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Hydrology and Earth System Sciences Discussions

Interactive comment on "Precipitation patterns and moisture fluxes in a sandy, tropical environment with a shallow water table" *by* M. R. Minihane and D. L. Freyberg

Anonymous Referee #1

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Review of: Precipitation patterns and moisture fluxes in a sandy, tropical environment with a shallow water table, submitted to HESS by M. R. Minihane, and D. L. Freyberg.

This work investigates the relations between water content dynamics, precipitation dynamics and antecedent water contents, in a shallow sandy vadose-zone, under tropical climate. The investigation is done by analysis of time series of soil water contents (from 0.1, 0.35 and 0.5 m depth, 10 minute time resolution), 15 minutes precipitation, and meteorological data for reference ET calculations. A 1D numerical model of Richards's equation is used for further exploration by simulations. The main results and conclu-

sions are: Water-contents changes at the deeper measurement depths (0.35, 0.5 m) are controlled by the total precipitation depth of the rain event and the antecedent water content, and not by peak rain intensity. A highly significant linear correlation (R2=0.98, n=16) between change in water content at 0.5 m and the product of precipitation depth and antecedent water content was found. Antecedent water content is controlled by time from previous rain event and depth to water-table level, hence, these conditions should be considered when assessing deep percolation and groundwater recharge.

General Comments

1. The simple data analysis revealed all the important and constructive results, while the modeling exercise is not very convincing and adds very little (reading the abstract after reading the paper, I haven't found any result or conclusion in it that was concluded from the model simulations, and haven't been clearly demonstrated before).

2. From the abstract it appears the study aims at the analysis of recharge, yet there are no calculations or estimations of recharge fluxes in the manuscript. I suggest being more accurate both in the abstract and title and not use " moisture fluxes" which are not calculated in this work . $\Delta\theta$ events at 0.5 m are associated with high recharge but the two shouldn't be mixed. Recharge fluxes can be significant also in steady water contents.

3. I assume some data on depth to water-table is available or at least can be estimated from data from nearby locations. It would have been better to introduce the reader to such data rather than only use depth to water-table in simulations to control initial (or before rain) water-content conditions.

4. I suggest two possible passages that can improve the manuscript significantly: 1) Invest more time in calibrating and validating the model to the temporal water-content data, and if possible to water-table level data. This will enable estimation of recharge fluxes, investigating the relationship between change in water-content at depth and recharge, and make any simulation more convincing. The homogenous domain and

a rather arbitrary depth (0.05 m) of the ET sink term (root depth) is too simplistic for use in a 1D numerical model if there is no good match with observations (Figure 8). I presume that a reasonable match between model and observed water –contents can be achieved, with some calibration of hydraulic parameters, sink term depth (can vary with depth), and may be adding a layer. This calibrated model will enable to gain much more from the simulation analysis than the current model that doesn't really improves our understanding or give any estimation of quantities of interest (i.e. recharge fluxes). 2) A minimalistic approach, in which the model part is discarded and we are left with a shorter but much more solid paper, is also a possibility.

Specific Comments

1. Page 8065 line 30 – "Since it . . ." I would have been more cautious with such a statement.

2. Page 8066 line 8 – q in Eq. 1 is either flux, or flow per unit area but not flux per unit area.

3. Page 8066 line 25 – delete "to be able" and delete "to estimate water availability . . .end of sentence.

4. Page 8067 lines 1 and 6 – avoid repletion.

5. Page 8072 line 15 – Reasoning for the chosen sink-term depth distribution.

6. Page 8072 line 25 – 8 m d-1 , before it was reported to be 6 m d-1, explain the difference.

7. Page 8081 line 25 to Page 8082 line 3, - why repeat?

8. Figures 3, 9, 10 11, and 12, I believe the legend should include depths of 0.1, 0.35, and 0.5 m rather than 0.1, 0.2 and 0.3.

9. Figure 5 a, b – it would be good to add the P value of the regression model's slope to assess the significance.

10. Figure 9 a the text on the panel "Results for field measured precipitation" is confusing.

11. Figure 11 a and c look extremely identical, check.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 8063, 2011.