

Interactive comment on “Further summer speedup of Jakobshavn Isbræ” by I. Joughin and B. E. Smith

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This manuscript presents new data for Jakobshavn Isbræ, which demonstrate a higher seasonal variability in speed during the last two years compared to the previously established record (1990–2011). As the glacier retreats, summer speedups are becoming more and more pronounced. This is an important finding, as glaciers’ seasonal fluctuation is a manifestation of their dynamic capability.

Although the manuscript is an extension of the authors’ previously published work, the new data comprise an entity of new information, which is both well presented and suitable for a fast-tracked brief communication in The Cryosphere.

My main recommendation is to reduce the description of future evolution of the flow

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of the glacier, which comes across as speculative in several places (see related comments below). The authors argue that the stability provided by a topographic bedrock high will only be temporary, and that the glacier is likely to continue its retreat even farther inland. While this is indeed a possible future scenario, I suggest adding “will likely”, “may” and “potentially” in this context.

What the authors do well is show that the potential ten-fold increase of discharge, as hypothesized a few years ago by Pfeffer et al. (2008), is not an unrealistic future scenario for Jakobshavn Isbræ. I think this is worth mentioning explicitly in the abstract. I would also welcome a comment by the author in relation to one or more of the statements in recent IPCC report.

Specific comments.

Page 2.

Abstract. State absolute magnitude of ‘new’ speed (mean annual as well as peak), as it is unclear what a percentage of the velocity during ‘previous summers’ amounts to. The last sentence, which includes descriptions such as “... slightly ... moderate ... likely ... a few decades ... rapidly ... end of century”, is rather speculative. Rather than this, the authors could simply put forward their key argument, which is that observations from 1990-2013 demonstrate that a ten-fold increase in speed during this century is a plausible and perhaps even likely scenario for Jakobshavn Isbræ.

Page 3.

The description of error is good and probably necessary, but also a bit distracting here. It could, if possible, be moved to a Methods section or Appendix at the end.

Page 4.

Understanding the dynamic response(s) to calving front proximity as well as water depth is clearly important, yet plotting speeds for a moving location (T09-T13) together with fixed points (M0-M43) on Figure 1 doesn’t fully resolve this question. It is also

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potentially confusing. To resolve the issue, I suggest trying two simple regressions: one with proximity to front as the predictor variable for peak summer (or mean annual) velocity at fixed locations, and another where water depth is the predictor. Judging from Figure 2 and the supplementary figure it seems likely that the second will yield a much higher R-squared value. If meaningful, this would make the analysis more robust and the text could subsequently focus simply on the velocities at fixed locations (which it sort of does already). If the authors retain the analysis as it stand, I suggest plotting T09-13 on Figures 1 and 2 with range of gray tones, so that it becomes clear how location (figure 1) and speed (figure 2) are spatially connected.

Page 5.

Discussion.

Line 1 is a bit awkward. What exactly is meant by “un-butressed”? (No mélange?) And what are the implications? (Summer only?)

The summary of the analysis by Howat et al. (2005) and Joughin et al. (2012) is good, but may be too short to fully convey the dynamics involved. Since it will not be straightforward to all readers, I recommend careful consideration of wording here and a slight expansion of the text if needed.

Bottom of page. Can you justify the statement that stability provided by the bedrock high is only transient? Add “may” if needed.

Page 6.

Paragraph 1. “... the relatively high slope region.” Explain why slope is key here. Re-word if necessary.

Paragraph 1. “... yielding speeds well above balance velocities”. Add ‘likely’ to be more accurate.

Paragraph 1. “... extreme velocities”. True, but you could leave this argument for the

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next paragraph.

Paragraph 1. Last sentence is a bit contrived as gridding artifact conceivably could work the other way around as well.

Paragraph 2. "... relative to (add: "those observed in") the 1990s."

Paragraph 2. Explain or summarize briefly what exactly Pfeffer et al. (2008) proposed.

Paragraph 2. Potential twelve-fold speed up at M26. Yes, perhaps, but this number is not directly comparable to the ten-fold speed-up hypothesized by Pfeffer et al., since the latter was a ten-fold increase in the total amount of discharged ice and not a ten-fold increase in flow at a fixed location.

Page 7.

Conclusions.

Observational record. Add: "of velocity on the Greenland Ice Sheet", to be precise.

"When retreat to shallower depths occurs, ice losses will likely become smaller because ... [explain briefly]."

"Unusual". 'Unique' may be a better word here.

"Sustain (add: 'similar') large increases in ice discharge"

Figure 1. It would be quite useful if bed topography contours were added on this figure.

Figure 2. Why not show the longer record here? (As in the Supplementary figure.)

Figure 3. Make sure the bed transect shown is indeed the best of alternatives.

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