

Interactive comment on “Beaded streams of Arctic permafrost landscapes” by C. D. Arp et al.

Anonymous Referee #2

Received and published: 13 October 2014

General Comments:

This paper provides a significant improvement in the knowledge of the distribution and biophysical characteristics of beaded streams in the Arctic. As the authors describe, previous work on beaded streams is limited to only a few sites in the region around Toolik Lake, AK. The authors map the pan-Arctic distribution of beaded streams using Google Earth imagery and aerial surveys and relate the distribution to regional permafrost and geological characteristics. Three issues detract from their findings: 1) the extent of their survey of Google Earth imagery is unclear, 2) the impacts of changing resolution on the uncertainty of their results are not quantified, and 3) the locations described are obscure to general readers. These issues could be partially resolved with one or more maps with these pertinent details (specifying where snow-off images of sufficient resolution are available); better maps could also improve discussion of the focused surveys and measurements made in the Fish Creek watershed. Uncertainty

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could be presented based on a case study of areas that exhibit minimal change in features over time, but span the range of image resolution available for the pan-Arctic region.

The authors present and evaluate hypotheses about beaded stream morphology and channel formation in the Fish Creek and Ublutuoch River watersheds in the results and discussion, but these hypotheses are not presented in the introduction section. This makes the results presented appear weaker. More context is needed for why Fish, Crea, and Blackfish sites are important and worth studying, and how they differ from most previous work. This is scattered throughout the manuscript, but it would be helpful to present the motivation and context for these sites early in the manuscript. Because the manuscript is already long, these revisions may require substantive revisions or rethinking the overall manuscript structure to ensure its accessibility to a broad audience.

The thermal and hydrological data from the authors' monitoring efforts are clearly presented in general, but merit comparison with other systems, either in similar systems in the Arctic or temperate systems. The implications of the seasonal thermal and hydrological regimes in beaded streams that the authors describe for fish habitat and dispersal are compelling.

Finally, there are numerous spelling, grammar, and sentence structure revisions needed before the manuscript is published. All acronyms must be defined at first use. Extra checks on figure and caption text would be warranted.

Specific Comments (page, line number):

TITLE: Too general. Consider something more descriptive, like, "Distribution and biophysical processes of beaded streams in Arctic permafrost landscapes"

ABSTRACT: captures the key points, but see general comments above.

INTRODUCTION: 11393, 10: no citations following "...limited to only one site." and

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then not discussed until the 3rd paragraph at line 21. Revise to help the reader follow what's been done and how your work fits in.

METHODS:

11395, 22-25: "All point locations for this survey..." This sentence is awkward and required rereading.

11396, 27: What does CIR stand for?

11396, 29: Source for the ifSAR DEM?

11397, 26: Is a gulch the same as a run? If so, use consistent terminology. I don't see any obvious gulches in the images of Figure 4.

11398, 4-8: Clarify terminology here. Why are these importance for identifying alluvial transitions?

11398, 21-22: "...black and white to avoid visual bias." Would be helpful to revise and end sentence this way.

11398, 27-28: Can you explain this hypothesis further and integrate it into the beginning of this paragraph rather than halfway through? Also need to be explicit later about tying back to this hypothesis.

11399, 13-18: These sentences should be rewritten so that they are more intelligible.

11400, 5-6: Revise sentence structure.

11400, 20-23: It seems to me there should be a sentence in here analogous to, "We assume that ratios X or greater indicate thermal stratification."

11401, 11: Move this paragraph about residence times so that it is the second paragraph in this section. More citations are needed in this paragraph as well.

11401, 16: Not always conservative, see lit. Have you evaluated the degree of adsorption possible here?

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11401, 26-28: Revise sentence structure.

RESULTS AND DISCUSSION:

11402, 23-26: Need some quantitative analysis of the conjectures in these two sentences.

