Results from a full coupling of the HIRHAM regional climate model and the MIKE SHE hydrological model for a Danish catchment - DTU Orbit (03/10/2019)

Results from a full coupling of the HIRHAM regional climate model and the MIKE SHE hydrological model for a Danish catchment

A major challenge in the emerging research field of coupling of existing regional climate models (RCMs) and hydrology/land-surface models is the computational interaction between the models. Here we present results from a full two-way coupling of the HIRHAM RCM over a 4000 km × 2800 km domain at 11 km resolution and the combined MIKE SHE-SWET hydrology and land-surface models over the 2500 km2 Skjern River catchment. A total of 26 one-year runs were performed to assess the influence of the data transfer interval (DTI) between the two models and the internal HIRHAM model variability of 10 variables. DTI frequencies between 12 and 120 min were assessed, where the computational overhead was found to increase substantially with increasing exchange frequency. In terms of hourly and daily performance statistics the coupled model simulations performed less accurately than the uncoupled simulations, whereas for longer-term cumulative precipitation the opposite was found, especially for more frequent DTI rates. Four of six output variables from HIRHAM, precipitation, relative humidity, wind speed and air temperature, showed statistically significant improvements in root-mean-square error (RMSE) by reducing the DTI. For these four variables, the HIRHAM RMSE variability corresponded to approximately half of the influence from the DTI frequency and the variability resulted in a large spread in simulated precipitation. Conversely, DTI was found to have only a limited impact on the energy fluxes and discharge simulated by MIKE SHE.

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