EGU2020-2335
https://doi.org/10.5194/egusphere-egu2020-2335
EGU General Assembly 2020

Small scale spatial variability of spectral Albedo on Jamtalferner, Austria

Lea Hartl[1], Lucia Felbauer[1], Gabriele Schwaizer[2], and Andrea Fischer[1]
[1]Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences, Innsbruck, Austria
[2]ENVEO IT GmbH, Innsbruck, Austria

Glacier albedo is one of the most important and most variable parameters affecting surface energy balance and directly impacts ice loss. We present preliminary results from a study aiming to quantify the range and variability of spectral reflectance on a glacier terminus and assess the effects of liquid water and impurities on ablation area reflectance. In a second step of the analysis, in-situ data is compared with Landsat 8 and Sentinel 2 surface reflectance products.

In-situ spectral reflectance data was collected for wavelengths from 350-1000nm, using a hand-held ASD spectroradiometer. 246 spectra were gathered along 16 profile lines.

The “brightest” profile has a maximum reflectance of 0.7 and consists of clean, dry ice. At several “dark” profiles, reflectance does not exceed 0.2. At these profiles, liquid water is present, often mixed with fine grained debris. Individual spectra can roughly be grouped into dry ice, wet ice, and dirt/rocks. However, transitions between groups are fluid and in practice these categories cannot always be clearly separated. The spread of reflectance values per profile is generally lower for darker profiles. The reflectance spectra for clean ice exhibit the typical shape found in literature, with highest reflectance values in the lower third of our wavelength range and declining values for wavelengths greater than approximately 580nm. For wet ice surfaces, the spectra follow roughly the same shape as for dry ice, but are strongly dampened in amplitude, with reflectance typically below 0.2.

For the comparison of in-situ and satellite data, we use a Sentinel 2A scene acquired the same day as the ground measurements and a Landsat 8 scene from the previous day. Both scenes are cloud free over the study area. The wavelength range of the in-situ data overlaps with Landsat 8 bands 1-5 and Sentinel 2 bands 1-9 and 8A, respectively.

Neither satellite captures the full range of in-situ reflectance values. In all bands in which both satellites overlap, Sentinel values are shifted up against Landsat, in the sense that the maximum values of the Sentinel data are closer to the maximum values measured on the ground, while the minimum Landsat data are closer to the minimum ground values. Comparing the mean of the spectral reflectances measured on the ground with the associated satellite band values yields Pearson correlation coefficients from 0.53 to 0.62 for Landsat and 0.3 to 0.65 for Sentinel. Correlation coefficients decrease significantly for lower resolution satellite bands.

When binning ground measurements by the associated satellite pixel, the difference between the median/mean ground value and the satellite value tends to decrease with increasing number of ground measurements mapped to unique satellite pixels. While this is expected, the relationship is not obviously linear for our data and differs between the satellites and different bands.

Further in-situ measurements and analysis of satellite data will be carried out to improve understanding of processes governing ablation area reflectance, satellite derived ablation area reflectance products, and the modelling of feedback mechanisms.