

On the speed and numerical stability of ice-dynamics approximations



i.e., How to have your cake and eat it too!

Alexander Robinson, William H. Lipscomb,
Daniel Goldberg and Jorge Alvarez-Solas

1. Five solvers implemented in the same model (same numerics) – all can be made to represent GrIS well.
2. 1D stability analysis (not shown) indicates DIVA is more stable than the Hybrid solver because it dissipates local driving stress via longitudinal stress.
3. GrIS simulations show two families of stability solutions. Approximations that rely on SIA are less stable/slower.
4. As resolution increases, performance gap between solvers increases. DIVA ~15x faster than Hybrid at 4km.
5. Out of all solvers, DIVA also shows highest fidelity to Full Stokes solutions in ISMIP-HOM experiments (not shown).

