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Fault activation due to glacially induced stresses

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Melting glaciers worldwide have an effect on sea level, but also on the stability of pre-existing faults. The load due to continental ice sheets or glaciers depresses the surface below, leading to changes in the lithospheric stresses. The accumulation of ice mass increases the vertical stress, and the horizontal stresses increase due to the accompanying flexure of the lithosphere. During deglaciation, ice-mass loss causes a simultaneous decrease in vertical stress; however, horizontal stresses decrease only slowly due to the slow readjusting of the Earth. After the end of deglaciation, only the induced horizontal stresses remain as the process of glacial isostatic adjustment (GIA) proceeds visco-elastically.
The modelling of this process and the estimation of fault slip is enabled by a new GIA-fault model. However, this finite-element model is only available in two dimensions, and the extension to three dimensions is a necessary step further to allow the comparison of obtained fault slips to observations of glacially induced faults in Europe and North America. The model has several input parameters, which affect the activation time of faults and their resulting slip (e.g. ice history, rheology of the Earth, frictional properties, pore-fluid pressure). We will present the results of the new 3D model and show the sensitivity of faults with respect to modelling parameters. Furthermore, a comparison to observations will be presented.