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Hydrology and
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Discussions

Interactive comment on "Novel evaporation experiment to determine soil hydraulic properties" *by* K. Schneider et al.

K. Schneider et al.

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General comments

The method proposed may indeed be used as a complement to the traditional MSO method with the combination of the two covering the entire range of interesting water contents and potentials. While in the present paper, we used MSO merely for quickly conditioning a coarse-grained column to save experiment time, the setup could easily be modified to combine the two methods by applying the boundary conditions at the same end. In the current setup, switch-over changes the direction of the water in the column and leads to undesirable hysteresis effects, as is also mentioned in the paper.

Concerning the applicability of MSO, we certainly agree with the referee that potentials must be considerably higher than -100 kPa. Our experience is that -20 kPa can be

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achieved with reasonable experimental effort. The value of -100 kPa was given in the paper as a fundamental limitation.

Concerning the title, we would like to stick to “novel evaporation experiment . . . ” since indeed we do not focus on MSO *per se* and its well-known limitations and neither do we consider the optimal combination of the two methods for a full range measurement.

Specific comments

(1) The referee asks for the measurement precision of vapour pressure and potential measurements. The errors of the measurements are discussed in the description of the test of the gas analyser, section 3.2, and the error analysis, sections 5.1 and 5.2: the error of the absolute water vapour concentration measurement is 0.05 mmol/mol (the absolute value was calibrated every hour), of the relative concentration measurement 0.016 mmol/mol (the concentration difference was calibrated every 8 hours), of the pressure measurement ± 0.05 kPa and of the temperature measurement 0.2 K. As the total error stems from many sources and varies in time due to varying observables, the relative errors were plotted against time in Figures 10 and 13. For typical values, $p_{\text{tot}} = (90 \pm 0.05)$ kPa, $T = (295 \pm 0.2)$ K and $x = (6 \pm 0.05)$ mmol/mol the vapour pressure precision is 5 Pa and the potential (-215 ± 2) MPa. On the other hand, at 95 % relative humidity, we would have $x = (27.71 \pm 0.05)$ mmol/mol and $p_w = (2.49 \pm 0.01)$ kPa, but $\psi = (-7.0 \pm 1.8)$ MPa as the potential depends logarithmically on the vapour pressure. At 99 % humidity, it would even be $\psi = (-1.4 \pm 1.8)$ MPa which is certainly an upper limit for measurable potentials. We added these typical error values to a revised version of the paper.

(2) Of course our diffusion model is only an approximation and the relationship between the diffusion coefficient in soil and free air may in fact depend on the soil water retention curve as stated by the referee. Notice however, that the only quantities estimated through the inversion are the values of the Brooks-Corey parametrisation. We only separate liquid water flow and vapor transport for the formulation of the numerical

model. As (11) illustrates, the two cannot be separated with this type of experiment. Furthermore, as with all inversions, any model inaccuracy, here of the diffusion coefficient, would be absorbed by the parameter values. Of course, this is only possible to the extent that the general form of the parametrisation is flexible enough. The very good agreement between the measurements and the inverted model makes us confident that we have found a reasonable effective description.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 1215, 2006.

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