Dear Editor,

We want to express our appreciation of your time and effort handling the peer review of our manuscript. We thank both referees for their positive and constructive comments that help improve the clarity of our manuscript. Attached please find our detailed point-by-point response to all referees' comments and changes we made in the revision.

We look forward to hearing from you.

Sincerely,

Yilin Fang and Co-authors

Response to RC1

We thank the referee for the constructive comments and thorough review for the improvement of our manuscript.

Hydrological mortality influences water availability and biomass. In this manuscript, the authors present the results of a study designed to incorporate the ELM, FATES, and Farflow to show the importance of lateral subsurface in above-ground biomass. The WTD, AGB, and Bowen ratio could be varied after using the three-dimensional hydrology model. This paper is valuable because it is the first to apply the three-dimensional hydrology model to the Earth System model. This work could be helpful for the researchers using ELM, FATES (or ED2). However, model explanation, design of experiments, and the results need more detail, and analysis is ambiguous in several places.

Thanks for the positive comments. Please see our point-by-point responses below.

Major comments

1. In section 2.1.3, while explanations of different hydraulic failure models are well described, the explanation of the biomass equation is insufficient. Clarify it (Equations calculating the above-ground biomass should be needed in this chapter).

   Above-ground biomass calculation in FATES is added and described below.

   FATES uses allometric relationships with stem diameter (*D*) to determine tree height (*h*) and crown area (*C*). There are five model options for tree height in FATES. In this study, we used a power function described in Obrien et al. (1995) for FATES input file F1 in the main text:

$$h = 10^{(log10(D_*)\cdot a+b)} \quad \text{(R1)}$$

$$D_* = \min{(D, D_{max})} \quad \text{(R2)}$$

   and a Michaelis–Menten form in Martinez Cano et al. (2019) for FATES input file F2:

$$h = \frac{cD_*^d}{k + D_*^d} \quad \text{(R3)}$$

The allometry function for crown area is

$$C = \begin{cases} fD^g & D < D_{max} \\ fD_{max}^g & D \geq D_{max} \end{cases} \quad \text{(R4)}$$

where *a, b, c, d , k, f,* and g are allometric parameters, D_{max} is diameter of plant where max height occurs.

Target biomass of leaf, structure, stem, fine root, seed, and storage are also calculated using allometry functions in FATES (Koven et al., 2020). Target biomass of fine root and storage are assumed to be linearly proportional to the target leaf biomass, and the target structure biomass is linearly proportional to the target sapwood biomass.

A power law allometric model is used for the target leaf biomass (L):

$$L = mD_*^g \quad \text{(R5)}$$

where *m* and *g* are allometric parameters, and *g* is the same as in Eq. R3.

FATES has three allometry function options to calculate target stem aboveground biomass (C_{agb}), we used the functional form in Saldarriaga et al. (1998) in F1:

$$C_{agb} = f_{agb} p_1 h^{p_2} D^{p_3} \rho^{p_4} \quad \text{(R6)}$$

and a functional form in Chave et al. (2014) in F2:

$$C_{agb} = \frac{1}{c2b} p_1 (\rho D^2 h)^{p_2} \quad \text{(R7)}$$

where f_{agb} is the fraction of stem above ground, p_1, p_2, p_3, and p_4 are allometry parameters, *c2b* is carbon to biomass ratio, ρ is the plant wood density.

Once tissue turnover and storage carbon demands are met, FATES uses a constant fraction of net primary production for seed production. Total aboveground biomass (AGB) reported in the study is the sum of leaf biomass, aboveground stem biomass and seed biomass.

2. The meteorological data which are employed in the model are from tower measurements. So, the same meteorological forcing is used in all grids? Is it a reasonable method? Moreover, which variables are used in this study (for example, temperature, precipitation, radiation).

   Note that the model can use spatial forcing, but we don't have the forcing data at the resolution of our model at BCI. We used the same meteorological forcing in all grids. It is reasonable for this site as the rain measured at the clearing near the Lutz catchment and the AVA tower (at the plateau of the 50 ha plot, ~1.25 km from the Lutz) agree pretty well on a monthly scale (Figure R1). Precipitation, air temperature, relative humidity, wind speed, surface pressure at the tower are used in this study.

