



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

Parallel Working Group Sessions: WGII Report

WGII REPORT

Working Group II: Satellite data and products

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

WGII/0 Objectives

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

WGII/1 Review of actions and recommendations from previous meetings

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

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

WGII/2 Image processing techniques and satellite imagery for nowcasting

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

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

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

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

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

WGII appreciated the report by KMA on this topic.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- ii) SSM/I: Total column water vapour, precipitation, liquid water path NOAA + EUMETSAT (CM-SAF) (proposal coordinator) + CMA (precipitation);
- iii) Surface albedo, clouds + aerosols from geostationary satellites JMA + EUMETSAT (Central Facilities (proposal coordinator) + CM SAF + NOAA + CMA;
- iv) Atmospheric Motion Vectors (AMV) + clear sky radiance JMA (proposal coordinator) + EUMETSAT (Central Facilities) + NOAA + CMA;
- v) Upper tropospheric humidity JMA + EUMETSAT (CF + CM SAF) + NOAA (proposal coordinator) + CMA.

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

One recommendation was raised following the discussions:

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

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

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

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

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

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

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

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

KMA-WP-04: KMA's GSICS Activities

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

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

CMA-WP-05: CMA Activities on GSICS

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

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

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

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

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

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

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

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

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

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

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

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

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

EUMETSAT-WP-06: Calibration Event Working Group

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

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

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

CGMS-41 actions – WGII						
Action	Action	#	Description	Deadline	Status	HLP P ref
GSICS	WGII/3	41.2 1	GSICS to take on calibration event monitoring activities following the recent work on calibration event monitoring. Such information should be included in the next update of the WMO OSCAR database.	CGMS-42	OPEN	HLP P #3.1

CGMS-41 actions – WGII						
Action	Action	#	Description	Deadline	Status	HLP P ref
CGMS space agencies	WGII/3	41.2 2	CGMS agencies to provide WPs on current and future capabilities for calibration monitoring and event logs – CGMS-42.	CGMS-42	OPEN	HLP P #3.1

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

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

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

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

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

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

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

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

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

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

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

WMO-WP-25: GSICS progress report

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

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

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

High level priorities for GSICS are:

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

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

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

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

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

WGII/4 Infrared/MicroWave sounding and ITWG matters

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

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

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

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

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

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

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

WGII/5 Precipitation and IPWG matters

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

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

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

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

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

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

The following actions were agreed:

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

WGII/6 Atmospheric Motion Vectors and IWWG matters

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

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

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

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

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

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

CGMS-41 was invited to:

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

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

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

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

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

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

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

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

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

Following the discussions, the below action was agreed:

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

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

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

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

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

NOAA also agreed to the following action:

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

JMA-WP-05 JMA's Atmospheric Motion Vectors

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

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

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

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

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

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

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

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

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

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

Following the discussions a recommendation was raised:

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

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

WGII/7 Radio occultation and IROWG matters

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

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

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

WGII/8 Cloud and ash/dust related matters

EUMETSAT-WP-05: Cloud Retrieval Evaluation Working Group

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

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

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

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

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

The following actions was agreed as a consequence:

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

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

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

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

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

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

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

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

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

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

As a consequence, JMA agreed to the following action:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

In summary, the following milestones apply:

- Current ICAO Annex 3 Requirements in Amendment 76 stress the need for better ash detection and forecasts;
- The 10-15 March 2013 WMO/IUGG Volcanic Ash Scientific workshop provided an opportunity for the science community to compare and align methodologies and processes employed by different groups;
- The 2nd WMO/IAVCEI Workshop to be held 18-20 November 2013 in Geneva on Volcanic Ash detection and modeling aims at further refinement of volcanic ash detection and forecasting techniques;
- Following the planned engine ash sensitivity tests in 2014, the operational establishment of quantitative detection and prediction methods will likely be required;
- The ICAO Annex 3 Requirements are expected to include quantitative ash load products as of November 2016.

