Hydrol. Earth Syst. Sci. Discuss., 6, C189–C191, 2009
www.hydrol-earth-syst-sci-discuss.net/6/C189/2009/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Diurnal pattern of the drying front in the desert and its application for determining the effective infiltration" *by* Y. Zeng et al.

Anonymous Referee #1

Received and published: 1 April 2009

In this paper, the authors intended to show numerically the detailed behavior of water, vapor, and heat at the Badain Jaran Desert in China before and after the rainfall using the HYDRUS-1D program. This is a relevant study not only for those interested in water and heat transport in soils but also for those interested in vegetation in arid and/or semi-arid regions. Below are my comments on this paper.

Many explanations appeared in 2.3.3 related to the soil surface boundary condition are, I think, not correct. In this version of HYDRUS, the "actual" but not "potential" evaporation rate is calculated using Eq. (10). Eq. (8) is then not applicable. Eq. (8) has been used in HYDRUS to mimic actual evaporation from the soil surface even

when vapor transport has not been considered. As for h_s, the authors said that it was set to zero because there was no runoff. That is incorrect. When h_s is set to zero, all excess water is removed as "runoff." If the user does not want to consider any runoff, a finite value, e.g., 10 mm, has to be assigned for h_s. For both cases, please see the HYDRUS manual for details.

In Figure 7(a), the authors divided the domain into two types, A- and B-type, based upon the behavior of downward fluxes. Although the authors took downward fluxes appeared in the bottom part of the domain something significant and meaningful, I think those downward fluxes are merely the effect of the zero-gradient boundary condition (free-drainage) applied to the lower bottom. The zero-gradient boundary condition keeps the bottom flux equal to the unsaturated hydraulic conductivity that corresponds to the pressure head at the bottom. This means that no matter how dry the soil is at the bottom, there is always a downward flux across the bottom boundary during the simulation. I think that is the reason there is a continuous darker area observed in Fig. 7(a). If so, the whole discussions related to A- and B-type need to be revisited.

In Introduction and the following chapter, the authors talk a lot about the Badain Jaran desert. However, in Results and Discussion and Conclusions, there is almost no single word or discussion related to this particular desert. This is very odd. I think the originality of this work comes mainly from this particular desert as simulation tools are not something new. Therefore, the authors need to add more discussions related to the Badain Jaran desert.

I have some minor comments as well.

1. P1031 L16: Is this model fitted to the laboratory measured retention curve or to the field measured curve? Please make it clear.

2. P1033, L23: Just for correctness, heat transport is not part of the Richards equation.

3. Fig. 4 and related texts: Although simulated water contents do not show diurnal

cycles before the rainfall, observed water contents show clear daily variations. Why simulated water contents do not show such variations?

4. P1036, L18-21: I don't understand this statement.

5. P1036, L27-28: I think almost everybody knows that the soil temperature amplitude decreased with depth. There is no need to write it down.

6. P1038, L5-8: Contradiction? Darker areas correspond to downward fluxes, which are negative fluxes. How come positive fluxes are greater than negative fluxes?

7. P1040, L17-20: I don't understand

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 1021, 2009.