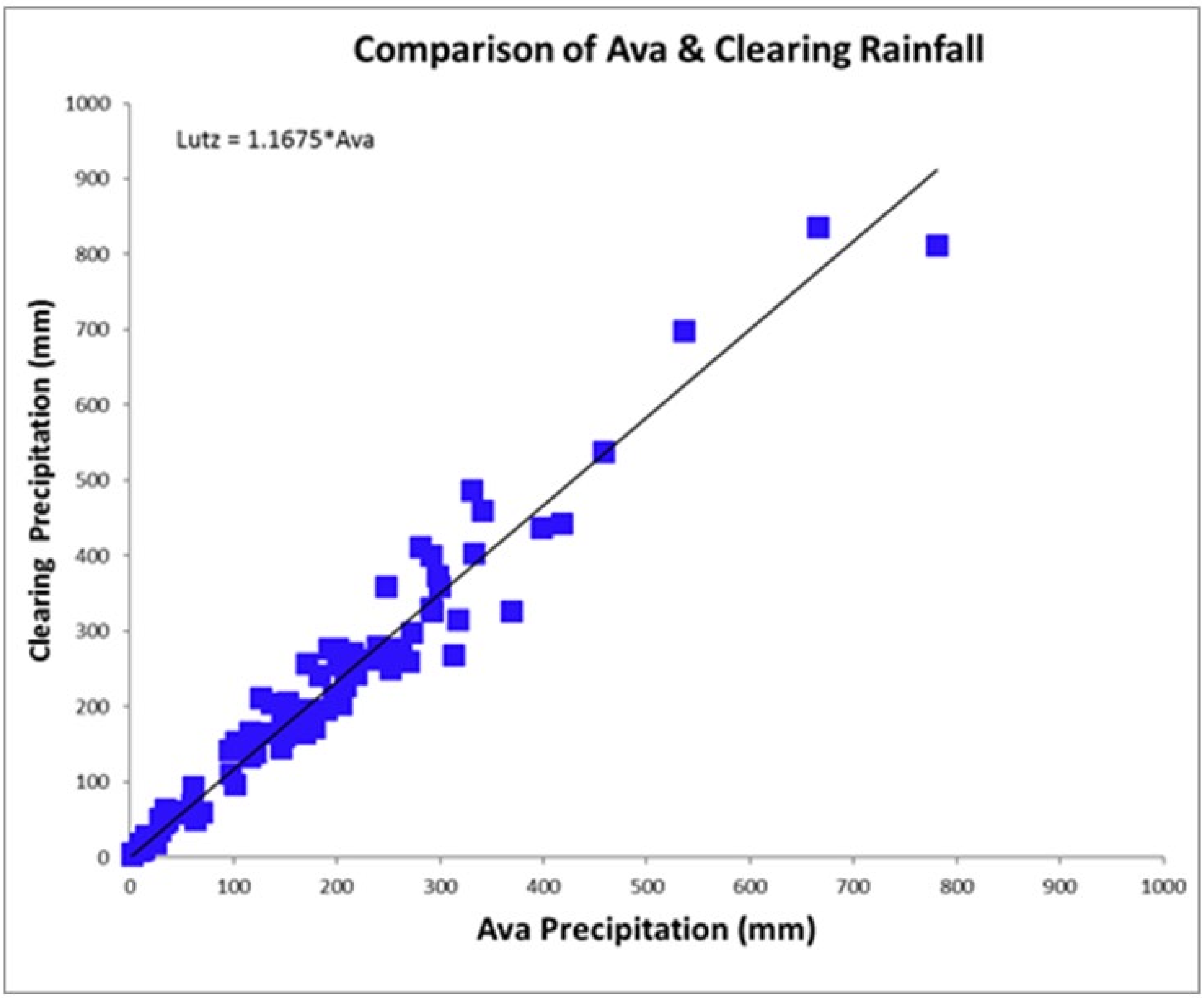

Figure R1. Comparison of precipitation at the AVA tower and at a clearing near the Lutz catchment.

This sentence now reads:

The model is driven by the same atmospheric forcing (i.e., precipitation, air temperature, relative humidity, wind speed, and surface pressure) for 2003-2016 measured at a meteorological tower near the Lutz catchment at BCI [*Faybishenko et al.,* 2018] in all grids due to the lack of spatial forcing. Comparison of the precipitation at the tower and a clearing near the Lutz catchment shows good agreement supporting the use of the same atmospheric forcing for all grids of the model.

3. Before starting the experiments, parameter tunning of the FATES model should be done because the FATES model has large uncertainties yet. The above-ground biomass in ELM-F1-M1, ELM-F1-M2, which are basic models (figure4 e) is quite underestimated because the parameter tunning was not done. After the parameter tunning was done, the results all could be different. (The effect of the 3-dimensional model on biomass may be reduced or increased.)

   The FATES parameters were selected from previous ensemble simulations for tropical forests which produced results close to the observations. We agree the results could be different after parameter tuning, but they will not affect our conclusion that water table dynamics can play large role when hydraulic failure is triggered. We made clarification in section 2.4:

   Two PFTs representing early successional and late successional species are simulated at the same time in competition with each other using two input files of plant traits selected from previous ensemble simulations that best matched observations for tropical forests [Chen et al. 2022, Huang et al. 2020]. Further parameter tuning is out of the scope of this work.

