

Interactive comment on “Bayesian calibration of a soil organic carbon model using $\Delta^{14}\text{C}$ measurements of soil organic carbon and heterotrophic respiration as joint constraints” by B. Ahrens et al.

Anonymous Referee #2

Received and published: 30 October 2013

Dear editor,

This is an interesting work presenting a very thorough analysis of the uncertainty of the parameters of a simple SOC decomposition model. It links a variety of observations including carbon stable isotopes, carbon stocks and respiration fluxes with model outputs under a Bayesian framework utilising MCMC procedures. It explores how well constrained the parameters were under the use of different number of observations and how the turnover rates were effected by relaxing the assumption that a steady-state exist for soil carbon pools.

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General comments: A very well written manuscript, with a large amount of information to present. Reading through however, felt somehow overwhelming because of this large amount of information the authors were trying to put through. It certainly is not an easy bed-time read. However, this did not reduced the value of the manuscript. On the contrary, the manuscript can be seen as a useful demonstration on how to explore and present the uncertainty of parameters and how to investigate the impact of “relaxing” the assumption of steady-state. The lack of clear sectioning between results and discussion made the latter less obvious in parts of the manuscript which really doesn't help getting the point across and giving definitive answers to the otherwise clearly stated objectives. The manuscript is certainly well written and for I could recommend its publication, however, I would strongly recommend the authors doing some changes such as 1) Maybe reduce the number of results presented by choosing those that directly answer the questions they have set from the start 2) split the results and discussion section for a more clear and focused discussion.

Below you can find some more specific comments/recommendations regarding the manuscript:

1. At the moment the way the second objective of the article is given in the abstract does not reflect the very important issue of relaxing the steady-state assumption. I find this very important issue, as the authors claim in the introduction it does affect the estimation of the turnover rate. I suggest the authors change the wording to make it more clear that this is what they are trying to do. It should be clear to the readers from the abstract.
2. Soil incubations: Why the authors used different methods for collecting soil samples. Does leaving the small roots in the cores cause an extra addition of carbon which was not included in the first site? Maybe the authors would like elaborate a bit more as to why they thought this would not be a problem.
3. Measurements at Howland Forest: Since there were no data for belowground litter input, why the authors thought that fixing the input to a similar order of magnitude to the aboveground litter would be sufficient? Maybe they can elaborate on this. They could also have

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also included it as a variable in the MCMC procedure. 4. The authors have done an amazing amount of work and even greater to be able to present in a concise and clear way the results. However, when they combined the results and the discussion, sometimes I felt sometimes like results were taking over the discussion, in some parts of the manuscript (e.g., section 3.1). Maybe a better approach would have been to have a separate section for the results and for the discussion. This helps keep the focus of the manuscript and making more clear the message it wants to take across. 5. Was the correlation of the parameters known prior the analysis? I understand that an assumption was made that nothing is known about the correlation of the parameters. However, it has been shown that ignoring correlation between the parameters can significantly alter the resulting posterior distribution of the parameters. I suggest some further exploration using multi-variate prior information based on covariance.

Interactive comment on Biogeosciences Discuss., 10, 13803, 2013.