Introducing GSICS

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Global Space-based Inter-Calibration System

- What is GSICS?
  - Global Space-based Inter-Calibration System
  - Effort to produce consistent, well-calibrated data from the international constellation of Earth Observing satellites
- What are the basic strategies of GSICS?
  - Improve on-orbit calibration by developing an integrated inter-comparison system
    - Initially for GEO-LEO Inter-satellite calibration
    - Being extended to LEO-LEO
    - Using external references as necessary
  - Best practices for prelaunch characterisation (with CEOS WGCV)
- This will allow us to:
  - Analyze root causes of biases, improve understanding of instrument absolute calibration
  - Improve consistency between instruments
  - Reduce bias in Level 1 and 2 products
  - Provide traceability of measurements
  - Retrospectively re-calibrate archive data
  - Better specify future instruments

EUMETSAT CNES JMA

NOAA CMA KMA

ISRO NASA WMO

USGS NIST JAXA

ROSHYDROMET IMD ESA

Interoperability

- Goal is to ensure consistency of measurement data sets acquired from different sources, and/or at different times

- Different issues
  - Sampling (time, space, pointing direction, orbit..)
  - Measurement specification (spectral band, energy level,..)
  - Sensor geometry
  - Spectral characteristics (SRF)
  - Radiometric calibration

Comparison of Collocated Radiances

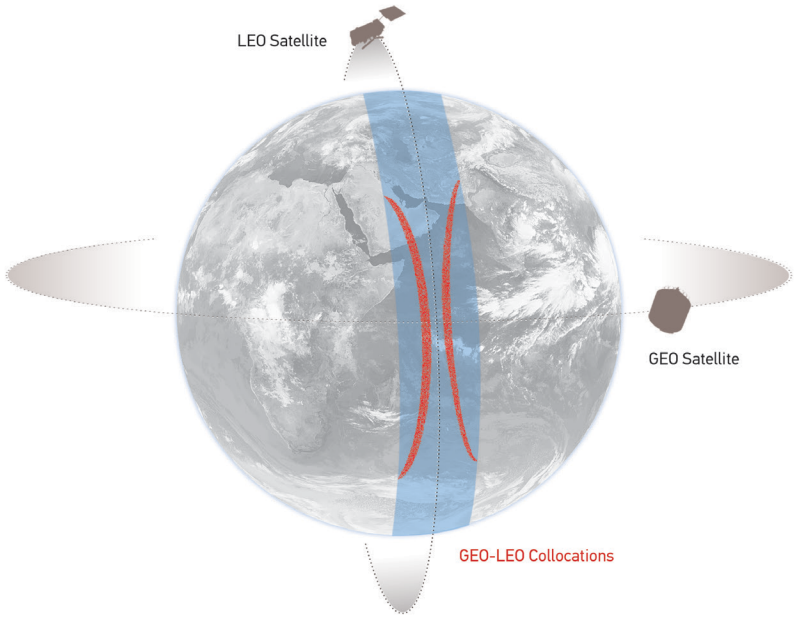
Simultaneous near-Nadir Overpass of GEO imager and LEO sounder

- Collocation Criteria:
- ΔLat<35° ΔLon<35°
- Δt < 5 mins
- $\Delta \sec\theta < 0.01$ (Atmospheric path diff.)

- Concentrated in tropics

~1000 collocations/orbit

~1 orbit/night



Schematic illustration of the geostationary orbit (GEO) and polar low Earth orbit (LEO) satellites and distribution of their collocated observations.

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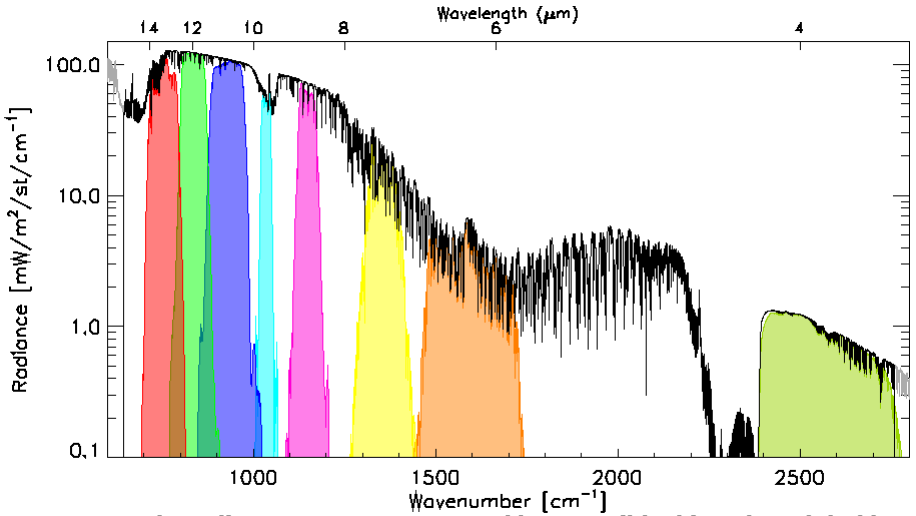
Data Transformations
(Spectral and Spatial)

