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

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General comments

The paper describes a new inventory of surging glaciers in the Pamir Mountains derived using optical satellite images and based on existing studies. This is a valuable research and can be used as a basis for further studies of surge dynamics. In line with the objectives of the journal, the paper presents the data accessible in an open repository. To fulfil the catchy title, a more detailed discussion of how the region/the glaciers are more dynamic than expected would be desirable.

>We agree that the title is on the catchy side but think it is justified for the presented observations. For example, we could nearly double the number of confirmed surges,

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observed massive surges for glaciers <1 km2, identified several glaciers surging twice, and revealed a large variability in surge behaviour. We have not listed these points explicitly to justify the title as we think this would come across a bit strange. However, we have added some of these findings in the conclusions to get the arc closed.

Apart from the minor comments below I see two major issues which have to be clarified before publication: In the introduction the authors point out the importance of discriminating between surge-type and surging glaciers and state that their study deals with surging glacier, i.e. glaciers actively surging during the observation period defined from 1988 to 2018. But there is an inconsistency within the inventory when they map maximum and minimum extents including images back to 1968. I guess this is the reason for the "strongest advance" (l. 414) at Garmo Glacier, which judging from a time lapse in Google Earth did not advance more than 6 km during the observation period 1988-2018. Guessing from Figure 3 the maximum extent was mapped in the 1968 Corona image, but this extent would refer to an earlier surge and thus is an "indirect evidences" for a surge-type glacier. As the authors explicitly study surging glaciers, properties should be restricted to the observation period (1988-2018).

>This is indeed an inconsistency we have internally discussed as well. There is certainly a benefit when the provided min/max glacier extents relate to the largest observed values but it comes with the caveat of a partly extended and thus inconsistent time period. We favoured the benefit (of the dataset) over the caveat (for the paper) and agree that it would then be required to better explain this decision. We now decided to adjust the maximum extents to those observed during 1988-2018 and then have the same temporal ‘keyhole’ view for all glaciers to keep the consistency.

The second issue is a technical one referring to the data files in the repository. Checking the maximum advance of 6665 m mentioned above I found that this number was given for another glacier (see comment l. 414 below). Likewise other large advances in the attribute table do not correspond to glaciers showing a large advance in their outlines. I suspect an error in the attribute table GI-3min.dbf. Should I be mistaken

I apologise in advance. With respect to the data structure in the inventory, I suggest to add a detailed description of the columns as an-other supplement. Most columns are self-explanatory, but not all. The correspondence between the paper and the data in the repository can be improved by adding the column names when describing e.g. the classification scheme on page 9. The order of the columns (dist_class dur_class srg_type tongue) in the data file (GI-3min.dbf) should be the same as used to form srg_code to be more comprehensible.

>We fully agree. Unfortunately, there was an error when merging different shapefiles to the final inventory file that we did not notice. It is the 'advance' column only that was incorrectly matched. We will update the attribute table and also make sure that the columns are in the same order as used for the surge code. We further recalculated the topographic parameters using the most recent version of the ASTER GDEM v3 instead of the v2. We already evaluated GDEMv3 and it is indeed far better than the former version and the used AW3D30 DEM.

Detailed comments

l. 10 What are "capable data"?

>Maybe a bit confusing. We changed it to valuable.

l. 82 glacier names or glacier's names

>We changed it to glacier's name.

l. 113 Insert glacier in "mean elevations" and check the numbers, they are not thesame as in the cited paper.

>We here referred only to the dataset presented in this publication rather than the publication itself. This has now been clarified.

l. 154 From Figure 1, it's not only west of Fedchenko. Maybe you could say west of lake Karakul.

>Yes, this is better and has been changed.

l. 154 I suggest "with a resolution of up to 6 m" instead of "up to a resolution of 6 m".

>Agreed and changed.

l. 161 Give more information on the sources within GE and bing.

>For GE we meanwhile only see ‘Maxar technologies’ as a source and Bing Maps does also not report specifics about the images.

l. 224 "Their inventory", which one?

>It refers to the inventory of Osipova et al. (1998), which is addressed in the sentence before.

l. 235 What are the "slightly different samples"?

>We have now better described this. It refers to the decision on the specific scenes to be animated. Sometimes changes are almost invisible with a yearly step size, but with more years in between changes appear.

l. 242 delete "c."

>We would prefer to keep the “c.” as it is not clear to which year the AW3D30 DEM refers to.

l. 258 Which "indirect evidence" did you introduce to the classification?

>Including features such as “surface structures” is the indirect evidence in this case. We have added this information.

l. 292 Check this sentence, esp. the two occurrences of the expression "own surge"

>We changed one “own surge” to make it clearer which glacier and surge is meant.

l. 308 "medium distance": Shouldn’t code 2123 mean long distance?

>Yes you are right. We changed it.

l. 313 Give elevation data source here again. How is the aspect sector derived? Explain for readers not familiar with glacier inventories or give reference.

>We included a reference that describes how the parameters were calculated.

l. 317 186 surging glaciers: In GI-3min there are 198 glaciers, in GI-3max 202. What is the reason for different numbers?

