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Glacier Earthquakes and Glacier Dynamics in Greenland

Glacial earthquakes were discovered 15 years ago, and by 2006 it was clear that earthquake numbers were increasing with time and were seasonally modulated, but the source mechanism remained unclear. A series of focused studies conducted over the last decade and including field observations, satellite remote sensing, global seismological analysis, and laboratory experiments, has led to a robust understanding of the seismic source of glacial earthquakes: momentum transfer between a (very large) calving iceberg and the solid earth combines with hydrodynamic effects to generate a seismic signal the size of a magnitude-5 tectonic earthquake, observable around the globe. We are now able to use the earthquakes to help constrain key glacier-dynamic indicators, including grounding state and calving style. Recordings of glacier motion following glacial earthquakes demonstrate the importance of ice loss as a control on glacier velocity variability, and an understanding of velocity and strain changes due to glacial-earthquake calving events allows us to assess the impact of meltwater input on the flow of large, marine-terminating glaciers.