

## Referee 1

Ding et al present an interesting study using the FATES model at the Soaproot site in the southern Sierra Nevada Mountains, USA, which is dominated by ponderosa pine trees. The authors explore parameter space for root depth, hydraulic, and stomatal parameters in their experimental design. The authors initialize FATES with the observed demography and turn off growth and mortality to observe how changes in climate over a major drought period impact simulated physiology, soil moisture, and water and carbon fluxes. The model is forced with 4km resolution MACA climate. Model predicted ET and GPP are compared to flux tower observed LH and tower modeled GPP. The exploration of hydraulic parameter space and rooting depths is a really interesting and important set of model experiments to perform for hydraulically enabled vegetation models and their application to terrestrial ecosystem processes. However, I have several major methodological concerns that I hope the authors can address

*We want to thank the reviewer for their positive assessment of the value of the manuscript.*

Method clarity: Some aspects of the experimental design are not clear. For example, how was the soil moisture initialized or spun up? Did the authors test the sensitivity of their conclusions to this method? What is the vertical resolution of the new multi soil layer model? Given that soil water is fundamental to these experiments, I think these are important details. I also wonder why the authors forced the model with MACA instead of the flux tower met.

*We set the initial soil water content to be 75% of saturated water content, close to field capacity. We believe this is the realistic value because the model is initialized in Jan, when the study area has high precipitation and trees are all in a dormant status, and in a year when there is not drought. We found that initializing with very dry soils led to numerical errors in the hydraulics model, but have not tested the sensitivity of the results to this assumption beyond that. We will explore this sensitivity during revisions.*

*The vertical soil is set to be 8 meter deep and divided into layer and the thickness of each layer (meter) is given as the following:*

0.015639592	0.010145736	0.01672749	0.027578969
0.045470033	0.074967411	0.123600365	0.203782551
0.335980626	0.553938405	0.913290032	1.505760701
2.482579697	4.093081953	6.748351278	11.12615029
18.34392065	30.24401217	49.86394617	

*We use MACA data for two reasons. First the flux tower data has large gaps, and thus needs filling with some reanalysis-based product. Second the MACA has the correct format for CLM and has been used in precious study for driving CLM. We have compared MACA data with flux tower data and they are similar. We will include as a supplementary figure in the revisions some results from this comparison.*

Assessment of model performance: I see this as a contextualized OSSE experiment. However, I do think that the authors should do a little more than calculate TMSE relative to GPP/ET. Perhaps use some of the standard ILAMB metrics in addition to RMSE like inter annual variability, monthly variability and phase shifts in annual cycles?

*We will consider whether it is possible to use the ILAMB approach for this, in particular some of the metrics beyond RMSE. However, we note that the datasets in ILAMB are mainly global-scale and thus not appropriate for the local-scale analysis in this study..*

The authors come off as defensive about the model predicted leaf water potentials, understandably because they are a physical (there are basically no trees that allow for LWP lower than -4 MPa, the -10 MPa cited in the text is for California chaparral and the correct citation is Tyree 1997 not Vesala 2017). I do appreciate that the experiments are designed to test relative sensitivities of physiological diagnostics to model parameters and that ecosystem dynamics are turned off, but with some of the parameterizations all the trees would be VERY dead before the drought started. I think with such ridiculous LWP values, the authors are going to lose the confidence of a large portion of their audience that has a physiology but not a modeling background, so I hope they will try to make some modifications to their experiments. The fact that the LWPs are dropping so low suggests that the authors might want to reconsider the vulnerability curve parameterization and parameter space that they explore for their experiments. Another option is to use the simulated water potentials to tell us more about the system (for example, to screen what parameter combinations are physiologically impossible at the site). It seems like these trees must have really deep roots to exist at this site with is in agreement with the conclusions of Goulden and Bales 2019. Why not direct the discussion in this direction instead?

*Thanks for pointing this out. Again, we reiterate that if we allow the trees to die in the experiment, then it will fundamentally change the interpretation of the results by making them a function of ecosystem structure and traits, rather than a function of traits alone conditional on the same fixed structure. We feel the second option you suggested matches better with the goal of this study and showing the advantage of using the model. We will incorporate the above content in the discussion section.*

### **Minor line specific comments**

There are grammatical problems throughout the text which could use further proofreading (tense problems etc)

*We will do a more thorough proofreading.*

Almost everywhere water potential units are written as 'Mpa' when they should be 'MPa'. Similarly, the authors should be consistent with capitalization/abbreviation of 'Fig.', 'fig', 'Figure' throughout the text. I'd also like the authors to denote the denominator as either  $1/x$  or  $x-1$  rather than using both in the text

*Thanks for the suggestion. We have made changes accordingly*

Instead of using kLWP as one of the parameters, can the authors choose a different letter, this is easily confused with conductance (k)

*Thanks for the suggestion. We will use a different symbol*

All of the figures would benefit from increased font size.

*We will increase the font size*

L359-361 I am having trouble understanding what the authors mean here, can they clarify?

*We will rephrase that sentence for better clarity.*