

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

**Anonymous Referee #1**

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Summary of Comments on Beaded streams of Arctic permafrost landscapes

General Comments: This is an important paper in that very little research has ever been published on beaded streams in the arctic region and yet these streams are one of the more common stream types in this environment. Until this paper we have known very little about their distribution and characteristics. The authors have done a nice job utilizing three nested spatial frameworks – from pan-arctic to regional to watershed – to explore the nature of beaded streams. The analyses are straightforward and the report narrative is reasonably clear, with appropriate figures and tables. There are, however, a number of revisions that need to be made before this manuscript is published, largely for clarity. These changes are detailed on the following specific comments with finer-scale editorial suggestions in the accompanying annotated PDF. One of the most important changes that needs to be made is to explain more clearly how the pan-arctic survey of Google Earth images actually proceeded. It seems, but is

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not clear, that a complete, manual survey of the entire pan-arctic region was done. This seems like a monumental undertaking and if that is what was done, kudos. But some other systematic sub-sampling survey was done, this was not adequately explained in the methods and should be. The scale at which the scanning survey was done should be identified. Was a consistent scale used throughout? If not, why not? The justification for the use of RWT needs to be clarified. RWT is not conservative it is degrades or sorbs onto OM and that needs to be more clearly stated. It would be helpful in the discussion about the stability of beaded stream structure to place this in the context of their stability relative to stability of other hydrogeomorphic features in permafrost-dominated landscapes. What is the turnover time of a thaw lake or a river meander? In the context of these other features, are beads more or less stable? I have noted a few suggestions to improve several figures. The manuscript should be thoroughly proofed. There were numerous grammatical errors, several of which have been noted in the annotated PDF. In addition I've offered several editorial suggestions.

Specific Comments Page: 5 I presume that only a subset of the total arctic area was survey. How were scenes selected for quantification? Were they randomly selected? What % of the area was sampled? Were all analyzed at the same scale?

Page: 7 If these are relevant they should be identified. "...as described below in the next section"?

Page: 8 Of a total drainage length of what for each watershed?

Page: 11 Vague. What measurements?

All of this is true, but phrase does not make sense. If RWT photodegrades it can't be conservative. In addition, the primary complaint about RWT is the it does stick somewhat to organic matter. Thus, beads would be one environment in which this could be a particular problem. The authors could put bounds on whether this is a large problem or not by summing the mass flux of RWT to identify how much of the tracer that was added upstream was recovered downstream. It is important quantify this because

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a loss of tracer due to sorption or photodegradation will appear as permanent loss of tracer (and water) from the system.

Page: 12 But how were these "found"? Was the entire pan-arctic region searched quantitatively? Or was a subsampling regime used? If sub-sampling, how? The method of searching matters with respect to how best to extrapolate to the pan-arctic. If you look until you find beads, count them, and then extrapolate to the entire region, this could vastly over estimate the coverage compared to random sampling of the region to identify how frequently beaded streams arise in that landscape type. What method was used to search?

Page: 13 It would be helpful to explain why this is perplexing to the authors, given that the following explanations seem reasonable.

Is this a generally accepted statement? If so, an appropriate citation should be included. If not, the statement should probably be qualified; i.e., "may be"

Page: 15 Fig 1a does not really help me understand this relationship. I see no lakes on Fig. 1a.

There appears from Fig 1a to be quite high densities in the southern finger of Fish Creek.

I don't think Fig. 5 really supports this statement.

Page: 16 "10 per 100 m" according to Fig. 3?

Page: 17 More useful to report ranges as for Q?

Page: 18 "scars"?

Page: 19 "relatively deep and sinuous"? Quantify average values.

I agree with the general sense of these conclusions. But a 20% turnover of the beads in 60 years - on a geomorphic time scale - seems significant. In this same area, what

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would the turnover time be for a river reach; i.e., a full period from point bar to point bar? Is the beaded "transformation" relatively slower, faster, or similar. Also, were the 18% of pools that changed at the smaller, average, or larger size? What percentage of the total pool area is 10.8 m<sup>2</sup> and 19.7 m<sup>2</sup>?

This definition of a gulch (which is not a technical term?) should appear earlier in the manuscript and then would not have to be reported here. The sentence is awkward as is.

Page: 20 Confusing. Is "medium" intended to be a size designation here. The transition from "sand" to "sediment" is not helpful. Sand is a sediment. Is the transition from an "organic poor sand to an organic rich silt" (or peat)?

Page: 30 Personally, I would switch the order of these last two paragraphs to more closely parallel the structure of the paper.

Figures Page: 44 The finer lines and shading in this figure are hard to see. Need to be bolder.

Page: 50 It would be helpful to put the discharge below each date. This should be italicized and not bolded. Otherwise it could be interpreted as a missing panel C.

Page: 51 Perhaps better to refer to the middle bead as having "cap" ice rather than "floating" ice. My guess is that the ice is pretty firmly attached to the edges and not really floating freely, as this suggests.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/11/C4441/2014/bgd-11-C4441-2014-supplement.pdf>

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