•Spectral Convolution:

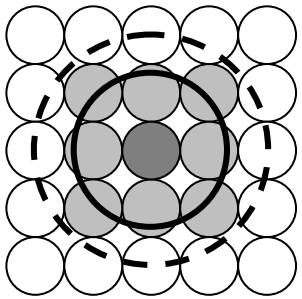
- Convolve LEO Radiance Spectra with GEO Spectral Response Functions
- to synthesise radiance in GEO channels



Example radiance spectra measured by IASI (black) and modeled by LBLRTM (grey), convolved with the Spectral Response Functions of SEVIRI channels 3-11 from right to left (colored shaded areas).
n.b. The IASI observations (645 – 2760 cm^{-1}) do not quite cover the full spectrum observed by SEVIRI.

•Spatial Averaging:

- Average GEO pixels in each LEO FoV
- Estimate uncertainty
  - –due to spatial variability
  - –as Standard Deviation of GEO pixels
- Use in weighted regression



LEO FoV~10km

~ 3x3 GEO pixels

Illustration of spatial transformation. Small circles represent the GEO FoVs and the two large circles represent the LEO FoV for the extreme cases of FY2-IASI, where *n*x*m*=3x3 and SEVIRI-IASI, where *n*x*m*=5x5.

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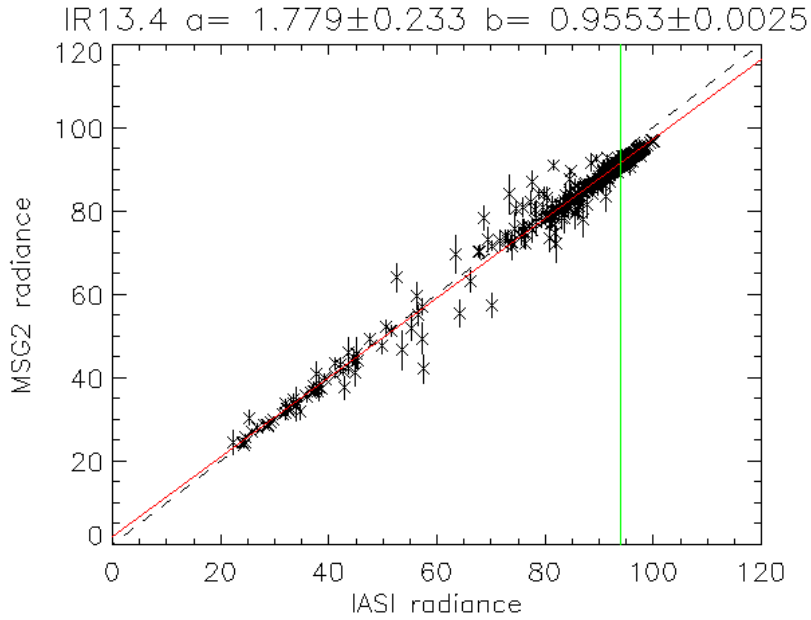
Comparison by Regression

- Compare collocated obs:
- GEO radiance
  - Spatially averaged
- Regressed against
- LEO radiance spectra,
  - convolved with GEO SRF
- Using Variance of GEO radiances + Noise
  - to estimate uncertainty on each collocation



Weighted linear regression of
$L_{GEO|REF}$ and $\langle L_{GEO} \rangle$
for Meteosat-9 13.4µm channel
based on single overpass of IASI

