Observations of Subsurface Meltwater Lake Collapse on an East Antarctic Ice Shelf

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C41A-02: Observations of Subsurface Meltwater Lake Collapse on an East Antarctic Ice Shelf

Thursday, 13 December 2018
08:15 - 08:30
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The presence of meltwater influences Antarctic ice shelf dynamics in a way that is poorly understood. In addition to surface meltwater, subsurface meltwater lakes have been discovered close to the ice shelf grounding line. Drainage and collapse of these subsurface lakes may induce hydrofracturing and poses a potential threat to ice shelf stability. Here, we present direct observations of the near-surface firn and ice shelf structure before and after the collapse of a subsurface meltwater lake near the grounding line of the Roi Baudouin Ice Shelf (RBIS). In February 2016, ground penetrating radar (GPR) data were collected of the subsurface lake, highlighting its depth and extent. Surprisingly, when the field team returned to the site in December 2017 to repeat the GPR surveying, they found that the lake had collapsed. These unique GPR and GPS observations highlight the heterogeneity of the lake structure after collapse and allow us to see structural differences before and after collapse. Continued geophysical monitoring and analysis could provide important information to estimate the volume and hydrodynamics of the interglacial lake (e.g. horizontal vs. vertical drainage). In addition to field data, we use a regional climate model and remote sensing observations to provide an analysis of the climate forcing that may have contributed to the lake collapse. We show that anomalously high surface melting in the summer season of 2016-2017 likely contributed to the collapse. Our results shed light on the impact of subsurface lake collapse on the ice shelf structure, dynamics, and surface height changes, which is essential to understand the impact of meltwater drainage on ice shelf stability.

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