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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Using measured soil water contents to estimate evapotranspiration and root water uptake profiles – a comparative study" *by* M. Guderle and A. Hildebrandt

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First of all, we would like to thank the anonymous referee #1 for the very useful and constructive comments on the paper (hess-2014-400). We have carefully considered the reviewer's comments and will include them into the revised version of the manuscript. Please find below a point by point response to the reviewer's comments.

Comments 1: The synthetic data of evapotranspiration and soil water uptake was used as reference in the manuscript (Sec 2.3). However, there is not enough statement on the reference data. For example, the accuracy of the synthetic values of evapotranspi-

ration and soil water uptake, the frequency of the input data to get the reference data. I suggest that a more detailed introduction of the reference data should be added. Please make sure that the synthetic data is accuracy enough to be the reference.

Response: We agree with the reviewer's comment that a more detailed introduction of the reference data is needed.

The used weather data to estimate evapotranspiration have a measurement resolution of 10 minutes. Before applying evapotranspiration and rainfall as input data to generate the synthetic reference soil moisture and root water uptake data, both data sets were aggregated to the temporal resolutions applied for the reference run (1 hour). Soil moisture and root water uptake were generated with the same temporal resolution. When translating the evapotranspiration to sink term profiles (precision 4 digits), rounding errors introduce a small in-accuracy. Thus, the sum of the sink term in the reference run deviates by 0.02% compared to the original evapotranspiration.

In-accuracies in our model are especially relevant for the inverse modeling procedure. We have avoided most of these errors, by using the same model set-up for the forward and backward simulations. This was done deliberately, in order to demonstrate that the inverse model performs excellently, when other errors are excluded. Besides the inverse modeling routine, rounding errors may introduce inaccuracies. We have estimated them by running the model forward for 1 to 24 hour steps (wet and dry periods) with rounded sink term profiles, where we reduced the accuracy to the one handled by our subroutine (4 digits for the sink term profiles). The resulting deviation of the volumetric water content from the non-rounded reference are very small (at the maximum on the order of 1e-5, but on average as small as 1e-9).

We agree that this is important to point it out in the manuscript and we will add the accuracy in the revised manuscript.

Comment 2: The "evapotranspiration" in Figure 1, is the actual evapotranspiration or potential evapotranspiration?

Response: The "Evapotranspiration“ in Figure 1 is the actual evapotranspiration. We will change the axis label accordingly in the revised manuscript.

Comment 3: Line 15, Sect 3.1: "The Inverse Model (im) predicted the daily evapotranspiration for a measurement frequency of 24 h with a very small relative bias of 0.89 %" It seems that 0.89% is for the frequency of 12h in Table 2?

Response: Yes, 0.89 % is for the frequency of 12 h (according to Table 2). We apologize for the typing error and we will change it to 12 h in the indicated sentence in the revised manuscript.

Comment 4: Please make the captions for Table 2 and 4 more clear: the model performance for evapotranspiration or root water uptake?

Response: Thank you for the useful suggestion. We will change the captions of Table 2 and 4 in the revised manuscript as follows:

Old

Table 2: Comparison of the model performance of the four data-driven methods regarding time resolution of soil moisture measurements. The model performance is expressed as correlation coefficient R, relative variability in simulated and reference values RV and relative bias (b) for the period 25 July to 26 August 2009. Days at which rainfall occurs were excluded for the data analysis.

Table 4: Comparison of the model performance of the Multi Step Multi Layer Regression and the Inverse Model regarding soil moisture measurement uncertainty. The model performance is expressed as correlation coefficient R, relative variability in simulated and reference values RV and relative bias (b) for the period 25 July to 26 August 2009. The precision uncertainty is abbreviated by prec err, the calibration uncertainty by cali err and the combined uncertainty by com err.

New

Table 2: Comparison of the model performance of the four data-driven methods for reproducing daily evapotranspiration for the particular time resolution of soil moisture measurements. The model performance is expressed as correlation coefficient R, relative variability in simulated and reference values RV and relative bias (b) for the period 25 July to 26 August 2009. Days at which rainfall occurs were excluded for the data analysis.

Table 4: Comparison of the model performance and with considering soil moisture measurement uncertainties for the Multi Step Multi Layer Regression and the Inverse Model for reproducing daily evapotranspiration. The model performance is expressed as correlation coefficient R, relative variability in simulated and reference values RV and relative bias (b) for the period 25 July to 26 August 2009. The precision uncertainty is abbreviated by prec err, the calibration uncertainty by cali err and the combined uncertainty by com err.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 10859, 2014.