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Interactive comment on "Nonlinear thermal and moisture dynamics of high Arctic wetland polygons following permafrost disturbance" *by* E. Godin et al.

Anonymous Referee #2

Received and published: 24 September 2015

Review of Godin et al's manuscript entitled "Nonlinear thermal and moisture dynamics of high Arctic wetland polygons"

Godin et al are presenting intensive 2-year long measurements of soil temperature and soil moisture from the centers of a group of ice wedge polygon. The study sites are represented by one intact low center polygon and three breached or eroded low centered polygons – all located near a deeper gully. The breached polygons used to have a closed center basin surrounded by intact rims, which have now partially eroded during the last ∼15 yrs. I think Godin et al's dataset has a place in the literature, especially considering the increased attention that is drawn to ice wedge degradation in the Arctic landscapes. I find that the manuscript (in general) and the presentation

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of a story (at large) and, therefore the data, require further attention. The manuscript in its current form is rather scattered and unclear and it doesn't help that the quality of the writing and its English is weakening the presentation. I am offering some detailed suggestions below, but I think that the authors need to take a step (or two!) back and decide where they want to go with their dataset. A good start may be to refine the title, which may help the authors to concentrate on a specific story line.

Detailed comments: "Centre" spelling (should be "center")

The authors are not showing data on impacts on greenhouse gases and carbon storage. The last sentence in the abstract is therefore misleading –as written.

To increase readability, I suggest to include references to the supplement in parenthesis, just like you do with regular references.

P4, L7: Suggest use a non-value laden term instead of "destroying". It is also unclear what the authors are referring to in the sentence on P4 L6-9. Please clarify.

The authors are missing some key references in the introduction section that is relevant to their story: Jorgenson, M. T., Y. L. Shur, and E. R. Pullman (2006), Abrupt increase in permafrost degradation in Arctic Alaska, Geophys. Res. Lett., 33, L02503, doi:10.1029/2005GL024960. Lara, Mark J., et al. "Polygonal tundra geomorphological change in response to warming alters future CO2 and CH4 flux on the Barrow Peninsula." Global change biology 21.4 (2015): 1634-1651. Liljedahl AK, Hinzman LD, Schulla J. (2012) Ice-Wedge polygon type controls low-gradient watershed-scale hydrology. Tenth International Conference on Permafrost, 1, 1–6.

P5, L7: Leave out "...for this interval".

P5, L22: I recommend to be specific about what temperature is referred to, i.e. air or soil? Here, please write soil or ground temperatures, for example.

P5, L22-25: Awkward and unnecessary long sentence. Please fix.

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How was solid precipitation measured?

P6. L8-10. Please include full sensor name/model and company in parenthesis.

P6. L10-11. Awkward sentence. Suggest replace “obtained” with “estimated” or “calculated”.

P6. L12-13. Please be clear. What “data” are you referring to? Each sentence are to be able to stand on its own to be a strong and easily understandable sentence and therefore, manuscript.

P6, L10-18: You are referring to the supplement for details, but then you are providing details. I suggest providing a basic approach in the manuscript, while leaving the details to the supplement.

P6. L19-22: What does “snow conditions” mean? Please be clear as it can mean a lot of things. I want to know what was measured.

P6, L24: If you do not intend to present the larger study, then omit that reference as it would be irrelevant.

P7, L3: Lacking details. Please clarify what you mean with “to ascertain that sites were similar to 2010”.

P8. L14-17: Please provide more details here (and omit them in the supplement) on how the ground elevation survey was designed and performed. There is a challenge to survey these landscapes due to the “fluffy” organic mats, so what is the estimated error?

P9. L1: Was the snow blown away inside the gully? The sentence is confusing to read.

P9. L3-4. This is the results section, not the background section so please move references to the background/site description.

Figure 2-4. Can figure 2 through 4 be combined into one figure?

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Can the polygon names, which are currently numbers, be replaced with a name that describes what makes each polygon/study site unique? For example, Eroded Polygon A, B and C (EP-A, EP-B and EP-C was 331, 333 and 563, respectively) and Intact Polygon A (IP-A, was 573) etc? It is quite hard for me to follow your story as a reader who is not familiar with your site.

P9. L21-26. This description is rather unclear and vague. What time periods do you refer to etc?

P9-10: I find the presentation of the soil moisture data and the different polygons thin and confusing, Figure 5 is quite descriptive and I think the authors can strengthen their written description of the results from Figure 5 and use Figure 6 as a supporting display. To me, it looks like the overall seasonal variability is too large between all the polygons to clearly say that the eroded versus intact polygons are significantly different. I hope this is discussed in the discussion? (I suspect this may have to do with the degree/extent/details of erosion at respective polygon and in general, the large variability in these landscapes).

Figure 6. Please expand the figure caption so it clearly explain what the information in the figure represent. For example, the x-axis is not explained effectively.

Sometimes the authors use “eroded” and sometime they use “breached”. Please stick to one term/naming style.

If the polygons were flooded and therefore, the near-surface soil saturated (and thawed), then the authors may consider to present their soil moisture data as percent saturation, which is a relative metric instead of an absolute metric (see Hinzman et al 1991). I think it can help simplify the rather comprehensive soil moisture dataset and aid site-to-site comparisons.

Figure 7. I suggest giving the “intact” polygon a separate symbol – assuming that the story of the manuscript is how the intact versus the eroded polygons differ (??)

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Figure 8. This figure is not readable. The information provided is way too tiny. I can't see at all what it is supposed to convey. I am not even convinced that this type of presentation (albeit at a better scale!) is the most effective presentation of the datasets (?) Instead, perhaps focus on presenting only temperature from one depth and plot all sites in the same figure (?) The supplemental can include data from the other depths if there is anything more interesting to show.

P13-15: The discussion section is poorly supported by the presentation in the result section, which results in a weak discussion section. I think you need to rebuild the result section and lift out your story more effectively, then you'll have an easier task to write a discussion section that is supported by your data. Also, a large section of the discussion (P14, L1-14) reads like a literature review and in general, a repetition of what was already said in the introduction.

P 15-17: The section about "Variability: Implication" seems like a side story. I suggest to remove or alternatively, place into the supplemental (if the authors can more effectively link it to their dataset/story).

P 17. L20-22. I disagree with the first statement ("... intact low center polygons...were homogenous in the center and between each other"). I only saw data from one intact low center polygon presented! So of course you have a 100% homogeneous match! I agree with your interpretation of data in the following sentence though (L22-26) (large variability between eroded polygons).

Interactive comment on Biogeosciences Discuss., 12, 11797, 2015.