Vol. 5 No. 4, December 2014

RA II WIGOS Project Newsletter

DEVELOPING SUPPORT FOR NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES IN SATELLITE DATA, PRODUCTS AND TRAINING

Contents of this issue

Report on the Fifth Asia/Oceania Meteorological Satellite Users' Conference (AOMSUC-5) and V-Lab workshop

Overview

The AOMSUC-5 hosted by the China Meteorological Administration (CMA) was held on 19-21 November 2014 in Shanghai, China, preceded by a two-day V-Lab training event from 17 to 18 November 2014. The conference got into the second cycle of hosting and as with previous AOMSUC's 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 Group on Earth Observations (GEO).

Over 130 satellite operators, users and researchers from 40 countries participated in this conference and it had been successfully progressed by outstanding hospitality of CMA, the Shanghai Meteorological Bureau, and the Shanghai Academy of Spaceflight Technology.

Sessions

The conference consisted of eight oral sessions, one round table discussion including keynote session as below and one poster session.

- Opening session : Opening speech by each co-sponsors
- Keynote session : Current and Future Satellite Programs and Systems
- Session 1 : Facilitation of data access and utilization, user preparation
- Session 2 : Application of satellite data to weather analysis, numerical weather prediction and nowcasting
- Session 3 : Application of satellite data to climate analysis, reanalysis, and process studies
- Session 4 : Application of satellite data to environmental monitoring and disaster risk reduction
- Session 5 : Land, ocean, and atmospheric parameters derived from satellite observations
- Session6 : Global Space-based Inter-calibration System (GSICS)

During those sessions, a lot of information was presented about plans of the operational satellite agencies (NSMC/CMA, EUMETSAT, JMA, KMA, NESDIS/NOAA, AuBOM and Roshdromet), research activities on various applications and improvement of satellite data services (calibration, demonstration of new applications, access to data and products, and training)

Most impressive topic of presentation was the JMA, CMA, and KMA will have top-notch geostationary satellite imagers which will be highly improve the temporal and spatial resolution of observation compared to current imagers. The strategies and close cooperation between space agencies for making synergy effect with those dense network of geostationary satellite observation over Asia/Oceania region are needed to get great benefits of all.

Announcement

It was announced that Roshydromet had joined as an AOMSUC co-sponsor. And JMA announced the tentative schedule of the next AOMSUC in the second week of November 2015 which will be hosted by JMA and held in Tokyo jointed with a two-day V-Lab training.

Conclusion

The conference concluded with each co-sponsor's appreciation of the conference accomplishments and remarks on the importance of AOMSUC to Asia/Oceania satellite communities.

In summary AOMSUC-5 was very successful meeting to interact directly with each satellite operators and users and to share a lot of information concerning current and future satellite related plans and research activities focusing on Asia/Oceania.

The all presentation materials of the conference are available on below web link provided by CMA;

http://www.nsmc.cma.gov.cn/aomsuc5/Agenda.html

V-Lab Workshop

Prior to AOMSUC-5 the V-Lab workshop was hosted by the Shanghai Meteorological Bureau, CMA on 17-18 November 2014. 83 users including 62 online participants attended the workshop.

The topic included current and future satellite planning, application for weather and climate, land and ocean monitoring of each space agencies was presented. Also user service systems, such as CMACast was introduced. For last session of this workshop, CMA provided the practice on how to use SWAP and SMART, which is CMA's visualization tool of satellite image, and sample software respectively.

(Hyunjong Oh, NMSC/KMA)

Completion of System Design Review (SDR) for GK2A KSEM

In July of 2014, KMA has achieved a major milestone to develop the instrument of Korean Space Environment Monitor referred to KSEM by successfully completing KSEM System Design Review (SDR).

KSEM is the first Korea Space weather mission to fly on geostationary orbit (GK2A), which is a suite of space weather for monitoring of fluctuations of energetic particles and magnetic field at geostationary orbits.

On the beginning of 2014, KMA in coordination with KARI selected Kyunghee University to develop KSEM. Kyunghee University is building KSEM with the extensive cooperation of SatrecI Inc., U.C. Berkeley and ESA.

