

Interactive comment on “The seasonal cycle of the greenhouse gas balance of a continental tundra site in the Indigirka lowlands, NE Siberia” by M. K. van der Molen et al.

Anonymous Referee #3

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1. General comments

The manuscript extends the poor quantitative knowledge on carbon dioxide and methane fluxes in the Russian Arctic, showing exceptionally high annual NEE. However, given the low seasonal coverage and missing winter/spring measurements, extended long-term observations have to confirm the exceptionally large annual NEE. The preliminary character of the results should be clearly mentioned in the manuscript.

2. Specific comments

Title should reflect the fact that no winter measurements are available.

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Generally the text contains too much qualitative information in the introduction/ site description. Shorten the general site description, while referring to the concise description by van Huisteden 2005. Figure 1 is very poor, climate data covered also by Table 1.

More emphasis on the specific site description, regarding the footprint partitioning of the eddy covariance tower (e.g., species composition, soil moisture) and its representativeness for up-scaling to a larger area (e.g., river versus lake emissions, active layer depth, soil moisture). This is a prerequisite for any quantitative up-scaling study as the site and larger area are reported to be heterogeneous.

It remains unclear to what area the areal fraction numbers in Table 2 refer (e.g., how big is the absolute area, and absolute area = tower footprint?).

Vegetation description would benefit from a general tag (e.g., bioclimatic zone or assign a class of the legend of the Circumpolar Arctic Vegetation Map giving a hint to how representative the measured vegetation type is for the Arctic).

The respiration measurement and parameterization description (sect. 2.2.2 and 3.3) need clarification in terms of no. and year of measurements, soil versus ecosystem respiration, flux variability for a single location throughout 1 experimental cycle (i.e., quality control) and choice of the model used to explain the data (the poor fit does not support it). Remove first sentence of Sect. 3.3 as eddy cov. fluxes are not used in this section. Corresponding Fig 6: Ecosystem or soil respiration (text says ecosystem; figure caption soil respiration)? Does it summarize data of several years? The parameterization of the chamber respiration data remains poor and thus further use is questionable. Include parameters directly in the text rather than separate table. Soil moisture is probably one of the most important factors contributing to the seasonal pattern/variability between years and should thus be observed additionally to the water table.

Not having access to the article by v.d. Molen et al., in review, the extrapolation to annual cumulative values remains questionable, and corresponding results should be

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regarded as preliminary. Also, the speculations onto longer time spans should be excluded, unless being based on climatological data/ model analysis.

Discussion is somewhat lengthy.

Given the vicinity of the methane measurements to the river/floodplain, a careful interpretation of the air/soil temperature/active layer depth versus water table/soil moisture (drying/rewetting) effect would be appropriate when concluding on the prospective arctic situation (e.g., concluding sentence).

Generally, the manuscript would profit from considerable shortening.

3. Technical corrections and comments

A more general reference for the evidence of climate change in arctic regions (instead of Chapin, 2005) would be Hinzman et al., Climatic Change (2005) 72: 251-298.

Introduce abbreviations and variables in the text/figure captions when used the first time (e.g., WNF, TW, TD, fCH4).

Leaf onset (instead of leave onset)

Fig. 6 - not well readable. What data are averaged for the means and standard deviations plotted?

Section 3.5, add year(s) of modeling exercise.

Caption Fig. 9 - revisit last sentence.

Caption Fig 11 - last sentence fluxes instead of fluxed.

Fig 12 - NEE, Re and GPP all eddy covariance based?

Fig 13 not readable, especially lower panel

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