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Autocorrelation analysis of high resolution weighing lysimeter time series for determining precipitation

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The accurate estimation of precipitation (P) is still a challenge, but imperative for calculating the soil water balance. Weighing lysimeters are proposed to quantify water balance components by experimentally determining mass changes and deep drainage rates. For high precision weighing lysimeters, P is potentially extractable from high-resolution time-series' of mass changes. For the quantification, positive values of lysimeter mass changes, ΔM, are assumed to indicate P and negative values to represent evapotranspiration. However, the data of ΔM are temporally auto-correlated and contain various noises. The objective of this study was how to deal with the autocorrelation and noise in order to obtain corrected values of P for uncorrelated time intervals. The corrected minute-based time series' have been averaged for time intervals of t = 60, 30, 10 minutes and compared. Resulting P-values varied up to more than 20 % at a temporal level of months. The use of a moving average before reducing data noise, did not completely remove errors indicated by differences between the three averaging time intervals. We found characteristic temporal autocorrelations for precipitation time series'. When using averaged values longer than the autocorrelated time lags for calculation of P, the results improved as demonstrated for four different seasons with contracting regimes of precipitation rates. Except for periods characterized by summer storm events, temporal autocorrelation was present up to about 60 minutes. Results suggest that P was overestimated when the averaging intervals were below t = 60 min as compared to reference data. The autocorrelation analysis improved the calculation of P from weighing lysimeter data.