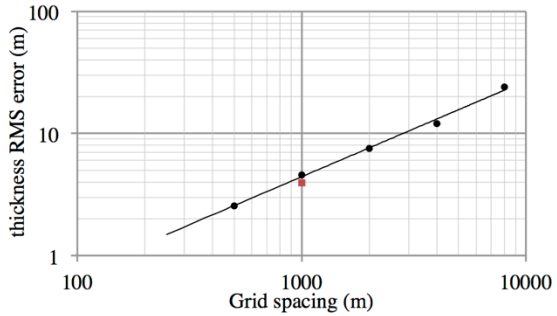
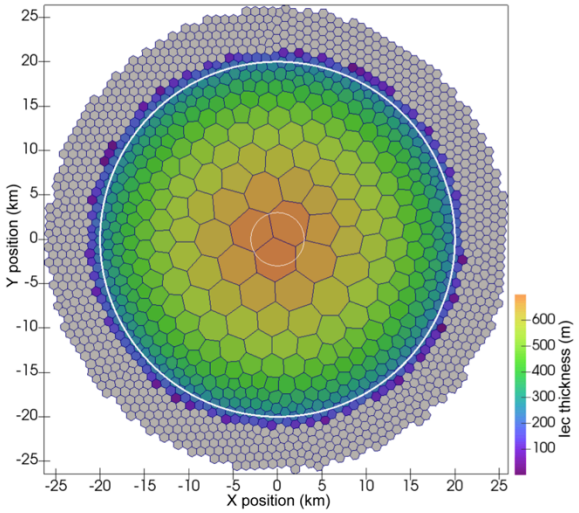
MPAS-Albany Land Ice (MALI): a variable-resolution ice sheet model for Earth System modeling using Voronoi grids





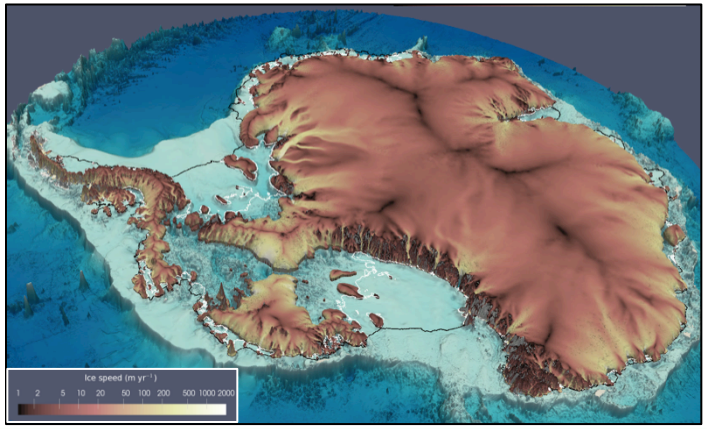
Modeled ice thickness error vs. mesh resolution for idealized, dome-shaped ice sheet (top). Red square shows error for variable-resolution mesh (bottom; color=ice thickness) focused at dynamic margins. A similar solution accuracy is given by half as many grid cells relative to a uniform resolution mesh.

Scientific Achievement

- MPAS-Albany Land Ice (MALI) v6.0 is a new, high-fidelity, variable-resolution ice sheet model
- MALI is built using the Model for Prediction Across Scales (MPAS) framework and the Albany multi-physics code base
- MALI is coupled to the U.S. Department of Energy's new Energy Exascale Earth System Model (E3SM, version 1).

Significance and Impact

- variable resolution can provide significant cost savings for similar solution accuracy (left)
- robust, scalable solvers allow for realistic, multi-century simulations of Antarctic ice sheet evolution at unprecedented fidelity and spatial resolution (below)



Simulated Antarctic ice sheet geometry and speed (color overlay) 200 years after the removal of all ice shelves. This experiment provides an estimate for the upper bound on ice sheet mass loss and sea-level rise from Antarctic ice sheet dynamics (here, 2.5 m after 200 years).

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