



## **Comparison of Landsat and MODIS for assessing surface properties of snow and ice**

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Assessment of the spatio-temporal variations in snow and ice properties provides valuable input for a variety of climatological, hydrological, glaciological applications ranging from energy and mass budget calculations to distributed snowmelt modelling. Within this context a variety of retrieval methods has been developed to assess surface properties from multi-spectral Landsat and MODIS data. These methods range from spectral index calculations and unmixing methods to combined remote sensing and radiative transfer approaches.

This study provides a quantitative analysis of the trade-offs between the state-of-the-art retrieval methodologies applied on Landsat and MODIS data. Within this context, spatio-temporal patterns of surface properties (e.g., snow cover fraction, albedo, grain size, impurity load, ponding melt water, snow/ice classification) are derived from Landsat and MODIS reflectance data over two study areas covering parts of the Greenland Ice Sheet and the Chilean Andes from 2000 to present. The retrieved properties are subsequently compared and validated based on reference in-situ 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 for surface properties not related to snow cover fractions. 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.