Modeling elastic stress of Langhovde Glacier in East Antarctica

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We measured the ice motion and icequakes on the floating part of Langhovde Glacier in East Antarctica to better understand the dynamic behavior of ice shelves and floating tongues (Minowa *et al*., 2019). We found that tide-induced hydrostatic stress caused the elastic bending of the floating tongue and generated icequakes with a maximum number during mid-rising and high tides (~500 events hr^{-1}). In order to interpret mechanisms of the observed icequakes and associated fracturing of the glacier, we numerically modeled deformation and stress distributions in the floating tongue using 2D Finite Elements (Fig. 1). We represent the floating ice as a linear elastic beam and model its deformation using observed floating tongue geometry and vertical ice motion as boundary conditions (Fig. 1a). The effective principal stress (EPS) was calculated, which we assume as a driver of the crevasse opening (Fig. 1b). The largest EPS was observed at the base of the glacier during the rising and high tides (Fig. 1b), suggesting that the observed high number of icequakes were generated by basal crevassing.

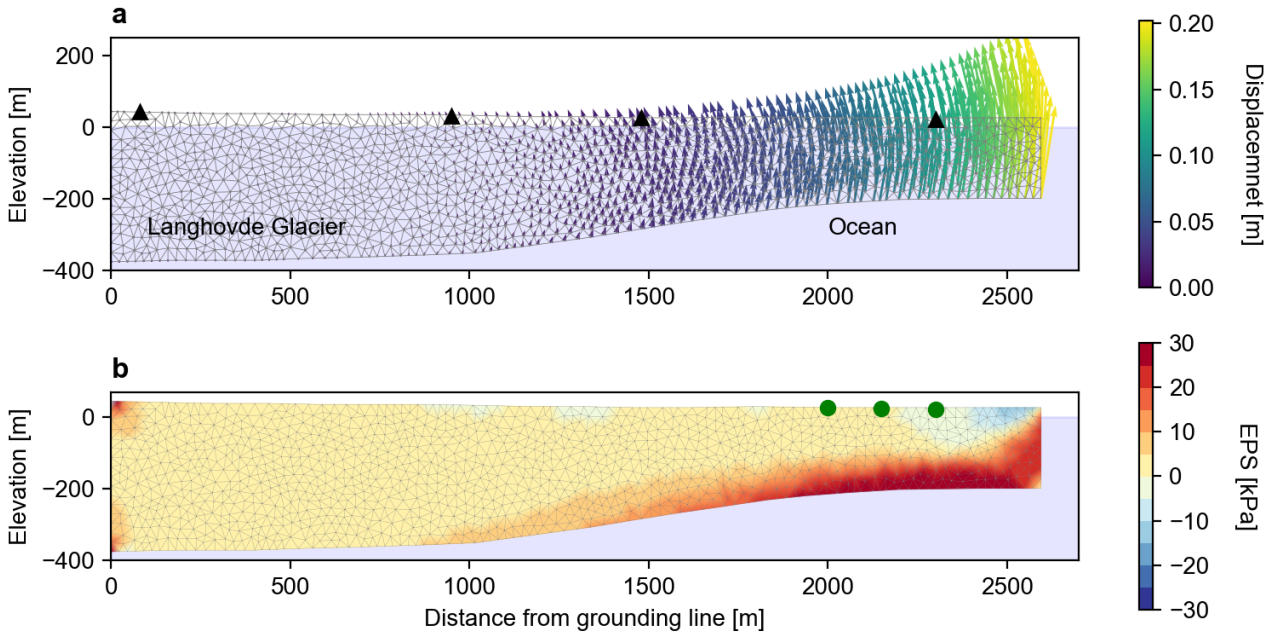

Figure 1. **(a)** Cross-sectional profile of Langhovde Glacier. Black triangulated lines indicate model mesh. A time snapshot of calculated vertical displacements is indicated by colored vectors (for Young's modulus E = 1 GPa and Poisson's ratio ν = 0.3). Four GNSS stations installed along the glacier were indicated by black triangles. **(b)** Calculated effective principal stress (EPS) distribution. Green dots indicate the locations of seismic stations. Our sign convention is "+" for tension and "–" for compression.

Reference

Minowa, M., E. A. Podolskiy, and S. Sugiyama, Tide-modulated ice motion and seismicity of a floating tongue in East Antarctica, *Annals of Glaciology*, **60**(79), 57–67, 2019