Applications of Landsat 8 to Ice Sheets

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Landsat 8 (formerly the Landsat Data Continuity Mission, LDCM) is the newest satellite in the Landsat series. It was launched on 11 February 2013, with operational imagery available starting on 12 April 2013. Onboard are two instruments – the Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS).

OLI bands have a nominal spatial resolution of 30 m, plus a visible-only panchromatic band (500-680 nm vs. ETM+'s 520-900 nm) with 15 m resolution. An improvement over Landsat 7's ETM+, OLI has two additional bands in the "coastal/aerosol" (427-459 nm) and "cirrus" (1341-1410 nm) ranges. Imaging deep blues, the coastal/aerosol band will be of interest for a range of applications, including (potentially) estimating the depth of supraglacial lakes. The cirrus band will improve the cloud-detection capabilities of OLI, a task which is often tricky over bright, cold glaciated areas. In addition, OLI mission requirements specify a higher signal-to-noise ratio than the ETM+ and data from all bands are quantized to 12 bits (as opposed ETM+'s 8-bit data). This enhanced radiometric resolution improves OLI's ability to image low contrast surfaces (such as ice sheet topographic variations) as well as simultaneously image scenes with both dark and light areas of interest (e.g. coastal areas) without sacrificing either area.

TIRS has two thermal infrared bands (10.6-11.2 and 11.5-12.5 μm) at a nominal spatial resolution of 100 m. While previous Landsat sensors featured only one thermal band (e.g. ETM+: 10-12.5 μm), TIRS' two thermal bands will allow for potential application of a split-window technique for more accurate measurement of surface temperature. However, in dry areas such as the Antarctic, a second band may be more appropriately used to simply validate temperature retrievals. TIRS data may be interesting for applications to ice sheet-marginal sea ice dynamics, supraglacial lake evolution, and polar night ice sheet monitoring, for example tracking the behavior of the large iceberg (B-31) recently calved from Pine Island Glacier.

This poster will present case studies which showcase the abilities and cryospheric applications of Landsat 8 data. We will also present the Landsat 8 acquisition plan for the Greenland Ice Sheet and gather suggestions and feedback for an Antarctic acquisition plan.