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Spatial and temporal variability of SMOS and ASCAT soil moisture products

Kathrina Rötzer, Carsten Montzka, and Harry Vereecken
Forschungszentrum Jülich, Institute of Bio- and Geosciences: Agrosphere (IBG 3), Jülich, Germany

The characterization of spatial and temporal dynamics of soil moisture is essential for improving hydrological and climate modeling, as well as numerical weather prediction.
Information about the spatial and temporal variability of soil moisture can also be used for data assimilation and up- and downscaling of remotely sensed soil moisture products, which is of high interest as these often have a low spatial resolution. The temporal and spatial variability of two remotely sensed soil moisture products, i.e. the Soil Moisture and Ocean Salinity (SMOS) Level 2 soil moisture product and the Advanced Scatterometer (ASCAT) surface soil moisture product are examined in this study.
The differences in the products are assessed through a temporal stability analysis. On basis of different soil types mean relative differences of the soil moisture pixels and their standard deviations are calculated and their ranks compared by ordering their mean relative differences from low to high. Similar ranking shows a similar spatio-temporal soil moisture distribution of both products.
We used the relationship between spatial variance and mean soil moisture content to characterize spatial variability of soil moisture. The temporal component of the soil moisture variation is separated into time-varying and time-invariant part. In this way the influence factors on the soil moisture variability can be identified and quantified, as "stable" factors like topography or land use can be distinguished from changing factors, for example seasonal changes.
The accuracy of SMOS and ASCAT soil moisture products and with that their utility for climate and hydrological modeling can be assessed through the differences of their spatio-temporal variability. Furthermore, driving factors on the temporal and spatial variability of soil moisture can be identified.