During SDR, senior engineers and expert from across the agency concluded the initial design of KSEM, associated manufacturing and the validation of its performance.

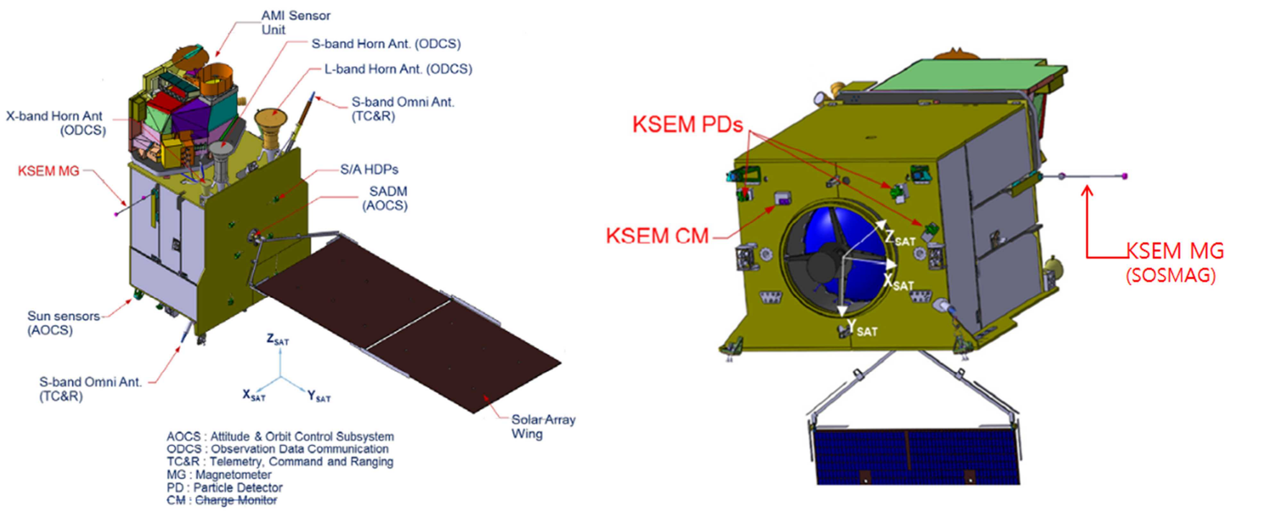

Figure 1 GK2A configuration : KSEM consists of 3 sensors, PD (particle detector), CM (satellite charging monitor) and MG (magnetometer). Left panel shows GK2A full configuration with its primary mission, meteorological imager(AMI sensor) while the space weather monitoring is secondary mission. Right panel present the location of KSEM 3 sensors.

Magnetometer Design Change

Major design change made for magnetometer during SDR. After a detail review, a boom type of magnetometer was finally selected for the magnetometer for which Kyunghee university initially proposed the body mount type. As a boom type of magnetometer, ESA's SOSMAG (Service Oriented Space Magnetometer) was reviewed in detail.

SOSMAG is the magnetometer with 1m size of boom to measure the geomagnetic field under the condition of non-magnetically clean satellite. SOSMAG consists of 1 digital process unit (DPU), 2 fluxgate magnetometer and 2 AMR magnetometer.

Kyunghee University made an agreement of cooperation with ESA to develop the magnetometer for KSEM and had a kick-off meeting with ESA in October, 2014. Figure 1 shows GK2A configuration with the newly adopted design of magnetometer.

KSEM SDR specification

KSEM specification is now almost finalized (Table 1).

Particle detector (PD) provides the energetic electrons and proton measurements. PD measure the population of charged particles in the energy range of at least 100 keV ~ 2 MeV for electrons and 100 keV ~ 20 MeV for protons for protons, respectively, over the six viewing angles.

Magnetometer (MG) samples the variations of low frequency magnetic fields at two different locations on a deployable boom to accurately measure the Earth's magnetic fields by separating the spacecraft contribution.

