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Other Product Developments at CGMS-39

(Submitted by Volker Gärtner, EUMETSAT)

Summary and Purpose of Document

This document presents a short summary of the discussions on product developments which were held in working group II of CGMS-39.

ACTION PROPOSED

The sixth session is invited to take note of the ongoing developments in the Coordination Group for Meteorological Satellites.

OTHER PRODUCT DEVELOPMENTS AT CGMS-39

1. Introduction

During CGMS meetings, an integral part of the meeting is the working group on products (WG II) which is set up to inform each other about ongoing product developments and to seek opportunities for cooperation amongst the satellite operators. The group also gets the feedback from the four scientific working groups of CGMS (ITWG, IPWG, IWWG and IROWG). The group can make recommendations and task the international working groups through their rapporteurs. The CGMS Working Group II on Satellite Products was chaired jointly by Prof. Vasily Asmus, from ROSHYDROMET, and Dr. Vaddi Rao, from IMD, Dr. Mitch Goldberg, NOAA, and Dr. Johannes Schmetz, EUMETSAT, assisted as rapporteurs with the help of Dr. Volker Gärtner and Dr. Stephan Bojinski. More than 50 working papers were presented and discussed by the 27 participants.

2. Image Processing Techniques

NOAA informed about special data sets that had been collected from its most recently launched GOES-14 and GOES-15 geostationary satellites and which formed the basis for simulated images for its future GOES-R Advanced Baseline Imager (ABI). The NOAA paper was in response to a recommendation of CGMS-38 asking NOAA to consider sharing 1 minute simulated imager upon request from CGMS agencies. In the spirit of the scientific collaboration described above, NOAA expects and is willing to share these data with its partners in the CGMS community.

3. Satellite Data Calibration and Validation

China introduced the integrated calibration and quality control system established for the three FY-3A optical instruments (the MEdium Resolution Spectral Imager - MERSI, the Visible and InfraRed Radiometer – VIRR, and the InfraRed Atmospheric Sounder - IRAS) and reported on the calibration trends and anomalies of these instruments determined by a combination of methods.

China also reported on FY-3 microwave instrument calibration anomalies. It started with a briefing on the instrument status and informed CGMS that the MicroWave Temperature Sounder (MWTS), the MicroWave Humidity Sounder (MWHS), and the MicroWave Radiation Imager (MWRI) are the MW payloads on FY-3A and FY-3B satellites. The three instruments onboard FY-3A have some problems, but the ones on FY-3B work well. In the discussion, it was pointed out that the Community Radiative Transfer Model (CRTM) was used to simulate both imager and sounder radiances. For comparison with model fields, simulations from ECMWF and NCEP were used by CMA.

Recent progress in the CMA GSICS Processing and Research Centre (GPRC) include the geostationary imager calibration monitoring based on the operational GEO-LEO IR inter-calibration for FY-2D/2E satellites, and on the LEO-LEO inter-calibration experiment for FY-3A/3B using AIRS, IASI and MODIS. GSICS GEO-LEO IR inter-calibration for FY-2 has been running operationally at CMA since the end of 2009. FY-2C GSICS recalibration processing since 2005 is completed. The inter-calibration results for FY-2D/2E show that the FY-2E has significant improvement in stray light elimination. Therefore, more stable calibration results have been achieved when compared to its predecessors FY-2C/2D. Also validation results of the FY-3B /Earth Radiation Measurement (ERM) scanner, by comparing it with the Aqua/CERES FM3 data were presented.

JMA summarised its GSICS and SCOPE-CM activities stating that operations of the MTSAT-1R infrared inter-calibration system on GSICS began in 2008. Later on the system was modified on the occasion of the switchover to MTSAT-2 from MTSAT-1R in July 2010. JMA has also reprocessed the calibrations of GMS-5 and MTSAT-1R visible images in collaboration with the University of Tokyo and Chiba University. With the switchover to MTSAT-2, the Agency began operational visible vicarious calibration and monitoring of its calibration coefficients. As a contribution to SCOPE-CM, JMA (re)processed the historical Atmospheric Motion Vector (AMV) and Clear Sky Radiance (CSR) dataset and made the results available to the re-analysis community. A study carried out using reprocessed

GMS AMV data showed a significant positive impact.

