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High-resolution estimation of the water balance of high-precision lysimeters

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Lysimeters offer the opportunity to determine precipitation, evapotranspiration and groundwater recharge with high accuracy. In comparison to other techniques, like Eddy-flux-systems or evaporation pans, lysimeters provide a direct measurement of evapotranspiration via the built-in weighing system. The measurement of precipitation can benefit of the much higher surface area compared to typical rain gauge systems. Nevertheless, lysimeters are exposed to several external influences that could falsify the calculated fluxes. Therefore, the estimation of the relevant fluxes requires an adequate data processing, while accounting for the various possible error sources. Most lysimeter studies correct noise in the data by applying a smoothing of the data using a time window of about one hour. These high averaging times can lead to a falsification of the water balance and a loss of information on the dynamics of the processes.

In the present study, we present a processing scheme which is based on five filter components that refer to different possible error sources and allow a simple implementation. We further use a set of 12 crop lysimeters and 6 grass lysimeters of the TERENO SoilCan research site Bad Lauchstädt to show that a temporally highly resolved data processing of lysimeter data with a high temporal resolution and good accuracy is possible.