bormann	ITWG	United Kingdom	n.bormann@ecmwf.int
Kazuo	Umezawa	JAXA	Japan	umezawa.kazuo@jaxa.jp
Yasushi	Izumikawa	JMA	Japan	y-izumikawa@met.kishou.go.jp
Toshiyuki	Kurino	JMA	Japan	tkurino@met.kishou.go.jp
Arata	Okuyama	JMA	Japan	okuyama.arata@met.kishou.go.jp
Koon-Ho	Yang	KARI	South Korea	khyang@kari.re.kr
Sungwook	Hong	KMA	South Korea	sesttiya@gmail.com
Jae-Dong	Jang	KMA	South Korea	jaedongjang@korea.kr
Dohyeong	Kim	KMA	South Korea	dkim@kma.go.kr
Tae Sun	Kwon	KMA	South Korea	tskwon@korea.kr
Jack	Kaye	NASA	USA	jack.kaye@nasa.gov
Dong	Wu	NASA	USA	dong.l.wu@nasa.gov
Manik	Bali	NOAA	USA	-
Suzanne	Hilding	NOAA	USA	suzanne.hilding@noaa.gov
Kimberly	Hurst	NOAA	USA	kimberly.hurst@noaa.gov
Mary	Kicza	NOAA	USA	mary.kicza@noaa.gov
Marvin	LeBlanc	NOAA	USA	marvin.leblanc@noaa.gov
Ajay	Mehta	NOAA	USA	ajay.mehta@noaa.gov
John	Murphy	NOAA	USA	John.d.Murphy@NOAA.GOV
Marlin	Perkins	NOAA	USA	Marlin.O.Perkins@noaa.gov
Charles	Wooldridge	NOAA	USA	charles.wooldridge@noaa.gov
John	Bates	NOAA (CEOS-CGMS JWG Climate)	USA	john.j.bates@noaa.gov
Ilya	Badaev	ROSCOSMOS	Russian Federation	tkachenko@laspace.ru
Alexander	Karelin	ROSCOSMOS	Russian Federation	avkarelin@mail.ru
Alexander	Konjakhin	ROSCOSMOS	Russian Federation	opoi@roscosmos.ru
Fedor	Lyubchenko	ROSCOSMOS	Russian Federation	fedornl@yandex.ru
Mikhail	Novikov	ROSCOSMOS	Russian Federation	smvd.vniim@mail.ru
Valeriy	Psarev	ROSCOSMOS	Russian Federation	SlastnayaAJu@tsniimash.ru
Anastasia	Slastnaya	ROSCOSMOS	Russian Federation	alarmia2007@yandex.ru
Alexander	Tkachenko	ROSCOSMOS	Russian Federation	tkachenk_2000@mail.ru

			Federation	
Zoya	Andreeva	ROSHYDROMET	Russian Federation	andreeva.planet@gmail.com
Vasily	Asmus	ROSHYDROMET	Russian Federation	asmus@planet.iitp.ru
Liubov	Kramareva	ROSHYDROMET	Russian Federation	arkweid@yandex.ru
Tatiana	Labenets	ROSHYDROMET	Russian Federation	laben@mcc.mecom.ru
Alexey	Rublev	ROSHYDROMET	Russian Federation	alex.rublev@mail.ru
Alexander	Uspenskiy	ROSHYDROMET	Russian Federation	uspensky@planet.iitp.ru
Jérôme	Lafeuille	WMO	Switzerland	jlafeuille@wmo.int
Mikael	Rattenborg	WMO	Switzerland	mikael@rattenborg.de
Lars Peter	Riishojgaard	WMO	Switzerland	lriishojgaard@wmo.int
Wenjian	Zhang	WMO	Switzerland	Wzhang@wmo.int
Hui	Wang	WMO (NMEFC)	Switzerland	wangh@nmeffc.gov.cn

