Numerical ice-sheet model based on the SIA-I algorithm

O. Soucek (1,2) and Z. Martinec (1,3)

(1) Charles University in Prague, Department of Geophysics, Praha 8, Czech Republic (soucek@karel.troja.mff.cuni.cz), (2) Research Institute of Geodesy, Topography and Cartography, Zdiby, Czech Republic, (3) GeoForschungsZentrum Potsdam, Germany

We present the numerical results of performance tests of a new numerical model for ice-sheet flow. The geometry evolution of the free surface is modeled by the essentially non-oscillatory (ENO) interpolation schemes with glacier boundaries tracked by the level-set method. The ice velocities and induced viscous stresses are computed by the SIA-I algorithm, developed by the authors, that iteratively improves the shallow-ice approximation. All governing equations are discretized on a non-uniform grid enabling locally increase a model resolution in areas of interest.

We present the results of model output for the ISMIP-HOM benchmark experiment F, that is for a 3D prognostic run. This numerical experiment is additionally extended for a non-linear ice rheology. We compare the results provided by our code with FEM simulations implemented in the Elmer software and show a very good numerical performance of our code with respect to both the accuracy and computational speed. This indicates good applicability of the SIA-I algorithm in complex evolutionary numerical glaciological models.