



High-resolution pan-European multi-model simulations of hydrologic states and fluxes

Bibi S Naz^{1,2}, Wendy Sharples³, Klaus Goergen^{1,2}, and Stefan Kollet^{1,2}

¹Institute of Bio- and Geosciences Agrosphere (IBG-3), Forschungszentrum Jülich, Jülich, Germany

²Centre for High-Performance Scientific Computing in Terrestrial Systems, Geoverbund ABC/J, Jülich, Germany

³Bureau of Meteorology, Melbourne, Australia

High-resolution large-scale predictions of hydrologic states and fluxes are important for many regional-scale applications and water resource management. However, because of uncertainties related to forcing data, model structural errors arising from simplified representations of hydrological processes or uncertain model parameters, model simulations remain uncertain. To quantify this uncertainty, multi-model simulations were performed at 3km resolution over the European continent using the Community Land Model (CLM3.5) and the ParFlow hydrologic model. While Parflow uses a similar approach as CLM in simulating the snow, vegetation and land-atmosphere exchange processes, it simulates three-dimensional variably saturated groundwater flow solving Richards equation and overland flow with a two-dimensional kinematic wave approximation. The CLM3.5 uses a simple groundwater model to account for groundwater recharge and discharge processes. Both models were driven with the COSMO-REA6 reanalysis dataset at 6km resolution for the time period from 2000 to 2006 at an hourly time step, and both used the same datasets for the static input variables (such as topography, vegetation and soil properties). The performance of both models was analyzed through comparisons with independent observations including satellite-derived and in-situ soil moisture, evapotranspiration, river discharge, water table depth and total water storage datasets. Overall, both models capture the interannual variability in the hydrologic states and fluxes well, however differences in performance between models showed the uncertainty associated with the representation of hydrological processes, such as groundwater flow and soil moisture and its control on latent and sensible heat fluxes at the surface.