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## **UPDATE ON 5<sup>th</sup> ASIA-OCEANIA METEOROLOGICAL SATELLITES USERS CONFERENCE**

*(Submitted by Anthony Rea, written by Agnes Lane)*

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### **Summary and Purpose of Document**

To provide an update on the fifth Asia Oceania Meteorological Satellite Users Conference.

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### **ACTION PROPOSED**

The session is invited to note the information.

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- Appendices:**
- A. Shanghai Statement of the 5<sup>th</sup> Asia Oceania Meteorological Satellite Users Conference
  - B. Summary of the 5<sup>th</sup> Asia Oceania Meteorological Satellite Users Conference

## DISCUSSION

### Introduction

1. The fifth Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC-5) was held in Shanghai, China from 19 – 21 November 2014. The conference was hosted and sponsored by the China Meteorological Administration (CMA) and was co-sponsored by the Japan Meteorological Agency (JMA), the Korean Meteorological Administration (KMA), the Australian Bureau of Meteorology (AuBOM), the World Meteorological Organization (WMO), and the Global Environmental Observing System of Systems (GEOSS). A key development was the announcement by Roshydromet that they wish to become a co-sponsor of future conferences.
2. As with previous AOMSUCs, the conference was preceded by a training event that brought together participants from WMO Regions II and V. Over 130 scientists, users, and satellite operators representing 40 countries participated in the AOMSUC-5. All attendees expressed their great appreciation of the outstanding efforts of CMA in its planning and hosting of the conference as well as the support of the co-sponsors and the work of the International Conference Steering Committee (ICSC).
3. In the keynote session, "Current and Future Satellite Programs and Systems", the operational space agencies (NSMC/CMA, EUMETSAT, JMA, KMA, NOAA/NESDIS and ROSHYDROMET) provided information on launch schedules for new satellites, and access to data, products, and training material. JMA presented information on the Advanced Himawari Imager, and Roshydromet presented some new FTS data from Meteor-MN2. Other plans before the end of the decade include launch of FY-3 and FY-4 series by NSMC/CMA; MTG and EPS-SG by EUMETSAT; Himawari-9 by JMA, GEO-KOMPSAT-2A and B by KMA; GOES-R and JPSS by NOAA/NESDIS; ELECTRO-L and -M geostationary-series and Meteor-MN3, Meteor-MP leo-series and Arctica in a Molniya orbit by Roshydromet. CMA's plans to possibly cover the early morning polar orbit with FY3 were noted to be of significant benefit to the WIGOS and NWP in particular.
4. Over the following three days, 42 presentations were given across six sessions:
  - In **Session 1**, "Facilitation of data access and utilization, user preparation," presentations focused on preparations undertaken by operators, data providers and users in Asia and Oceania for the new generation of geostationary satellites, represented here by Himawari-8/9, FY-4 and GK-2.
  - Session 2**, "Application of satellite data to weather analysis, numerical weather prediction and nowcasting" covered methodologies for performing and validating nowcasting, data quality and methodology improvement for data assimilation in regional NWP models, and preparations for application of next generation of geostationary advanced measurements.
  - Session 3**, "Application of satellite data to climate analysis, reanalysis, and process studies," plans and results from re-processing past sensor data.
  - Session 4**, "Application of satellite data to environmental monitoring and disaster risk reduction," presentations noted that satellites have proven to be invaluable at all stages of disaster mitigation, from preparation to warnings, providing real-time intelligence as disasters unfold, and for post-event impact analysis. The conference was informed on the work done within the Coordination Group on Meteorological Satellites on measuring the socio-economic benefit of satellite observing systems, of which a key area is disaster risk reduction.
  - Session 5**, "Land, Ocean, and Atmospheric parameters derived from satellite observations," focused on the broad scope of capabilities with current sensors and anticipated improvements with future sensors.
  - Session 6**, "Global Space-based Inter-calibration System (GSICS)," provided an update on

various topics related to GSICS, including GSICS Inter-Calibration Product Development, characterization of ATMS on-orbit calibration accuracy for GSICS Applications, GSICS product development in CMA, and activities and plans at the GSICS Coordination Centre.

