Geophysical Research Abstracts, Vol. 8, 09829, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09829

Linked from below — The impact of shallow groundwater dynamics on the spatial variability of soil moisture along hillslopes

Patrick W. Bogaart (1), A. (Ryan) J. Teuling (1), Peter. A. Troch (1,2)

(1) Hydrology and Quantitative Water Management Group, Wageningen University, The Netherlands, (2) Department of Hydrology and Water Resources, The University of Arizona, Tucson, AZ. (patrick.bogaart@wur.nl / Phone: +31-317-484017)

Because land-atmosphere evapotranspiration fluxes are nonlinearly dependent on soil moisture content, information on spatial variability of soil moisture is required for making reliable estimates of area-averaged fluxes on a large scale. On this poster we investigate the hypothesis that the lateral water movement on hillslope scale that is caused by perched groundwater table dynamics, does affect soil moisture spatial variability.

We model the unsaturated zone with a one-dimensional daily water balance model, and the perched groundwater table dynamics with the semi-distributed hillslope-storage Boussinesq model. The models are fully coupled because the unsaturated zone generates recharge of the perched groundwater table, and rising groundwater tables may limit drainage from the unsaturated zone.

We run a series of numerical experiments in which a field of unsaturated zone columns, with spatially variable soil properties, are coupled to a single perched groundwater aquifer. This setup then forms a single, convergent, hillslope. In a control experiment, the soil columns are not coupled to the aquifer. Both these models are subjected to a prescribed artificial climate, consisting of rainfall events embedded within a seasonal climatology.

We find a strong effect of the aquifer on resulting spatial variability in soil moisture. During the ‘relatively-cold-and-wet’ part of the cycle, the spatial variability is twice that of the control experiment. This is caused by the formation of a (near) saturated

zone at the lower part of the hillslope. While small-range soil moisture variability is decreased, due to the rising water tables, large range (i.e. hillslope-scale) variability is increased.