

Interactive comment on “Calibration of the Crop model in the Community Land Model” by X. Zeng et al.

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We thank the referee for carefully reading the paper, their suggestions, and pertinent arguments. Addressing these led to a much cleaner and improved presentation. We hope that the referee will find the comments and our point-by-point responses and changes discussed below satisfactory. A revised manuscript will be uploaded shortly in the GMD system.

-the corresponding authors

Comment: The authors describe their application of a parameter calibration method to their newly developed crop component of the Community Land Model. They show that this MCMC based parameter calibration successfully improves the model-data fit.

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Their methodology is not particularly novel, but the authors show that this standard parameter calibration method can be successfully applied to this complex model. Overall, the study seems to be executed well, and the paper is well-written.

I have one significant concern with the methodology: If I understand right, the authors adjust 6 parameters to fit just 10 values. It seems to me that they would risk over-fitting the data since the number of degrees of freedom is close to the number of data points. I would like to at least see this addressed somewhere in the paper.

Response: This is an excellent comment and an integral part of any statistical study that we considered but never articulated in the paper. The referee is correct, and to this end, we had provided a one-way validation experiment, which does provide some confidence but not proof of a robust fit. More data from multiple sites will allow us to improve the calibration results and perform multiple validation experiments, and will arguably alleviate overfitting if any. We have added a discussion to reflect these elements in the text.

Additional comments follow:

Comment: 1. The text in section 1 before 1.1 feels like an introduction. I would reorganize the

headings so that this is “1 Introduction”, then section 2 becomes “The CLM-Crop model”, which begins with what is currently 1.1 (which will be renumbered to 2.1).

Response: Thank you for the suggestion, we have revised the numbering of the headings.

Comment: 2. P 385, L 13: How is GPP derived at this site?

Response: GPP is derived using the Net Ecosystem Exchange and net ecosystem respiration. We modified the text to clarify: “We used daily averaged eddy covariance measurements of NEE and derived GPP in our model calibration procedure, which are

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categorized as Level 4 data published on the AmeriFlux site, gap filled by using the Marginal Distribution Sampling procedure outlined by Reichstein et al. (2005). GPP is derived as the difference between ecosystem respiration and NEE, where ecosystem respiration is estimated using Reichstein et al. (2005)”

Comment: 3. P 385, L 16-18: What is the frequency of biomass measurements?

Response: Measurements are generally taken every seven days, starting a few weeks after planting and continuing through harvest. We have added text to reflect this in the revised manuscript.

Comment: 4. P 385, L 19-27: A number of details are unclear here. These are generally addressed later in the paper, but should be addressed here: (1) did you take the max and slope of all of these variables? (2) describe the computation of slope in more detail – both from the model and from observations; (3) is the end result a single slope and single max value per each variable per year?

Response: The slope was computed for GPP, NEE, LEAFC, and STEMC, only. The end result is a single value for the maximum and a single value for the slope per year for each variable considered (10 observations in total/crop/year). We have updated the manuscript with the slope calculation procedure and the details above.

Comment: 5. Section 1.4: What parameters were used for spinup? I assume you didn't redo the spinup each time you changed the parameters? This is a tricky aspect of calibrating parameters for a model with such a long spinup time, and this issue should be addressed here.

Response: The Crop Model was calibrated against uncertainties in the C/N parameters with the rest of the parameters and initial conditions fixed. The spinup was carried out with the default parameters because a direct spinup calculation would have made sampling prohibitively expensive. We had carried out a simple sensitivity analysis for the observed quantities with respect to the litter/soil c/soil n pools and smin. We observed

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some variation, however, it was relatively limited. We will address this issue in a future study by including these pools in the calibration procedure. Furthermore, we also plan to use multiple sites for calibration which will likely sharpen our posterior results.

Comment: 6. P 388, L 12: perturbed by how much?

Response: 30% - the statement was clarified in the text.

Comment: 7. P 388, L 20-21: (1) When you say max(NEE), do you mean the most negative value?; (2) when you say the slope from planting to the max value, is the value at planting 0 for everything except NEE?

Response: We agree - these elements were clarified in the text: 1) correct and 2) contained an error now rectified in the text.

Comment: 8. P 389, L 3-11, and Fig 1b: Particularly for parameters with large standard deviation, it is helpful to separate whether this is due to their being unconstrained by data, and/or being correlated with other parameters. To this end, it would be helpful to see correlation plots between at least some pairs of parameters, and/or a correlation matrix in tabular form.

Response: This is a good point and to that end we included the correlation matrix (of the posterior distribution) in the document. This indicates relatively small correlations between calibration parameters.

Comment: 9. P 389, L 23-27, and other parts of the paper: Simulations probably need to be redone with corrected use of the Sacks et al dataset, as per my comment on the Drewniak et al. paper describing CLM-Crop

Response: We reported in error using the Sacks et al. (2010) Crop Calendar Dataset for the planting date in the calibration and validation of this model. The standard CLM-Crop model does use the Crop Calendar Dataset to assign planting date; however, for this exercise we used the exact planting date as reported for 2004 by the Bondville AmeriFlux site. We used the same planting date for the year 2002 validation since

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planting dates are fixed in the model. We apologize for the error and have corrected the paper to reflect the actual planting date used.

Comment: 10. P. 390, L 2-5: I don't understand the connection between this and the rest of section 3.3

Response: We agree that this is an inappropriate place for this statement and have moved it to the end of the second paragraph in section 4.2 Calibration using real data.

Interactive comment on Geosci. Model Dev. Discuss., 6, 379, 2013.

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