**Introduction**

To better accommodate climate change monitoring and improved weather forecasting, there is an established need for higher accuracy and more refined error characterization of radiance measurements from space and the corresponding geophysical products. This need has led to emphasizing improvements of on-orbit performance, referred to as on-orbit validation.

Currently, validation typically involves (1) collecting high-quality reference data from airborne and/or ground-based instruments during the validation period, and (2) calculating/estimating the calibration uncertainty between the satellite-based radiance measurements and the corresponding high-quality reference data.

Additionally, for future missions technology advancements at University of Wisconsin Space Science and Engineering Center (UW-SSEC) have led to the development of an on-orbit active radiometric reference utilizing miniature phase change cells to provide direct on-orbit traceability to International Standards ([1], [2]).

The first Suomi NPP airborne active calibration validation campaign was conducted May 2013 with a primary objective of demonstrating detailed validation of CrIS radiance observations. During this calibration validation campaign, the NASA ER-2 aircraft instrument payload included the SUHIS [3], the INDOEX Atmospheric Sounder Testbed-Interferometer (IST), and the NASA-JPL, Airborne Visible/Infrared Imaging Spectrometer (AVIRIS).

Detailed results for the validation of the CrIS radiance observations with the S-HIS sensor are presented below.

- **Efficient radiance validation conditions** (high scene uniformity, good spatial and temporal colocation) for 2013-05-15, 2013-05-30, and 2013-06-01
- **High scene uniformity** as observed by the AVIRIS

For method details, refer to [3, 4], and references therein.

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**Calibration Verification Results**

- Excellent radiance validation conditions (high scene uniformity, good spatial and temporal co-location) for 2013-05-15, 2013-06-01.
- Brightness Temperature maps presented below overview CrIS and S-HIS field of view footprints as circular (rather than elliptical).

**Double Obs - Calc Comparison Methodology**

1. Spatial colocation is achieved by selecting scenes with low variability and covering the selected CrIS FOVs with S-HIS observations.
2. Compare results from calculations:
   - S-HIS and CrIS calculations are each completed at correct altitudes, view angles, and atmospheric conditions.
   - Calculations are completed using same forward model, atmospheric state, and instrument parameters.
3. Compare residuals with Spectral Resolutions made similar.
   - The 4x4 double-obs method accounts for altitude and view angle differences and differences in instrument line shapes.

**Double Obs - Calc Comparison with Radiometric Uncertainty (RU) Estimates**

<table>
<thead>
<tr>
<th>Date</th>
<th>BT Diff (K)</th>
<th>RU Estimates</th>
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<tbody>
<tr>
<td>2013-05-15</td>
<td>-0.4</td>
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<tr>
<td>2013-05-30</td>
<td>-0.4</td>
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**For reference, the AVIRIS instrument payload included the Single-Channel Infrared Interference Spectrometer (S-CO), the NASA-JPL, Airborne Visible/Infrared Imaging Spectrometer (AVIRIS), and the NASA-JPL, Airborne Visible/Infrared Imaging Spectrometer (AVIRIS).**

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**CrIS**

- Developed 1996 - 1998 at the MSISE of the University of Wisconsin at Madison. In 1999, the instrument was delivered to NASA's Goddard Space Flight Center (GSFC).
- Infrared Fourier transform spectrometer with 186 spectral channels; produces high-resolution, three-dimensional temperature, pressure, and wind profiles; provides accuracy and consistency error characterization information about Earth's atmosphere and improve weather forecasts and monitoring of climate change.

**Overview:**

- CrIS Brightness Temperature Spectra and RU
- Single CrIS Scan Line (full sweep, 30 FORs)
- Single CrIS Scan Line (full sweep, 30 FORs)

**S-HIS**

- Single Channel Infrared Interference Spectrometer (S-CO)
- Designed to give scientists more accurate and refined moisture profiles. Designed to give scientists more accurate and refined moisture profiles.

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