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A comparison of vertically integrated and three-dimensional longitudinal stress schemes.

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Perturbation analyses (Hindmarsh, 2004) have shown that longitudinal stress schemes which explicitly solve for the vertical distribution of the horizontal velocity (e.g. Blatter and others, 1995) and certain vertically integrated schemes perform far better than the shallow ice approximation, and are comparable with solutions to the full system down to wavelengths of about five times the ice thickness.

Here, these analyses are extended to finite amplitude disturbances. Solutions for the full Stokes equations, the longitudinal stress approximation and the vertically integrated longitudinal stress approximation are compared. A pseudo-spectral collocation method is used. It is cyclic in the horizontal dimensions, where it uses Fourier pseudo-spectral, and it uses Chebysheve pseudo-spectral collocation in the vertical dimension for the full system and LSA approximations.

Hindmarsh, R.C.A. (2004b) “A numerical comparison of approximations to the Stokes equations used in ice-sheet and glacier modeling”, *J. Geophys. Res.* 109F01012), doi:10.1029/2003JF000065