Vast-area mapping of ice drift using Landsat 8OLI sensor

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Abstract

We report on the evolution of optical satellite-image-based ice velocity mapping over thelarge glaciered areas and ice sheets, enabled by the internal geometric accuracy and high radiometric resolution of Landsat 8's Operational Land Imager (OLI) sensor. Exhaustive large-area single-season mosaics and time-series maps as well as the monitoring of ice drift were created using data spanning 2013 to 2015. The 12-bit radiometric quantization and 30m pixel scale resolution of OLI band 8 enable displacement tracking of subtle snow-drift patterns on ice sheet surfaces. Ice sheet and snowfield snow-drift structures and geographies persist for typically 16 to 64 days, depending primarily on snow accumulation rates. This results in spatially incessant mapping and monitoring of ice flow, encompassing the mapping proficiency beyond crevassed regions. Our method uses image chip cross-correlation and sub-pixel peak-fitting in matching Landsat path/row pairs. High-pass filtering is applied to the imagery to augment local superficial texture. The contemporary high image achieving rates of Landsat 8 (725 scenes per day globally) lessens the influence of high cloudiness in mountain terrain and polar regionsand permits rapid gathering of large areas, or dense temporal coverage of seasonal snow flow variations. The results rival the accurateness and coverage of interferometric Synthetic Aperture Radar (InSAR) mapping.

Keyword; Landsat 8 OLI Sensor, Ice Drift, Antarctica, Remote sensing technique and Filtering.