This poster describes a plan for validating the CrIS spectral radiances using Earth scenes. The Cross-Track Infrared Sounder (CrIS) will fly on the National Polar-Orbiting Operational Environmental Satellite System Preparatory Project (NPP). The CrIS is a Michelson interferometer measuring the spectral range from 650 to 2550 cm⁻¹. The CrIS spectral calibration relies on an on-board laser metrology system whose stability is monitored using a reference neon wavelength. The instrument line shape parameters for CrIS were determined pre-launch and are not expected to vary significantly post-launch. However, initially on-orbit it may be necessary to adjust for shifts in the reference neon wavelength and the center FOV alignment to the interferometer boresight. Periodic checks of spectral stability will be performed using Earth scene atmospheric reference lines in the longwave region of the CrIS spectrum. The objective is to validate to much better than 10 ppm uncertainty (2 ppm desired) the channel centers of the CrIS calibrated radiances, and update the FOV position information used by the SDR algorithm for the spectral correction. The development of the Earth scene spectral calibration will use the EUMETSAT MetOp-A Infrared Atmospheric Sounding Interferometer (IASI) clear sky spectral radiances as proxy for CrIS.

**CrIS Sensor Overview:**
CrIS provides cross-track measurements of top-of-atmosphere (TOA) radiances to permit the calculation of vertical profiles of temperature and humidity in the Earth’s atmosphere. Three bands in the CrIS spectral range each have different spectral resolutions: long-, mid-, and short-wave (denoted as LWIR, MWIR, and SWIR, respectively).

**Laser Metrology Spectral Calibration System:**
The wavelength measurement system provides a laser wavelength measurement based on the comparison of the wavelength of the metrology laser and a filtered neon lamp. The filtered neon lamp is injected in the interferometer with the same optical path as the metrology laser. Metrology detectors convert the optical signal to an electrical signal. This occurs nominally once per orbit, to determine precise metrology laser wavelength based on neon reference wavelength (at ~703.45 cm⁻¹).

**Criteria for Spectral Calibration Using Earth Scenes:**
Use LWR spectral regions with well separated line features, relatively free of continuum effects
- Use multiple line features in emission and absorption spectral regions:
  - CO₂ Emission Region (671 cm⁻¹ to 690 cm⁻¹)
  - CO₂ Absorption Region 722 cm⁻¹ to 759 cm⁻¹
  - Single Water Vapor Line at 784.3 cm⁻¹
- Achieve needed S/N Ratio of ~900 via multi-scene processing (15-20 CrIS scans, focusing on nadir Earth scenes) (S/N equivalent to amount of interpolation needed between adjacent channel centers to resolve 1 ppm)
- Adjust MWIR and SWIR by equivalent values determined from LWR spectra

**On-orbit ILS Tuning Process:**
- Observed Earth spectrum is compared to a “Truth” spectrum
  - EDR algorithm provides Truth spectrum on user grid via temperature, moisture and pressure profile retrieval combined with on-orbit TVAC parameters
  - FOV 5 (center FOV in FPR) offset correction in urad is determined as well as spectral wavelength deviation based on ppm error from FOV
- Initial on-orbit tuning of ILS parameters will be performed but adjustments are expected to be small:
  - Effective neon wavelength adjustment < ±2 ppm
  - Spectral errors corrected by 30 day Engineering Packet Updates
- No adjustment of band to band relative neon wavelength is planned
- Any ppm adjustment determined for LWIR will be applied to MWIR and SWIR bands, while retaining the relative neon offsets determined from ground testing
- Subsequent checks are planned every 30 days primarily for validation purposes

**Earth Scene Selection Criteria:**
- Ocean only scenes in bulk latitudes (+/-45° of Equator)
- Low thermal contrast for 9 FOVs in a FOR (possibly use IR clear scene classification in EDR algorithm)
- Compare EDR derived SST and/or atmospheric-corrected window radiances which closely match NWP SST (within 3°C)

**Summary:**
A plan for developing spectral validation of CrIS radiances using Earth scenes is being implemented.

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