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Towards improved hydrologic predictions using data assimilation techniques for water resource management at the continental scale

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More accurate and reliable hydrologic simulations are important for many applications such as water resource management, future water availability projections and predictions of extreme events. However, simulation of spatial and temporal variations in the critical water budget components such as precipitation, snow, evaporation and runoff is highly uncertain, due to errors in e.g. model structure and inputs (hydrologic parameters and forcings). In this study, we use data assimilation techniques to improve the predictability of continental-scale water fluxes using in-situ measurements along with remotely sensed information to improve hydrologic predications for water resource systems. The Community Land Model, version 3.5 (CLM) integrated with the Parallel Data Assimilation Framework (PDAF) was implemented at spatial resolution of 1/36 degree (3 km) over the European CORDEX domain. The modeling system was forced with a high-resolution reanalysis system COSMO-REA6 from Hans-Ertel Centre for Weather Research (HErZ) and ERA-Interim datasets for time period of 1994-2014. A series of data assimilation experiments were conducted to assess the efficiency of assimilation of various observations, such as river discharge data, remotely sensed soil moisture, terrestrial water storage and snow measurements into the CLM-PDAF at regional to continental scales. This setup not only allows to quantify uncertainties, but also improves streamflow predictions by updating simultaneously model states and parameters utilizing observational information. The results from different regions, watershed sizes, spatial resolutions and timescales are compared and discussed in this study.