GSICS
Products and Deliverables

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with extensive input from GSICS Team Members

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Disclaimer

- **“The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the author(s) and do not necessarily reflect the views of NOAA or the Department of Commerce."**

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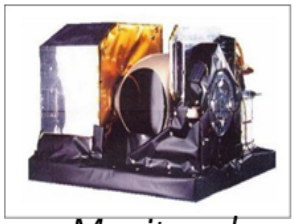
GSICS Global Space-based Inter-Calibration System

Schematic representation of GSICS holdings and deliverables (from J. Lafeuille)



Monitored instrument

GSICS core inter-calibration products

By-products

Certified output

Delivered output

Instrument behaviour assessment

(monitoring results, statistics, records of anomalies, target reflectivities)

Instrument correction algorithms

(bias, gain, non-linearity, λ shift, new SRF)

Near Real Time corrections

Time–centered corrections

Bias adjustment sequences (archive)

Users

Shared science resources	**Solar & lunar spectra**	**Target characteristics**	**Calibration datasets**	**etc.**	**Spectroscopy database, RTM**
GSICS standards & procedures	**References (benchmarks)**	**Metadata & Data Formats**	**Standard vocabulary**	**Procedures**	**etc.**
GSICS tools	**SNO matchup**	**Bias monitoring**	**Ray matching**	**Plotting, readers**	**etc.**
GSICS user services	**Registration, messaging**	**Product catalogue**	**Data servers**	**wiki, website**	**Documentation info, etc.**

GSICS Global Space-based Inter-Calibration System

GSICS inter-calibration products related to specific instruments.

Assessment of instrument behavior (results of instrument monitoring, statistical analysis of these results, records of anomalies, measured reflectivities of known targets, etc.)

Correction algorithms based on these assessments (correction algorithm for bias, gain, non-linearity, wavelength shift, change of SRF, etc.)

Corrections based on these algorithms (generated in near-real time, or time centered, or bias adjustment sequences of archived data). **These corrections are either adjusted calibration coefficients, or adjustments to be applied by the user to the operational calibration coefficients .**

These inter-calibration products are generated by GSICS members in accordance with GSICS practices, standards, procedures and principles. Their compliance is assessed by a strict peer-review process. They are registered in the GSICS Catalogue.

GSICS tools

Infrastructure elements giving access to the data (THREDDS servers, etc.)

Software tools used for the generation of intercalibration products (for Simultaneous Nadir Observation matchup, Bias monitoring, Ray matching)

Software tools used by satellite data users (For example, Plotting)

Software tools to facilitate product development (Format readers, product generator, etc.

GSICS user services

Registration and messaging

Product catalogue

Wiki and websites

Documentation and information **on different media to assist satellite data users and GSICS member agencies in understanding GSICS activities and using GSICS services.**

GSICS best practices, standards and procedures.

These practices, standards and procedures are supporting the generation of inter-calibration products, but may also be more widely applicable. They include for instance:

- **Metadata and data formats**
- **Standard vocabulary**
- **Procedures (for product acceptance, for versioning, for archiving, for selection of a reference sensor)**
- **Best practices (for instance for pre-launch instrument characterization, or instrument performance monitoring)**

Contributions to maintaining resources shared by the calibration community

- **Selected space-based reference instruments and calibration datasets**
- **Ground-based calibration targets with their characteristics**
- **Solar spectra, lunar spectra**
- **Models and calibration datasets,**

The calibration references are either ground-based or space-based, to provide the best possible support to radiometric measurement in the various spectral domains used by the WIGOS space-based component.

Categorization of existing and potential GSICS Holdings / Commodities

- **Core products**
  - Subject to GPPA (Stamp of Approval)
- **Models and data sets**
  - These should be reviewed by GSICS prior to recommendation for use.
- **Tools**
  - These are made available because GSICS members find them useful.
- **GSICS Documents**
  - These are related to products, protocol and procedures.
- **GPRC and OSCAR Documents and Resources**
  - GSICS Disclaimer for external website content.

