Vol. 8 No. 2, August 2017

RA II WIGOS Project Newsletter

DEVELOPING SUPPORT FOR NATIONAL METEOROLOGICAL AND HYDRO-LOGICAL SERVICES IN SATELLITE DATA, PRODUCTS AND TRAINING

Contents of this issue

The 45 meeting of the Coordination Group for Meteorological Satellites (CGMS-45), in Jeju-Island, Korea, 11-16 June 2017

Background

CGMS provides an international forum for the exchange of technical information on geostationary and polar orbiting meteorological satellite systems.

The 45th CGMS was held on 11-16 June 2017 in Jeju-Island, Korea. The meeting was hosted by KMA/NMSC.

The meeting was chaired by Dr. Hoon Park MNSC Director-General and Mr. Alain Ratier, EUMETSAT Director-General and Head of the CGMS Secretariat.

The Plenary session in the period 15-16 June 2017 was preceded by the four CGMS Working Groups (WG I: Global issues on satellite systems and telecommunication coordination, WG II: Satellite data and products, WG III: Operational continuity and contingency planning, and WG IV: Global data dissemination) as well as the meeting on space weather in 11 June 2017.

In addition, there was a joint WG II and WG III session, related to carbon observations, on Tuesday 13 June 2017.

Objectives of CGMS

The main objectives of CGMS are:

- To have a clear focus on coordination of long-term and sustainable satellite systems relevant to weather and climate to which both operational and R&D agencies contribute;
- To give a *technical* focus to the discussions handled by the group; and
- Through a close interaction with WMO, to respond as far as possible to requirements from WMO and related programmes (e.g. WIGOS, IOC, GCOS).

Discussion on CARBON observations

In plenary session, the carbon observations session started by the CGMS Secretariat introduction on various reports by the National Research Council (Verifying Greenhouse Gas Emissions, 2010), GEO (GEO Carbon Strategy, 2010), CEOS (CEOS Strategy for Carbon Observations from Space, 2014) and the European Commission (Towards a European Operational Observing System to Monitor Fossil CO2 Emissions, 2015). It also included the collaboration between CGMS and CEOS Atmospheric Composition Virtual Constellation (AC-VC).

During the plenary discussion, the commitment by CGMS to support the development and operation of a space-based carbon monitoring system was re-emphasised. Plenary confirmed the CGMS contribution to the CEOS AC-VC writing team and the specific contribution CGMS can provide to a future space-based carbon monitoring system. It also noted the potential contribution that the current operational meteorological missions can provide. In addition, it was emphasised that no system can work in isolation and it is important to incorporate ground-based/in situ measurements as well. Plenary endorsed the following HLPP(High Level Priority Plan) item: "Provide a coordinated contribution to the planning of a future satellite-based carbon constellation and to related activities on mission coordination, data distribution, exchange, formatting, and on training and outreach".

Working Group I: Global Issues on Satellite Systems and Telecommunication Coordination

WG I discussed the optimization and harmonization of direct readout dissemination of CGMS DB global specifications. In the future, it was confirmed to use the netCDF format and creation of best practices, via dedicated inter-sessional meetings, for the representation of satellite imagery data in netCDF.

At the WGI and WGIV joint session, there were discussion of the need to review the scope of both working groups to address overlap and to consider adding relevant topics related to satellite and ground system operational topics not currently covered in either of the two working groups. And it is recommended to the CGMS plenary that a small task team be established to examine the current Terms of Reference in light of the thematic areas covered by both working groups and to report to CGMS-46

Working Group III: Operational Continuity and Contingency Planning

There was considerable discussion on CGMS Global Contingency Plan:

- Plan predates the current CGMS Baseline from 2011; therefore is in urgent need of update.
- New framework for organizing the plan discussed comprising three elements: a) steps to characterize/analyse the risk (e.g., WMO gap analysis against the CGMS baseline); b) steps to reduce the likelihood of a break in continuity; and c) steps to mitigate the impacts of a gap should one occur
- WG-III recommends establishing a Task Team to update the plan
- WMO offered to organize an ad-hoc face-to-face meeting to initiate the effort remaining work would be completed via inter-sessional and CGMS meetings
- WMO, EUMETSAT and NOAA have volunteered to participate in Task Team; other Agencies invited to participate as well

Working Group IV: Global Data Dissemination

As for the IODC data dissemination plan of CMA, EUMETSAT, ISRO and ROSHYDROMET, the set of essential data for the IODC region is well defined and agreed with data providers. The most suitable data access method with complete coverage for users in the IODC region is a combination of EUMETCast (Europe and/or Africa) and CMACast.

For the Global data exchange from next generation GEO satellites, it is reported that with few high volume GEO satellites active (Himawari-8, GOES-16), data exchange between CGMS agencies (point to point using download services) is working well, considering that only reduced data volumes are exchanged. And Scalability of download services may become an issue, with increasing data volumes and increasing number of users when high volumes or full resolution data is downloaded.

