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Interactive comment on "A Two-Station Seismic Method to Localize Glacier Calving" *by* M. J. Mei et al.

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Mei et al. analyze passive source seismic data mainly from Helheim glacier to localize calving events. For the localization they pick the first arrival of the seismic signal of the calving event. Combined with a predetermined velocity hyperbolas are calculated to determine the source location. This method is used for calving events at Helheim between Sep 2014 and Jul 2015, localizing 11 events in total. Finally, the authors use these events to determine the size of the calving event and speculate that the clustering of the calving events on the northern half of Helheim might be due to larger ice thickness and differences in surface roughness. The paper uses a seismic method not applied for the localization of calving events before. It is great to see a different method applied to the subject of localizing calving events from nearby seismometers. The paper is in most parts easy to understand. The method should be explained in a

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bit more detail in certain parts and I do have some questions regarding the validity on how the method is applied here.

General comments:

It is not a hundred present clear to me, what the main focus of the paper is. Is it to introduce the hyperbolic method for the localization of calving events and Helheim glacier is just an example of the application of this method, or is it the localization and interpretation of the calving events for which the hyperbolic method is introduced? I think that should be clarified and the text adjusted accordingly.

You use a lot of fill words and subjective descriptions, that make sentences unnecessarily long (also, some, severely, powerful). Readability and understandability would increase significantly if the sentences were shorter and the sentence structure less complex. Often it would be easy to split one sentence into two sentences.

Chapter 3 Hyperbolic Method: I do have some question regarding the method: - Why does the cross correlation not work? Are the waveforms so different due to the difference in interference of the different wave types at the different stations? Could you please clarify this? Did you try different bandpass filters and window length for the cross correlation.

-How big is the error when you pick the first arrival (estimate), what does this mean for the precision of your localization?

- If you do not determine the wave type how can you be sure that the first break you are picking is coherent. Most likely and in most cases you will pick the surface wave. Which would be totally valid, and you later state that it is the surface wave you are analyzing. So why not determine the phase you are using for the analysis and use surface waves. My fear with this technique is that you might have a seismometer close to the source and it is not possible to see the P-wave first arrival, so you would pick the surface wave. For a seismometer that is further away the P-wave and surface wave

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might be separated better, hence the wave you pick would be the P-wave. But if you pick different wave phases at different stations how do you want to use one velocity to find the correct location of your source. Imagine you pick the P-wave at seismometer 1 and the surface wave at seismometer 3. For the analysis you then use the velocity of 1.17 km/s, your localization would be totally wrong. This is a crucial point and the way I understand your analysis I can't see that the analysis is correct as you apply it. Please clarify this!

- How was the location of the calving events observed by persons determined. Where this events filmed? Small errors in the location of the observed calving events will lead to big errors in the derived velocity. How do you derive such a small error as 0.1 km/s? Please clarify how this velocity is determined in more detail.

- How can you use the data from Jacobshavn to determine the velocity. It's a completely different setting then Helheim. At Helheim your seismometers are located inland of the glacier front, i.e., waves will travel a large part through glacier ice. At Jacobshavn the seismometer are locates, mostly (except of seismometer 3), downstream of the glacier front, i.e. waves mainly travel through water and ice mélange. You must derive totally different velocities for these two locations.

- Did you try a grid search. As you do have multiple seismometers you could use the derived lag of all combination and find the global maximum testing different directions and velocities.

Discusssion: Large parts of the Discussion are not a discussion but an interpretation of the results or even speculation of what their causes are. This needs to be clearly differentiated, discussion and interpretation.

Determination of magnitude: For the method of Brune, you say, you have to use the corner frequency of the S-wave. But you don't use the S-wave, so why should that method be valid here at all. Further, I have trouble seeing the corner frequency between 1-5 Hz in your plots in Fig. 12. And why do you choose this small time interval

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you are using for the calculation of this spectrum?

Figures: Must appear in the order in which they appear in the Text. Fig 6 – page 6 line 6, Fig 5 – page 6 line 20. Always refer to the Figure by number, not see the above Figure. It is not necessary to write (see Figure ...) instead (Figure ...) is sufficient. It is totally clear that I'm supposed to have a look at the Figure.

Considering merging Fig 1 and Fig 2. One subplot of these two Figures will be enough to show the difference.

Google earth figures: I think it would be more appropriate to use maps or satellite images like Landsat here (http://earthexplorer.usgs.gov/). Further these images need, some reference frame, coordinates, a north arrow, a map where we are in Greenland.

Figure 1: Why don't you use the transfer function of the seismometers to show the data as displacement? That will be much easier to understand for someone not that familiar with passive seismic data.

Figure 11: I don't think that Figure is necessary. It can be well seen on Figure 8.

Specific comments:

For line specific comments see the attached PDF.

Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/tc-2016-85/tc-2016-85-RC3-supplement.pdf

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