Assimilation of SMOS data into a coupled land surface and radiative transfer model for improving surface water management

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The Soil Moisture and Ocean Salinity (SMOS) satellite mission is routinely providing novel accurate data with a high acquisition frequency at the global scale. However, the integration of low resolution SMOS observations into finer resolution land surface models poses significant challenges, through which the potential of the satellite mission for operational hydrology is at present poorly understood. Therefore, this study aims at developing a robust end-to-end methodology that allows for the assimilation of SMOS data (either brightness temperature or soil moisture) into land surface models and for assessing the usefulness of SMOS data with respect to flood forecast.

The assimilation system is being set up for the Variable Infiltration Capacity (VIC) land surface model, coupled to a river routing scheme. The VIC model will be run over two large river basins, the Upper Mississippi Basin in central USA, and the Murray Darling Basin in Eastern Australia, both of which are characterized by a low contamination with radio frequency interference (RFI). A radiative transfer model, the Community Microwave Emission Model (CMEM), is being coupled to VIC in order to assimilate the top of atmosphere (TOA) brightness temperatures from SMOS over both river basins, in addition to derived soil moisture. The data assimilation system to be used is the Ensemble Kalman filter. Thereby, different disaggregation strategies will be followed to analyze the optimal way for integrating low resolution SMOS observations into higher resolution land surface models. The aim of the study is to demonstrate the potential and limits of the SMOS level 1 and level 2 products and their benefits for flood prediction.