Space Weather Task Team

The objective of SWTT is to define the methodology by which we would implement space weather into CGMS in line with the CGMS Space Weather Activities Terms of Reference: "The overarching goal of CGMS Space Weather activities is to support the continuity and integration of space-based observing capabilities for operational Space Weather products and services."

CGMS' unique role in space weather has been socialized amongst space weather international organizations and its potential role was recognized. And discussions in the SWTT with the WG leads have established paths forward on many of the space weather related HLPP items and presented them in the WG meetings.

Working Group II (Satellite data and products) and International Science Working Groups (ISWG)

A successful story of WGII as the GSICS and improved instrumentation is that ISRO has implemented the GSICS instrument monitoring toolkit and generating GSICS correction coefficients for INSAT-3D. GSICS is preparing for the second joint GSICS/IVOS Lunar Workshop in China, 6-10 November 2017.

The White Paper was prepared by the Task Team on Calibration Events Logging (referred to as Task Team) and reviewed by the GSICS Research and Data Working Groups (GRWG & GDWG). The paper provides Satellite Operators with guidelines to standardise *Satellite/Instrument Calibration Landing Pages* accessed via WMO-OSCAR, and to use common Nomenclature and Standards for reporting on calibration events.

As for the SCOPE-CM, all projects have progressed the maturity of their CDRs, and new two members of KMA and ISRO were confirmed. Currently SCOPE-CM drafted implementation plan for phase 2+ in 2018 mainly focuses on: to continue focus on maturing CDR production; to emphasize transition to sustained production; to focus on coordination and sustainment.

Summary of ISWG is the following:

International Radio-Occultation WG

The IROWG expressed that its aim is to ensure measurement continuity and maximise the number of high quality RO observations that can be freely exchanged. And the WG emphasized that COSMIC-2 Polar, or a mission with the same high quality is needed to maintain the impact of RO.

IROWG strongly supports the aims of the NOAA Commercial data pilot study: It is crucial to determine the actual capabilities of the various options. And the WG recommended that CGMS should encourage GNSS providers and agencies to make ICDs (Interface Control Documents) of GLONASS and Beidou Open Service signals available as soon as possible.

International Precipitation WG

International Precipitation WG (IPWG) expressed the continuity of the current constellation of passive microwave sensors (for high quality satellite precipitation products for weather, climate and hydrological applications) through proper coordination of satellites, sensors and equatorial crossing times. And in addition, it raised the action on all CGMS members for the timely (< 1 hr) and free access to all geostationary visible, IR and water vapor data is required to improve global hydrological prediction.

International Wind WG

International Wind WG (IWWG) planned the 3rd Intercomparison, using image triplets from Himawari-8/AHI, date 21 July 2016 (common with ICWG), which will be collocated with Radiosonde observations at 12:00 UTC and with A-Train and MISR winds around 05:23 UTC. It will use two sets of tests: one is all wind producers use a prescribed configuration and the other is each wind producer can use their own configuration. Results could be expected by IWW14 (April 2018).

Draft Protocol for Himawari-8/9 event-driven rapid scanning

Recognized the advantages of rapid scanning for monitoring severe meteorological events such as tropical cyclones, JMA developed draft protocol for request-based HIMAWARI-8/9 rapid scanning. The draft protocol describes the mechanisms to be considered by JMA to support the handling of requests from WMO RA II and RA V Members for event-driven rapid scanning in certain areas of interest.

RA II and V member countries will be required to email observation requests to JMA and AuBoM, respectively, based on their own analysis/forecasts, including information on the center position of the window and the start/end times of Target area observation. In response, the satellite operator will determine priority, reconfigure the relevant satellite systems and establish related operating processes before commencing Target area observation. The maximum duration of requests should not exceed 48 hours, and any extension will require a further request in line with this protocol.

The technical implementation includes: i) JMA, AuBoM and individual NMHSs to determine authorized contact points; ii) JMA to establish an email request form; iii) AuBoM to inform JMA of center position and start/end times of Target area observation based on the specified format; iv) AuBoM to coordinate with RA V Members; v) RA II Members to inform JMA of those information in the same format

WMO RA II WIGOS project

JMA and KMA provided a progress report on the RA II WIGOS project to develop support for NHMSs in satellite data, products and training.

Recent accomplishments made under the RA II WIGOS Project (from May 2016 to April 2017) are summarized: (1) Issuance of newsletters to RA II Members; (2) 7th Asia/Oceania Meteorological Satellite Users' Conference and training event; (3) 4th Meeting of the Coordinating Group of the WMO Regional Association II (Asia) WIGOS Project in Songdo, Korea on 28 October 2016 in conjunction with the 7th AOMSUC.

The report summarized the regional WIGOS Implementation Plan 2017-2020 (R-WIP-II) approved by RA II-16 at Abu Dhabi, UAE in 14 Feb 2017. This newly approved project includes: (1) to facilitate the timely provision of satellite-related information; (2) to identify requirements and current and planned utilization capabilities of NMHSs; (3) To strengthen capabilities of NMHSs in RA II; (4) to develop a protocol and to assist NMHSs to utilize rapid scan data in support of DRR in response to their requests; (5) to continue the issuance of the quarterly Newsletters.

