Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-148

Anonymous Referee #2

Referee comment on "Modeling the topographic influence on aboveground biomass using a coupled model of hillslope hydrology and ecosystem dynamics" by Yilin Fang et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-148-RC2, 2022

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.

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.

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)

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.

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.

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

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

Table 1 legend, what is K ?

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

L582 -587 results presented here need to cite figures or tables where the information

contained in the text is shown

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

L605 -615 -needs figures or tables to support text

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

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

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.

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