EGU24-6218, updated on 19 Jan 2025
https://doi.org/10.5194/egusphere-egu24-6218
EGU General Assembly 2024

High resolution observations of tide induced icequake activity at the Astrolabe glacier grounding zone

Tifenn Le Bris[1], Guilhem Barruol[2], Florent Gimbert[2], Emmanuel Le Meur[2], and Dimitri Zigone[3]
[1]UGA, IGE , INP, CNRS, France (tifenn.le-bris@univ-grenoble-alpes.fr)
[2]UGA, IGE, INP, CNRS, France
[3]Institut Terre et Environnement de Strasbourg, UMR 7063, Université de Strasbourg

Cryoseismology, which records ice-induced seismic activity, is emerging as a powerful tool for studying the grounding zone - a critical spatio-temporal area where outlet glaciers grounded on the continent starts floating and interacting with the ocean underneath. The SEIS-ADELICE project supported by the French Polar Institute (IPEV) aims to characterise the dynamics of the Astrolabe glacier in Terre Adélie (East Antarctica), from its grounded part to its terminus in the ocean. Over the past 3 years, we deployed broad-band seismometers both at the grounding zone and on stable ice around the glacier, along with ocean bottom seismometers (OBS) close to the glacier terminus. In January 2023, the recording system was complemented by a dense array of 50 seismic nodes over the grounding zone. This allowed us to cover spatial scales from metres to several kilometres, providing a high-resolution observation of tidal forcing on the floating tongue and its repercussions on the glacier behaviour. The seismic records contain a wide range of signals, including icequakes, accepted to result from the brittle deformation of the ice. Although the seismic patterns at the different stations show clear modulation of icequakes by tidal cycles, their phasing with the tide depends on the location of the sensors, whether they are grounded or floating and on their distance from the active part of the glacier. This highlights the importance of the network typology and its proximity to the grounding line when characterising icequake occurrence patterns. Local icequakes detected at the grounding line exhibit a consistent occurrence during both rising and falling tides, with the peak activity observed during high tide. Source location analysis reveals that events are distributed across both the grounding line and the lateral shear zones of the glacier which are under strong stress from the ice-ocean interactions during tides.