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Comparison of evapotranspiration estimates using the water balance and eddy correlation methods

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Closing the water balance at plot scale based on independent measurements of precipitation, recharge and changes in moisture content is subject to uncertainty due to measurement errors and uncertainties, but it is not expected that the errors are biased. The eddy correlation method is considered as the most reliable method for measuring the energy fluxes above the land-surface. However, it is a well-documented fact that the energy balance cannot be closed by using this method and that the error is subject to bias. The available energy, i.e. the sum of the net radiation and the ground heat flux, is, in most cases, found to be larger than the sum of the turbulent fluxes of sensible and latent heat.

Evapotranspiration is a shared component in both the water balance and energy balance equations. In this study, we analyze and compare evapotranspiration estimates from eddy covariance with evapotranspiration calculated from the water balance approach for different temporal resolutions to identify systematic correlations and deviations.

The study is based on data from a field observatory, which is part of the Danish Hydrological Observatory (HOBE). State-of-the-art instrumentation, i.e. WMO reference precipitation gauge, time-domain reflectometry and deep percolation lysimeters, is used to quantify the various water balance elements while in- and outgoing energy fluxes are measured using eddy correlation instrumentation installed in a flux tower.

Our hypothesis is that the imbalance in the energy balance using the eddy covariance method is to a less degree caused by errors in the latent heat estimates but can mainly be referred to errors in the other energy flux components. Such a finding would be important for the use of latent heat flux measurements for hydrological purposes.