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Modelling the sensitivity of the Larsen C ice shelf and its tributaries to ice shelf thinning and calving events

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The Larsen C ice shelf (LCIS), situated on the Antarctic Peninsula, is the fourth largest ice shelf in Antarctica. After the collapse of the Larsen B ice shelf in 2002, the future stability of the LCIS and the consequences of its thinning, or collapse, has been called into question. Satellite observations show that the LCIS has been thinning over the past two decades and in July 2017 it calved one of the largest icebergs ever recorded. The reduction in ice shelf thickness and extent can lead to a reduction in buttressing at the grounding line and an acceleration of the grounded ice that flows into the shelf. Here, the LCIS and its tributaries are studied with a numerical ice flow model, Úa, which uses finite element methods to solve the shallow shelf approximation (SSA) to the full Stokes equations. Prognostic model runs are used to assess the time-dependent response of the system to both ice shelf thinning and calving event scenarios. A set of perturbation experiments are carried out to test the sensitivity of the system to different thinning rates and patterns, and to the removal of different regions of the shelf. Changes in ice velocity, ice thickness and the location of the grounding line are modelled to assess the stability of the ice shelf and its tributaries and the potential contribution to future sea level rise.