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Comment on tc-2021-33

Surui Xie (Referee)

Referee comment on "Automated detection and analysis of surface calving waves with a terrestrial radar interferometer at the front of Eqip Sermia, Greenland" by Adrien Wehrlé et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-33-RC1, 2021

Review for “Automated detection and analysis of surface calving waves with a terrestrial radar interferometer at the front of Eqip Sermia, Greenland” by WehrleÌ□ et al.

Summary: This manuscript presents a method of using terrestrial radar interferometer measurements for calving wave detection at the front of Eqip Sermia, Greenland. Fourier transform magnitudes of the differentiated radar intensity images were used as measures of the calving wave powers. Occurrence times, relative magnitudes, and along calving front locations were estimated. Over a study period of about 7 days, the detected calving waves show different characteristics between the shallow- and deep-water sectors of the glacier front. The higher wave activity in the deep-water sector was explained by a combination of more frequent meltwater plumes and better connections to warm deep ocean water.

The topic and scope of this study suit well for The Cryosphere. It is an excellent example of what detailed analysis of TRI data can contribute to understanding of iceberg calving at marine-terminating glacier termini. My questions mainly focus on clarification and interpretation of the results.

1) According to the authors, the deep-water sector of Eqip Sermia calves more frequent, has a larger average calving size, and has better thermal exchange with the ocean. To my understanding, all these could make the deep sector lose ice faster than the shallow sector. However, the glacier does not show a significant contrast in terminal positions between the shallow and deep sectors (from Figures 2a and 5a and Walter et al., 2020). Why is that?

2) Section 5.1 listed some differences between the TeRACWA and the SECEM methods. "Despite these method differences, we find similar calving characteristics with TeRACWA as were reported with SECEM (Walter et al., 2020). A higher number of calving events was detected in the deep sector than in the shallow sector." (lines 258-259). And in several other places the authors were trying to echo Walter et al. (2020). However, I think results from the two studies are quite different: more frequent calving events at the shallow sector were reported by Walter et al. (2020), whereas this manuscript shows the opposite.

3) Was the source really located? The range of calving waves along the radar azimuth may be determined. Need to clarify the source location.

4) Rotation or break up of icebergs in the fjord may cause similar waves.

5) Some calving events can last several minutes to tens of minutes, they may be counted as multiple calving events by the method.

Detailed comments:

Title: Since the manuscript discussed both surface and submarine calving activities, would it be more appropriate to delete “surface” or change to “surface waves generated by calving” or “calving waves on the surface”?

Line 32: 50m -- > 50 m, and elsewhere, eg., in line 60: 17.4mm -- > 17.4 mm, line 179, 4am – > 4 am….

Line 80: Figure 4 was quoted before Figure 3 in the text. If the journal requires figures to appear in the same order as they are quoted in the text, then the figures need to be rearranged.

Line 112, Setp 5: What are the typical “WPIs” or peak prominences with false detection when no calving waves exist in the fjord?

Line 126: Or only one calving wave can be detected if there are multiple calving events occurred at about the same time.

Line 137: What are the reasons that simpler measures are less suitable? On intuition one

may think that the maximum wave height should also be a good measure. And I don't see significant difference in the relationships shown in Figure 8.

Line 169: … both the average WPI …, add "average".

Lines 217-218: If submarine calving events can be detected by the TeRACWA based on intensity images, TRI phase interferometry should be able to detect some of them (in favorable conditions) since they cause elevation and velocity perturbations in the fjord. The challenges are that TRI interferometry may suffer from temporal decorrelation for velocity estimates and may not be precise enough to detect elevation changes caused by some submarine calving events.

Line 219: I think it is subjective to say that time-lapse photography cannot be easily automated.

Line 263: Or due to noise.

Line 311: Fig. 2 instead of Fig. 4?

Line 388: Some people may disagree.

Figure 3d: Add a line to show the high-cutoff wavelength?

Figure A1: Add one more panel to show the de-tided water surface heights? Readers may be curious to see their correlation with the cumulated WPI.

--Surui Xie

Ref:

Walter, A., Lüthi, M. P., and Vieli, A.: Calving event size measurements and statistics of Eqip Sermia, Greenland, from terrestrial radar interferometry, The Cryosphere, 14, 1051–1066