Referee's comments to the author: 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.

Authors' reply: We would like to thank you for your remarks and specific suggestions for improving the manuscript. Since reading your comments, we see how we can make the paper better. We need to improve both the structure, address sources of uncertainty, and refine several figures for improving their clarity.

The remarks from the two referees point us toward a revised manuscript with increased emphasis on the sensitivity of the landscape methane flux to future large-scale erosion in Zackenberg Valley while also scaling down the repetitive sections about existing published literature. The comments from the referees are in good agreement with each other, and in combination, they chart a clear direction for a carefully revised version of this manuscript.

There will be several significant changes to both the upscaling of fluxes from 2006-2019 and major edits to how the sensitivity study is designed in the revised manuscript. We do this to include as much of the measured fluxes as possible while basing even more of the sensitivity study on previously published data. These changes will also help us quantify the sources of error, enabling a thorough discussion of uncertainties. The changes in the calculations will also naturally lead to increasing the emphasis on the methane fluxes from the gully because the gully fluxes play a more prominent role in the revised sensitivity study.

Referee's comments to the author:

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?

Authors' reply: The detailed comments include a list of suggestions which we agree need some improvements and discussion. The questions raised in these comments will be valuable to us when revising this manuscript as soon as possible.

Referee's comments to the author:

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 CH_4 flux represented in this plot?

Authors' reply: We understand that there is a need for improving the figures, including their captions, and we will make sure that the questions will be answered in a revised paper. Figure 3 will be omitted from a future revision of the paper, which will allow for a larger emphasis on the landscape fluxes. Figure 4 will have boxplots added, with bolder colors. The calculation behind Figure 6 will be updated, improving its clarity while also allow for uncertainty estimates. An updated Figure 7 will not include the inset figure, and finally, the caption will be double-checked.

Again, thank you very much for reviewing our manuscript and the many detailed comments specific questions, which will help our editing in the coming weeks.

Final remarks from the authors: We hope our detailed replies to the general comments from the respective referees show a convincing and clear plan for how the manuscript will be revised in relation to the major comments received. In addition, all minor comments and corrections will be accepted and corrections made accordingly. With this we are hoping that the editor agrees to let us proceed with the submission of a revised version of this manuscript.