4. With the 3-dimensional model, the AGB and GPP were simulated bigger at lowland than at highland. Do you have observation or reference? Does the fact that the simulated wetter soil in lowland using a three-dimensional model show the improving model performance or just model comparison?

   Unfortunately, we don’t have spatial observations that cover both lowland and highland to validate the simulated AGB and GPP. The difference at lowland and highland is model comparison. It is clarified as:

   Note this is based on model comparisons. Spatial observations at those locations are needed to validate the model but such observations are not currently available.

5. In section 3.2, while the results of ELM-PF-FL-M1 are well written, the explanation of ELM-PF-F2-M1 was quietly insufficient. Moreover, what is difference between F1 and F2? This explanation could be added in section 2.4.

   Thanks for the suggestion. We added explanation of ELM-PF-F2-M1. Please see our response to the following Comment 6. The main difference between F1 and F2 are the allometric models described in Comment 1 above. F2 also has lower carbon starvation mortality rate. These two input files are now included in the Supplement. The following descriptions are added in section 2.4:

   The allometric models for tree height and target stem aboveground biomass in F1 are defined in Eqs. 4 and 9, respectively, and those in F2 are defined in Eqs. 6 and 10, respectively.

   The complete parameters for F1 and F2 are included in the Supplement.

6. With F2, the AGB increases, but GPP decreases. In general, the AGB is positive correlated with GPP, but it is not in this case. This could be discussed with a trait of plants. (Line 476). And it would be better to think about it the direct impact of plant trait on AGB and the indirect impact (plant trait -> WTD -> AGB)

   As the soil moisture simulated using F1 and F2 are close, GPP is mainly affected by growth allometry while AGB is the result of both growth and mortality. From Fig. R2 we can see that using F2 results in larger growth rates and significantly lower mortality rates, thus increasing AGB for F2 compared to F1. However, simulation with F2 results in much lower exposed leaf area index, thus lower GPP compared to that with F1. If we use the same input file, increasing only V_{cmax} will increase both AGB and GPP as shown in Fig. 5. The following are added in the manuscript in response to Comments 5 and 6. Fig. S1 below refers to Fig. R2 in this response.

   The spatial standard deviations (STDs) of the aforementioned-variables of interest for simulation ELM-PF-F2-M1 are slightly smaller than for ELM-PF-F1-M1. The difference in STD between ELM-PF-F2-M1 and ELM-PF-F1-M1 is larger for VWC, LH, and SH compared to GPP, AGB and WTD. With this plant traits F2, AGB increases by 47.5% and GPP decreases by 19% on average (Fig. 4). As the soil moisture (VWC) simulated using ELM-PF-F1-M1 and ELM-PF-F2-M1 are close , GPP is mainly affected by growth allometry while AGB is the result of both growth and mortality. Using plant traits F2 results in larger growth rates and significantly lower mortality rates (Fig. S1), thus increasing AGB for F2 compared to F1. However, simulation with F2 results in much lower exposed leaf area index, thus lower GPP compared to that with F1.

