Discussion to promote GSICS DCC VIS calibration to GSICS product

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DCC agency paper for visible channels

- I have the introduction and methodology written
- Need to discuss the uncertainty section
- Discuss Raj's and Sebs' ATBD
- Discuss the netCDF format and parameters

DCC Calibration Uncertainty Analysis

- **The Reference sensor absolute calibration uncertainty**
- Aqua-MODIS RSB uncertainty ~2% (solar diffuser BRDF)
- N20-VIIRS RSB uncertainty ~2%
  - Both NOAA and NASA operational calibration groups, which independently monitor the stability of N20-VIIRS, show a consistent RSB calibration within 0.2%
- Note that the Aqua-MODIS/N20-VIIRS RSB calibration difference ~4%
  - There are no operational RSB imagers that have an absolute calibration uncertainty less than 2%
- Need to wait until CLARREO launches to obtain an absolute calibration reference in space within ~0.3%
  - CLARREO launch now postponed until 2025
  - Once CLARREO has established the absolute calibration reference, the use of overlapping N20-VIIRS and Aqua-MODIS records will transfer the calibration back in time
- Reference Sensor stability
  - The DCC reference sensor reflectance (VIIRS) over the target (GEO) sensor is taken over the first 5-years of operation
  - Reference sensor stability uncertainty is reduced by, longer operational records, reprocessing after onboard calibration anomalies, and more onboard calibration monitoring (solar diffuser, moon, Earth invariant targets)
  - N20 VIIRS is ~0.2%/year

DCC Calibration Uncertainty Analysis

- **Evaluation of the reference to target sensor calibration transfer**
- Reference domain DCC natural variability
  - The monthly DCC reflectance standard deviation (From Raj's reference DCC reflectance table
  - How to take into account stratospheric aerosol (volcanic eruptions), make sure the reference and target sensor are based on the same time period, this would impact all Earth invariant target approaches
- Target domain DCC natural variability
  - Utilize deseasonalization if the variability is repeatable over the year
  - This is the monthly DCC mode reflectance standard deviation after known trends have been removed
- DCC spectral band adjustment factor (SBAF) to convert the reference DCC reflectance to match the target reflectance
  - From the NASA-Langley SBAF tool, is the standard error about slope
- MODIS and VIIRS are reflectance based absolute calibration, to convert the reference sensor reflectance to radiance use HSRS solar spectra

DCC Calibration Uncertainty Analysis

- **DCC methodology uncertainty**
- DCC PDF mode interval (reflectance interval divided by the mean DCC mode reflectance)
- Reference and Target sensor DCC IR window channel BT consistency used in identifying the pixel level DCC
  - The regression standard error of the target and reference sensor ray-matched BTs
  - Takes into account the IR spectral spectral BT differences and any onboard IR calibration inadequacies at low radiances, Assumes BT is stable
  - DCC mode reflectance dependent on the BT threshold
- DCC BRDF
  - For visible wavelengths, Hu model
  - For SWIR bands, Hu model inadequate, wavelength dependent seasonal BRDFs need to be developed
- Pixel resolution, homogeneity VIS and IR spatial extent resolution
  - Has not been well studied

DCC Calibration Uncertainty Analysis

- The uncertainty analysis is defined for the mean imager conditions over the DCC PDF time interval
  - All known onboard calibration artifacts should be mitigated before applying DCC calibration
  - The DCC calibration methodology cannot resolve short term temporal noise less than the DCC PDF interval
  - However, if the DCC method is applied to individual detectors, mirror sides, etc., it can be used to improve the onboard calibration.
- DCC calibration is valid for the high end of the dynamic range
  - Assumes that the sensor has a linear response

GSICS netCDF and plotting tool discussion

Current VIS/NIR activities (outside of lunar)

- Promote the DCC visible calibration to product status

- Develop the DCC SWIR calibration methodology

- Would like to have the GSICS agency report visible analysis to be given at future web meetings

VIS/NIR new calibration approaches

- GISCS VIS/NIR calibration strategy,
  - Use multiple calibration approaches to evaluate consistency and designed for specific retrievals
  - Use SBAFs to transfer the reference sensor calibration to the target sensor
- Current VIS/NIR approaches
  - Lunar
  - DCC
- Other VIS/NIR approaches
  - Rayleigh scattering (with UV group)
  - Ray-matching with VIIRS
  - RTM inter-calibration, such MODIS cloud properties to infer target references
  - Deserts/PICS, Desert, Dome-C
- Combining calibration methods
  - Lunar and DCC blended product