GLOBAL SPACE-BASED INTERCALIBRATION SYSTEM

EXECUTIVE PANEL

EIGHTEENTH SESSION
JEJU, REPUBLIC OF KOREA, 8-9 JUNE 2017

FINAL REPORT
WMO General Regulations

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation of behalf of the constituent body when the matter is, in his opinion, urgent and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).
GSICS-18 participants:
From left to right (back to front): Dohyeong Kim, Sergey Zorin, Alexandr Chunosov, Kenneth Holmlund, Toshiyuki Kurino, Alexey Rublev, Jeong-Sic Yun, Minju Gu, Larry Flynn, Ksenia Zubkova, Manik Bali, James Butler, Mitch Goldberg, Xiaoxiong Xiong, Peter Miu, Masaya Takahashi, Misako Kachi, Vasily Asmus
1. Opening of the meeting

The eighteenth session of the GSICS Executive Panel (EP) was held in Jeju, Republic of Korea, from 8 to 9 June 2017, in advance of the 45th CGMS meeting. It was attended by representatives of CMA, EUMETSAT, ISRO, JAXA, JMA, KMA, NASA, NOAA, ROSHYDROMET, WMO (Secretariat), the GCC(Director, Deputy-Director), GDWG(Co-chairs), GRWG (Chair). See the list of participants in Annex 1. Note: the present report contains hyperlinks to the presentations which are available on the GSICS-EP-18 web page: http://www.wmo.int/pages/prog/sat/meetings/GSICS-EP-18/GSICS-EP-18.html

As the GSICS Chair Zhang Peng, CMA, was not able to attend the meeting, it was agreed that the meeting would be chaired by the Vice-chair Ken Holmlund, EUMETSAT. The agenda of the meeting was approved, as contained in Annex 2.

2. Election of New Chair

Zhang Peng conveyed his intention to step down the Chair before the GSICS-EP-18 meeting, the GSICS EP discussed and elected Mitch Goldberg, NOAA/NESDIS to the GSICS Chair. The EP expressed its thanks to Zhang Peng for his many years of support to GSICS. Mitch Goldberg expressed his wishes as the new Chair.


Toshiyuki Kurino, WMO Secretariat, reviewed the final report of GSICS-EP-17 with outstanding actions and other decisions and recommendations from previous meetings (see Annex 3).

4. Report from the GSICS Centre and Working Groups

4.1. Report from the GSICS Coordination Centre (GCC)

GCC Director, Larry Flynn of NOAA, provided a summary of GCC activities during the past year. The report from the GCC will cover the support of GSICS activities including meetings and workshops. The GCC hosted a very successful Users’ Workshop as part of a NOAA Science Team Meeting and is organizing this year’s Users’ workshop as a session at the AOMSUC. Four issues of the GSICS Quarterly were published including 22 research articles and 15 news items. The GCC has updated the GPPA and used it to guide the promotion of nine new demonstration products. They have also worked to help provide feedback pages, a template for product pages and a better system for creating and tracking action items.

4.2. Report from the GSICS Research Working Group (GRWG)

GRWG Chair, Dohyeong Kim (KMA) provided a summary of GRWG activities during the past year. Dohyeong informed the panel of the successful GSICS Annual Meeting organized at Madison, Wisconsin in March 2017. The participants in the meeting made a strong pitch to connect with users of GSICS algorithms and products. GSICS would support the development and launch of the
CLARREO IR mission by writing a white paper and to present in the CGMS-45. He then provided a breakdown of advances in each subgroup (IR, VIS/NIR, MW, UV).

The IR subgroup Chaired by Tim Hewison (Eumetsat) summarized the progress in CGO-LEO IR including the necessity of accounting for the diurnal and seasonal variations, midnight calibration correction, its application to SST and so on. The summary also includes the potential alternative inter-calibration algorithms, that is spectral corrections for the SRF shift. Dohyeong reviewed the progress made by the Visible and Near Infrared Subgroup, chaired by Dave Doelling (NASA). The subgroup has made advances in developing techniques that use Deep Convective Clouds by evaluating the DCC BRDF, deseasonalization methods, PDF statistics, inter-annual variability. Plans are progressing for Second Joint GSICS / IVOS Lunar Calibration Workshop to be held in China 13-16 November 2017.

The Microwave subgroup led by Ralph Ferraro (NOAA) is spearheading working on three major areas 1) to develop candidate satellite/sensor (inventory) as in-orbit references for specific channels, 2) to provide a draft uncertainty analysis describing the comparison of example (microwave) instruments to GRUAN, and 3) To develop RTM approaches as a calibration transfer tool.

The UV subgroup lead by Rosemary Munro (Eumetsat) has made strong pitch to work on topics to develop consensus and lead on many topics. These include the following: 1) A Reference Solar Spectrum project to compare solar measurements, 2) A White paper on ground-based characterization, 3) A direct match-ups and target sites project to compare reflective channel performance, and 4) A project for cross-calibration below 300 nm by using forward models and climatology as transfer methods.

4.3. Report from the GSICS Data Management Working Group (GDWG)

GDWG Co-Chair, Peter Miu (EUMETSAT) provided a summary of GDWG activities during the past year. The GDWG EP Report summarised the Data Management activities since the GSICS EP-17 meeting and the GSICS annual joint meeting that took place in Madison, USA from 2017-03-20/24. The report also addressed a CGMS action (A44.04) as well as a GDWG action to provide clarification for selecting GSICS chairs. Both of these actions have been addressed by updating the GSICS Terms of Reference (ToR).

