ABSTRACT

TITLE:	Estimation of South Cascade Glacier Summer Mass Balance Derived from High-Resolution Satellite Imagery in 2004 and 2008, Washington
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PRESENTED AT:	2016 Undergraduate Research and Creative Activities Symposium, Fort Lewis College

ABSTRACT: A technique to estimate the South Cascade Glacier summer mass balance derived from remote sensing and GIS is evaluated by comparison to a traditional field-calculated mass balance measurement. The process of transforming surficial snow into glacial ice occurs at various rates throughout the glacier surface, creating zones of accumulation (firn) and ablation (ice), visibly appearing on the glacier as the firn line. Glacial firn and ice have a unique spectral signature that can be discriminated from IKONOS and WorldView-1 satellite imagery and used to estimate an accumulation area ratio (AAR). This technique was evaluated using an established relationship between the South Cascade Glacier AAR in 2004 and a known field-calculated mass balance of the same year. The mass balance in a subsequent year (2008) was then estimated from the satellite image. Results for the summer mass balance in 2008 estimated from satellite imagery were -3.81 mWE; results from field-calculated measurement were -3.51 mWE. The resulting error of 8.66% was predominantly due to shadows cast on to the glacier surface from adjacent outcrops and rocks on the surface of the glacier. This method produced a measurement that estimates mass balance using a ratio between pixels of glacial firn and ice more efficient relative to field-calculated data. In order for the proposed technique to be effective, high temporal and spatial resolution satellite images are needed to supplement preliminary data. The proposed technique will minimize the need for volume, density, and stream discharge field measurements and provide a more efficient technique to estimate changing glacier dynamics.