The Cryosphere Discuss.,
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The Cryosphere Discussions

Interactive comment on "Warming of SE Greenland shelf waters in 2016 primes large glacier for runaway retreat" *by* Suzanne L. Bevan

Anonymous Referee #2

Received and published: 11 March 2019

Review of "Warming of SE Greenland shelf waters in 2016 primes large glacier for runaway retreat" by Bevan et al. (2019), The Cryosphere Discussions.

This paper uses a suite of remotely-sensed observations to show that Kangerdlugsuaq Glacier (KG) in southeast Greenland experienced substantial retreat during 2017–2018. This is important as KG may soon transition to a retrograde bed, which could lead to further inland migration. The authors provide observations that suggests a weakening of the winter ice mélange during this period, which they attribute to anomalous warming of near-surface shelf waters during 2016–early 2017. They then conclude that warm near-surface shelf waters weakened the ice mélange, altered the seasonal calving cycle, and triggered terminus retreat.

This paper is generally well written, and the time series of remotely-sensed observa-

tions will be highly useful to the community. However, in its present form, the oceanographic component of the paper is too speculative in its attribution to the mechanisms that inhibited/weakened the ice mélange and caused terminus retreat. In general, the authors should qualify their statements more (or provide quantitative evidence for their conclusions), along with considering all likely mechanisms for the observed retreat.

Major comments:

1. The authors propose that anomalously warm near-surface shelf waters during 2016–early 2017 reached the inner fjord, weakening the ice mélange. However, this result is only valid if the near-surface temperature variability on the shelf is directly transported to the inner fjord without significant damping. Do you have further evidence that these near-surface waters retained their anomalous heat content during their transit from the shelf to the inner KG fjord?

2. The authors should discuss how much up-fjord heat transport in the near-surface layer would be needed to substantially melt or inhibit the ice mélange. How does this heat transport compare to previous ocean modeling work (e.g., Cowton et al., 2016) and observations/theory (Sutherland et al., 2014; Jackson et al., 2016)?

3. Was there a coincident anomalous signal in subsurface ocean temperature, air temperature, or ice sheet runoff? These processes should also be considered/discussed as possible mechanisms for destabilizing the ice mélange/terminus.

Minor comments:

Page 1, L1: dash is not needed in "south-east" here or throughout the manuscript.

Page 1, L3: the statement "Here we show that the current retreat was driven" is too strong for the level of analysis presented in this manuscript. Please rephrase.

Page 1, L11: dash not needed in "run-off".

Page 1, L17: remove "specific".

Page 1, L23: change “glacier geometry, fjord and shape,” to “glacier and fjord geometry”.

Page 2, L5: add reference for Sutherland et al. (2014) (JGR: Oceans).

Page 2, L12: change “is currently” to “has currently”.

Page 6, L6: It would be clearer to use “fjord mouth” instead of “down-fjord end”.

Page 6, L9: change “thus reflects” to “could reflect”.

Page 6, L20: change “in to” to “into”.

Page 6, L23: change “meaning that it is well situated to interfere with” to “which could possibly inhibit”.

Page 6, L27: change colon to semicolon.

Page 6, L31–32: this statement is too strong, please change the language to reflect your descriptive analysis.

Figure 1: dash is not needed in “re-analysis”.

Figure 2, lower panel: do you have estimates of the spatial variability (i.e., show the standard deviation) in mean near-surface ocean temperatures from the reanalysis product?

Figure 5: it would be helpful to thicken the lines on the 2017 OMG CTD profiles

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