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Ice-tongue vibrations modelled by a full 3-D depth-integrated elastic model

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Ice tongue forced vibration modeling is performed using a full 3D depth-integrated finite-difference elastic model, which also takes into account sub-ice seawater flow. The ocean flow in the cavity is described by the wave equation, therefore ice tongue flexures result from hydrostatic pressure perturbations in sub-ice seawater layer. Numerical experiments have been carried out for idealized rectangular and trapezoidal ice-shelf geometries. The ice-plate vibrations are modeled for harmonic in-going pressure perturbations and for high-frequency wave spectra of ocean swell. The spectra show distinct resonance peaks, which demonstrate the ability to model a resonant-like motion in the suitable conditions of forcing. The spectra and ice tongue deformations obtained by the full 3D depth-integrated model are compared with exact solutions for an elastic thin plate with two fixed edges and two free edges (e.g., Landau and Lifshitz (1986)) – the exact solutions imply the consideration of the thin plate without the water layer. The spectra and ice tongue deformations obtained by the full 3D depth-integrated model also are compared with the spectra and the deformations modeled by the thin-plate Holdsworth and Glynn model (1978).