The 8th AOMSUC and training event (16-20 October 2017), and 5th Meeting of the Coordinating Group of the RA II WIGOS Project (21 October 2017) will be held in Russia.

(Dohyeong Kim/KMA)

Application of correction to COMS MI Water Vapor resulted from SRF shift

Introduction

The first Korean geostationary observation satellite COMS(Communication, Ocean, and Meteorological Satellite) was successfully launched on June 27, 2010 at the operational orbit of 128.2°E. COMS MI (Meteorological Imager) has been monitored following GSICS (Global Space-based Inter-Calibration System) since April 2011.

Using GSICS with IASI (Infrared Atmospheric Sounding Interferometer), the bias for water vapor of COMS data, from February 21 to June 13, 2017, shows a large cold bias of -0.8091K as figure 1. The bias characteristics that are dependent on the target Tb are also shown in the heritage instruments. The main causes for the bias characteristics are known to be due to the uncertainty in the Spectral Response Function (SRF) of the imaging instrument on-board the geostationary satellite. This systematic bias was identified by the uncertainty in the SRF of water vapor channel.

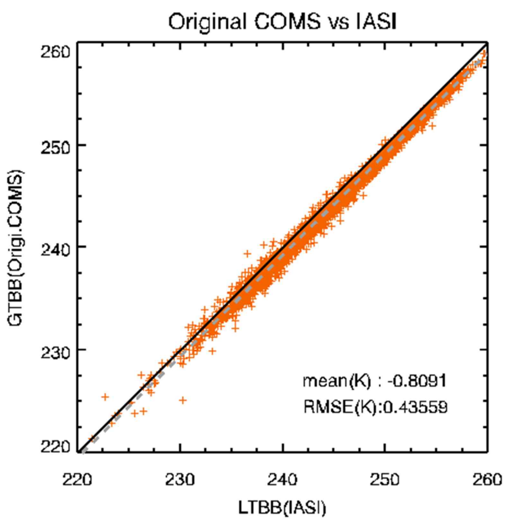

Figure 1. Scatter plot for TB from COMS/MI and MetOpA/IASI for WV channel, from February 21 to June 13, 2017

Data and Methodology

As the instrument spectral performance determines the outputs of calibration targets that are used to calculate the calibration coefficients, the SRF can directly affect the radiometric calibration accuracy.

As the estimated uncertainty in the SRF shape is not readily available, KMA uses to shift the center wavenumber of SRF, it is identified the most practical way to reduce the bias. The shifted SRF affects the earth view radiance of new simulated IASI radiance and new calibrated earth scene radiance measured by COMS/MI. While the IASI radiance is simulated by convolving with the shifted SRF and the calibrated radiance of COMS/MI should be estimated with the new calibration coefficients which are derived from the new blackbody radiance.

By using the collocated data of MI and IASI, the correction value for the SRF uncertainty is estimated to about +3.5cm-1 shift for center wavenumber of original WV SRF.

So Preprocess of KMA was conducted by application of correction to COMS MI WV resulted in an SRF shift. As this reprocess, KMA's operation system of test generated L1b data applied coefficient about the shifted SRF.

Result

Thus, by using the collocated data of the calibrated MI radiance with shifted SRF for WV and IASI, Figure 2 shows compared result of the collocated data for IASI data and MI data obtained at before and after application of the SRF shift. The bias(COMS TB- IASI TB) after application of the SRF shift shows -0.0908K of the better result than it before application. Also, the RMSE for bias after application of the SRF shift shows 0.3955K of the better result than 0.4356K of the better result than it before application.

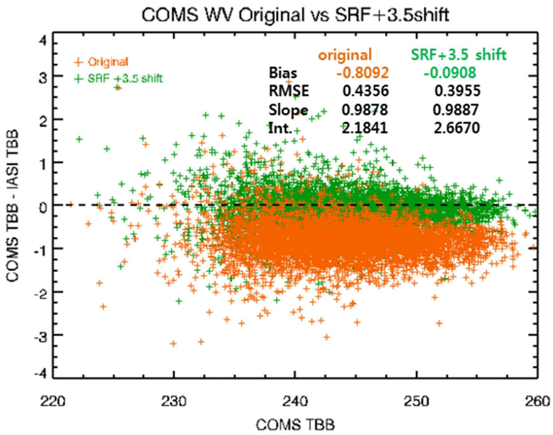

Figure 2. The TB difference(orange) between MI with original SRF and IASI, the TB difference(green) between MI with SRF shifted +3.5cm^{-1} as a function of the MI TB from February 21 to June 13, 2017

In the future, with the accumulation of the longer time period of the collocation dataset, we will investigate seasonal variations for the bias after SRF shift. We expect that preprocessing will be improved by shifting the SRF for WV channel and radiometric calibration for it will be accurate than before applying shifted SRF of +3.5cm^{-1}.

