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Analysing soil moisture reactions to precipitation for soil moisture regionalization

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Storage and turnover of water in soils have an important impact on processes of runoff generation. To consider soil moisture in precipitation-runoff-models data with high spatial and temporal resolution are required. In a mesoscale catchment (about 300 km^2) in the hilly landscape of the Sauerland (Western-Germany) an online monitoring network collects data by 48 pF-meters and four precipitation collectors. Because data is generated discrete in time and space at a few sites an upscaling for every point in time from local point measurements to the mesoscale is necessary. Our approach to regionalize the actual soil moisture not only interpolates the measurements of observed random variables like classic geostatistical methods do, e.g. kriging interpolations, but uses locally variable properties of the study area that support our estimation. Such properties are on the one hand temporally constant parameters like land use, soil properties and topography from satellite images, soil maps and a digital elevation model and on the other hand temporally variable parameters derived from solar radiation data and precipitation time series. The regionalization model thus incorporates results of these time series, such as the time between a precipitation event and the depth-dependent soil moisture reaction. In order to achieve this, precipitation time series are separated into events and soil moisture time series are divided into intervals of increasing, decreasing and constant soil moisture. Intervals of time series with decreasing soil moisture are matched to previous precipitation events. Then characteristic attributes like the time between a precipitation event and the depth-dependent decreasing soil moisture are calculated. The results are used to develop a soil moisture regionalization model based on temporally constant and dynamic parameters. The nonlinear relation between these parameters and soil moisture are learned from given data, e.g. by an artificial neural network. In our paper the results of analysing precipitation and soil moisture time series are shown, as well as the application of the regionalization model of soil moisture on a mesoscale catchment.