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Discussions

Interactive comment on "Environmental controls on ecosystem-scale cold season methane and carbon dioxide fluxes in an Arctic tundra ecosystem" *by* Dean Howard et al.

Anonymous Referee #2

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The paper "Environmental controls on ecosystem-scale cold season methane and carbon dioxide fluxes in an Arctic tundra ecosystem" by Howard et al. presents new year-round measurements and analysis of methane and carbon dioxide fluxes and environmental variables in an undersampled ecosystem type. Through well-reasoned and well-written description, the authors differentiate the impacts of soil temperature on microbial activity in the upper and lower portions of the active soil profile, specifically highlighting the role that unfrozen deep layer soil can have on the total methane emissions in Arctic tundra. This is an important insight, supported by in-situ data, that is worthy of rapid publication in Biogeosciences and may significantly impact future understanding of this system in a changing climate.

Specific minor comments and suggestions follow below:

1. The laboratory study in lines 43-46 seems a bit old to be the only one mentioned. Have there now been any more recent studies of these relationships? Perhaps the incubation studies on page 11 could be integrated into this introduction?

2. The additional measurements are clearly useful to have. More emphasis could be added at the end of the introduction relating to what sets this study location apart from those in Zona et al. 2016.

3. Is the gap-filling in line 133 applied with daily value for days with at least some PAR < 5? This is a bit unclear.

4. The large range cited for the wet sedge tundra site in line 227 is a result of a changing state at this location, rather than the representative variability of wet sedge itself.

5. Additional discussion could be added after line 400 relating to what happens to the methane flux in the case that high VWC soil freezes. Does frozen water present in the soil inhibit the gas transfer upward from the methanogens?

6. Perhaps toward the end of section 3.5 point out the importance of additional soil temperature information to improving gridded products, which are needed to fully quantify regional to pan-Arctic scale carbon fluxes.

7. Could the letter labels from Figure 2 be added to their appropriate time positions in Figure 1? This would better link the data during the description sections.

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