

REPORT FROM THE GLOBAL SPACE-BASED INTERCALIBRATION SYSTEM

HLPP reference: 3.1.1 and 3.1.2

CGMS members are collaborating in the framework of GSICS to develop and apply “best practices” for state-of-the-art and homogeneous calibration.

Upon its 10th anniversary the GSICS community is gradually encompassing all CGMS members. GSICS proves to be a great capacity building and collaboration opportunity. Its products are increasing in maturity. The practical value of GSICS was demonstrated in the role played to facilitate the commissioning operations of several satellite programmes in the most recent years. GSICS benefits to satellite operators-through sharing of resources and best practices, and to satellite data users through improved calibration, assessments, and traceability to common references.

Several challenges were identified and led to specific recommendations to CGMS Members

Action/Recommendation proposed:

- All satellite operators should participate in GSICS Working Groups, including GDWG (as a target, it is recommended that every GRWG or GDWG member plans a yearly contribution at the level of at least one man-month).
- All satellite operators to evaluate their requirements for GSICS resources, products and services to serve the needs of their users
- Procedures, best practices and calibration resources required to ensure the consistency of data records through accurate and homogeneous calibration should be defined by GSICS and CEOS WGCV as an input to the Architecture for Climate Monitoring from Space.
- Give increased attention to ground calibration sites
- Consider enhancing ground-based Moon observatories in order to reduce the absolute uncertainty of satellite instrument calibration by lunar observation.

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1. Why GSICS?

Space-based observations required for weather and climate applications have to rely on multiple satellite missions from different agencies around the world. In order to be reliable and interoperable, these different sources must be precisely calibrated with similar methods and common references. Poor or inhomogeneous calibration would result in degraded performance.

This is why CGMS members are collaborating in the framework of GSICS to develop and apply “best practices” for state-of-the-art and homogeneous calibration.

2. What is GSICS doing ?

GSICS addresses, instrument performance monitoring, anomaly resolution, comparison of sensors, and correction if necessary, as well as prelaunch instrument characterization.

GSICS holdings and deliverables include:

- Calibration resources, such as references, software/hardware tools, standards and guidelines,
- Calibration products, such as methodologies and algorithms, assessments, and operational corrections,
- Support services for user registration, product subscription, and user information through publications, events, and web services.

3. Who benefits from GSICS ?

CGMS acknowledged that GSICS benefits first of all to satellite operators, through sharing development effort and sharing resources (calibration references, datasets, software tools) and capacity building in sharing best practices (for instrument monitoring, traceability, sensor comparison and correction).

It also benefits ultimately to satellite data users through the improvement of calibration, the availability of corrections to align to a common reference, through assessments for better understanding of instrument characterization, algorithms enabling to reprocess data records.

Clearly, the improved and consistent calibration across the different agencies is a factor of interoperability within the WMO Integrated Global Observing System (WIGOS) thus supporting a strategic goal of WMO Members; it builds confidence on reliability of each other's data, and thus increases the benefit taken from global data exchange.

4. Recent evolution highlights

Scientific development are currently focused on the combined use of multiple reference spectrometers for IR intercalibration, and the developments of methods for solar channels (VIS and NIR), including the use of Deep Convective Clouds and of the Moon as calibration targets.

As indicated in Table 1, 27 GSICS correction products are currently in demonstration phase and 8 GSICS correction products in pre-operational phase (two of them in transition to operations). These corrections are calculated either in near real-time or in delayed time for use in re-processing.

Table 1: Status of GSICS correction products

| Pre-operational correction products | | | |
|-------------------------------------|-----------------------|-----------------|---------------|
| EUMETSAT | MSG-1/SEVIRI - IASI | Near real- time | Re-processing |
| EUMETSAT | MSG-2/SEVIRI - IASI | Near real-time | Re-processing |
| NOAA | GOES-13/imager - IASI | Near real-time | Re-processing |
| NOAA | GOES-15/imager- IASI | Near real-time | Re-processing |
| Demonstration correction products | | | |
| EUMETSAT | Met-7/MVIRI - IASI | Near real-time | Re-processing |
| EUMETSAT | MSG-1/MVIRI - IASI | Near real-time | Re-processing |
| NOAA | GOES-11/imager - IASI | | Re-processing |

| | | | |
|------|----------------------------------|----------------|---------------|
| NOAA | GOES-12/imager - IASI | | Re-processing |
| NOAA | (NOAA-6/19)AVHRR - MODIS | | Re-processing |
| NOAA | TIROS-N/AVHRR - MODIS | | Re-processing |
| JMA | MTSAT-2 – Aqua/AIRS | Near real-time | Re-processing |
| JMA | MTSAT-2 – Metop-2/IASI | Near real-time | Re-processing |
| JMA | MTSAT-2 – Aqua/IASI-Metop-2/IASI | Near real-time | Re-processing |

In terms of organization, GSICS has now experienced a rotation of all its leadership positions, with:

- P. Zhang and K. Holmlund as Executive Panel Chair and Vice-Chair;
- D. Kim, T. Hewison and L. Hu as GRWG Chair and vice-Chairs;
- P. Miu and M. Takahashi as GDWG Co-Chairs;
- L. Flynn and M. Bali as GCC Director and Deputy.

5. Accomplishments and challenges

The GSICS Chair raises the attention of CGMS to the following accomplishments, challenges, and recommendations.

Upon its 10th anniversary the GSICS community is gradually encompassing all CGMS members. It proves to be a great capacity building and collaboration opportunity. Its products are increasing in maturity. The practical value of GSICS was demonstrated in the role played to facilitate the commissioning operations of several satellite programmes in the most recent years. Several challenges were identified, in the following areas:

- Need of stronger engagement of GSICS members in the GSICS Research Working Group (GRWG) and Data Management Working Group (GDWG)
- Though the need for accurate and homogeneous calibration is widely understood, we are missing a formal set of user requirements, which GSICS products could be traceable to, and which could help refining prioritizing the

specifications of GSICS products. As a starting point, GSICS shall record the requirements of CGMS satellite operators and of GCOS.

- There is currently no action to address calibration issues in the Architecture for Climate Monitoring from Space. Procedures, best practices and calibration resources required to ensure the consistency of data records are thought to belong in part to the «sensing pillar» (e.g. space segment design, pre-launch characterization, maintaining references, instrument monitoring and calibration) and in part to the «CDR creation and preservation pillar» (inter-calibration, re-calibration). GSICS is in a position, together with CEOS/WGCV to provide input in this respect.
- An effort is initiated to provide an updated set of GSICS Reference documents, to ensure a same understanding and shared vision of GSICS by its members, but also to allow greater external visibility, and recognition of GSICS as a building block of WIGOS and of the Architecture for Climate Monitoring.
- The crucial importance of calibration references is emphasized, including surface-based, or in-orbit, as well as the Moon. The traceability of satellite instruments calibration by lunar observation is achieved by ground-based Moon observatories, the accuracy of these ground-based observations is however a current limitation in the absolute uncertainty of using the Moon as calibration target.

6. Recommendations proposed to CGMS

- All satellite operators should participate in GSICS Working Groups, including GDWG, to be afterwards in a position to implement the agreed practices and standards and take advantage of GSICS. As a target, every GRWG or GDWG member should plan a yearly contribution at the level of at least one man-month
 - All satellite operators to evaluate their requirements for GSICS resources, products and services to serve the needs of their users
 - Procedures, best practices and calibration resources required to ensure the consistency of data records through accurate and homogeneous calibration should be defined by GSICS and CEOS WGCV as an input to the Architecture for Climate Monitoring from Space.
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