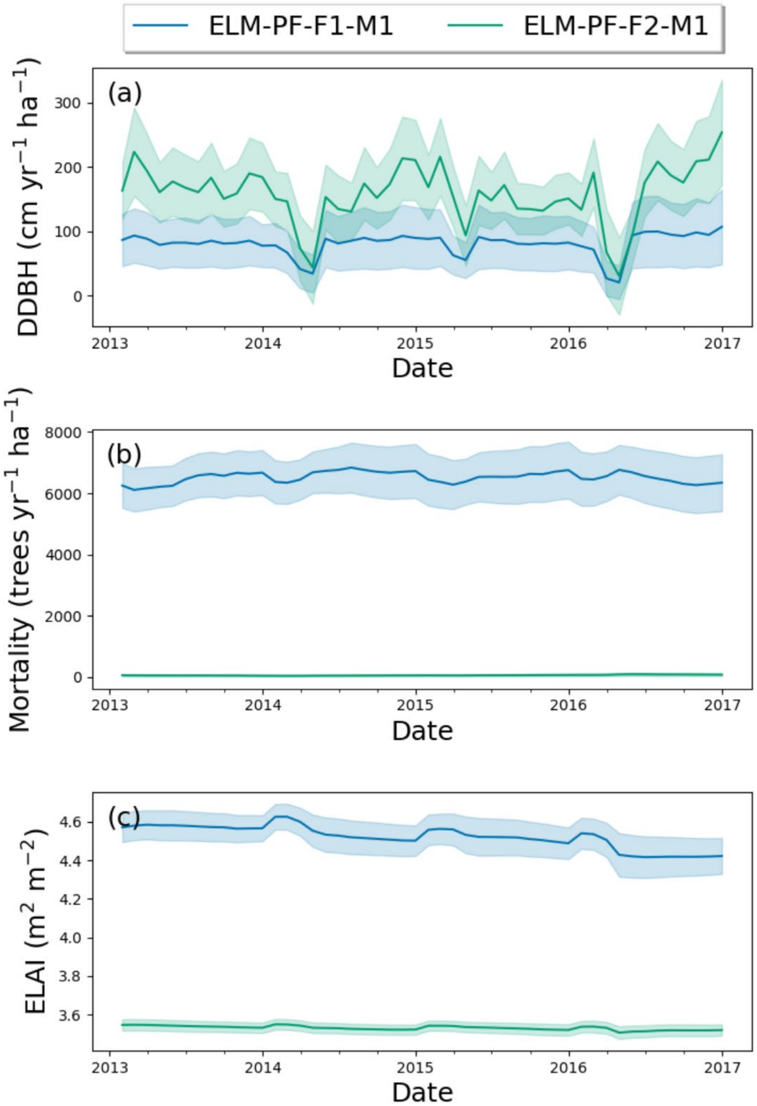

Figure R2. Growth (increment of diameter at breadth height, DDBH) (a) vs. mortality (b), and exposed leaf area index (c) for ELM-PF-F1-M1 and ELM-PF-F2-M1. Solid line is spatial average and shaded area is the standard deviation over the simulation domain.

7. In-Line 479~484, I was confused that the experiment with adjusting the VCMAX was shown suddenly. There is no experiment in Table 1 and in Section 2.4. And why did you multiply 1.9? Is there any reference?

   As it was pointed out in Comment 3, our untuned parameters underestimated AGB. This experiment was introduced to show that tuning parameters can improve the simulated AGB, but the AGB variability is still too small compared to the observation. The factor of 1.9 is determined through trial and error, and there is no reference. We removed the experiment from the text and Fig. 5 to avoid confusion. It now reads

AGB can be further increased by parameter tuning for better agreement with observations, but we don't expect it to significantly change the AGB variability.

8. In section 3.3. it is very interesting about the response of AGB, VWC, Water table depth, H mortality and C mortality to M1, M2 and M3 model. In Line 514, you mentioned that M2 simulates wetter soil in the dry season compared to M3. But it seems likely that simulated AGB in M3 is more than M2 (Figure 6 (a), (b)). Could you add the results of AGB in M2 and M3 in dry seasons and discuss that why is AGB in M3 is more than M2? To my knowledge, the vegetation in wetter soil makes more carbon, especially in dry seasons.

   Thanks for the comment. The higher AGB in M3 is mainly at locations near the shallow water table where M3 simulates lower hydraulic mortality. We added the results and discussion shown below. Fig. S2 in the following refers to Fig. R3 in this response.

   AGB from ELM-PF-F1-M2 is smaller compared to that from ELM-PF-F1-M3, especially at locations where the water table is shallow (WTD < 2 m). That is due to the higher mortality rate triggered by hydraulic failure in ELM-PF-F1-M2 at those locations (Fig. 6c), resulting in fewer grids with AGB > 4.5 kg C/m^2 (Fig. S2).

