

Fine structure of repeating cryogenic seismicity near a shear margin of the Fimbul Ice Shelf, East Antarctica, by cluster analysis, and implications for the study of ice sheet dynamics

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Since the beginning of 2012, when the TROLL seismic station was installed at the Troll research base, in Dronning Maud Land, Antarctica, seismic activity of cryogenic origin and of variable levels of intensity has been observed at the eastern margin of the outlet of the Jutulstraumen glacier, near the Kupol Moskovskij ice rise. The repetitive character of this activity, with events of highly similar waveforms, allowed a reasonably good mapping of their temporal distribution by the use of a waveform cross-correlation detector, despite their small size and the location of the nearest seismic stations (TROLL and SNAA) at distances of about 220 km. It also revealed that, in particular the most intense activity phases show a strong tidal modulation, both with the spring-neap and the diurnal tidal cycle.

The largest number of events, with the highest recurrence rates, was observed between August 2013 and January 2014. However, lower levels of activity were observed earlier, in 2012, and later as late as 2015. The earliest manifestations of activity, at least for the particular source region and source mechanism, seem to be the ones in 2012, as SNAA records, going back to 1997, show.

In order to gain insight into the finer structure of this distribution, a cluster analysis was performed. The results show not only a separation between groups of cryogenic seismicity well apart in time, but also variations within each of them that suggest that not all observed cryoseismic events share the same source location and/or mechanism. The resulting cluster distribution will be presented, and its implications on the information that can be used to study the dynamics of the ice sheet at this specific source region will be discussed. This insight is particularly valuable considering the lack of seismic stations installed locally.