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Merging multi-mission microwave soil moisture observations to obtain long-term time series in support of climate change studies

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Satellite based soil moisture products dating back to the late 1970s have now become available for several past and present operational scatterometers and radiometers and will soon be complemented with observations from the recently launched Soil Moisture and Ocean Salinity (SMOS) mission. Combining these measurements into a single multi-decadal data set would significantly increase the temporal coverage and resolution, thus providing a unique opportunity to study climate related trends in soil moisture. This potential has been recognised by ESA who, in collaboration with the Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Program, in 2008 launched the Water Cycle Multi-Mission Observation Strategy (WACMOS) project.

The scope of the soil moisture theme within WACMOS is to generate a 30 years consistent soil moisture time series based on active (ERS SCAT, MetOp ASCAT) and passive (SMMR, SSM/I, TRMM, AMSR-E, Windsat) microwave observations. Combining data of different origin poses many challenges as differences between measurement frequencies and retrieval algorithms have to be bridged. First, we used the cumulative distribution function (CDF) matching technique to intercalibrate the different soil moisture products and to bring them into a common reference format. Second, using ECMWF modelled soil moisture data as an independent reference, we were able to characterise the uncertainties of the individual microwave data sets with a triple collocation technique. Finally, the uncertainties of the different data sets were used to design an adequate merging scheme and to calculate the uncertainty of the merged product. This presentation will give an overview of the implemented techniques and show some first results of the merged product. We expect that the final merged 30+ years time series will enhance our understanding of the impacts of climate change on the water cycle.