LIST OF WORKING GROUP PARTICIPANTS

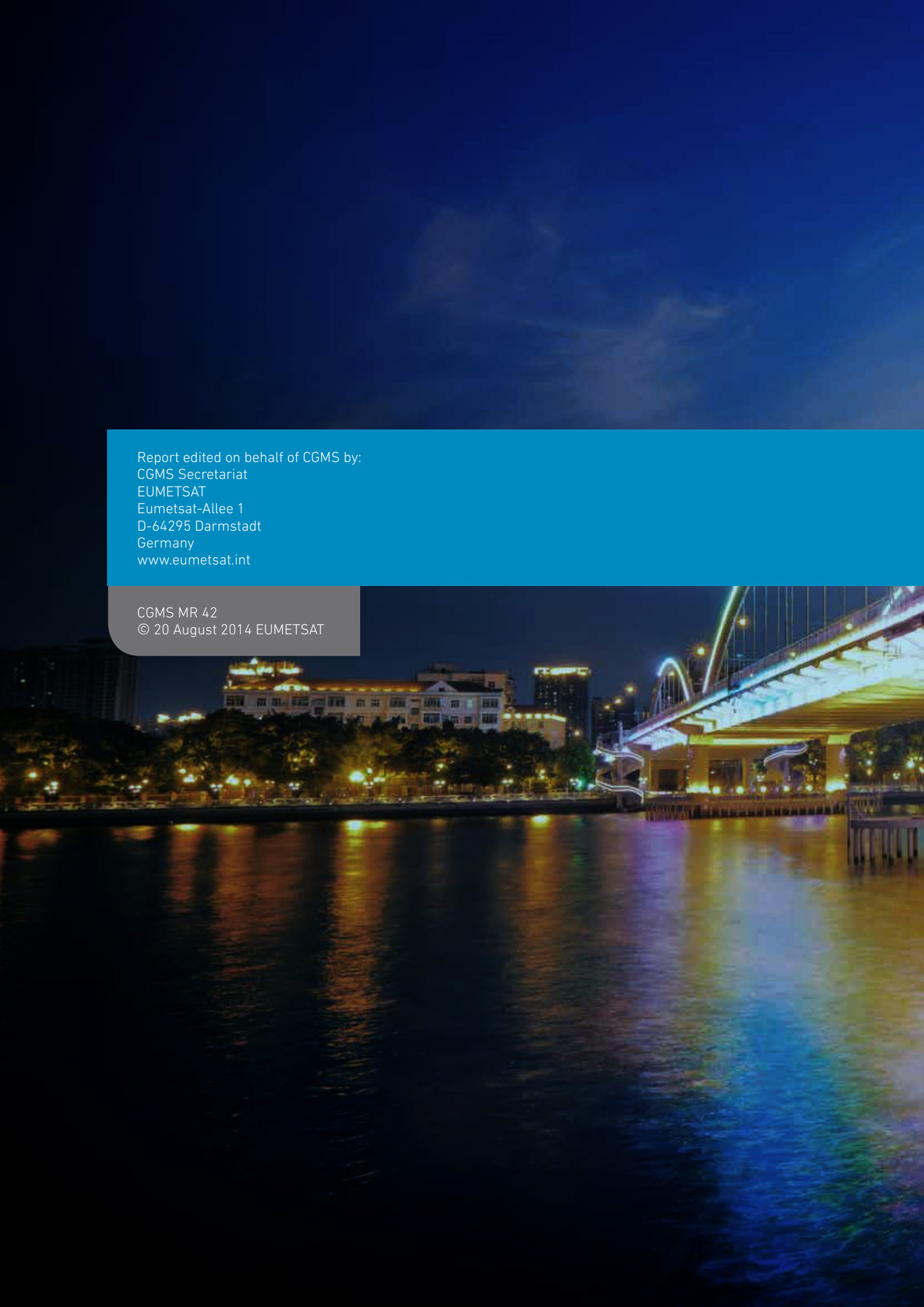
WG I List of Participants - CGMS-42				
First name	Last name	Organisation	Country	Email
Dongfeng	Luo	CMA	China	luodf@cma.gov.cn
Zhiqing	Zhang	CMA	China	zqzhang@cma.gov.cn
Jian	Liu	CMA	China	liuj@cma.gov.cn
Chungfang	Wang	CMA	China	wangcf@cma.gov.cn
Jun	Gao	CNSA	China	gaojun8858@sina.com
Ying	Luo	CNSA	China	luoying@dfhsat.com
Qi	Yu	CNSA	China	yuqi@radi.ac.cn
Michael	Manore	EC Canada	Canada	Mike.Manore@ec.gc.ca
Joaquin	Gonzalez Picazo	EUMETSAT	Germany	joaquin.gonzalez@eumetsat.int
Livio	Mastroddi	EUMETSAT	Germany	livio.mastroddi@eumetsat.int
Klaus Peter	Renner	EUMETSAT	Germany	klauspeter.renner@eumetsat.int
Osamu	Ochiai	GEO	Switzerland	oochiai@geosec.org
Virendra	Singh	IMD	India	vsvsingh69@gmail.com
Rajagopalan	Ramakrishnan	ISRO	India	rama@sac.isro.gov.in
Yasushi	Izumikawa	JMA	Japan	y-izumikawa@met.kishou.go.jp
Koon-Ho	YANG	KARI	South Korea	khyang@kari.re.kr
Jae-Dong	Jang	KMA	South Korea	jaedongjang@korea.kr
Marlin	Perkins	NOAA	USA	Marlin.O.Perkins@noaa.gov
Charles	Wooldridge	NOAA	USA	charles.wooldridge@noaa.gov
Alexander	Karelin	ROSCOSMOS	Russia	avkarelin@mail.ru
Mikhail	Novikov	ROSCOSMOS	Russia	smvd.vniiem@mail.ru
Valeriy	Psarev	ROSCOSMOS	Russia	SlasnayaAJu@tsniimash.ru
Anastasia	Slasnaya	ROSCOSMOS	Russia	alarmia2007@yandex.ru
Zoya	Andreeva	ROSHYDROMET	Russia	andreeva.planet@gmail.com
Vasily	Asmus	ROSHYDROMET	Russia	asmus@planet.iitp.ru
Tatiana	Labenets	ROSHYDROMET	Russia	laben@mcc.mecom.ru
Jérôme	Lafeuille	WMO	Switzerland	jlafeuille@wmo.int
Mikael	Rattenborg	WMO	Germany	mikael@rattenborg.de

