

Replies to Reviewer #1

Thank you for your detailed comments and suggestions. They have greatly improved the manuscript.

Line 12: drop "and whenever possible"

Corrected in text

Lines 43-53: combine with previous paragraph?

Corrected in text

Line 56: "...with focused pond studies in 2008 and 2009." – reword?

Corrected in text

Line 95: Drop "In this paper", not needed; also, why not just say "We describe" rather than "we focus on describing..."

Corrected in text

Line 97: "whereas" instead of "while".

Corrected in text

Line 99: "Substrate type varied across the ponds" is this within the pond, or the surrounding?

Clarified and revised in in text

Line 112: "Less frequent manual measurements while manual estimates were made at distant ponds" Not clear

Clarified wording in text

Line 122: "avoiding the flattening of data at low and high temperatures" not clear?

Removed wording in text

Line 125: "normality" or "normalcy"?

Took out section along with Line 126 in text

Line 126: “Given that autocorrelation did exist amongst the data (k-1) and is commonly found when comparing air to water temperatures (Johnson et al., 2014), no further work was carried out to develop a predictive model between air temperature and pond water.” Not clear this is an unsolvable issue. The autocorrelation of data is not an issue, it is the residuals in regression analysis. But also, can you remove the autocorrelation, perhaps using first differences or some other way? In any event, if you are not developing a model, then just drop this sentence?

Thank you. Took out section in text.

Line 149: should this be in Discussion?

Removed and placed in Discussion.

Line 153: Do you mean that Pond 1 and others show similar seasonal cycles? Reword?

Reworded text.

Line 174: “Warming is comparable to that seen in Figure 2 ...”, or something to that effect.

Corrected in text.

Line 178: Are these separate t-tests, and is there a multiple comparison problem?

Yes, these are separate t-tests, there is no multiple comparison problems. We are only comparing two sample means at a time.

Line 187: Mean July Temperature?

Corrected in text.

Line 188: Move to Discussion or Introduction.

Thank you, corrected in text.

Line 189-194. Drop sentence “Fig 5 plots...”. Move sentence from 194-195 to beginning of paragraph and add (Fig 5) at end. Since you mention here in the text the details of other data added, the caption within Figure 5 could be reduced to simply Dranga et al; Woo and Guan, Croft 2011.

Thank you, the text and diagram have been corrected.

Line 223-224 could be changed to: There is no significance difference in the cumulative relative frequency of periphery ponds across PBP (Fig 9).

Corrected in text

Line 224: “The curve of South Small Pond...”

Corrected in text.

Line 234: “Figure 10 shows the ...” Also, on the graphs, in 2008, most points are above the 1:1 line, except those near the origin; when pond temperatures are less than ~20C, air temperatures are greater. Is this interesting, or simply noise? It is only a couple of points, but happens in all but East Medium Pond. It seems much rarer in 2009, but still sometimes seen.

Thank you, we have added additional text to describe the pattern, and refer the reader to Fig. 3. The points are due to delay in ice-off for different ponds.

Line 259: do you mean Pond 12 rather than 11? Line 365: drop first sentence?

No I meant pond 11, as we were referring to 3 years of data, Pond 12 only had two years of data. I did add that Pond 12 had the deepest thaw in 2008 and 2009.

Line 288: Why not start with the next paragraph with your results, and then incorporate the results of this paragraph (lines 288-293) in relation to yours.

Thank you, I revised the text.

Line 307: Perhaps reword in the form: “The effects of warming and permafrost thaw on Arctic freshwater ecosystems remain poorly understood (Lougheed et al. 2011).”

Corrected in text.

Line 313: Reword to “The porosity of pond sediments depends on ice content” – is that what you mean?

No, I clarified the text.

Line 318: Is this sentence generally true, or only in relatively wet tundra systems? What about dry shrub tundra or polar desert?

I revised the text.

Line 324: Perhaps explain more “... vertical pond seepage ...”, Do you mean “...deeper thaw in warm or dry years contributes to more downward seepage of water into the deeper active layer which leads to drying of the pond.” – or change this for your meaning. And does it have to be both warm and dry or either?

I added additional text in the paper.

Line 325: “... from one year to the next in the same pond ...” And is it only colour or is it other aspects? Your supplemental figure shows grain size but is not mentioned in the text. It seems this is useful data, based on your conclusions, so perhaps move the figure into the text (unless HESS includes Appendix as part of the pdf of the paper, but at the end).

I added additional text in the paper about soil texture and referred to Supplemental Figure 1 and Table 1. HESS publishes appendices.

Lines 328-330: combine into one sentence? “In the Old Crow Flats, Yukon, Roy-Leveillee and Burn (2017) found that near-shore taliks could develop in shallow (often less than 20 cm) lake/pond water, when warm summers increased the thawing degree days.”

Corrected in text.

Lines 331-335: Not clear why you mention this. Needed?

Removed this text.

Line 345: “conclusion” rather than “pattern”

Corrected in text.

Line 353: what do you mean by “terrestrial water inputs”? Do you mean “streamflow or groundwater rather than precipitation”?

Clarified text

Line 403: obtain rather than attain?

