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Mechanical response of Larsen C Ice Shelf following the A68 calving event: observations from field-based geophysical measurements

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Ice shelves represent an important buffer to rapid ice loss from grounded Antarctic ice, hence accurate forecasts of their long-term stability are important in predictive models of Antarctic mass balance. On 12^{th} July 2017, Larsen C Ice Shelf (LCIS) calved one of the largest icebergs ever observed, following decades of sporadic rift propagation. Named A68, the iceberg represented ~12% (5800 km^2) of LCIS's surface area. Such calving events could precondition ice shelves for instability: Larsen B Ice Shelf calved a large iceberg in January 1995, and retreated until it collapsed catastrophically seven years later.

Computer models of LCIS's evolution (e.g., BISICLES) imply that pre-existing zones of damage such as surface/basal crevasses have an important role in determining the stability of the remaining shelf. The calving of A68 should remove backstress at the new calving front and increase extensional longitudinal stress. Such a regime would place additional stress on existing flow-transverse crevasses, potentially leading to exacerbated calving rates and potential instability (further enhanced by basal melting and firn densification). Measurements of ice shelves in the aftermath of such calving events are scarce, despite their importance for predicting the long-term shelf evolution.

In December 2017, geophysical data were acquired close to LCIS's new calving front. Azimuthal seismic and ground-penetrating radar (GPR) surveys were conducted to measure any anisotropy in the mechanical properties of the ice shelf consistent with enhanced longitudinal stress. Acquisitions were made at two locations: the first an advected site originally surveyed in 2008/9 in the *SOLIS* project, and the second within 7 km of the centre of the new calving front. These field data are complemented by new *TerraSAR-X* feature tracking, designed to measure variation in surface velocities from the centre of the new calving front to the pinning-point at Bawden Ice Rise. Perturbations in surface velocity at a scale shorter than the 11-day *TerraSAR-X* repeat cycle are reconstructed using GPS stations installed on LCIS. These data sets will be compared to damage factor estimates from the BISICLES ice-flow model.