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Coupled hydro-meteorological simulations for the Poyang lake region, China

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On all scales, the components of the hydrological cycle are continuously changing. Hydrological change can be mainly attributed to climate change due to increased greenhouse gas emissions, land cover conversions, and water resources management as a result of human development. In all three cases, feedback mechanisms among the atmosphere, the land surface, and the subsurface play a crucial role for the correct quantification of past, current and future expected water availability. Dynamic feedbacks between the compartments are primarily caused by water and energy fluxes between the land surface and the atmosphere. The investigation of these water and energy flux feedbacks requires a fully two-way coupled modeling system. Our approach combines a regional atmospheric (WRF-ARW) and a distributed hydrological model (HMS), both using the same land surface model (Noah-LSM). The coupled model system enables the investigation of the impact of joint land-use and climate changes on the regional water cycle.

The research areas for the application of the model system are the Poyang Lake region and the Hai River basin in China.

The presentation focuses first on uncoupled simulations of the advanced weather research and forecast model (WRF-ARW) to identify of a suited setup for the two target regions. Therefore, several configurations of the WRF-ARW model were performed with respect to model physics and vertical resolutions. As global driving data ECMWF's ERA-INTERIM reanalysis is used, covering the period 2003-2005. The simulations are evaluated for mean values and the annual cycles of temperature and precipitation. Secondly, an overview about the integration of the hydrological model HMS into WRF-ARW is presented. Changes to the pre-processing system and the introduction of a hydrology driver routine in the WRF-ARW code were necessary. With this coupled model system, first integrated, one-way WRF-HMS simulations were performed with the selected stand-alone WRF-ARW setup.