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Hydrology and Earth System Sciences Discussions

Interactive comment on "Numerical study of the evaporation process and parameter estimation analysis of an evaporation experiment" *by* K. Schneider-Zapp et al.

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General Comments

This work investigated the effect of multi-step atmospheric boundary condition on reliability of determined hydraulic functions including dry range in which traditional evaporation methods using tensiometers can not cover. This topic would be informative for many readers of HESSD and manuscript is generally well written. However, there are several points to be corrected or clarified before acceptance for publication. As the authors admit, the experimental setup causes drop in soil temperature in the initial

stage. Latent heat loss must be compensated by horizontal and upward conduction from the column walls. I would recommend to improve the experimental setup such that automatically-controlled radiation keeps the soil temperature the same as ambient one. The authors also admit that the multistep procedure forces the investigator to consider hysteresis for accurate determination of hydraulic properties. I suppose that the effect of hysteresis is not critical in low pressure head range. However, the authors should evaluate the validity of neglecting hysteresis. A simple hysteresis model such as Scott et al. (1983) may be valid and the authors are able to do it. I think that additional retention data using vapor equilibrium or psychrometer are required to precisely determine retention curve in dry range. Deviation from "true" retention function may be avoided if such information is provided.

Specific Comments

P7389L5: Realistic hydraulic functions should be used in numerical experiments. In my knowledge, van Genuchten's hydraulic functions are not suitable for describing hydraulic functions in low pressure (dry) range. I have never seen a soil that can be appropriately fitted with van Genuchten's retention curve in whole saturation range. The authors should consider to use Fayer's or similar hydraulic functions proposed to cover dry range. (Fayer, M.H. and Simmons, C.S. (1995) : Modified soil water retention functions for all matric suctions. Water Resour. Res.,31: 1233-1328)

P7391L12: Table 1 and Fig.16. Again, realistic hydraulic functions should be used. I have never seen a sandy loam whose saturation becomes zero at -100 kPa or silt whose saturation becomes zero at -1 MPa. The authors should use parameter values that have measured including dry range.

P7391L21: Table 3. Accuracy in the measurement of Jw should be given in absolute value (mm/h), not in relative one (%), because it depends on accuracy in the measurement of air humidity or weight of the core. In Fig.15, standard deviation of Jw seems to be around 0.01 mm/h with an interval of about 1h. I think it is unrealistic to

assume such a high accuracy. Usually, it is difficult to measure sharp drop or increase in evaporation rate as shown in Fig.8 and 15.

P7400L16: Regime does not back to Regime I. In Regime I, evaporation rate must be constant under a constant meteorological condition and soil temperature. In Fig.15, no such stage is found in (b) and (c). In (a), the second constant evaporation rate was formed before entering Regime II.

Figure 15: Why initial evaporation rate could not be reproduced for the rejected ones? Usually, rb can be determined from the initial evaporation rate and thus should not be treated as a fitting parameter.

Technical Comments

P7387L17: At this line, psi_m has not been defined. P7387L21: Generally, "matric potential" is used to refer pressure in soil water. Please consider to replace "matrix potential" to "matric potential". P7388L9: measurand –> measurement? P7389L9: theta is not defined. P7390L10: "of atmosphere" should be added after "partial pressure of water vapour". P7392L20: Please consider to add "value" after "jth parameter".

P7395L16 Definition of "saturated hydraulic resistance" is unclear. P7401L2: At which depth does the changes in the sign of delta-h occur? What is h? Figure 16: Scale of potential should be unified among the three figures.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 7385, 2009.