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The temporal variation of snow surface roughness in Sodankylä Finnish Lapland in 2009-2010

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Snow surface roughness is a key factor in interpreting the remote sensing data of snow surfaces. It also affects the radiation budget of the earth and therefore constitutes to the climate change. We measured the seasonal snow surface roughness in Sodankylä Finnish Lapland (67.4 °N, 26.6 °E) during the Snow Reflectance Transition Experiment (SNORTEX) –campaign. The test site was 10 km in diameter and included more than 50 measurement locations. Most of the places were measured twice. In 2010 more than 20 of the places were remeasured. The land cover classes varied from open bogs to forests of varying density. In addition, snow cover on lake ice was included. The snow pit measurements included thickness, density, grains size and temperature profiles as well as snow water equivalent of the snow pack. The snow surface roughness measurements were made alongside other daily field measurements in different places every day. In addition to these, a similar measurement was repeated every day at a chosen location near the FMI-ARC premises. The snow surface roughness measurements include tachymeter profiles and plate measurements. We repeated the measurements at same location daily from 11th March 2009 to 18th of March 2009 and again from 20th April 2009 to 27th March 2009. In extracting the profile from the image we used an automatic photogrammetry based plate method developed in FMI.

The scale dependence and directionality of snow surface roughness makes it a challenging phenomenon to parameterize. Using the a and b of the logarithm of root mean square of the profile as function of measured length x: log (σ) = a + b*log (x) to characterize the surface roughness features we were able to distinguish the daily development of the surface roughness during the melting season 2009 in Finnish Lapland. The results clearly show how the surface turns rougher in the melting season. They also show the effect of a snow fall during the 16th March.