

Interactive comment on “More dynamic than expected: An updated survey of surging glaciers in the Pamir” by Franz Goerlich et al.

Anonymous Referee #1

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General comments

This paper provides a useful update of the number of known surging glaciers in the Pamir, including the identification of several new ones. The dataset is certainly useful, and will help to build on our global knowledge of why some glaciers surge, while others in the same region do not. However, I currently find the text a bit difficult to follow as the paper lacks a clear description of how surging glaciers were identified, and there is a lack of clarity and preciseness in the wording. The authors implicitly assume that the reader will understand what they're referring to in relation to glacier surging, but terms need to be better defined. For example, there needs to be a clearer definition of what a 'typical surge pattern' is (L243), and what is meant by 'opposing patterns of surface elevation change' (L240).

C1

Detailed comments are provided by line number below, and minor language and typographical issues are addressed in the attached PDF (make sure to view comments in the PDF to see all of them).

Detailed comments

L1: you haven't really demonstrated that the surging glaciers are 'More dynamic than expected', so I would suggest dropping this part of the title. Indeed, you don't determine glacier velocities and so it's hard to say that you've quantified dynamics, and your 186 surging glaciers are less than the 561 presented as possibly surge-type by Sevestre and Benn (2015)

L14: in the paper it's clear that you use more than just Landsat images to identify surges (e.g., Corona, Bing), so it would be useful to mention those other sources here

L15: instead of listing the methods used to analyse satellite imagery (e.g., animations, flicker images), it would be more useful to list the physical characteristics that you used in the satellite imagery to uniquely identify a glacier as surging (e.g., rapid terminus advance, large elevation change)

L50: for readers unfamiliar with previous literature it would be useful to provide a more complete description of the evidence used to identify surge-type glaciers (e.g., Why are looped moraines associated with surging? What exactly are 'post-surge down-wasting features'?), and references to back up your statements

L61: I assume that this sentence refers to Pamir surge-type glaciers only? If so, then make this clear.

L63: Unclear as to what the 'three instead of six classes' here refers to; needs better description

L70-76: this para would seem to fit better in the Discussion than here, as you haven't yet fully described your approach or that of Osipova et al. (1988). Or if you want to leave this text in the intro, then the Osipova et al. (1988) study needs to be much better

C2

described at the start of the previous para

L78-85: unclear as to what 'this inventory (here named GI-1)' refers to. It's also unclear as to whether GI-1 or GI-2 refer to an inventory of all glaciers in the Pamir, or just surging ones? I see later that you provide a better description of these datasets in Section 3.3 (L201-L214), which basically duplicates everything written here, so I think that you should delete or dramatically shorten this earlier text.

L92: please provide more detail about the Russian topographic maps so that a reader could find them if they wanted to – e.g., name of publisher, date of publication, name of series

L100: it would be useful to include labels in Fig. 1 or elsewhere for major features mentioned in the text, such as Mt Kongur and Fedchechno Glacier, as well as country boundaries

L107: provide the elevation of Fedchenko weather station

L123: clarify what's meant by 'possibly cycle'. E.g., do you mean length of the active surge phase?

L156: it would be useful to provide an estimate of the resolution of the 'very high-resolution satellite images' that you refer to in this section

L182: note that the GDEMv2 has now been superseded by GDEMv3: <https://asterweb.jpl.nasa.gov/gdem.asp>. This is for informational purposes; there isn't a need to complete new analyses using it, unless it can improve your results.

L188/189: I assume that you mean 15 km x 180 km here? This is a very different meaning to 15 x 180 km² (=2700 km²!). Also for 130 x 130 km² (= 16,900 km²!)

L195: there are three clauses here (gain/loss, lower/upper, active/quiescent), so it's ambiguous as to what exactly you're referring to for each one

L216-L268: what I'm missing in this section (and the paper in general) is a clear defini-

C3

tion of how you distinguished surging glaciers from non-surging glaciers? You mention things such as changes in surface elevation, but by exactly how much does a glacier have to change to be classified as surging? Similarly, how quickly does a glacier terminus have to advance? Exactly what changes in surface characteristics indicate a surge? The current explanation is quite general, and doesn't provide enough detail for a reader to go back and unambiguously identify the same glaciers that you did as surging. Several of the comments below provide specific questions in relation to this.