Based on the discussion all AMV and CSR product providers are invited to continue or start the regular reprocessing of those products with state-of-the-art algorithms.

Also KMA described their ongoing GSICS activities. KMA began to operate GSICS using COMS for IR inter-calibration system with LEOs (AIRS and IASI) after the completion of the IOT at the end of January. KMA also performed visible channel vicarious calibration using the Australian Simpson desert region and deep convection cloud with Seoul National University.

NASA provided an update of NASA Calibration and Validation activities. Recent NASA satellite and airborne instrument calibration and validation activities and assets of interest to the meteorological remote sensing community include the following: (1) improvement in the production of calibrated, geo-located (i.e. Level 1B) radiances from the Advanced InfraRed Sounder (AIRS) instrument on the Earth Observing System (EOS) Aqua satellite, (2) improvements in the production of calibrated, geo-located (i.e. Level 1B) reflectances/radiances from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the EOS Terra and Aqua satellites, (3) the Committee on Earth Observation Satellites (CEOS) Visualization Environment (COVE) tool for satellite data acquisition planning and visualization, (4) the development of the Enhanced MODIS Airborne Simulator (eMAS), and (5) the development of the Airborne Visible/Imaging Infrared Spectrometer-Next Generation (AVIRIS-NG). These cal/val activities are essential for maintaining and improving the quality of the measurements and derived products for the life of the sensor.

NASA and NOAA were asked to report on cal/val results from the NPP instruments, including comparisons of NPP sensors with EOS sensors and with airborne instruments.

NOAA reported on the past year's calibration performance from NOAA instruments, as well as life-time performance, using the NOAA Instrument Calibration Validation System (ICVS) Instrument performance monitoring is critical for ensuring level 1b product quality for both numerical weather prediction and climate change detection. Since these products are increasingly dependent on data from the international constellation of Earth Observing Satellites, it is important to establish a central interface from which NOAA's instrument monitoring information can be easily accessed. This information is essential for the development of climate data records as well for real-time applications which relies on updated information on sensor performance. It also provides early warning of instrument problems, thereby enabling resolution in a timely manner when possible.

All CGMS agencies are encouraged to provide instrument monitoring results at CGMS-40.

The WMO presented the progress of Global Space-based Inter-Calibration System (GSICS). The discussion highlighted EUMETSAT's and NOAA's work on intercalibration. It was noted that GSICS is a successful example of international collaboration between space agencies.

The calibration discussions ended with a set of recommendations, namely:

CGMS Satellite Operators

- **to provide regular information on satellite/instruments events affecting calibration and establish corresponding websites.**
- **to provide Instrument Performance Monitoring information routinely on their respective websites.**
- **If participating in GSICS, to provide a representative in the GSICS Data Management Working Group (GDWG).**

and generally

CGMS to support the development of guidelines by WMO for the design of future instruments with a view of harmonizing some spectral characteristics (e.g. central λ) of at least some core geostationary imager channels.

CGMS Members that are not currently participating to consider an active role in the future progress of GSICS, enabling their sensors to be used for inter-calibration and to benefit from the experience collected in GSICS.

4. Infrared/MicroWave sounding and ITWG Matters

NOAA reported on NOAA's new stratospheric temperature climate data record derived from recalibrated Stratospheric Sounding Unit (SSU) observations. NOAA/NESDIS has generated a 27-year (1978-2006) stratospheric temperature data record from Stratospheric Sounding Unit (SSU) observations for climate trend and variability detection. This is the first set of well-documented and well-calibrated global gridded datasets available to the climate community for long-term stratospheric temperature monitoring and investigation, and for validating climate model simulations of stratospheric climate change. For 1979-2006, the dataset had a global mean stratospheric temperature trend around -0.93 to -1.24 K/decade. Spatial trend pattern analyses indicated that this cooling occurred globally with larger cooling over the tropical stratosphere.

Further information on ITWG matters is provided in document ET-SUP-6/Doc.10.2.

