

ISSM Viscous Model Description

Helene SEROUSSI

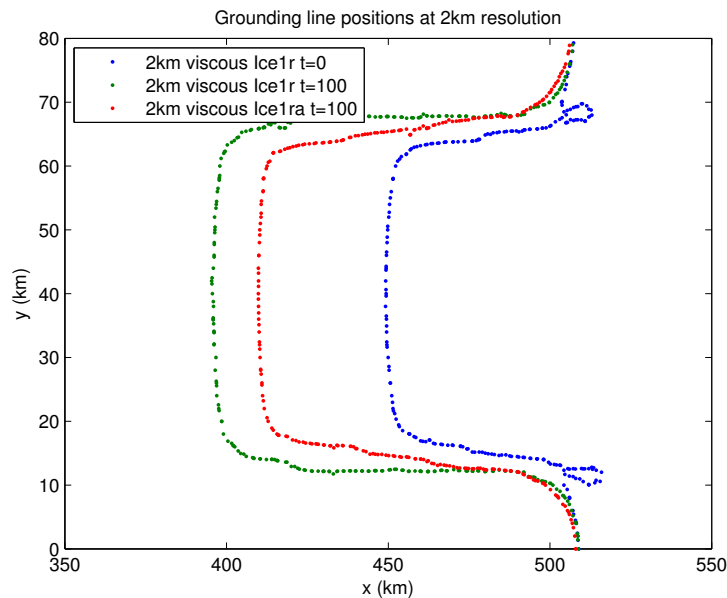
Model Description

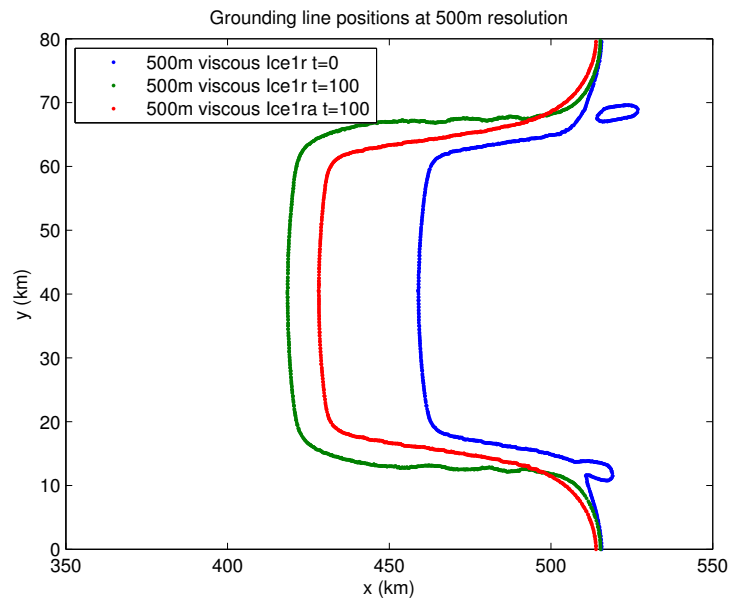
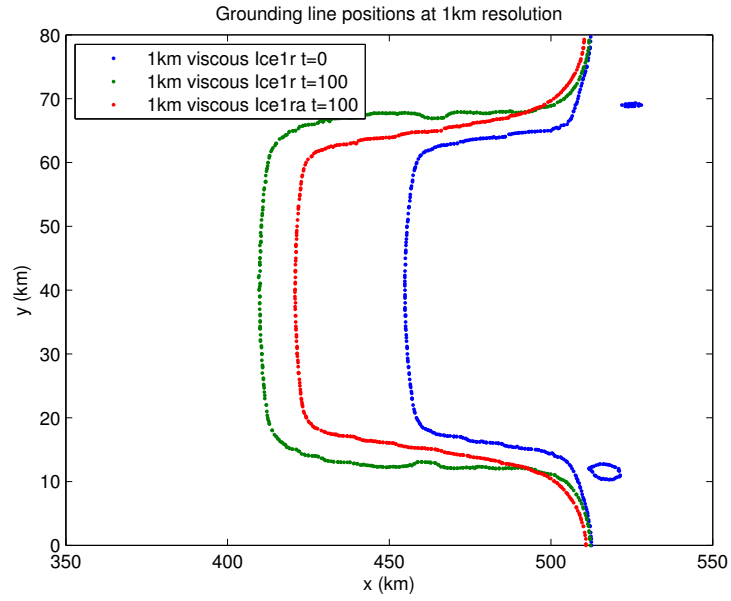
1. Model name: Ice Sheet System Model [[Larour et al., 2012](#)]
2. Stress balance approximation: 2d Shallow Shelf Approximation (SSA, [MacAyeal \[1989\]](#)),
 $A = 2.010^{-17} Pa^{-3} a^{-1}$
3. Basal friction: viscous friction law with $\beta = 1.010^4 Pa^{1/3} a^{1/3}$
4. Spatial discretisation: finite element with triangular mesh, uniform 1 km unstructured mesh
5. Time discretization: semi-implicit with $\Delta t = 0.25$ yr
6. Grounding line: position based on hydrostatic equilibrium, sub-element parameterization of grounding line position (SEP1 in [Seroussi et al. \[2014\]](#))
7. MISMIP3d: HSE improved with sub-element grounding line parameterization