5. Prior to AOMSUC-5 the VLab Workshop was hosted by the Shanghai Meteorological Service, CMA, on 17-18 November 2014. The objectives of the workshop were a) to provide details on the next generation of satellites to assist with user preparedness, b) to give users an appreciation of the various applications of meteorological satellite data and products, and c) to provide participants with the skills to apply meteorological satellite observations to weather analysis, climate monitoring, and environment and disaster management. The workshop was attended by 83 participants, including 62 online participants, from nine different countries. The workshop lecturers provided information on current and future satellite data, and the application of this data for weather and climate analysis, land and ocean monitoring, and disaster mitigation. Presenters also provided information on how to access to data and products, such as via CMACast. Another common theme of the workshop was user preparedness for the next generation of satellite systems, and related to this, information was provided on the activities of the WMO Task Teams on Satellite Utilization. During the final session of the workshop, CMA gave participants the opportunity to sample CMA's visualization tools SWAP and SMART.

6. The annual AOMSUC continues to be an excellent forum for members within the Asia Oceania community to meet and enhance their joint efforts in the utilization of satellite data and products for improved weather and climate services. AOMSUC-5 featured high quality presentations in eight oral sessions, one panel, one round table, and one poster session. The current activities and plans presented by the satellite operators in Asia Oceania are most impressive. Noteworthy is that JMA, CMA, and KMA in the next decade will all have cutting edge geostationary satellite imagers that will be capable of multispectral measurements at high temporal and spatial resolution with rapid scan as a routine part of their operation. In addition CMA will introduce the first hyperspectral infrared geostationary satellite sounder. The operational and research satellite communities and users within Asia Oceania continue to cooperate closely to great benefit of all.

7. The 5<sup>th</sup> AOMSUC also agreed to issue a statement which will be forwarded to the WMO Permanent Representatives of the co-sponsoring agencies. The statement is intended to institutionalise the AOMSUC and establish a secretariat to support the hosting of subsequent conferences. The Statement is provided as Appendix A and the Conference Summary at Appendix B.

8. In summary AOMSUC-5 was very successful in meeting the four goals of these conferences; (1) to promote the importance of satellite observations and highlight their utility; (2) to advance satellite remote sensing science by enabling scientist to scientist information exchanges focused on Asia/Oceania; (3) to provide a means for satellite operators to interact directly with the user community concerning current and future satellite related activities and plans, and (4) to engage young people entering into the field.

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**Appendix A: Shanghai statement from the AOMSUC-5**

**Statement**  
**from Shanghai**  
**of the**  
**Fifth Asia Oceania Meteorological Satellite Users' Conference**

November 21, 2014

--Maximizing the benefit of meteorological satellite observations to sustain social-economic development

**We**, the participants assembled at the Fifth Session of Asia-Oceania Meteorological Satellite User Conference (AOMSUC-5) in Shanghai, China from 19 – 21, November, 2014:

**Recalling** the overwhelming success of the Asia Oceania Meteorological Satellite Users Conferences held so far, with the first conference in Beijing, China in November 2010, followed by the second in Tokyo, Japan (2011), the third in Jeju Island, Korea (2012) and the fourth in Melbourne, Australia (2013), and the fifth in Shanghai, China (2014).

**Recalling further** that the AOMSUCs provide an excellent forum for members within the Asia Oceania community to meet and improve their joint efforts in the utilization of satellite data and products for enhanced weather and climate services. The conferences feature high quality oral and poster presentations, as well as panel discussions that address topical issues such as utilization of satellite data in Weather Analysis and Forecasting, Climate and Environmental Monitoring, Numerical Weather Prediction and Disaster Monitoring. The conferences have proven very effective in:

- (1) Promoting the importance of satellite observations and highlighting their utility;
- (2) Advancing satellite remote sensing science by enabling information exchange between scientists from the Asia/Oceania region and focusing on regional issues;
- (3) Providing a means for satellite operators to interact directly with the user community with respect to current and future satellite related activities and plans and respond to the requirements of those users, and
- (4) Engaging young scientists entering the field.

