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Biogeosciences Discussions

Interactive comment on "Reducing impacts of systematic errors in the observation data on inversing ecosystem model parameters using different normalization methods" *by* L. Zhang et al.

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The authors thank the editor Prof. Chen for his comments to clarify and improve the manuscript. Our responses to editor's comments are as follows.

Q: While I appreciate the motivation of this work to optimize a key ecosystem parameter Vcmax, I fail to see the usefulness of the normalization techniques for "inversing model parameters". There are following issues that prevent me from understanding the significance of this work: 1. What data are used for inverting the model parameters? In Eq. 1, what are observations and simulations used? Are tower flux data used or just artificial LAI? The whole exercise does not seem to make sense if no actual observations are used for inverting any parameter. 2. Are the normalization methods applied to both observations and simulated results? I can't comprehend how observations can be nor-malized to obtain a meaningful absolute value of a parameter. For example, if flux data are normalized, the absolute value that determines Vcmax is lost. If the whole purpose is to suppress the impact of LAI errors on Vcmax regardless of its influence on the absolute flux values, this work would have very limited value to publish. 3. It is not clear how LAI could affect Vcmax in the AVIM2 model. I guess AVIM2 is a big-leaf model, and Eqs. A1-A5 represent a canopy, not a leaf. In this case, A5 represents canopy conductance, rather than stomatal conductance. Is this true? Is the influence of LAI on A made through its influence on canopy conductance? The Appendix also needs an equation showing how NPP at the canopy level is related to variables in A1-A5. 4. The usefulness of this work is rather limited if the estimation of the leaf-level or canopy-level Vcmax is based on a big-leaf model and canopy-level flux measurements because bigleaf modeling is an incorrect upcaling methodology from leaf to canopy. In this way the inverted leaf-level Vcmax would depend on LAI itself, and the canopy-level Vcmax has no real meaning (it would change with sun angle on the same day, for example). The title may be changed to "Reducing impacts of systematic errors in LAI observation on inverting ecosystem model parameters using different normalization methods". There are many grammatical typographical errors in the text, and it needs to be thoroughly edited.

A: In previous studies on parameter estimation using remote sensing data such as VI, LAI and fAPAR, the absolute values have usually been used to constrain model parameters without or less considering the impact of systematic errors of observations and models, which can result in the bias of estimation of parameters. Although these absolute values of remote sensing data contain unknown errors, their spatial patterns are robust and reliable. Thus, to make good use of the information of spatial pattern of remote sensing data, we tried to use normalized observed and simulated data to calculate the cost function Ω' (Eqn. 2) to reduce the impacts of systematic errors on parameter estimation. The purpose of our study is to not to obtain the optimized values

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of model parameters so as to make prediction but rather to investigate if normalization can be used to reduce the impact of systematic errors on parameter estimation by conducting model experiments of parameter estimation with the AVIM2 model.

1.The data used for inverting model parameters are synthetic LAI in model experiments in the original manuscript. In the revised manuscript, we also used the MODIS LAI product to estimate the model parameters. We have clarified the data that we used in the revised manuscript.

2.The normalization methods were applied to both observations and simulated results. The normalization methods were used to extract the information on spatial pattern of modeled and observed data. If the observation was normalized alone, the lost of absolute information of the observations will lead to incorrect estimation for parameters. In contrast, given the observation and model output were normalized simultaneously, the cost function was calculated to define the mismatch of spatial pattern between modeled and observed LAI data. In this case the parameters can be constrained as our results showed. This method was only suitable to remote sensing data with similar error property not to eddy flux data measured at a local site.

3.In the AVIM2 model, Vcmax was determined by Vcmax,25 and response functions of temperature, soil moisture, and nitrogen content. The parameter Vcmax,25 will affect the simulation of LAI because the LAI is calculated by leaf biomass and specific leaf area, where leaf biomass is simulated based on NPP and the allocation of NPP to leaves. As suggested by the editor, we have added the description of LAI simulation method and an equation showing the relationship between NPP and variables in A1-A5 in the revised manuscript.

4.We really agree with the editor that the big-leaf model is limited to estimate canopy photosynthesis. Herein, we just used the AVIM2 model as an example to examine the feasibility of the normalization method for parameter estimation. We would prefer to use the two leaf model to upscale the photosynthesis from leaf to canopy and to estimate

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related parameters in future work. As suggested by the editor, we revised the title as “Reducing impacts of systematic errors in LAI observation on inversing ecosystem model parameters using different normalization methods”. We corrected grammatical typographical errors in the revised manuscript.

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