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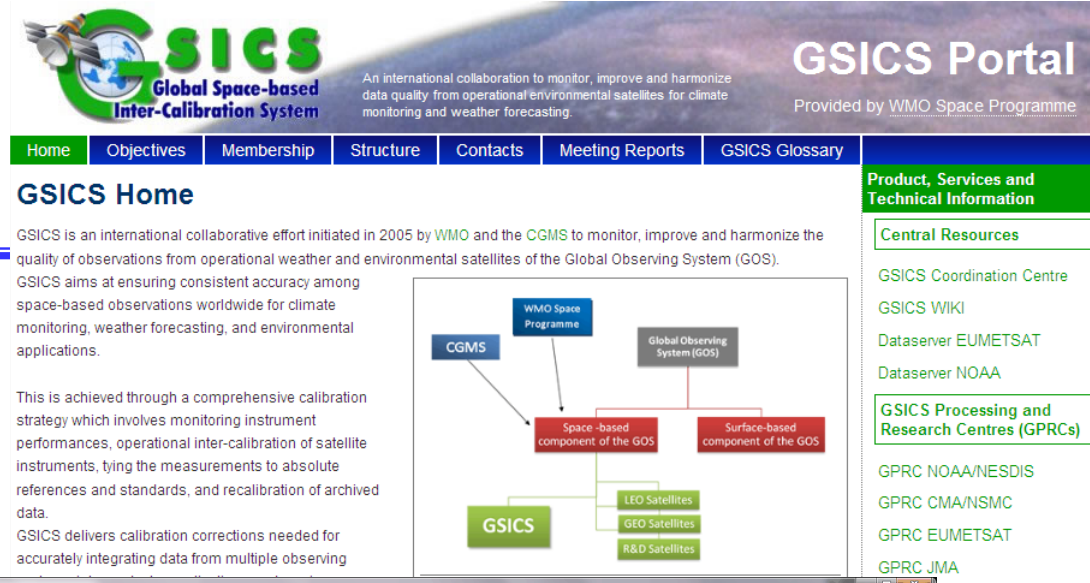
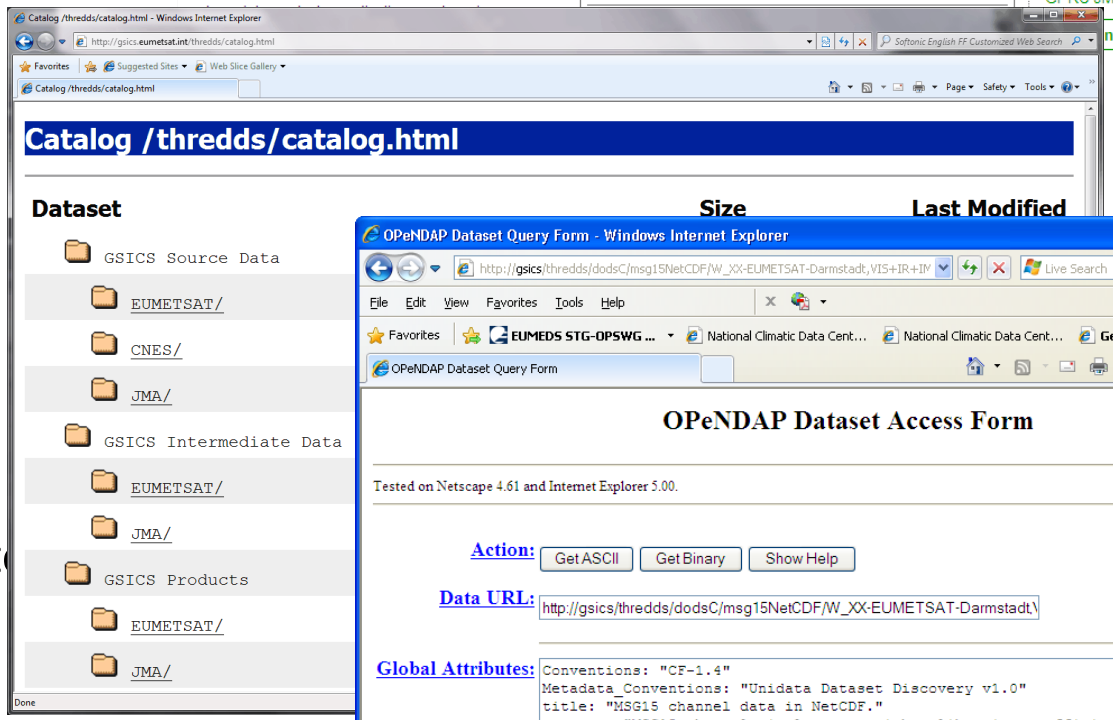
Where to get the data?

- GSICS Bias Monitoring (prototype)
  - Hosted on websites of GSICS Processing & Research Centres (GPRCs)
- GSICS Corrections
  - GSICS Data & Products Servers
  - THREDDS-based system
  - NetCDF format
  - WMO GTS standard file names
  - Unidata & CF conventions
- See gsics.wmo.int for links
- Recommendations for:
  - Instrument performance monit
  - Event log

