The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2018-66-RC1, 2018
© Author(s) 2018. This work is distributed under
the Creative Commons Attribution 4.0 License.

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "Extracting recent short-term glacier velocity evolution over Southern Alaska from a large collection of Landsat data" *by* Bas Altena et al.

Anonymous Referee #1

Received and published: 26 May 2018

General comments:

Altena et al. present a novel methodology to extract valid observations in a set of remote-sensing derived surface velocity fields, highly contaminated with noise and outliers, and to improve the visualization of short-span (32 days) velocity time series. They apply this methodology to a set of GoLive velocity fields obtained from feature-tracking of Landsat images over Alaska and period 2013-2017.

The methodology proposed in the study is novel, should help improve analysis of velocity time series, and is much needed in a context of fast-growing access to satellite-derived velocity products. The method is sound and properly referenced, but the poor

Printer-friendly version

Discussion paper

quality of the writing as well as several missing information hampers at the moment a full understanding of the methods and reproducibility. The glaciological interpretation of the results is interesting although, as mentioned by the authors, mostly discusses previously reported observations.

Specific comments:

Abtstract: You should rearrange the abstract to discuss the methodology first, and the application next. For example, l 10-13 should be moved to the end of line 4.

Section 3.1: I don't quite understand the value of AG here (except for visualization) and the connection with the following methods. What is for example the link with A in equation 1? Why is AG filled with 1 whereas the text says 'individual days are specified'? Do you assume 1-day pairs in this example?

Section 3.2: Some information is missing to fully understand the methods described here. The Hough transform proposed here is not standard and should be better introduced. At the moment, it is not possible to understand how Figure 2b is generated. For example, I understand that a pair that overlap only with X1 (resp. X2) is associated with a vertical (resp. horizontal) line, but how is the diagonal line (d32,64 - d0,32) obtained? Also introduce X1 and X2.

Section 3.3: Equation 2 needs to be fully explained, as of now, most elements are never introduced. What is x (the variable to be smoothed?), i (the pixel index?), hat operator (smoothed variable?) ? The smoothing only considers 1 dimension here, how do you consider the 3 dimensions (space + time)? I don't fully understand figure 4. Why is the variogram (4a) a scatter plot, I would expect a line. Does it show different samples or is the variability from one point to another very large? In this case, maybe use a larger step? Why are all dots of the same color, shouldn't the color scale be linked to the value of the variogram (y axis)? What is the unit of the color scale? The terms 'nugget', 'still' and 'range' are never mentioned anywhere, either introduce or delete. Rewrite the caption to clearly explain panels a and b. Finally, after reading the

CC BY

variograms, I still don't understand why the 'anisotropy factor' is set to 4.

Section 4.1: A more quantitative analysis would be expected here, and some sort of conclusions. For example, lines 17-19, I would like to see more qualitative measures of how the open vs closed configuration compare in term of coverage and noise in the stable grounds. Figure 5, 6 and 7 need to be improved significantly. It is sometimes impossible to see the differences between 5a and 5b or 6a and 6b discussed in the text. The panels must be either enlarged or zoom to specific areas should be provided. Here are some suggestions: - increase the size of the panels by removing redundant axes and color scales - merge figures 5 and 6 into 1? I don't even understand the difference between panels 5b and 6a, should they not be the same? You discuss coverage, but the figures don't show any 'no data', is 0 no data? What period are the velocity fields extracted from? I would like to see a comparison with an individual velocity field here. The whole discussion is somewhat informative but remain very theoretical without any good reference field.

Section 5: This whole section should be moved before the glaciological interpretation in section 4.2.

Section 5.1: This part puzzles me. Until this section, I am convinced that the methodology is a step forward, but after this section I am not so convinced anymore. I understand the arguments that the result of the voting is obtained fully automatically and that it is limited because of gaps in the network, but (and I'm being voluntarily provocative here) if the result is not more satisfying than an individual field, why not just find a method to select the best field instead? What is the difference between figures 5, 6a and 11 and why do the results look much worse on the latter? Is a larger period considered in figures 5 and 6? Or are the results on these figures not better? In which case this confirms the need to improve figures 5 and 6, in particular enlarge and add a 'no data' color. Also the authors decided not to make this choice, how would the results change with a slight (as in not very strict threshold) filtering before the voting, or a weighting, based for example on the correlation score. I would think this help removing

Printer-friendly version

Discussion paper

CC BY

a large part of outliers, in particular in cloudy or sea areas, that seem to cause a lot of gaps. On the same topic, the results for the individual field (GoLive) and median are usually filtered post-processing using for example the cross-correlations score. It would be interesting to show such results. This would probably remove outliers at the expense of coverage, giving maybe more importance to your results? This would also highly reduce the MAD. . .

