Biogeosciences Discuss., 9, C5850–C5851, 2012
www.biogeosciences-discuss.net/9/C5850/2012/

Biogeosciences Discussions

Interactive comment on "The climate dependence of the terrestrial carbon cycle; including parameter and structural uncertainties" *by* M. J. Smith et al.

Anonymous Referee #2

Received and published: 21 November 2012

The manuscript "The climate dependence of the terrestrial carbon cycle; including parameter and structural uncertainties" by M. J. Smith et al. is an interesting analysis showing a methodology for the estimation of parameters of a novel model proposed. Moreover, by using many data streams, representing different processes, combined with different model components and parameters estimation routines, the authors investigated i) the degree of empirical support for simple functional representations of component processes of the carbon cycle, ii) if the inferred relationship are consistent with the current understanding of processes and iii) a methodology to identify the appropriate balance of details (processes, input data, parameters) that need to be described to better constrain probabilistic projections of the carbon cycle into the future. In my opinion the manuscript is very interesting and the analysis proposed is crucial for improving terrestrial biosphere models. I have some concerns regarding the presen-

tation and the structure of the manuscript. In my opinion the model description could be shorten and many equations can be moved in an Appendix. Sometimes I had the feeling that this is a paper describing a new model, but the objectives of the paper are different and more ambitious. By shortening the model description I think that the authors can deliver better their message. I have found the description of the parameter inference methodology quite interesting. However, I would invite the authors to emphasize the importance of weighting the optimization process using observational errors, considering that many datasets contain an estimation of the observational uncertainty. Some important datasets are overlooked, like the FLUXNET dataset for water and carbon fluxes, the GFED and GFAS dataset for fires, and FPAR datasets. In particular the latter it's in my opinion quite relevant and should be mentioned considering the poor performances of biogeochemical models in describing the seasonality of LAI, that lead to biased annual photosynthetic carbon uptake estimates. I would not ask the authors to repeat the analysis, rather I would invite them to mention these dataset in the discussion and describe how these data streams can be used to improve processes description. Again, moving toward the perspective of including processes that are not "seen" in the available datasets (too short time series, few extreme years, etc.), I would invite the authors to describe how manipulation experiments can be used as additional constrain in their methodology. Finally, I would invite the authors to structure the discussion in three sections according to the objectives stated in the introduction (Lines 20-25 p 13443).

Interactive comment on Biogeosciences Discuss., 9, 13439, 2012.

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