Global Space-based Inter-Calibration System Research Methods and Resources

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Introduction
This poster presents an overview of GSICS research and development activities. It introduces some of the calibration comparisons methods, data sets and tools with examples of their use for creating GSICS products. The methods include Simultaneous Nadir Overpass (SN0) for LEO to LEO comparisons, eeg matches underpass for LEO to GEO comparisons, and orbital tracking for GEO to GEO comparisons. The last website has links to all of the talks presented at the recent annual research meeting held in Shanghai China from March 19th to March 22nd 2018.

Match-Up Comparisons
A variety of methods are used to obtain match-ups between measurements from instruments on different satellites. Approaches include: (1) LEO vs LEO Simultaneous Nadir Overpass (and its non-simultaneous No-Local-Time-Difference zonal means)

The figure above shows that the Metop-A and S-NPP pass over 72° N at the same time of day. Given the relative precession of their orbital tracks, they will be only ever close, to the same location at close to the same time on occasion. Those are called Simultaneous Nadir Overpass (SN0) events. One can also produce daily zonal means in a band about this latitude. Comparisons of these zonal means should not be affected by diurnal variations.

(2) LEO underflights of GEO and L-1 instruments – Coincident Line-of-Sight Observations.

They can be used as Pseudo Invariant Targets to transfer calibration from MODIS to GEO imagers. Here is a brief description of the process to use them as calibration transfer targets:
- Select the coldest, brightest pixels,
- Identify them by using a Threshold,
- Limit viewing and solar angles,
- Build up monthly PDF statistics, and
- Compare time series of modes and means with those from reference observations.

Gains for Meteosat-7/11 VIS using Aqua/MODIS Reference via DCs

<table>
<thead>
<tr>
<th>Time, Year</th>
<th>Gain, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3.3</td>
</tr>
<tr>
<td>2011</td>
<td>2.9</td>
</tr>
<tr>
<td>2012</td>
<td>2.6</td>
</tr>
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<td>2013</td>
<td>2.3</td>
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<tr>
<td>2014</td>
<td>2.0</td>
</tr>
<tr>
<td>2015</td>
<td>1.7</td>
</tr>
</tbody>
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Microwave – Challenges, Methods, Progress
GSICS comparisons for Microwave instruments are complicated by a lack of a "true" reference for MW. NIST is developing on-ground reference use with JPL/NASA instruments. The diversity of sensor channel (e.g., Window, O, and H$_2$O channels) and sensor types (e.g., conical, imagers, cross-track) makes on-ground comparisons more difficult. Progress is being made with the following approaches:
- (1) SN0 - used by many ground radars and solar calibration M. Burgard, U. Hamburg, GSFC Microwave Imager (W. Berg, Colu. State Univ/NASA-W-Cal team), (4) GREAS observations with RCM (T. Reke, NOAA), J. Barret, UKHSO, and MW FCDR (K. Fowart, EUMETSAT, C.-Z. Zou, NOAA). The Moon as a MW Reference

The Moon is an excellent target for in-flight comparisons. It is a dark, natural, extremely stable solar diffuser with no atmosphere, and it is globally available for viewing at all reflected solar channels. Eumetsat has implemented a model (HRO-GLOD) to estimate the expect lunar spectra for different phases by using USGS ROLO measurements. https://www.eumetsat.int/website/home/News/DAT_3460357.html

GSICS Products and Resources
The GSICS Inter-calibration products along with ATBDs and other documents on their creation and performance are available from links at: https://www.star.nesdis.noaa.gov/smcd/GCC/index.php

You can sign up for meeting notifications and to receive the quarterly newsletters with a link at the GSICS Coordination Center homepage: https://www.star.nesdis.noaa.gov/smcd/GCC/index.php

You can view one of the GSICS pages, for example, http://dx.d ata.jma.go.jp/twsp/data/datasource/calibration.html

References