Geophysical Research Abstracts
Vol. 19, EGU2017-14200-1, 2017
EGU General Assembly 2017

Enhancement of hydrological parameterization and its impact on atmospheric modeling: a WRF-Hydro case study in the upper Heihe river basin, China

Zhenyu Zhang (1,2), Joel Arnault (1), Sven Wagner (1,2), Harald Kunstmann (1,2)

(1) Institute of Meteorology and Climate Research (IMK-IFU), Karlsruhe Institute of Technology, Campus Alpin, Garmisch-Partenkirchen, Germany, (2) Institute of Geography, Chair for Regional Climate and Hydrology, University of Augsburg, Germany

The upper Heihe river basin (10,020 km2) is situated in the alpine region of northwestern China, where gauge coverage is poor. Water-related activity is essential for the human economy in this region, which requires detailed knowledge of the available water resources. However, the lack of hydro-meteorological data makes any water balance investigation challenging. The use of regional atmospheric models can compensate this lack of data. The aim of this study is to investigate which improvement can be gained by enhancing the hydrological parameterization in atmospheric models. For this purpose, we employ the Weather Research and Forecasting model (WRF) and its coupled atmospheric-hydrological version (WRF-Hydro). In comparison to WRF, WRF-Hydro integrates horizontal terrestrial water transport at the land surface and subsurface. Atmospheric processes are downscaled from ECMWF operational analysis to 4 km resolution, and lateral terrestrial water flows are resolved on a sub-grid at 400 m. The study period is 2008-2009, during which observed discharge is available at three gauge stations. The joint terrestrial-atmospheric water budget is investigated in both WRF and WRF-Hydro. In WRF-Hydro, overland flow and re-infiltration increase the soil water storage, consequently increasing evapotranspiration and decreasing river runoff. This change in evapotranspiration influences moisture convergence in the atmosphere, and slightly changes precipitation patterns. Comparing model results with in-situ and gridded datasets (ITP-CAS forcing data, FLUXNET-MTE), WRF-Hydro shows improvement on precipitation and evapotranspiration simulation. The ability of WRF-Hydro to reproduce observed streamflow is also demonstrated.