Hydrology and Earth System Sciences Discussions

Interactive comment on "

Capillary rise quantification by field injection of artificial deuterium and laboratory soil characterization" *by* O. Grünberger et al.

Anonymous Referee #2

Received and published: 29 November 2010

Gruenberger et al. present a field study on a tracer experiment to determine steady-state moisture fluxes from a shallow water table toward the landsurface due to evaporation. Results are juxtaposed with simple calculations of 1D steady-state Darcy-Buckingham equation using van Genuchten moisture-retention approximation, and numerical simulations.

Application of the proposed tracer technique in conjunction with equation 1 hinges

on the steady-state assumption or the assumption of some dynamic equilibrium over longer time periods. It is not clear to me why the authors put this assumption in quotation marks throughout the manuscript and state that "no hypothesis around steady state water regime is compulsory" in the conclusion section. Clearly, equation 1 is based on the steady-state assumption, and any deviation from this assumption may lead to erroneous results. The authors do not convince the reader that the system was at steady state over the course of the experiment nor do they provide an assessment of the impact on the results if the steady-state assumption was violated. Additionally the impact of soil heterogeneity, which is not considered as I understand, is barely mentioned. In my opinion, the study and manuscript requires considerable improvements which are beyond major revisions. Therefore, unfortunately, I can not recommend the manuscript for publication. Please find more specific comments below.

Site description - The climatology is incomplete. The authors talk about the piezometric level of the free water table. How was the water table measured exactly, with a piezometer screened at a certain aquifer depth or with an observation well screened across the free water table? It is stated that the water level was at a depth of 2.44m at the beginning and at the end of the experiment. Does that mean that the water level was exactly at 2.44m and did not change at all over the course of the experiment? It would be very satisfying in the assessment of the steady-state assumption and the Hydrus results to have a plot of the time series of water table depth over the course of the experiment. From analytical and/or numerical considerations it becomes obvious that even small changes in water table depth will have considerable transient impacts on the soil moisture profile over the time scale under consideration. This has also been shown in previous studies.

Section 2.3 - The first paragraphs on the inversion are difficult to follow. What do the authors mean by observation nodes data, etc.? Definition of the coordinate system is missing that determines the sign in equation 4. The part on the integration can be omitted, since standard techniques are available today (I am not sure why the authors

resorted to a spreadsheet application, which may be highly inaccurate). If the part on the integration is retained in the manuscript the comparison with the numerical solution using Hydrus needs to be shown.

Section 3.1 - This section is convoluted and difficult to read in my opinion. Where are the results from Hydrus simulations for shallow depths (<50cm) in Figure 2?

Section 3.2 - Again, this section is convoluted and difficult to read in my opinion. Lines 5 to 6, where do I find the values 0.59 to 3.46 in Table 1? Looking at the values I see a range from 0.1 to 3.74. Also on line 7, where do I find the range 0.8 to 1.2? I believe I see a range of 0.47 to 1.71, although "Average" in Table 1 is not defined as the geometric average. Table 1 is difficult to understand and the caption is incomplete.

Section 3.3 - Extrapolating the flux estimates from a 35 day experiment to a yearly average is a stretch in my opinion. How was the best fit of Hydrus-2D obtained with the measurements? Did the authors simultaneously fit moisture content and 2H content?

Section 4 - In the section, the authors introduce the term "stability" in the evaporation state as the major assumption in the calculation of the fluxes. Do they mean steady-state? If so, why to they put stead-state in quotation marks through the manuscript and introduce a new and ambiguous term here? In the following, the authors refer to a long-term Hydrus simulation without providing a reference or additional specifics and results. This is unsatisfying for the reader and does not support the results and findings of the study.

The language is sometimes convolute and often ambiguous in my opinion. Some sections are difficult to follow such as section 3.1 and 3.2. Therefore, I recommend careful restructuring, and language and grammar editing. The figures are useful though the captions need to be expanded. In figure 2, a legend is missing. Table 1 contains a lot of information that needs to be explained more clearly in the caption and in the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 7757, 2010.