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# Different methods to derive evapotranspiration from lysimeter measurements

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The determination of the water balance parameters precipitation (P), leachate (L), evapotranspiration (ET) and storage change (ΔS) plays an important role for understanding the processes within the interface atmosphere, vegetation, soil and groundwater. Furthermore, these parameters are also required for the calibration of environmental models (e.g., vadose zone models), which can be applied at larger areas for managing water resources at the aquifer scale.

Weighable lysimeters are qualified tools to measure the water balance parameters in-situ in high temporal resolution. However, there exist different methods to derive evapotranspiration from lysimeter measurements. A simple approach uses precipitation measurements by external gauges and determine ET = P – L – ΔS for certain time steps. This method implicates precipitation gauge errors (e.g., due to wind loss, wetting loss, evaporation loss and due to in- and out-splashing water drops), which are transferred to ET calculation. Measuring errors can be reduced by a larger area of the measuring gauge´s surface and positioning the collecting vessel at ground level. Large weighing lysimeters are integrated into their typical surrounding and avoid oasis effects. Thus, lysimeter provide a perfect situated measuring tool for quantifying precipitation by measuring the positive mass changes as well as evapotranspiration by measuring the negative mass changes of the upper boundary fluxes. Though, this method implicates external effects (background noise, influence of vegetation and wind) which affect the mass time series. While the background noise of the weighing is rather well known and can be filtered out of the mass time series, the influence of wind, which blows through the vegetation and affects measured lysimeter mass, cannot be corrected easily since there is no clear relation between wind speed and the measured outliers of lysimeter mass. Moreover, the influence of random noise is dependent on the evaluation interval, lysimeter design, load cells etc. The “averaging method”, where measured lysimeter masses are averaged over a certain period of time (e.g., 1 min lysimeter mass measurements are averaged to a 10 min mean) would minimize the problem of random noise, but is not able to consider short mass change events. Another method uses threshold values to separate random noise from real mass changes (mass changes smaller than the threshold are not counted as P or ET). This “threshold method” does still have limitations, because an adequate threshold is dependent on the occurring event (smooth evaporation, heavy precipitation or strong wind) and, therefore, need to be adjusted over the time. The most sophisticated method (“AWAT”) combines a moving average with a variable window width and a variable threshold value (Peters et al., 2014). The presented work shows a comparison between the above mentioned methods for a lysimeter from

Wagna test site (Austria).

Peters, A., T. Nehls, H. Schonsky, G. Wessolek (2014): Separating precipitation and evapotranspiration from noise – a new filter routine for high-resolution lysimeter data. Hydrology and Earth System Sciences 18, 1189-1198.