Regional rumble: glacial earthquakes in Greenland

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Glacial earthquakes are slow slip-events located under major outlet glaciers. These pe-
culiar events were first discovered by Ekstrom et al in 2003 using teleseismic data and
a global detection algorithm based on surface waves. The waveforms are consistent
with a landslide-type focal mechanism, thus indicating that the seismological signals
are linked to glacier movements.

The vast majority of the world's glacial earthquakes occur in Greenland, where we
have good regional coverage from broad band (BB) seismographs. Since 2000 a total
of 28 BB seismographs have been deployed for shorter or longer periods in Green-
land in connection with several research projects. The seismographs were originally
deployed for tomographic and receiver function studies, but the data are equally well
suited for the study of glacial earthquakes. We use these seismological data to lo-
cate glacial earthquakes in Greenland, and we supplement with data from Canada and
Iceland where appropriate. Using these regional data we are able to obtain a better lo-
cation accuracy and a lower detection threshold than possible with global data alone.
Here we present a study of the Greenland glacial earthquakes using regional seismo-
logical data

A Rayleigh wave detection algorithm has been applied to the data, as the glacial earth-
quakes do not generate discernable P- and S-waves. 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 selected threshold mark a possible event. The algorithm has been tested on already
known glacial earthquakes before using it on the Greenland data set to identify new
signals and locate smaller events