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Impact of model coupling and grid scale on diurnal catchment ET patterns - a verified model approach with WRF-HYDRO-NOAH-MP

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The energy balance over temperate catchments can significantly influence convective processes and is inherently shaped by soil-vegetation-atmosphere (SVA) feedbacks, such as turbulence characteristics. Up until now though, the impact strength of model land surface-atmosphere coupling on catchment evapotranspiration (ET) is still unclear and has not been fully investigated via comparison of coupled and non-coupled models. Furthermore, simulations are often conducted at scales of 2 - 4 km, where turbulence is necessarily parameterized and the representation of elevation, soil and land use data is necessarily coarser than finer scale grid resolutions. It is not known whether spatially distributed and mean catchment ET would change significantly at finer grid scales which incorporate explicitly resolved turbulence and a more detailed land surface representation.

Catchment simulations at 2700, 900, 300, and 100m scales were conducted with the WRF-Hydro-NOAH-MP model over the Attert catchment in Luxembourg. The model was verified with surface energy balance observations including turbulent fluxes and with aircraft multi-spectral observations. Then, spatial mean and variance of the distributed energy balances were examined and compared at the different grid scales. The coupled model results were also compared with offline simulations to assess the impact of coupling on the same quantities.

Such comparisons of model scale and investigation of feedback strength on catchment ET has profound implications both for process understanding and for the identification of minimum model grid resolutions for effective catchment simulations.