11402-11403: The geographic descriptions are difficult to follow without additional more detailed maps of these regions for those who are not intimately familiar with Arctic geography. Additionally, locations like Imnavait Creek are referenced multiple times but not included on the map, although Toolik Lake, which is mentioned once, is.

11403, 1-2: What are the differences in the sizes of areas surveyed?

11406, 8-9: Are they going to be identified later, or do you mean the overarching Fish Creek Watershed study and not this manuscript?

11406, 13-15: Again, a hypothesis that should be mentioned earlier.

11406, 28-30: Figure 3 does not show these relationships, but a figure that does would be helpful for following along with the ideas in this paragraph.

11408, 10: Where is the Ublutuoch River? This should be on the study area figure along with Fish Creek, Imnavait Creek and Judy Creek that are mentioned earlier, and Crea Creek, discussed later.

11408, 24: Assuming you meant meander scars, not scares.

11408, 26: after(space)which

11410, 12: vaguely? I would say it “may attest...”

11410, 16: What are the errors on these age estimates?

11411, 22: “yielded less certain” not “gave dubious”? can you quantify this?

11411, 24-27: “However...” incomplete sentence, and the next sentence requires

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rewriting.

11413, 13-15: Sentence needs revising or could be removed.

11413, 16-18: still bed temperatures? Or reference to adjacent tundra/stream?

11414, 1: Remove “also.”

11415, 3: Remove “interesting” (also appears elsewhere).

11415, 14: characteristics

11415, 20-23: Run-on sentence.

11416, 3-8: cite or show data; paragraph is extensive review of Heim 2014 – consider whether it’s needed in this much detail

11417, 24-26: need to demonstrate the in-channel storage assertion (and potentially move this sentence later in this section); is the argument that in-channel storage is so large that it must swamp hyporheic zone storage in most beaded streams? Need to be explicit about this with the data presented.

11417, 27-30: more info on tracer tests needed: % recovery? transience of flow over measurement time period? Steady flow at any time with successful recovery?

11418, 13-17: How does this distribution of water velocities compare to other Arctic and more temperate systems of comparable size?

11418, 29: Remove “importantly.”

11419, 14: Ditto to above.

11420, 12: “Increase...by 18-fold”: assume this is compared to lakes alone

CONCLUSIONS:

11420, 14-16: Perhaps rewrite as “The coupled biophysical processes of beaded stream systems that provide key ecosystem functionality are described conceptually

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in Fig. 13.”

REFERENCES: ok

TABLES: ok

FIGURES:

Figure 1: It would be more helpful in the inset to show the regions where Google Earth imagery was of adequate resolution to delineate beaded streams, rather than showing regions of continuous and discontinuous permafrost, since almost 99% of beaded streams occurred on continuous permafrost. Also consider maintaining blue for water instead of land. Define all colors used in legend.

Figure 2: Need to define ice-content ranges here. Context for why Fish Creek should be presented here or earlier in text.

Figure 3. Crea and Blackfish should be discussed here or earlier in text. Reader should be directed to Figure 4 for definitions of morphological characteristics.

Figure 5: Would be good to put this in context of McNamara et al.'s 1999 geomorphic scaling study.

Figure 6: I would like to see the same scales for the axes of each site in order to better visually compare them.

Figure 8: It is unclear what Core A and Core B refer to, as this nomenclature are not used in the manuscript text. Include the Blackfish Creek core, and the location of samples taken for ^{14}C analysis. In the manuscript text, it is said that there are photographs of the cores. I would like to see this addition to the figure if they clearly show the distinction between the three layers.

Figure 9: sites should be indicated in a detailed map, or summarized in supplemental table with GPS coordinates

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Figure 10. clarify whether stratification ratio was calculated for 7/1-8/15 for the year specified, or was the max reported for the duration specified in the text

Figure 12: X-axis can be misleading. (e.g., earlier injections can be misperceived to have slower water velocities because values are presented from high to low). Also need to include the discharge (or discharge range) during the time of injection along with the date within the distributions.

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