The CGMS action is closed by clarifying the tasks performed by the GDWG as a body where members collaborate together to agree and specify guidelines, convention and standards as well as data management systems to facilitate interoperability and ease of use of GSICS deliverables. The GDWG does not develop or operate these data management systems. Resource for these systems should be part of the routine operations of the satellite operators. To further address this action, the EP chair tasked the GDWG chairs to produce a Fact Sheet to highlight why satellite operators should invest in the work done by the GDWG. This was produced and sent to the EP chair on the final day of the GSICS EP-18 meeting.

Regarding the GDWG action, the ToR was updated on how all chairs are selected by the working groups for recommendation to the GSICS EP for acceptance.
The updated ToR was endorsed by the EP.

Finally, the EP was informed that the 3 years term of the current GDWG co-chair will complete in the first quarter of 2018, and a GDWG recommendation was made to them to extend their terms but revert back to a chair and vice chair role following the chairing roles of other GSICS working groups. Masaya Takahashi (JMA) was recommended to take on the GDWG chair and this was endorsed by the EP. Peter Miu (EUMETSAT) was recommended to take on the GDWG vice chair role, the EP endorsed this with an action to report back to the EP after discussing with Dr A. K. Mitra (IMD) if he can also take on a vice-chair role as he has expressed an interest in the future chairing of the GDWG.

5. Update from GSICS Members and observers

5.1. Report from EUMETSAT:

Kenneth Holmlund, EUMETSAT presented on the current status and future plan for EUMETSAT satellites. EUMETSAT contribution to GSICS/GRWG and GDWG related actions were presented with highlights of other EUMETSAT calibration activities.

5.2. Report from JAXA:

Misako Kachi, JAXA presented current status and future plan of satellites. GPM and GCOM-W is now in the Extended Mission Phase, and GCOM-C will be launched in JFY2017 and GOSAT-2 and EarthCARE in JFY2018. JAXA conducted preparation for lunar calibration of GCOM-C/SGLI and GOSAT-2/CAI-2 using GIRO provided by GSICS. Cross-calibration of passive microwave imagers (e.g., AMSR2, AMSR-E, GMI, TMI) is implementing periodically when L1 product updates, and that of precipitation radars (e.g., TRMM/PR, GPM/DPR) was also implemented to reflect its result to the latest DPR L1 V05 data, released in May 2017. New method for cross-calibration of IR channels to retrieve SST instead of GSICS correction is developed by using SST and transmittance data, which are physically retrieved from satellite IR data, considering inter-band correlation/dependency. This correction method works well to remove biases in SSTs between Himawari-8/AHI and Terra/MODIS, and JAXA plans to apply it to JAXA’s IR SST products.

5.3. Report from JMA:

Masaya Takahashi, JMA presented on A new-generation Himawari-8 geostationary meteorological satellite of Japan Meteorological Agency (JMA) began operation in July 2015 after in-orbit testing and checking of the overall system. The identically configured Himawari-9 was launched on 2 November 2016, and was put into in-orbit standby as backup for Himawari-8 on 10 March 2017 after in-orbit testing. JMA has been mainly contributing to GRWG activities on developing GEO-LEO-IR and -VNIR inter-calibration methods in collaboration with other agencies. Updating GSICS products' conventions and standardization of GSICS SRF convention are ongoing by JMA GDWG member. Validation results of Himawari-9/AHI radiometric calibration during its in-orbit test were reported. The group lauded that JMA's inter-calibration monitoring webpages are very useful for users. An usefulness of blending GEO-LEO and GEO-GEO inter-calibration/comparison methods for understanding diurnal calibration variation was also pointed out.
5.4. Report from KMA:

Dohyeong Kim presented an update on KMA GSICS activities. First, he introduced the plan of new satellites, GEO-KOMPSAT-2A in 2018, and LEO (MW sounder) in 2022. He reported the progress of GSICS GEO-LEO product for COMS/MI which is now demonstration mode, generating regularly and provided the results on the web. For the VIS calibration, DCC/KMA, desert, clouds targets are running as test operation, and showing the degradation results of DCC and lunar calibration about -1.25%/year and -1.29%/year, respectively.

He reported the SRF shift of the water vapor channel about 3.5 cm-1 and is ready to implement to operational for the public service. He also reported the diurnal variation of IR channels inter-calibration showing increased biases at near the local midnight due to the midnight thermal stress of 3-axis stabilized satellite.

5.5. Report from NASA:

James Butler, NASA presented the current status and future plans for NASA Earth observing missions. At the time of the GSICS EP-18 meeting, there are 22 NASA Earth science missions on orbit, 3 of which are deployed on the International Space Station and 19 on free-flying satellites. Several missions involve interagency or international partnerships. The status of NASA Earth science missions since the GSICS EP-17 in Biot, France was presented. Missions launched in the past year include the Cyclone Global Navigation Satellite System (CYGNSS), GOES-R, the Stratospheric Aerosol and Gas Experiment-III (SAGE-III), and Lightning Imaging Sensor (LIS). Missions which ended in the past year included the ISS-Rapid Scatterometer (ISS-RapidScat) and the Earth Observing-1 (EO-1) missions. Missions currently scheduled for launch in the 2017 to 2019 timeframe include the Total and Spectral Solar Irradiance-1 (TSIS) mission, the Ice, Cloud, and land Elevation Satellite-2 (ICESat-2), the Gravity Recovery and Climate Experiment-Follow On (GRACE-FO) mission, the Global Ecosystem Dynamics Investigation (GEDI) mission, and the ECOSystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS). The Landsat 9 mission was reported to be scheduled for a 2020-2021 launch. Missions under formulation or development include the Tropospheric Emissions: Monitoring of Pollution (TEMPO) mission, the NASA/CNES/CSA/UKSA Surface Water and Ocean Topography (SWOT) mission, the NASA-ISRO Synthetic Aperture Radar (NISAR), the NASA/NOAA/ESA/EUMETSAT Sentinel-6 mission, the Multi-Angle Imager for Aerosols (MAIA) mission and the Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Satellites (TROPICS). Since GSICS EP-17, NASA continued significant and active participation in and support to GSICS EP and Research Working Group (GRWG). The operational status of the MODIS Terra and Aqua and the AIRS Aqua instruments was presented with updates on any plans for data reprocessing or calibration updates. Proposals selected for funding in August 2016 through the NASA Research Opportunities in Earth and Space Science (ROSES) Solicitation on Satellite Calibration Interconsistency Studies (SCIS) were shown. This ROSES SCIS solicitation is of great interest to GSICS. Lastly, NASA’s increasing interest in CubeSat instruments was discussed. As an example, information on the CubeSat Infrared Atmospheric Sounder (CIRAS) funded through NASA’s In-Space Validation of Earth Science Technologies (InVEST) program and under development by NASA JPL was presented.
5.6. Report from NOAA:

Mitch Goldberg, NOAA presented on current status and future plan of NOAA satellites with prospective GSICS products. The highlights of NOAA calibration activities were also presented.

5.7. Report from ROSHYDROMET:

Alexey Rublev, ROSHYDROMET presented on current status and future plan of ROSHYDROMET that will consist of four Meteor-M polar-orbiting satellites, three Electro-L geostationary satellites, two highly elliptical orbit (non-geostationary) Arctica satellites, and about 10 R&D environmental satellites.

5.8. Report from ROSCOSMOS:

ROSCOSMOS is involved in calibration of targeted instruments during in-flight operation and validates multi-purpose remote sensing data products. Throughout the spacecraft operation ROSCOSMOS monitors the sensor payload radiometric characteristics. ROSCOSMOS delegation presented the results of intercalibration of the Russian KMSS instrument versus MODIS data in 2014-2015 years, the method of implemented intercalibration, its assumptions and constrains. Also, ROSCOSMOS delegation considered some reasons of choosing MODIS as a reference instrument. Preliminary analysis of method accuracy gives relative error near 5-6% that proves the effectiveness of the method.

6. Status review of outstanding actions from previous meetings

EP reviewed the actions/recommendations and other decisions from previous meetings. (see the list of actions in Annex 3)

7. Space- and Ground-based Calibration Reference

7.1. CLARREO mission

Dohyeong Kim, GRWG Chair, presented on GSICS' s need for reference observations and endorses activities and resources needed to proceed with missions to obtain reference observations. GSICS recommends that these reference measurements be included in the WMO Integrated Global Observing System (WIGOS) in 2040 (WIGOS Space Vision 2040) which is now being formulated, but also advocates for such missions to be implemented as soon as possible.

The use of reference instruments is key to the inter-calibration strategy of the Global Space-based Inter-Calibration System (GSICS) – both for instrument monitoring, as well as for the generation of current GSICS Corrections, which users can apply to operational Level 1 satellite data to correct its radiometric calibration to be consistent with that of a reference instrument. These corrections can be radiometric or spectral in nature and are referred to collectively as GSICS inter-calibration products.
WMO support for the CLARREO mission in response to GSICS-EP-10 action: "WMO to communicate to NASA its support to the CLARREO project and express in particular the views of GSICS that a mission such as CLARREO would bring a unique benefit in providing absolute traceability and improved instrument inter-calibration, and therefore increase the value, of a number of other, either research or operational, environmental missions; WMO to express furthermore the expectation that the CLARREO mission be reconsidered for implementation in the coming years."

This need for reference observations has also been recognized by numerous other agencies and reports. As just one example, in CGMS working paper CGMS-42-ITWG-WP-01, a top recommendation from ITSC-19 is: “To satellite agencies: noting that absolute calibration with on-orbit SI traceability is critical for significantly reducing uncertainties in monitoring climate trends, ITWG recommends to pursue the realization of absolute calibration missions (such as CLARREO), including considering flight opportunities on the ISS.”

Although many current instruments are characterized on ground, the traceability chain of their calibration to SI-standards is broken by the changing environmental conditions during launch. This introduces unknown uncertainties into their absolute calibration on-orbit. Furthermore, it is important that these reference instruments provide hyperspectral observations to accurately represent the spectral response of a range of target instruments.

8. GSICS and WIGOS Vision/Space 2040

The WMO Secretariat reported the present status of drafting “Vision for the WIGOS space-based component in 2040 (WIGOS/Vision/Space 2040)”. WIGOS/Vision/Space 2040 has been developed with very substantial involvement from the satellite community and the CGMS agencies, and it has undergone further modification and editing since CGMS-44. WIGOS/Vision/Space 2040 will be presented in EUMETSAT Users Conference in October in consultation with a broad group of stakeholders.


9. GSICS and OSCAR/Space Database

The WMO Secretariat gave a demonstration of a new version v2.0 of the Observing Systems Analysis and Review Tool / Space (OSCAR/Space), which was released in September 2016. It was recognized that OSCAR/Space was widely used by users. With the new version, it was felt that the value of OSCAR/Space would further increase.

It was also recognized that setting up a maintenance and management structure to ensure sustained operations of the resource is a current priority. The GSICS members encouraged the Secretariat to secure resources to maintain this service of great benefit to the space provider and
user community, and it was proposed to set up a “Support Team” and a “Scientific and Technical Advisory Team” for OSCAR/Space. Engagement of satellite operators in CGMS as well as key user communities such as International Science Working Groups is critical in this regard.

