

Detection of Soil Moisture and Soil Freeze Using Microwave Radars

Tuomo Smolander, Jouni Pulliainen

Finnish Meteorological Institute

PL 503

00101 HELSINKI

Finland

A method for detection of soil moisture and soil freeze using microwave radar measurements is presented. The detection is based on an inversion method presented by Pulliainen et al. in [1]. It employs a semiempirical backscattering model that describes the dependence of radar backscattering of forest as a function of stem volume, soil moisture, vegetation canopy moisture, surface roughness and incidence angle. The backscattering model was developed using C- and X-band airborne HUTSCAT scatterometer data. The backscattering of soil is determined using model presented in [2]. The inversion is made using a constrained least-squares algorithm.

The method gives an estimate of soil moisture. It can be used to detect soil freeze by determining a threshold value below which the soil is considered to be frozen. This method can be used with both low resolution scatterometer measurements and higher resolution SAR-radars. We are applying it to space borne ASCAT and ASAR instruments. The main validation site is FMI Sodankylä-Pallas supersite.

References

- [1] Jouni T. Pulliainen, Terhikki Manninen, and Martti T. Hallikainen, "Application of ERS-1 Wind Scatterometer Data to Soil Frost and Soil Moisture Monitoring in Boreal Forest Zone," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 36, no. 3, pp. 849-863, May 1998.
- [2] Yisok Oh, Kamal Sarabandi, and Fawwaz T. Ulaby, "An Empirical Model and an Inversion Technique for Radar Scattering from Bare Soil Surfaces," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 30, no. 2, pp. 370-381, March 1992.