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Geoscientific Model Development Discussions

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 #2

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General comments and overall evaluation: Bayesian statistics, based on probability theory, is a logical choice for model calibration; it provides parameter estimates by quantifying the uncertainties in the data and model structure. The authors employ Bayesian method to calibrate the Shuttleworth-Wallace model, using eddy-covariance evapotranspiration measurements and daily soil evaporation. The work is interesting but some technical aspects should be clarified and additional analyses should be carried out.

1. In order to test model performances the authors split the dataset in two parts by tak-

ing alternate measurements and using one sub-dataset for model calibration and the other for model evaluation. The authors claim that the sub-datasets are independent, but for an independent validation of the model data from different site should be used. If that is not possible, model evaluation would be more rigorous if the first half of the data is used for calibration and the second half for model validation, i.e. defining the sub-dataset using subsequent measurements and not alternate measurements. Finally parameter estimates reported in Table 1 and Figure 4 should be obtained using the whole dataset, i.e. a new calibration should be carried out using all the available data.

2. Results from the Gelman and Rubin test should be reported at least in the text. By observing the marginal posterior distribution of parameter k1, k2 and k3 it seems that convergence was not reached.

3. lines 318- 321. Sensitivity analysis are always conditional to the parameter space and the input data used in the analysis. I strongly suggest you to carry out a global sensitivity analysis (such as the Morris method) using the prior parameter ranges to understand which are the key parameters of the model in your case study.

4. Which prior do you use? I suppose you were using a uniform prior with the minimum and maximum values of Table 1. Please, state it more clearly in the manuscript.

5. Uncertainty in the data is really important when using a Bayesian approach. How did you define the measurement errors of equation 22?

6. Why did you include 6 parameters in the calibration and not the whole parameter vector? And which values did you assign to the parameters not included in the calibration? Please provide the references.

7. Which parameter vector did you use to generate model outputs? You should use the maximum a posteriori parameter vector.

8. Bayesian statistics allows to quantify uncertainties. Was the calibration effective in

reducing uncertainties of model predictions? The posterior uncertainty of simulated ET and E are not shown and discussed.

9. The manuscript is relatively well written, but in my opinion the Results and discussion session should be slitted in two parts in order to provide more clear take-home messages.

Minor comments: Abstract. Line: 31-33. “The posterior distributions .... intervals.” this phrase is not clear what do you mean for well updated?

Introduction. Line: 79-81. The main advantage of Bayesian method is that uncertainties can be properly quantified. Optimization algorithms can also be used to optimize parameters in the light of multiple data sources.

Materials and methods. Line: 106-107. Which dryness index was used. Line: 136. “Air temperature and relative humidity”: Air temperature, relative humidity Line: 199. “Eqns.(1)-(3) is calculated”: Eqns.(1)-(3) are calculated

Line: 256-264. Which MCMC algorithm did you use? From the description it seems to be the Metropolis algorithm and not the Metropolis-Hastings.

Results and discussion Line: 359. “In this case, a good agreement ...”: A good agreement Line: “On the other hand, the diurnal variation”: On the other hand must go after on one hand.

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