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Soil moisture estimates as discharge predictors and their value to understand hydrological processes

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The root zone moisture content of a catchment is a main predictor of the runoff response. With increasing spatial and temporal resolution of satellite-based estimates of soil moisture, independent data sources become available to determine the initial state of a catchment for hydrological predictions. Discharge predictions using soil moisture as unique input can be achieved through cumulative distribution matching (CDF) of discharge and soil moisture observations (van Dijk et al., 2016). Hydrological models also keep track of the root zone state through continuous accounting of incoming and outgoing fluxes; however, modeled root zone dynamics are likely affected by subjective model structure choices. The Antecedent Precipitation Index (API) is a commonly used soil moisture proxy that relies on precipitation and temperature, which is typically the data used to force hydrological models. In this study, we determine the value of satellite-based soil moisture products (including NASA SPL3SMP-E (O'Neill et al. 2018) and VanderSat) during specific hydrological events in several catchments of the Meuse basin, when compared to a benchmark soil moisture proxy using only meteorological data (API). To this end, we compare the predicted discharges using the CDF relations from different soil moisture products for several events. We use additional sources of data, including groundwater levels to determine the hydrological processes that likely occurred to evaluate the soil moisture responses. This data-driven approach is complementary to commonly used approaches of hydrological modeling or data-assimilation and aims to pinpoint the value of different soil moisture products in relation to occurring hydrological processes.

References:

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