Geoscientific
Model Development
Discussions

Interactive comment on "A new step-wise Carbon Cycle Data Assimilation System using multiple data streams to constrain the simulated land surface carbon cycle" *by* P. Peylin et al.

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Peylin et al. contribute an interesting study on the effect of using a stepwise optimisation rather than merging all data streams in a single cost function. This is a procedure that we have used in e.g. catchment scale water quality modelling where one first calibrates the water cycle before calibrating parameters relevant to nutrient diffusion (e.g. Exbrayat et al., 2011). However, this approach has not been investigated in details in the frame of the (global) carbon cycle. Therefore, I agree with reviewer #1 that this paper is highly relevant to the community. I particularly like the several steps used by the authors to reconcile site-scale calibration with global atmospheric concentrations. I have some very minor comments on the paper that should be straightforward

to address:

p.5 l.1: another alternative to stepwise optimisation and simultaneous procedure is a simultaneous, multi-objective approach based on the Pareto ranking of several cost functions to account for trade-offs (e.g. Yapo et al., 1998). Would it be realistic to use such an approach in this system to avoid the increase in RMSE against MODIS NDVI from step1 to step2 (fig. 8, TeBD)?

p.5 l.12-13: Using a restricted number of parameters is a valid point but it needs to be mentioned here that one must proceed to some sort of sensitivity analysis to accurately select these parameters.

p.8 l.1: why not using only days with data?

p.9 l.26: please mention the resolution of the model here

p. 10 l.1: is it robust to assume that carbon pools are at equilibrium in 1990? Could this system use a prior from soil and biomass maps instead (like e.g. Bloom et al., 2016)?

p. 18 l.6: How is fire simulated during spin-up?

p.26 l.29: perhaps "ecosystem data streams" is more correct (LE is not carbon sensu stricto)

p. 29 l.17: see also Bloom et al. (2016)

Figure 1: lower box, "carbon"

Figure 5: please add scale on x-axis

References

Bloom, A. A., Exbrayat, J.-F., van der Velde, I. R., Feng, L. and Williams, M.: The decadal state of the terrestrial carbon cycle: Global retrievals of terrestrial carbon allocation, pools, and residence times., Proc. Natl. Acad. Sci. U. S. A., 113(5), 1285–1290, doi:10.1073/pnas.1515160113, 2016.

Exbrayat, J.-F., Viney, N. R., Frede, H.-G. and Breuer, L.: Probabilistic multi-model ensemble predictions of nitrogen concentrations in river systems, Geophys. Res. Lett., 38, L12401, doi:10.1029/2011GL047522, 2011.

Yapo, P.O., Gupta, H.V. and Sorooshian, S., 1998. Multi-objective global optimization for hydrologic models, J. Hydrol., 204, 83-97.

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