WG II List of Participants - CGMS-42				
First name	Last name	Organisation	Country	Email
Qiang	Guo	CMA	China	guoqiang@cma.gov.cn
Feng	Lu	CMA	China	lufeng@cma.gov.cn
Peng	Zhang	CMA	China	zhangp@cma.gov.cn
Jiashen	Zhang	CMA	China	zhangjs@cma.gov.cn
Ying	Wang	CNSA	China	wangying@radi.ac.cn
Tianhai	Cheng	CNSA	China	chength@radi.ac.cn
Li	Liu	CNSA	China	liulicugb@126.com
Yong	Xie	CNSA	China	xieyong@radi.ac.cn
Shaohua	Zhao	CNSA	China	zshyytt@126.com
Jean-Louis	Fellous	ESA	France	jfellous@noos.fr
Kenneth	Holmlund	EUMETSAT	Germany	kenneth.holmlund@eumetsat.int
Johannes	Schmetz	EUMETSAT	Germany	johannes.schmetz@eumetsat.int
Virendra	Singh	IMD	India	vsvsingh69@gmail.com
Rajagopalan	Ramakrishnan	ISRO	India	rama@sac.isro.gov.in
Arumugam	Senthil Kumar	ISRO	India	senthilkumar_a@nrs.gov.in
Niels	Bormann	ITWG		niels.bormann@ecmwf
Kazuo	Umezawa	JAXA	Japan	umezawa.kazuo@jaxa.jp
Toshiyuki	Kurino	JMA	Japan	tkurino@met.kishou.go.jp
Arata	Okuyama	JMA	Japan	okuyama.arata@met.kishou.go.jp
Sungwook	Hong	KMA	South Korea	sesttiya@gmail.com
Dohyeong	Kim	KMA	South Korea	dkim@kma.go.kr
Tae Sun	Kwon	KMA	South Korea	tskwon@korea.kr
Dong	Wu	NASA	USA	dong.l.wu@nasa.gov
Ajay	Mehta	NOAA	USA	ajay.mehta@noaa.gov
Manik	Bali	NOAA		manik.bali@noaa.gov
Marvin	LeBlanc	NOAA	USA	marvin.leblanc@noaa.gov
John	Bates	NOAA (CEOS- CGMS JWG Climate)	USA	john.j.bates@noaa.gov
Ilya	Badaev	ROSCOSMOS	Russia	tkachenko@laspace.ru
Alexander	Konjakhin	ROSCOSMOS	Russia	opoi@roscosmos.ru
Fedor	Lyubchenko	ROSCOSMOS	Russia	fedornl@yandex.ru
Alexander	Tkachenko	ROSCOSMOS	Russia	tkachenk_2000@mail.ru
Liubov	Kramareva	ROSHYDROMET	Russia	arkweid@yandex.ru
Tatiana	Labenets	ROSHYDROMET	Russia	laben@mcc.mecom.ru
Alexey	Rublev	ROSHYDROMET	Russia	alex.rublev@mail.ru
Alexander	Uspenskiy	ROSHYDROMET	Russia	uspensky@planet.iitp.ru
Lars Peter	Riishojgaard	WMO	Switzerland	lriishojgaard@wmo.int
Mikael	Rattenborg	WMO	Germany	mikael@rattenborg.de

