The paper is well written and well-illustrated. It is quite easy to read and suitable for publication in HESS. It requires some revision before publication (see comments below).

Comments

Richards equation is linearized with a one step Newton-Raphson scheme. How is the scheme's accuracy checked? Depending on the time step length and/or the parameter values used in the closed-form equations, the scheme accuracy is difficult to verify. Moreover, how do you handle boundary conditions that depend on the variable value like seepage?

Evaporation is assumed to take place in the first layer of one centimeter (L178). This is a very strong assumption that will limit evaporation. Please justify.

No information is provided about the intercepted rain for the lysimeters with vegetation. Is it neglected?

The artificial addition of the fine layer of 5cm (L183) is not convincingly justified. Seepage boundary conditions do not need an additional layer. To my knowledge, Tifafi et al. (2017) or Séré et al. (2012) did not use an additional layer. Please justify. Moreover, the hydraulic parameters of this layer may significantly impact drainage.

Considering hydraulic conductivity as constant over depth is a very strong assumption, especially for lysimeters G4, O1 and O3 (see soil texture Table 1). Please justify. It questions the results obtained for parameters *b* and *n*. The key parameter is the hydraulic conductivity which is a function of hydraulic conductivity at saturation (Ksat) and the relative hydraulic conductivity that depends on *b* and *n*. Therefore, values of *b* and *n* may compensate the assumption of homogeneous Ksat. You may get very similar simulations by taking *b* and *n* constant over depth and varying Ksat… This may also impact your conclusion (L535-536) which is 'limited' to your data and model concept. Please comment.

L342: Please define what is the 'most usable observations', is it related to number, accuracy, variability in time?

§5.1: I do not understand the interest of this paragraph. You show that the soil homogeneity assumption is not appropriate and you perform a sensitivity based on a wrong assumption. This part can be removed.

HESS Data policy. Copernicus Publications requests depositing data that correspond to journal articles in reliable (public) data repositories, assigning digital object identifiers, and properly citing data sets as individual contributions.

Minor comments

L174: “Crank Nicholson implicit”, the time discretization is called usually Crank Nicholson, or Implicit.

L351: typo

L391-392: Are the differences really significant?

L414-415: typo

L440: I guess the mean value is the arithmetic mean? Since BC and VG are non-linear functions, the mean can be defined in several ways (like harmonic mean for hydraulic conductivity in 1D flow).

L514 : This is a numerical limitation related to your numerical model.

Séré et al, not at the right place in the references.