Comment on gmd-2022-96
Anonymous Referee #2

Referee comment on "Pixel-level parameter optimization of a terrestrial biosphere model for improving estimation of carbon fluxes with an efficient model-data fusion method and satellite-derived LAI and GPP data" by Rui Ma et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-96-RC2, 2022

This paper proposed a two-step framework to estimate the essential parameters of the revised Integrated Biosphere Simulator (IBIS) at pixel level. The paper was well prepared, organized and clearly presented. However, there are still some issues that the authors should address before the paper is considered for the publication.

1\r\r\r1\r\r\rThis study used global LAI and GPP products from the Global Land Surface Satellite (GLASS) suite as "observations" ("true values") for parameter calibration on a spatial scale. If the GLASS product is good enough to serve as "true values", what is the significance of model parameter correction? Please clarify it clearly in Introduction.

2\r\r\r2\r\r\rThe paper mainly focused on deciduous forests in the eastern United States. How about the accuracy of other products in the study area? If you want to take GLASS products as the reference values, please elaborate the accuracy of GLASS products used in the study area.

3\r\r\r3\r\r\rIn Line 228, the ten sensitive parameters derived in the study are sensitive parameters for which indicators (GPP, LAI, or ER, NEE?)?

4\r\r\r4\r\r\rThe ranges of parameters are very important because they directly limit the boundaries of parameter optimization and the range of parameter space variation. Therefore, how did the authors determine the ranges of the prior parameters in this study?
Lines 337-338, as you mentioned, for the testing set, the estimated errors (RMSE and DISO) using XGBoost were slightly less correlated with the corresponding accuracy indexes of the MASM approach. However, the input of the target values in Xboost’s training set are the parameter values obtained by MASM. So is the training effect of the Xboost model unsatisfactory?

Both MASM and Xboost can be used to obtain spatial distribution of sensitivity parameters. Introducing XGBoost to predict other spatial parameters from some partially corrected parameters may cause greater uncertainty. So why did the authors choose these two methods? It seems that the necessity of two-step correction is not clear in the article.

Parameter screening and optimization mainly targeted at LAI and GPP, while ER and NEE were added to the final carbon flux prediction. NEE means GPP minus ecosystem respiration and disturbance. I wonder if the parameters associated with these two processes were corrected? In addition, suggest to analyze the uncertainties of these two carbon flux results.