Core Products – Subject to GPPA

- **Products currently in the Catalog**
- **Estimates of Level 1 changes other than simple biases**
  - **Biases with diurnal, seasonal or other variations**
  - **Wavelength scale drift estimates**
  - **SRF estimates**
- **Estimates from vicarious calibration, especially for stability and transfer**
  - **DCC statistics, target reflectivities**
- **Reference instrument records over some period of time**
  - **A stand-alone ECVR – E.g., this record is found to have xx accuracy and yy precision and zz stability over 20aa to 20bb for nighttime ocean scenes**
- **Products connected with ECVRs or FCDRs**
  - **a sequence of bias adjustments**
  - **a record segment that is adjusted from beginning to end and has good error estimates included.**

GSICS Product Catalog

www.star.nesdis.noaa.gov/smcd/GCC/ProductCatalog.php

Product Type	Algorithm Type	Data Producer	Maturity Level	Monitored Instrument	Reference Instrument	Version	Data Start Date	Data End Date	Docs URL	Data URL
Near-Real Time Correction	GEO-LEO IR	EUMETSAT	Operational	MSG-3 SEVIRI	Metop-A IASI	1	2013-01-24	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	NESDIS	Preoperational	GOES-13 Imager	Metop-A IASI	1	2013-01-16	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	NESDIS	Preoperational	GOES-15 Imager	Metop-A IASI	1	2013-01-16	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	EUMETSAT	Operational	MSG-3 SEVIRI	Metop-A IASI	1	2013-01-10	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	EUMETSAT	Operational	MSG-2 SEVIRI	Metop-A IASI	1	2012-11-08	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	JMA	Demonstration	MTSAT-2	Aqua AIRS	1	2012-01-25	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	JMA	Demonstration	MTSAT-2	Aqua AIRS & Metop-A IASI	1	2012-01-25	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	JMA	Demonstration	MTSAT-2	Metop-A IASI	1	2012-01-25	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	JMA	Demonstration	MTSAT-2	Aqua AIRS	1	2011-08-31	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	NESDIS	Preoperational	GOES-15 Imager	Metop-A IASI	1	2011-08-23	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	EUMETSAT	Operational	MSG-2 SEVIRI	Metop-A IASI	1	2011-01-01	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	JMA	Demonstration	MTSAT-2	Aqua AIRS & Metop-A IASI	1	2010-08-03	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	JMA	Demonstration	MTSAT-2	Metop-A IASI	1	2010-08-03	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	NESDIS	Preoperational	GOES-13 Imager	Metop-A IASI	1	2010-04-16	Present	Docs	Data
Re-analysis Correction	LEO-LEO IR	EUMETSAT	Prototype	Metop-A HIRS	Metop-A IASI	3	2009-05-13	Present	Docs	Data
Near-Real Time Correction	LEO-LEO IR	EUMETSAT	Prototype	Metop-A HIRS	Metop-A IASI	3	2009-04-29	Present	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-19 AVHRR	MODIS	1	2009-02-10	2009-08-30	Docs	Data
Re-analysis Correction	GEO-LEO IR	EUMETSAT	Demonstration	Meteosat-7 MVIRI	Metop-A IASI	3	2008-06-01	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	EUMETSAT	Demonstration	MSG-1 SEVIRI	Metop-A IASI	3	2008-06-01	Present	Docs	Data
Near-Real Time Correction	GEO-LEO IR	EUMETSAT	Demonstration	Meteosat-7 MVIRI	Metop-A IASI	3	2008-05-15	2012-03-08	Docs	Data
Near-Real Time Correction	GEO-LEO IR	EUMETSAT	Demonstration	MSG-1 SEVIRI	Metop-A IASI	3	2008-05-15	Present	Docs	Data
Re-analysis Correction	GEO-LEO IR	NESDIS	Demonstration	GOES-12 Imager	Metop-A IASI	2	2007-07-16	2011-11-07	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	Metop-A AVHRR	MODIS	1	2007-07-07	2009-08-30	Docs	Data
Re-analysis Correction	GEO-LEO IR	NESDIS	Demonstration	GOES-11 Imager	Metop-A IASI	2	2007-06-16	2011-11-07	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-18 AVHRR	MODIS	1	2005-07-07	2009-08-30	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-17 AVHRR	MODIS	1	2002-07-07	2009-08-30	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-16 AVHRR	MODIS	1	2001-03-09	2009-08-30	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-15 AVHRR	MODIS	1	2000-07-07	2009-08-30	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-14 AVHRR	MODIS	1	1995-01-08	2002-01-31	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-12 AVHRR	MODIS	1	1991-12-06	1998-12-13	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-11 AVHRR	MODIS	1	1988-12-05	1993-12-29	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-10 AVHRR	MODIS	1	1986-12-06	1991-01-31	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-9 AVHRR	MODIS	1	1985-03-09	1988-10-29	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-8 AVHRR	MODIS	1	1983-06-07	1985-10-13	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-7 AVHRR	MODIS	1	1981-10-06	1985-01-31	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-6 AVHRR	MODIS	1	1980-01-01	1980-10-31	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	TIROS-N AVHRR	MODIS	1	1978-12-01	1980-01-31	Docs	Data

