Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-160-AC2, 2017

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Is Annual Recharge Coefficient a Valid Concept in Arid and Semi-Arid Region?" *by* Yiben Cheng et al.

Yiben Cheng et al.

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Received and published: 9 July 2017

I have not up load the revised paper, because the English is checking by a native English speaker right now. I think it will be finished in a few days. But I want to response the comments first.

I generally like this article as it is based on three years of observations and in groundwater hydrology, specifically recharge, there is no substitute for observations are these are far and few.

Response: Thank you for the positive comment.

Specific comments: (1) The authors seem to knock on annual recharge coefficient as well as models and state neither would work. I concur with the first one (annual

recharge coefficient) but I am not so sure that you can make the same statement on models. Most models are complete depictions of hydrological cycle and if done correctly (implying that all the components of the water balance are correct), then recharge should be accurate

Response: This is a nice comment. We have revised the text to only concentrate on questioning the annual recharge coefficient, but the models. As corrected stated by this author, if the model is established properly, recharge should be accurately estimated.

(2) I find the figures 3, 4 and 5 very interesting. However, there is a large component of the infiltrating water that evaporates and if that is not subtracted from the rainfall you cannot estimate the recharge. In fact you cannot just compare 2013 to 2014 to 2015 without accounting for evaporation of the infiltrating water in the inter-storm periods. I think your observation that recharge is dictated by high intensity rainfall is correct; during high intensity (and long duration rainfall) the saturation of the soil profile hastens recharge and decreases evaporation (due to lesser atmospheric demand especially if it is raining!).

Response: This is a nice comment. Firstly, there is no runoff at the studied area which is essential desert and easy to penetrate. Secondly, as stated correctly by this reviewer, the basic idea of lysimeter is water balance. So if the point of measurement is relatively shallow, one must consider evaporation and transpiration process. However, the DSR measurement reported in this study is NOT at relatively shallow depth, instead, it is specifically at a sufficiently deep location (2 m) is to make sure that evaporation and transpiration are both negligible. In another word, the downward DSR measured at such a deep depth is regarded as completely recharging the underneath groundwater aquifer.

(3) A better analysis of length of the storm, atmospheric evaporation demand (should be very easy to calculate) should help in estimating recharge (with a simple model as compared to SWAT or HYDRUS). This will in fact justify your hypothesis that recharge

is dependent on a few high intensity events.

Response: This is an interesting suggestion and certainly will be pursued in a future study to justify the hypothesis that recharge is dependent on a few high intensity events. The purpose of this study, which represents a first step in such an endeavor, is to provide direct field evidences to question the concept of annual recharge coefficient. A complete modeling of the storm, atmospheric evaporation demand will be pursued elsewhere.

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