Toward a next-generation community ice sheet model: Progress and plans

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The ice sheet modeling community is under increasing pressure to make credible predictions of 21st century sea level rise. There is general agreement on the need for next-generation models with higher-order dynamics, improved subglacial hydrology and basal physics, finer grid resolution, coupling to atmosphere and ocean GCMs, and realistic treatments of sub-shelf melting, iceberg calving, and grounding line migration. No such model exists, although many of the required elements are being developed. Time is limited if we are to make a meaningful contribution to the next IPCC assessment report, AR5, which is scheduled for release in 2013. Model development must be largely complete by 2010 and results submitted for publication by 2011 to meet IPCC deadlines. Since the ice sheet modeling community is relatively small, it is essential that we coordinate our efforts.

Responding to this need, a workshop entitled "Building a next-generation community ice sheet model" was held at Los Alamos National Laboratory in August 2008. The goal of the workshop was to create a detailed plan for developing a community ice sheet model, or CISM, suitable for sea level prediction. CISM will be the ice sheet component of the U.S. Community Climate System Model (CCSM) and will be openly available to the glaciology and climate communities for both standalone and coupled experiments. Workshop participants agreed on a software development strategy and identified physical processes that should be included in CISM in time for AR5. The dynamical core will initially consist of modules from the existing GLIMMER model, modified so that they can be called from other high-level drivers. Software infrastructure will be based on the POP and CICE models, which serve as the ocean and sea ice components of CCSM. Modules for generic functions such as coupling, I/O, and MPI communication can be adapted from POP and CICE with minimal effort. During the next year the ice flow model will be upgraded to a higher-order model with a unified treatment of stresses. Standard datasets will be developed for forcing, initialization, verification, and validation. Improved parameterizations of ice sheet hydrology, grounding line migration, and iceberg calving will be tested in process-scale models and implemented in CISM. Focus groups have been formed to coordinate the development of software, datasets, and new parameterizations and to design strategies for sea-level assessment. We welcome participation from others in the glaciology and ice sheet modeling communities.