

ISSM Higher-Order Viscous Model Description

Helene SEROUSSI

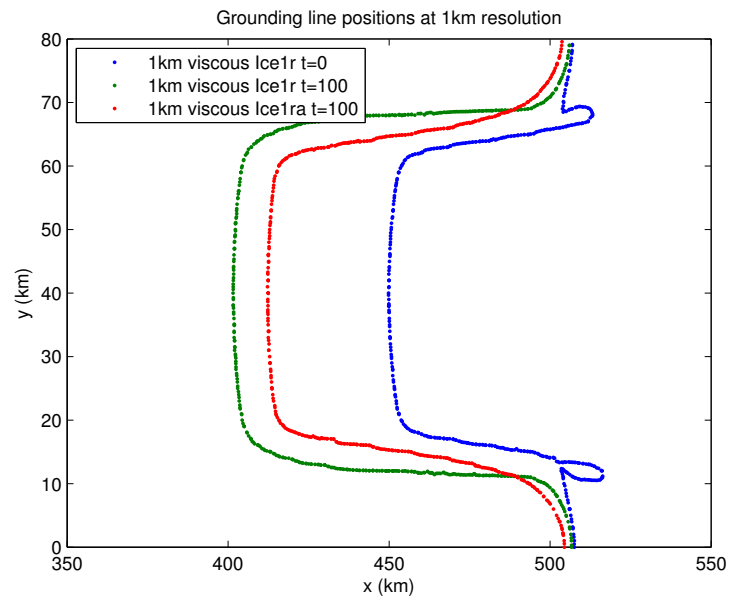
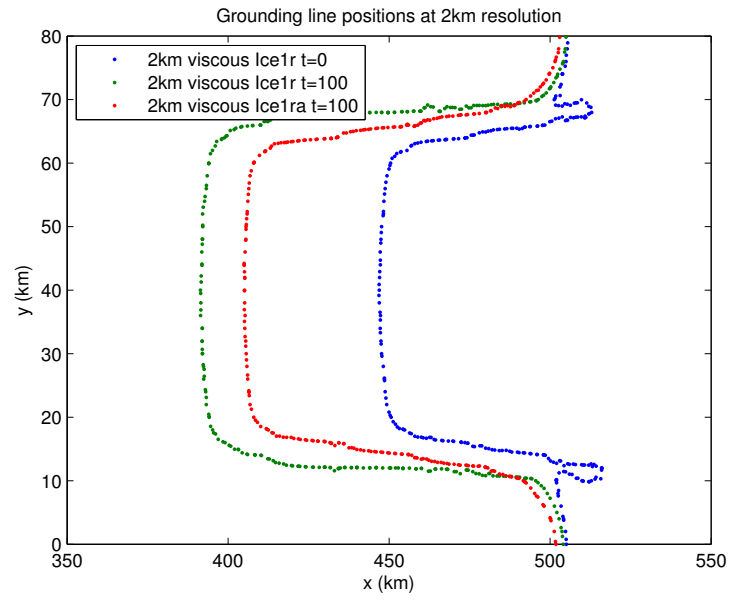
Model Description

1. Model name: Ice Sheet System Model [[Larour et al., 2012](#)]
2. Stress balance approximation: 3d Higher-Order Model (HO, [Pattyn \[2003\]](#)), $A = 2.010^{-17} Pa^{-3} a^{-1}$
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 and higher-order