(Minju Gu, KMA/NMSC)

Validation of Himawari-9/AHI Level-1 data during In-orbit Test

The Himawari-9 geostationary meteorological satellite of the Japan Meteorological Agency (JMA) was launched on 2 November 2016 and put into in-orbit standby as backup for Himawari-8 on 10 March 2017. Himawari-9 features the Advanced Himawari Imager (AHI), which is identical to the AHI on board Himawari-8. As accurate image navigation and radiometric calibration are essential in leveraging the imager's potential, Himawari-9/AHI Level-1 data performance was validated during the satellite's period of in-orbit test (IOT).

Image navigation and registration (INR) errors determined from observation during the IOT phase were in the same order as those of Himawari-8/AHI. The validation results for Himawari-9/AHI (AHI-9) calibration generally show close correspondence to those for Himawari-8/AHI (AHI-8), although larger biases are seen in several bands. Further evaluation will be performed in the near future.

AHI Basics

Table 1 and Figure 3 show observing band configuration and the spectral response functions (SRFs) of AHI-8 and -9, respectively. SRF data are provided on JMA's Meteorological Satellite Center (MSC) website at:
http://www.data.jma.go.jp/mscweb/en/himawari89/space_segment/spsg_ahi.html

Image Navigation and Registration

The INR process for AHI-9 is identical to that of AHI-8, which is based on information from star trackers, inertia reference units and angular rate sensors on board the satellite. JMA validated the INR performance of AHI-9 during in-orbit test using the landmark and band-to-band co-registration analysis methods. The former involves comparing coastlines recognized in observation data with those on reference maps to derive absolute INR errors. The latter is similar, but involves comparison of cloud patterns as well as coastlines in target-band observation data with those in the reference band (e.g., B13) for estimation of band-to-band relative INR errors in each band with the reference band.

Table 1. Band configuration of AHI-8/-9 and IMAGER on MTSAT-2. Wlen is the central wavelength [μm], and Sres represents spatial resolution at the SSP [km].

		B01	B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	B14	B15	B16
Himawari-8/-9	Wlen	0.47	0.51	0.64	0.86	1.6	2.3	3.9	6.2	6.9	7.3	8.6	9.6	10.4	11.2	12.4	13.3
	Sres	1	1	0.5	1	2	2	2	2	2	2	2	2	2	2	2	2
MTSAT-2	Wlen			0.68				3.7	6.8					10.8		12.0	
	Sres			1				4	4					4		4	

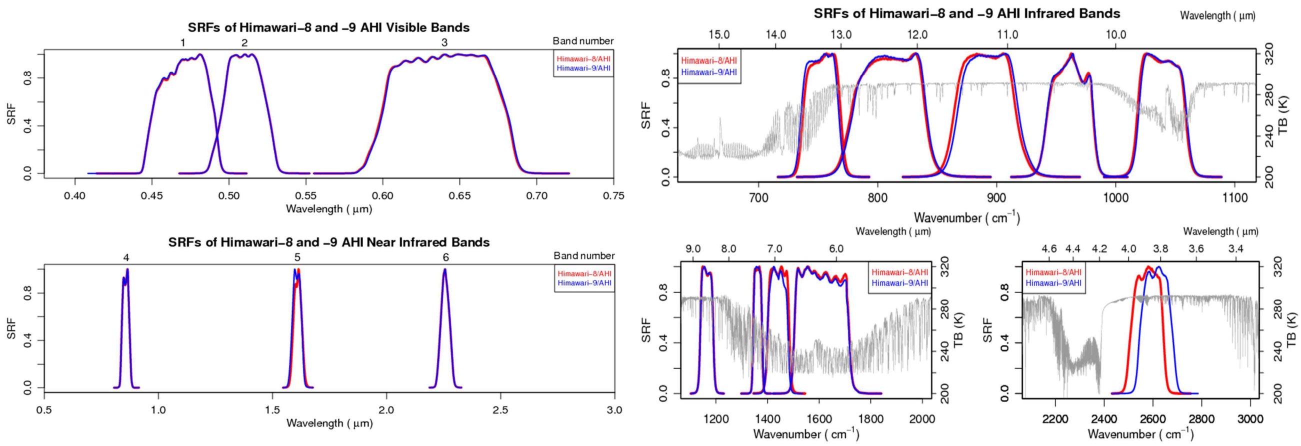

Figure 3. Spectral response functions of AHI-8 (red) and -9 (blue)

Figure 4 shows landmark analysis results for B13 Himawari Standard Data (i.e., Level-1 data after rectification). The estimated magnitudes of image navigation errors are around 7.37 μrad (0.26 km at the sub-satellite point (SSP)) and 10.5 μrad (0.38 km at the SSP) at 00:00 and 12:00 UTC, respectively.