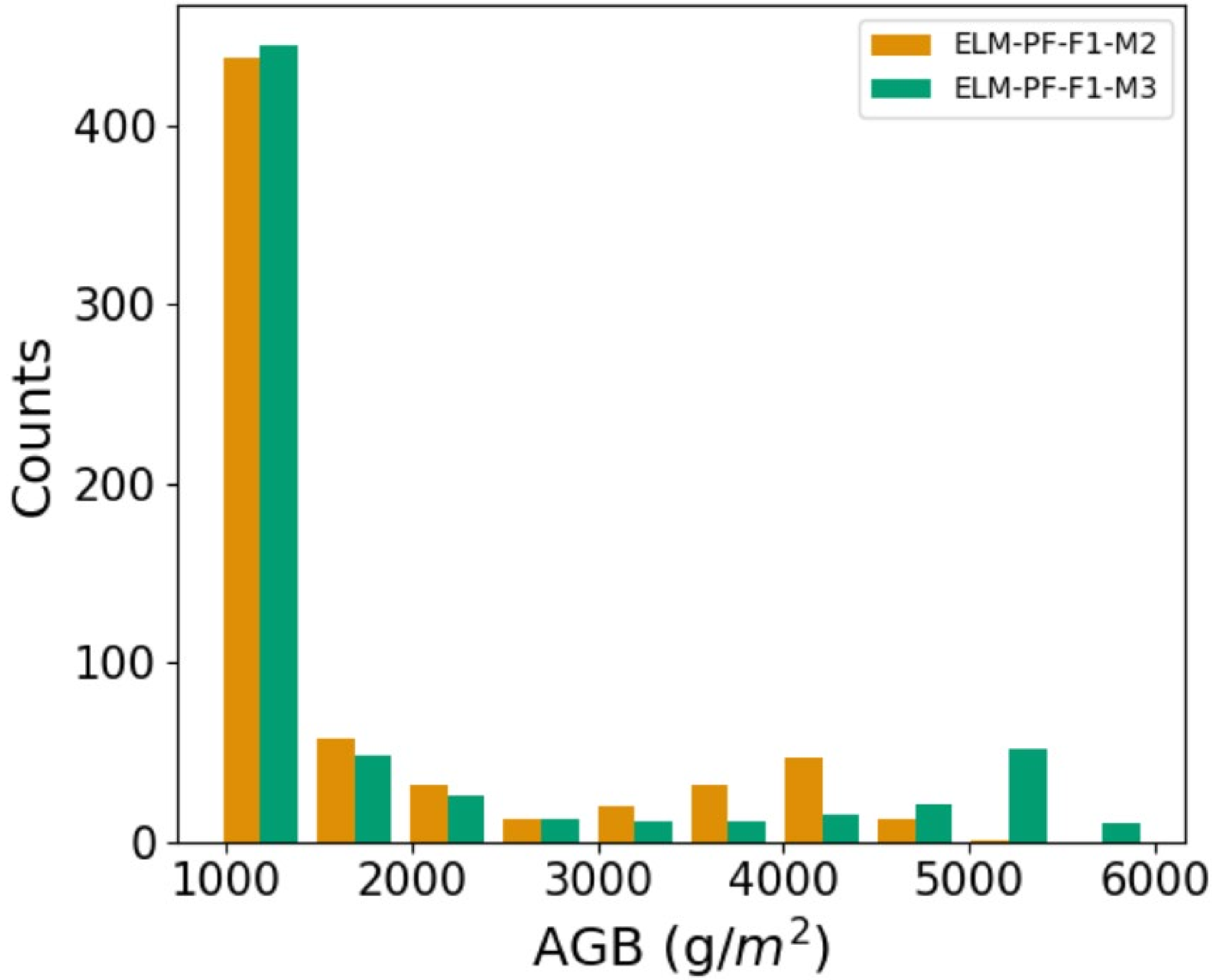

Figure R3. Histogram of simulated AGB for ELM-PF-F1-M2 and ELM-PF-F1-M3

9. In section 3.4, the description of variable importance of AGB, WTD was written. How did you calculate the importance? It should be added in section 2.5.

   We added the following in section 2.5:

   To calculate the permutation importance, a reference score (prediction error) for a trained regression model *m* is first calculated. Each feature *j* (a column) in the training or testing dataset is randomly shuffled to generate a corrupted dataset and the score of the model *m* on the corrupted dataset is calculated. The shuffling and corrupted dataset score computation are repeated multiple times. The importance of feature *j* is computed as the difference between the reference score and the arithmetic mean of the scores of the model *m* on the corrupted datasets. This is documented in https://scikit-learn.org/stable/about.html#citing-scikit-learn.

10. It is necessary to first show the performance of how well AGB and WTD are predicted by the random forest method. It is necessary to show the importance after presenting the results and discussing them. Moreover, why did you select elevation, slope, convexity, and vwc using the random forest? Is this sufficient to explain the importance of AGB and WTD?

    Thanks for the comment. We adjusted the order of results and the importance and it now reads:

    The RF models have shown good performance. They can explain 90% and more of the variance (VAR_{ex} in Table 2) in AGB and WTD for both the training data and the unseen test data, suggesting the predictors selected are sufficient to explain AGB and WTD. They perform better for AGB than for WTD with mean absolute percentage error (MAPE) less than 10% as opposed to 30% for WTD (Table 2). All explanatory variables used as predictors in the RF models can capture portions of the variability of the simulated AGB and WTD, but the relative importance of the predictors is different for the different ELM-PF models (Fig. 7).

    The reason we selected elevation, slope, convexity, and vwc is because they have previously been shown to affect AGB and WTD, and the reason was provided at the beginning of section 2.5 in the original submission. Our selection of the predictor variables is supported by the results of our random forest models showing that those predictors are sufficient to explain AGB and WTD.

