



Spatio-temporal soil moisture patterns across gradients of vegetation and topography

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Soil moisture dynamics control hydrological processes on various scales: changes in local water storage and potential activation of preferential flow paths influence connectivity and runoff from hillslopes and ultimately the discharge response of the stream. The spatio-temporal patterns of soil moisture, however, are dependent on a combination of local parameters such as soil type, vegetation and topography as well as meteorological conditions, antecedent moisture and seasonality.

In an integrative monitoring study carried out within the CAOS observatory in Luxemburg (<http://www.caos-project.de/>), soil moisture was measured at 21 sites with 3 soil moisture profiles each. These sites include grassland as well as forest on the one hand and cover different hillslope positions on the other hand. This setup allows us to study both vegetation and topographic effects.

The spatio-temporal patterns of soil moisture were analysed using two approaches: 1) we examined temporal persistence of soil moisture patterns with rank stability plots and addressed the variability within and between sites for contrasting meteorological conditions. 2) In a next step we focused on specific hydrologic events: two periods during summer recession were distinguished, first the drying out of the soils during a period of no precipitation, but also the continuing decline even after summer rains have started. Furthermore, the soil moisture response to three different rainfall events was examined, varying in intensity and antecedent moisture conditions. The emerging contrasts in patterns were put into context of site-specific characteristics such as vegetation and topographical position to identify controls on soil moisture dynamics for our range of sites. Ultimately, linking similarity in soil moisture response in landscapes to these controls can elucidate the hydrological functioning of landscape units and thus facilitate modelling efforts.