The behaviour of scene reflectance in boreal forest

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Forest canopy impairs the detection of snow underneath by remote sensing. Interpretation models tend to underestimate the snow coverage. The effect of prevailing measurement conditions on snow reflectance is well understood, but the sensitivity of scene reflectance on these properties has not been much examined. In order to investigate scene reflectance from a boreal forest, an Analytical Spectral Device (ASD) Field Spec Pro JR was installed at the top of a 30-metre-high mast continuously monitoring fixed spots in a forest and forest opening in Sodankylä, northern Finland. The data consist of average reflectance spectra of the range 350–2500 nm, as well as simultaneously produced digital images. Since the models investigated in this work for assessing the fractional snow-covered area (FSC) are based on MODIS data, similar reflectance bands were derived from the ASD spectra. One goal of this research was to examine the behaviour of normalized difference snow index (NDSI), which is typically used in FCA modeling – e.g., by MODIS snow mapping by National Snow and Ice Data Center (NSIDC). Time series analysis of NDSI, normalized difference vegetation index (NDVI) and reflectance values of selected wavelengths illustrate well the behaviour of reflectance in snow-covered forest.

Variations in snow reflectance induced particularly great variation in the scene reflectance and NDSI, though visible snow-covered ground accounted for only half of the measured area, as a result of the blocking effect of the trees (Fig. 1). Our findings indicate that the blocking effect of trees, as well as the effect of prevailing measurement conditions should be more taken into account in the develop of the EO based snow cover monitoring.

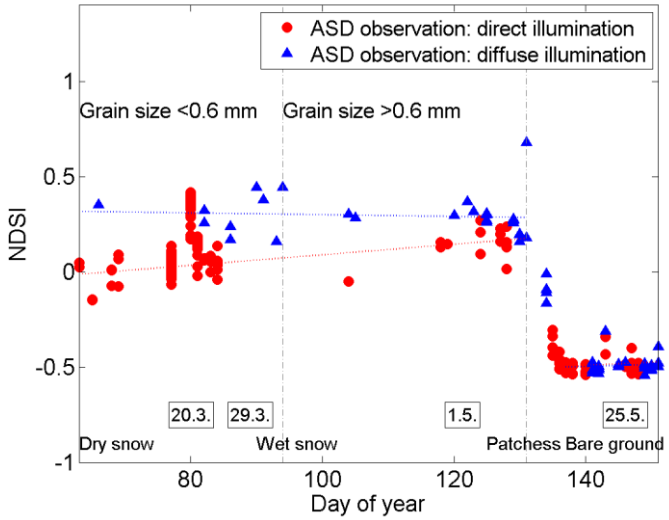

Fig. 1. Time series of NDSI from 4 March 2010 to 31 May 2010 as measured by mast-based spectrometer under direct or diffuse solar illumination. The dates in figure presents the days of snowfall.