Hydrol. Earth Syst. Sci. Discuss., 11, C5106–C5109, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C5106/2014/

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

Anonymous Referee #2

Received and published: 17 November 2014

In this study, the authors investigate the appropriateness of four methods aiming at estimating evapotranspiration (ET) and root water uptake (RWU) distribution from soil water content observation. As RWU distribution cannot be measured directly and thus cannot be used to validate the tested methods, the authors generated a synthetic dataset of water content dynamics for which root water uptake distribution is known. The methods of multi-step multi-layer (msml) and inverse modelling (im) are demonstrated to be more appropriate to estimate ET and RWU, but once synthetic measurement errors are accounted for, the im method becomes unreliable.

From a general point of view, the manuscript is sound, well-written and structured. The

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

compared analysis of the four methods is interesting, and the introduction of measurement errors delivers surprising results. An illustration displaying what goes wrong with the im method for an isolated simulation would be helpful in addition to the confidence intervals of Fig. 5. The basic assumption of the msml method (invariance of mflow during day and night) could be further discussed and illustrated using the synthetic data. The im method would gain being clarified.

Specific comments:

1) Page 10861, line 13 (P61, L13): As the sink term is defined as water extraction, and increasing water extraction decreases water storage, it seems more appropriate to have the sign "-" in front of S(z,t).

2) P62, L13: This method does not specifically neglect "vertical" soil water flow, it neglects soil water flow more generally.

3) P62, L27: The cited studies do not fit parameters of "time constant RWU profiles" as their RWU profiles are not time constant. Their RWU model parameters are time constant but as soil matric potential and transpiration vary, their RWU profiles change. The following ("whereas . . ." L27-29) does not contradict the cited studies then.

4) P64, L18: Here it could also be mentioned that a RWU model is used in addition of a soil water flow model.

5) P65, L20: During dry periods, non-null "q" may occur as capillary rise (q is then negative), especially if the water table is no deeper than 2 meters. A possible justification to prevent capillary rise from happening in the synthetic dataset would be to define the "water table" as the bottom of a lysimeter. Didn't capillary rise occur during dry periods in the synthetic dataset?

6) P66, L2: A more precise definition of dry period should be provided here. I believe that later in the manuscript it is mentioned that the dry periods start 24 hours after the end of rain events. Was there no leaching later than that? I insist on these points

HESSD

11, C5106–C5109, 2014

(5 and 6) because they could be a major reason why the method ssml fails to predict accurate evapotranspiration.

7) P67, L20: The assumption that mflow does not change significantly between day and night is interesting and could be directly illustrated from the synthetic dataset as mflow is known at all times.

8) P67, L21: Here it is not clear to me which nights are included in mflow. Is “antecedent and preceding nights” limited to two nights? In case daytime mflow would be correlated to night-time mflow, I would expect that the highest correlation would be with mflow from the most recent night. What additional pieces of information would other preceding nights provide?

9) P68, L22: I found the inverse model section quite confusing. It seems like the method of Zuo and Zhang is first explained, then for some reason a second method is explained. The first method would not be implemented though. I understand from the first sentences that the sink terms are optimized at each depth and each time step (while usually the RWU model parameters are optimized). Hopefully what follows can be clarified and made more concise.

10) P70, L21: Here I did not find the spatial resolution of the simulation (1 cm?).

11) P72, L4-5: This sentence could be removed as its content is repeated in more detail in the next sentence.

12) P74, L16: According to Table 2 the best result (b=0.89%) corresponds to the measurement frequency of 12h, not 24h. The captions of Table 2 and 4 do not specify what variable prediction is evaluated. From the rest of the text I believe it is the daily averaged ET though.

13) P75, L14: “The results show that lesser complex methods better reproduce ET”. Isn’t it the opposite, more complex methods (msml and im) better predict ET?

14) P75, L27: It is explained that the standard deviation of z_25%, z_50% and z_90%

HESSD

11, C5106–C5109, 2014

from the synthetic dataset is almost 0. In consequence the RV index tends to values too high to be indicative, and its numerator (std dev of estimated z_25%, z_50% and z_90%) is used instead. Smaller std dev of estmations then become indicator of quality of fit, which makes sense. I am surprised though that the authors (i) insist in the introduction and discussion on the dynamism of RWU which adapts itself to soil moisture distribution, (ii) use a RWU model that has compensation implemented, but eventually generate a synthetic dataset that does not seem to have significant variations of RWU relative distribution. . .

15) P80, L17: The word “uptake” probably missing between “root water” and “model”.

16) P81, L12: The word “and” between “calibration error” and “but”. . .

17) P95: More results could be provided in Table 4, if not within the body of the article, it could be added in appendix.

18) P98: If found the successive grey and white bands for respectively day and night to be sort of confusing as dark is commonly associated to night.

19) Page 10901: The coloured bands are not all visible due to overlapping.

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