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Interactive comment on "Velocity response of Petermann Glacier, northwest Greenland to past and future calving events" *by* Emily A. Hill et al.

Anonymous Referee #2

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I am neither glaciologist nor modeler, but physical observations related to force and mass balances in air, oceans, ice constitute my academic bread and butter. My subsequent comments should be read with these biases in mind as I am also unfamiliar with reviewing for Open Access journals such as The Cryosphere.

I thoroughly enjoyed reading this manuscript and endorse it for publication, because its language is concise, elegant, and largely clear of disciplinary jargon. The results are novel, exciting, and will stimulate further observational and modeling work at ice shelves in general and those on Greenland like Petermann or 79N Glaciers. The modeling section-2 is particular clear to me in its detailed and clear discussion of model set-up, initialization, boundary conditions, inversions, limitations, and uncertainties. Nevertheless, an equation or two or three should be given to illuminate both text and

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results. Graphics are clear and often free of "chart junk" but the authors can improve their presentation by closer alignment with design principles outlined in

https://www.edwardtufte.com/tufte/books_ei

Fig.-2 in the present manuscript serves as an example for poor design and Fig.-7 as an example for good design.

There are few (minor) quibbles or comments that I have with the manuscript:

(p1, line-23) Khan et al. (2014) is an unfortunate and poor choice to reference the role of sea ice in waters adjacent to glaciers, because the papers merely shows crude (25 km resolution) maps sea ice along with erroneous ocean temperatures (2007 stands out as a particular warm water year off 79 N Glacier in the paper only because no ocean temperatures were collected within 300 km of the coast that year). Furthermore, Khan et al (2014) contains none of the dynamical insights of ice-ocean-glacier interactions such as are provided by Shroyer et al (2017) for Petermann Fjord. Please replace a misleading and poor with a good and relevant reference.

(p2, line-16 and line-31) The authors claim repeatedly that Petermann Glacier's drainage area constitutes 6% of the Greenland Ice Sheet (GIS). This number is used incorrectly by many uncritical glaciologists and oceanographers alike. The mistake, I suppose, originates in Rignot and Kanagaratnam (2006) who in their Table-1 list areas of many glacier drainage basins that add up to 1.2 Mil kmˆ2. This is NOT the total area of the GIS which is closer to 1.7 Mil. kmˆ2 as published by Citterio and Ahlstrom (2013). Using the wrong total area, I get a 6.1% for Petermann, when the correct value is 4.3%. The Geological Survey of Denmark and Greenland distributes the correct digital ice mask. Please correct this common mistake.

(p2, line-22 and subsequent) More complete glacier velocities from time series of GPS measurements on Petermann Glacier are contained in Muenchow et al. (2016) and a year-long time series in Ahlstrom et al. (2013).

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(p2, line-31) The rift as a precursor for the next calving can be referenced as Muenchow et al. (2016) who first speculated on the next calving location of Petermann Glacier.

(p6, line-6) Thank you for a wonderful descriptions of different ice flow modeling approaches. May I perhaps ask 2-3 descriptive equations (conversation of mass and momentum as well as stress-law?) that could show me concisely and quickly what kind of dynamics (linear vs. nonlinear, time dependence) are contained. Is "shallow stream" perhaps the same as "shallow water" equations that allow, perhaps, low-frequency wave motions?

(p9, line-15) Could not the central channel at Petermann Glacier with its water-filled river in summer partially explain the discrepancies here? Furthermore, the ice-shelf has substantial small scale topography that is captured in both Operation IceBridge radar and altimeter data and to anyone trying to walk on the floating section. It would be amazing (unlikely), if a model could resolve the details of the velocity field of such small scale divergence and convergences in the ice flow of the floating section of the glacier. What would be the role of basal channels in the model and how are they included or not?

(p20, line-4) The Mix et al reference is neither peer-reviewed nor relevant given several peer-reviewed publications that resulted from this expedition, e.g., Jakobsson et al (2018) or Muenchow et al. (2016).

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