Biogeosciences Discuss., 9, C1283–C1286, 2012
www.biogeosciences-discuss.net/9/C1283/2012/

Biogeosciences Discussions

Interactive comment on "Predicting decadal trends and transient responses of radiocarbon storage and fluxes in a temperate forest soil" *by* C. A. Sierra et al.

C. A. Sierra et al.

csierra@bgc-jena.mpg.de

Received and published: 16 May 2012

1 Response to specific comments

- Δ^{14}C *value of atmospheric* CO_2: We of course agree that a local estimate of Δ^{14}C of growing season atmospheric CO_2 is important, and thank the referee for pointing out that this was not prominent in our discussion of the modeling. Our record of atmospheric $\Delta^{14}C-CO_2$ is derived from atmospheric samples we collected over the entire measurement period, and from tree ring samples for earlier periods. Our results show that on average the growing season $\Delta^{14}C-CO_2$ is about

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

5 ‰ depleted compared to the background atmosphere (see also regional data from Hsueh et al. 2007). On specific dates, this effect can be larger or smaller, according to local meteorological conditions (see for example, Figure 4, which shows the atmospheric $^{14}CO_2$ values sampled at the same time as the field soil CO_2 efflux). The tree ring and atmospheric data can be found in Gaudinski et al. 2010 – we have updated this with our own measurements at the site (see Figure 4 and the supplemental material associated with this paper). We have added to the text of the model description and the caption to Figure 2 to make this clear.

- $\Delta^{14}C$ *variation associated with timing of plant uptake*: We only measured $\Delta^{14}C-CO_2$ during the growing season, and tree rings record only growing season $\Delta^{14}C-CO_2$. We expect (as in Turnbull et al., 2006), that fossil fuel influence will be larger in winter (non-growing season) at the Harvard forest site, given the rectifier effect.

- *Describe in what circumstances differences between hypotheses might be observable*: One important observation derived from our analysis is that very different hypotheses that are often discussed in the literature in terms of relative changes in decomposition rates (Fig 7a), make little difference when analyzed as the absolute change in decomposition rates (Fig 7b). In terms of radiocarbon, these different hypotheses can hardly be detected because their predictions are below detection limits under the current experimental set up and technical conditions of the radiocarbon method. The question is not whether we can observe differences under these hypotheses, but rather what hypotheses would actually show a difference. Given that the observations in the experimental study did show differences, it is important therefore to identify those hypothetical mechanisms under model predictions would show important differences.

- *Formalize additional hypothesis*: We followed this suggestion and presented the idea of changes in pool sizes as an additional hypothesis.

- *Combination of fractions*: The size fractions on the original samples were not available and we have to combine these fractions in the model to compare with the observations. The radiocarbon measurements from the combined fractions would represent a weighted average of the radiocarbon in the original fractions. Given that the size of the A, LF ($< 80\mu$m) is very large compare to the ($> 80\mu$m) it would dominate the average ^{14}C values, which probably makes little difference despite the differences in turnover times. This is only done to interpret the results in Fig 3 and should not have any implication in the subsequent tests of the model and in the interpretation of its predictions.

2 Response to technical corrections

The term ‘radiocarbon signature’ was removed from the manuscript and changed to “Δ^{14}C value” as suggested by the referee.

P2210 L3-11. We used ANOVA with Dunnett’s correction for multiple comparisons. This is stated in the caption of figure 5, but we added this information in this paragraph for clarity.

3 References

Hsueh Diana Y.; Krakauer Nir Y.; Randerson James T.; Xu, X; Trumbore SE; Southon, JR: Regional patterns of radiocarbon and fossil fuel-derived CO2 in surface air across North America, Geophysical Research Letters 34: L02816, 2007.
Turnbull, J. C., Miller, J. B., Lehman, S. J., Tans, P. P., Sparks, R. J., and Southon, J.: Comparison of 14CO2, CO, and SF6 as tracers for recently added fossil fuel CO2 in the atmosphere and implications for biological CO2 exchange, Geophys. Res. Lett.,

BGD

9, C1283–C1286, 2012

Interactive Comment

33, L01817, 10.1029/2005gl024213, 2006.

Interactive comment on Biogeosciences Discuss., 9, 2197, 2012.