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Simplified algorithm for SMOS: adaptation of the Land Parameter Retrieval Model

D.J. Leroux (1), Y.H. Kerr (1), R.A.M. de Jeu (2), and A. Mialon (1)

(1) Centre d'Etudes Spatiales de la BIOsphère, Toulouse, France (delphine.leroux@cesbio.cnes.fr), (2) Vrije Universitat, Amsterdam, Netherlands

SMOS (Soil Moisture and Ocean Salinity, Kerr et al., 2010) data have been available now for more than two years after a successful launch in November 2009. SMOS is the first mission entirely dedicated to soil moisture retrieval over land with a L-band passive radiometer (1.4 GHz). SMOS provides a global coverage every three days with a 43 km resolution and an accuracy goal on the soil moisture product of 0.04 m3/m3 and represents the top 3-5 cm of the soil.

SMOS acquires brightness temperatures at multiple incidence angles (from 0° to 50° with full polarization). The angular signature is the key element of the algorithm that retrieves the soil moisture and the vegetation optical depth (which expresses the quantity of signal that is absorbed by the vegetation layer) through the minimization of a cost function between modeled (L-MEB, Wigneron et al., 2007) and acquired brightness temperatures. The novelty of the SMOS algorithm is in the consideration of the heterogeneity inside the field of view of the radiometer (Kerr et al., accepted).

The goal of this work is to study the impact of this heterogeneity in the retrievals by applying an homogeneous algorithm to SMOS brightness temperatures.

We have chosen the Land Parameter Retrieval Model (LPRM, Owe et al., 2001) that has already been applied to previous passive microwave radiometers at C, X and K bands. This algorithm retrieves the soil moisture and the vegetation optical depth by computing the microwave polarization difference index and the soil temperature is derived from the 36 GHz channel. It takes into account the incidence angle, such that it can be applied to brightness temperatures acquired at different angles but it does not retrieve the soil moisture from multi-angular acquisitions.

The first step of this study is to adapt the LPRM algorithm to SMOS acquisitions: L-band multi-angular brightness temperatures. The parameter values proposed in de Jeu et al. (2009) for L-band observations have been used. The model has then been adapted to multi-angular acquisitions by implementing a cost function between the modeled and the observed brightness temperatures in order to retrieve the soil moisture and the vegetation optical depth values that minimize the difference between them.

The first results show a good agreement between SMOS and adapted LPRM retrievals over homogeneous regions (with a significant bias however), and some discrepancies are observed over more heterogeneous areas.

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