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Interactive comment on "Description and validation of an intermediate complexity model for ecosystem photosynthesis and evapo-transpiration: ACM-GPP-ETv1" *by* Thomas Luke Smallman and Mathew Williams

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The Smallman et al Paper describe a new intermediate complexity model of photosynthesis and evapotranspiration. Such model is partly processes based but using a single canopy layer and daily output is 2000 time faster than full process based models based on half-hourly time steps. The paper is well written. The description of the model, the calibration and validation procedure are sound. The model show good performances compared to the SPA model used for calibration. So I have only few remarks on the model description. However what is missing here is what is really the added value of such a model and what are the final objectives for the development of this model ? It is

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Discussion paper

stated in the abstract "that model of high complexity cannot be evaluated for their parameter sensitivity nor calibrated thru assimilation of large ensemble" but it is not clear how a model like ACM-GPP-ET can solve this problem ? Indeed, they are not based on the same parameters and set of equations so how to infer sensitivity of parameters from the complex model from sensitivity of parameters from intermediate complexity model ? Likewise how calibration of intermediate complexity model helps to calibrate complex model (especially in the case on the paper it is the opposite). Likewise authors compare results for ACM-GPP-ET to different learning machine algorithms showing similar skill. But then what is the added values of such model compare to machine learning approaches ? For me machine learning algorithms, are very well suited to interpolate informations but are difficult to use outside of their domain of training set. On the opposite model, based on process can be extrapolated. Then such model could be used for past or future climate conditions for instance. But ACM-GPP-ET is not a full vegetation model. In particular, it depend of LAI that should be prescribed and not calculated. So simulation are limited to conditions where LAI observations are available. So it would be interesting to know if the final objective is to include such kind of model in a TEM to be able to simulate the complete carbon cycle. In summary the description of the model and its validation is correct. The model give very satisfying result. But what is really missing in the paper is what are the objective and perspective for such a model.

For more specific points:

- One argument for the intermediate complexity model is the difficulty to have sub-daily climate forcing. I am not very convinced since, first of all most of global products are available at 3 to 6 hourly time steps. Then, even for data only available at daily time-steps, most of the TEM use weather generators to simulate a pseudo diurnal cycle. So this is not really a limit. An interesting question could be to know if intermediate complexity model directly based on daily data are performing better with daily data that more complex models coupled with a weather generator ? The paper partly reply to this point in the comparison between SPA and ACM-GPP-ET on fluxnet site where ACM-

GPP-ET seems to perform a little better that SPA. However the difference is relatively small. This first point brings me to a second one about FLUXNET. As ACM-GPP-ET is calibrated on SPA, it will obviously tend to have the same behaviour and then the same discrepancies when compare to FLUXNET (which is visible on Figure 7).So as suggested in the further opportunities it would be interesting to make a calibration of ACM-GPP-ET on observed GPP and ET from fluxnet to see how the calibration differ and how model improve compared to fluxnet.

- I am a little surprised by the calibration protocol making a simulation from 2001 to 2012 with rapid increase of CO2 ? Since I guess there is some prognostic variables it means that there is correlations between the successive years of simulation and then the rapid (and unrealistic) change in CO2 could lead to artefact in the simulation. So to explore the range of CO2 why not doing a series of simulations from 2001 to 2012 with different (but fixes) levels of CO2 ?

- The way LAI is used in the calibration is not clear. It is stated that it is retrieved from DALEC and few lines after it is stated that CARDAMOM assimilate MODIS LAI ? So which LAI is used everyday to force ACm6GPP-ET ? And is the LAI from DALEC is retrieved from a previous simulation or done with a simulation with the same Era-iterim forcing (and CO2 increase) ? this point must be clarified

- in equation 12 use P to define day length where different Pn,Pd,Pi represent different GPP limited term is not very appropriate !

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