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Impact of downscaled atmospheric forcing on surface energy flux partitioning

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Dynamical processes in the atmosphere, at the land surface and within the subsurface act at their intrinsic spatial and temporal scales. With increasing computational power, integrated modeling platforms such as the Terrestrial Systems Modeling Platform (TerrSysMP) coupling atmospheric component model COSMO, land surface model CLM and hydrological subsurface model ParFlow are increasingly used to account for interactions and feedback processes between the components in a scale consistent manner. TerrSysMP exploits the mosaic approach for the land surface and groundwater model to improve flux estimates, but typically neglects subscale variability of the near-surface atmosphere. An appropriate atmospheric downscaling which recovers subscale variability of the near-surface atmospheric variables (temperature, wind speed, etc.) might further improve flux estimates as well as the simulation of threshold dependent processes such as snow melt or soil freezing.

Different downscaling techniques using spline-interpolation, linear regression, simple noise generators and genetic programming have been developed during the past years and implemented in the OASIS3 coupling interface of the TerrSysMP. In this study, we report on the different downscaling techniques, along with their application in a sensitivity study using both offline runs with CLM and coupled runs with COSMO-CLM over the western part of Germany. The results from the sensitivity study are used to address the following specific questions: 1) How strong is the influence of atmospheric downscaling on the simulated fluxes?, and 2) Is the influence systematic, e.g., does downscaling increase spatial and/or temporal variability of latent and sensible heat flux?