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Validation of satellite soil moisture products in southwestern France using model simulations and in-situ data

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Abstract

A long term data acquisition effort of profile soil moisture is currently underway at 13 automatic weather stations located in southwestern France. This ground network was developed in order to validate remote sensing and model soil moisture estimates. In particular, the in-situ soil moisture observations will be used for the CAL/VAL of the ESA's Soil Moisture and Ocean Salinity (SMOS) mission, to be launched in 2009. The SMOSMANIA network (Calvet et al. 2007, Albergel et al. 2008) is based on the operational automatic weather station network of Météo-France (RADOME). It includes 12 stations forming a transect between the Mediterranean sea and the Atlantic ocean. The SMOSREX experimental site (De Rosnay et al. 2006) is located along the same transect.

In order to assess the capability of local soil moisture observations to validate the satellite-derived surface soil moisture (SSM) seasonal and day to day variability, the topmost soil moisture in-situ observations were compared with different SSM products. A number of SSM products were considered, based on C-band and/or X-band channels from active and passive instruments: ERS-Scat, ASCAT, and AMSR-E, Windsat, respectively.

In addition, a satellite/model/in-situ cross-validation study was performed with a number of SSM products. The reanalysis soil moisture predictions over France from the model suite SIM (SAFRAN-ISBA-MODCOU) of Météo-France was used, for the years 2003 to 2005, and AMSR-E, ERS-Scat (Rüdiger et al. 2009), and Windsat SSM products. In the case of AMSR-E, 2 products were considered.

The good correlations between point observations and the low resolution model predictions and satellite observations show the importance of single point observations for the verification of land surface models and remotely sensed soil moisture products.

Although one AMSR-E product is poorly correlated to the other SSM estimates, all the scaled SSM anomalies calculated for a period of 5 weeks present significant correlations with in-situ anomalies. The correlation level varies, however, from one season to another.

However, the apparent good quality of SSM products derived from C-band or X-band instruments is surprising in a densely vegetated region. Further studies are required to validate their physical meaning or relevance. The PORTOS-93 data set (Wigneron et al. 1995), includes radiometric observations of sparse to dense agricultural crops at 1.4 GHz, 5.05 GHz, 10.65 GHz, 23.8 GHz, 36.5 GHz, and 90 GHz. The main results of the PORTOS experiment are reviewed.