

Interactive comment on “The amount and timing of precipitation control the magnitude, seasonality and sources (^{14}C) of ecosystem respiration in a polar semi-desert, NW Greenland” by M. Lupascu et al.

Anonymous Referee #1

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General comments:

The manuscript examines effects of warming and precipitation changes on ecosystem respiration in the High Arctic. The research is conducted at a warming and irrigation experiment that mimics observed and projected climate changes for this region. The study measured CO_2 fluxes as well as $^{14}\text{CO}_2$ to identify the age of carbon that is being respired from this ecosystem. The methods, results and research focus are highly relevant, and the manuscript was well-organized and well-written. There are some gaps in the methods and results (e.g., statistics), but once these are filled, I feel

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this study will make an important contribution to understanding of permafrost carbon feedbacks to climate and, more generally, to controls over ecosystem respiration.

Specific comments:

1. Title & general: While results seem to show effects of both temperature and precipitation on Reco, the title and discussion seem to play down the temperature effect in lieu of a precipitation alone. I think the study is important because it examines Reco responses to soil moisture, which is not always considered in the context of Arctic climate change. But, the manuscript text downplays the temperature effect more than is warranted from the results.
2. Methods, page 2463-2464: Need to fill in detail on the experiment. At the very least, how many replicates did you have for each treatment? Plot distances?
3. Methods, Climate trends, page 2464: Why use overlapping intervals?
4. Methods: The manuscript provides no information on statistical analysis! Please add this in. I was unable to review the appropriateness of statistics (when presented) in the results section.
5. Climate trends: R^2 ? Can you include a figure (in the supplement) showing the trends? It would be a lot easier to see the change over time.
6. Results: Include information on treatment effects on soil temperature and thaw depth, and warming effects on soil moisture.
7. Results, page 2469, lines 8-9. The sentence discusses the treatments and refers to the figure, but the figure only shows control plot data.
8. Results, page 2470, line 2: Here and throughout, there are several areas noted 'data not shown', but the data are relevant to this study. Can you please provide these data in a supplement.
9. Results, pg 2470, lines 9-12: stats? P values?

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10. Results, pg 2470, line 19: text states that pore space [CO₂] not affected by warming, but it looks like warm + precip is always the highest. This means that combined warming and precipitation are both important. Some stats here would also be useful.
11. Results, pg 2470, line 21: text states that there is a bimodal pattern of [CO₂]. From the figure, I don't see this: There's no peak in 2010, a single early peak in 2011, and several peaks in 2012.
12. Results, page 2470, line 25: Is it just an irrigation effect, or is there a significant irrigation x warming? Please discuss these and all results in terms of statistical significance.
13. Results, page 2471, lines 16-19: What are these 14C values? Are these source values or your measured Reco mixed values? Why show separate values for each year for 'recently fixed C' and not for other sources?
14. Discussion, page 2472, line 20: change to "is strongly modulated by both SWC and temperature"
15. Discussion, page 2472, line 22: "fluxes are positively correlated to snow". Three points/years, isn't really sufficient for a correlation, which wasn't presented in results.
16. Discussion, general q.: In this system, what role, if any, does ground thaw play in seasonal/long-term variation in soil moisture? Do you have thaw depth data? If so, please present it.
- 17: Discussion, page 2473, line 2: "two distinct periods, a dry and a wet one". Those periods are only somewhat obvious in 2010.
18. Discussion, page 2476, line 17-18: I don't believe that you identified the C sources because you didn't partition Reco. Just refine the wording slightly.
19. Table 1: Why not compare discrete (10-year) time intervals, rather than overlapping?

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20. Table 3: Please note significance. Also, this is the first time I saw sample size.
21. Figures: I like the overall format of the figures, but it's really difficult to see the symbols and the text because they are so small. Consistency in symbol color/shape across figures would help.
22. Figure 2: Bottom panels for 2010 and 2011 show 2 sets of open square symbols and no open triangle.

Technical comments:

1. page 2460, line 8: change 'accompanying the warming' to 'accompanying warming'
2. page 2460, line 12: change 'for the regional' to 'for regional'
3. page 2460, line 17: change extend to extent; why 'and,or'? change to 'and'
4. page 2462, question 2: Change to: 'How do simulated long-term increases in summer rainfall and temperature alter seasonal patterns of soil CO₂ and Reco fluxes?'
5. page 2463, question 3: change and/or to and
6. page 2463, line 6: change "This study is" to "This study was". Throughout the manuscript there are many places where verb tense should be changed from present to past. I have not noted them all here.
7. page 2474, line 2: change "cooberate" to "corroborate"
8. page 2476, line 13: 'low-Arctic' or 'sub-Arctic'?
9. Page 2478, line 15: change to: "These data further support"

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