Geosci. Model Dev. Discuss., 7, C80–C85, 2014
www.geosci-model-dev-discuss.net/7/C80/2014/

Geoscientific Model Development Discussions
Open Access

GMDD
7, C80–C85, 2014

Interactive Comment

Interactive comment on "Simultaneous parameterization of the two-source evapotranspiration model by Bayesian approach: application to spring maize in an arid region of northwest China" *by* G. F. Zhu et al.

Anonymous Referee #1

Received and published: 11 March 2014

General comments and overall evaluation:

Parameter optimization by MCMC method for the evapotranspiration model is one of the best solutions for improving the estimation accuracy. Zhu et al. did an interesting work on simultaneous assimilation of two different data streams: 30min evapotranspiration (ET) and daily evaporation (E), then finally gained the moderately good accordance between the simulations and the observations. The efforts proved a new feature for optimizing the canopy transpiration and soil evaporation parameters, and also brought the direction for further improvement of such ET model. However, this paper is suffering

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

from insufficient explanation on the optimization scheme and on the optimization of which parameter reduced the uncertainty on model simulation, and on how individual measurement data of two data steams improved your model simulation.

The authors miss the explanations on the parameter optimization processes and results. First, why don't you optimize other parameters for better estimation? Your former paper, Zhu et al. (2013), used gmax q50, d50, kq, ka more than this study. Explain the reason why you chose 6 parameters for optimization in this study. Second, how did you decide the measurement error variance, σ? Third, the arithmetic mean values from posterior parameter probability density were picked up as the optimized parameter numbers in this study. However, I think that the median values should be used for them although the mean and median would be the same if there is a perfect Gaussian probability distribution. However, normally it is not the case. So you should take the median value for the optimized parameter number. Fourth, you compare the range of posterior parameter values to those of other posterior parameter values. But, if you like to inter-compare the relative influence by each parameter optimization on reducing total ET error, you have to use the relative range of parameter values, by dividing the absolute parameter value range by posterior/prior parameter uncertainty value.

This study assimilated daily E in addition to 30min ET, which is already used in your previous study on the Qinghai Tibetan Plateau (Zhu et al., 2013). This is a good originality of this study. So I like to know how the estimation accuracy will change if you optimize single data (ET or E), and how the accuracy on E estimation is if only ET is assimilated, and vice versa.

For advection, you concluded that the underestimation by S-W model was induced by no representation of enhanced ET by such dry air advection so-called as an oasis effect. I guess that the hot/dry airflow effect by advection could be reflected by enhanced air temperature and enhanced vapor pressure deficit, which would give higher ET estimation by S-W model to some extent.

GMDD
7, C80–C85, 2014

The S-W model is a nicely simple model to be applied for estimating ET in the sparsely-planted crop field to take into account the considerable soil evaporation, which could not be represented by widely-used Penman-Monteith model. However, the optimized S-W simulation shows that the relative contribution by soil evaporation on total ET was quite low (less than 0.1 for most of growing season), so that the S-W model is not necessarily required this time actually.

Minor comments:

Title: What does "Simultaneous parameterization" mean? Does it mean that 6 parameters are optimized concurrently? Either, do you mean that S-W model assimilates two data sets, λET and E, together at once? You modify the title to appeal the focal point of this research concerning such “simultaneous parameterization”.

Page 742, Line 10, “a good agreement”: I do not think that the regression line’s slope, 0.84, shows a good agreement.

Page 742, Line 11-13: This is a speculation. You should not write in this way, which strongly affirms the advection although you did not measure it directly.

Page 742, Line 14, “accounted”: account?

Page 742, Line 15-16: This is a speculation again.

Page 743, Line 12, “has”: have?

Page 744, Line 25, “The spring wheat”: How sparsely was it planted? Normally the S-W model is needed for the crop land where the crop is planted sparsely. But, you have not mentioned anything about the crop density. You clarify it.

Page 745, Line 4-20: You have to address about the estimation accuracy or energy closure for eddy flux measurement, which could relate to the error range of assimilated data set.

