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Transregional Collaborative Research Centre 32: Patterns in Soil-Vegetation-Atmosphere-Systems

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The soil-vegetation-atmosphere system is characterized by non-linear exchanges of mass, momentum and energy with complex patterns, structures and processes that act at different temporal and spatial scales. Under the TR32 framework, the characterisation of these structures and patterns will lead to a deeper qualitative and quantitative understanding of the SVA system, and ultimately to better predictions of the SVA state.

Research in TR32 is based on three methodological pillars: Monitoring, Modelling and Data Assimilation.

Focusing our research on the Rur Catchment (Germany), patterns are monitored since 2006 continuously using existing and novel geophysical and remote sensing techniques from the local to the catchment scale based on ground penetrating radar methods, induced polarization, radiomagnetotellurics, electrical resistivity tomography, boundary layer scintillometry, lidar techniques, cosmic-ray, microwave radiometry, and precipitation radars with polarization diversity.

Modelling approaches involve development of scaled consistent coupled model platform: high resolution numerical weather prediction (NWP; 400m) and hydrological models (few meters). In the second phase (2011-2014), the focus is on the integration of models from the groundwater to the atmosphere for both the m- and km-scale and the extension of the experimental monitoring in respect to vegetation. The coupled modelling platform is based on the atmospheric model COSMO, the land surface model CLM and the hydrological model ParFlow. A scale consistent two-way coupling is performed using the external OASIS coupler.

Example work includes the transfer of laboratory methods to the field; the measurements of patterns of soil-carbon, evapotranspiration and respiration measured in the field; catchment-scale modeling of exchange processes and the setup of an atmospheric boundary layer monitoring network. These modern and predominantly non-invasive measurement techniques are exploited in combination with advanced modelling systems by data assimilation to yield improved numerical models for the prediction of water-, energy and CO_2-transfer by accounting for the patterns occurring at various scales.