**Recognizing** that the Asia-Oceania is a weather disaster-prone region, particularly affected by tropical cyclones, severe weather events, etc. The super typhoon Haiyan in 2013 was one of the strongest tropical cyclones ever recorded, that devastated portions of Southeast Asia, particularly the Philippines, causing significant casualties and disruption to socio-economic activities in the region. Most observations of the typhoon were taken from space, and satellite data played an important role in determining Haiyan's position and strength and in forecasting its movement as well as its intensity. The Haiyan case demonstrated importance of satellite data and coordination at global and regional levels

including the reception of data and products from meteorological and environmental satellites for meeting future needs.

**Recognizing** that the Global Framework for Climate Services (GFCS), a United Nations led initiative spearheaded by the World Meteorological Organization (WMO) to guide the development and application of science-based climate information and services in support of decision-making. Regional climate outlook forums now exist all over the world, including in the Asia-Oceania region. They are providing meteorological expertise to agriculture, food, disaster, health, energy and megacity managers that will lead to huge socio-economic development benefits. The development of an Architecture for Climate Monitoring from Space needs unprecedented collaboration and support among the Asia-Oceania space agencies and among the users to help insure that climate records derived from satellite observations will play an important role in the provision of climate services.

**Noting** the important roles played by the International Conference Steering Committee (ICSC) of the AOMSUCs, composed of both scientists and satellite operators from China (CMA/NSMC), Japan (JMA) and Korea (KMA), as well as from Australia (AuBOM) representing Oceania, and international renown scientists, together with the sponsoring organizations WMO and Group on Earth Observations (GEO). The ICSC was very successful in helping formulate the roles of the key cosponsors, in setting up the programmes of the conferences, in helping to attract strong science participation from across the globe, and in setting the pathway for future conferences.

**Noting with appreciation** that Roshydromet joined the ICSC and became a co-sponsor of the AOMSUC at the 2014 conference.

**Noting** the expectations of the participants that the AOMSUCs will continue to contribute to building an effective platform and a long-term cooperative mechanism that engages meteorological satellite operators and users in the Asia-Oceania region and in the rest of the world at large, and in this aspect, the participants reached further the following consensuses:

1. **Note with satisfaction** that the AOMSUCs have provided a forum that facilitated improved collaboration among the space agencies and with the broader user communities of the Asia-Oceania region, that provided an unique atmosphere where users and satellite operators could communicate positively to address the challenges that ranged from utilization to future satellite systems and requirements, and that attached great importance to the cooperation and exchange of Earth observations from space.
2. **Recommends continuing** the AOMSUCs as an annual satellite user conferences with focus areas that reflect the needs of Asia/Oceania, and with the hosts coming from one of the regional satellite operators and some major users representative countries of the Asia Oceania region, and to expand invitation to more satellite operators of the region, and to encourage more active participation from all the Asia Oceania countries to benefit by utilizing the new generation of meteorological satellites.

3. **Recommends further** to retain the current mandate of the International Conference Steering Committee (ICSC) of AOMSUC in line with the opportunities and challenges provided by new generation of meteorological and environmental satellites and new emerging services requirements.
4. **Recommends further** to proceed with an ICSC that is composed of a chair that is chosen by the ICSC and serves for one complete rotation of the AOMSUC, a co-chair from the host country, preferably the permanent representative with WMO, or his/her high level representative, with members composed of high level representatives from satellite operators and major user countries of the region, as well as internationally renowned scientists recommended by the co-sponsors.
5. **Recommends further** to establish a permanent secretariat to sustain the AOMSUC mechanism by facilitating the organization and coordination of future AOMSUCs, supporting the ICSC meetings, liaising with EUMETSAT and NOAA conference secretariats. Provide support to AOMSUC co-sponsors and others in Asia/Oceania to strengthen existing, and foster the future establishment of regional centers of excellence on utilization and exploitation of satellite data and help coordinate their activities. The secretariat would reside within the WMO Space Programme Office as volunteer and in-kind contribution secondments and/or trust fund of the satellite operators and countries of the Asia-Oceania region.
6. **Recommends further** the WMO Secretary General to bring these recommendations to the attention of the Permanent Representatives of WMO Members sponsoring the AOMSUCs with the aim of placing the conference on an annual self-perpetuating basis.
7. **Extend** deep appreciation to all the host countries for graciously hosting the AOMSUCs; and acknowledge and value the contributions of WMO and GEO as the co-sponsored organizations to the success of the AOMSUCs, and special gratitude to the ICSC chair Dr. James Purdom and members, as well as the local organizing committee members for dedicating their time, efforts and resources to the success of AOMSUCs.

