Summary MISMIP+ ElmerIce Grenoble for SSA*

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1 Summary

1-Model: Elmer/Ice [1]

2-Englacial stresses: SSA*, Glen's law, $n = 3$, $A = 2 \times 10^{-17} Pa^{-3} a^{-1}$.

3-Basal traction: Power law , $\beta^2 = 10^4 m^{-1/3} a^{1/3}$, $\alpha^2 = 0.5$.

4-Space discretization = Finite elements. 500m resolution regular triangular-element-mesh into a box defined by $380000 < x < 520000$. Non uniform triangular-element-mesh with progressive resolution from 500m to 5000m in $x < 380000$, and non-uniform triangular-element-mesh with progressive resolution from 500m to 2000m in $x > 380000$

5-Time stepping: constant time steps of 0.1 yr.

6-Grounding line: Hydrostatic approximation with sub-element parameterization of the basal friction (SEP3 in [2])

7-MISMIP3d name: MISMIP3d was run in Full-Stokes using Elmer/Ice and related experiments were named LFA

2 Mesh resolution

The experiment Ice1r was performed with various model spatial resolutions for SSA equations in order to test the model convergence. We assume that model convergence of SSA problem is equivalent to the SSA* problem Figure 1 shows the initial and final position of the grounding line for different model resolutions (see Figure 2 for the color code). Figure 2 represents the volume above flotation (VAF) computed along the 100-year test Ice1r. As it is shown in both figures, differences between the 500m test case and the finest resolution tested (250m) are minimal. In these two tests, at the end of Ice1r, relative VAF differences are $\sim 0.05\%$ and grounding line position differs $250m$. Coarser resolutions (1km and 2km) produce faster grounding line retreat and loss of VAF. According to the very limited gain in running the experiments at 250 m of model resolution, we choose the complete MISMIP+ using 500 m at resolution as described above.

References

[1] O. Gagliardini, T. Zwinger, F. Gillet-Chaulet, G. Durand, L. Favier, B. De Fleurian, R. Greve, M. Malinen, C. Martín, P. Råback, et al. Capabilities and performance of elmer/ice, a new-generation ice sheet model. *Geoscientific Model Development*, 6(4):1299–1318, 2013.

[2] H. Seroussi, M. Morlighem, E. Larour, E. Rignot, and A. Khazendar. Hydrostatic grounding line parameterization in ice sheet models. *Cryosphere*, 8(6), 2014.

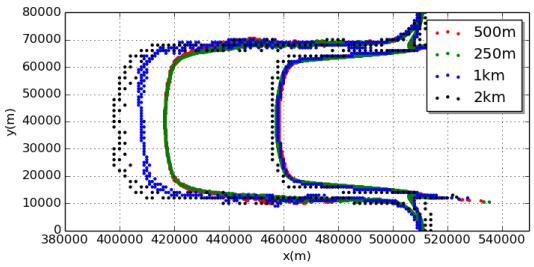

Figure 1: Grounded points at the first and at the last time step of Ice1r test for different model spatial resolution

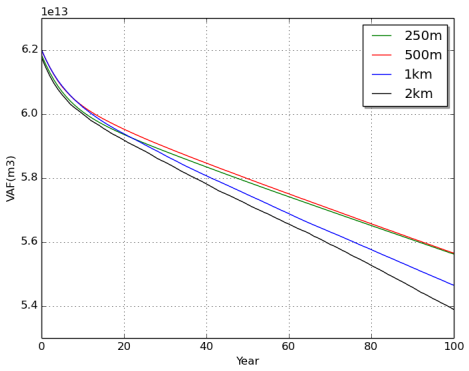

Figure 2: Volume above flotation during Ice1r test for different model spatial resolutions