Long-period glaciogenic ocean waves revealed by coastal broadband seismometers near Jakobshavn Isbræ, Greenland

Jason Amundson (1), John Clinton (2), Martin Luethi (3), Emile Okal (4), Doug MacAyeal (1), and Marco Olivieri (5)

(1) Department of Geophysical Sciences, University of Chicago, Chicago, IL, USA (amundson@uchicago.edu), (2) Swiss Seismological Service, ETH Zurich, Zurich, Switzerland (john.clinton@sed.ethz.ch), (3) Versuchsanstalt fur Wasserbau, Hydrologie und Glaziologie, ETH Zurich, Zurich, Switzerland (luethi@vaw.baug.ethz.ch), (4) Department of Earth and Planetary Sciences, Northwestern University, Evanston, IL, USA (emile@earth.northwestern.edu), (5) Department of Geophysical Sciences, University of Chicago, Chicago, IL, USA (drm7@midway.uchicago.edu)), (6) Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy (marco.olivieri@bo.ingv.it)

Tide gauges and coastal broadband seismometers located near Jakobshavn Isbrae, Greenland, regularly record low-frequency (0.001-0.01 Hz) ocean waves that are generated by calving icebergs. The waves can be observed at least 150 km from the glacier terminus, often persist for several hours, have distinct spectral peaks, and show little variation between events. These observations suggest that the waves may be "seiches", or basin-wide standing waves, with amplitudes determined by the forcing mechanism (iceberg calving) and the frequencies determined by fjord bathymetry. The unique characteristics of the waves can be used to confidently identify large calving events. Although the ocean waves are most easily identifiable in tide gauge data, seismometers have the added benefits of recording (1) very broadband seismic signals, including higher frequency (e.g., 2-5 Hz) seismic signals from calving events (not just their aftermath), (2) ocean waves in ice-choked fjords and bays that are impossible to instrument with tide gauges, and (3) continuous, real time signals over multiple years. Ultimately, ocean wave measurements may be used in conjunction with other datasets to study the energetics of iceberg calving.