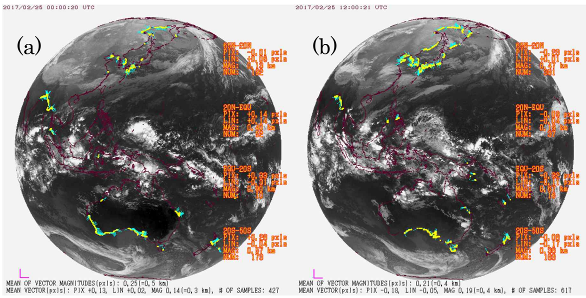

Figure 4. (a) AHI-9 Landmark analysis results for B13 at 00:00 on UTC 25 Feb. 2017 (b) As per (a), but for 12:00 UTC. Yellow circles show reference points used to compute misplacement. Blue segments connected with the yellow circles indicate directions and magnitudes of misplacement at each reference point. The short magenta segment (bottom-left) represents the unit length of magnitude for misplacement (i.e., 56 μrad, or one pixel for infrared bands, for which the horizontal resolution is 2 km at the SSP).

Table 2 shows diurnally averaged INR errors based on landmark analysis for several bands on the same day. The results indicate that AHI-9 image navigation performance is comparable to that of AHI-8. However, several significant navigation errors are observed daily in AHI-9 observation imagery (figures not shown). The root cause of this is currently being researched by the satellite vendor.

Table 2. Diurnally averaged INR errors based on landmark analysis for several AHI-9 bands on 25 Feb. 2017

	B01	B07	B13	B15
East-West (μRad)	0.026	-4.145	-3.309	-3.329
North-South (μRad)	-3.461	-0.241	1.287	3.134
Bias Magnitude(μRad)	9.100	10.313	9.633	10.531

Band-to-band co-registration correction has been applied since the start of AHI-9 in-orbit test. Figure 5 shows the co-registration analysis results for B07 and B15 with respect to B13. The magnitude of the misplacement is below 1.1 μrad (0.04 km at the SSP), and the co-registration performance of other bands is comparable.

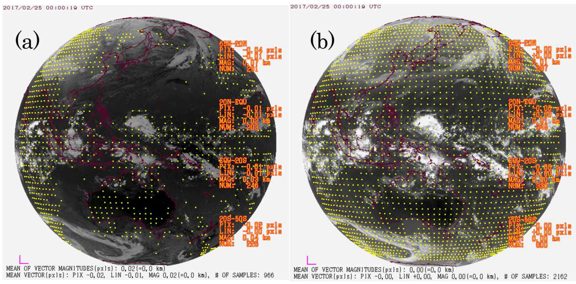

Figure 5 band-to-band co-registration analysis for B07 in comparison with B13 at 00:00 UTC on 25 Feb. 2017, and (b) the same for B15. Yellow circles and blue segments show reference points and their magnitudes as in Figure 4.

Table 3 shows diurnally averaged band-to-band co-registration errors for all bands based on observation data for 25 February 2017. As with image navigation performance, AHI-9 co-registration performance is comparable to that of AHI-8.

Table 3 Diurnally averaged band-to-band co-registration errors for all bands with respect to B13 for 25 February 2017

Band number	B01	B02	B03	B04	B05
Bias Magnitude(μRad)	0.990	1.014	1.220	1.553	1.313

Band number	B06	B07	B08	B09	B10
Bias Magnitude(μRad)	1.327	0.817	0.289	0.444	0.501

Band number	B11	B12	B14	B15	B16
Bias Magnitude(μRad)	0.576	0.519	0.579	0.223	0.286

Calibration

For calibration of observation data, the AHI has a solar diffuser serving as a solar calibration target for visible and near-infrared bands (i.e., B01-06) and a blackbody serving as an internal calibration target for 10 infrared bands (i.e., B07-16). JMA has been validating AHI-8 data quality based on the GEO-LEO technique (involving inter-calibration and vicarious calibration), lunar calibration and other approaches. These calibration and validation methods have been developed via international collaboration with NOAA, EUMETSAT and GSICS member agencies in addition to collaborative research with the Atmosphere and Ocean Research Institute at the University of Tokyo. This article reports on AHI-9 validation using some of these approaches.

For visible and near-infrared bands, radiances were validated based on 1) comparison with top-of-atmosphere radiance computed via radiative transfer simulation (vicarious calibration) and 2) a ray-matching approach with reference to S-NPP/VIIRS. Estimated radiance biases of AHI-9 from the vicarious calibration approach were +2.94 and -5.48% for B01 and B06, but the biases for other bands were less than +/- 2.0%. The ray-matching approach provided results consistent with those of the vicarious calibration approach for B01 and B06. Infrared inter-calibration with reference to hyperspectral infrared sounders such as Metop-A/IASI showed that brightness temperature biases for AHI-9 are in the same order as those validated for AHI-8 (less than 0.25 K for standard scenes (i.e., simulated brightness temperature for the US standard atmosphere)) in all 10 infrared bands.

The frequent full-disk observation conducted by AHI-8 and -9 (with a repeat cycle of 10-minutes) also enables application of the highly useful GEO-GEO comparison approach. Although the GEO-GEO approach is a relative comparison method without accurate reference sensor such as IASI and VIIRS, the huge amounts of collocated data enable identification of calibration issues (such as diurnal variation of biases, stray light and banding) on a real-time basis. In this study, AHI-8 and -9 Himawari Standard Data from the same observation time and the same band were averaged for areas of 19 x 19 pixels and compared in terms of scaled radiance (for visible and near-infrared bands) and brightness temperature (for infrared bands).