Annex 1: Terms of Reference of Host, Cosponsors, ICSC and Secretariat of AOMSUCs and ICSC members present at the 5<sup>th</sup> AOMSUC

## Appendix B: Summary of the AOMSUC-5



# AOMSUC-5 Conference Summary

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The fifth Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC-5) was held in Shanghai, China from 19 – 21 November 2014. The conference was hosted and sponsored by the China Meteorological Administration (CMA) and was co-sponsored by the Japan Meteorological Agency (JMA), the Korean Meteorological Administration (KMA), the Australian Bureau of Meteorology (AuBOM), the World Meteorological Organization (WMO), and the Global Environmental Observing System and Systems (GEOSS). As with previous AOMSUC's, the conference was preceded by a training event (summarized in the conclusions) that brought together participants from WMO Regions II and V. Over 130 scientists, users, and satellite operators representing 40 countries participated in the AOMSUC-5. All attendees expressed their great appreciation of the outstanding efforts of CMA in its planning and hosting of the conference as well as the support of the co-sponsors and the work of the International Conference Steering Committee (ICSC). The outstanding hospitality by CMA, Shanghai Meteorological Service, and Shanghai Academy of Spaceflight Technology was remarked upon and very well appreciated by all attendees.

Noting that in the next decade the Space Based Component of the WMO Integrated Global Observing System (WIGOS) will realize an unprecedented stream of new data, it is imperative that efforts be undertaken as soon as possible toward coordinating the generation of new products and services and preparing the worldwide user community. It will be a significant undertaking for the operational space agencies in the coming years and these annual conferences of the Asia Oceania satellite community are an important part of that effort.

The conference was opened by Dr Guoguang Zheng, CMA Administrator. Administrator Zheng welcomed the participants and noted that this conference was building on the past success of the last four conferences with this conference beginning the second cycle of hosting. He stressed the importance of this conference as an opportunity for enhancing cooperation, exchanging information, and improving satellite data utilization. In their welcoming remarks, Dr Yang Jun, Director General, National Satellite Meteorological Center, CMA, Dr Sang Jin Lyu, Director, Satellite Analysis Division, KMA, and Dr Toshiyuki Kurino, Satellite Program Division, JMA, all reflected on the importance of the AOMSUC's in bringing together satellite operators and the user community. Dr Anthony Rea, Assistant Director, Observing Strategy and Operations Australian Bureau of Meteorology, noted the increasing efforts to engage the user community and to offer training on site and remotely in order to achieve improved satellite data utilization. Dr Osamu Ochiai, representing GEO, noted that GEO11 marked the beginning of a new decade for enhancing scientific understanding through international cooperation and collaboration. Dr Jeremiah Lengoasa, Deputy Secretary General of the WMO, lauded the

vibrancy of the Asia-Oceania meteorological satellite community and complimented them for their good efforts in sharing data and information across the region. He noted that the increase in satellite data quality, volume, and information content presents a challenge to the community to realize the opportunity for improved weather and climate services; he cited disaster risk reduction as a prime area for joint efforts.

