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Quantifying the irrigation water use by assimilating SMAP-Sentinel1 1km soil moisture data using a particle batch smoother approach

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Irrigation is the largest human intervention in the water cycle that can modulate climate extremes. Despite the importance of irrigation, global irrigation water use (IWU) remains largely unknown. Microwave remote sensing offers a low-cost solution to quantify IWU by monitoring the changes in the soil moisture caused by irrigation. However, high-resolution satellite soil moisture data has fewer observations and might miss irrigation events. This study tests a method to quantify the IWU by assimilating high resolution (~1km), but less frequent SMAP-Sentinel1 (SMAP-S1) remotely sensed soil moisture with a land surface model. We use a particle batch smoother (PBS) to assimilate the SMAP-S1 soil moisture data with the VIC (4.2d) land surface model. It is important to remove the biases between the model and the satellite observations prior to the data assimilation, so we also evaluate the impact of model calibration during the irrigation or rainy season on the quantified irrigation. Moreover, we conducted a synthetic experiment in which the uncertainty due to the noise in assimilated soil moisture data, the frequency of the satellite observations, and the knowledge of irrigation timing was investigated. We will present the results of these studies.