The spacecraft charging monitor (CM) measures the integrated fluxes of electrons above ~1MeV that is crucial for the satellite operations.

Table 1. KSEM Specification

Sensor	Specification
Energetic Particle Detector	Electron energy range : ~50keV ~ 2 MeV Proton energy range : ~100keV ~ 20MeV Angular Resolution(pitch angle): 60° at least
Magnetometer	Measurement range : ± 350nT (in 3 axes) Field resolution : 1nT at least (on orbit)
Satellite Charging Monitor	Current range: ± 3pA/cm2 Measurement resolution : 0.01pA/cm2

Future plan

2015 is a momentous period for KSEM development. Both of Preliminary Design Review (PDR) and Critical Design Review (SDR) is scheduled on 2015. KSEM development is very challengeable project to KMA, however, it is expected that KSEM data contribute to secure the satellite operation and to protect the high-tech ground infra-structure.

(Hyesook Lee, NMSC/KMA)

JMA's cloud products for Himawari-8/9

Cloud property information is the most essential meteorological product derived from satellite observations not only because it is used for weather analysis but also because it is applied to retrieval of other products (e.g. the Sea Surface Temperature (SST), the Clear Sky Radiance (CSR), the aerosol detection and the Atmospheric Motion Vector (AMV)). For example, masking the cloud area is a first step of investigation of surface parameters in satellite remote sensing. Taking into account its importance, The Japan Meteorological Agency (JMA) is currently developing fundamental cloud products from Himawari-8/9.

Fundamental cloud product provides cloud mask, cloud top height, cloud type and phase for each pixel of the Himawari-8/9 infrared bands (2 km at the sub-satellite point). The algorithm is based on the methods developed by the Nowcasting Satellite Application Facility (Meteo-France 2012). It uses threshold technique with brightness temperature and reflectivity for cloud mask and cloud type/phase retrieval. It also uses local radiative center and threshold tuning method developed by NOAA/NESDIS (Heidinger 2011). Radiance Fitting, intercept (Szejwach 1982) and radiance ratioing method (Menzel et al. 1983) are applied to cloud height assignment. Fundamental cloud product algorithm uses radiative transfer calculation results obtained from the numerical prediction data to determine thresholds for clear sky radiance, brightness temperature and reflectance. Prototype product was made by using Meteosat Second Generation (MSG)/Spinning Enhanced Visible and InfraRed Imager (SEVIRI) data (Schmetz at al. 2002). Sample output is shown in Figure 2. Table 2 shows the evaluation results of the prototype cloud mask, cloud top height, cloud type and phase compared with The MODerate resolution Imaging Spectroradiometer (MODIS) product of the Aqua/Terra satellites, which is regarded as “TRUTH” (“Observation” in Table 2 (d)) in the calculation of scores. The evaluation periods are two weeks in every season such as 28 December 2011 - 10 January 2012, 28 March 2012 – 10 April 2012, 27 June 2012 – 10 July 2012 and 27 September 2012 – 10 October 2012. Scores are calculated using collocated data within the four periods. Accuracy is defined as the ratio of the correct detection and correct negatives to all data. Hit rate is the ratio of the correct detection to the detection totals (correct detection plus false alarms). Cloud mask detection accuracy was 85 % and most of the other scores were also reasonable.

(Takahito Imai, MSC/JMA)

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Schmetz, J., P. Pili, S. Tjemkes, D. Just, J. Kerkmann, S. Rota, A. Ratier, 2002: An introduction to Meteosat Second Generation (MSG). Bull. Amer. Meteor. Soc., 83, 977-992.