The keynote Session, “Current and Future Satellite Programs and Systems,” was chaired by Drs Naimeng Lu (CMA) and Paul Menzel (University of Wisconsin). Eight speakers provided information about the plans of the operational space agencies (NSMC/CMA, EUMETSAT, JMA, KMA, NOAA/NESDIS and ROSHYDROMET), preparations for use, and anticipated impact on the WMO Global Observing System (GOS). All agencies are working towards continuity and improvement of satellite data services (calibration, demonstration of new applications, access to data and products, and training). Japan had just launched the first of the new generation of geostationary satellite imagers, the Advanced Himawari Imager, and Roshydromet presented some new FTS data from Meteor-MN2. Other plans before the end of the decade include launch of FY-3 and FY-4 series by NSMC/CMA (FY-4A is anticipated to introduce geostationary satellite high spectral resolution infrared (IR) measurements); MTG and EPS-SG by EUMETSAT; Himawari-9 by JMA, GEO-KOMPSAT-2A and B by KMA; GOES-R and JPSS by NOAA/NESDIS; ELECTRO-L and -M geostationary-series and Meteor-MN3, Meteor-MP leo-series and Arctica in a Molniya orbit by Roshydromet. CMA plans to cover the early morning polar orbit with FY3 were noted to be of significant benefit to the WIGOS and NWP in particular. It was also noted that with the anticipated launch of five more geostationary satellite high quality imagers before the end of the decade that global imaging from geostationary orbit will be significantly upgraded and provide new challenges and information to the user community. Addressing this issue, ABoM summarized recent training efforts toward improved product utilization by the Asia Oceania community using VLAB and other mechanisms. From the WMO perspective, it was noted that these satellite plans bring to fruition many of the recommendations from the Expert Team on the Evolution of the GOS.

Continuation of the keynote session was chaired by Drs Steve Goodman (NOAA/NESDIS) and Wenjian Zhang (WMO) with each session speaker gave a keynote presentation that pertained to one of the subsequent six sessions in the conference. For session 1, Mikael Rattenborg presented an overview of the new WMO SATURN (SATellite User Readiness Navigator) portal for the next generation of geostationary satellites for user readiness and training. The portal offers a single point of access for all key information pertinent to the global user community. The portal provides information on satellite capabilities, product descriptions, test data, and associated tools to advance training and capacity building. As an opening of Session 2, Jim Purdom discussed satellite constellation synergy for weather forecasting and analysis offering insights, opportunities, and challenges for exploiting the greater spatial, temporal, spectral, and

signal to noise accuracy of the new instruments in geostationary and low earth orbit. Dynamic and adaptive tasking, fusion, and blending of information to understand atmospheric phenomena and structure using multi-sensor, multi-platform observations is in its infancy and holds great promise for breaking away from the stovepipe single sensor, single platform development of products. Such an effort will require international partnerships and collaborations to make the most effective use of the next generation of satellite systems in developing applications for broad societal benefit. Introducing Session 3, Tillman Mohr introduced an architecture for monitoring climate from space. The framework for this architecture was approved in 2012 by the WMO with a work plan underway for implementation in 2014-2016 beginning with space agencies responding to a request for an inventory of Essential Climate Variables. To date 28 of 50 ECVs have been identified that can be extracted from satellite data. The inventory will help identify the constellation of measurements at product level to identify gaps and shortfalls. For Session 4, Yoshira Tanaka described the higher frequency rapid refresh imagery soon to be routinely available from the forthcoming global constellation of new geostationary satellites ushered in 7 October 2014 with the successful launch of JMAs Himawari-8. The higher resolution in space and time information will enable more accurate and earlier warnings of high impact and extreme weather, as well as improved and new applications necessary to activate the public into taking action that will protect lives and property. Key challenges to reach this future state involve service delivery, efficiently manipulating large volumes of data (i.e., “Big Data”), and international cooperation. As a first paper in Session 5, Jhoon Kim described the current and new KMA geostationary GEO-KOMPSAT-2 (GK-2) capabilities for weather, environment, and ocean color imaging at high spatial and temporal resolution. The Geostationary Environment Spectrometer (GEMS) will provide a new capability in concert with the NASA Tropospheric Emissions Monitoring of Pollutants (TEMPO) and ESA Sentinel-4 UV-Visible-NIR (UVN) missions to advance the understanding of the global distribution and transport of atmospheric composition, aerosols, and air pollution and the interactions between the meteorology and atmospheric chemistry. Finally, toward Session 6, Peng Zhang closed the session with a report on the Global Space-Based Inter-Calibration System (GSICS) highlighting the improved calibration accuracy of our satellite measurements, and emphasizing the global cooperation necessary to monitor, improve, and harmonize the highest quality, most accurate data that can be shared among the global network of satellite operators and algorithm developers. The cooperation will result in consistent and traceable methodologies, comparisons, and corrections.

