Session: C30 Poster: W109A

Advanced ice sheet modeling: A parallel finite element implementation of higher-order models

Mauro Perego[†]; Max Gunzburger; John Burkardt; William Lipscomb; Steve Price
[†] Florida State University, USA
Leading author: mperego@fsu.edu

A key component of an ice sheet model consists of the momentum equations which determine the velocity of the ice flow. It is widely accepted that ice behaves like an incompressible non-Newtonian fluid modeled by the Stokes equations with nonlinear rheology. Several approximations of the Stokes equations have been developed exploiting the small aspect-ratio between the characteristic thickness and the characteristic horizontal extent of an ice sheet. In this work we focus on higher-order approximations such as the Blatter-Pattyn first-order model and the L1L2 model by Schoof and Hindmarsh. The models are implemented on parallel architectures, using the finite element method which is capable of naturally handling unstructured grids as well as typical physical boundary conditions. A comparison between different approximations of the Stokes model are carried out on realistic geometries. Moreover we address the problem of efficiently solving the non linear system associated with the discretized problem, with particular attention to the scalability of the solution.