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

Kati Anttila*, Terhikki Manninen, Tuure Karjalainen, Panu Lahtinen, Aku Riihelä and Niilo Siljamo

Finnish Meteorological Institute, P.O.BOX 503, FI-00101 Helsinki, Finland
* kati.anttila@fmi.fi

SNORTEX

Measurements

The snow surface roughness was measured using a photogrammetry based method

- In Sodankylä Finnish Lapland (67.4 °N, 26.6 °E)
- In March 2009, April 2009, February 2010 and March 2010
- As part of the Snow Reflectance and Transition Experiment (SNORTEX) –campaign (Roujean et al. 2010)

The measurements consist of 777 plate profiles from several locations around Sodankylä. In addition to the plate measurements tacymeter profiles were measured in 2009. Daily repeated measurements were made in Tähtelä.

The used method produces 2D profiles that are 1 meter long.

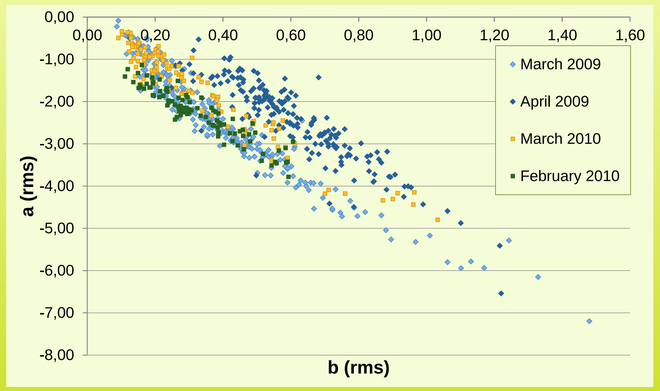
Multiscale analysis of root mean square (*rms*) and correlation length (*cl*) was made from the profiles.

Methods

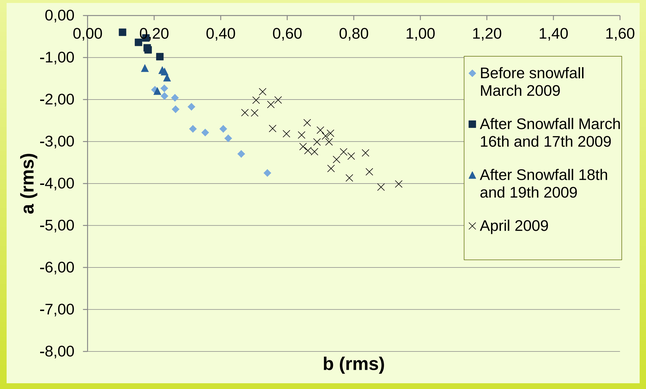
1. A black board with scales on the sides is partly inserted into the snow and a photo is taken of the plate and the snow-plate interface
2. A 2D profile is automatically extracted from the photo as presented in Manninen et al. (accepted)
3. Multiscale rms and cl are calculated from the profile as function of measured length/window size (Manninen 2003)
   - Logarithm of rms (σ) is linearly dependent on the logarithm of measured length x

     $\sigma(x)=e^{a}x^{b}$
4. The parameters used in the results presented here are a and b
5. These parameters are extracted from the data and calculated for every 5% of the maximum measured length.
   - The values for 60% of maximum measured length are used in the analysis

Results



Parameters a (rms) and b (rms) of all plate measurements. The surface turns rougher as the melting season starts in April 2009. March 2010 matches March 2009 well even though the snow pack development conditions have been different in 2009 and 2010. March 2010 was warmer than March 2009 but the melting period had not yet started.



Parameters a (rms) and b (rms) of Tähtelä measurements from 2009. The effect of a snow fall event the 16th March 2009 has a clear effect on the snow surface roughness. During April 2009 there were no big snow fall events during the measurement period.

Conclusions

- There is a clear change from mid-winter to melting season in snow surface roughness
- The surface roughness of old and fresh snow are clearly distinguishable

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