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Comparison between ECMWF L-band brightness temperatures and SMOS observations using the Community Microwave Emission Modelling Platform (CMEM)

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Soil moisture initialisation is crucial for Numerical Weather Prediction (NWP). New generations of satellites, such as SMOS (Soil Moisture and Ocean Salinity) and SMAP (Soil Moisture Active and Passive) provide highly suitable data from passive and active microwave sensors for soil moisture remote sensing. In order to make it possible to combine use of satellite, in situ and proxy observations to analyse soil moisture, ECMWF implemented an Extended Kalman Filter (EKF) soil moisture analysis which is used for operational NWP in the ECMWF Integrated Forecasting System (IFS). The use of passive microwave sensors in the EKF soil moisture data assimilation requires an accurate radiative transfer model.

In this poster we present ECMWF developments in radiative transfer modelling conducted to use SMOS and SMAP brightness temperature observations in the ECMWF data assimilation system. The ECMWF Community Microwave Emission Modelling Platform (CMEM) is described. CMEM input global fields, including soil moisture, soil temperature, snow depth and vegetation cover, were obtained from H-TESSEL land surface model simulations forced by ERA-Interim atmospheric conditions. CMEM multi-year simulations were performed using a land surface model configuration which is similar to the current operational IFS.

In CMEM, combinations of three soil dielectric models, three vegetation opacity models and four soil roughness parametrizations were used, allowing comparing 36 different configurations of the microwave emission model. Global scale forward simulations of dual polarization L-band (1.4 GHz) brightness temperature were conducted at 40 degrees incidence angle for each radiative transfer model and evaluated using the SMOS near real time brightness temperature data for 2010. Best

microwave emission model performances were obtained with the Wang and Schmugge dielectric model combined with the Wigneron vegetation opacity model and the simple Wigneron soil roughness parametrization. The best CMEM configuration was used to simulate multi-angular brightness temperature at 30, 40 and 50 degrees incidence angle for 2010-2013 and evaluated against the observed SMOS brightness temperature. Results are presented at global and regional scales using RMSE, correlation and bias metrics in order to evaluate CMEM both at the monthly and annual time scales.