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Assessing surface properties of the Greenland ice sheet from multi-sensor optical remote sensing

Stef Lhermitte and Nicole Van Lipzig
KULeuven, Department of Earth & Environmental Sciences, Heverlee (Leuven), Belgium (stef.lhermitte@ees.kuleuven.be)

Assessment of the spatio-temporal variations in surface properties of the Greenland ice sheet provides valuable input for various applications ranging from energy and mass budget calculations to climate model validation. Within this context a variety of retrieval methods has been developed to assess surface properties from multi-spectral satellite sensors (e.g. Landsat, MODIS, ...) . These methods range from multi-spectral classification to combined approaches that incorporate radiative transfer calculations.

This study provides a quantitative analysis of the trade-offs between the state-of-the-art retrieval methodologies for assessing the surface properties of the Greenland ice sheet. Within this context, spatio-temporal patterns of surface properties (e.g., albedo, grain size, impurity load, ponding melt water, snow/ice classification) are derived from Landsat and MODIS reflectance data over the Greenland ice sheet from 2000 to present. The retrieved properties are subsequently compared and validated based on reference measurements.

Analysis of the differences in derived surface properties from Landsat and MODIS reveals the importance of understanding the spatial and temporal scales at which variations occur. Large spatial variability within a MODIS pixel complicates the performance of retrieval methods for MODIS time series, especially in the ablation region, where the surface is very heterogeneous. Large temporal variability, on the other hand, constrains the validity of time series of Landsat retrievals and also has a large impact on the use of multi-day composite MODIS data.