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The AWRA modelled soil moisture estimates to evaluate the C-band SAR soil moisture retrieval error

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The high temporal sampling rate and the operational configuration of Sentinel-1 make it of interest for operational soil moisture monitoring. Currently a soil moisture monitoring service at 1-km spatial resolution exists for parts of the globe that uses data from the Global Mode (GM) of the Advanced Synthetic Aperture Radar (ASAR) onboard ENVISAT. A common approach for demonstrating the benefit of satellite-derived data relies on their assimilation into existing models.

To prepare for assimilation of C-band medium resolution soil moisture estimates we evaluated the existing ASAR GM soil moisture error by using the surface soil moisture modelled by the Australian water resources assessment (AWRA) model system. In particular, we used a model that relates the R and RMSE between satellite and modelled data to the error characteristics in both datasets. Given the independency of the two observed and estimated methods for RMSE and R estimation, the high correspondence of the RMSE and R maps demonstrates a good quality of the introduced models and, more importantly, a good quality of the ASAR GM error estimate.

An identical error propagation model to that used for ASAR GM can be applied to soil moisture estimates retrieved from Sentinel-1 radar observations. The ASAR retrieval error is large due to the high noise level in ASAR GM backscatter measurements (1.2 dB), and it is therefore expected that the retrieval error for Sentinel-1 will be magnitudes lower. Operationally available medium resolution soil moisture estimates from Sentinel-1 have the potential to be of great benefit for flux exchange, crop growth, and water balance monitoring and modeling.