Concerns and Discussion

- The GPPA needs some modifications for new products.
- Who are the users of each product and what are their requirements?
- The GPPA demands input for the reviews from users – how do products with the developer as primary user move forward?
- How do products that have served their purpose (e.g., were used to make an ECV) identify users?
- Do the adjusted ECV record holdings fall under a climate data program's domain more naturally?

Examples for Discussion

- **Spectral Response Function (SRF) shift estimates**
- **Sequence of bias adjustments used to merge time series components for ECVs**
- **Reference Instruments (Anchors)**
  - **Transitions as instruments are retired**
  - **GEO Ring enduring reference**
- **DCC-based Bias Adjustments**

Models and Data Sets – Community Standards?

- Lunar Spectra / GIRO + GLOD
- Reference Solar Spectra
  - Or do we leave this up to CEOS IVOS or someone else?
- Key calibration data sets
  - Or should these live at GPRCs or OSCAR with links at GSICS?
- Target Reflectivity/Emissivity
  - Or are these possible new products?
- Emission Lines and Absorption Constants (e.g., NIST)
  - How do we agree on the best sources?
- Radiative Transfer Models (e.g., JCSDA CRTM)
  - Are these needed for vicarious calibration?

Concerns and Discussion

- These should be reviewed/scrutinized by GSICS RWGs and recommended for use. We should require some amount of documentation on the theory and use.
- Each one should be considered on a case by case basis as to where they live, who maintains them, what the GSICS associations are, and who will manage licensing and any restrictions on model and data use.
- Many key calibration data sets are just accepted as the agency best effort. They may also be discussed for consideration as products. That is, go through elements of the GPPA and other GSICS reviews to establish their uncertainties and error bounds.
- Are the primary users for these resources the GRWG members?
- Is external versus internal users a helpful classification criterion for what should become GSICS holdings?

Tools – GSICS Recommended?

- SNO Matchup software
- FOV alignment and Ray matching tools
- Bias Monitoring tool
- Readers for Level 1 data sets
  - Or should these live at GPRCs?
- SBAF Plotting, Plotting tools, THREDDS servers, product generation environment, wiki, Data processing tools developed within GSICS (e.g., NetCDF, HDF and other kinds of database manipulation)
- Observed versus Forecast Models

Concerns and Discussion

- Some of these may or may not be available directly from GSICS web sites.
- If the developers of tools want them to be recommended / approved for use by GSICS, will we need to review them and may require users' guides, ATDBs etc.
- Can we prescribe a minimum set of tools and documents that should be available for any instrument with measurements used in GSICS? If so, then we could provide a standard set of links to these resources as provide by each agency. Is this a new category tracking instrument maturity?

GSICS Documents

Examples of these are in the current GSICS holdings.

