Geophysical Research Abstracts,
Vol. 11, EGU2009-2949, 2009
EGU General Assembly 2009

Use of boundary layer scintillometer data for spatially distributed hydrologic model validation

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An accurate understanding of the behavior of the different water and energy balance terms at the catchment scale is of interest for hydrologic modeling and operational flood forecasting. Flood forecast models are usually based on two different kinds of meteorological inputs, more specifically the catchment averaged precipitation and evapotranspiration rates. These are then related to the catchment discharge through a number of conceptual equations, of which the parameters are tuned through a comparison of the modeled discharge to observations.
The most difficult meteorological forcing to quantify is the catchment averaged evapotranspiration rate. More specifically, evapotranspiration rates are spatially very variable, are rather expensive to measure at small spatial scales, and up till present cannot be continuously observed at the catchment scale. The scintillation method is an attractive alternative for a routinely observation of the sensible heat flux across large distances. These can then be converted into evapotranspiration rates at large spatial scales.

This research is conducted entirely in the catchment of the Dender in Belgium. For this catchment, a fully process-based spatially distributed water and energy balance model has been calibrated, based on observed discharge rates, and point-scale Bowen Ratio Energy Balance (BREB) observations of the net radiation and latent, sensible and ground heat fluxes.

The objective of this presentation is to validate this hydrologic model with sensible heat fluxes from a boundary layer scintillometer. These fluxes are observed over a distance of approximately 10 km in the catchment. Using the hydrologic model results, methods can then be derived to directly convert the scintillometer data into spatially averaged evapotranspiration rates, which can then be used by flood forecast models as model forcing.