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Use of SMAP for Numerical Weather Prediction: monitoring of SMAP brightness temperature at ECMWF

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Soil moisture initialisation is key component of Numerical Weather Prediction (NWP) systems. It influences the accuracy of the lowest level atmospheric forecasts at all ranges, including hourly, daily and seasonal scales. Most of the current NWP operational systems rely two-meter temperature and relative humidity observations to analyse soil moisture conditions. At the European Centre for Medium-Range Weather Forecasts (ECMWF) recent developments showed that using satellite observations from active (Advanced Scatterometer, ASCAT) and passive (Soil Moisture and Ocean Salinity, SMOS) microwave sensors is highly relevant to analyse surface soil moisture conditions for NWP applications.

SMOS was the first soil moisture dedicated satellite mission. Since November 2009 it has been continuously providing multi-angular L-band measurements at 40 km resolution. Five year after SMOS was launched, SMAP will be, from November 2014, the first satellite to ensure a continuity of L-band measurements from space. SMAP brightness temperature will be available at 40 degrees incidence angle.

In this paper we use the SMOS L-band observations at 40 degrees to investigate for the year 2012 the accuracy of ECMWF simulated brightness temperature. The Community Microwave Emission Modelling Platform (CMEM) is used to simulate ECMWF brightness temperature at horizontal and vertical polarisations as provided in the SMAP level 1C product. Monthly and annual scale monitoring results show that global mean first-guess departure RMSE are 14K and 17 K for vertical and horizontal polarisations, respectively. Global mean correlation between observed and simulated data are 0.49 (vertical) and 0.52 (horizontal). The global mean bias (observation minus model) is -1.3K (vertical) and -1.3K (horizontal), with however large spatial and seasonal differences which will be presented and discussed. These SMAP monitoring results constitute the first step toward data assimilation implementation.