For verification of consistency between the GEO-LEO and GEO-GEO approaches mentioned above, the relative differences between AHI-8 and -9 of the GEO-LEO approaches are shown in Figure 6 along with GEO-GEO approach results. Ratios of AHI-9/AHI-8 are shown for visible and near-infrared bands, and differences in biases for AHI-9 minus AHI-8 in standard scenes for infrared bands are shown in the figure, and close correspondence between the comparison results for each approach is observed. This validation approach offers a promising solution for the generation of a new inter-calibration product combining GEO-LEO and GEO-GEO comparison results to account for diurnal calibration variations.

Conclusion

Himawari-9, which features the new-generation AHI visible and infrared imager, was launched on 2 November 2016 and put into in-orbit standby as backup for Himawari-8 on 10 March 2017. This paper reports on the current status of AHI-9's Level-1 products.

INR errors as determined from observation

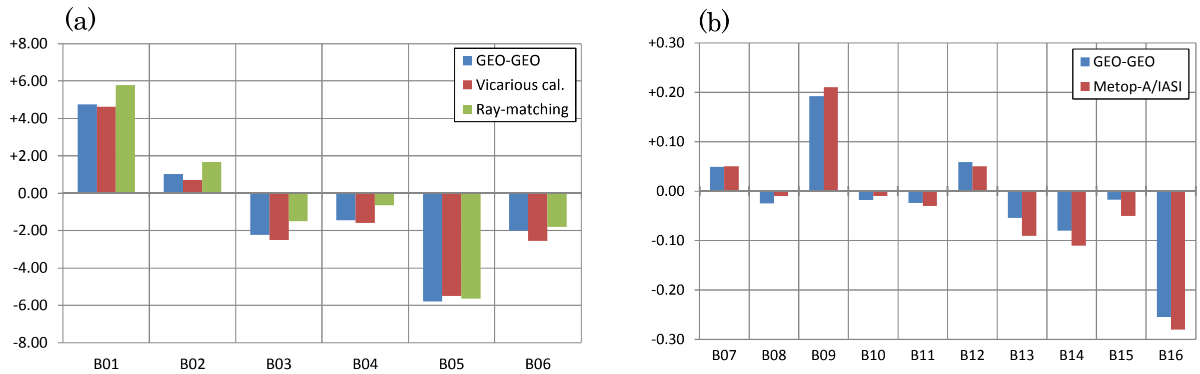

Figure 6. Consistency of different approaches in terms of (a) ratios of (AHI-9)/(AHI-8) [%] for visible and near-infrared bands, and (b) differences in biases [K] for AHI-9 minus AHI-8 for infrared bands.

during the IOT phase are in the same order as those for AHI-8. To validate calibration performance, both GEO-LEO and GEO-GEO approaches were adopted for all 16 bands of AHI-8 and -9. The validation results for AHI-9 calibration generally show close correspondence with those for AHI-8. However, larger biases are seen in several AHI-9 bands (e.g., B01, B06 and B16). One possible reason for the discrepancy in visible and near-infrared bands is that pre-launch calibration slopes were used for AHI-9, whereas coefficients derived from solar diffuser observation are used for AHI-8 bands. In addition to the implementation of new calibration and validation approaches such as a lunar method, calibration trends will also be evaluated further in the near future.

References

"Validation of Himawari-9/AHI Level-1 and -2 data during In-orbit Test", CGMS-45-JMA-WP-04, CGMS-45, 2017.

(Kouji Yamashita, MSC/JMA)

Improvement of Himawari-8 observation data quality

The Japan Meteorological Agency (JMA) modified its Himawari-8 ground processing system at 04:00 UTC on 25 July 2017 in order to improve the quality of Himawari-8 imagery and to update the Himawari Standard Data (HSD) format with the latest calibration coefficients in consideration of sensor sensitivity. The modification includes:

1) Reduction of banding and stripe noise
2) Improvement of quantization noise
3) Updating of the HSD format

Reduction of banding and stripe noise

Himawari-8/Advanced Himawari Imager (AHI-8) imagery from the visible and near-infrared (VNIR) bands (i.e., Bands 1 to 6) had included banding and stripe noise in the east-west direction (Figures 7 (a) and 8 (a)). These were generally attributable to incorrect calibration slopes derived from solar diffuser (SD) observation by the Himawari-8 satellite. Specifically in this regard, the bidirectional reflectance distribution function (BRDF) of the AHI-8 SD underwent an erroneous reversion from north to south during calibration slope derivation.

In relation to AHI-8 VNIR imagery, calibration coefficients for Bands 1 to 6 were corrected at 04:00 UTC on 25 July 2017. The new calibration slopes are expected to significantly reduce banding (Figure 7 (b)) and striping (Figure 8 (b)).