5. Atmospheric Motion Vectors and IWWG Matters

EUMETSAT presented the status of preparations for the 11th International Winds Workshop to be held in 2012. 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. This paper announced the 11th Workshop of the International Winds Working Group (IWW11) to be held in Auckland, New Zealand from 20 - 24 February 2012. The workshop is hosted at the University of Auckland by Prof. Roger Davies. The paper recalled the background of relevant activities that were discussed and put into action at earlier CGMS meetings and Wind Workshops. The paper also put forward additional topics for discussion at CGMS 39 in WGII with the suggestion to consider those topics for further elaboration at IWW11. Working Group II acknowledged the progress that had been made notably on i) the stand-alone software for the derivation of AMVs and ii) on plans for a second AMV intercomparison.

All AMV providers should make an effort to have the quality of their products tested by NWP centers. It is recommended to present such results already at the 11th International Winds Workshop in February 2012.

CGMS-39 advised IWWG 11 to further address the salient issues and topics listed in EUM-WP-27.

CGMS agencies are encouraged to support scientists to attend the next IWWG.

Finally the rapporteur explained that the 5th WMO Workshop on the ‘Impact of Various Observing Systems on NWP’ will be held in Sedona, Arizona, USA from 22-25 May 2012. This will be an additional opportunity to report on and compare results of impact studies in a broader context.

EUMETSAT presented the IWWG Work Plan for a Second AMV Inter-Comparison Study. The main objective of the initial AMV inter-comparison study was to compare the operational algorithms of all satellite wind producers including the height assignment of AMVs from clouds using a common data set from SEVIRI on MSG, and the same ancillary data. In an initial study AMVs generated from a

common MSG-SEVIRI dataset (18 August 2006) by five AMV producers – EUMETSAT, NOAA-NESDIS, JMA, KMA, and the Brazilian Meteorological services, were inter-compared.

EUMETSAT also reported on a validation campaign for AMVs Derived with the NWC SAF Portable AMV Software Package and gave an overview on the scientific validation of the last version of the SAFNWC HRW software.

CGMS Agencies were invited:

- **to further test the performance of the NWCSAF AMV software package by testing the products in a NWP data monitoring/assimilation system, and**

- **to extend the current software to clear-sky WV AMVs.**

IMD presented the retrieval and validation of Atmospheric Motion Vectors from the Indian National Satellite System KALPANA-1. The India Meteorological Department has been processing 3 Channel Very High Resolution Radiometer (VHRR) data from KALPANA-1 and INSAT-3A Satellites since September, 2002 and April 2003 respectively. The retrieval of Atmospheric Motion Vectors using Infrared and Water vapor channels is one of the products derived from the KALPANA-1 Satellite. The overall improvement in the error values, especially in high level winds over the period indicates that the data is suitable for assimilation into NWP models as well as input for synoptic forecasting.

JMA reported on the recent status of JMA's AMVs from MTSAT-2 and MTSAT-1R, and outlines responses to Recommendations 38.14 and 38.15 JMA's Meteorological Satellite Center increased the frequency of AMV dissemination via the GTS in March 2011. Although AMV data from MTSAT-2 computed on an hourly basis were previously used only internally, they are now disseminated every hour via the GTS in BUFR format.

JMA plans to examine the efficiency of the NWC-SAF portable AMV software package. This test is expected to significantly contribute to the improvement of JMA's AMVs. JMA currently computes Rapid Scan AMVs from images taken at five-minute intervals by MTSAT-1R. These vectors will be useful for the development of next-generation AMVs applicable to JMA's follow-on satellite observations.

Satellite AMV providers are invited to examine the stand-alone AMV software package from the NWCSAF and to report back to CGMS 40.

KMA discussed the current status of Atmospheric Motion Vector derivation at KMA.

NOAA/NESDIS' expressed interest in the EUMETSAT NWC SAF's Atmospheric Motion Vector portable software. More specifically, this AMV software package presents an opportunity for NOAA/NESDIS AMV algorithm experts to increase their collaborations with AMV algorithm experts not only at EUMETSAT and the NWC SAF AMV, but also with AMV algorithm experts at the other satellite AMV processing centers or universities.

EUMETSAT NWC SAF to consider providing a tested option to allow running of alternative algorithms to support algorithm intercomparisons studies.

Further information on IWWG matters is provided in document ET-SUP-6/Doc.10.3.

