

## ***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.***

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general comments This paper is a good contribution to enhance the accuracy of C allocation to soil pools and obtain a faster convergence thanks to a semi-analytical solution. Spin-up runs are by themselves an issue and the number of alternative method is very low, so it worth a publication, after some editing work.

However authors should consider in their conclusion that the method would not “work” on a model were NPP stabilization is only reached when soil organic matter is also stabilized. So for some model like Century (which contains a “very simple vegetation model”) it would work, whereas for some model with more interactions like PaSim, it

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would not be very efficient.

specific comments: P808 , line 7 : I guess it is more aboveground biomass than just woody biomass or leaves biomass is ignored?

P809, line 5: may be it could be useful to precise that A represent C fluxes from respiration and transfers to another pool.

P810, line 5: Why using C/N ratio of the end of the spin-up run for Uss, and not annual average values, as for  $\bar{A}$ . Isn't there dynamics within a year?

P812, line 13: it is not clear to me what is the needed time step of the forcing? If meteorological forcing is generated a 3 hour time step, then it is sub-daily and not daily data.

P813, line 11. I guess stabilization is more accurate than steady-state. Cf. general comments.

P813, line 21. If I understood well, it might be useful to precise than mean changes are smaller than 0.01% per year compared to previous cycle.

P814, line 6: The comparison between each year and not each cycle may be problematic for extreme year (e.g. 2003 for Europe). Indeed these year will naturally induce high change in C pools. Is the passive pools stable enough in your model to support that?

P814, line 7-10: This is right that slower pool needs longer time to reach equilibrium, but due to initialization forced values, passive pool may be forced at steady state values whereas other pools are not. I would suggest to extend criteria to other pools. P815, line 18, same remark are previous one

P817, line 16-17 Right, but comparison of line numbers is only relevant if it is the language (i.e. Fortran), which I am not sure?

P820, line 20: This is still costly, I think SAS alone is not enough to reach such a goal.

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technical corrections : P810, line 6 and 12: it is not equation 3 but 4.

P810, line 18: the reference is just Kowalczyk (2006)

P814, line 1: It is equation 4 and not 3.

P818, line 18: it is the RothC model (not RathC)

P820, line 25 and 28; P821, line 4, equation 4 and not 3

P832, P833. In the legend, the unit is kg instead of  $\text{kg/m}^2$

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

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