Review of: Winter speed-up of quiescent surge-type glaciers in Yukon Canada
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Summary:
The authors have a nice dataset of ice velocities over several glaciers in Alaska and the Yukon. They use this dataset to investigate winter accelerations that occur in the upstream portions of many glaciers in their study area. The authors do highlight interesting velocity patterns, but I found the text hard to follow in many places.

Note to authors: Unless it is a TCD requirement (which I don't believe it is), please use continuous line numbering. Your line numbering restarts on each new page, which is slightly annoying as a reviewer.

Main Points:
What's the relevance to surge-type?

- The abstract and introduction implies that the fact that the glaciers in your study are surge-type and in their quiescent phase is important. However, this characteristic is not revisited in the discussion, and I'm confused how a quiescent glacier can still move ~200 m/yr in its upper reaches. This seems pretty fast!

Timescales and mechanisms:

- In many cases it seems like you're describing a seasonal cycle, not a mini-surge. How are you distinguishing between the two?
- The discussion does a good job describing some mechanisms that could cause fast flow in the winter. However, I found the transition between mini-surge mechanisms and seasonal variability confusing. Perhaps the authors are also confused about these distinctions.
- If the magnitude of the previous melt season is an important trigger for fast winter flow, can't you investigate this with a simple PDD model?

Propagation direction:

- The velocities are not continuous, so inferring propagation direction and seasonal vs anomalous behavior is tricky.

Figure interpretation:

- I had difficulty interpreting the flow direction in Figures 2-5. I assume that the flow is from left to right, but then had trouble following the discussion of up-flow surging and propagation.

Organization:

- This paper presents interesting results and I hope the authors will address these points and resubmit the manuscript. The organization and writing throughout the manuscript needs improvement so that it is easier to follow. Observations that are obvious to the authors need to be described clearly for the reader. In addition, distinctions between seasonality and surging, mechanisms and timing need to be more clearly presented.

Abstract: I suggest rewriting this abstract. It is a bit unclear as it is now.
Line 9-10: Why does the summer speed-up make it difficult to understand the winter surge?
Line 10: no question was posed in the previous sentence
12: the Yukon
13: "upstream acceleration" is confusing. Is the speed-up just located upstream, or is it migrating upstream?
13: title implies all the glaciers are in their quiescent stage
14: It's confusing to relate the winter speed-up to the summer seasonal acceleration. I suggest removing the first half of this sentence.
15: delete "upstream" – there likely isn't meltwater input anywhere in winter
16: does not (not "do")
17: delete "as winter occurs"
18: your findings (or results from models) won't affect future glacier dynamics (but might help us understand them!)

Introduction
21: sheets
21: "Ice flow…is typically greatest…"
23: the Zwally reference doesn't fit here (nor is the Bartholomaus one, really)
27-9: I think all you really need is the brief description at the start about seasonality and efficient drainage systems. This part is a bit basic. If you want to keep it in, I suggest the following edits:

- delete "more and more" (too colloquial)
- change "that lead" to "causing"
- "These factors" – what factors? Be descriptive
- It is awkward to pose questions in the middle of your introduction. Reword.

P2, line 8: "to be in between" is confusing. Specify that you're talking about the magnitude of ice flow.
10: The Burgess paper is quite relevant here and should be described in more detail. Describe what they found in more specific terms.
12: delete "due to the harsh …"
17: Can you reword this to be in an active voice (Cavity closure and water pressure increase caused…)? It is confusing as is.
21: reference
p3, line 3: advances
5: delete "there"
6-12: these are results and shouldn't be in the intro

Data sets and analysis method
26: Scenes were…
30: why were these mods used?
P4: I found the description of the pixel methodology confusing. What is the approximate pixel size? What is the difference between a search patch and sampling interval?

9: Specify that this geometry was used for most glaciers.
13: "range dimension is the same as that of the FBS data"….which is what?
15: delete "That is"
16: delete "also"
20: "…there remained few topography-correlated artifact offsets" – this needs to be quantified.
25: replace thinning with "surface elevation change". If these are quiescent glaciers, why aren't they thickening?
26-28: I don't understand this sentence at all. How can you average the area over a 1-D flowline?
29-2: This sentence is awkward. It might be clearer to start the sentence at "The uncertainties of offset tracking are estimated to be between…" "Two data images" sounds awkward – are they data or scenes?

Observation results
P5, line 5: It's more focused if you reorder the sentence "Here we focus on…., although surging episodes occurred at…"
7: Is Hubbard really a surge-type glacier?
11: "Major 17 glacier are shown in Figure 1"?????
13: delete "Notice that" – the reader doesn't like to be told what to do!
Figure 2: I had a hard time seeing this trend that you mention. It might be clearer if you show the velocity pattern as a timeseries plot.
18-24: This is speculation/interpretation so should be moved to the discussion
25-30: I'm confused why the author is focused on fall vs winter speeds. Oftentimes the fall speeds are the slowest of alpine glaciers because of efficient drainage networks.

- Figure 3: is this distance along the flowline (so 25 km is more downstream?). this is what I am guessing, but was confused by it in the text.
- 30: It's hard to tell that the winter speed is >50% greater than the fall speed on Walsh Glacier. The record is pretty spotty. It's definitely faster than the summer velocity. If this is a big part of your story, I suggest also plotting it as a graph – perhaps with the x-axis as month and y-axis as velocity. Plot each year as a different line.

P6, line 1: This writing is awkward. Just state the differences between seasonal trends, don't ask the reader to do it.
2: for all glaciers? I don't see that (downstream speeds in summer are faster in winter)
4: This is where I got confused about what is upstream. Is "20-km point upstream" at distance of 5 km in the figure, or 20-km in the figure. If the latter, delete "upstream".
10: I don't understand how you infer propagation direction from this data/figure?
14: I also don't understand how this is interpreted as a surging episode?
15-20: I'm confused by this paragraph and the phrase that "glacier dynamics at lower reaches are consistent with previous findings". Maybe start out by saying what the seasonal trends are and then state that your spotty record seems to match

this. It's a tough transition from the previous paragraph, which focuses on surging episodes and unique winter velocities, to this paragraph about "typical" seasonality patterns. Which is it?
27: So, maybe this is just the seasonal trend, not a surging episode. How are you distinguishing the two?
28: Fragment

Discussion
The discussion is actually well thought out and addresses several potential mechanisms for the winter speed-up. It just needs to be better organized so that there is a clear distinction between surges and seasonality.

p7, line 12: What does Variegated have to do with this?
12-15: Again, I don't understand the propagation direction conclusion
16: How did you calculate this?
25: pointed <u>out</u> by
17-26: This description of mini-surges only loosely relates to your story here. Your observed speed-ups seem to last longer than 1 day and are more repeatable.
29: reaching <u>a</u> maximum
p8, 1-10: can't you test this by comparing your speed change with PDD estimates?