P2 Fully coupled regional atmospheric-hydrological modeling with WRF-Hydro and WRF-HMS.

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Feedback among the atmosphere, land surface and subsurface is important to understand the non-linear connections within the hydrological cycle. Investigations of such feedback mechanisms require fully-coupled atmospheric-hydrological modeling systems with a more detailed description of the complex hydrological processes in comparison to standard regional atmospheric models.

To account for this, we employ two fully coupled atmospheric-hydrological modeling systems to investigate the feedback mechanisms at different spatial and temporal scales and for different regions worldwide: first, the hydrologically enhanced version of the WRF model, namely WRF-Hydro. Second, we have developed the fully coupled, mesoscale modeling system WRF-HMS, where the WRF model is extended with the hydrological model HMS to include lateral water fluxes at the land surface and subsurface and two-way interaction between the saturated and the unsaturated zone.

The WRF-Hydro modeling system is setup over Germany and the Alps for a one-year period with a 2.8 km resolution for the atmospheric and 280 m for hydrological processes. It is investigated whether the improved representation of hydrological processes leads to a more sophisticated description of soil moisture variability in WRF-Hydro. In another one-year study for the Sissili catchment (12,800 km^2) in West Africa, the role of runoff-infiltration partitioning and resolved overland flow on land-atmosphere feedback is investigated.

The WRF-HMS model system enables in particular fully coupled atmospheric-hydrological simulations at regional and long-term scales. This is demonstrated for the Poyang Lake basin (160,000 km^2) in Southern China for the years 1979-1986 with a 10 km resolution. The performance and the impact of groundwater coupling on soil moisture, evapotranspiration, temperature and precipitation is investigated.

We will present the coupling strategies, performances and potentials of both fully coupled modeling systems for investigations of the feedback mechanisms at different spatial and temporal scales.