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Validation of a coupled hydrological and meteorological model system for investigating feedback effects

J. Overgaard, (1,2), M. Butts (1) and **D. Rosbjerg** (2)

(1) DHI Water & Environment, Agern Allé 5, DK-2970 Hørsholm, Denmark (Email: jov@dhi.dk/Fax: +45 4516 9292), (2) Environment & Resources DTU, Technical University of Denmark, DK-2800 Kongens Lyngby, Denmark (Email: dr@er.dtu.dk/Fax: +45 4593 2850)

Understanding of the interaction within the land surface hydrological processes is key to determining the effect of land-use change and climate change on the hydrological systems. Traditionally, the hydrological impacts of climate change have been based on driving hydrological models with the output of region climate models. This approach ignores the feedbacks between the hydrological and meteorological system. These climate models often operate at spatial and temporal scales that are much larger than the scales required to analyse the effects on the hydrological system. This is in part because of computational limitations and in part because of the physics of the regional models do not justify much higher resolution. Furthermore, there is an inherent contradiction in this approach since these climate models include their own hydrological model component. Similarly, in analysing the hydrological effects of land-use change the feedback to the meteorological system is often neglected.

To address these issues a coupled hydrological and meteorological model system for evaluating interactions at hydrological (catchment) scales has been developed. A comprehensive hydrological modelling system describing the terrestrial component of the hydrological cycle has been modified to allow coupling to a local scale meteorological models. The hydrological mode includes both catchment rainfall-runoff processes and routing and hydraulic processes in the river system. As simulations can be run with and without coupling to the meteorological model, it is possible to evaluate the impact of feedbacks between the two systems on hydrological predictions.

The uncoupled system is first validated against eddy correlation measurements at the field scale. The coupled system is then validated against field data describing both the

atmosphere and hydrological system. Finally, a sensitivity analysis is carried out to examine the sensitivity of hydrological predictions to atmospheric feedbacks.