Convergence study

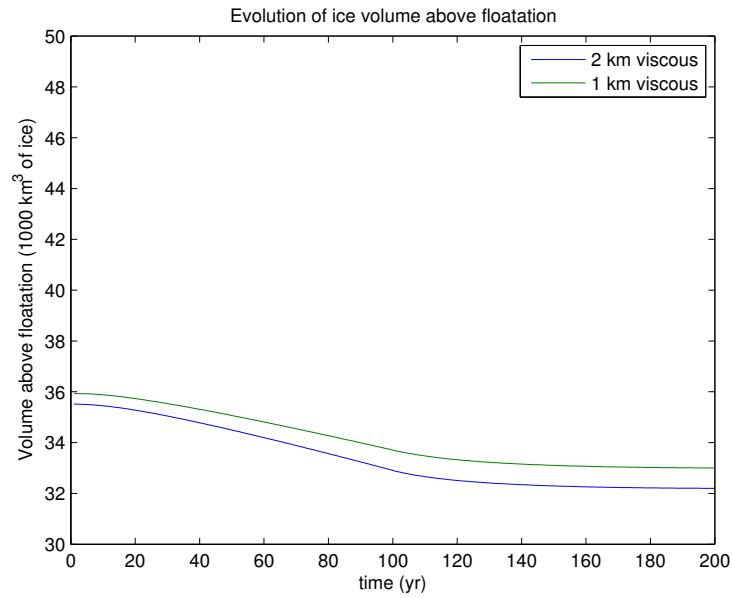
Grounding line position

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 and 1 km.



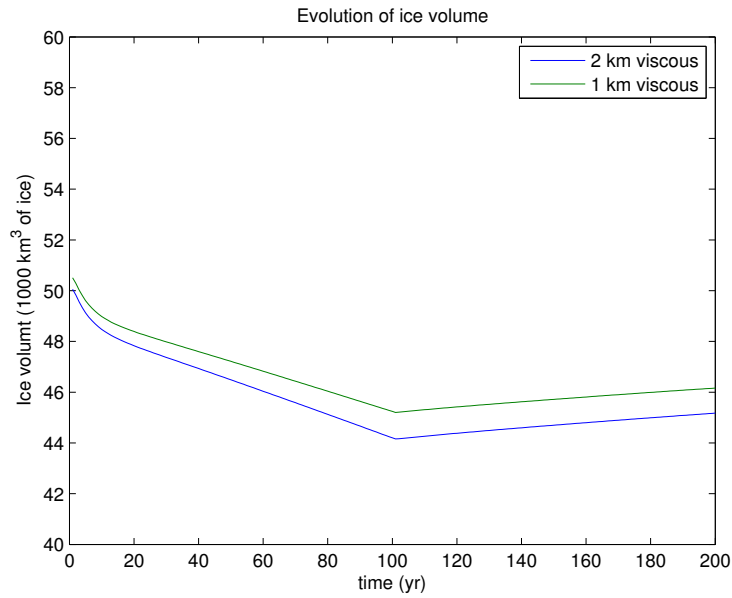
Volume above floatation

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



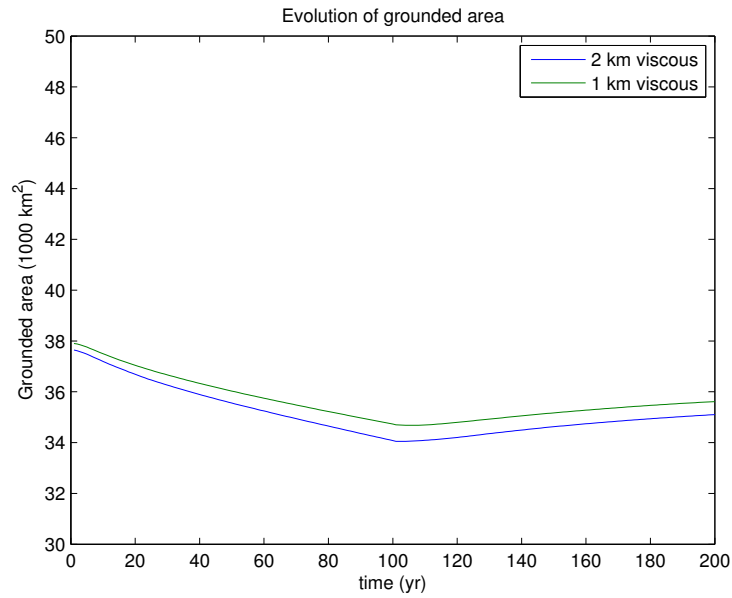
Ice volume

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.
- Pattyn, F., A new three-dimensional higher-order thermomechanical ice sheet model: Basic sensitivity, ice stream development, and ice flow across subglacial lakes, *J. Geophys. Res.*, *108*(B8), 1–15, doi:10.1029/2002JB002329, 2003.
- 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.