



A coupled 3D solution of the full stress velocity field in ice sheet - ice shelf models

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Ice sheet models which take the floating shelf into account usually solve two different sets of equations, one at the sheet and one at the shelf part, to obtain the 3D velocity field. Because the sheet - shelf boundary, the grounding line, varies in time, one had to handle varying boundary conditions for the different equations at the sheet-shelf transition. This is sometimes solved by a separate set of equations for the grounding line. Here, we formulate a general set of three equations, including all stresses, in terms of velocity, but in a form which facilitates solution of many flow problems, like sheet flow, shelf flow, or inclusion of longitudinal stresses. This set of three equations solves the 3D velocity components u, v, w simultaneously. It is shown that the equation can be solved by a sparse matrix solver. Modeling of large ice sheets including ground line migration can now be solved, with one set of equations, in a consistent way.