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Test of a simplified radiative transfer model: passive microwave brightness temperatures simulated at L, C and X-band

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ESA's Soil Moisture and Ocean Salinity (SMOS) mission, successfully launched in November, 2009, acquires brightness temperatures relying on an L-band (1.4 GHz) interferometric radiometer. Within the context of the preparation for this mission over land, the Valencia Anchor Station (VAS) experimental site, in Spain, was selected to be one of the main test sites in Europe for the SMOS Calibration/Validation (Cal/Val) activities. It is a semiarid environment with low annual precipitation (around 400mm) and is characterized by an extensive network of measurements in the atmosphere and in the soil.

The objective of this research is to propose a parametrization of a radiative transfer model in order to simulate the passive microwave brightness temperature at SMOS scale (an average of 50km^2) at three different bands: L-band (1.4 GHz), C-band (6.7 GHz) and X-band (10.9 GHz). In this framework, a coupled SVAT (Soil-Vegetation-Atmosphere-Transfer) - radiative transfer model was considered for modelling the soil moisture and the resulting microwave emission. The hydrological processes are simulated using a SVAT model named ISBA (Interactions between Soil Biosphere Atmosphere), while the microwave emission is simulated using the L-MEB (L-band Microwave Emission of the Biosphere) model.
L-MEB is adapted regarding the surface features of VAS area and is computed using the new parametrisation in order to simulate brightness temperature at L, C and X-band. The results obtained were compared with remote sensing data from SMOS and AMSR-E (Advanced Microwave Scanning Radiometer of the Earth Observing System (EOS)). A very high correlation coefficient (more than 0.90) is obtained when comparing with AMSR-E data at C and X-band.

This method allows simulating the brightness temperature at different frequencies for a wide area and is of first interests as passive sensors (SMOS, AMSR-E) have a large footprint (several tens of km) so to better understand the signal is interesting to focus over large areas.