



## **Contrasting snow and ice albedos derived from MODIS, Landsat ETM+ and airborne data from Langjökull, Iceland**

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Surface albedo is a key parameter in the energy balance of glaciers and ice sheets because it controls the shortwave radiation budget, which is often the dominant term of a glacier's surface energy balance. Monitoring surface albedo is a key application of remote sensing and achieving consistency between instruments is crucial to accurate assessment of changing albedo. These measurements may then be used to quantify past reflectance, energy balance and melt characteristics. Here we compare near contemporaneous ETM+ (30 m), MODIS (250 m) and airborne multispectral imagery (ATM; 5 m) that were collected over Langjökull, Iceland's second largest ice cap (910 km<sup>2</sup>) in 2007. All three radiance datasets are converted to reflectance by applying commonly used atmospheric correction schemes: 6S and FLAASH. These are used to derive broadband albedos. We first compare the similarity of albedo values produced by the different atmospheric correction schemes for the same instrument, then contrast results from the different instruments. In this way we are able to evaluate the consistency of the available atmospheric correction algorithms and to consider the impacts of different spatial resolutions.

Albedo is shown to be highly variable at small spatial scales. Different retrieval methods for surface albedo from the same instrument are shown to produce locally inconsistent measurements of surface albedo. Differences between the atmospheric correction schemes of 6S and FLAASH therefore produce significant contrasts in surface albedo. Comparison of the 6S corrected ATM dataset, a 6S corrected ETM+ dataset and an MCD43 dataset showed inconsistencies between the datasets associated with specific glacier facies. These differences result in contrasting stepped albedo maps which would imply spatially different melt regimes across the glacier surface. These inconsistencies are hypothesised to be the result of the certainty with which sub-pixel scale differences in albedo, Bi-directional Reflection Distribution Functions, surface geometry and surface roughness could be captured by the different spatial resolutions of the different images.