Geophysical Research Abstracts
Vol. 12, EGU2010-5666-1, 2010
EGU General Assembly 2010

Evaluating the sensitivity of an ice sheet model to changes in bed elevation and inclusion of membrane stresses

Andy Aschwanden (1), Ed Bueler (2), and Constantine Khroulev (3)

(1) Arctic Region Supercomputing Center, Fairbanks, United States (andy.aschwanden@arsc.edu), (2) Dept. Mathematics and Statistics, University of Alaska, Fairbanks, Alaska, USA (elbueler@alaska.edu), (3) Geophysical Institute, Fairbanks, Alaska, USA (ckhroulev@alaska.edu)

To predict Greenland's contribution to global sea level rise in the next few centuries with some confidence, an accurate representation of its current state is crucial. Simulations of the present state of Greenland using the "Parallel Ice Sheet Model" (PISM) capture the essential flow features but overestimate the current volume by about 30%. Possible sources of error include (1) limited understanding of physical processes involved, (2) the choice of approximations made by the numerical model, (3) values of tunable parameters, and (4) uncertainties in boundary conditions.

The response of an ice sheet model to given forcing contains the above mentioned error sources, with unknown weights. In this work we focus on a small subset, namely errors arising from uncertainties in bed elevation and whether or not membrane stresses are included in the stress balance. CReSIS provides recently updated bedrock maps for Greenland include high-resolution data for Jacobshavn Isbræ and Petermann Glacier. We present a four-way comparison between the original BEDMAP, the new CReSIS bedrock data, a non-sliding shallow ice model, and hybrid model which includes the shallow shelf approximation as a sliding law. Large gradients possibly found in high-resolution bedrock elevation are expected to make a hybrid model the more appropriate choice. To elucidate this question, runs are performed on a unprecedented high spatial resolution of 2km for the whole ice sheet. Finally, model predictions are evaluated against observed quantities such as surface velocities, ice thickness, and temperature profiles in bore holes using different metrics.