6. Radio Occultation and IROWG Matters

IMD presented a case study of GPS Meteorology addressing the underestimation of IPWV (integrated precipitable water vapour) by ground based GPS system in some meso-scale Thunder storms. It is concluded that for the fast developing thunder clouds the number of GPS satellites which are spanning the atmosphere and the size of the thunder cells play a major role in determining the accuracy of

perceptible water vapour using GPS.

NASA reported on radio occultation activities at NASA. NASA/JPL has been involved in radio occultation (RO) science since its early demonstration and development on planetary missions in the 1970s. NASA's instrument design is the basis for operational assimilation of RO data from the following missions: COSMIC, CHAMP, SAC-C, C/NOFS, GRACE, and TerraSAR-X (CHAMP is now de-orbited). NASA is currently developing a next-generation instrument for planned Earth science missions, to increase science return from transmissions of Global Navigation Satellite Systems (GNSS).

New opportunities to host RO instruments on appropriate missions are under active consideration by the RO community. The Korean KOMPSAT-5 mission has purchased a modified NASA-designed receiver from Broad Reach Engineering, possibly representing another source of operational data. NASA recognizes that hosting opportunities increase as resource requirements go yet lower. JPL is currently considering advances in GNSS RO technology that have reduced power and mass requirements while preserving most functionality of the Trig instrument. Their ability to pursue such approaches is dependent on availability of funding.

Further IROWG matters are presented in document ET-SUP-6/Doc. 10.4.

7. Cloud and Ash/Dust related Matters

CMA reported on Satellite Volcanic Ash monitoring and Operational Service and the recent work at CMA that tries to establish the warning and dynamic monitoring of volcano ash. First results using the example of the ash cloud from the Eyafyalla eruption in April 2010 were presented.

CMA summarised work on Operational Dust Storm Remote Sensing. Specifically the working paper reported on CMA work to monitor the outbreak and extension of dust storms from satellites. It mentions that dust monitoring is one of operational tasks of NSMC and describes the method to identify the outbreak of a dust storm and the quantitative algorithm to retrieve the optical depth and particle size.

CMA provided a report on the Operational Use of Satellite Data for Nowcasting Convective Cloud Systems. It described the operational use by CMA of satellite data for nowcasting. Satellite data in operational use for nowcasting is primarily used to identify, track and warn of convective clouds.

EUMETSAT reported on the current support to the Working Group for Nowcasting Research of the World Weather Research Programme (WWRP-WGNR). This Working Group for Nowcasting Research (WGNR) is a part of the WMO World Weather Research Programme. Established in 2001, past activities of the group encompassed nowcasting Demonstration Projects, including necessary training. The Nowcasting Research Working Group had realized that knowledge of potential of satellite observations for nowcasting purposes had not been well represented and thus asked for the participation of a EUMETSAT representative in the group. In a recent WGNR meeting, EUMETSAT and NOAA informed the group about the nowcasting capabilities of MSG and of the future GOES-R and MTG programmes. The value of these observations on otherwise data sparse regions (e.g. Africa and parts of South America) was highlighted and acknowledged by the Working Group.

EUMETSAT also reported on capabilities and plans to support volcanic ash monitoring. Following the raised interest in quantitative volcanic ash information derived from satellite observations after the 2010 Eyjafjalla eruption, EUMETSAT commissioned two science studies with the aim of exploring the information content of Metesoat Second Generation (MSG) observations in this respect.

EUMETSAT summarised nowcasting Applications, including Cloud Analysis, Fog Detection and Forest Fires. The overview summarised established nowcasting applications based on Meteosat Second Generation (MSG) observations. These applications range from the use of pure imagery data, mainly

based on channel combinations as e.g. channel differences or RGB composites, to more elaborate higher level products. A wealth of nowcasting products is provided through the software of the EUMETSAT Satellite Application Facility in Support to Nowcasting and Short-Range Weather Forecasting (NWC-SAF).

JMA addressed nowcasting products based on MTSAT-1R Rapid Scan Observations. JMA's MTSAT-1R Rapid Scan (RS) operation activities and nowcasting products produced using related data were described. Since 7 June 2011, JMA has disseminated information on clouds around Japan to aviation users.

