Soil Moisture Retrieval in Boreal Forests with HUT-2D Synthetic Aperture Radiometer

Jaakko Seppänen [(1)] **, Juha Kainulainen** [(1)] **, Kimmo Rautiainen** [(1)] **, Martti Hallikainen** [(1)]
Marko Mäkynen [(1)]

[(1)] ***Helsinki University of Technology***
Department of Radio Science and Engineering
P.O.BOX 3000, 02015 TKK, Finland
Email: jaakko.seppanen@tkk.fi

L-band radiometry is a promising technology for measuring soil surface moisture [2, 3, 4, 5]. Soil Moisture and Ocean Salinity (SMOS), scheduled for launch in 2009, is the European Space Agency's Earth Explorer satellite for global monitoring of soil moisture, and also sea surface salinity. It utilizes a single instrument: Microwave Imaging Radiometer by Aperture Synthesis (MIRAS), which is a passive instrument operating at a frequency of 1.4 GHz and using interferometry for producing two-dimensional brightness temperature images. [1]

Because the spatial resolution of the MIRAS is 30-50 km [1], each pixel covers several different land usage classes and vegetation types. L-band radiometry is preferred over higher-frequency sensors because of its relatively low sensitivity to vegetation [2, 3, 4, 5]. However, the effects of vegetation are still significant [6]. In the boreal zone forests and bogs are the dominant vegetation conditions, and knowing their emissivity properties is imperative to succesful global measurements of soil moisture.

HUT-2D is an airborne interferometric radiometer designed, manufactured and tested by Helsinki University of Technology and completed in spring 2006 [7]. The major technical characteristics of HUT-2D are similar to those of MIRAS and it can thus be used to collect datasets similar to SMOS products.

In 2007 the HUT-2D was used to collect a dataset including measurements over forested soils. These measurements were used to examine the retrieval of soil surface moisture in varying vegetation conditions. Where vegetation cover was abundant and polymorphic, reliable estimation of vegetation parameters proved problematic, but the results indicated, that succesful retrieval of soil parameters is still possible.

This paper describes the measurements carried out over forested areas during the measurement campaign of August 2007 in Finland with HUT-2D and the corresponding ground measurements. A method to model the above surface layer is examined. The accuracy of the measurements and the retrieval process s assessed and applicability of HUT-2D for retrieval purposes is discussed.

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