IMPROVING GLOBAL SATELLITE SOIL MOISTURE RECORDS BY COMBINING SCATTEROMETER AND RADIOMETER OBSERVATIONS

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ABSTRACT

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. Appropriately combining the various datasets into a single data set provides a unique opportunity to improve temporal and spatial coverage, temporal resolution, and accuracy compared to the single-sensor products. The resulting 30+ years global data set is expected to strongly support studies on climate related trends in soil moisture. This potential has been recognised by ESA who, in collaboration with the Global Energy and Water Cycle Experiment of the World Climate Research Program, in 2008 launched the WACMOS project (Water Cycle Multi-Mission Observation Strategy).

This study presents the methods and results of generating a 30 years consistent soil moisture time series based on active (ERS SCAT, MetOp ASCAT) and passive (SMMR, SSM/I, TRMM, AMSR-E) microwave observations. Scatterometer-based retrievals were based on the Vienna University of Technology retrieval algorithm, whereas radiometer-based retrievals were obtained using the VU Amsterdam LPRM package. Merging the different soil moisture data sets into a single product faces many challenges. Cumulative distribution function (CDF) matching techniques were used to overcome soil moisture differences between data sets related to differences in frequency and retrieval approaches and to bring the different observations into a common reference format. The triple collocation technique was used to characterise the uncertainties of the individual microwave data sets and to define a ranking strategy according to which data sets were merged. According to this merging scheme, radiometer observations were favoured over (semi-)arid regions whereas scatterometer-based retrievals were used in moderately vegetated areas. In transition zones, both products were used to calculate the final product. First analyses show that soil moisture trends in the merged product show a high correspondence with trends observed in other hydrological variables such as evapotranspiration and run-off.