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Copula based assimilation of modeled and observed soil moisture on catchment scales

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For several years, satellite missions like SMOS or AMSR-E provide spatially distributed information on soil moisture. However, this data is mainly restricted to the surface or the first few centimeters in the soil e.g. due to a limited penetration depth of L-Band radar and might show large uncertainties over heavily vegetated areas. This holds also true for airborne observations, while they further suffer from a very limited temporal availability. Therefore, one still has to rely on models and *in situ* observations, if the water content of deeper soil layers is of interest. Significant differences certainly occur when modeled and observed total soil moisture is compared due to the models' discrete soil levels or uncertainties in the driving fields like precipitation or evaporation. This study focuses on the assimilation of soil moisture from the high-resolution hydrologic models NLDAS NOAH and NLDAS MOSAIC with *in situ* observations from the International Soil Moisture Network (ISM) over a sub-region of the Mississippi basin. The spatio-temporal dependence structure between time-series of terrestrial observations and model-based fields of soil moisture is analyzed. First investigations, including the application of suitable goodness of fit tests, show that standard Copula models, such as the Frank or Clayton Copula, are well suited to describe this dependency. This information is used to perform an event-based assimilation of modeled and observed soil moisture which incorporates (1) a bias correction to improve the absolute values and (2) an improvement of the spatial patterns based on the derived dependence structures. The assimilated fields are then cross-validated with observed soil moisture in order to quantify the gain of the applied method.