11. This paper has novelty because a three-dimensional model is incorporated with Earth system modeling. In this paper, the domain is very small, while the domain and spatial resolution of research using the Earth system model are still large. Using a three-dimensional model may have inaccurate results or no significant impact with large resolution. It would be good to add a discussion on using a three-dimensional model in a global scale.

    Thanks for the positive comment and suggestion. We added the following discussion:

    Using a three-dimensional model in current Earth system models typically run at ~100 km grid resolution may yield inaccurate results or have no significant impact on vegetation dynamics. A reasonable grid resolution for groundwater flow simulation is around 1 km (Xie et al. 2020 and references therein). Moving from 100 km to 1 km resolution for global scale vegetation dynamics simulation coupled with a 3D integrated hydrologic model is computationally challenging at present, but it may be a realistic goal with advances of computation power and architecture in the future. The model in this study provides opportunities for improving hydrological, ecological, and meteorological predictions of Earth system models.

Minor comments

Contracted words are inappropriate in a science paper.

Line 103 during1983 -> during 1983

Thanks for the correction.

Line 198 The words of leaf area index are repeated

Thanks. Deleted.

Line 293~295 The sentence about ET could be deleted

The sentence is rewritten as to describe the source of the observations. It now reads

Observed evapotranspiration (ET), gross primary production (GPP), sensible heat flux (SH), and latent heat flux (LH) at the site were obtained from an eddy-covariance system installed in July 2012 on the AVA tower.

Line 318~319 and 321~322 These sentences should be rearranged (-> in section 2.3)

Thanks. They are moved to section 2.3.

Line 333 2)->1)

Thanks. Corrected.

Line 349~357 The explanations about spin up and experimental design are quietly hard to understanding. The case 3 was run 200 years and after that additionality runs for 16 years was done due to the comparing case 6 and case 7. It would be nice to show this in Table 1. And did you run the CASE 5 after case 4?

Yes, Case 5 was run after Case 4. Table 1 is revised as in the following:

Table 1. Definition of model experiments with ELM, PF, F, and M denoting E3SM land model, ParFlow, different parameters for plant traits, and different mortality models, respectively. "K" in experiment name of Case 5 indicates soil property derived from Kupers et al. [2019b] is used. Extra 16 years of simulation were conducted for four experiments.

Cases	Model Experiments	Plant Traits	Soil Property	ParFlow	Drought Mortality Model	Extra simulation years for model comparison
1	ELM-F1-M1	F1	S1	No	Eq. (11)	0
2	ELM-F2-M1	F2	S1	No	Eq. (11)	0
3	ELM-PF-F1-M1	F1	S1	Yes	Eq. (11)	16 from Case 3
4	ELM-PF-F2-M1	F2	S1	Yes	Eq. (11)	0
5	ELM-PF-F2-M1,K	F2	S2	Yes	Eq. (11)	16 from Case 4
6	ELM-PF-F1-M2	F1	S1	Yes	Eq. (13)	16 from Case 3
7	ELM-PF-F1-M3	F1	S1	Yes	Eq. (14)	16 form Case 3

VWC is already shown in Figure 6, but there is no description of VWC in section 3.3. The first introduction of VWC is in section 3.4

Thanks! We added the introduction of VWC after "soil moisture content" in section 3.3.

Line 610 adds the discussion why the results of test data was not good.

We discussed that "the data is sparse and/or the observed AGB may depend on other factors such as soil heterogeneity and nutrient availability" at the end of the paragraph in the original submission.

References:

Chave, J., Réjou-Méchain, M., Búrquez, A., Chidumayo, E., Colgan, M. S., Delitti, W. B. C., Duque, A., Eid, T., Fearnside, P. M., Goodman, R. C., Henry, M., Martínez-Yrízar, A., Mugasha, W. A., Muller-Landau, H. C., Mencuccini, M., Nelson, B. W., Ngomanda, A., Nogueira, E. M., Ortiz-Malavassi, E., Pélissier, R., Ploton, P., Ryan, C. M., Saldarriaga, J. G., and Vieilledent, G.: Improved allometric models to estimate the aboveground biomass of tropical trees, Glob. Change Biol., 20, 3177–3190, 2014

Martínez Cano, I., Muller-Landau, H. C., Wright, S. J., Bohlman, S. A., and Pacala, S. W.: Tropical tree height and crown allometries for the Barro Colorado Nature Monument, Panama: a comparison of alternative hierarchical models incorporating interspecific variation in relation to life history traits, Biogeosciences, 16, 847–862, https://doi.org/10.5194/bg-16-847-2019, 2019.

