

Interactive comment on “Water table height and microtopography control biogeochemical cycling in an Arctic coastal tundra ecosystem” by D. A. Lipson et al.

Anonymous Referee #2

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This manuscript investigates the influence topographic and water table variability have on biogeochemical cycling in a polygenized drained thaw lake basin on the Arctic coastal plain of northern Alaska. The authors experimentally manipulate the water table and observe the influence water table height has on dissolved oxygen (DO), oxidation-reduction potential, pH, iron concentrations and speciation / oxidation state, and dissolved carbon dioxide and methane – among other things. In addition, the authors investigate how topographic variability and associated water table dynamics (i.e., higher water table in topographic low points) relate to the biogeochemical parameters listed above. They note that lower areas, and experimentally flooded areas, have higher water table levels (they are wetter), and tend to have lower DO and ORP, higher

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pH, and dissolution and reduction of iron (Fe). They further go on to note that these anoxic conditions could potentially lead to increased methane production – however, the increased availability of Fe(III) could inhibit methane production. I think that this should be highlighted more than it has in this paper. It is mentioned at the top of page 6362 that climate change could promote methane production – but that in this particular system (or other similar systems) high availability of Fe(III) could limit methane production – a point that I find to be particularly relevant given current climate change scenarios but it seems buried in this paper. I also don't think that the figures and analyses do the data justice and that the figures are not particularly informative or illustrative the way they are currently presented. For instance, the discussion of CO₂:CH₄ beginning on line 20 of page 6361 is nice discussion – but there isn't really a figure that highlights these dynamics. I also found tables 2 and 3 fairly confusing – particularly table 2. For instance, if 6 and 7 are non-parametric indicators of suboxic and oxic conditions, and values of 0 – 5 indicate the depth at which DO drops to near-anoxic levels then what does a value of 6.67 or 6.63 mean? Also the meaning of the parenthetical values is not addressed. Table 3 is also difficult to interpret – and I acknowledge I may be missing something but more explanation / clarification may be warranted. So essentially – I think that this is a valuable and worthwhile topic but that the presentation (i.e., figures) and analysis need to go further and that the figures and tables need to be more informative and illustrative. I liked the discussion – but I did not think that the results section or the figures referenced in the result section built this story very well. It seemed like a jump from the results to the discussion that was laid out. This should be remedied. Also – I think that a solid headline or main point should be determined and brought to the front. I didn't feel as though that has been developed very well as the paper currently stands. The potential for high available iron to limit methane production under future climate change scenarios seems like a nice point and could be highlighted more than it was. I would like to see this manuscript published in Biogeosciences – but feel that further work to improve the quality including deeper analysis, improved presentation, and clear points that are novel and well supported needs to occur prior to

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publication.

Specific comments:

Page 6346 line 13 – 15: the word areas shows up 3 times and the sentence is awkward.

Page 6348 line 10: should there be a comma between permafrost and lake?

Page 6349 lines 24 – 26: This sentence is awkward – suggest editing.

Page 6350 lines 22 – 25: Then how do you get values of 6.63 and 6.67 (see table 2).

Page 6352 lines 5 – 11: Was this done with a septum? Clarification could be useful – I wasn't completely sure how this was done. It states that 'the headspace was sampled by syringe'; was this through a septum?

Page 6353 line 9: I think the word 'the' directly before the word 'July' should be deleted.

Page 6358 line 12: insert the word 'in' between 'changes' and 'water'.

Page 6362 line 1 – 3: I feel like this point should be brought more to the front – as it is now it seems buried.

Page 6364 lines 6 – 7: The decline of nutrients after the snowmelt pulse could have something to do with plant uptake – but also hydrologic flushing of a finite resource (i.e., supply limited).

Tables: the tables need to be improved – they are hard to interpret in their current state.

Figures: Again the figures need to be improved so that they are more informative and illustrative – see above. A specific comment is that I would suggest keeping the layout consistent when you have 4-panel figures. For example, figure 2 has panel A above panel B, whereas figure 3 has panel A next to panel B. This is a minor point but I like to see consistency between figures.

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