

Reviewer comments: “Methane in Zackenberg Valley, NE Greenland: Multidecadal growing season fluxes of a high Arctic tundra” – Johan J. Scheller et al.

I thank Scheller et al. for producing an interesting paper. However, although an important topic and a very impressive dataset, the variety of methods used and the results presented do make it slightly hard to follow. I do think the authors could remove some of the repetitiveness with the existing published literature to make it easier to follow. Furthermore, maybe a focus towards the uncertainties found using different methodologies would be a useful addition (rather than just a review of the papers).

The introduction is quite short, therefore there should be some room to expand on the processes linked to the potential increase in methane emissions from Arctic wetlands. At the moment, it really feels like it’s missing from the current manuscript.

Although the study on methane emissions from the gully are super interesting and data like this is lacking in the published literature, it gets lost in the sea of all the other data presented. Given the lack of data from this specific study, I don’t think it can be a stand-alone paper, but I would put more emphasis on this throughout to make sure it finds its place otherwise it does feel like an add-on.

Detailed comments

Line 70 – 71: This line seems repetitive. I would end the introduction on the paragraph beginning on line 67. I would incorporate the use of new data into the paragraph starting line 60.

Section 2.1: I find it hard to follow this section with all the discussion of previous studies and the acronyms used for field sites etc. Could this be paired back and made clearer? Also, your use of Fig. 2a is not clear? Do you mean site (a) in the map?

Could you make the label for the Gully larger? I missed it the first time.

Line 233. You state linear flux model? What type? I think this needs more detail.

Section 3.2: Given the focus of this paper is on the fluxes and your methods section on the details of how this map is produced is very brief, I would move this section either up to the site description or remove to supplementary information alongside Table 2 (which seems unnecessary – either remove from text or remove table).

Section 4.1: I think you could bring in more discussion here about the uncertainties between the different methodologies. This would really strengthen this section.

The presentation of the flux values in the paragraphs in this section make it seem like a results section? You don’t really discuss WHY the results may be different? This could be re-written to put more emphasis on why differences were found?

Figures:

Figure 3: I wonder if it would be better to make a figure that shows these fluxes in relation to where they are in the landscape? At the moment, from the figure alone I can't tell where Chambers 1 to 6 are located and why we might be seeing differences.

Figure 4: I lost these numbers the first time I looked through the manuscript so they need to be bigger and bolder. Make the dashed line a brighter colour. I think you could present the data for this section more robustly than just a value on a photograph. I would like to see a boxplot to show the variation in fluxes across the 10-day measurement period.

Figure 6: I don't understand this figure unfortunately and I think it could be revised for clarity. Make clearer in caption what the pale green shading represents

Figure 7: What does the inset figure show? Is it just showing the whole year? I'm not sure this is needed.

Figure 7 and 8 have the same figure caption? I presume it is incorrect for Figure 7 given the mention of different marker shapes.

Figure 8: Is this mean CH₄ flux represented in this plot?