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Fine resolution soil water fluxes measured with a small Smart Field Lysimeter: The noise removal and further interpretation

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A weighable Smart Field Lysimeter (30 cm diameter, 30 cm depth) with an adaptively regulated suction at its bottom was used to measure soil water fluxes at the surface and at the 30 cm depth of a short grass stand. No overland flow or accumulation of water at the surface were observed and there was no groundwater table within the soil profile. Appropriate distinction between the fluxes of different directions made it possible to separately estimate actual evapotranspiration (upward surface flux), precipitation and condensation (downward surface flux and dew on grass leaves), percolation (downward flux at 30 cm) and capillary rise (upward flux at 30 cm). The primary data were collected at 1 minute intervals but required digital filtering to remove the information noise. Various methods of filtering were tested, with a special regard to intensive rain events. The resulting data have a 10-minute resolution. The lysimeter is capable of self-recovery after a period of drought but the noise of percolation and capillary rise estimates is enhanced for some time during, before and after this period. In these situations, it is important that a porous matrix sensor measures the suction in parallel to the reference tensiometer. Both the precipitation and the actual evapotranspiration derived from the lysimeter data alone are in absolute values higher than the analogous quantities obtained with the help of the directly measured tipping bucket precipitation. These discrepancies are probably due to the rain gauge underestimating true precipitation, but partly also due to numerical noise, however smoothed. If the rain gauge data are used only to distinguish the periods of rain from the rainless periods, than the condensation of water in the soil and on the grass leaves can be estimated. The actual evapotranspiration measured by the lysimeter has a diurnal patterns depending on actual weather. The maximum occurs, on average, shortly after the noon. The percolation curves after rain events make it possible to estimate the soil hydraulic properties on the principle of the outflow method.