

Long-term monitoring of icequakes on the grounding zone of Langhovde Glacier, East Antarctica

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The dynamics of glaciers at the grounding zone control the mass change of the Antarctic ice sheet and have to be better understood¹). Glacier emits discrete seismic signals when it fractures and slides over the bedrock²). Therefore, passive icequake monitoring can provide an opportunity to study glacier dynamics. Since 2021, we have started comprehensive geophysical monitoring of the dynamics at the grounding zone of Langhovde Glacier, East Antarctica. Two borehole seismometers were installed into the glacier at 4 m and 200 m depths, where the thickness of the glacier was 551 m. We used a Lennartz LE-3/BH(s) MkIII seismometer with DATA-CUBE³ Type 2 recorder sampling at 50 Hz. The system was powered by a 12 V 110 Ah battery and a 24 W solar panel. The direction, pitch and roll of the seismometer were also measured by a magnetometer and tilt sensor (HMR3300) every three to four times per day. Figure 1 shows a spectrogram and tremors of the observed signals of the deepest borehole seismometer between 25 December 2021 and 20 January 2023. The number of icequakes shows diurnal, weekly, and seasonal variations. For example, we observed about ten times greater seismic tremor during Austral summer than winter in the frequencies between 1 and 10 Hz (Fig. 1b). The seismic tremor in the frequencies between 0.1 and 1 Hz increased between January and June in 2022 (Fig. 1c). We are going to further investigate the diurnal to seasonal variations in the icequakes of Langhovde Glacier to understand its dynamics, by also using GNSS and other seismometers deployed on the glacier surface during our concentrated fieldwork in the austral summer of 2021/2022.

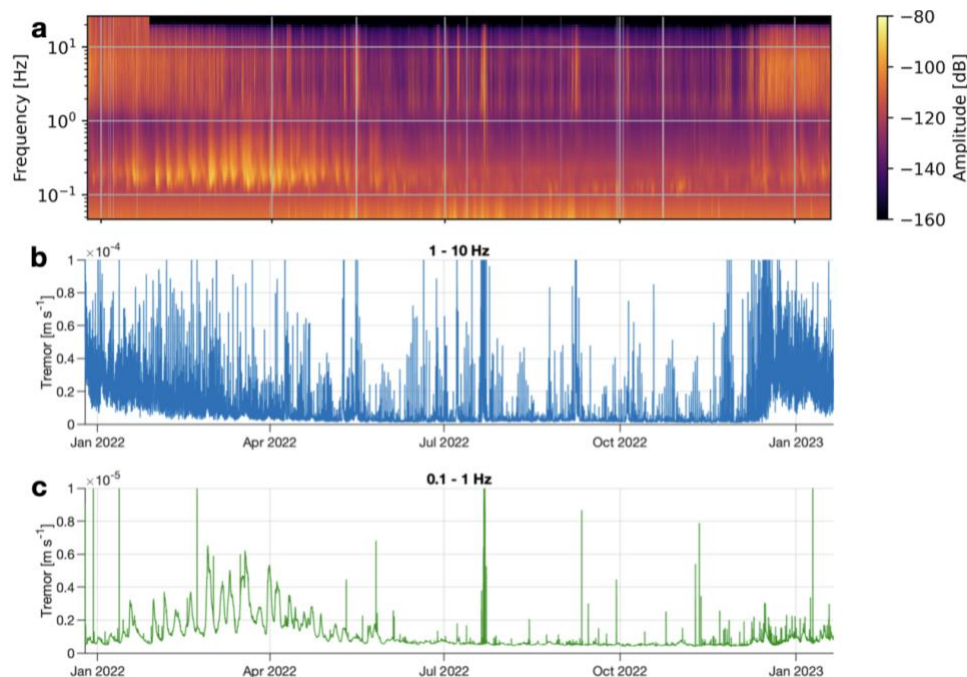


Figure 1. (a) Spectrogram for 13 months of seismic activity near the grounding zone of Langhovde Glacier at 200 m depth. Seismic tremor for the frequency band between (b) 1 and 10 Hz and between (c) 0.1 and 1 Hz.

References

- [1] Shepherd et al. (2018): doi: 10.1038/s41586-018-0171-6
- [2] Podolskiy, E., and Walter F. (2016): doi: 10.1002/2016RG000526