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Application of a wavelet-based, adaptive-grid, multigrid solver to simulate the migration of an ice sheet grounding line.

Robert Arthern
British Antarctic Survey, Physical Sciences Division, Cambridge, United Kingdom (rart@bas.ac.uk)

Analytical approximations of the stress field near the grounding line of a marine ice sheet indicate the presence of a boundary region of elevated stresses near the coast. The stress field within this narrow region must be resolved (or parameterised) if numerical simulations are to accurately simulate how the grounding line migrates over time. One promising approach to resolving the boundary region, without wasting computational resources elsewhere, is to use an adaptive grid that places more grid points near the grounding line than elsewhere on the ice sheet. This poster described the application of a wavelet-based adaptive grid technique (Vasilyev and Kevlahan, 2005). In this algorithm the location of grid-points is chosen automatically, at each time step, by applying a wavelet transform. The only grid-points retained are collocation points needed to reconstruct those wavelet basis functions that have coefficients above a prescribed threshold. Wavelet-based interpolation and sub-sampling are also used in the smoothing, prolongation, and restriction operators needed for a multigrid (V-cycle) solver. As a test case, the approach is applied to the MacAyeal/Morland equations to simulate the advance and retreat of a grounding line in two horizontal dimensions.