Tsunami excitation of the Ross Ice Shelf, Antarctica

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Peter Gerstoft, Peter Bromirski, Zhao Chen, Ralph A. Stephen, Doug A. Wiens, and A. Nyblade

Topics
- Flexural waves
- Seismology
- Gravity wave
- Oceanography
- Cryosphere
- Earthquakes
- Geophysical techniques

Abstract

The responses of the Ross Ice Shelf (RIS) to the September 16, 2015 8.3 Mw Chilean earthquake tsunami (>75 s period) and infragravity (IG) waves (50-300 s period) were recorded by a 34 element broadband seismic array deployed on the RIS for one year from November 2014. Tsunami and IG-generated signals travel from the RIS front as water-ice coupled flexural waves at gravity wave speeds (~70 m/s). Displacements across the RIS are affected by gravity wave incident direction, bathymetry under and north of RIS, and water and ice shelf thickness/properties. Horizontal displacements are about 5 times larger than vertical, producing extensional motions that may facilitate expansion of existing fractures. Excitation is continuously observed throughout the year, with horizontal displacements highest during the austral winter (>20 cm). Because flexural waves exhibit weak attenuation, significant flexural wave energy reaches the grounding zone. Flexural waves provide year-round excitation of the RIS that likely promotes iceberg calving and thus ice shelf evolution. Understanding the ocean-ice shelf mechanical interactions is important to reduce the uncertainty in the global sea level rise.