Landsat 8 OLI & TIRS On-Orbit Radiometric Performance

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Figure 1a: OLI Coastal Aerosol (CA) Band Signal-to-Noise Ratio at "typical" radiance

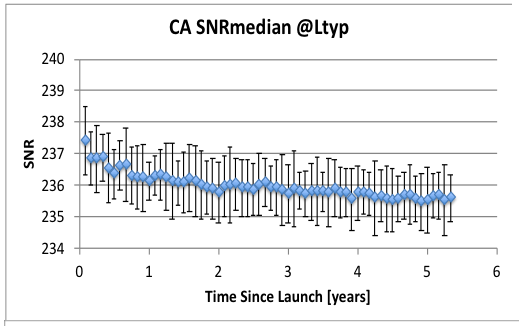


Figure 1b: OLI Coastal Aerosol (CA) Band Radiometric Stability

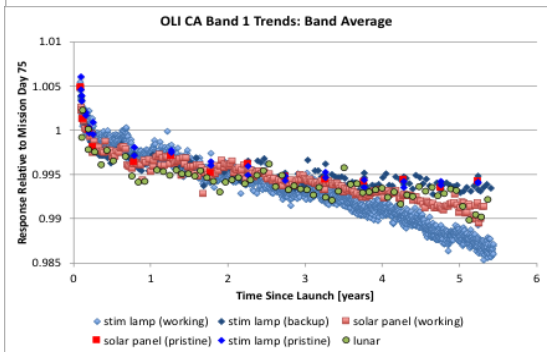


Figure 2a: TIRS Noise Equivalent Temperatures at 300K

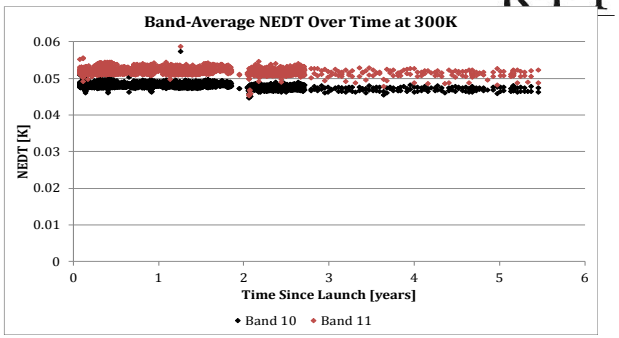
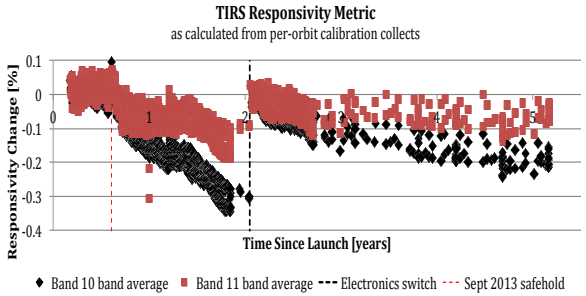


Figure 2b: TIRS Radiometric Stability



1. The Landsat-8 Operational Land Imager (OLI) continues its record of remarkable radiometric stability over 5+ years. The CA band change is the largest at ~1.3% over this period. All radiometric calibration techniques give consistent results within ~0.5%. Some degradation is apparent in working stim lamp output.
2. The Landsat-8 Thermal Infrared Sensor (TIRS) is similarly extremely stable over the mission, changing in response to the on-board blackbody by <0.5%. The stability has allowed maintenance of the instrument calibration in spite of the need to reduce calibration data acquisition frequency due to scene select mirror encoder anomalies.

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References:

2018 Markham, B., Barsi, J., Montanaro, M., McCorkel, J., Gerace, A., Pedelty, J., Hook, S., Raqueno, N., Anderson, C. and Haque, Md Obaidul, Landsat-8 On-orbit and Landsat-9 Pre-launch Sensor Radiometric Characterization, *Proc. SPIE Asia Pacific Remote Sensing Conference, September 24-26, 2018, Honolulu, HI, 14 pp.*

Technical Description of Images:

Figure 1. The Landsat-8 OLI radiometric trends: (a) The signal-to-noise ratio of the Coastal Aerosol band at “typical” radiance levels over the mission life measured using the on-board calibration systems. (b) the radiometric responsivity normalized to an early mission date. The coastal aerosol shows the largest changes of all the OLI bands, but are still less than 1.5% in responsivity and 1% in signal-to-noise.

Figure 2. The Landsat-8 TIRS radiometric trends: (a) The noise-equivalent delta temperature of both bands at 300K over the mission life measured using the on-board calibration systems. (b) the radiometric responsivity normalized to an early mission date. On the primary electronics side (first 2 mission years) the response to the blackbody decreased 0.2% to 0.3%. On the secondary electronics side (after first 2 years), the response decreased 0.1% to 0.2%. Some portion of the change may relate to the blackbody as opposed to the instrument itself. About mission year 3, the operations concept was changed, with calibrations roughly twice a month versus twice an orbit. Noise performance has been stable.

Scientific significance, societal relevance and relationship to Decadal Survey:

Inherent radiometric stability of remote sensing instruments as demonstrated by both the Landsat-8 OLI and TIRS, provides a strong basis for generating high quality consistent data products as are needed for detecting Earth surface changes over extended periods of time. This, combined with consistency between missions, which although not discussed here, has been part of the Landsat program for many years, provides Earth sciences the long term datasets they need.