

## ***Interactive comment on “Sudden cold temperature regulates the time-lag between plant CO<sub>2</sub> uptake and release” by M. Barthel et al.***

**M. Barthel et al.**

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Response to comments by anonymous referee 3 (C7882-2014)

We thank the Referee for this positive and constructive review. The incorporation of the referee's contributions have strengthened our paper and improved its overall quality and impact. Please find below our respective responses to the specific comments, suggestions and corrections (our replies start with #).

“... The paper is relevant in its scope for BG readers and presents innovative analysis and data to an ongoing research area. The work was well written and following some minor changes and clarifications, I would recommend it for publication. Additional comments:

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1) I would recommend that the title be modified to reflect the full analysis conducted (i.e. not just transport time, but also allocation). Perhaps something along the lines of: “Sudden cold temperatures prolong CO<sub>2</sub> transport between shoots and roots, increase respiration and decrease carbon accumulation in roots.” # While this suggested new title does describe more aspects of our study, it is not strictly correct. For example, CO<sub>2</sub> is not transported (C is, in different forms); respiration and carbon allocation to roots change only in relative terms, rather than absolute values. This complexity is hard to capture correctly in a short title. We have decided to retain our original title.

2) The hypothesis/objectives should reflect your multiple analysis and results (i.e. transport and accumulation in tissues). # Done as suggested: we have incorporated specific hypotheses and re-organised the following sections accordingly.

3) Please explain why you chose the 25 °C and 10 °C temperatures for your experiment (or a 15°C reduction). # We have now incorporated a paragraph detailing the selection of the treatment temperatures. “The temperature treatments were chosen to cover a range of realistic climatic conditions in pasture-growing regions, and with the expectation of a treatment effect. While perhaps uncommon in more continental areas, a 15 °C difference in temperature from one day to the next is a recurring event in highly changeable, oceanic climates. For example, in the agricultural region of Canterbury, New Zealand, on average every year there are more than ten occasions when the difference in daily maximum temperatures between subsequent days exceeds 10 °C, and one occasion where this difference exceeds 14 °C (Lincoln Broadfield weather station, 1999-2013, data available from [www.cliflo.niwa.co.nz](http://www.cliflo.niwa.co.nz)).”.

4) What was the daily radiation regime of the plants in each of the cabinets? This maybe of interest for anyone interested in replicating your methods. # We have added these details to methods section.

5) Please clarify in Figure 4, panels C and D, that “respiration [value]” is a fraction (“respiration” by itself suggests rate. Overall it is a very nice summarizing figure, although

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the changes in the root C-13-excess with time are a bit hard to differentiate due to scale. # In Figure 4C and 4D the y-axis is called 'fraction carbon allocation'. From that, we believe, the reader will understand 'root biomass', 'shoot biomass' and 'respiration' as the respective fractions rather than absolute values. The given values do also sum up to 1. Further, we agree with the reviewer that root C-13-excess changes are hard to differentiate in panel A and B of this figure. One of the main reasons including panel A and B was to provide the first logical step for obtaining the fractional values in panel C and D. Changes in  $\delta^{13}\text{C}$  are also visualized in Fig 3. For these reasons we would like to leave the Fig as it is.

6) please add units of tau to Table 1. # We have changed 'tau' to 'lambda' to be in line with the standard decay function and added unit h<sup>-1</sup> for lambda (tau) in Table 1.

7) Why is there such a large gap in data collection in panel F and J (before 50hr and around 150 hours)? # These panels show the results for the  $\delta^{13}\text{C}$  of bulk roots and shoots. These were sub-sampled and sent away for analyses. Since these analyses are fairly costly, and should relate to the patterns found in the signatures of respiration, we decided to have only the sample of Day 2 and Day 7 analysed for bulk  $\delta^{13}\text{C}$ .

Minor edits: 1) Line 20: change "to" to "too", p.17950 # Done as suggested

2) Add comma after: "scale" on line 21, p.17950; "of respiration" line 3, p.17951; "time" on line 11, and line 23, "Fagus saplings" p.17953; "growth/storage", line 7, "patterns" line 10, "grasslands" line 18, p.17954 # Done as suggested

3) Line 22, p.17954, "temperature drop. . ." to "temperature-drop" # Done as suggested

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Interactive comment on Biogeosciences Discuss., 10, 17939, 2013.