

Remote sensing of snow with radar and microwave radiometer

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Abstract

The main characteristics of seasonal snow cover for hydrological applications are its extent (percentage of area covered by snow) and water equivalent. In the spring, frequent information on the snow melt run-off still available in a river basin is needed in order to optimize hydropower generation.

The feasibility of microwave remote sensing for measuring the snow extent during the melting season was studied with the following sensors: (1) ERS-1 SAR (5.3 GHz), (2) airborne scatterometer (radar) HUTSCAT (5.4 and 9.8 GHz) and (3) airborne microwave radiometer (24, 35, 48, 94 GHz). The goal was to determine the optimum active and passive channels for the task, considering the effect of various land-cover categories ranging from agricultural areas and forest canopies to bogs.

The test site was located in northern Finland and the data was obtained during the winters of 1991-1992 and 1992-1993. The capability of ERS-1 SAR to discriminate snow-free terrain from snow-covered ground was examined. The effect of incidence angle (23 to 45 degrees off nadir), polarization (VV, HH, VH, HV) and frequency (5.4/9.8 GHz) to snow extent determination with radar was studied using scatterometer data. For microwave radiometer data, the effect of frequency was mainly examined.

Keywords: Snow extent. ERS SAR. Scatterometer. Microwave radiometer. Sensor optimization.

Keywords: ESA European Space Agency - Agence spatiale europeenne, observation de la terre, earth observation, satellite remote sensing, teledetection, geophysique, altimetrie, radar, chimique atmospherique, geophysics, altimetry, radar, atmospheric chemistry

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