

Reviewer Recommendation & Comments for TCD Manuscript

Paper No.: tcd-9-4943-2015 (revision)

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Title: Brief Communication: Twelve-year cyclic surging episode of Donjek Glacier in Yukon Canada

General Comments

I was pleased to read the revised version of this manuscript by Abe et al. The authors have made great strides in improving their paper, however I still have reservations about their lack of analysis of glacier surface slopes. First I provide comments on their responses to my own initial criticisms. The line and page numbering described is as used in the original manuscript. I then provide line-by-line comments on the revised manuscript and the page/line numbering refers to the revised manuscript (using the version with response to reviewers for page numbering).

Specific comments on comments

P5945 L11 re: “Donjek River Valley System noun” The authors describe how Clarke and Holdsworth capitalize the words ‘Donjek River Valley System’ and how they (Abe et al) are thus surprised that I suggested they make it lowercase. I repeat that ‘Donjek River Valley System’ is not a proper noun and so ‘valley system’ should be lower case. The only place that Clarke and Holdsworth use uppercase is in the title of the subsection.

P5948 L6 – re: “coarse temporal resolution” The authors describe how, due to the coarse temporal resolution of their data, they cannot more precisely pin down the dates of terminus advances. Have the authors consulted the ASTER database? Last month, all ASTER data were made freely available. Perhaps by including ASTER data, the authors can reduce the time lag they speak of, at least for the latter two events.

P5948 L13 – re: “constriction in Donjek Glacier width” The authors initially described a 35% reduction in width of Donjek Glacier, which I questioned in my initial review. I am pleased that the authors added a panel of glacier width to their Fig 1. I have two further comments. First, it appears that the region of the glacier that sped up in 1989, 2001 and 2013 versus quiescence, is actually a fair bit upstream of the constriction at about km20. Of course, this is somewhat subjective, but it appears that the velocity increases begin at about km25. Second, I was left wanting with respect to the authors’ discussion and interpretation of the constriction. They describe how there is likely a “strong control of the valley constriction on the surge dynamics” but expand only briefly on this interesting idea (later, on P31, beginning L31). They imagine that the constriction may generate a steeper surface slope, but as I discuss below, do not test this quantitatively.

P5949 L8 – re: “glacier surface slope at constriction: The authors claim to be unable to examine surface slopes. I don’t buy this argument. Datasets from the Canadian government (CDED: <http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/3A537B2D-7058-FCED-8D0B-76452EC9D01F.html>), Yukon Government (interpolated 30m DEM: http://www.env.gov.yk.ca/publications-maps/geomatics/data/30m_dem.php) and the

ASTER GDEM2 (<https://asterweb.jpl.nasa.gov/gdem.asp>) are freely available, but seem to simply not have been consulted. At the very least, the authors should look at surface slope changes (e.g. longitudinal/downstream, not necessarily temporal) to confirm whether there is a steepening at the constriction. They conflate my comments here and on P5950 L13 (see below) where I mention the idea of looking at *temporal* gradient changes.

P5949 L12 – re: “recurrence vs recurrent interval” The authors use the term “recurrent interval” in most places, but “recurrence interval” here. Please change all instances to “recurrence”.

P5950 L13 – re: “ice thickening locally” The authors claim that no publicly available elevation datasets are available to examine the elevation changes they expect to have occurred. I agree with them that an appropriately spaced (in time) set of DEMs is likely not available (e.g. only a couple are available, as I describe above). However, the authors do not even make an attempt to look at elevation in their analysis, yet they pin a lot on those elevation changes happening. I suggest they examine what data are available to see gradient changes with distance down-glacier at the very least.

Figure 1 – re: “jet colorbar vs others” Upon trying my suggestion that they use something other than ‘jet’, the authors found that the patterns they observed became much less obvious. This was my original point exactly. See here (<https://jakevdp.github.io/blog/2014/10/16/how-bad-is-your-colormap/>), here (<http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833>) and here (<https://betterfigures.org/2015/06/23/picking-a-colour-scale-for-scientific-graphics/>). From the last page: “[jet]...introduce perceived sharp transitions in places where none exist in the data”. I agree with Abe et al that the ‘Jet’ figure is the prettiest of those they provide, but is it the one that most accurately portrays the data?