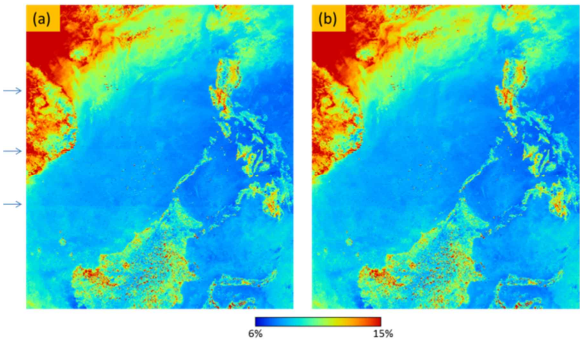

Figure 7. (a) Minimum albedos [%] of AHI-8 Band 2 as extracted from 22 HSDs for 03:10 UTC from 10 to 31 March 2016. (b) As per (a), but with bug-fixed calibration slope computation. The extraction is performed at each HSD pixel for (a) and (b). The three clear lines observed at swath boundaries (i.e., banding) in (a) are significantly reduced in (b).

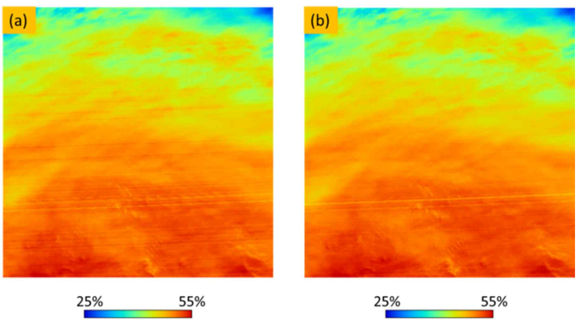

Figure 8. (a) Albedos [%] of AHI-8 Band 2 at 03:10 UTC on 15 March 2016. (b) As per (a), but with bug-fixed calibration slope computation. The clear striping seen in (a) is mitigated in (b).

The new slopes were determined by averaging solar diffuser observation data collected from 7 March to 22 May 2015. As the same SD observation dataset continues to be used after the updates, any changes in AHI-8 characteristics, such as sensitivity degradation, are not taken into account in the updated slopes.

Improvement of quantization noise

AHI-8 earth observation samples are downlinked to the ground station by truncating digital counts from 14 bits to 11 bits (Bands 1, 2, 3, 4, 5, 6, 8, 9, 16) or 12 bits (Bands 10, 11, 12, 13, 14, 15) except for Band 7. No truncation is applied to other information such as black body observation data for infrared calibration. To compensate biases stemming from such truncation, a value of 0.5 was previously added to the raw digital counts for all AHI-8 bands during HSD generation.

However, as this practice was found to cause quantization noise, the values added to raw digital counts are now:

Bands 1, 2, 3, 4, 5, 6, 8, 9, 16: +0.4375
Bands 10, 11, 12, 13, 14, 15: +0.375
Band 7: 0

Table 4 shows how the correction of raw digital counts affects albedo in VNIR bands, and Table 5 shows related effects on brightness temperature in other infrared bands (Table 5; averaging for the full-disk area as of 12:10 UTC on 4 October 2016).

Table 4. Impacts of raw digital count correction on albedo [%] in VNIR bands

band	bits	corrected raw digital counts	change in albedo (%)
B01	11	−0.0625	−4.9E−03
B02	11	−0.0625	−5.0E−03
B03	11	−0.0625	−6.8E−03
B04	11	−0.0625	−8.4E−03
B05	11	−0.0625	−4.5E−03
B06	11	−0.0625	−5.2E−03

Table 5. Impacts of raw digital count correction on brightness temperature [K] in IR bands

band	bits	corrected raw digital counts	change in brightness temperature (K)
B07	14	−0.5000	−0.129
B08	11	−0.0625	−0.015
B09	11	−0.0625	−0.012
B10	12	−0.1250	−0.011
B11	12	−0.1250	−0.009
B12	12	−0.1250	−0.008
B13	12	−0.1250	+0.009
B14	12	−0.1250	+0.008
B15	12	−0.1250	+0.011
B16	11	−0.0625	+0.022

Updating of the HSD format

Sensitivity and other sensor performance characteristics determined in pre-launch ground testing may change in orbit. Figure 9 shows sensitivity trends of AHI-8 VNIR bands with an SD on board the Himawari-8 satellite as a solar calibration target. The validation results indicate degradation of approximately 0.5% a year in Bands 1 to 4.

Calibration slopes determined at the pre-launch stage were used provisionally after launch, and the coefficients were updated on 8 June 2015 using SD observation data. AHI-8 SD observation is performed approximately every two weeks. The calibration slopes derived from 7 SD observation events from March to May 2015 were averaged and used for the update. No further updates have been implemented.