- **Documents associated with products (e.g., ATBDs, Reviews, Users' Guides, metadata rules)**
- **Documents associated with GSICS mission, implementation, processes and procedures**
- **Spreadsheet of Action Items and their Outcomes**
- **Quarterly newsletters**
- **Documents associated with meetings (Presentations, Minutes)**
- **GSICS Technical Notes – Approval Process? (e.g., Best Practices)**
- **Websites and WIKI**

Some of these documents have procedures for reviews, while others will need approval from the EP as they enter the system or their contents are updated.

Examples of GPRC and OSCAR Documents and Resources

- **Instrument Landing Pages**
  - Instrument validation and laboratory testing reports
  - Instrument and platform events and anomaly/status timeline compilation
  - Instrument specifications and performance (Or are these calibration data sets?)
- **Product monitoring by instrument operating agency.**
- **Agency comparison and monitoring results not submitted as products**

These live at the GPRCs or other locations, e.g., OSCAR or NOAA ICVS. They will be listed (with links) as resources at the GCC. We should interact with the instrument operator to determine what links should be provided for each instrument at GSICS and where the content should live. We should interact with the agencies and the WMO if we think there is a need for additional content.

Overarching Concerns

- What should each agency commit to provide along with an instrument's measurements? (E.g., SRFs, readers, FOVs, Pointing, two-line elements – NORAD, …)
- How do users and researchers find what they want or even know it exists?
- Where should different resources live and who maintains them?
- What happens to products after an instrument's end-of-life?

The GSICS Procedure for Product Acceptance (GPPA)

QA4EO - Guidelines

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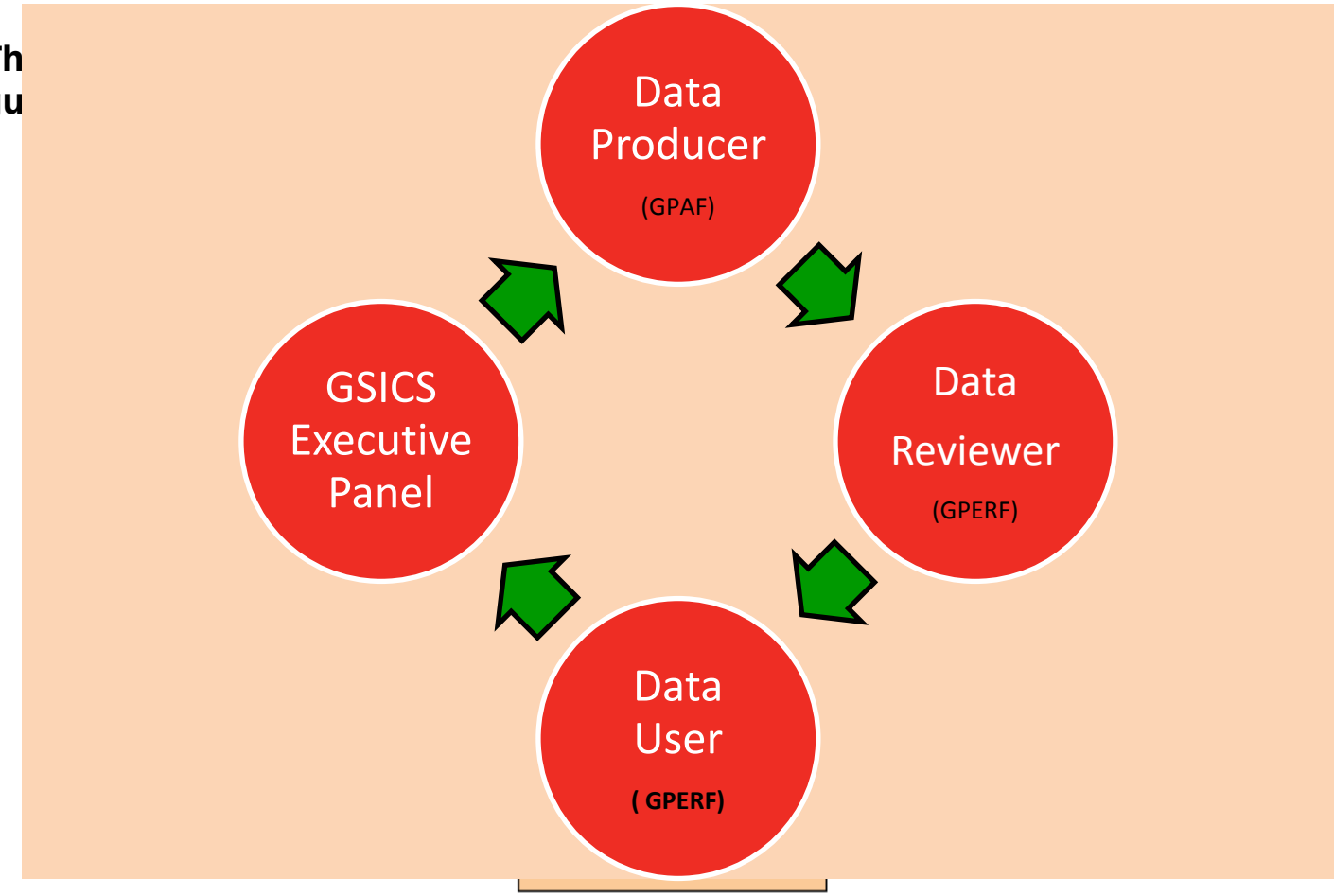