Table 2: Evaluation of fundamental cloud product (prototype)

(a) Accuracy of cloud mask for each cloud type and phase

		Accuracy or Hit Rate
Mask (Accuracy)		0.85
Type	Opaque (Hit Rate)	0.66
	Semi-transparent (Hit Rate)	0.80
Phase	Ice cloud (Hit Rate)	0.98
	Liquid water cloud (Hit Rate)	0.94

(b) Accuracy of cloud mask in each season and surface

Mask		Accuracy				
		Winter	Spring	Summer	Autumn	All
All region		0.86	0.85	0.85	0.85	0.85
Respective	Sea	0.86	0.85	0.85	0.86	0.85
	Snow/Ice	0.86	0.81	0.72	0.86	0.81
	Dessert	0.87	0.86	0.86	0.89	0.87
	Vegetation	0.86	0.84	0.83	0.83	0.84
	Others	0.80	0.82	0.86	0.84	0.84

(c) Bias and standard deviation of cloud height for each cloud type

Height	Bias (km)	Standard deviation (km)	number
Low opaque	-0.10	1.34	2296940
High/mid opaque	0.31	1.33	1375505
Opaque	0.05	1.34	3672445
Semi-transparent (intercept or radiance rationing)	2.38	3.34	877586

(d) Definitions of accuracy and hit rate

		Observation	
		Yes	No
Detection	Yes	Correct detection	False alarms
	No	Misses	Correct negatives

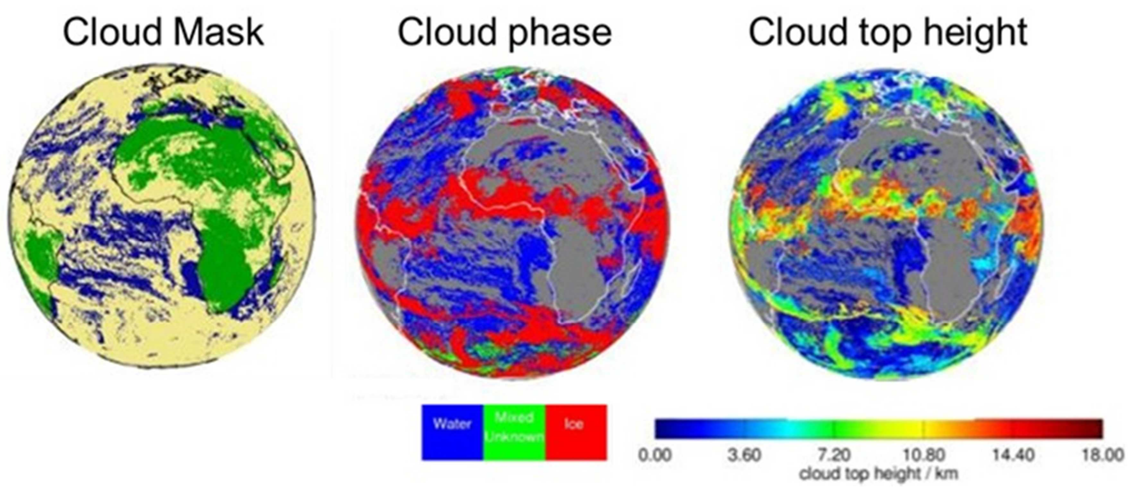

Figure 2: Sample output of prototype: 1200 UTC 13th June 2008

First images from Himawari-8

At 02:40 UTC on 18 December 2014, the first images from all 16 bands were captured by JMA's Himawari-8 next-generation geostationary meteorological satellite, which was launched on 7 October 2014.

Testing and checking of the Himawari-8 system, including related ground facilities, are going well. Himawari-8 is scheduled to start operation in mid-2015.

For more information, please refer the following MSC/JMA webpage:
http://www.data.jma.go.jp/mscweb/en/himawari89/index.html

(Kazuki Yasui, JMA)