Session 1, “Facilitation of data access and utilization, user preparation,” was chaired by Drs Lars Peter Riishojgaard (WMO) and Fuzhong Weng (NOAA/NESDIS). Ten presentations focused on preparations undertaken by operators, data providers and users in Asia and Oceania for the new generation of geostationary satellites, represented here by Himawari-8/9, FY-4 and GK-2.

For the most part the technical work on the space segment is at a high level of maturity, and the focus is now on developing the ground and user segments; thus the focus has shifted to data product generation, data services, improving the computational capabilities for data assimilation, and user training. This work is driven to an increasing degree by the users and their needs, and some operators and data providers are now engaging directly with the users to seek feedback on activities in this area. Reports were also provided on the JPSS program in the US and on the ground-based GNSS work undertaken in China. And finally, the audience was briefed about various activities undertaken by the WMO, namely the efforts toward improving the integration of satellite observations into WIGOS, and its V-LAB training of current and future users of satellite data.

Session 2, “Application of satellite data to weather analysis, numerical weather prediction and nowcasting” was chaired by Drs Jun Li (UW/CIMSS) and Sang Jin Lyu (KMA). Twelve presentations covered methodologies for performing and validating nowcasting, data quality and methodology improvement for data assimilation in regional NWP models, and preparations for application of next generation of geostationary advanced measurements. Regarding nowcasting, several methodologies for nowcasting product generation and validation from geostationary satellites were introduced – these include water vapor band brightness temperature, cloud top height, cloud type, cloud phase, convective rain rate and rapid developing thunderstorm applied to severe storm and heavy precipitation warning. One example showed a good relationship of the temperature difference of cloud top and bottom with precipitation that has potential value for heavy precipitation warnings 2 hours in advance. The WMO Sustained Co-Ordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-Nowcasting) was introduced as a mechanism through which satellite data can be made available simply and quickly, for nowcasting applications, especially for the users in smaller or developing countries where application of the data may be limited. One presentation offered the promise that data assimilation in regional NWP models (WRF, HWRF) can benefit from destriping the ATMS brightness temperature through improvement of the bias correction, better background error characterization, and quality monitoring before assimilation. Another presentation showed positive impact on tropical cyclone (TCs) forecasts from improved utilization of AIRS and IASI measurements, including a near real time demonstration system developed at CIMSS toward improving utilization of satellite data as well as providing forecast research products to the end users. Finally several presentations noted that readiness for next generation of geostationary satellite advanced measurements has been enhanced through user access to prototype advanced products well before launch – their evaluation and feedback to application developers can help to ensure that the end products meet their requirements. The promising value of high spectral resolution IR measurements from geostationary satellites was also highlighted in the positive results from a regional Observing System Simulation Experiment.

Session 3, “Application of satellite data to climate analysis, reanalysis, and process studies,” was chaired by Drs Toshiyuki Kurino (JMA) and Xiaolei Zou (UMd/ESSIC). Two papers presented plans and results from re-processing past sensor data. HIRS recalibration through intercalibration with IASI was shown to reduce sensor to sensor radiance biases and to produce long term water vapor observations of similar quality that are worthy of long term trend analysis. CMA presented status and plans for long term reprocessing of NOAA / AVHRR , FY-2C/2D/2E , FY-1C/1D and GMS/ MTSAT data from 1988 onwards. Recalibration results from GSICS will be used and current algorithms for cloud amount, land surface temperature, snow coverage, vegetation and outgoing long wave radiation will be implemented. The considerable effort involved in long term data reprocessing was noted along with the significant benefit of improved radiance records for future efforts.