It was proposed that the OSCAR/Space Database Users’ Workshop is planned to be held in Rome, Italy on 4 October 2017, in conjunction with 2017 EUMETSAT Meteorological Satellite Conference.

10. GSICS Reference Documentation

The WMO Secretariat presented the status of GSICS related documents.

GSICS related documents archived in "Space Programme Reports & Publications (http://www.wmo.int/pages/prog/sat/publications_en.php)" are as follows;

- "GSICS Implementation Plan" (Ver.1, 2006)
- GSICS-RD002: "VISION OF GSICS IN THE 2020s" (Ver.1.1, June 2015)
- GSICS-RD004: "TERMS OF REFERENCE of GCC, EP, GDWG and GRWG" (Ver.1.0, June 2015)

However, in GSICS-RD000: "GSICS Documentation Plan" (Ver. 0.4, May 2016), the following five documents are listed as "GSICS high-level reference documents" to be submitted to Executive Panel for approval;

RD001: Introduction to GSICS
RD002: Vision of GSICS
RD003: Guide to GSICS Products and Services
RD004: Terms of Reference of GCC, EP, GDWG and GRWG
RD005: GSICS User Requirements

with remark for RD005 as follows;

GIRO and GLOD Dataset Usage Policy (http://www.wmo.int/pages/prog/sat/meetings/documents/GSICS-EP-16_Doc_13_GIRO-GLOD-policy.pdf) was regarded as RD005 in the previous documentation plan (Ver. 0.3, May 2015: http://www.wmo.int/pages/prog/sat/meetings/linkedfiles/GSICS-EP-16_Doc_06-02_RD000-doc-plan.docx), and it was approved at GSICS-EP-16 in May 2015. In this version (V.0.4, May 2016), GIRO/GLOD document is regarded as “RDXX”. There was no discussion on this version at GSICS-EP-17. If “GSICS User Requirements” document does not exist yet, RD005 would be better to assign to GIRO/GLOD document. Alternatively, the reference number of GIRO/GLOD document should be changed from RD005 to RD006.

Based on the above recognition, the following GSICS related documents were reviewed and approved in EP;
- RD000 (GSICS Documentation Plan), RD001, RD003, RD004, RD005, and RD006 were approved in EP, and archived in "Space Programme Reports & Publications".

In parallel, RD001 and RD003 will be reviewed by WIGOS members to be referred in the WIGOS document titled "Initial Guide to WIGOS"; http://www.wmo.int/pages/prog/www/wigos/WGM.html

**11. Outstanding Actions and Recommendations from previous EP meetings**

A summary status of actions from previous EP meetings was reviewed. A number of actions had been completed at the meeting and were closed. A few other old outstanding actions which were no longer relevant were closed. An updated status of outstanding actions is contained in **Annex 3**.

**12. Summary of Actions and Recommendations/Decisions**

The Chairman summarized the achievements of the meeting and recalled the agreed recommendations and actions. The list of new actions from this meeting is provided in **Annex 4**. Other key decisions and recommendations are listed in **Annex 5**.

**13. Any other business**

13.1. 2\textsuperscript{nd} Lunar Calibration Workshop
EP extended the offer of China to host the second GSICS Workshop on Lunar Calibration during the fourth quarter of 2017. WMO, as GSICS secretariat, will submit the letter of gratitude to CMA for hosting the workshop.

13.2. GSICS Users’ Workshop
It was proposed that GSICS Users’ Workshop will be held at AOMSUC-8, Vladivostok, Russia, 15-21 October 2017.

13.3. OSCAR/Space Users’ Workshop
It was proposed that OSCAR/Space Users’ Workshop will be held at EUMETSAT Meteorological Satellite Conference, Rome, Italy, 4 October 2017. Tim Hewison, EUMETSAT will attend at the workshop for giving a talk on OSCAR/Space for GSICS.

13.4. 2018 Annual GRWG and GDWG Meeting
It was proposed that the annual GRWG and GDWG meeting will be held in China. CMA will host the meeting.

**14. Drafting report to CGMS-45**
As a summary, the Panel agreed to draft the report to CGMS, which should recall the achievements of GSICS, its increasing maturity and emphasize the benefits to satellite data users (see Annex 6).

15. Closing of the Meeting (Chair)

The meeting was closed at 16h00 on Friday 9 June 2017.
# ANNEX 1: LIST OF PARTICIPANTS

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Remote attendance (via WebEx)

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## ANNEX 2: PROVISIONAL AGENDA

