R: Simulating Marine Ice Sheet Dynamics in MPAS Land Ice

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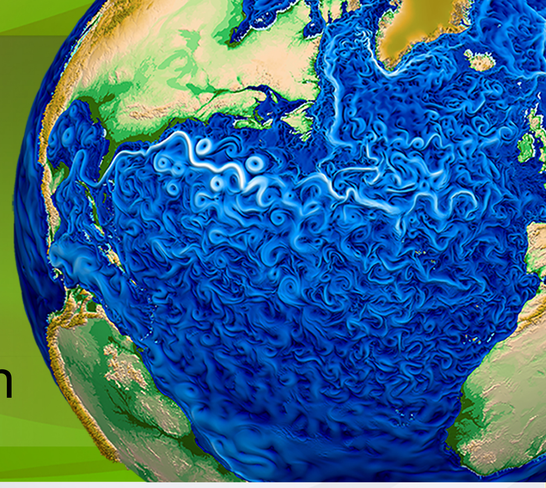


Objective

Grounding line (G.L.) dynamics

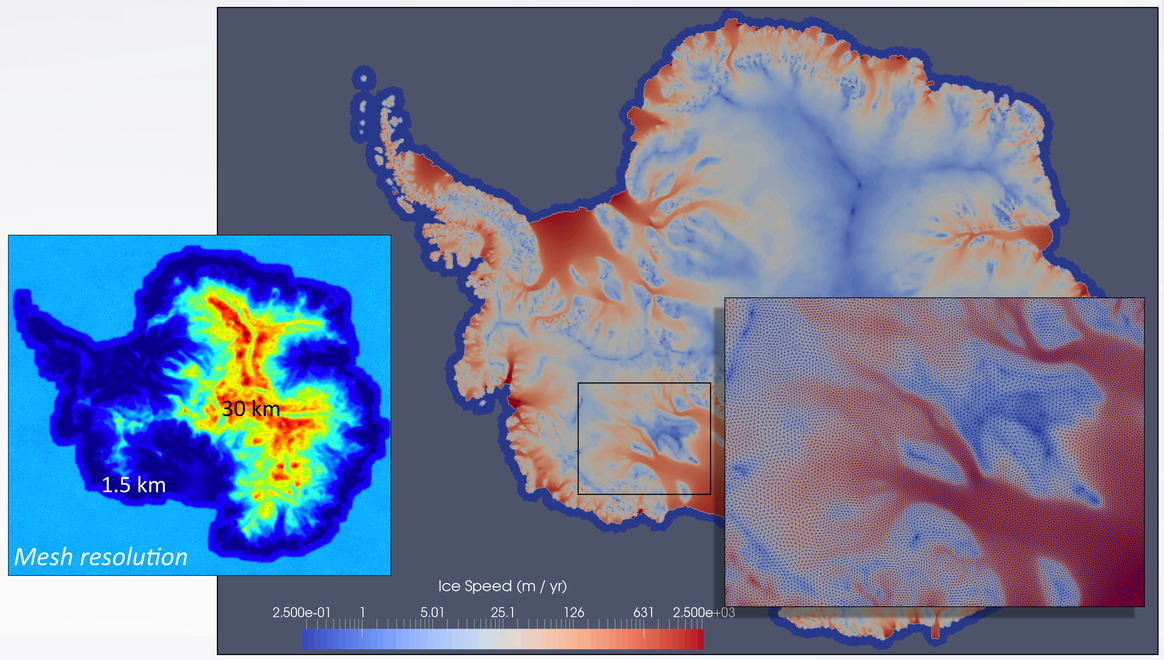
- Processes there have a first-order control on ice sheet stability and associated sea level changes.
- Challenging to model accurately in ice sheet models.

Marine Ice Sheet Model Intercomparison Project for planview models (MISMIP3D)

- Series of community benchmarks for grounding line dynamics and marine ice sheet modeling fidelity.
- Success here is required before simulating Antarctica.

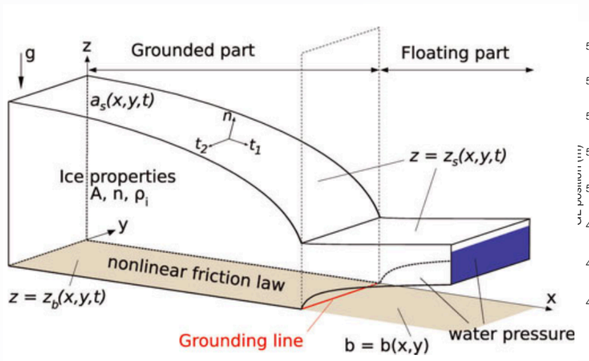
Continuing work

Generate variable resolution meshes of Antarctica with necessary high resolution at grounding lines.

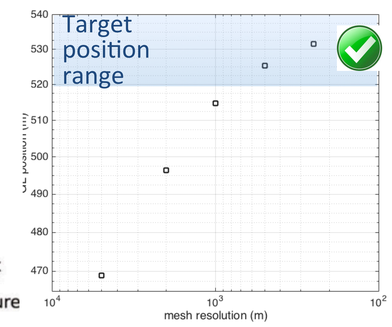


MISMIP3D Results Using MPAS Land Ice with Albany velocity solver

"Stnd" test: Starting from no ice and steady accumulation rate, grow a marine ice sheet. Study grid convergence of steady state G.L. position after 30,000 year spin up.



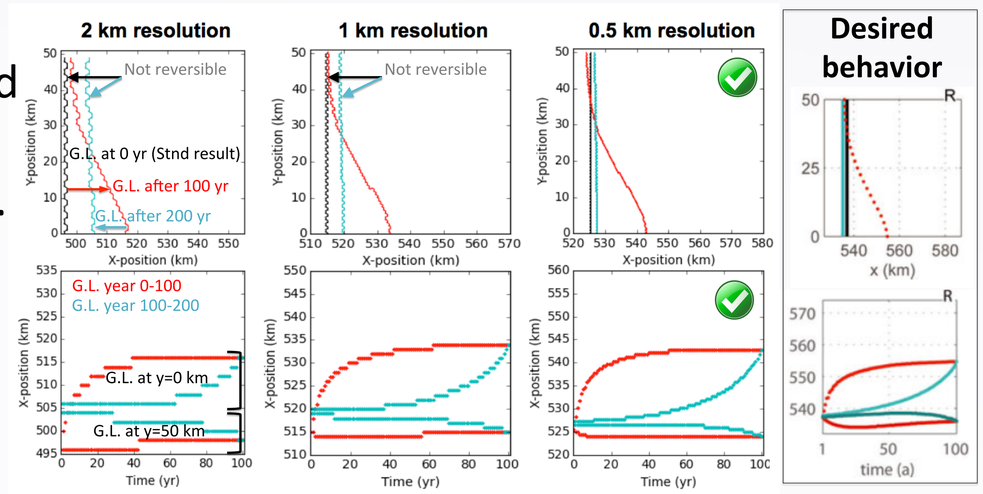
Geometry at the end of the Stnd experiment



Grid convergence. Sub-km resolution is necessary.

"P75" test:
Starting from final Stnd state, add 'slippery' patch at middle of G.L. for 100 yr, forcing G.L. advance.

Then remove slippery patch, and G.L. should return to original position after another 100 yr.



Summary: At sub-km resolution, MPAS-Land Ice passes MISMIP3D tests. Similar results at ~km resolution can be achieved with a Grounding Line Parameterization (in progress).

ACME Accelerated Climate Modeling for Energy

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