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European extreme events simulations with the fully coupled TerrSysMP

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We present a 20 year (1989-2008) time series of fully-coupled groundwater-to-atmosphere simulation results using the Terrestrial Systems Modeling Platform (TerrSysMP) over the EURO-CORDEX domain at 12km resolution. In the analyses focus is placed on the added value of 3D groundwater dynamics on land-surface and atmosphere feedback processes to reproduce extreme events as heat waves and intense precipitation.

In previous studies, the capacity of current available regional climate models (RCMs) of reproducing heat waves in the past two decades has been examined and compared to observational reference data. In this study, we interrogate, whether the 3D representation of groundwater dynamics potentially improves simulated spatial variation of soil moisture and therefore better captures the feedbacks between land-surface and atmosphere at the climate time scale.

The present long-term simulations allow further investigation on the capacity of the model to represent extremes and climatological annual and seasonal mean values. TerrSysMP simulations are compared to observations (ECA&D data set) but also to the outputs of other EURO-CORDEX models, focusing particularly on climate indices to evaluate the added value of including groundwater dynamics to the simulation of extreme events. In addition to the typical atmospheric and land surface variables simulated by RCMs, the fully coupled model provides the climatology of groundwater depth and ground water recharge, improving our understanding of past evolution of the water cycle at the continental scale.