L227: it would be useful to list the period over which the Osipova et al. (1998) and Sevestre and Benn (2015) 'confirmed' glaciers relate to, so that it's clear how they relate to the period covered by your inventory

L240: clarify what you mean by 'opposing patterns of surface elevation change' – e.g., Along the glacier length? Within just the ablation zone? Over a multi-year period?

L243: explain what the 'typical surge pattern' is

L244: clarify what you mean by 'limited changes of the terminus'. E.g., Changes in terminus extent? Figure 3 shows that there were marked changes in the elevation of some termini, but I don't think that you're referring to that here

L257: explain how you differentiated between 'surges' and regular 'advances'

L258: provide details about the 'indirect evidence' you refer to here

L275: please indicate how the reader can access the attribute table. I assume that this relates to a shapefile? However, I can't find a shapefile to download from the URL provided in section 8 (unless this will be added once this paper has been accepted for publication?)

L285-L290 & L718: there seems to be an offset in timing between what's described in the text compared to the Figure 5 caption. In the text it says that the surge of glacier (2) is in Fig. 5a, but the figure caption says it starts in Fig. 5b. The text says that glacier (3) starts surging in Fig. 5b, but the figure caption says that it starts in Fig. 5c. Please

C4

make these consistent!

L302: somewhere in this section please provide a description of the difference between 'advancing', 'internal' and 'combined' surges

L312: please state the date used for the area in km², and whether the area is varied for GI-3min and GI-3max.

L319-L320: please include these place names in Fig. 6 so that the reader can understand what's being referred to

L347: please provide some information as to how the aspect was calculated. E.g., how was the aspect defined for glaciers which dramatically change their orientation along their length, such as when as they join a main valley from a tributary valley.

L355: the axis labels on Fig. 9 indicate median elevation, rather than mean elevation. Please make sure that wording is consistent, and check elsewhere.

L366-367: as with earlier comment, make sure that place names you refer to here are shown on a map (e.g., Mustagh, Petr Alervogo west)

L394: please provide information as to how you determined surge duration. You didn't determine glacier velocities in your study, so how can you know how long a surge lasted for?

L406-L416 & L690: I can't follow the text here and don't understand what Table 4 is trying to show or how the numbers were calculated. What does DEM 1, 2 and 3 refer to? What does Tongue, Type, Duration and Distance refer to? My guess is something related to the description in Section 4.1, but I can't tell what. I also don't understand why glaciers without terminus advance aren't included here, when they're included everywhere else. Please completely rewrite this section.

L419-L430: it would be useful to add a figure or table to help illustrate what is being discussed in this para

C5

L427: provide specific example(s)

L430: provide the reference numbers of the glaciers being referred to here

L453: I don't understand what 'handed flexible' means. This section is also difficult to follow as you haven't clearly described how you identified surges earlier in the paper (comments for L216-L268)

L461: I'm unclear whether the 'additional minimum and maximum extents' were included in your database? You say that your study period covers 1988-2018, but this statement suggests that you also included data from earlier times.

L503: how many of the glaciers you identify as surge-type overlap with the 561 identified as possibly surge-type by Sevestre and Benn (2015)?

L504-L506: please define what categories 3, 2 and 1 refer to here. On L226 you indicate that confirmed = 1, probable = 2 and possible = 3, but here it seems that the sequence is reversed. For example, your statement that 'the 51 most reliably classified (3) surge-type glaciers' suggests that category 3 refers to confirmed surges.

L510-L511: as with earlier comments, I don't know where these regions are as they aren't labelled on any of your maps

L534: in addition to the electronic dataset I would like to see a printed Table included in the paper (either in the main text or as supplementary material) that lists the basic characteristics for each glacier. E.g., ID number, latitude, longitude, elevation, aspect, surge timing. This would enable the paper to stand alone if access to the electronic resource is ever lost, and make it easier for the reader to follow the descriptions provided in the text.

L709: Provide dates for the DEMs mentioned here. Would also be useful to add a comment in the caption as to why the elevation changes don't line up with some glacier outlines (e.g., 80)

C6

L713: the white outlines are difficult to see in the figure; please use a different colour!

L714: please provide a date for the base image used in this figure, as well as the ID numbers/names of the glaciers shown

Please also note the supplement to this comment:

<https://www.earth-syst-sci-data-discuss.net/essd-2020-79/essd-2020-79-RC1-supplement.pdf>

Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2020-79>, 2020.