>Glaciers are differently separated from their “main glaciers”. This is possible because the often deformed surface structures reveal the “terminus” of the glacier even when pushing into another glacier. In the minimum extent it was often not possible to find a proper separation line.

l. 317 What are "spatially distinct surges"? In your data you have repeated surges forindividual glaciers. So, do you mean temporally distinct?

>This means that within one glacier entity (where it is impossible to divide the glacier into two or several individual glaciers) two or more probably independent surge regions/systems exist. The related individual surges are mentioned in the attribute table. We have now better explained this.

l. 319 It is difficult to relate the geographic description to the map, because the names are given in none of the figures.

>Yes, this has also been noted by reviewer one. We have now added the names of the mentioned regions to Fig. 6.

l. 328 and 332 Combine sentence about small glaciers into one.

>We combined the sentences.

l. 330 You should mention here, that the tributary Bivachny is a surging glacier.

>Yes, included.

l. 347 "mean aspect sector distribution": Explain in few words what this is.

>We have now written ‘the frequency distribution of aspect sectors’ to be clearer.

l. 355 "scatter plot showing mean elevation vs. mean aspect", Figure 9 reads: "Meanaspect vs. median glacier". Is it mean or median elevation?

>It should indeed be median elevation. Thank you for spotting.

l. 363 Mean or median? If different elevation averages are used, explain why.

>Median is correct here.

l. 381 Revise sentence structure.

>Done.

l. 382 surge duration: But all glaciers in the file have years associated. Do you mean the ones that started before 1988?

>With surge durations we refer to the duration of the active surge phase from the start to the end year given in the attribute table. Glaciers with surges starting before 1988 and ending after 2018 are not included in this number.

l. 392-394 But Fig. 13a only lists the 27 surges that started in 1989. Adapt either text or label of the first bin.

>We have added a sentence to better explain what is shown in Fig 13a.

l. 398 Replace "started in 1989 or later and ending in 2017 or before (black bars "with" started after 1988 and ending before 2018 (grey)

>Yes, that makes it easier to understand and has been changed.

l. 402 Out of curiosity: Do these 9 glaciers have something else in common? Size, aspect, elevation...

>No, they are all very different.

l. 414 See above. Check the advance of Garmo (80). While the outline in Gl-3max seems to be the maximum since 1968 it is not an advance during the study period you defined as 1988-2018. I looked for this advance in the file Gl-3min (arg_adv_m) and found it given for glacier 198 (Kuokuosele Glacier). Garmo (80) has an advance of only 509 m in the file. Furthermore, I had a look on other large advances and they don't coincide with glaciers that have large differences between their minimum and maximum extents. Maybe I got something wrong, but I strongly recommend checking the attributes in your data files.

>Thank you for spotting this inconsistency. Something went wrong during digital data merging for the attribute table. We reworked the dataset completely.

l. 476 "real number of surging glaciers" Following your distinction in the introduction, these would be surge-type glaciers.

>Yes, indeed (changed).

l. 495 How did you assign the class for multiple surges of the same glacier for criteria D and E when they fall in different classes? The most extreme one?

>We assigned the class of the main trunk of the glacier. This has now been clarified it in the text.

l. 523 see line 317 and adapt line 17 in the abstract

>This is now explained (see L317) and has been rewritten in L17.

l. 526 see line 382

>This has now been clarified in line 382.

l. 528 "central ... mountain ranges": But you say there is a gap in central Pamir (l. 320).

>Yes correct. We have now changed L320 and deleted "central Pamir".

l. 529 What is special about a descend of more than 800 m? In line 424 you

say:"âĹij1300 m further down at their maximum extent." How does this match?

>Thank you for spotting this. 855 m is the observed maximum, more than 800 m is reached by 3 glaciers. We corrected the respective sentences in the text.

l. 580 In Finaev et al. (2016) give full details: 9(3):88-105, doi:10.15356/2071-9388_03v09_2016_06

>We added the missing information.

l. 632 In Osipova (2015): Ice and Snow, 55(1), in Russian. Add "in Russian" where applicable.

>Added.

l. 633 Ice and Snow, 50(4)

>Changed.

l. 687 Table 3: In the introduction you say you map surging and not surge-type glaciers. Which ones do you list in the table?

>It is also only the surging glaciers. We changed it in the table.

l. 690 Table 4: Refer to criteria B-E in 4.2. What does DEM refer to?

>This was a mistake. We revised the table.

l. 691 "distance criterion" instead of "duration criteria"?

>We changed it.

l. 710 Fig. 3: Better give the years of elevation difference than the data source or both.

>We added the periods.

l. 715 Fig. 4: Give type of Image: Landsat 8, panchromatic?

>It is the Corona image. We added the credits to the caption.

l. 747 Fig. 12: What is the additional value of this figure? There is no meaningful pattern that can be interpreted with the glaciers listed by their IDs, but individual glaciers cannot be examined either. Which glacier ID is it? There are 198 glaciers in GI-3min.

>This figure should reveal that there is no temporal clustering of surges for neighbouring glaci-ers (consecutive IDs often refer to neighbouring glaciers). It should also reveal the high variability of surge durations and has also been used for glacier surges in the Karakoram by Bhambri et al. (2017). Unfortunately there was an old version oft he figure included in the manuscript with 146 entries only. Now the correct figure with 198 entries is shown.

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