Thank you, corrected in text.

Line 453: Is the Lehnherr reference correct; the title and author list seem wrong?

Thank you. We corrected the reference.

Although acceptable, they can be improved to make it easier for the reader to study the results more quickly. However, I think it would be up to the author to decide if they want to make the effort, depending on how comfortable they are with graphics programming.

The figures are not created with graphics programming; most suggested edits will be made, while adhering the best we can to the journal standards for colour-blind accommodations.

Fig 1: Lat-Lon lines may be useful on the upper-left map, at least. Also, the upper-left map is not labelled (a), (b) ...; is this intentional? The a-b-c is confusing, and I am not convinced these letters are needed; the red squares seem to be enough.

Revising this figure with new pictures and will add coordinates to the overview figure.

In the graphs: Why are some lines dotted and others solid? Why are some thicker than others? It would be much nicer to make all solid lines, different colours and thinner. (The thick lines may be good for presentations, but in a paper, thin lines would be sufficient; too much is hidden behind the thick lines). It would also help if you maintained the same colour for the ponds, (when plotting them together), or the years (if that is what is being compared) between graphs. The journal can weigh in here, but these “pastel” colours don’t separate much, and

bolder colours may be easier to see? But maybe this will create a problem with making accessible graphs. It would also be nice if the x-axis were the same for all plots – ie the same time span (ie 15 May - 15 Sept?), as this would allow for easier comparison between graphs.

The journal has rules to follow for colour blind accommodation: the lines need to be identifiable without colour, hence the varying thickness and colours, all of which appear distinct in greyscale. We will explore more options to help readability with colours. However, some varying thicknesses and styles may still be needed. Will ensure individual ponds have the same line style across figures. Some figures will be adjusted to better match axes; however, that will not be suitable for all.

Fig 2: Is the inset graph needed - doesn't it just duplicate what is already on the graph? It would be nicer if the x-axis intersected the y-axis at -10, and maybe a horizontal, faint dotted line at 0oC if you wish

Inset will be removed.

Fig 3: As above. Here is an example where you could use thinner solid coloured lines for the Pond temperatures, and use a dotted line for the Air temperature, to more easily indicate the difference.

Air temperature can be adjusted as suggested, however, 7 clearly distinguishable lines are required in greyscale, so some pattern/thickness variation will be required.

Fig 4: It would help the reader if these were plotted the same as other - stacked on top of each other rather than 3 across. Vertically oriented x on the x axis is a pain to read.

This figure has been stacked vertically as suggested and reformatted to facilitate annual comparison.

Fig 5: Maybe make the points larger, although points would cover each other? But is there some other way to plot these? You can see year-to-year differences (cold vs warm) but distinguishing any one pond or seeing any relation to other properties of the pond (ie sediment colour) is difficult in the present form. And these symbols are a problem; for example Pond 6 could also be Pond 5 and 8 simply plotted on top of each other. Maybe a spaghetti plot would work? Or google to get some inspiration of other types of graph; many websites also include the necessary code (NOT bar graph, for example). What is CR1 and CR2? You may consider a light dotted horizontal line, or a light bar (including the s.e.) across the whole graph area at the appropriate value for the Dranga et al average, explaining it in the caption (if I am interpreting this correctly). What is the slash on the y- axis between 10 and 12? If it is from the Woo and Guan paper, then maybe the x-axis should go to 2004.

We will explore options for this graph, however, no coding is being used. CR1 and CR2 are just ponds, named that way from previous study.

Fig 7: This stacked panels, with 2 columns is another way to present data from, for example, Figure 2, with each year in a separate panel. In that way, you avoid the issue of colour, although it is true that it makes it more difficult to compare between years. However, if the x- and y-axes are the same in all 7 graphs, and a faint grid is used, it may work.

We will explore options for this graph.

Figure 8: Here you switch to Julian day. Is there a reason for the 2 different x-axes? This makes it difficult to compare between figures.

Dates have been adjusted to calendar.

Fig 11: Why using points instead of lines? This makes it hard to distinguish between lines, as they cover each other. It is also “ugly”. On the y axis, it is not clear to which graph the -1.0 applies, so perhaps eliminate it, except on the bottom?

Figure has been changed to line and panels separated slightly.

Fig 12: As in Fig 5 above. Maybe spaghetti plots may work? Or some other kind? On the vertical line separating the two panels, there are some lines. Are these from 2008 or 2009? Some separation would be helpful. And again, it seems that you should either use Julian or calendar dates for all graphs.

As above, dates have been changed to calendar.

Data Files

Data are included as Excel files in a zip file. Within the zip, the files are labelled as “DRAFT”. Does this mean they are not final? If they are, then perhaps rename. Also, could you pass through the files and make sure all columns are well labelled, with units and if needed, with extra lines to explain clearly what each sheet and row/column includes. For example, in File “Fig10...”, sheet “2009 correlations” there are unlabelled columns. In the same File, sheet “2008 tair tw” there are unlabelled columns, and rows do not align. In File “Fig 9...” it is not clear what many of the columns are. This is a nice dataset, but it may be frustrating for people (or the authors in the future) to use it in the present form.

These will be updated for final publication.