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## Observed and modelled meltwater-induced flexure and fracture at a doline on north George VI Ice Shelf, Antarctica

**Alison Banwell**<sup>1</sup>, Ian Willis<sup>2</sup>, Laura Stevens<sup>3</sup>, Rebecca Dell<sup>2</sup>, and Douglas MacAyeal<sup>4</sup>

<sup>1</sup>Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado Boulder, Boulder, USA  
(alison.banwell@colorado.edu)

<sup>2</sup>Scott Polar Research Institute, University of Cambridge, Cambridge, UK

<sup>3</sup>Department of Earth Sciences, University of Oxford, Oxford, UK

<sup>4</sup>Department of the Geophysical Sciences, University of Chicago, Chicago, USA.

Hundreds of surface lakes are known to form each summer on north George VI Ice Shelf, Antarctic Peninsula. To investigate surface-meltwater induced ice-shelf flexure and fracture, we obtained Global Navigation Satellite System (GNSS) observations and ground-based timelapse photography over north George VI for three melt seasons from November 2019 to November 2022.

In particular, we used these field observations to characterize the flexure and fracture behaviour of a mature doline (i.e. drained lake basin formed in a prior melt season) on north George VI Ice Shelf. The GNSS displacement timeseries shows a downward vertical displacement of the doline centre with respect to the doline rim of ~60 cm in response to loading from the development of a central meltwater lake. Viscous flexure modelling indicates that this vertical displacement generates flexure tensile surface stresses of ~75 kPa. The GNSS data also show a tens-of-days episode of rapid-onset, exponentially decaying horizontal displacement, where the horizontal distance from the rim of the doline with respect to its centre increases by ~70 cm. We interpret this event as the initiation and/or widening of a single fracture, possibly aided by stress perturbations associated with meltwater loading in the doline basin. This observation, together with our observations of circular fractures around the doline basin in timelapse imagery, suggests the first such documentation of “ring fracture” formation on an ice shelf, equivalent to the type of fracture proposed to be part of the chain reaction lake drainage process involved in the 2002 breakup of Larsen B Ice Shelf.