Geosci. Model Dev. Discuss., 5, C301–C303, 2012
www.geosci-model-dev-discuss.net/5/C301/2012/

Geoscientific
Model Development
Discussions

Interactive comment on "A semi-analytical solution to accelerate spin-up of a coupled carbon and nitrogen land model to steady state" *by* J. Xia et al.

C. Koven (Referee)

cdkoven@lbl.gov

Received and published: 18 June 2012

Overall comments: This is a useful approach that ought to be considered more widely as a way of calculating equilibrium conditions for C and C-N models. I have concerns about the generality of the approach, in particular the role of feedbacks that some models may include in making the initial NPP estimate and allocation terms differ between what is calculated in the short spinup period 1 and the final equilibration period 3 from figure 2; this may make the approach better estimated as an iterative procedure to work in more complex models that may include more nonlinear interactions between C stock and NPP/allocation. In addition, more clarity on the comparison that is being

made between the "traditional" and revised approaches would benefit the paper.

Specific comments:

Abstract, line 14: Need to define what the traditional method that is being used as a point of comparison here. Is it the full model?

page 805, Line 1; "Modeling ecosystem biogeochemical cycles is an initial value problem." I disagree, modeling ecosystem biogeochemical cycles is much more than an initial value problem! Perhaps better to just say that "Modeling ecosystem biogeochemical cycles is highly dependent on initial values because of long-term persistence of ecosystem state properties"

page 807, line 3: Not necessarily, in principle spinup could be achieved using a long-term model run that is non-repeating.

p. 807, line 9-14. This isn't clear. An with coupled C-N models is that the productivity of the ecosystem is tied to the slowest pool N stock by mineralization of N through decomposition of soil organic matter. So how do you estimate the NPP via a short initial spinup if you don't know what the N mineralization is?

p. 809; lines 14-21: this assumes that the allocation parameters are independent of productivity. What if this is not the case; e.g. autotrophic respiration or allocation depend nonlinearly on the C stock in a given pool?

p. 810, line 9: It is not clear how this method avoids the issue that NPP is a function of N and therefore the NPP will be different between the initial step and the final step. Is this the reason why the final step is needed? Why not iterate through the loop until the model converges?

p. 814, lines 13 and 19. Can you replace loop units with years in this discussion? Also, what is the "traditional" spinup procedure used here? I think replacing traditional with a more informative description of what is being compared against (e.g. "full model"), throughout the paper would make the comparison more clear.

GMDD

5, C301–C303, 2012

p. 818-819. It would be useful to lay out exactly what assumptions are required for this method to work; i.e. can there be any nonlinearities within equation 1 and still have this work?

p. 820, last paragraph. Analyses of equilibrium solutions to biogeochemical analyses using similar types of methods have been done, and it may be good to flesh out some of this discussion with references to the relevant papers, e.g. Bolker et al. (1998), "Linear analysis of soil decomposition: Insights from the century model".

Interactive comment on Geosci. Model Dev. Discuss., 5, 803, 2012.