KMA reported on the current status of weather forecast support for nowcasting and very-short range forecasts. KMA has improved its satellite image analysis technique through the introduction of new, advanced skills provided by the NWCSAF of EUMETSAT.

NASA provided an overview of NASA satellite observations of clouds, ash, and dust. NASA Earth observation satellites have contributed immensely toward effective monitoring of meteorological and other physical phenomena that affect the Earth system. Numerous operating satellites and instruments are currently used for this purpose. The parameters routinely observed by NASA satellites include optical depth or thickness, particle/droplet/crystal type or shape, effective radius (of aerosol particles or cloud droplets/crystals), size distribution, layer height, layer thickness, vertical distribution, among others.

Data from MODIS, MISR, and CALIPSO, together with that from the Ozone Monitoring Instrument (OMI on Aura) provide a variety of information about aerosols, with particular synergy coming from the near coincident measurements made by Aqua MODIS, CALIPSO, and OMI as part of the A-train. A number of NASA's cloud and aerosol data are being used operationally, with particular examples being in weather forecasting, air quality forecasting, aerosol assimilation, outreach and education, international partnerships in data delivery and utilization, and several community-based and international assessments.

NASA continues to plan for the eventual implementation of the GeoCAPE mission, a geostationary satellite to study atmospheric composition including aerosols that was suggested by the US National Research Council in its 2007 Decadal Survey for Earth sciences. While current plans do not have a launch date scheduled, small investments are being made through the flight program, with additional investments made by NASA's Earth Science Technology Office.

NOAA provided an overview of differing regional capabilities in satellite-based volcanic ash cloud detection. Satellite capabilities relevant to volcanic ash cloud tracking are not globally uniform, and thus vary across (or even within) areas of responsibility of the nine Volcanic Ash Advisory Centres (VAACs). They described how regional variations in satellite-based ash cloud tracking capabilities impact VAAC operations and summarized how regional satellite capabilities will change as new satellites are placed into operations over the next 10 years. Volcanic cloud monitoring would greatly benefit from high-spectral-resolution infrared measurements in geostationary orbit and highly elliptical orbits that provide improved coverage of high latitude regions. In recognition of the need to better observe the Arctic from space, the Canadian Space Agency, in partnership with Environment Canada, are planning the Polar Communications and Weather (PCW) mission.

NOAA also reported on progress in the development of a NearCasting system to provide forecasts between 1 and 9 hours. Unlike Nowcasts, which generally provide 0-2 hour guidance based on extrapolations of radar and satellite observations after clouds appear, the NearCasting system uses multi-spectral infra-red geostationary satellite products to understand the detailed moisture and stability structure of the atmosphere 1-9 hours before storms form. The NearCasting system is designed to detect and retain extreme variations in the atmosphere (especially moisture fields) and to incorporate large volumes of perishable high-resolution a-synoptic data.

NOAA/CIMSS were invited to report on additional case study results using NearCasting, and, if

practical, to include collaboration with the Severe Weather Forecasting Demonstration Project (SWFDP) for the Lake Victoria region.

8. Ocean Parameters

EUMETSAT provided a report on Ocean Products including those from the OSI SAF. Those products and services from the EUMETSAT Distributed Application Ground Segment include a number of oceanic parameters that are retrieved from satellite data.

The JMA activities were described on the development of new multi channel sea surface temperature (SST) algorithm. JMA's activities are directed towards the development of a new sea surface temperature (SST) algorithm and its application to MTSAT data. JMA has operationally retrieved SSTs from GEO data since GMS-5 was launched in 1995. These SSTs indicate good performance for ocean monitoring status, but additional efforts to reduce bias are necessary.

NASA reported on NASA's program of breakthrough research to advance fundamental knowledge on the most important scientific questions on the global and regional integrated Earth system. The oceans are a major component of the global integrated Earth system, continually interacting with land and the atmosphere. NASA's goal is to understand the changing ocean environment and its interaction with life. NASA satellite ocean and ocean-related measurements are chlorophyll-a, clouds, gravity, rainfall, sea ice, sea surface salinity, sea surface temperature, sea surface topography, sea surface wind speed, seasurface wind vector, and sea surface radiative fluxes. Ten of NASA's fifteen on-orbit satellites record one or more of the ocean and ocean-related variables.