WG III List of Participants - CGMS-42				
First name	Last name	Organisation	Country	Email
Chungfang	Wang	CMA	China	wangcf@cma.gov.cn
Tianhai	Cheng	CNSA	China	chength@radi.ac.cn
Jun	Gao	CNSA	China	gaojun8858@sina.com
Ying	Luo	CNSA	China	luoying@dfhsat.com
Michael	Manore	EC Canada	Canada	Mike.Manore@ec.gc.ca
Joaquin	Gonzalez Picazo	EUMETSAT	Germany	joaquin.gonzalez@eumetsat.int
Kenneth	Holmlund	EUMETSAT	Germany	kenneth.holmlund@eumetsat.int
Livio	Mastroddi	EUMETSAT	Germany	zeynep.dinsi@eumetsat.int
Klaus Peter	Renner	EUMETSAT	Germany	klauspeter.renner@eumetsat.int
Osamu	Ochiai	GEO	Switzerland	oochiai@geosec.org
Virendra	Singh	IMD	India	vsvsingh69@gmail.com
Rajagopalan	Ramakrishnan	ISRO	India	rama@sac.isro.gov.in
Yasushi	Izumikawa	JMA	Japan	y-izumikawa@met.kishou.go.jp
Koon-Ho	Yang	KARI	South Korea	khyang@kari.re.kr
Jae-Dong	Jang	KMA	South Korea	jaedongjang@korea.kr
Suzanne	Hilding	NOAA	USA	suzanne.hilding@noaa.gov
Kimberly	Hurst	NOAA	USA	kimberly.hurst@noaa.gov
Ajay	Mehta	NOAA	USA	ajay.mehta@noaa.gov
Marlin	Perkins	NOAA	USA	Marlin.O.Perkins@noaa.gov
Charles	Wooldridge	NOAA	USA	charles.wooldridge@noaa.gov
Mikhail	Novikov	ROSCOSMOS	Russia	smvd.vniem@mail.ru
Valeriy	Psarev	ROSCOSMOS	Russia	SlastnayaAJu@tsniimash.ru
Anastasia	Slastnaya	ROSCOSMOS	Russia	SlastnayaAJu@tsniimash.ru
Zoya	Andreeva	ROSHYDROMET	Russia	andreeva.planet@gmail.com
Vasily	Asmus	ROSHYDROMET	Russia	asmus@planet.iitp.ru
Jérôme	Lafeuille	WMO	Switzerland	jlafeuille@wmo.int
Mikael	Rattenborg	WMO	Germany	mikael@rattenborg.de

