

Interactive comment on “Controls on spatial and temporal patterns of soil nitrogen availability in a High Arctic wetland” by Jacqueline K. Y. Hung et al.

Anonymous Referee #1

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General comments:

Overall, this paper provides a clear method section and presents an extensive analysis of a dataset of available inorganic nitrogen in a high arctic wet sedge meadow. The spatial extent of data collection is welcome and given the importance of arctic wetlands, this study could provide a valuable addition from a different site. There is definitely value in improving understanding the controls on C and N cycling in arctic wetlands and there are potentially interesting data here. The manuscript, however, would benefit from an appropriate title, clearer aims and a greater effort to highlight what novel contribution the study makes. There is a substantial quantity of introductory

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text and results, and given that a fairly high proportion of the material confirms existing knowledge (such as the importance of hydrology in determining abiotic processes in wetlands, the importance of fine scale variability in Arctic ecosystems, the multiple environmental drivers of soil nutrient availability), a more concise summary of previous work would leave more room to explore novel findings. In view of the fact that the main issues are mostly to with approach to structure and content, I have provided comments in combination with the minor technical notes.

Specific and technical comments:

Title and abstract - the abstract has a strong focus on N availability and fits well with the title, but a substantial proportion of the results and discussion relate to C exchange. Title and abstract should be modified to better reflect the content of the rest of the paper.

The introduction would benefit greatly from a reduction in length, through taking a more focused approach to presenting the background information and rationale specific to this particular study. The current information is a sort of mini-review demonstrating the breadth of understanding of various elements of arctic ecosystem function but the text moves rapidly between wider issues such as global climate change (p3 lines 3-7), and the specifics of the study several times and this makes it challenging to disentangle exactly what the current understanding is and what gaps this study addresses. Specific sections - p2 line 16 to p4 line 6 includes multiple statements where the relevance isn't clear (for example, the lack of long-term studies in the Arctic, when this a short term study), and p3 lines 20-30 could be summarized in much less text. The sentence at lines 4-6 is one of the few mentions of the key information underpinning this study and yet it is not stated what the past research is or what it showed.

P2, line 15 – ‘this study looked at spatial patterns to see how these patterns shift through the growing season’ – I presume what is meant is that spatial variability and temporal variability were investigated (doesn't make sense).

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P2, line 15 and elsewhere – the investigation of growing season variability seems overstated – is two sampling periods sufficient to investigate temporal patterns of nutrient availability, even in such a short season?

P2, line 28 “global C changes” is vague – clarify what processes are being referred to here.

P4, line 5 – seems to be the first mention of the CBAWO wetlands, if so, define abbreviation.

P4, line 7 – not sure ‘nutrient regime in plant growth’ is the right phraseology for what is meant here.

P4, line 25 – this sentence is unclear – what is meant by ‘help in future predictions of decreasing carbon storage?’

P5, line 11 – what is a ‘spatial lens’? Please clarify what exactly it is that hasn’t been previously investigated.

Methods

Throughout methods paper refers to early and late season. This implies that the experiment took place either side of the ‘mid’ season, when actually it’s a main growing season experiment that doesn’t include ‘early’ and ‘late’ growing season (as acknowledged by the authors in the second paragraph of section 4.2). Suggest either using real time descriptions or clarifying in the methods section (2.2) where the sampled timed periods fit in the overall growing season.

P6, lines 4 and 5 – it is not clear how the vegetation communities differ between wet and dry tracks (i.e. do sedges and grasses dominate, with lesser elements of *Salix arctica* and herbaceous flowering plants in each of the different types, or does *Salix arctica* dominate in wet tracks?) With the genera (*Carex* and *Eriophorum*), can the authors say whether they’re referring to two or more species (spp.) or one unspecified species (sp.)? Also, is there a word (herbaceous?) missing between flowering and

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'Eriophorum' (and if so, is this appropriate description as Eriophorum belongs to the Cyperaceae). I think Gramineae is now Poaceae. I appreciate that biotic controls are outside of the scope of this experiment, but there is a surprising lack of mention of the possible role of vegetation in any of the relationships described later, given that different species / plant functional types preferentially use different N sources (e.g. NH₄, NO₃, organic N).

P6, line 13 – alternate? (not alternative)

P6, line 15 – was? (not is)

Results – is there a reason why this is structured in a different order from the methods? Consistency would make for an easier read.

P9, lines 3-5 – the comparison of data from this study with 2014 and 2015 comes out of nowhere – what is the importance of the June 2015 temperature to this study?

P9 line 19, and P10, lines 5-8 and line 15 – where are the different tracks and what general concept does comparisons of difference between them relate to? This issue is common throughout much of the results (the spatial findings in particular) - references to what is happening on specific parts of the site by name rather than in context don't indicate to the reader how the findings of this study can be applied beyond this specific site.

P10, line 13 – incoming GPP?

P11, line 11 and P12, line 2 – opening sentences should be in the methods, not results

P11, line 25 – this is a common finding with ion exchange resins in arctic ecosystems – saturation seems improbable when deploying the same resins in more nutrient rich ecosystems records often much higher totals, so could it be that in a longer burial some kind of equilibrium with soil levels is reached?

P11, line 30 – further investigation of what?

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Discussion and conclusions

These should be checked to see whether the data provide evidence to support all the assertions made, especially where they relate to processes that were assumed rather than measured - such as mineralization, nitrification and transport.

Although there is discussion in context of other studies, the discussion is lacking in implications and does not clearly demonstrate what it is that this study shows that does not simply agree with previous findings (the majority). Where differences are highlighted (e.g. the presence of nitrate) no further thoughts are provided as to why this might be or what this will mean.

Substantial parts of section 4.2 are suggestions for other studies – although this is interesting, it doesn't relate to the sub-heading and it could be summarized in a couple of sentences, rather than providing a heavily referenced rationale.

In the conclusions, some of them seem not arise from the results presented (for example, was there a test of the relationship between distance from snowpack on N availability, and is there any evidence that mineralization promotes photosynthetic activity?) and many of them are readily referenced to other older studies that it is not clear what has been found that is not already well known.

Figs 5 and 6 – add y-axis labels.

Table 7 – title doesn't match table contents.

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