O'Brien, S. T., Hubbell, S. P., Spiro, P., Condit, R., and Foster, R. B.: Diameter, Height, Crown, and Age Relationship in Eight Neotropical Tree Species, Ecology, 76, 1926–1939, 1995.

Saldarriaga, J. G., West, D. C., Tharp, M. L., and Uhl, C.: Long-Term Chronosequence of Forest Succession in the Upper Rio Negro of Colombia and Venezuela, J. Ecol., 76, 938–958, 1988.

Xie, Z., Wang, L., Wang, Y., Liu, B., Li, R., Xie, J., et al. (2020). Land surface model CAS-LSM: Model description and evaluation. Journal of Advances in Modeling Earth Systems,12, e2020MS002339. https://doi.org/10.1029/2020MS002339

Response to RC2

We are very grateful to this referee for the thoughtful critique and suggestions, which we believe have improved the readability of the manuscript.

Review of Modelling the topographic influence on aboveground biomass using a coupled model of hillslope hydrology and ecosystem dynamics by Yilin Fang et al

The study combines hillslope hydrological processes and ecosystem demography within an Earth system model framework. This is done by coupling a land component (ELM) of an earth system model (E3SM) using the FATES model as the vegetation demography component with a 3-D hydrology model (ParFlow). The model is applied and evaluated at BCI, Panama using hidrological and vegetation observations from the study site. The scientific aim is to investigate the influence of topography via hydrological processes on AGB. The paper presents a series of model sensitivities to model structure, plant traits, soil properties and hydraulic failure representations.

Combining 3-D hydrology, ecosystem demography and testing of various drought mortality functions on an ESM framework and testing it at site level is worth of publication in GMD. The work is overall well written and mostly clear. Unfortunately, the site selection was not ideal for testing impacts of hillslope water availability on AGB due to the low elevation at the site which could have been known a priory with the digital elevation model information.

Thanks for the positive comments. We selected this site as it has some relevant observations and meteorological forcing available for our model development and testing. ELM-FATES-ParFlow is being applied to another tropical forest region with ongoing measurements of hillslope flow, groundwater table, and vegetation dynamics.

There are various minor comments are important to improve comprehension of the analysis, discussion and conclusion.

The results and discussion section need to make a clearer differentiation of text referring to predictions and to observations. This is not clear in many parts. I was unable to find the figures and tables that refer analysis related to AGB observations. A suggestion is that sections that are only model sensitivity analysis and do not use the observations need to be separated from the section dealing with observations.

Thanks for the suggestion. We clarified in each section that has only model sensitivity analysis. The following sentences are added in section 3.1 and 3.3, respectively:

This section focuses on model sensitivity analysis as no spatial observations are available for comparison to the model simulations.

As there is no spatial observation of the relationship between AGB and WTD at the site, this section is for model comparison only.

Section 3.2 refers to spatial variability of simulated and observed variables with various model configurations , yet it shows temporal figures (fig 4 and 5). Spatial variability of the observations (ABG for example) is no shown, for other variables I understand that only a time series at a single location is available, but maybe should not refer to spatial variability if the comparison is to a single point observation. Some of the work done in this section is new to the results section, i.e not mentioned in the methods (Vcmax sensitivity)

Thanks for the comment. The spatial variability of the model was used to compare the effect of topography on water availability at different elevations and consequentially on the variables of interest. It can help us infer under what conditions the model can better match the observations. We showed spatial variability of variables when available. The Vcmax experiment was removed from the text and Fig. 5 to avoid confusion and replaced with

AGB can be further increased by parameter tuning for better agreement with observations, but we don't expect it to significantly change the AGB variability.

The discussion on factors that could explain observed AGB variability is succinct and vague, this section needs to elaborate further, for example it should include discussion possible variability of wood density.

Thanks for the suggestion. We added some discussions in section 3.2:

Based on the model results, species competition also cannot explain the observed variance of AGB at the 50-ha plot without accounting for the spatial heterogeneity of soil properties, nutrient availability, plant traits, etc. in the model. For example, wood density can contribute to the observed variability as it is a parameter used to define the allometry function (Eq. 10).

Eq. 10 was added in the text. It is a functional form in Chave et al. (2014):

$$C_{agb} = \frac{1}{c2b} p_1 (\rho D^2 h)^{p_2} \tag{10}$$

where C_{agb} is the target stem aboveground biomass, p_1 and p_2 are allometry parameters, c2b is carbon to biomass ratio, ρ is the plant wood density, D is stem diameter, and h is tree height.

