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Interactive comment on "Sudden cold temperature regulates the time-lag between plant CO_2 uptake and release" *by* M. Barthel et al.

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Response to comments by anonymous referee 2 (C7856-2014)

We thank anonymous Referee 2 for this positive and constructive review. 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 #). "Overall, the work makes a valuable contribution to the field and I would like to see it published. However, the quality of the manuscript could be significantly improved by some modification of the structure, and the impact enhanced by adding consideration of how the experimental findings relate to field situations, and what future enquiries are needed in response to the findings presented here. # We have incorporated these suggestions within the discussion section

1) p 17941 line 26 – 17942 line 13: need to state more clearly the importance of understanding both single-factor responses and interactions # Done as suggested

2) p 17942 line 20: briefly explain the experimental approach – explaining the shift in temperature is to avoid acclimation and justifying the selection of the 25°C /10°C range # 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)." In the section immediately above, we clearly state that the reason for the quick drop in temperature is to avoid acclimation.

3) p17942, line 27: 'biological and physical processes' seems vague - an explanatory sentence detailing these processes would link the introduction more clearly to the later discussions. # We have provided some more detail, which as suggested also enhance the link between sections.

4) p17942, line 27: The single hypothesis stated here relates only to transport time, when the experiment actually had a somewhat broader scope (e.g. line 20). I would suggest defining additional objectives and focusing on these to create a clearer structure for subsequent sections. # We have incorporated specific hypotheses and reorganised the following sections accordingly.

5) The methods section would benefit from a reduction in length. Methodological details could be described more succinctly throughout, and authors could also consider moving more findings from preliminary investigations to the supplementary section (e.g.

Fig 1, p17945 lines 19-23). # Done as suggested. We moved Fig 1 to the supplement as well as rearranged and shortened the methods section.

6) p 17947, lines 5-9: what is the relevance of this information? # We have deleted this section on Leaf Area Index – it was meant as a bit more background on the size of the plants etc, but may be distracting and lengthened the Methods section unnecessarily.

7) p17954, lines 9-25: it would be interesting here to have comment on whether/why the authors feel that an allocation response to temperature would be the same as that shown in drought and shading studies # We have included a paragraph on plant response to climatic stress, and that it appears that there are some general patterns in these responses, regardless of the stress induced (e.g. temperature, drought or shading).

8) Since this is a short-term growth chamber experiment, it would be very valuable to include comment on how the findings might differ in field situations and also briefly identify the key outstanding questions in relation to the influence of temperature on short-term C cycling in plants. # We have included a paragraph in the discussion detailing these issues.

Technical comments 9) p 17948, line 18: state abbreviation again in words for clarity # Done as suggested.

10) p17953, line 1: the possibility of hydraulic adaptations is hypothetical, so should be stated as "would represent an underestimate. . ." # Done as suggested.

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