GTS = Global Telecommunication System
CF = Climate and Forecast





First GSICS Guideline document

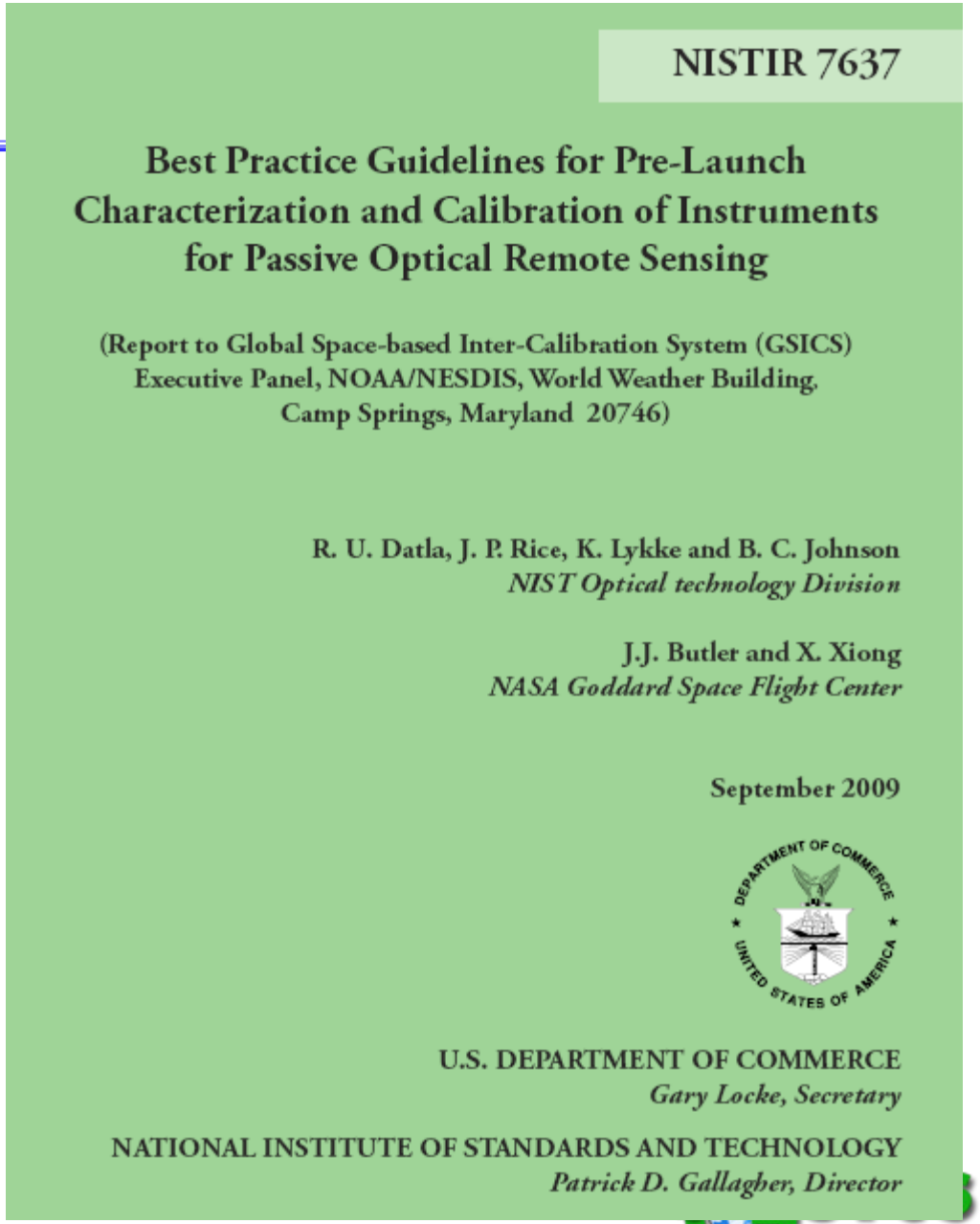
Best Practice Guidelines for Pre-Launch Characterization and Calibration of Instruments for Passive Optical Remote Sensing

Report to GSICS Executive Panel

R.U. Datla, J.P. Rice, K. Lykke and B.C. Johnson (NIST)

J.J. Butler and X. Xiong (NASA)

September 2009



Special Issue on Satellite Inter-Calibration

- IEEE Transactions on Geoscience and Remote Sensing
- On inter-calibration of satellite instruments
- 5 Guest GSICS/IVOS Editors
- 40 papers – incl. 13 Open Access
  - From CAS, CMA, CNES, ESA, EUMETSAT, ISRO, JAXA, KMA, JMA, MIT, NASA, NOAA, SDSU, USGS, etc.
  - Covering AVHRR, AMSU, (A)ATSR, CLARREO, ETM+, FY-2 & -3B, GOES, HIRS, Hyperion, IASI, Jason-2/OSTM, MODIS, PROBA, SCAIMACHY, Sentinel-2, etc.
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