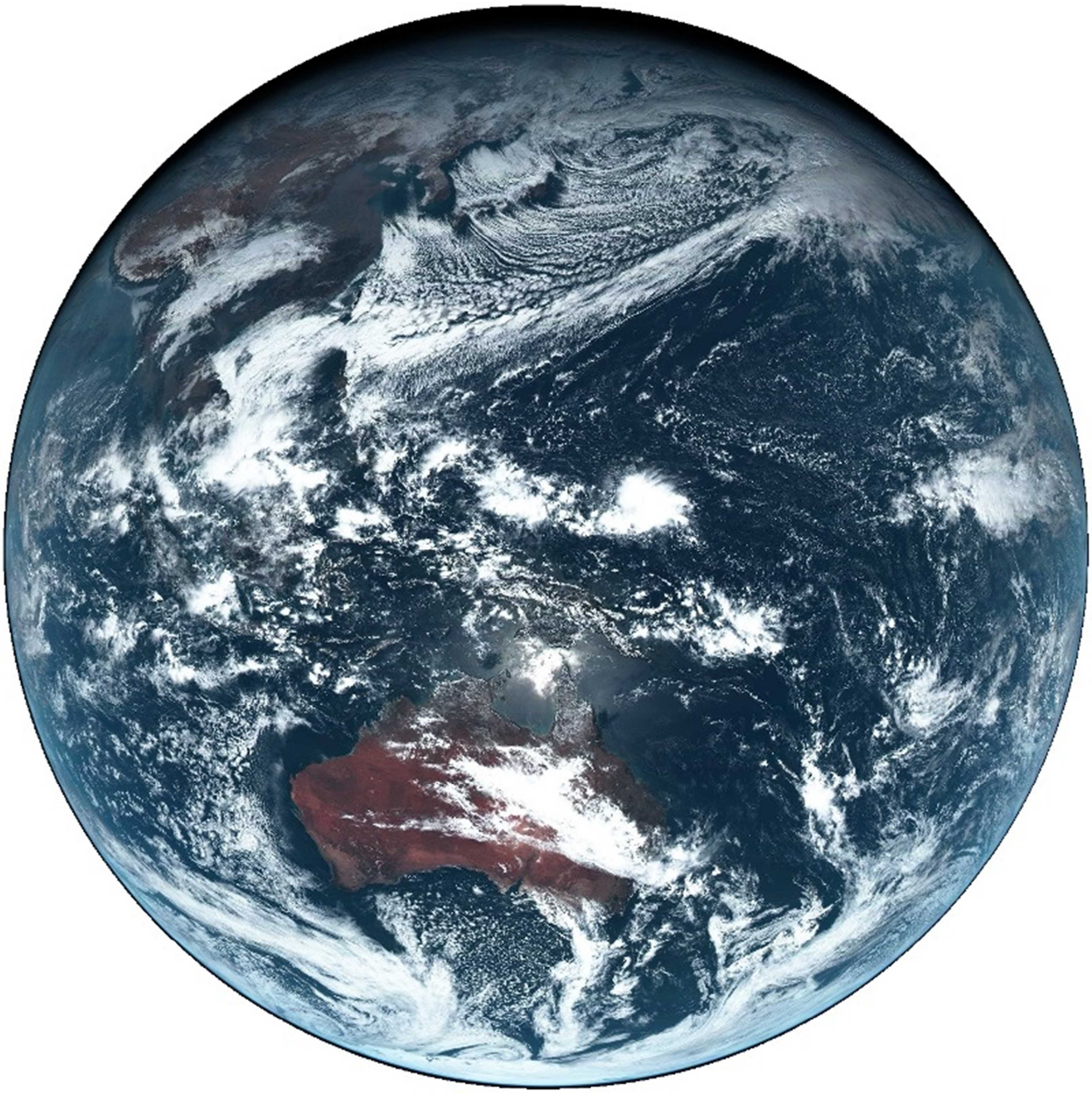

Figure 3: First image of Himawari-8: 02:40 UTC on 18 December 2014
Color composite image of visible three bands (brightness adjusted)

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From the Co-editors

The co-editors invite contributions to the newsletter. Although it is assumed that the major contributors for the time being will be satellite operators, we also welcome articles (short contributions of less than a page are fine) from all RA II Members, regardless of whether they are registered with the WMO Secretariat as members of the WIGOS Project Coordinating Group. We look forward to receiving your contributions to the newsletter.
(*Dohyeong KIM, KMA, and Tomoo OHNO, JMA*)

RA II WIGOS Project Home Page

http://www.wmo.int/pages/prog/sat/ra2wigos project-intro_en.php

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