

Interactive comment on “Net ecosystem exchange of carbon dioxide and water of far eastern Siberian Larch (*Larix dahurica*) on permafrost” by A. J. Dolman et al.

Anonymous Referee #3

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General comments:

The paper reports important data of CO₂ and water vapour fluxes over a larch forest in eastern Siberia. Eddy correlation measurements were made during a total of a little more than 9 months, split over two years and mainly in the growing season. The paper discusses the net ecosystem exchange of CO₂ (NEE) in relation to water availability and permafrost and estimates annual values of NEE for the two years. The authors estimate the annual NEE of the forest to be 1.7 ton C ha⁻¹.

The introduction should be better structured. *E.g.* it jumps from CO₂ to H₂O without context (p.277, l.27 and following lines), then comes back to CO₂ (p. 278, l.18). The “Introduction” does not relate evaporation to NEE. The “Results” section includes quite a lot of discussion. It would be better to structure this section only to present the results and to move all the discussion to a separate “Discussion” section, which could

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preferably be sub-structured. Likewise, a rewritten "Conclusions" section should only include conclusions.

Generally, I find that the results merit publication, but that the manuscript needs a much more careful editing before publication; please see some suggestions below.

Specific comments:

Abstract:

p.276, l.19: "normalized net ecosystem uptake" is not immediately understandable at this point.

Introduction:

p.277, l.9: "eddy correlation estimates". I suppose that what is meant is estimates based on eddy correlation measurements made over restricted periods.

p.277, l.11: "these atmospheric modelling techniques". Which?

p.277, l.19-26: It is not clear which areas the numbers refer to; define "Siberia" and "Far East" as opposed to "East Siberia".

p.278, l.16: the sentence "even for a forest without any substantial water stress" is not readily understandable. Please clarify!

p.278, l.18: When talking about "maximum rates of NEE" it should be made clear what the maximum is. Is it a single (half hour) peak? Is it the maximum of an ensemble average over a month? If not calculated the same way such figures are not comparable. Here the tree species are presumably also different.

p.279, l.23: The reader is lead to believe that the paper describes a full two year period of measurements, which is (as we learn later) not the case.

Site description and methods:

p.280, l.27: Presumably "plant area" refers to plant area index (PAI) but this should be specified.

p.281, l.12: Information about other instrumentation (e.g. soil moisture, soil temperature, solar radiation ...) should be given.

p.281, l.13: Here the periods of the measurements are given: they cover 4.5 months

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in 2000 and slightly more than 5 months in 2001. Obviously it is difficult to carry out the measurements during winter, but there is no information about this at this point in the paper.

Results:

The periods of the results presented in Figure 2 (and 4) does not correspond to the information given in the preceding section. The period of data for 2000 (if that is the upper figure) is approximately mid July to beginning of October (as opposed to 14 July to 1 December in the text). What happened to the remaining part of the data? The figure shows data for 2001 (if that is the lower figure) from end of April to end of November, but the text tells that measurements stopped 25 September. Also Table 1 gives no values for November. This needs some kind of explanation or correction.

p.284, l.3: Correction for storage does not generally change sums of NEE over longer periods, so what exactly is the problem here? It seems that storage is mixed with loss of flux due to drainage and low friction velocity during night.

The information given in Table 1 and Figure 3 is the same. One of these could be omitted.

p.284, l.26: There is still no consensus in the international community whether the u_* correction is appropriate, but it is very useful to have both estimates as given here.

p.287, l. 15: Is the term “specific humidity deficit” different from the term “vapour pressure deficit” used in the sub-heading?

p.288, l.9: What is “the atmospheric demand”?

p.290, l.5: At this point in the paper, it has not been explained how an annual NEE estimate is obtained, neither has the “growing season” been defined. Some explanation is given in the following sentences, but the method of arriving to annual values could preferably be more clearly explained in the beginning of the paragraph. The authors state that measurements during mid-winter are missing. Other studies in northern areas (Scandinavia, Greenland) have shown that respired CO_2 builds up under the snow which could lead to a slightly lower annual NEE.

p.291, l.1: Why should the growing season be expanded by 20 days?

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Discussion and conclusions:

p.292, l.21: The statement “The forest is completely dormant for nine month of the year” might be true, but since no measurements were actually made during the winter, the statement needs modification. Clearly the trees are not dead during winter so some respiration (although maybe very small and difficult to measure) must be occurring.

p.294, l.13: What about permafrost melting?

Technical corrections:

p.277, l.5: "Northern hemisphere" should be lower case "n".

p.278, l.15: "1.5 m day⁻¹" should be "1.5 mm day⁻¹".

p.279, l. 21: The sentence starting with "It first describes" is redundant.

p.280, l.5: "3103 thousand km²". This is a strange unit; why not "3.103 10⁶ km²".

p.280, l.19: Latin names should be typeset in *italics*.

p.281, l.4: "instrument" should most likely be "instrumentation".

p.281, l.7: "net ecosystem flux (NEE)" would be more informative if written "net ecosystem exchange of CO₂ (NEE)".

p.283, l.27: either “the larch has shed its needles” or “the larch trees have shed their needles”.

p.284, l.13: “ $u_* < 0.6$ ” should be “ $u_* > 0.6$ ”. A rather high threshold by the way.

p.285, l.14: “under storey” should be “understorey”.

p.285, l.15: “Ohta et al.” year missing!

p.285, l.28: “This suggests 2001 that either” some words missing?

p.293, l.10: one “only” should be enough!

p.293, l.21: “an in” should be “in an”.

Table 1(b): The columns for July seem to have shifted to the left.

Figure 2: The labeling of the axes should be given with a much larger font. Also, the year should be indicated on the sub-figures. Figures 4 and 7 need similar improvement.

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