Acceptance is through meeting GSICS Goals.

Maturity is Acceptance+ satisfying user

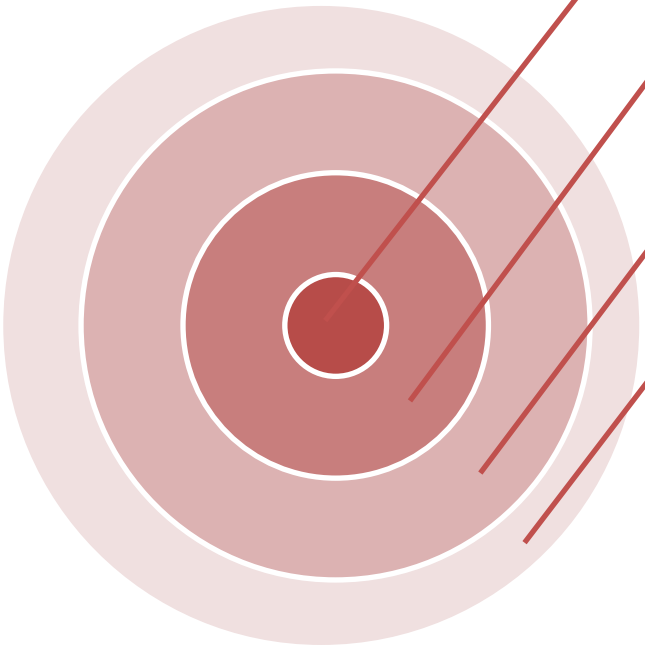
- Quality Indicators
- Traceability
- Reference (measurement)Standard
- Uncertainty

Ref: QA4EO The Guide

GSICS Global Space-based Inter-Calibration System

Action: b)

Acceptance and maturity for Proposed Classification of Entities(Talk 2.s)



Core Products: Bias products, new additions, products connected with ECV/FCDR

directly follow the GISCS Conventions.

Acceptance and Maturity of GPPA Can be applied

GSICS Resources and Documents:

GPRCs, ICVS, Corrections not following GSICS convections but meeting GSICS goals.

Acceptance and Maturity of the GPPA Can be applied Partly

Models and Data Sets:

GIRO, SBAF, Solar, Lunar, references, Intermediate Datasets used to create core products, Pre-Launch key data sets.

Accepted in the subgroup. One or all conditions to be fulfilled

Models / Data sets published and peer reviewed and internationally accepted. Have users within the group.

Tools:

SNO Matchup, Bias Monitoring, Display Tools, Readers, SBAF

Accepted in the subgroup. One or all conditions to be fulfilled

Models / Data sets published and peer reviewed and internationally accepted. Have users within the group.

GSICS Global Space-based Inter-Calibration System