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## ***Interactive comment on “A dual isotope approach to isolate carbon pools of different turnover times” by M. S. Torn et al.***

**M. S. Torn et al.**

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This is a reply to Anonymous Referee #1. We first excerpt the relevant comment and then describe our response.

[Excerpt of the Review]How much do the results of the experimental part of the study depend on the assumption that soil organic carbon pools are in a steady state (Equation 4 and related text)? Concentrations of CO<sub>2</sub> were almost doubled in the labelled plots (to > 700 ppm). Even a much smaller enhancement of CO<sub>2</sub> concentrations (to 475 ppm) can already substantially affect the size of carbon pools and respiration (Ross et al., Soil Biol. Biochem. 58, 265-274, 2013). I am wondering, to what extent does the better performance of the two-pool model in simulating similar turnover-times in control and elevated CO<sub>2</sub> treatments result from its ability to better compensate a possible

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discrepancy between the steady state assumption in the model and a non-steady state behavior in the field? Could there be a circularity between assumption and result? Please discuss.

[Response] Thank you for the questions and comments. Following the suggestion of both reviewers, we have added modeling results for a non-steady-state case. Specifically, we used published literature on the Jasper Ridge Open Top Chamber experiment, where our study was sited, to create a plausible estimate of increased plant inputs under the elevated CO<sub>2</sub> treatment. We now report the results of both steady state and non-steady state in Table 4. The turnover times of the fast pools were slightly longer under non-steady-state case, but not enough to change any of the observed patterns. We found that the estimated turnover times and the comparisons between soil type, depth, density fraction, and fast- versus slow-cycling component in each fraction were similar for steady-state and non-steady-state cases. Therefore, the qualitative results and findings were not affected by the assumption of steady or non-steady state soil carbon cycling in the elevated CO<sub>2</sub> treatment. Please see Table 4 and related text in Lines 189-203, 268-281, and 447-449 for a more detailed explanation. Please also see the response to Referee #2.

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Interactive comment on Biogeosciences Discuss., 10, 10189, 2013.

**BGD**

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