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Effect of uncertainty on CMEM forcing data on SMOS brightness temperature predictions in the Rur and Erft Catchments in Germany

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The objectives of ESA's Soil Moisture and Ocean Salinity (SMOS) mission over land are to provide soil moisture observations for weather forecasting, climate monitoring, and investigating the global freshwater cycle. MIRAS (Microwave Imaging Radiometer by Aperture Synthesis), the radiometer on board the SMOS satellite has been providing two-dimensional brightness temperature images of the Earth surface at a frequency of 1.4 GHz (L-band) since November 2009. These brightness temperature images can be inverted into maps of soil moisture at the catchment, regional and global scales using a suitable radiative transfer model like CMEM (Community Microwave Emission Model). The soil maps so obtained are plagued with uncertainties which propagate from hydro-meteorological and biophysical data used to force the model in addition to errors linked to radiative transfer parameters and measurement errors in the brightness temperature maps. It is postulated that the soil moisture product can be enhanced by Data Assimilation (DA) approaches which optimally merge model predictions with observations. This requires some type of state forecast error covariance information. Most often this information is dynamically derived by the introduction of random noise in model states, fluxes and or forcing data. This implies that the type and magnitude of the introduced noise is an important prerequisite for the optimal performance of DA systems. Besides the type and magnitude of introduced noise, the sensitivity of model predictions to perturbations of forcing data can also determine the contribution of specific forcing data to the overall uncertainty. As a first step towards the development of an efficient DA system for the enhancement of soil moisture from SMOS brightness temperatures in the Rur and Erft Catchments in Germany, this study investigates the sensitivity of SMOS brightness temperature predictions to uncertainties in CMEM forcing data.