WG IV List of Participants - CGMS-42				
First name	Last name	Organisation	Country	Email
Chungfang	Wang	CMA	China	wangcf@cma.gov.cn
Tianhai	Cheng	CNSA	China	chength@radi.ac.cn
Jun	Gao	CNSA	China	gaojun8858@sina.com
Ying	Luo	CNSA	China	luoying@dfhsat.com
Michael	Manore	EC Canada	Canada	Mike.Manore@ec.gc.ca
Joaquin	Gonzalez Picazo	EUMETSAT	Germany	joaquin.gonzalez@eumetsat.int
Kenneth	Holmlund	EUMETSAT	Germany	kenneth.holmlund@eumetsat.int
Livio	Mastroddi	EUMETSAT	Germany	livio.mastroddi@eumetsat.int
Klaus Peter	Renner	EUMETSAT	Germany	klauspeter.renner@eumetsat.int
Osamu	Ochiai	GEO	Switzerland	oochiai@geosec.org
Virendra	Singh	IMD	India	vsvsingh69@gmail.com
Rajagopalan	Ramakrishnan	ISRO	India	rama@sac.isro.gov.in
Yasushi	Izumikawa	JMA	Japan	y-zumikawa@met.kishou.go.jp
Koon-Ho	Yang	KARI	South Korea	khyang@kari.re.kr
Jae-Dong	Jang	KMA	South Korea	jaedongjang@korea.kr
Marlin	Perkins	NOAA	USA	Marlin.O.Perkins@noaa.gov
Charles	Wooldridge	NOAA	USA	charles.wooldridge@noaa.gov
Mikhail	Novikov	ROSCOSMOS	Russia	smvd.vniiem@mail.ru
Zoya	Andreeva	ROSHYDROMET	Russia	andreeva.planet@gmail.com
Vasily	Asmus	ROSHYDROMET	Russia	asmus@planet.iitp.ru
Jérôme	Lafeuille	WMO	Switzerland	jlafeuille@wmo.int
Mikael	Rattenborg	WMO	Germany	mikael@rattenborg.de

Ad-hoc meeting on Space Weather List of Participants - CGMS-42				
First name	Last name	Organisation	Country	Email
Xiaoxin	ZHANG	CMA	China	xxzhang@cma.gov.cn
Yasushi	IZUMIKAWA	JMA	Japan	satellite@ml.kishou.go.jp
Koon-Ho	YANG	KARI	South Korea	khyang@kari.re.kr
Dohyeong	KIM	KMA	South Korea	dkim@kma.go.kr
Elsayed	TALAAT	NASA	USA	elsayed.r.talaat@nasa.gov
Tsutomu	NAGATSUMA	NICT	Japan	tnagatsu@nict.go.jp
Suzanne	HILDING	NOAA	USA	suzanne.hilding@noaa.gov
Kimberly	HURST	NOAA	USA	kimberly.hurst@noaa.gov
Ajay	MEHTA	NOAA	USA	ajay.mehta@noaa.gov
John	MURPHY	NOAA	USA	john.d.murphy@noaa.gov
Charles	WOOLDRIDGE	NOAA	USA	charles.wooldridge@noaa.gov
Alexander	KARELIN	ROSCOSMOS	Russian Federation	avkarelin@mail.ru
Anastasia	SLATSNAYA	ROSCOSMOS	Russian Federation	alarmia2007@yandex.ru
Jérôme	LAFEUILLE	WMO	Switzerland	jlafeuille@wmo.int
Wenjian	ZHANG	WMO	Switzerland	wzhang@wmo.int
Mikael	RATTENBORG	CGMS Secretariat	Germany	mikael@rattenborg.de



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

CGMS MR 42
© 20 August 2014 EUMETSAT