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Viscoelastic modelling of the evolution of a melt channel on Filchner Ice Shelf, Antarctica

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Melt channels were found on various ice shelves around Antarctica and in the recent past interest in their role in ice shelf stability was rising. Satellite radar imagery, reflecting surface depressions, are showing that most of the channels are fading out over larger distances. These channels are locations where the ice shelf is initially not in hydrostatic equilibrium, but evolves viscoelastic into hydrostatic equilibrium over time. Here we aim at modelling the evolution of a melt channel found on the southern Filchner Ice Shelf, Antarctica, for which a reasonable data has been acquired just recently. The numerical model assumes the ice to be represented by a Maxwell material model, with a short term elastic response and a long term viscous response. We are using non-linear continuum mechanics, accounting for large strain, and discretize the set of equations using finite elements. The kinematic boundary conditions in the reference configuration are incorporating surface and basal mass balance respectively. Here, we present how the surface and base of the melt channel, as well as strain evolves over time and distance. In addition, the temporal evolution is studied as a function of elastic and viscous parameters, as well as parameterization of basal melt rate.