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On the performance of integrated hydrologic models in simulating catchment scale land surface fluxes

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Improved estimation of catchment scale land surface fluxes requires proper representation of physical processes in hydrologic models. Traditionally, land surface models with simplified representation of subsurface flow have been used to provide catchment scale evapotranspiration (ET) and recharge estimates. Recently, a number of physically-based coupled surface water-groundwater models with different coupling schemes have been developed to represent feedback processes between surface and subsurface hydrologic systems. Here, the ParFlow modelling package coupled with the Common Land Model (CLM) is used to simulate 3-D variably saturated groundwater flow and surface water and energy balances at the land surface. The study area is a 200 km2 catchment at Ringkobing Fjord catchment, Denmark where observational data including climatic forcing, groundwater levels and stream discharge are available for the period 2001-2009. Land use in the catchment is dominated by agriculture and forest. A series of sensitivity analysis were performed to investigate the impact of parameter uncertainty on recharge and ET estimations. Further, impacts of water table depth on land energy budget are explored. It is expected that through better understanding and characterizing the groundwater-surface water-atmosphere hydrological interactions at local and regional scales, an improved capacity to examine impacts of climate variability and land cover change on groundwater resources will result.