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Modelling the deformation and movement of an ice tunnel in Langjökull ice cap, Iceland

Guðfinna Aðalgeirsdóttir

University of Iceland, Institute of Earth Sciences, Reykjavík, Iceland (gua@hi.is)

In winter 2014-2015 a long tunnel was dug into the ice cap Langjökull at about 1260 m a.s.l., close to the ELA. The tunnel was opened for tourists in spring 2015 (<https://intotheclacier.is/>) and has since then become a popular tourist attraction. Before the tunnel was opened in winter 2015 and in the subsequent two years measurements of the tunnel deformation, temperature and density along the tunnel has been measured. The tunnel is both closing because of ice deformation and it deforms with the glacier flow, which causes the entrance into the ice tunnel to become gradually steeper. We use a full-Stokes ice flow model to compute the evolution of the tunnel floor and the closure of the tunnel. The deformation measurements are used to constrain the ice viscosity and the floor measurements to validate the modeled glacier flow. The model simulations are then used to predict the movement of the tunnel in the coming few years, which is useful for the planning of the tunnel entrance renovations.