At 04:00 UTC on 25 July 2017, JMA updated part of the Header block in Himawari Standard Data format to incorporate the latest calibration information derived from SD observations for VNIR bands. Figure 10 summarizes the update. Among the 104 bytes spare in the #5 calibration information block, 24 bytes were assigned to 1) the updated time (MJD; modified Julian date) of the latest calibration coefficients; 2) the latest slope for the count-radiance conversion equation, and 3) the latest intercept for the count-radiance conversion equation. Based on 2) and 3), users can derive radiances in which the sensor trend is appropriately considered. JMA plans to update its calibration information periodically, and only the latest such information will be stored as the most recent. A history of calibration information is available on the Meteorological Satellite Center's webpage.

The calibration information (i.e., the value of Nos. 8 and 9 in the #5 calibration information block) used still is that derived from SD observations conducted between March and May 2015. Accordingly, this format update does not affect users' former processing.

The format for IR bands did not change.

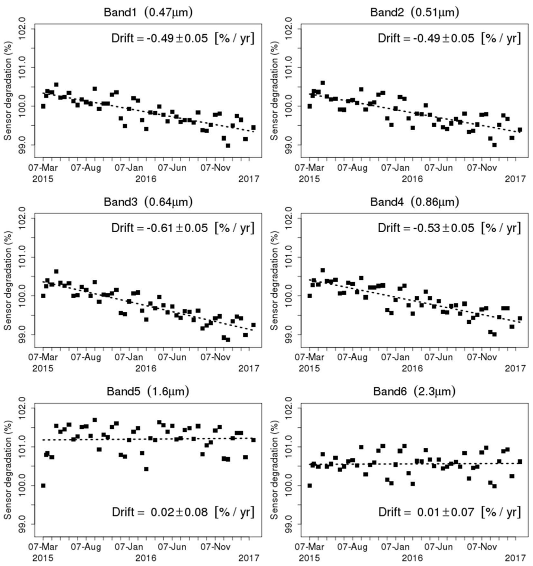

Figure 9. Sensor sensitivity trends for AHI-8 VNIR bands. Time-series representations for the inverse of calibration slopes derived from AHI-8 SD observations. Averaged values over for detectors which are normalized for the first observation on 7 March 2015 are shown.

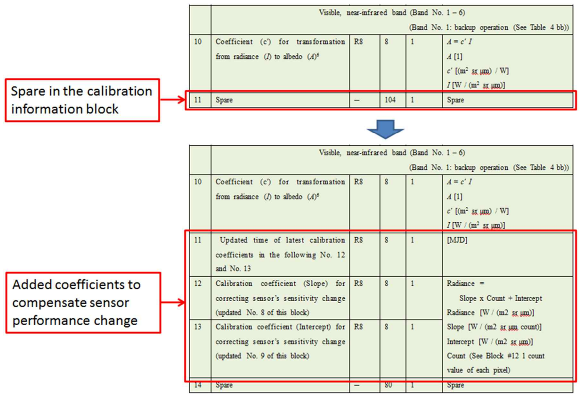

Figure 10. Himawari Standard Data format update

References

" Improvement of Himawari-8 observation data quality", Meteorological Satellite Center of JMA, 21 July 2017.

"Correction of the Himawari-8 AHI's Sensitivity Trend", Meteorological Satellite Center of JMA, 21 July 2017.

http://www.jma-net.go.jp/msc/en/

(Kouji Yamashita, MSC/JMA)

Members of the Coordinating Group

JAPAN (Co-coordinator)
Dr Hiroshi KUNIMATSU
Senior Supervisor for Satellite Operations
Satellite Program Division
Japan Meteorological Agency

REPUBLIC OF KOREA (Co-coordinator)
Dr Dohyeong KIM
Senior Researcher
Satellite Planning Division,
National Meteorological Satellite Center
Korea Meteorological Administration

CHINA
Mr Xiang FANG
Director, Remote Sensing Data Application
National Satellite Meteorological Center
China Meteorological Administration

INDIA
Mr A. K. SHARMA
Deputy Director General of Meteorology
India Meteorological Department

RUSSIAN FEDERATION
Ms Tatiana BOURTSEVA
Chief, Information Department
ROSHYDROMET

Dr Oleg POKROVSKIY
Principal Scientist, Main Geophysical Observatory
ROSHYDROMET

EUMETSAT (Observer)
Dr Kenneth HOLMLUND
Chief Scientist
EUMETSAT

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 Hiroshi KUNIMATSU, JMA)

RA II WIGOS Project Home Page

http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html

Editorials and Inquiries

Hiroshi KUNIMATSU (Dr.)
Senior Supervisor for Satellite Operations
Satellite Program Division
Observation Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
Tokyo 100-8122, Japan

Tel: +81-3-3201-8677
Fax: +81-3-3217-1036
Email: kunimatu@met.kishou.go.jp

Dohyeong KIM (Dr.)
Senior Researcher
Satellite Planning Division,
National Meteorological Satellite Center
Korea Meteorological Administration
64-18 Guam-gil, Gwanghyewon, Jincheon,
Chungbuk, 365-830, Republic of Korea

Tel: +82-43-717-0205
Fax: +82-43-717-0210
Email: dkim@kma.go.kr

(Editor-in-chief of this issue: Dohyeong Kim)