Modeled and observed fast flow in the Greenland ice sheet

Ed Bueler (1), Constantine Khroulev (2), Andy Aschwanden (3), Ian Joughin (4), and Ben E. Smith (4)

(1) Dept of Mathematics and Statistics, University of Alaska Fairbanks, USA, (2) Geophysical Institute, University of Alaska Fairbanks, USA, (3) Arctic Region Supercomputing Center, Fairbanks, United States (andy.aschwanden@arsc.edu), (4) Polar Science Center, Applied Physics Lab, University of Washington, Seattle, Washington, USA

Satellite surface velocity measurements covering 86% of the Greenland Ice Sheet were used to evaluate a prognostic ice dynamics model on a 3 km grid. A small, but systematic, exploration of the parameter space considered changes in just three critical model parameters, describing ice softness, nonlinear basal rheology, and basal water pressure, respectively. Parameter combinations were evaluated by comparing the modeled and observed surface speeds. Best fit to the observed distribution of fast flow occurred with no enhancement of ice softness, nearly-plastic basal material, and high basal water pressure under fast-flowing ice. The use of a standard amount of ice flow enhancement was seen to generate a distribution of fast flow which is fundamentally different from that in the observed flow, while a specific parameterization of basal sliding generated a close-to-observed distribution.