Page 746, Line 8-9: The position of lysimeter installation is very important to think of

GMDD
7, C80–C85, 2014

estimation accuracy. If the lysimeter was installed just in the middle of rows, the soil evaporation located closer to row is missed. In this situation, when plant gets large, you may overestimate the E under the shades of leaves. It contributes to underestimate T by modeling due to adjusting the soil conductance to match the modeled E with the overestimated E by lysimeter.

Page 750, Section 2.5: Add a flow chart of data calibration and evaluation steps.

Page 750, Line 21, "is": are?

Page 751, Line 2, σi2: How did you decide this number? It is a very important number, which decides the relative influence by each measured data in the assimilation process. So you have to write about it.

Page 751, Line 22-23: I do not understand this sentence.

Page 751, Line 23-25: You should add the flowchart of this sequence.

Page 753, Section 3.2: There are several problems in this subsection. You did not make the proper explanation of results in many places. For ex., how did you calculate the corr. coefficient of 0.85? From what kind of data do you calculate this corr. coeff.? Another thing is that you did not make the discussion. At the end of paragraphs, you are finishing with the mention that the optimized parameters were within reported values. Is that all to say here? This is just a report, but discussion. You have to discuss more about why the optimized parameters fell into such reported ranges. And why did k1 and k3 have no Gaussian distribution?

Page 753, Line 24-25, "while $\sim$": k1 and k3 did not have a Gaussian distribution. Then you finally could not have the proper mean or median value, which should be located in the middle of parabola of parameter histograms. So it means that the optimization did not work for those two parameters. Another thing is that it proves that Transpiration was not sensitive to Rs and D while T was sensitive to Tair and soil moisture.

Page 753, Line 25-27, "Ortega-Farias et al. (2007)$\sim$": First, I do not understand what

GMDD
7, C80–C85, 2014

you are trying to say here. Second, I assume that you mean here that 95% probability intervals narrower than your prior parameter ranges and relatively clear Gaussian distribution in rstmin show those sensitivity of rstmin, and also that relatively wider parameter ranges in b1, b2 and k2 and no Gaussan distribution in k1 and k3 show less sensitivity to uncertainties in other parameters. If my assumptions are correct, I do not agree with them. You cannot estimate relative sensitivity of parameter only from the absolute range between max and min. You have to divide the absolute range by prior or posterior uncertainty of each parameter for comparison of relative influence by error. For ex., (p(95%ile)-p(5%ile))/Unc_p should be applied for this comparison.

Page 754, Line 1, “estimated”: optimized?

Page 754, Line 2-4: You should explain more about the results, from which you can consider if there are the inter-correlations. In which Figure and Table can we see the corr. Coeff. Number of 0.85? And what does corr. Coefficient mean? There is no proper information about the corresponding results written here. You cannot confirm the inter-correlations without calculating the covariance in errors in each combination of two parameters.

Page 754, Line 13, “plantshave”: plants have?

Page 754, Line 20, “was”: were?

Page 754, Line 22, “were”: was?

Page 754, Line 23, “predicate”: predict?

Page 755, Line 21, “daily ET was”: daily ETs were?

Page 756, Subsection 3.4: There should be great uncertainty in eddy flux measurement for ET and lysimeter measurement for E. So in this subsection you also have to discuss the possibility of containing the great unc. by the errors in measurement data.

Page 756, Line 9, “micro-scale advection”: Did not you measure the lateral wind speed

GMDD

7, C80–C85, 2014

and direction to directly probe the advection?

Page 756, Line 18, “representing”: represent?

Page 757, Line 20, “when micro-scale advection occurred”: You cannot conclude it yet.

Page 769, Fig. 3: you have to add the signs “(a)” to “(f)” in panels and legends to identify the variable.

Page 775, Fig. 9: The color assignment of RH is not intuitive. I prefer that the red is dry and the blue is wet.

Interactive comment on Geosci. Model Dev. Discuss., 7, 741, 2014.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper