

GSICS perspective

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http://gsicswiki.net/pub/Development/20160229/3e_manik_reference.pptx

Global Space-based Inter-Calibration System (GSICS) Introduction

- A WMO international organization to harmonize retrievals from operational weather and climate satellites sensors
 - Need to have all operational imagers on the same radiometric scale
 - There are still other differences, such as pixel resolution that will effect retrievals
- Use a common on-orbit calibration reference to scale or calibrate operational weather sensors
 - For example, Geostationary imagers, AVHRR, MODIS, VIIRS
- For the IR, GSICS uses the Metop-IASI hyperspectral sensor as the calibration reference
 - In order to scale the operational IR radiances with the IASI calibration reference, the IASI hyperspectral radiances are convolved with the operational spectral response function
 - Coincident, matched view angle, IASI and operational radiance pairs are regressed to obtain the scaling factors

GSICS product page for Himawari-8 IR channel calibration

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	JMA	Demonstration	Himawari-8 AHI	IASI-A	1	10/30/2017	Present	Docs □	Data □
Near-Real Time Correction	GEO-LEO IR	JMA	Demonstration	Himawari-8 AHI	IASI-B	1	10/30/2017	Present	Docs □	Data □
Near-Real Time Correction	GEO-LEO IR	JMA	Demonstration	Himawari-8 AHI	Aqua AIRS	1	10/30/2017	Present	Docs □	Data □

You can download Him-8 calibration coefficients to either the IASA-A, IASI-B, and Aqua-AIRS reference

Product Type	Algorithm Type	Data Producer	Maturity Level	Monitored Instrument	Reference Instrument	Version	Data Start Date	Data End Date	Docs URL	Data URL
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	Metop-A AVHRR	MODIS	1	7/7/2007	8/30/2009	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-10 AVHRR	MODIS	1	12/6/1986	1/31/1991	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-11 AVHRR	MODIS	1	12/5/1988	12/29/1993	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-12 AVHRR	MODIS	1	12/6/1991	12/13/1998	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-14 AVHRR	MODIS	1	1/8/1995	1/31/2002	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-15 AVHRR	MODIS	1	7/7/2000	8/30/2009	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-16 AVHRR	MODIS	1	3/9/2001	8/30/2009	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-17 AVHRR	MODIS	1	7/7/2002	8/30/2009	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-18 AVHRR	MODIS	1	7/7/2005	8/30/2009	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-19 AVHRR	MODIS	1	2/10/2009	8/30/2009	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-6 AVHRR	MODIS	1	1/1/1980	10/31/1980	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-7 AVHRR	MODIS	1	10/6/1981	1/31/1985	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-8 AVHRR	MODIS	1	6/7/1983	10/13/1985	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	NOAA-9 AVHRR	MODIS	1	3/9/1985	10/29/1988	Docs	Data
Re-analysis Correction	LEO-LEO VIS	NESDIS	Demonstration	TIROS-N AVHRR	MODIS	1	12/1/1978	1/31/1980	Docs	Data

Andy Heidinger's (NOAA ICWG member) GSICS Calibration Products spanning series of AVHRR's sensors

Connection/Interaction between GSICS and ICWG



GSICS is an international collaborative effort initiated in 2005 by [WMO](#) and the [CGMS](#) to monitor, improve and harmonize the quality of observations from operational weather and environmental satellites of the Global Observing System (GOS).

The Coordination Group
for Meteorological Satellites



International Cloud Working Group (ICWG)

The International Clouds Working Group (ICWG) was established as a formal Coordination Group for Meteorological Satellites (CGMS) working group in 2014.

Recent GSICS – ICWG Interactions

ICWG and GSICS both
have origins in CGMS

Advent of ICWG in 2014, gave GSICS community opportunity to directly connect with a group that can use GSICS inter-calibration products and algorithms and provide feedback to GSICS community on their products.

In 2018 Annual Meeting ICWG Requirements were shared with GSICS

Recommendation: ICWG acknowledges GSICS's efforts to calibrate infrared (IR) and water vapour (WV) channels, and recommends cloud product providers of to use the IR and WV recalibrations from GSICS for their quantitative retrievals from passive imagers.

Recommendation: ICWG confirms the need for accurate calibration of the visible (VIS) and near-infrared (NIR) channels of passive images (2-3%), and stresses the importance of providing these calibrations for the current and the heritage instruments (e.g. *MVIRI, SEVIRI, AVHRR, MODIS, VISSR, IMAGER, VIIRS*).

Ref: Frank Ruethrich et al 2018 GSICS Annual Meeting, Shanghai, China

http://qsics.atmos.umd.edu/pub/Development/20180319/3p_Ruethrich_FIDUCEO_Requirements.ppt

[ISCCP Action A.GCc.2017.9f.1](#)

GCC to coordinate provision of GSICS Corrected test data from the 0.6 μ m and 11 μ m channels of all available GEO imagers during Dec 2009 to Ken Knapp to assess the impact of the corrections on ISCCP products.

GSICS has recommended VIIRS as a calibration reference

- The GSICS VIS/NIR community has recommended the use of NPP-VIIRS as the calibration reference
 - Each operational imager channel is referenced to the VIIRS spectral band that most resembles the GEO spectral band
 - A spectral band adjustment factor (SBAF) is applied to remove any radiance discrepancy due to spectral band differences
 - Multiple ray-matching and invariant Earth targets are used to transfer the reference calibration. Consistency among approaches validates the methods
- Aqua-MODIS C6.1 has been used as the calibration reference since the late 2000s
 - The Aqua-MODIS is ageing and will be de-orbited in the early 2020s

Global Space-based Inter-Calibration System (GSICS) Introduction

- GSICS also wants to promote calibration best practices across agencies based on both onboard and vicarious methods
 - Incorporate these GSICS inter-calibration methods across agencies in order to have consistent calibration scaling factors that can be applied to the L1B products
- Ultimately, the GSICS VIS/NIR calibration reference will be tied to a SI traceable on orbit sensor such as CLARREO or TRUTHS
- The calibration reference can then be transferred from CLARREO to VIIRS to MODIS to AVHRR back into time
 - This should minimize the retrieval discontinuities when using a sequence of various sensors

Requirements of a reference sensor

- Data is publicly available and easily ordered and downloaded.
 - The data format is HDF or netCDF or readers are available
 - Version changes are documented and easily identified in the filename
 - Data will be available/archived (in perpetuity) after the sensor is decommissioned
- The ground characterization and on orbit calibration is well understood and the sensor is fully operational and monitored by a funded calibration team
 - Users can easily cite peer reviewed calibration references, which provide the calibration uncertainty
- Hyper-spectral sensors are preferred so the radiances can be convolved with the given spectral response function
- GSICS can provide multiple calibration references, in order to obtain consistency across sensors.

A schematic of user driven processing

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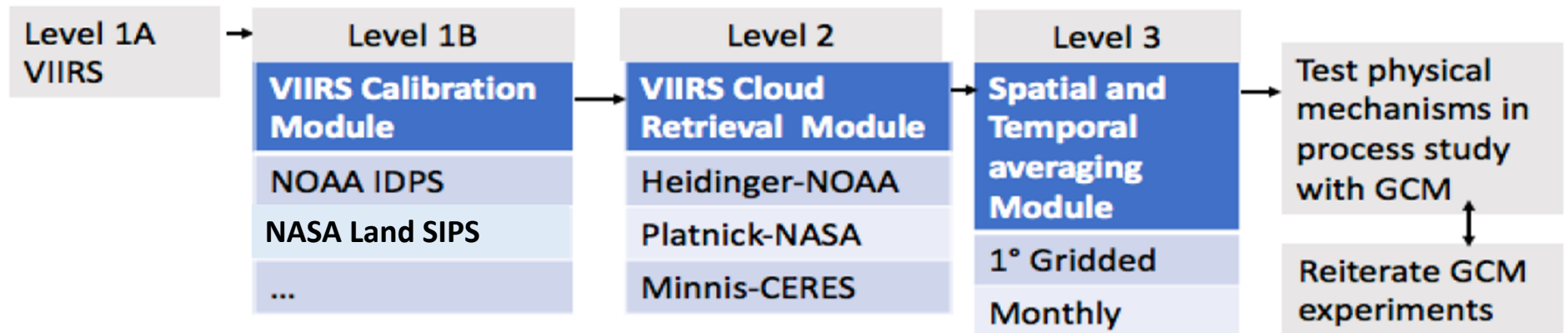


Figure 1. Example schematic of a processing flow starting from VIIRS level 1A for the purpose of yielding cloud properties applicable to a certain user's GCM studies.

The user can select the calibration module, the retrieval module and the statistical module to compare GCM output. This approach requires that all codes and input datasets are available, where the VIIRS L1A is one of the inputs.

GSICS platform to become a one stop shop for calibration information

- GSICS could tpo become the platform to provide information on the various VIIRS calibration efforts and versions as well as the location of the calibration modules and documentation and references.
 - For example scaling factors between sensors to provide consistent retrievals
- GSICS/ICWG could also offer guidance for the retrieval community or retrieval users, which calibration is best for the retrieval
 - What calibration components are similar across agencies, what components are handled differently.
 - Can the channel absolute calibration differences of the various versions and sources be highlighted in table as uncertainties?

Which NPP-VIIRS calibrated dataset?

- Many retrieval groups and agencies provide VIIRS calibrated datasets
 - NOAA IDPS
 - NASA Land SIPS
 - Ocean color and other retrieval groups have optimized the VIIRS calibration for their application
- NOAA VIIRS calibration team, which is responsible and funded to calibrate the VIIRS dataset at the NOAA CLASS archive is considered the official calibration product.
 - Currently only the nominal V0 VIIRS L1B product is available at CLASS
 - During the NOAA STAR VIIRS meeting, several options were discussed to make the V2 data available. On the fly processing from L1A, process V2 over invariant targets, provide code to convert L1A TO L1B.

Move to releasing VIIRS L1A or nominal L1B data

- The VIIRS L1B dataset are large and there will updates with the calibration due to onboard calibration anomalies. It will be difficult to archive all of these versions into perpetuity.
 - It also does not make sense to download this volume of data at the retrieval centers after each new version is released.
 - Any calibration improvements to mitigate unforeseen calibration anomalies might take years before the user community can access the data at NOAA CLASS and reduce the number of recalibration efforts.
- Is it better to archive the L1A or nominal L1B and provide calibration modules and calibration LUT that are in version control and repositories to ensure faithful processing of the L1B reflectances from L1A or nominal L1B?
 - Also multiple calibration modules can be made available, as optimized by retrieval parameter, stability, absolute calibration, inter-band consistency, etc.
 - For retrieval centers the same calibration version can be used when reprocessing, thus avoiding retrieval discontinuities when new version are introduced.

Or provide subsetted datasets

- An update to the calibration can be applied to a sub-setted dataset, that contains a very small fraction of the complete record, that can be used to help validate and assess the retrieval impact
- Guidance can be given of how to convert the nominal VIIRS complete dataset using the sub-setted dataset as input for the conversion.
- The advantage of the sub-setted dataset is that the entire record can be analyzed for both calibration and retrieval temporal stability

What would the cloud retrieval community want from GSICS?

Conclusions

- GSICS is a WMO international organization designed to harmonize retrievals from operational weather and climate satellites sensors
- GSICS uses Metop-IASI and NPP-VIIRS as the calibration references to scale other operational imagers. Tie all the reference sensors to an absolute on-orbit calibration reference
- How do we update the sensor calibration scaling factors for the user community in a timely manner and avoid storing large datasets for several calibration versions?
- Can GSICS provide a platform to provide calibration information
- What else can GSICS provide the cloud retrieval community to assist in providing harmonized retrievals across sensors.