Section 5.2: Again, move this section after describing the methods. P 16 last line 'the distribution also show a clear improvement'. Improvement to the voting but what about compared to the individual fields, or other methods such as median? This kind of analysis could also be used to discuss the open vs closed network.

Appendix: It took me a while to realize that the figures were described in the text. Move every description of the figures to the figures captions. Figures A should be merged together rather than being scattered on several pages. Figures B: Explain the boxplot. What is the red box (IQR?), red circle with black circle inside (median?) ? The reader does not have to guess. These figures should be improved for readability too: - simplify the boxplot, maybe show only IQR and median? - make the plots wider - for the scatter plot, change the x limits so that the scatter plot occupies the whole figure instead of $\frac{1}{4}$ of it. Since you show the 1:1 line, there is no problem in using axes with different scales.

Detailed comments:

- abstract, l 5-7: "The visualization tool. . .. as glacier surge" Keep this sentence for the main text but remove from the abstract.

- p 1, l18 "they can contribute considerably" -> "they contribute considerably"

- p3, l 9-11: this paragraph is important since it tells the reader in one line what you are going to do. Rewrite because it is too vague right now.

- section 2.1: what is the maximum time span in the GoLive products? Specify in the

CC BY

text.

- p 4, l3: You mean 42 000 km2 ?

- l 4: "the glaciological distribution of glaciers is diverse" Please explain, are you talking about ocean- vs land-terminating? Size? Aspect?

- l 11: "at least two acquisitions" It is a weird statement, I assume you want to encompass the triplets in Altena and Kääb 2017? I think what is important is that the measure represents a time span (as opposed to instantaneous measure).

- l 16 "multiple combinations of . . . 16 days" Rephrase as it is a bit clumsy.

- l 19 "In this network every acquisition" -> "In this network, every acquisition". Here and in many places, a comma is missing which makes it harder to understand.

- Figure 2: Just a warning, the figure does not show correctly depending on the pdf viewer. In the caption: "At the right" -> "On the right,"

- equation 1: use v instead of x? This makes more sense since you are talking about velocity.

- p8, l 6: "Resulting in a spatio-temporal stack. . ." This sentence has no subject and does not make sense.

- equation 2: again, introduce all the terms here.

- p 9, l 26: it took me a while to understand this sentence, rephrase or cut with punctuation, in particular "surrounding of glaciers are stable or slow moving terrain" confused me.

- p 10, l 7: "stable terrain, which has no movement" a bit redundant. . .

- p 11, l17: "as the surge front progresses" It seems like the sentence was not finished. . .

- p 12, l 5: "but seems to slow down" I would add, "as shown by the break in slope" so

CC BY

that the reader understand what you are referring to.

- l 6: I don't understand how you come to these conclusions, please explain or remove

- l 7: Which figure is showing the speedup?

- l 10-11 and p 13 L 1: I don't' understand these sentences. Please rephrase, some sentences are incomplete.

- figure 10, caption: mention the period here.

- figure 11: half of the color scale for the velocity is saturated, please use a different one. It also looks like the 'voting' and 'median' results are much higher than the GoLive but this might be mostly due to the choice of the color scale?

- Figure 12: panel d 'GoLive' -> 'Voting'. The title should be 'voting vs RapideEye' (y vs x) not the opposite, same for panel c.

- p 17, l 10-16: A suggestion would be to calculate a sigma that would be the (squared root) sum of the measurement error (that decreases with the time span) and the natural variability (that increases with the time span)

- p18, l 24: Here and other places, you discuss the benefits of adding data from other sensors (e.g. Sentinel). I expect velocities obtained from different sensors, with different resolution and hence sensitivity to different features, to be quite different (as shown by figure 11 between RapidEye and GoLive for example). Would that not hamper the combination of the velocities?

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2018-66, 2018.

CC BY