Highlights of NASA ocean science and technology activities in 2010-2011 were described. In September 2010, all ocean and ocean-related missions were extended for two years. In 2010, there were nearly 400 science and technology projects related to ocean science and technology. On 9 June 2010, NASA launched the Argentine satellite SAC-D with the NASA Aquarius instrument to measure sea surface salinity.

The WMO reported on Satellite Products in support of the SWFDP requirements for the Great Lakes and Coastal Areas in Tropical Regions. The report contained information on the Severe Weather Forecasting Demonstration Project (SWFDP) developments in Eastern Africa and describes its needs for satellite products for the Lake Victoria Basin region, which will improve severe weather forecasting in this region, and thereby will support various socio-economic sectors and application areas, including hydrology (e.g. in flood monitoring and forecasting) and water resources, agriculture and fisheries, and maritime safety, in addition to the general public. EUMETSAT commented that the cooperation on provision of satellite products in support to the Lake Victoria project would be another opportunity for strengthening the use of satellite data in Africa with the aim to enhance the warning capabilities for disaster mitigation purposes. Furthermore the methodologies and training capabilities of the WMO VLab could be used to support the SWFDP.

CGMS Satellite Operators were invited to advise on satellite products that could be made available in response to the needs of the SWFDP – Eastern Africa, to facilitate the timely provision of such satellite-related information, and to consider the SWFDP needs for the Lake Victoria Basin region in future product development activities.

WMO discussed the Requirements for Satellite Information for Coastal Inundation Forecasting and Warning. The Coastal Inundation Forecasting Demonstration Project (CIFDP) was initiated jointly by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the WMO Commission for Hydrology (CHy), aiming to provide an example of cooperative work as a strategy for building improved operational forecast and warning capability for coastal inundation from combined extreme waves, surges and river flooding events, that can be sustained by the responsible national agencies. Satellite observations have clearly demonstrated the potential to provide information to improve coastal inundation monitoring, forecasting and warnings; yet the quality and usability of

these observations are still to be improved. This paper introduces the currently identified requirements for satellite information in support of the associated coastal applications, and proposes actions for CGMS Satellite Operators to participate in and contribute to the CIFDP implementation.

ESA drew attention to the ESA-funded eSurge project (http://www.storm-surge.info).

CGMS Satellite Operators to consider the requirements of satellite information for coastal applications that are described in WMO-W-30, and provide comments to WMO (blee@wmo.int).

CGMS Members are encouraged to identify opportunities to develop and improve products and services contributing to CIFDP.

For more information on JCOMM-related matters, please see document ET-SUP-6/Doc. 10.5.

9. Other Parameters and Products

EUMETSAT reported on the availability of IASI Level-1 Product Extraction Software for Direct Readout. Summary information on the availability of IASI Level-1 processing software for direct readout was given. A software package called OPS-LRS, which is based on the operational global IASI Level-1 processor software, developed by CNES and operated routinely by EUMETSAT in the Core Ground Segment (CGS), was modified and maintained for local processing by the EUMETSAT Satellite Application Facility on Numerical Weather Prediction (NWP SAF). Users can obtain the software in the framework of the AAPP package from the NWP-SAF via their web-page. Since 2011, the software is maintained by EUMETSAT in the Core Ground Segment. For that purpose, the software was made compatible with a Linux environment and is now identical to the operational global version.

IMD reported on recent developments in predicting atmospheric instability with MODIS profiles using real time direct broadcast data over the Indian region. The National Satellite Meteorological Center (NSMC) of IMD has installed three real time direct broadcast ground receiving and processing systems. These systems currently receive Earth observation data from polar orbiting satellites, such as NOAA (National Oceanic and Atmospheric Administration) meteorological satellite series, Metop and the MODIS Terra and Aqua satellites for New Delhi, Chennai and Guwahati stations. The study suggests that the inclusion of MODIS Profile Instability (MPI) as a stability parameter in physical or statistical modelling can improve local severe storm predictions.

