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The Cryosphere Discussions

Interactive comment on "Seasonal variations of glacier dynamics at Kronebreen, Svalbard revealed by calving related seismicity" *by* A. Köhler et al.

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Review of Seasonal variations of glacier dynamics at Kronebreen, Svalbard revealed by calving related seismicity by Köhler, Chapuis, Nuth, Kohler, and Weidle

This study analyzes seismic data collected by a geophone located near the terminus of Kronebreen. The authors develop an autonomous detection and classification scheme (that uses self-organizing maps) in order to quantify calving-related seismicity. It is primarily a methods paper – and I think that the methods developed here will be highly useful for future attempts to quantify calving mass losses using seismic data. I look forward to trying them on my own data.

I have only a few main concerns (which can probably be addressed quite easily):

(1) This paper shares some similarities to West et al. (2010), which also attempts to classify glacier (micro)seismicity. I would like to see the similarities and differences between these methods stated more explicitly, perhaps at the beginning of Section 3.

(2) I would also like to see a more careful comparison to work done by other researchers (especially O'Neel). For example, how does the frequency content of the signals that you've detected compare to previous studies of calving-related seismicity? Are there types of calving-generated seismic signals that haven't been observed previously? Maybe this should be done in Section 5.2.

(3) I'm a little bit skeptical about the glaciological interpretation of the seismic record, given that the authors were only able to detect 10% of the calving events that occurred in a small section of the glacier. At any rate, this is not the main thrust of the paper, nor should it be. For that reason, I suggest changing the title to something like "Autonomous classification of calving-related seismicity". That would be a more honest depiction of what is in the paper.

(4) This is not the first paper to notice an increase in calving activity in late summer/early fall. Although interesting, I don't find that result surprising. Two papers that come to mind are O'Neel et al. (2010) and Motyka et al. (2003), but I'm pretty sure that there are others. Maybe you are seeing changes in calving rates due to changes in ocean temperature (it takes a while for fjords to warm up in summer).

Some more specific comments:

(1) How confident are you that the detection algorithm (STA/LTA) is picking up all of the important events – especially those with emergent onsets? Did you do a visual test?

(2) How are you computing the seismic envelope?

(3) Section 3.2: A brief description of the signals with high standard deviation or skewness could help. For example, I assume that a cigar-shaped envelope will have a low

standard deviation.

(4) Section 5.1: “The recognition rate increases with size of the observed calving event up to 16%.” This sentence is vague.

(5) Section 5.2/5.3: Any idea what the different seismic classes might represent? In Amundson et al. (2010), we claimed that signals similar to your Class I were due to objects falling/avalanching, whereas signals similar to your Class II were due to ice fracturing (sounded like shotgun blasts in audio recordings).

(6) Section 5.3: Can any of the seasonality be attributed to variations in seismic “noise” (which changes your number of detections)?

(7) Figure 1: I assume that the black line indicates the terminus position at some point in time. When? And when were the images taken? I also suggest indicating Zones 2-6.

(8) Figure 2: Please fix the tick labels on the x-axes. Especially in the upper right panel.

(9) Figure 5: Why do you think there were so many more detections in 2009 than 2010?

Interactive comment on The Cryosphere Discuss., 5, 3291, 2011.