

Monitoring of Snow Characteristics in Finland with Spaceborne Ku-Band Scatterometer

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Since seasonal snow mostly appears at high latitudes, microwave radiometer and radar, due to their nearly all-weather capability and independence of lighting conditions, are suitable for monitoring seasonal snow on various scales. However, interpretation of these data in terms of snow cover characteristics is not straightforward. A considerable amount of work has been done regarding the use of multi-channel microwave radiometry and C-band SAR observations of snow, whereas the use of high-frequency radar for snow monitoring is a more recent topic.

In this paper we present results on using satellite data from the Ku-band SeaWinds sensor on the QuikScat satellite for remote sensing of seasonal snow cover in Finland. The data consist of horizontally and vertically polarized backscattering coefficients separately for ascending (morning) and descending (evening) orbits for the winters of 1999-2000 through 2003-2004. Additional data include daily maximum and minimum air temperatures, snow water equivalent and depth values, and land-cover information. We discuss the feasibility of these scatterometer data for monitoring snow cover characteristics during both the accumulation and melting period. We have several test sites in Finland, representing the two main types of land-cover categories: forested and agricultural/forested areas.

We discuss and evaluate methods for retrieval of snow water equivalent from QuikScat data. We report results for the onset and end of the seasonal snow-melting period. Our results for the extent of snow-covered area during the melting season suggest that obtaining good accuracy may not be as straightforward as reported in previous studies that employed few C-band SAR images per winter. We discuss the critical factors that include variation of daily air temperature, selection of reference backscatter values for wet snow and snow-free ground, and selection of orbit.