Coupling Ice Sheet Momentum and Thickness Evolution Equations

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ABSTRACT

Modeling ice sheet dynamics is of paramount importance for predicting climate evolution and in particular for accurately estimating the sea level rise in next the decades/centuries [1].

Ice behaves as a highly viscous non-Newtonian shear-thinning fluid, and it can be modeled using nonlinear Stokes equations coupled with a hyperbolic advection equation for the ice thickness evolution. Due to the shallow nature of the ice sheets, the Stokes equations and the advection equations are tightly coupled and a simple explicit coupling can lead to the use of prohibitively small time steps. As a matter of fact, using the so called Shallow Ice Approximation [2] (asymptotically valid for certain regimes), one can explicitly write the velocity as a function of the thickness, and show that the thickness equation has a parabolic nature.

In this talk we analyze the coupled problem and we propose a method to effectively solve the coupled system. Numerical results on idealized and realistic geometries are shown.

REFERENCES

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