Dear Editor Müller,

Thank you very much for your time spent handling our manuscript entitled “Identification of key parameters controlling demographically structured vegetation dynamics in a Land Surface Model [CLM4.5(ED)]”. We have addressed the minor revision suggestions from review #2 and hope that it is now acceptable for publication at GMD.

Yours

Chonggang Xu

On behalf of all coauthors

Responses to Referee #2 (Xiangtao Xu, xu.withoutwax@gmail.com)

Comment 1: I am generally happy with the revision. It helps to improve the manuscript by a lot. The correlation analysis between climate forcing and sensitivity indices are helpful and make sense. The re-organization of figures improves readability. My only suggestion is to connect such kind of computational sensitivity analysis with theoretical ecological analysis in vegetation demography in the Conclusion part. The FAST method presented here can provide a more comprehensive analysis of the parameters that control vegetation demography while simpler but more tractable theoretical ecology models (e.g. Farrior et al. 2016 and Falster et al. 2018) can provide more mechanistic understanding (e.g. why and how allometry influences demography). Such modeling exercises at different scales and complexity are complementary, especially when vegetation models are getting more and more complex nowadays.

Farrior, C.E., Bohlman, S.A., Hubbell, S. & Pacala, S.W. (2016) Dominance of the suppressed: Power-law size structure in tropical forests. Science, 351, 155–157.
Falster, D.S., Duursma, R.A. & FitzJohn, R.G. (2018) How functional traits influence plant growth and shade tolerance across the life cycle. Proceedings of the National Academy of Sciences, 115, E6789–E6798.

Response 1: This is an excellent point and per your suggestion, we have added the following sentence to the end of discussion section of the manuscript:

Although the FAST method presented in this study can provide a more comprehensive analysis of the parameters that control vegetation demography, it is mostly built on statistical relationships (e.g., Fig.8). A complementary approach is to use more tractable theoretical ecology models (e.g. Farrior et al. 2016 and Falster et al. 2018) to approximate the underlying model input-output relationships, which can provide more mechanistic understanding of model behavior.

Comment 2: In addition, Page 19 Line 1-5 discussed the model-data comparison for mortality. My understanding is that the authors extracted and averaged instantaneous mortality in the model, which is calculated differently from the census-based mortality. For example, if all the trees of a given size class died within a 10-year census, the mortality from the observation would be 0.1 per year although they might have already died in the first few years (i.e. actual mortality is higher). So I am not so surprised at the modeled mortality for small trees is higher than the

observed because they are at different time scales. An apple-to-apple comparison should simulate census processes in the model as well, which involves tracking cohorts in the model. This is definitely too much for this manuscript but it is worthy of mentioning in the discussion to avoid confusion.

Response 2: Thank you for pointing this out and we have added the following sentence to the manuscript,

"It is also possible that the observed mortality rate for small trees could potentially be underestimated if all the trees in a certain size classes died at a shorter time frame than the census intervals."