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

WGII/9 Ocean parameters

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

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

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

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

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

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

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

In concluding the discussions the following recommendation was made:

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

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

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

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

ESA-WP-03 informed CGMS about some outstanding results from the Earth Explorer missions GOCE, CryoSat-2 and SMOS. In orbit since March 2009, the Gravity field and steady-state Ocean Explorer (GOCE) is measuring Earth's gravity field with unprecedented detail to advance our understanding of ocean circulation, sea-level change and Earth-interior processes. Launched on 2 November 2009, SMOS is the second Earth Explorer Opportunity mission to be developed as part of ESA's Living Planet Programme. The data acquired from the SMOS mission will lead to better weather and extreme-event forecasting, and contribute to seasonal-climate forecasting, as demonstrated in the results presented. ESA's Earth Explorer CryoSat-2 mission, launched on 8 April 2010, is dedicated to precise monitoring of the changes in the thickness of marine ice floating in the polar oceans and variations in the thickness of the vast ice sheets that overlie Greenland and Antarctica.

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

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

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

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

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

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

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

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

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

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

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

The following action was agreed:

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

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

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

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

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

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

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

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

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

- b. Expand NOAA Operational Use/Users: Significant expanded use of ocean colour data in at least the following areas: NMFS/fisheries management models, input to NWS/NCEP models, and production of HAB products for NWS/OPC (all U.S. coastal areas) has begun. Use of VIIRS ocean colour for hazards management (oil spills, etc) will be pursued in over the next year.
- c. Develop/deploy Next Generation VIIRS Distribution Portal: Develop and deploy a next generation community consensus data portal including expanded data search and retrieval features and (human) user support.
- d. Develop/Deploy User Requested Ocean colour Products: The national and international ocean colour community has come to expect the routine availability of a large array of time and geographically binned products. NOAA will develop these products and prototype their distribution via NOAA STAR access assets.

WGII/10 Other parameters and products

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

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

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

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

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

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

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

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

The following recommendation was placed:

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

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

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

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

NASA-WP-09: The Terrestrial Reference Frame

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

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

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

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

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

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

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

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

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

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

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

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

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

WMO-WP-11: PSTG Update

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

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

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

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

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

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

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

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

Key results from the survey include:

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

- Satellite data formats should be harmonised and simplified, for platform-independent use;
- Many users are insufficiently prepared for the new generation of operational satellites planned for 2014-2020;
- Targeted and continuous training is required to build and maintain human capacity;
- Future surveys should be conducted by Region on a 2-3 year basis, complemented by WMO-led global surveys on a 4-5 year basis;

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

WGII appreciated the availability of the survey.

WMO-WP-20: Satellite applications for agriculture

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

- WMO/EUMETSAT/GMA Land SAF/Satellite Products Training Course on the Use of Satellite Products for Agrometeorological Applications in Accra, Ghana, 10-14 June 2013;
- Agricultural Meteorology and Soil Moisture Applications Pilot Projects in Africa - based on MODIS products;
- Participation in the IIASA/ZAMG project "Farm Support: Demonstrating the Potential of EO-derived Soil Moisture and Weather Forecasts in Farmer Decision Support and Crop Modeling"; and
- Participation in the G20 GEO Global Agriculture Monitoring Initiative (GEO -GLAM).

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

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

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

ECV Inventory

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

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

WGII/11 Review and updating of the HLPP

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

WGII/12 Any other business

WGII recommended that at future CGMS sessions, CGMS members should include references to ATBDs, scientific papers or other sources of information providing background to their generation in all WPs describing datasets and products.

Volker Gärtner announced his retirement as rapporteur on the IPWG to CGMS. WGII expressed its appreciation for his service to CGMS. Hence, a new rapporteur needs to be identified, and the Co-chairs of the IPWG will nominate someone for this function.

WGII/13 Planning of inter-sessional activities/meetings

Inter-sessional meetings for reviewing the status of WGII-related actions, recommendations and for discussing topics for consideration at CGMS-42 were agreed for the following dates:

26 November 2013, 13.00 UTC

3 April 2014, 13.00 UTC

These meetings are held remotely via telephone and online conference tools; invitations shall follow by e-mail in due course. All CGMS members are invited to participate.

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

WGII reviewed the actions and recommendations drafted by the co-chairs and rapporteurs, which were subsequently forwarded to the CGMS Secretariat. The full list of WGII actions and recommendations are available [here](#).

The session closed at 17.30 on Tuesday 9 July 2013.