Convergence study

Grounding line position

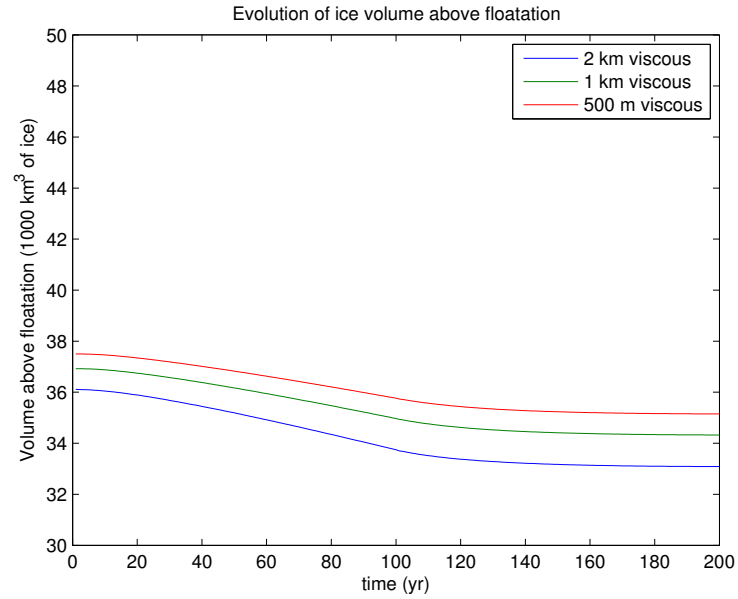
Grounding line position at the beginning of experiment Ice1r, end of experiment Ice1r and 100 into experiment Ice1ra. Results are show for uniform meshes with a spatial resolution of 2 km, 1 km and 500 m.





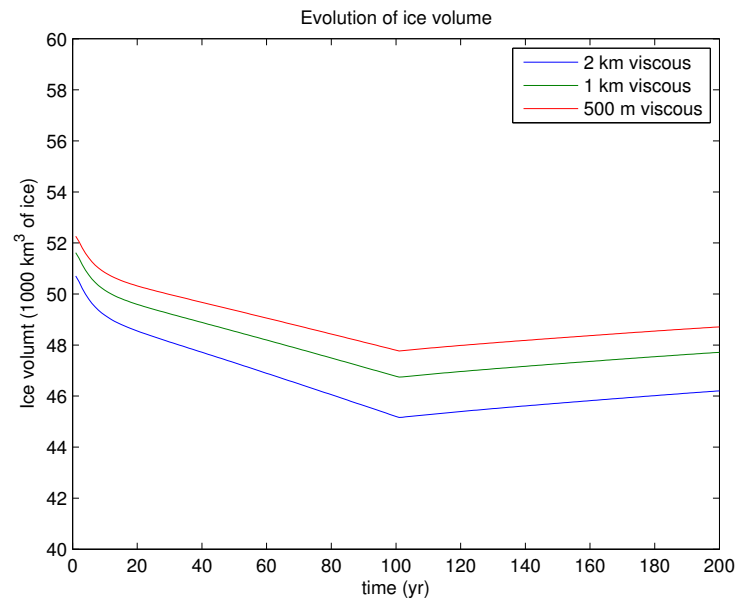
Volume above floatation

Evolution of ice volume above floatation with for experiment Ice1r (first 100 years) and experiment Ice1ra (last 100 years) for the three mesh resolution.



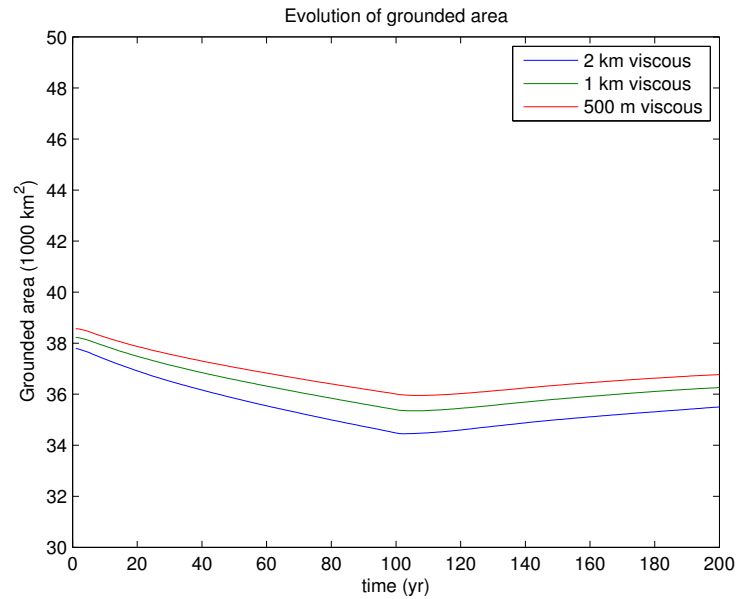
Ice volume

Evolution of ice volume with for experiment Ice1r (first 100 years) and experiment Ice1ra (last 100 years) for the three mesh resolution.



Grounded area

Evolution of grounded area with for experiment Ice1r (first 100 years) and experiment Ice1ra (last 100 years) for the three mesh resolution.



References

- Larour, E., H. Seroussi, M. Morlighem, and E. Rignot, Continental scale, high order, high spatial resolution, ice sheet modeling using the Ice Sheet System Model (ISSM), *J. Geophys. Res.*, *117*(F01022), 1–20, doi:10.1029/2011JF002140, 2012.
- MacAyeal, D., Large-scale ice flow over a viscous basal sediment: Theory and application to Ice Stream B, Antarctica, *J. Geophys. Res.*, *94*(B4), 4071–4087, 1989.
- Seroussi, H., M. Morlighem, E. Larour, E. Rignot, and A. Khazendar, Hydrostatic grounding line parameterization in ice sheet models, *Cryosphere*, *8*(6), 2075–2087, doi:10.5194/tc-8-2075-2014, 2014.