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Modelling SMOS brightness temperature by use of coupled SVAT and radiative transfer models over the Valencia Anchor Station

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Soil moisture is a key variable that controls water and heat energy interactions occurring at the land atmosphere interface. This parameter, very important for the weather and climate modelling, is not well monitored at a global scale. A number of experiments have shown the high potential of L-band microwave radiometry for monitoring surface soil moisture. In this context, the SMOS (Soil Moisture and Ocean Salinity) mission was designed to observe soil moisture over continental surfaces as well as ocean salinity. Due to be launched in summer 2009, it will provide global soil moisture maps every 3 days at least, with an average spatial resolution of 40 km x 40 km.

The VAS (Valencia Anchor Station) experimental site, in Spain, is a cornerstone of the SMOS Cal/Val plan. It is a semiarid environment and is characterized by an extensive set of measurements at different levels (in the atmosphere and in the soil) in order to derive surface energy fluxes.

In the framework of SMOS preparation, the research presented here deals with the use of surface variables from the VAS site to simulate passive microwave brightness temperature so as to have Satellite “match ups” for CalVal and to test retrieval algorithms.

First, ground and meteorological measurements from the VAS site are used to simulate soil moisture using a Soil-Vegetation-Atmosphere-Transfer (SVAT) model (ISBA) from Météo France. In order to validate this approach, a point to point comparison with ground measurements has been done. We obtain a very good agreement between the simulated and measured soil moisture and we find that, as expected, the simulated soil moisture is mostly driven by precipitation patterns. Then, we propose a spatialization method using all the available data in order to have soil moisture estimates representative of a SMOS pixel. The results are compared with remotely sensed data such as soil moisture from AMSR-E. An amplitude difference between both soil moisture data is observed but also a good agreement in terms of temporal variability. Discrepancies appear mostly during the growing season, the AMSR-E signal being strongly influenced by the vegetation. Better correlation is obtained using polarization ratio which has often been used to study soil moisture.

The second step consists in using output data from ISBA model to simulate the surface emission through the use of radiative transfer models (L-MEB - L-band Microwave Emission of the Biosphere model). Parameterization has been done in order to simulate brightness temperature at C and X-band. A very high correlation coefficient (more than 0.90) has been obtained when comparing with AMSR-E data at 6.9 (C-band) GHz and 10.7 (X-band) GHz.
We will present also the first simulation in L-band which will help better understanding of the exact signification of the SMOS signal and thus give a first insight of the SMOS data.