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Editorial

Landsat-8 Sensor Characterization and Calibration

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Landsat-8 was launched on 11 February 2013 with two new Earth Imaging sensors to provide a continued data record with the previous Landsats. For Landsat-8, pushbroom technology was adopted, and the reflective bands and thermal bands were split into two instruments. The Operational Land Imager (OLI) is the reflective band sensor and the Thermal Infrared Sensor (TIRS), the thermal. In addition to these fundamental changes, bands were added, spectral bandpasses were refined, dynamic range and data quantization were improved, and numerous other enhancements were implemented. As in previous Landsat missions, the National Aeronautics and Space Administration (NASA) and United States Geological Survey (USGS) cooperated in the development, launch and operation of the Landsat-8 mission. One key aspect of this cooperation was in the characterization and calibration of the instruments and their data. This Special Issue documents the efforts of the joint USGS and NASA calibration team and affiliates to characterize the new sensors and their data for the benefit of the scientific and application users of the Landsat archive. A key scientific use of Landsat data is to assess changes in the land-use and land cover of the Earth's surface over the now 43-year record. In order to perform these analyses and avoid confusing sensor changes with Earth surface changes, a solid understanding of the sensors' performance, consistent geolocation and radiometry are essential. Particularly with the significant changes in the Landsat-8 sensors relative to previous Landsat missions, this characterization becomes all the more important.

The content of the special issue is approximately evenly split between the two sensors and similar material is covered for each sensor, though not necessarily parsed the same way into papers. The instruments' design and pre-launch characterization are covered in one paper for each instrument (Knight and Kvaran [1] for OLI; Reuter *et al.* [2], for TIRS). Additional details on the TIRS pre-launch radiometric characterization are included in Montanaro *et al.* [3] for TIRS, including the spectral response characterization. For OLI the spectral response characterization is separately discussed in a dedicated paper (Barsi *et al.* [4]). Spatial characterization is included in the OLI design paper, but broken out separately for TIRS in Wenny *et al.* [5], and this paper includes on-orbit results as well. A particular aspect of the spatial performance of the TIRS instrument that has been the focus of much attention, stray light, is discussed in detail in Montanaro *et al.* [6].

Geometric characterization of the instrument and data both prior to launch and on-orbit are covered in Storey *et al.* [7] for OLI and Storey *et al.* [8] for TIRS. Radiometric performance of the two sensors is covered in a number of papers. Details of the on-orbit performance in terms of noise, detector operability, linearity, dynamic range and similar topics is covered in Morfitt *et al.* [9] for OLI and Montanaro *et al.* [10] for TIRS. Absolute calibration and stability using the on-board calibration devices is covered in the same paper [10] for TIRS, but in detail in a separate paper for OLI (Markham *et al.*, [11]). Analysis of an alternate way to perform detector-to-detector relative radiometric calibration to reduce striping and banding artifacts in imagery is discussed in two papers: Pesta *et al.* [12] which specifically examines OLI and Gerace *et al.* [13], which examines strategies from a more theoretical standpoint using simulations. Validation of the OLI and TIRS radiometric calibrations by using surface measurements, also known as vicarious calibration and by comparison to other instruments, e.g., the Landsat-7 ETM+ is covered in five papers. Czapla-Myers *et al.* [14] reports on the vicarious calibration of OLI and Mishra *et al.*, [15] and Flood [16] examine OLI's cross calibration with Landsat-7 ETM+. Barsi *et al.* [17] and Cook *et al.* [18] focus on the vicarious calibration of the TIRS instrument.

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Author Contributions

All authors contributed equally to this work.

Conflicts of Interest

The authors declare no conflict of interest.

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