



EGUsphere, author comment AC2
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Reply on RC2

Stefania Danesi et al.

Author comment on "Cryo-seismicity triggered by ice mass discharge through the Antarctic subglacial hydrographic network" by Stefania Danesi et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-29-AC2>, 2022

Dear Ugo

we are really grateful for your positive comments.

In the following we show how we have changed the manuscript in accord with your requests:

- I find this study very informative, but I have a difficult time to see (especially in the Introduction) the research question or the red thread of this study other than reanalysing this dataset. I would suggest to make the scope of the study a bit more clear in the introduction, as well as its outcomes in the conclusion. I think the purpose of this work could be made more clear.

We have integrated the Introduction as follows:

Miles et al., (2022) pointed out that the variability of the David ice discharge between 2005 and 2018 was associated to changes in ice shelf buttressing and the modulating effect of local glacier geometry.

[...]

Assuming that the seismicity does not have a tectonic origin, but is rather activated by the dynamics of the glacier, we aim to provide a quantitative estimate of any causal processes of environmental origin that may have triggered the seismic events.

In the Discussion we have changed the following lines:

On the other hand, significant fluctuations in the David Glacier flow velocity, characterized by sudden transient increases in the ice speed (about 5-10%) with no regularity over time, were observed by Moon et al. (2021) and Miles et al. (2022). Moon et al. (2021) pointed out that the observed glacier velocities are inclined to increase during the Antarctic summer for at least three years during the 2016-2020 period probably due to the extension of the summer melt in ice surface and thus the increase of basal sliding. Besides, Miles et al. (2022) stated that the ice discharge change could be driven by both external forcing (e.g. katabatic wind), and also by internal ice sheet processes.

We conclude with:

Our result shows that continuous measurements of the seismic activity at ice/bedrock interface could be a helpful tool for the monitoring of ice sheet dynamics.

The new item (Miles et al. 2022) was added to the References

- Have you calculated the events magnitude, it would be interesting to see the values and compare it with other, for instance in the Whillans Ice Plain

In Section 2.3.2 an estimate of earthquake magnitude was provided with no details about the method. Earthquake magnitudes were estimated in continuity with Danesi et al. 2007. We have added this piece of information in Section 2.3.2

($M \leq 1.8$, calculated as in Danesi et al. 2007)

and, later:

It is noteworthy that the magnitude estimate comes from a few numbers of observations, therefore it is affected by significant uncertainty.

- How can you discriminate that the events you observe are basal events? It would be nice to have a bit more details on what can of seismicity you are observing.

Yes, you are right. We have added these considerations in Section 2.3 .

The seismic network has recorded thousands of events, most of which can be classified as icequakes, i.e. episodes of fracturing of the ice layer. A few hundred events can be classified as basal events occurring at the interface ice-bedrock, principally on the basis of some signal characteristics: the frequency content, the duration, the hypocenter depth, and smaller attenuation with distance. In particular, (i) the seismic spectrum of icequakes has maximum amplitudes at frequencies higher than 5-10 Hz, while the earthquake spectrum is shifted towards lower frequencies; (ii) the icequake signal can only be recorded in one or two nearby stations because it decays very quickly while basal events can be detected even at stations tens of km away; (iii) icequakes have a signal duration of a few seconds, while generally basal events have longer waveform durations. This work is focused on the analysis of basal events, therefore we neglect all signals classified as icequakes.

Here are some minor comments:

- L 68: what do you mean by extreme scenarios?

We have changed into: It is worth noting that seismological analyses in harsh climate scenarios such as Antarctica cannot overlook the particular environmental conditions.

▪ *L132: do you mean earthquakes or icequakes?*

In Section 2.3 we have added:

This work is focused on the analysis of basal events, therefore we neglect all signals classified as icequakes.

- L147: is it manual or automatic location?

We manually re-located with NLL the events under study. We have added this piece of

information.

- L227-229: could you describe a bit more how the reader should read figure 8, the wavelet analysis is not that common

We have added some indications about the interpretation of the cross-wavelet power spectrum:

Interestingly, the resulting cross-wavelet power spectrum (Figure 8) implies that the inter-event time during the 5-weeks clustered seismicity is not correlated with the tide period, because the values are close to zero and the cross-wavelet power spectrum can be interpreted as the local covariance between two time-series.

- Fig 9 is a bit difficult to read, maybe splitting it would help.

OK - done