Specific comments on revised manuscript (page numbering refers to combined file with author response and revised ‘track changes’ manuscript)

P23 L12 – In the abstract, the authors describe how “...detailed observations of the evolution cycles [of surge-type glaciers] have been limited...”, implying that their own study provides such “detailed observations”. I suggest that they tone down this language, as their observations, while interesting, are not particularly detailed. Of course this is a subjective statement, but when I think of a detailed study of surge processes, I think of papers like Kamb et al (1995, *Science*), complete with several lines of *in situ* measurements and commensurate insights.

P23 L16 – Here, the authors argue that the width constriction at ~km20 must strongly govern the surge dynamics of Donjek Glacier. This is an interesting observation but without investigating this line of inquiry further, I feel the paper will have much less impact. As I’ve described already, the authors ought at the very least to examine the available DEMs.

P24 L16 – After the words “Near the border of Alaska and the” were removed, the rest of the sentence is incomplete. ***Note: when I look at the version of the revised manuscript that does not show track changes, these words do not seem to be deleted, so I don’t know what’s going on with these various versions! This is not the only place this occurs. For example, on P27 L31, the first word of the paragraph (“Figure”) is not struck out in the track changes document, but does not appear in the non-track changes document. Another example is on P28 L7, where the sentence (in the track changes document) begins “uations superimposed on a gradual decrease.” This makes me wonder whether there was an interim version of the manuscript with more changes that was not uploaded. And it also makes me wonder about the quality of the language editing that the authors contracted out.

P24 L23 – As above, the deletion of part of a sentence rendered the remaining sentence incomplete. The revised sentences read “Recent advances in spaceborne remote sensing. In particular, synthetic aperture radar (SAR) images...” Instead, the authors might consider writing “Recent advances in spaceborne remote sensing, in particular, synthetic aperture radar (SAR) images...”

P24 L27 – Although the authors’ are correct saying that SAR does not yet provide a long-enough time series for quantifying surge cycles, a perhaps equally problematic issue is that InSAR is near impossible on temperate glaciers such as Donjek with most satellites due to decorrelation over relatively long repeat times.

P25 L3 – The authors state here that they investigate not only Donjek Glacier but also other nearby glaciers but those data don’t appear in the paper.

P25 L10 – See my earlier comments about “Donjek River Valley System”.

P25 L12 – it is unclear what these length and area figures refer to. Are these for Donjek Glacier only, or the entire ‘valley system’?

P26 L18 – Why didn’t the authors pan-sharpen their imagery?

P26 L24 – This sentence is confusing and should be rewritten – it currently says “The red curve in Fig 2a shows how this speed changes of the years.”

P28 L1 – How can the glacier “rapidly increase in late 2000-2001”? Does that mean 2001? Or early winter 2001? I realize the authors claim that the data do not allow monthly or seasonal specificity but annual specificity should be ok, shouldn’t it? Saying *late* 2000-2001 does not make sense. Similar language is used for a variety of time periods in this paragraph.

P28 L13 – Larson is misspelled (it should be Larsen).

P29 L6 – Remove the word “from”.

P29 L10 – The authors argue that the 1960s advances may be better described as pulses rather than surges, but do not provide much supporting evidence. They imply that the small advance of <500m described by Johnson is not sufficient to be called a proper surge. Although Abe et al don't describe terminus advances (aside from areal changes), in their supplement Fig S2 it can be seen that the total range of terminus positions varies by ~1km from 1975 to 2015.

P31 L6 – Change the word “evolves” to “involves”.

P31 L10 – The authors here state that there “...seems to be no clear initiation seasons” at Donjek Glacier, but earlier they said that they couldn't determine the seasonality due to the temporal coarseness of their data. These are very different – as written here, the authors state that Donjek Glacier surges occur randomly throughout the year. As written earlier, the authors state that their data does not allow determination of when the surges initiate. The following sentence (L11) clears up the confusion, but the wording in the L10 sentence should be changed.

P32 L5 – Here in the conclusions, the authors state that they use the Landsat data to examine the interaction of one of Donjek's tributaries with the main stem. This came as a bit of a surprise to me, since they do not previously describe the tributary except in passing. Their figure 3 does however, look at the tributary, but is not described until P32 L7, which is in the conclusions section, very close to the end of the paper. I suggest moving this material to earlier in the paper.