### DAY 1

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<tbody>
<tr>
<td>1. Opening of the meeting</td>
<td>09.00</td>
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<td>Introduction of participants and approval of agenda</td>
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<tr>
<td>2. Election of Chairperson</td>
<td>09.10</td>
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<tr>
<td>3. Approval of Final Report of GSICS-EP-17</td>
<td>09.15</td>
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<tr>
<td>4. Report from the GSICS Centre and Working Groups</td>
<td></td>
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<tr>
<td></td>
<td>Report from GCC 09.20</td>
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<tr>
<td></td>
<td>Report from GRWG 10.00</td>
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<tr>
<td></td>
<td>(Morning break) 10.40</td>
</tr>
<tr>
<td></td>
<td>Report from GDWG 11.00</td>
</tr>
<tr>
<td>5. Update from GSICS Members and Observers</td>
<td>11.40</td>
</tr>
<tr>
<td></td>
<td>CMA (TBD) 13.00</td>
</tr>
<tr>
<td></td>
<td>EUMETSAT (TBD)</td>
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<tr>
<td></td>
<td>JAXA (TBD)</td>
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<tr>
<td></td>
<td>JMA (TBD)</td>
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<tr>
<td></td>
<td>KMA (TBD)</td>
</tr>
<tr>
<td></td>
<td>(Lunch Break)</td>
</tr>
<tr>
<td></td>
<td>NOAA (TBD) 14.00</td>
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<tr>
<td></td>
<td>NASA (TBD) 14.20</td>
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<td></td>
<td>ISRO (TBD) 14.40</td>
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<tr>
<td></td>
<td>ROSHYDROMET (TBD) 15.00</td>
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<tr>
<td></td>
<td>(Afternoon Break) 15.20</td>
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<td></td>
<td>USGS (TBD) 15.40</td>
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<td></td>
<td>WMO (TBD) 16.00</td>
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<tr>
<td></td>
<td>ESA, ROSCOSMOS, CNSA (TBD) 16.20</td>
</tr>
<tr>
<td>6. Status Review of Outstanding Actions from Previous Meetings</td>
<td>17.00</td>
</tr>
</tbody>
</table>
Discussion
(including review of actions/recommendations, decisions from previous meetings, and also extracting new actions/recommendations, decisions from this meetings)

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>DAY 2</strong></td>
<td><strong>Tentative timing</strong></td>
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<tr>
<td>7.</td>
<td>Space- and Ground-based Calibration Reference</td>
</tr>
<tr>
<td>8.</td>
<td>GSICS and WIGOS Vision/Space 2040</td>
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<tr>
<td>9.</td>
<td>GSICS and OSCAR/Space Database</td>
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<td>10.</td>
<td>GSICS and Climate</td>
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<tr>
<td>11.</td>
<td>GSICS and Space Weather</td>
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<tr>
<td></td>
<td><em>(Morning break)</em></td>
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<tr>
<td>12.</td>
<td>GSICS Reference Documentation</td>
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<td></td>
<td><em>(Lunch Break)</em> 13.00 – 14.00</td>
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<tr>
<td>13.</td>
<td>GSICS Outreach</td>
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<td></td>
<td>- GSICS Users' Workshop</td>
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<td></td>
<td>- publications, web presence, others</td>
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<tr>
<td>14.</td>
<td>Partnership, membership and organizational issues</td>
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<tr>
<td>15.</td>
<td>Other issues raised by the Working Groups or EP members</td>
</tr>
<tr>
<td>16.</td>
<td>Priority actions for 2017-2018, guidance to GCC, GDWG and GRWG</td>
</tr>
<tr>
<td></td>
<td><em>(Afternoon Break)</em></td>
</tr>
<tr>
<td>17.</td>
<td>Drafting report to CGMS-45</td>
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<tr>
<td>18.</td>
<td>Future Meeting of GRWG and GDWG and User Meeting</td>
</tr>
<tr>
<td>19.</td>
<td>Wrap up <em>(Chair)</em></td>
</tr>
</tbody>
</table>

Adjourn. 17.00
## Annex 3: REVIEW OF OUTSTANDING ACTIONS FROM PREVIOUS MEETINGS

### Actions and Recommendations from GSICS-EP-17

<table>
<thead>
<tr>
<th>Reference</th>
<th>Action Description</th>
<th>Due date</th>
<th>Status in May 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EP-17.A01</strong></td>
<td>CGMS members to evaluate the relevance and implications of adding “calibration alert system” and “SNO and GEO-LEO collocation data” to the GSICS portfolio, and report to the Executive Panel. (Replaced from EP-14.01 in new Action to all CGMS members)</td>
<td>EP-18</td>
<td>In progress; Implementation of “calibration alert system” is still in progress in satellite agencies. New action to EP to provide guideline for the requirements for instrument monitoring. (CGMS-46) GEO-LEO collocation data was provided by JMA KMA in accordance with GDWG template. New action to GDWG for providing timeline (EP-19)</td>
</tr>
<tr>
<td><strong>EP-17.A02</strong></td>
<td>GCC to float the Users requirements to the GSICS Community</td>
<td>EP-18</td>
<td>Closed:</td>
</tr>
<tr>
<td><strong>EP-17.A03</strong></td>
<td>Through GRWG Subgroups to review the user requirements and how they are meeting them.</td>
<td>EP-18</td>
<td>In progress</td>
</tr>
<tr>
<td><strong>EP-17.A04</strong></td>
<td>WMO Secretariat to invite comments on the GSICS Basic Documents from WIGOS community - GSICS FUNCTIONS AND ORGANIZATION - GSICS USER GUIDE Using GSICS Products and Services - GSICS USER REQUIREMENTS DOCUMENT</td>
<td>EP-18</td>
<td>In progress WIGOS will refer the GSICS documents into WIGOS document</td>
</tr>
<tr>
<td><strong>EP-17.A05</strong></td>
<td>JAXA, on behalf of GSICS-EP, to introduce examples of GSICS corrections applied to Himawari-8/AHI at the GHRSSST (Group for High Resolution SST)</td>
<td>EP-18</td>
<td>In progress; GHRSS Science Team Meeting during June 6-10, 2016 in Tysons Corner (US) and seek the PoC for further</td>
</tr>
<tr>
<td>EP-17.A06</td>
<td>GSICS to review the GDWG Terms of Reference and associated indicated levels of effort of the members (CGMS WGII/4: A44.04)</td>
<td>CGMS-45</td>
<td>Closed:</td>
</tr>
<tr>
<td>EP-17.A07</td>
<td>GRWG to discuss with ISCCP (SCOPE-CM Project 9) a detailed project proposal for the use of GSICS methodologies to produce a GSICS-compliant ISCCP dataset for evaluation (CGMS WGII/4: A44.05)</td>
<td>CGMS-45</td>
<td>Closed: GSICS provide recalibration information to ISCCP</td>
</tr>
<tr>
<td>EP-17.A08</td>
<td>GSICS EP to encourage CGMS agencies to employ the GSICS Correction as part of their operational procedures (CGMS WGII/4: R44.04)</td>
<td>CGMS-45</td>
<td>Closed: Followed by GSICS white paper: guide line</td>
</tr>
<tr>
<td>EP-17.A09</td>
<td>CGMS members to consider removing spectral gaps from future hyperspectral sounders to support GSICS inter-calibration of IR imagers (Replaced from CGMS WGII/3: R43.01)</td>
<td>CGMS-45</td>
<td>Closed: There is no spectral gaps in the operation of CrISS and IASI. The spectral gaps among three polar orbits will be added in the list of risk area (CGMS-45 WMO-WP-11)</td>
</tr>
</tbody>
</table>