IMD also presented recent advances in satellite applications for Tropical Cyclone monitoring and forecasting over the North Indian Ocean. Visible and Infrared (IR) imageries from Kalpana –I are being used for estimation of centre and intensity of tropical cyclones. Nowadays Microwave and other imageries are also available from SSMI, SSMIS, Metop, TMI, AMSRE, WINDSAT, AMSUA, AMSUB satellites and accessed through a cyclone module in the forecasting workstation installed in India Meteorological Department have proved very useful in centre and intensity estimation of weaker tropical systems Scatterometer winds from Oceansat-II have also proved to be very useful for estimating the centre of systems.

JMA presented the preparation for new products expected from follow-on satellites. The AHI imagers on board Himawari-8/9 (JMA's follow-on satellites to MTSAT-2) will have a higher level of observing capability than the MTSAT-2 imager. In association with this enhancement, JMA is improving its current satellite products (particularly those based on atmospheric motion vector data) as well as developing new products related to instability indices and volcanic ash. To support these developments, Himawari-8/9 simulated images are generated in two ways – one involving the accumulation of high-spectral-channel observations from hyper sounders such as AIRS and IASI, and the other using radiative transfer computation based on the provisional response functions of Himawari-8/9.

KMA reported on the current status of satellite data assimilation in the numerical weather prediction centre in KMA. KMA has been operating the UK Met Office Unified Model and data assimilation (4DVAR) system since May 2010. As COMS started to release its products in April 2011,KMA NWP centre tested the model to use COMS atmospheric motion vectors (AMV) successfully.

KMA also provided a summary of the current status of COMS products services. Currently, KMA is producing 16 meteorological parameters including cloud analysis, fog, Asian dust, atmospheric motion vector, and ocean variables from COMS raw data in support of various applications such as nowcasting, numerical weather prediction models, climate monitoring and so on. Among them, 10 COMS meteorological products are distributed to users and the others (e.g. land surface temperature, sea ice/snow cover) will be distributed by the end of 2011.

NOAA reported on progress towards using SSMIS to extend the SSMI total precipitable data record .The Special Sensor Microwave Imager/Sounder (SSMIS) aboard the Defence Microwave Satellite Program (DMSP) F16/F17/F18 satellites measures the Earth-emitted radiation at frequencies from 19 to 183 GHz. Compared to the Special Sensor Microwave Imager (SSM/I), SSMIS has similar imaging channels except for two at 85.5 GHz replaced by the 91.655 GHz frequency. After the calibration of SSMIS imager channels, the temperature data record (TDR) can be utilized operationally to derive both atmospheric and surface parameters. Both the relatively small mean bias and standard deviation indicate that the SSMIS total precipitable water may replace the SSM/I products for operational use.

The WMO summarised the outcome of the International Workshop on Satellite Analysis of Tropical Cyclones which was the first WMO International Workshop on Satellite Analysis of Tropical Cyclones (IWSATC) organized by the WMO Tropical Cyclone Programme, in collaboration with the WMO World Weather Research Programme and the World Data Center for Meteorology at NOAA/NCDC. The main purpose of the workshop was to increase the accuracy and reliability of satellite analyses of tropical cyclones (TCs) by sharing the latest knowledge and techniques amongst researchers and operational forecasters of the major warning centres. This included discussions on recent developments in satellite analysis of TCs, particularly the objective satellite-based TC analysis methods.

NASA pointed out its significant contribution to tropical convection research by making all relevant datasets available to the science community. Upon request by NASA, WMO agreed to provide clarification on the linkage between the satellite-related activities of the WMO Tropical Cyclone Programme and the joint WWRP/THORPEX-WCRP Year of Tropical Convection (YOTC) project.

Finally WMO described the outcome of the GCOS Implementation Plan Satellite Supplement Updating. The draft up-date of the satellite-based component of the in 2010 updated “Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC” provides supplemental detail related to the generation of global climate products derived from measurements made from satellites.

While it was considered helpful to guide agencies in their coordinated response to GCOS needs, some discussion ensured on the correctness and completeness of the ‘agents for implementation’ of climate data records in support of satellite-based Essential Climate Variables (ECVs), as identified in Annex I of WMO-WP-23. The importance of active international expert groups tasked to investigate the issues related to climate data record generation for all satellite-based ECVs in a coordinated manner was emphasized.

Conclusion

This document presents a short summary of the discussions on product developments which were held in working group II of CGMS-39.