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Towards a bias-free filter routine to determine precipitation and evapotranspiration from high precision lysimeter measurements

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Weighing lysimeters are known to be the best means for a precise and unbiased measurement of water fluxes at the interface between the soil-plant system and the atmosphere. The measured data need to be filtered to separate evapotranspiration (ET) and precipitation (P) from noise. Such filter routines apply typically two steps: (i) a low pass filter, like moving average, which is used to smooth noisy data, and (ii) a threshold filter to separate significant from insignificant mass changes. Recent developments of these filters have revealed and solved many problems regarding bias in the data processing. A remaining problem is that each change in flow direction is accompanied with a systematic flow underestimation due to the threshold scheme.

In this contribution we show and analyze this systematic effect and propose a heuristic solution by introducing a so-called snap routine. The routine is calibrated and tested with synthetic flux data and applied to real data from a precision lysimeter for a 10-month period. We show that the absolute systematic effect is independent of the magnitude of a certain flux event. Thus, for small events, like dew or rime formation, the relative error is highest and can be in the same order of magnitude as the flux itself. The heuristic snap routine effectively overcomes these problems and yields an almost unbiased representation of the real signal.