**OLDER OUTSTANDING ACTIONS**

| EP-16.A01 | GCC to recall in the GSICS Quarterly the disclaimer and the ownership clause applying to GSICS products and other deliverables | EP-18 | Closed |
| EP-16.A10 | All satellite operators to evaluate their requirements for GSICS resources, products and services to serve the needs of their internal users (for NRT products or climate applications such as SCOPE-CM projects): identify application areas, draft requirement indicating the characteristics of the product needed, quality criteria and delivery mode. | EP-18 | Closed |
EP-16.A12 | GCC to analyse, in consultation with GCOS/AOPC, the implications of GCOS observation needs on GSICS products. | EP-18 | Open: |
---|---|---|---|
EP-15.A01 | GCC to register the GSICS catalogue as a service in the WMO Information System (WIS), to ensure it is discoverable in the WIS. | EP-18 | Closed: |
EP-15.A02 | Every GPRC to nominate at least one representative on the GDWG | EP-18 | Open: |
EP-15.A03 | GCC and WMO Secretariat to coordinate with a view to send a letter of recognition from WMO to acknowledge significant personal contributions to GSICS. | EP-18 | Closed: |
EP-14.A08 | NASA to present a paper about maturity levels of instrument calibration in support of re-processing, taking MODIS as an example, at a future web meeting of the Executive Panel | EP-18 | Closed: |

**OTHER DECISIONS AND RECOMMENDATIONS FROM GSICS-EP-17**

**Recommendation:**

**EP-17.R01:** The Panel recommended giving consideration to enhancing ground-based Moon observatories, at least for a 3-year campaign, in order to reduce the absolute uncertainty of satellite instrument calibration by lunar observation.

**EP-17.R02:** All GPRC should endeavour to generate GSICS Corrections for all current GSICS reference instruments, and strive to build a blending capability.
**Decision:**

GSICS Documents - publication on GCC website - approval through agency - then review through GCC director, on case-by-case basis

EP agreed with the definition of Anchor references instruments in GSICS. This could be applicable to Prime Products and GEO Ring inter-comparisons.

EP formally declared EUMETSAT SEVIRI-IASI cross calibration product Operational (product review page is here)


EP gave GCC Director the discretion of acceptance of products in Demonstration Phase – abeyance of the requirement in submission of these documents lies with the GCC Director.

EP gave GCC Director the discretion of automatic acceptance of products in Demo Phase for products that fall under the “family category”.

EP recommended that agencies, reviewers and users support the GCC in updating the review pages.

The agency shall provide the GCC relevant documents to demonstrate that a given product is being made from a cross calibration of instruments that belong to a family.
**Annex 4: OUTSTANDING ACTIONS FROM EP-18**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Action Description</th>
<th>Actionee</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EP-18.A03</strong></td>
<td>GDWG and GRWG to develop an approach for an Annual GSICS report on the State of the Observing System with respect to Instrument Performance and Inter-comparisons with GSICS Reference Instruments (from presentations given at the GRWG meeting)</td>
<td>GDWG and GRWG</td>
<td>EP-19</td>
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</table>

**Older Outstanding Action:**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Action Description</th>
<th>Actionee</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EP-17.A01</strong></td>
<td>GCC to float the Users requirements to the GSICS Community</td>
<td>GCC</td>
<td>EP-19</td>
</tr>
<tr>
<td><strong>EP-17.A04</strong></td>
<td>WMO Secretariat to invite comments on the GSICS Basic Documents from WIGOS community - <strong>GSICS FUNCTIONS AND ORGANIZATION</strong> - <strong>GSICS USER GUIDE Using GSICS Products and Services</strong> - <strong>GSICS USER REQUIREMENTS DOCUMENT</strong></td>
<td>WMO Secretariat</td>
<td>EP-19</td>
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</tbody>
</table>

**Recommendation:**

**EP-18.R01:** The GSICS Members are urged to apply the process from development to operations in a quick and efficient manner in order to ensure appropriate visibility to their data and products.

**Older Outstanding Recommendation:**

**EP-17.R02:** All GPRC should endeavour to generate GSICS Corrections for all current GSICS reference instruments, and strive to build a blending capability.

