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Comparison of marine ice sheet models response to sea level variation

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The grounding line migration is known to play an important role on the stability of marine ice sheets such as the West Antarctica Ice Sheet. In order to properly model these dynamics, models of higher order than the zeroth-order Shallow Ice Approximation should be developped. The range of approximations that is used by the different existing models is quite important and therefore leads to a large range of solutions. The intercomparison programs (EISMINT, MISMIP) try to identify the solutions that are more likely to be the appropriated ones. However, the high computation costs of these high-order models restrict the number of experiences that can be performed. Several existing approximations of the Stokes equations and some different treatments of the grounding line position have been coded in a two-dimensional flow line model. The equations are solved using a finite difference scheme. The different approximations, as well as the influence of the grid refinement, time step size and treatment of grounding line position are compared on a simple overdeepened polynomial bed shape as in Schoof (2007). Different values of sea level variation are used and the corresponding response of the models assessed.

Reference

Schoof, C.(2007). Ice sheet grounding line dynamics: steady state, stability and hysteresis,J. Geophys. Res., 112, F03S28, doi:10.1029/2004GL021,284.