

Use of in situ and modelled soil moisture estimates to evaluate microwave remotely sensed products in southwestern France

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A long term data acquisition effort of profile soil moisture is currently underway at 13 automatic weather stations located in southwestern France. 12 belong to the SMOSMANIA network (Soil Moisture Observing System-Meteorological Automatic Network Integrated Application). This group of stations forms a 400 km transect along the climatic gradient between the Atlantic Ocean and the Mediterranean Sea, with all stations being equipped with probes measuring the volumetric soil moisture content at various depths. The other one, SMOSREX (Surface Monitoring Of the Soil Reservoir EXperiment) experimental site is located along the same transect and is also included in the study, as SMOSREX includes profile soil moisture measurements. This ground network was developed in order to validate remote sensing and model soil moisture estimates.

As a first step, an exponential filter and its recursive formulation were used in order to estimate the Soil Water Index (SWI) from in-situ surface soil moisture measurements (SSM, at a depth of 5 cm) and comparing those to observations at 30cm. Most often than not, the estimated SWI correlates well with the in-situ measurements. The only parameter required is a characteristic time length  $T$ , where a single value of  $T=6$  days allows to estimate soil moisture at a depth of 30cm from observations at 5cm for the whole group of station. This parameter is determined by optimizing the Nash-Sutcliffe coefficient between the retrieval SWI and observed soil moisture at a depth of 30cm.

A synthetic soil moisture data set covering continental France is also used. Resulting in a median  $T$ -value of 15 days. From this data set the added value of using the filter to estimate the SWI is demonstrated. It is also shown that using a median  $T$ -value instead of an optimal  $T$  leads to good results. The  $T$  parameter does not appear sensitive

Also, soil moisture measured in-situ at 5 cm is used to evaluate the normalized SSM estimates derived from coarse-resolution (25 km) active microwave data of the ASCAT scatterometer instrument (onboard METOP since the end of 2006), issued by EUMETSAT, for a period of 6 months (April-September) in 2007. The correlation between ASCAT SSM and 5cm observations were determined as a function of the location of the ASCAT grid with respect to the station (ASCAT grid point at north, south, west or east) and for the whole pool of data. Nine stations present significant correlation levels. For two stations, a significant correlation is obtained when considering only part of the ASCAT data. In order to remove the seasonal trend, the satellite and the in-situ time series soil moisture observations are transformed into normalised anomalies. The soil moisture measured in-situ at those stations, at 30 cm, is used to estimate the characteristic time length ( $T$ ) of an exponential filter applied to the ASCAT product. The best correlation between a soil water index derived from ASCAT and the in-situ soil moisture observations at 30 cm is obtained with a  $T$ -value of 14 days.