**Decision:**

**EP-18.D01:** Mitch Goldberg (NOAA) was elected EP Chair

**EP-18.D02:** Kenneth Holmlund (EUMETSAT) continues as EP vice-chair

**EP-18.D03:** GSICS to support OSCAR/Space Science and Technical Advisory Team

**EP-18.D04:** GDWG ToRs approved

**EP-18.D05:** Masaya Takahashi (JMA) elected GDWG Chair
(A.K. Mitra, IMD will be nominated vice-chairs with Peter Miu, EUMETSAT after GSICS ToR will be updated)

**EP-18.D06:** Approach for electing GDWG vice-Chair was agreed

**EP-18.D07:** GSICS to participate in Oscar/Space Users’ Workshop

**Consideration:**

**EP-18.C01:** GSICS and Space Weather activities
- Discussion with Space Weather Task Force on Space Weather Intercalibration Framework
- One option is an adoption of a GSICS like structure
- The Maturity of SW intercalibration activities need to be assessed
- GSICS to consider participation in relevant SW Workshops to demonstrate the GSICS model
Annex 6: GSICS REPORT TO CGMS-45

GSICS REPORT
CGMS-45 WMO-WP-WG II

Mitch Goldberg (GSICS-EP Chair)
Kenneth HOLMLUND (GSICS-EP Vice-Chair)
Toshiyuki KURINO (Secretariat)

Outline

1. GSICS purpose and organization
2. Highlights of recent activities
3. Actions/Recommendations, Decisions
Why GSICS?

- Space-based observations from various satellite missions and agencies must be precisely calibrated with similar methods against common references to be reliable and interoperable.
- Poor or inhomogeneous calibration results in degraded performance and lower benefits.
- CGMS members are collaborating within GSICS to develop and apply “best practices” for homogeneous calibration.
- GSICS provides: references, guidelines, methodologies and tools enabling satellite operators to evaluate and improve their calibration and to deliver intercalibration adjustments (GSICS Corrections).
Who benefits from GSICS?

• Satellite operators participating in GSICS
  - Sharing development effort and resources (calibration references, datasets, software tools)
  - Capacity building (best practices for instrument monitoring, traceability, sensor comparison and correction)
  - Improved instrument assessment, faster identification and correction of anomalies, facilitating commissioning and operation
  - Interoperability within the CGMS constellation,

• Satellite data users
  - Improved calibration
  - Interoperability through inter-calibration
  - Assessments, reports, for better understanding
  - Algorithms enabling to reprocess data records

GSICS leverages the value of individual missions

GSICS membership

GSICS Members:
• China Meteorological Administration (CMA)
• Centre National d’Etudes Spatialles (CNES)
• European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)
• Indian Space Research Organization (ISRO)
• India Meteorological Department (IMD)
• Japan Aerospace Exploration Agency (JAXA)
• Japan Meteorological Agency (JMA)
• Korea Meteorological Agency (KMA)
• National Aeronautics and Space Administration (NASA)
• National Institute of Standards and Technology (NIST)
• National Oceanic and Atmospheric Administration (NOAA)
• Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)
• United States Geological Survey (USGS)
• World Meteorological Organization (WMO)

Anticipated New Member:
• Roscosmos State Corporation (ROSCOSMOS): New representative to be nominated

Associate member:
• Inter-satellite Calibration WG of the Global Precipitation Measurement Mission (GPM X-Cal)

Observer:
• European Space Agency (ESA) New representative to be nominated
• Committee on Earth Observation Satellites (CEOS)
• CEOS Working Group on Calibration and Validation (WGCV)
GSICS leadership and Secretariat

Executive Panel:
- Mitch Goldberg (NOAA) elected Chair by EP-18
- Ken Holmlund (EUMETSAT) Vice-Chair

GRWG:
- Dohyeong Kim (KMA) Chair
- Tim Hewison (EUMETSAT) and Scott Hu (CMA) Vice-Chairs

GDWG:
- Takahashi (JMA) elected Chair by EP-18
- Peter Miu (EUMETSAT) elected Co-Chair by EP-18

GSICS Coordination Centre (GCC):
- Larry Flynn (NOAA) Director
- Manik Bali (NOAA) Deputy-Director

Secretariat:
- Toshiyuki Kurino (WMO)

Outline

1. GSICS purpose and organization

2. Highlights of recent activities

3. Actions/Recommendations, Decisions
2017 GRWG/GDWG Annual Meeting

- Monday: Mini Conference + Agency Reports (Plenary)
- Tuesday: Sub-Group Briefing Report
- Wednesday: GRWG : UV Sub-Group + IR Sub-Group, MW Sub-Group, GDWG
- Thursday: GRWG : VIS/NIR Sub-Group, GDWG
- Friday: Briefing + Wrap-up (Plenary)

Actions Webpage

A new actions page is online

Replaces the wiki actions page.
- Actions are entered directly on google sheets instead of wiki.
- These would be immediately visible on the Actions Webpage.

Features
- Fast Search.
- Chairs groups/subgroups and Co-Chairs can directly key in and update the actions.
- Extract Actions/Recommendation/Decision from Minute Document (Capability can be offered to WMO and Agencies)
- Significant reduction in overhead on Chairs and GCC.

Actions webpage: https://www.star.nesdis.noaa.gov/smcd/GCC/MeetingActions.php
Nine New Products were Accepted into the GSICS Demonstration Phase

New Products that were accepted:
- EUMETSAT: SEVIRI – IASI-A (Transfer: IASI –B) IR Prime Products (4)
- EUMETSAT: SEVIRI – MODIS (Transfer: DCC) VIS Products (2)
- ISRO: INSAT-3D – IASI-A (Imager & Sounder) IR Products (2)
- KMA: COMS – IASI-A IR Product (1)

Product Summary
- Operational: 4 product [4 EUMETSAT]
- Preoperational: 4 products [4 NOAA]
- Demonstration: 34 products [14 EUMETSAT, 13 NOAA, 6 JMA, 2 ISRO, 1 KMA]

GSICS Newsletter
https://www.star.nesdis.noaa.gov/smcd/GCC/newsletters.php

Four new Issues of the GSICS Newsletter over the last year
- Over 22 Research Articles and 15 Topics of News to which
- Over 70 Scientists contributed as Authors & Co-Authors.
- Reviewed contemporary journal policy on content sharing.
- Contributions from non-GSICS members have increased.
- Replaced mailchimp with NOAA-Email for distribution.