Session 4, “Application of satellite data to environmental monitoring and disaster risk reduction,” was chaired by Drs Tillmann Mohr (WMO) and Anthony Rea (ABoM). Four presentations noted that satellites have proven to be invaluable at all stages of disaster mitigation, from preparation to warnings, providing real-time intelligence as disasters unfold, and for post-event impact analysis. The conference was informed on the work done within the Coordination Group on Meteorological Satellites on measuring the socio-economic benefit of satellite observing systems, of which a key area is disaster risk reduction. The value of satellites in a range of situations was demonstrated, in particular for regions where conventional observations are difficult to obtain, or where a high-level overview of the situation is required. It was also highlighted that there is need for further work on ensuring that information is effectively communicated to decision makers and the general public during events.

Session 5, “Land, Ocean, and Atmospheric parameters derived from satellite observations,” was chaired by Drs Agnes Lane (ABoM) and Paul Menzel (UW/CIMSS). Nine presentations focused on the broad scope of capabilities with current sensors and anticipated improvements with future sensors. Regarding aerosol and cloud remote sensing it was noted that accurate correction of the optical path length increased by aerosols is one of major problems for improving the column CO<sub>2</sub> loading retrieval to better than 1%; redesign of the Cloud and Aerosol Imager (CAI) on board the GOSAT by installing two near ultra-violet bands of 340nm and 380nm and two along-track viewing angles is expected to enhance the capabilities of CAI-2 of the GOSAT-2. Also a new retrieval algorithm for surface energy flux has been developed for application with the Advanced Himawari Imager (AHI) to benefit the solar power energy generation sector. CMA presented improvement to atmospheric motion vector (AMV) derivation from FY-2 through calibration, navigation, and cloud height adjustments. In addition the reprocessing of AMVs from FY-2C,-2D, and -2E by the end of 2015 was announced. NESDIS presented a comprehensive paper detailing the GOES-R Algorithm Working Groups and how they have been positioned to evaluate post-launch level 2 products and to enhance the user

experience CMA/NSMC showed exciting simulation results on soundings achieved from the upcoming FY-4 high spectral resolution infrared sounder and their impact on depiction of a severe storm affecting Beijing. The session also included a presentation on marine boundary layer detection by the Cloud Profiling Radar; many are eluding detection and suggesting that significant biases in quantitative characterization of low level clouds. CMA/NSMC presented a sea wind retrieval method using the Microwave Radiation Imager (MWRI) on board FY-3B/C, based on an empirical method for retrieving sea surface wind speeds. Comparison with the TMI on board TRMM, and validation with buoy data during a typhoon event showed good results. The Shanghai Centre for Satellite Remote Sensing Applications have used NOAA/AVHRR, EOS/MODIS and FY-3 observations to analyze urban heat island expansion in Shanghai, and to monitor the impact of pollution on wetland and forest areas on Chongming Island. NSMC and the Centre for Space Science and Applied Research presented a study of the performance of the Global Navigation Satellite System Occultation Sounder (GNOS) on board FY-3C. Comparison of the GNOS observations with co-located radiosonde soundings show good correlation between 5 to 25km. Finally BMKG of Indonesia presented a technique to estimate the height of volcanic ash over the Indonesian region. The MTSAT split window technique compares well with observations from the Moderate Resolution Imaging Spectroradiometer (MODIS).

Session 6, "Global Space-based Inter-calibration System (GSICS)," was chaired by Drs Ken Holmlund (EUMETSAT) and Peng Zhang (CMA/NSMC). GSICS was introduced to the Conference in a Key-note lecture. This session provided further detailed information and was composed of five presentations. The presentations were further supported by a number of posters. The first presentation gave an update on GSICS Inter-Calibration Product Development. The current highlights include geostationary IR GSICS calibration is being introduced for all operators and are in different stage of implementation. Visible calibration techniques are also under development and specific subgroups for UV and microwave have been established. NESDIS then gave an overview of the characterization of ATMS on-orbit calibration accuracy for GSICS Applications. For the upper tropospheric sounding channels ATMS displays strong striping and therefore a Principal component analysis de-striping method is recommended. Comparing to temperature simulations with COSMIC and using simultaneous nadir overpasses with other microwave instruments the presentation demonstrated that SNPP ATMS is now well merged into the AMSU data family. The prospects for developing an Infrared Hyperspectral Benchmark Radiance Measurement through intercomparison of CrIS radiances with IASI and AIRS were shown to be excellent; a comprehensive overview of CrIS data quality and demonstrated a high agreement with IASI with differences of 0.1 to 0.2 for medium and longwave IR bands and 0.3 K for the shortwave band. CMA introduced the CMA GSICS product development; significant progress has been made with operational derivation of infrared GSICS calibration of all FY-2 and FY-3 satellites and development of visible calibration using various techniques like surface targets, deep convective clouds, lunar and cross-calibration of FY-2 and FY-3 data with other

