SMOS soil moisture data assimilation for operational numerical weather prediction

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This paper presents an overview of the Soil Moisture and Ocean Salinity (SMOS) mission data assimilation activities conducted at the European Centre for Medium-Range Weather Forecasts (ECMWF). SMOS brightness temperature is used operationally in the ECMWF Integrated Forecasting System (IFS) for monitoring purpose. Long term monitoring based on observed and reanalysed forward SMOS brightness temperatures show a consistent improvement in the SMOS observations quality through the SMOS lifetime. In 2018, a new Neural Network (NN) SMOS soil moisture product was developed, trained on ECMWF soil moisture. The processor was implemented to produce near real time soil moisture from SMOS brightness temperature. The SMOS-ECMWF NN soil moisture product captures the SMOS signal variability in time and space, while by design its climatology is consistent with that of the ECMWF soil moisture, which makes it suitable for data assimilation purpose. SMOS NN soil moisture data assimilation was implemented in the land surface analysis of the IFS cycle 46r1, which will be operational in 2019. SMOS data assimilation is shown to slightly improve root zone soil moisture and independent verification against aircraft humidity profiles also show that SMOS data assimilation improves humidity in the summer of the northern hemisphere. These results illustrate the value of the SMOS soil moisture observations for operational NWP. Perspectives for exploring the potential of SMOS data to improve fire and floods forecasts, in the context of ECMWF activities with the Copernicus Emergency Management Services (CEMS) will be discussed.