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Upper-soil moisture inter-comparison from SMOS's products and land surface models over the Iberian Peninsula

Jan Polcher (1,6), Anaïs Barella-Ortiz (1,6), Filipe Aires (2,6), Gianpaolo Balsamo (3), Emiliano Gelati (4,6), Nemesio Rodríguez-Fernández (5,6)

(1) Laboratoire de Météorologie Dynamique du CNRS, UMR8539, CNRS – IPSL, France, (6) Centre National de la Recherche Scientifique (CNRS), (2) LERMA, UMR8112, CNRS Observatoire de Paris, France, (3) European Centre for Medium-Range Weather Forecasts (ECMWF), Reading, UK, (4) CNRM-GAME (Météo-France, CNRS), Toulouse, France, (5) CESBIO, UMR5126, CNRS, Toulouse, France

Soil moisture is a key state variable of the hydrological cycle. It conditions runoff, infiltration and evaporation over continental surfaces, and is key for forecasting droughts and floods. It plays thus an important role in surface-atmosphere interactions. Surface Soil Moisture (SSM) can be measured by in situ measurements, by satellite observations or modelled using land surface models. As a complementary tool, data assimilation can be used to combine both modelling and satellite observations. The work presented here is an inter-comparison of retrieved and modelled SSM data, for the 2010 - 2012 period, over the Iberian Peninsula. The region has been chosen because its vegetation cover is not very dense and includes strong contrasts in the rainfall regimes and thus a diversity of behaviours for SSM. Furthermore this semi-arid region is strongly dependent on a good management of its water resources.

Satellite observations correspond to the Soil Moisture and Ocean Salinity (SMOS) retrievals: the L2 product from an optimal interpolation retrieval, and 3 other products using Neural Network retrievals with different input information: SMOS time indexes, purely SMOS data, or addition of the European Advanced Scaterometer (ASCAT) backscattering, and the Moderate-Resolution Imaging Spectrometer (MODIS) surface temperature information. The modelled soil moistures have been taken from the ORCHIDEE (ORganising Carbon and Hydrology In Dynamic EcosystEms) and the HTESSEL (Hydrology-Tiled ECMWF Scheme for Surface Exchanges over Land) land surface models. Both models are forced with the same atmospheric conditions (as part of the Earth2Observe FP7 project) over the period but they represent the surface soil moisture with very different degrees of complexity. ORCHIDEE has 5 levels in the top 5 centimetres of soil while in HTESSEL this variable is part of the top soil moisture level.

The two types of SMOS retrievals are compared to the model outputs in their spatial and temporal characteristics. The comparison with the model helps to identify which retrieval configuration is most consistent with our understanding of surface soil moisture in this region. In particular we have determined how each of the soil moisture products is related to the spatio-temporal variations of rainfall. In large parts of the Iberian Peninsula the covariance of remote sensed SSM and rainfall is consistent with that of the models. But for some regions questions are raised. The variability of SSM observed by SMOS in the North West of the Iberian Peninsula is similar to that of rainfall, at least this relation of SSM and rainfall is closer than suggested by the two models.