instruments. To conclude, the GSICS Coordination Center (GCC) director, L. Flynn, reported on the activities and plans at the GCC. He introduced the GCC Quarterly publication activities and outreach. Furthermore new and planned products and product acceptance and promotion procedures were introduced. Finally the presentation invited the user community for feedback and engagement. Overall a comprehensive overview of GSICS and the activities in various centers was presented. Detailed examples on the use and benefit of the GSICS products were given and well demonstrated the established role GSICS has as part of the space-based observation system. Further it was emphasized that GSICS enables the community to do better science through better calibration!

The conference concluded with comments from each of the co-sponsors. Each expressed appreciation of the conference accomplishments and stressed the importance of continuing the AOMSUC as a future venue. Further, it was announced that Roshydromet had joined as an AOMSUC co-sponsor, thus expanding the reach of these conferences. Toward continuation, JMA announced that they are making arrangement to host the next AOMSUC in the second week of November 2015 and invited prospective attendees to Tokyo. Dr James Purdom, chair of the ICSc, organized a presentation of a statement of resolve to continue the AOMSUC (to be introduced to the co-sponsor PRs at the next WMO Congress 2015), the mechanisms for continuation, and terms of reference of the hosting institute.

As noted earlier in this summary, prior to AOMSUC-5 the VLab Workshop was hosted by the Shanghai Meteorological Service, CMA, on 17-18 November 2014. The objectives of the workshop were a) to provide details on the next generation of satellites to assist with user preparedness, b) to give users an appreciation of the various applications of meteorological satellite data and products, and c) to provide participants with the skills to apply meteorological satellite observations to weather analysis, climate monitoring, and environment and disaster management. The workshop was attended by 83 participants, including 62 online participants, from nine different countries. The workshop lecturers provided information on current and future satellite data, and the application of this data for weather and climate analysis, land and ocean monitoring, and disaster mitigation. Presenters also provided information on how to access to data and products, such as via CMACast. Another common theme of the workshop was user preparedness for the next generation of satellite systems, and related to this, information was provided on the activities of the WMO Task Teams on Satellite Utilization. During the final session of the workshop, CMA gave participants the opportunity to sample CMA's visualization tools SWAP and SMART.

The annual AOMSUC continues to be an excellent forum for members within the Asia Oceania community to meet and enhance their joint efforts in the utilization of satellite data and products for improved weather and climate services. AOMSUC-5 featured high quality

presentations in eight oral sessions, one panel, one round table, and one poster session. The current activities and plans presented by the satellite operators in Asia Oceania are most impressive. Noteworthy is that JMA, CMA, and KMA in the next decade will all have cutting edge geostationary satellite imagers that will be capable of multispectral measurements at high temporal and spatial resolution with rapid scan as a routine part of their operation. In addition CMA will introduce the first hyperspectral infrared geostationary satellite sounder. The operational and research satellite communities and users within Asia Oceania continue to cooperate closely to great benefit of all.

In summary AOMSUC-5 was very successful in meeting the four goals of these conferences; (1) to promote the importance of satellite observations and highlight their utility; (2) to advance satellite remote sensing science by enabling scientist to scientist information exchanges focused on Asia/Oceania; (3) to provide a means for satellite operators to interact directly with the user community concerning current and future satellite related activities and plans, and (4) to engage young people entering into the field.