



## **Contribution of lateral terrestrial water flows to the regional hydrological cycle: A joint soil-atmospheric moisture tagging procedure with WRF-Hydro**

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Water resources management requires an accurate knowledge of the behavior of the regional hydrological cycle components, including precipitation, evapotranspiration, river discharge and soil water storage. Atmospheric models such as the Weather Research and Forecasting (WRF) model provide a tool to evaluate these components. The main drawback of these atmospheric models, however, is that the terrestrial segment of the hydrological cycle is reduced to vertical infiltration, and that lateral terrestrial water flows are neglected. Recent model developments have focused on coupled atmospheric-hydrological modeling systems, such as WRF-hydro, in order to take into account subsurface, overland and river flow. The aim of this study is to investigate the contribution of lateral terrestrial water flows to the regional hydrological cycle, with the help of a joint soil-atmospheric moisture tagging procedure. This procedure is the extended version of an existing atmospheric moisture tagging method developed in WRF and WRF-Hydro (Arnault et al. 2017). It is used to quantify the partitioning of precipitation into water stored in the soil, runoff, evapotranspiration, and potentially subsequent precipitation through regional recycling. An application to a high precipitation event on 23 June 2009 in the upper Danube river basin, Germany and Austria, is presented. Precipitating water during this day is tagged for the period 2009-2011. Its contribution to runoff and evapotranspiration decreases with time, but is still not negligible in the summer 2011. At the end of the study period, less than 5 % of the precipitating water on 23 June 2009 remains in the soil. The additionally resolved lateral terrestrial water flows in WRF-Hydro modify the partitioning between surface and underground runoff, in association with a slight increase of evapotranspiration and recycled precipitation.

### Reference:

Arnault, J., R. Knoche, J. Wei, and H. Kunstmann (2016), Evaporation tagging and atmospheric water budget analysis with WRF: A regional precipitation recycling study for West Africa, *Water Resour. Res.*, 52, 1544–1567, doi:10.1002/2015WR017704.