News Letter included in SCOPUS and extensively cited by agencies and friends of GSICS (google scholar, twitter, facebook).
2016 Users’ Workshop Report

User’s Workshop was conducted as an all-day session at the STAR JPSS Annual meeting in College Park MD.

Over 50 researchers and users met to exchange information on advances, applications and requirements for calibration products.

The following were among the key take-away messages:
1. GSICS activities have matured to the point where they are providing the foundation for a truly Global System of Infrared instrument measurements including Polar and Geostationary satellites,
2. Methods for Visible, Microwave and Ultraviolet instruments are progressing and are addressing differences in the reference measurements, sensor technologies and Earth signatures in their different spectral regions, and
3. The ICVS is an important asset in the NOAA participation in GSICS activities.

The complete agenda with links to the talks is available at

Collaboration with ISCCP

<table>
<thead>
<tr>
<th>GRWG</th>
<th>WGII/4</th>
<th>A44.05</th>
<th>GRWG to discuss with ISCCP (SCOPE-CM Project 9) a detailed project proposal for the use of GSICS methodologies to produce a GSICS-compliant ISCCP dataset for evaluation</th>
<th>CGMS-45</th>
<th>OPEN</th>
<th>S.1 (NLPP ref)</th>
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- Review the history of ISCCP activities (phase I: 1983-2009) and discuss collaboration between ISCCP and GSICS
  - Phase II will cover extended period (1982-1983, 2010-2015)
  - Cloud products uncertainties are limited by atmospheric correction rather than calibration
- ISCCP calibration three stages (Nominal, Normal, Absolute (temporally stable))
  - VIS is based on vicarious terrestrial targets while IR based on the CDFs
  - ISCCP data cannot be used for temperature trends, but can trend some cloud products (e.g. cloudiness)
- ISCCP could evaluate the impact of GSICS Corrections for GEO imagers on ISCCP cloud products, based on case studies → GCC to coordinate
  - GPRC to provide tables that map IR (11μm) counts to radiance and/or TB
  - GPRC to produce/provide a table mapping VIS (0.6μm) counts to radiance/scaled radiance if possible
  - Updated tables for the month of Dec 2009 are the target (other months are also available)
GSICS Reference Documents

- GSICS Documentation Plan (approved at EP-18 and will be published)
- Introduction to GSICS (approved at EP-18 and will be published)
- Vision of GSICS (published)
- Guide to GSICS Products and Services (approved at EP-18 and will be published)
- Terms of Reference (published: updates approved at EP-18)
- GSICS User Requirements replaced by GSICS Services Specification
  — will be discussed and published
- GIRO and GLOD Dataset Usage Policy (approved at EP-18 and will be published)

- To promote shared vision among GSICS members
- For more visibility, and external recognition of GSICS, GSICS Reference documents will be referred in the WIGOS document titled "Initial Guide to WIGOS"

Issue raised by GSICS Data Working Group (GDWG)

The activities of the GDWG are not adequately supported by CGMS agencies.
- New GDWG fact sheet developed to emphasize the benefits of GDWG

Intercalibration data management services, like those provided by the GDWG, are often not explicitly defined in the requirements of the satellite program and therefore are not properly resourced.

E.G: Instrument performance monitoring is a clear requirement of any satellite agency. But part of instrument performance monitoring needs to include intercomparisons with other sensors - which has its own additional data management needs — which are well defined by GDWG and carried out through GSICS. But GSICS has no funding. It leverages funding from satellite programs.

GSICS will develop a best practices and guidelines for instrument performance monitoring so that they can be considered in all satellite programs.
New actions

- GRWG to prepare specifications and methodologies for CGMS agency development of operational instrument performance monitoring systems.
- GRWG to assess the utilization RO for microwave instrument monitoring purposes.
- GDWG and GRWG to develop an approach for an Annual GSICS report on the State of the Observing System with respect to Instrument Performance and Intercomparisons with GSICS Reference Instruments (from presentations given at the GRWG meeting).
- GRWG to assess the value of GEO-to-GEO intercalibration for GSICS.
- GRWG to develop GSICS Service Specification Document.
- EP members to nominate PoC for GDWG.
- EP to review maturity criteria for product status.
- Recommendation: The GSICS Members are urged to apply the process from development to operations in a quick and efficient manner in order to ensure appropriate visibility to their data and products.
- Decision GSICS to support OSCAR/Space Science and Technical Advisory Team.

Considerations

- GSICS and Space Weather activities
  - Discussion with Space Weather Task Force on Space Weather Intercalibration Framework.
  - One option is an adoption of a GSICS like structure.
  - The Maturity of SW intercalibration activities need to be assessed.
  - GSICS to consider participation in relevant SW Workshops to demonstrate the GSICS model.

- GSICS User Workshop at AOMSUC-8, Vladivostok, Russia, 16-21, October, 2017.
Decisions

- Mitch Goldberg (NOAA) was elected EP Chair
- Kenneth Holmlund (EUMETSAT) continues as EP vice-chair
- GDWG ToRs approved
- Masaya Takahashi (NOAA) elected GDWG Chair
- Approach for electing GDWG vice-Chair was agreed
- GSICS to participate in Oscar Space User Workshop

THANK YOU