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Processing and comparison of two weighing lysimeters at the Rietholzbach catchment

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Weighing lysimeters are a well-established means of accurately obtaining local-scale estimates of actual evapotranspiration and seepage within soils. Current state-of-the-art devices have very high temporal resolutions and weighing precisions, and can also be used to estimate precipitation. These, however, require complex filtering to first remove noise (e.g. resulting from wind influence) from the mass measurements. At the Rietholzbach research catchment in northeastern Switzerland, two weighing lysimeters are in operation. One is a recently-installed state-of-the-art mini-lysimeter with a pump-controlled lower boundary; the other is a large free-drainage lysimeter in operation since 1976. To determine the optimal processing approach for the mini-lysimeter, a number of reported approaches were applied, with the resulting evapotranspiration and precipitation records being compared to those of the large lysimeter and a tipping bucket, respectively. Out of those examined, we found the Adaptive-Window and Adaptive-Threshold (AWAT) filter and a similar, non-adaptive approach, to perform best. Using the AWAT-filtered mini-lysimeter data as a reference, additional, retrospectively-applicable processing steps for the large lysimeter were then investigated. Those found to be most beneficial were the application of a three-point (10-min) moving mean to the mass measurements, and the setting-to-zero of estimated evapotranspiration and condensation in hours with greater-than-zero reference tipping bucket precipitation recordings. A comparison of lysimeter mass increases associated with precipitation revealed that the large lysimeter experiences a previously unknown under-catch of 11.1% (for liquid precipitation). Daily seepage measurements were found to be generally greater from the mini-lysimeter, probably reflecting the reduced input of water to the large lysimeter due to this under-catch.