

Interactive comment on “Seasonal and annual variation of carbon fluxes in a young Siberian larch (*Larix sibirica*) plantation in Iceland” by B. Bjarnadottir et al.

Anonymous Referee #2

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General comments

Bjarnadottir et al. presents a study on interannual and seasonal variation of NEE and the component fluxes with the aim to clarify how climatic factors control the site's carbon balance. The authors base their work on field measurements of NEE by eddy covariance technique. Bjarnadottir et al. measured also the most important environmental factors. The study addresses a relevant scientific question about environmental factors affecting CO₂ exchange over an ecosystem in Iceland as well as an afforested area which both are underrepresented in the literature.

In general the underlying methodology seems sound and the paper is of interest to the

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readers of Biogeosciences. Description of experiments and calculations is complete and precise and relevant studies are cited. However, the authors could better structure their work and add years 2007 and 2008 in the analysis if the measurements have been running. If the data is not available, the manuscript should be directed towards the seasonality and annual changes because as it is, the number of years is too low to draw any conclusions on the interannual variation. Also the introduction lacks the structure to deliver a clear and straightforward aim for the study and therefore the conclusions are rather vague. Hence, the manuscript would need some improvements before being acceptable for publication.

Specific comments

The introduction is too wide and should be tied up. For example the third paragraph of the introduction is irrelevant for this study. As well some of the referred studies are not necessary to introduce the work. Some of them might be useful to bring up in the Discussion. Please perform some restructuring in this section.

The description of seasonal and annual variation in physical factors (3.1 and 3.2) is otherwise sufficient but information is missing regarding snow. Were there a snow cover and was some of the precipitation in the form of snow?

The discussion on the reasons behind the abrupt switch from a net source to a net sink is a little unconvincing. First, it seems to me that the figure 1 shows that the soil has thawed already earlier than the stand becomes a net sink, at least in 1cm depth. In the case of water-logging as the authors suggest (p 6612 l. 14-18), the figure 3 should indicate depression in soil respiration at the date of thaw before the rapid change in NEE. However, the figure indicates that the level of respiration has been rather invariable during the early phase of the year. Nevertheless, the comparison is rather difficult from the separate figures without any additional information on the dates of thaw etc. Please clarify your thoughts or give more details.

It is not clear, how you have partitioned heterotrophic and autotrophic respiration (p.

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6612 I. 25-27). Some of the discussion is mentioned to be speculative but not all.

In general, it would be very informative if the authors would present the temporal profiles of GPP and Re as they have presented the daily course of NEE. Also, it would be great benefit if the authors could further fractionate the different components e.g. to heterotrophic and autotrophic respiration. However as I understand, the authors do not have additional chamber measurements from soil, for example, and therefore the partitioning is pretty impossible without additional models and assumptions. Nevertheless, I think that the data still has value as it is now but the discussion on the annual variation in ecosystem respiration (3.6.), for example, is thin and too simplified and does not discuss true causes and consequences.

Each year was divided into four intervals: winter, spring, . . . These seem rather artificial and at least the figure 4 gives an impression that the seasons are not constant because the Re in the autumn of 2006 has "summer-kind" of response to temperature. I suggest that the different periods would be somehow connected to biological or physical changes in the environment. The figure would need r² values too.

At the study site, LAI increased from 1.34 to 3.37 from 2004-2006 as well as the irradiation, soil and air temperatures and soil water potential changed from year to year. Also a frost event occurred in 2005. These all have direct and indirect, partly complex effects on CO₂ exchange. Therefore I find that the three data points in the figures 5 and 7 do not show any credible results on the responses of GPP and Re. I would suggest that you remove these or justify these more carefully in the text. Moving the emphasis more on the seasonal and instantaneous responses would be appropriate too.

Technical comments

p. 6603 I.10: Could you be more detailed with the reference (IPCC, 2007).

p. 6603 I.12: Remove "a" or add the additional reference it in the list (IPCCa, 2007)

p. 6606 I.21-24 Please make the sentences more fluent by removing the repetition e.g.

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"Eddy covariance measurements at the experimental site Vallanes, started in late 2003 as described by Bjarnadottir et al. (2007a). This paper presents continuous data for three years, 2004–2006. The eddy covariance system was an open path. . ."

p. 6607 I.7-10 Please clarify the sentence ("The flux data. . .")

p. 6610 I.17-18 The mean annual air temperature was 6.7 and 6.8 for years 2004 and 2006 indicating that 2004 was slightly warmer than 2006?? Please clarify.

p. 6613 I. 4-5 Subscripts are missing (E₀). I guess all the used parameters should be italics throughout the whole manuscript including equations.

P. 6613 I 11-20 The paragraph needs fluency. It is also quite speculative.

Table 1 Shortest distance to edge? Does this mean the distance between the ec tower and stand edge? Please clarify

Table 2 Please give r² values

Fig. 3 Please check the units of the y-axis

Fig. 4 Time units are missing from the y-axis title. Please add the depth of soil temp measurements

Fig. 6 Time units are missing from the y-axis title. Please give r² values or confidence intervals.

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