



Glacial earthquakes in Greenland

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Glacial earthquakes in Greenland were discovered in 2003 by Ekström et al using data from the global seismograph network. The vast majority of glacial earthquakes are located beneath large glaciers. The spectral signature of the events indicate a landslide-type focal mechanism, and the occurrence of the events has a strong seasonal variability, indicating a connection between the observed seismological signals and glacier movements.

Glacial earthquakes, as opposed to normal earthquakes, generate primarily long-period surface waves. Therefore normal detection methods based on high-frequency P- and S-waves fail. Instead, a Rayleigh wave detection algorithm has been applied to the data. The algorithm searches a grid of possible epicenters by removing wave propagation effects relative to the grid point, and correlating the resulting signals with a reference signal. Correlation values above a threshold value marks a possible event. The algorithm has been tested on already known glacial earthquakes before using it on the Greenland data set to identify signals and locate smaller events.

The Greenlandic glacial earthquakes have now for the first time been studied, using data from the network of 28 temporary and permanent broadband seismographs operating for shorter or longer periods of time in Greenland, supplemented by data from 3 Canadian and 2 Icelandic stations. The use of local data will improve the location accuracy and lower the detection threshold, which appears to be 4.7 on the Richter scale using the global data only.

Current and future activities include the determination of focal mechanisms using local data, simultaneous tracking of glacier movements using GPS and seismograph measurements, and the modelling of ice flow mechanics. If a firm connection can be

established between glacier dynamics and glacial earthquakes, we have a new and simple tool for surveillance of the Greenland ice sheet.