Reference:

Chave, J., Réjou-Méchain, M., Búrquez, A., Chidumayo, E., Colgan, M. S., Delitti, W. B. C., Duque, A., Eid, T., Fearnside, P. M., Goodman, R. C., Henry, M., Martínez-Yrízar, A., Mugasha, W. A., Muller-Landau, H. C., Mencuccini, M., Nelson, B. W., Ngomanda, A., Nogueira, E. M., Ortiz-Malavassi, E., Pélissier, R., Ploton, P., Ryan, C. M., Saldarriaga, J. G., and Vieilledent, G.: Improved allometric models to estimate the aboveground biomass of tropical trees, Glob. Change Biol., 20, 3177–3190, 2014.

The study concludes that data needs to be collected to support findings of this study but does not elaborate (L700). There is a need to inform the ecological/plant physiology community on what is needed to be able to represent these processes/and or parameters needed in Earth System Models. L701-L702 are equally vague, authors need to be more specific on what is needed.

We added the following for elaboration:

For example, soil moisture, WTD, AGB, and plant traits across hydrologic gradient (from low land to high land).

Future modeling research should also account for spatial heterogeneity of soil resource (i.e., water and nutrients) and plant functional traits (e.g., mortality, growth, rooting depth etc.), as well as anthropogenic factors (habitat loss due to deforestation, degradation, and fragmentation [Miranda et al., 2017]) on the structure of plant communities.

Reference:

Miranda, A., Altamirano, A., Cayuela, L., Lara, A., Gonzalez, M., 2017. Native forest loss in the Chilean biodiversity hotspot: revealing the evidence. Reg Environ Change 17, 285-297.

Section 3.4 is full of statements that miss a figure or a table supporting the text.

Figure and table are now cited to support the text. Please see the response to the specific comments below.

Specific comments

L73, Clark et al 2015 is missing in the reference list, if this refers to JULES, that might be Clark et al 2011,doi:10.5194/gmd-4-701-2011 which focuses on the carbon cycle, Best et al 2011, doi:10.5194/gmd-4-677-2011 has more focus on the energy balance probably more appropriate. Jules has been used to represent ecosystems along topographic gradients,

See Hsi-Kai Chou, Boris F. Ochoa-Tocachi, Simon Moulds & Wouter Buytaert (2022): Parameterizing the JULES land surface model for different land covers in the tropical Andes, Hydrological Sciences Journal, DOI: 10.1080/02626667.2022.2094709

Thanks for the references. We were referring to:

Clark, M. P., Fan, Y., Lawrence, D. M., Adam, J. C., Bolster, D., Gochis, D. J., Hooper, R. P., Kumar, M., Leung, L. R., & Mackay, D. S. (2015). Improving the representation of hydrologic processes in Earth System Models. Water Resources Research, 51, 5929–5956. https://doi.org/10.1002/2015WR017096

Table 1 legend, what is K ?

K refers to the case where soil hydraulic parameters from Kupers et al. 2019 were derived. It's now defined in the Table caption as "K in the experiment name of Case 5 indicates soil property derived from Kupers et al. [2019b] is used."

Most of the end part of section 3.4 needs to use table and figures to support the all statements in the text (text is not using panels from figure 8 which I imagine needs to be included) Here two examples

Thanks! We added table and figures to support the statements in the text of section 3.4.

L582 -587 results presented here need to cite figures or tables where the information contained in the text is shown

Thanks! We cited Fig. 8 in this section.

L594, indicate in the text where is it shown that inclusion of VWC can explain more than 80% of the variance

Thanks! We cited Table 2 in this sentence.

L605 -615 -needs figures or tables to support text

As the model is not good, only performance scores were reported in lines 607 and 608 of the original submission. Figure is not shown as indicated in line 609 of the original submission.

I could not find (figure and table) on which the model is trying to explain the observations.

We clarified in sections where there is only model comparison. Please see our response above in the general comments.

Section 3.4 unclear where the sensitivity is trying to explain spatial variation of modelled AGB or observed AGB.

We now cited tables and figures where appropriate.

The paper has many abbreviations some of which are not defined. Please carefully check they are all explained (including those in tables, i.e table 2) or include a table with all abbreviations.

Thanks! We checked to make sure all abbreviations are defined. Those in Table 2 are added in the caption of Table 2 as shown in the response below.

Table 2: the authors might want to add extra explanation to the reader on how to interpret this busy table.

The caption of Table 2 now reads:

Table 2. Random Forest Model Performance on the simulated above ground biomass (AGB) and water table depth (WTD) from the site wide and 50-ha locations, respectively. Model performance is quantified by mean absolute percentage error (MAPE (%)) and percent of variance explained (VAR_{ex} (%)). The paired data separated by "/" in each column are metrics for training data (left) and unseen test data (right). Subscript RF1 indicates models using topographic features while subscript RF2 indicates model using simulated soil moisture as predictor in addition to the predictors used in RF1 models.