Geophysical Research Abstracts
Vol. 14, EGU2012-13422, 2012
EGU General Assembly 2012

A method for simulating dynamic ice shelves in global ocean models

X. S. Asay-Davis
Los Alamos National Laboratory

There is an increasing consensus that ice-sheet component models are needed in Earth System Models (ESMs) in order to make accurate sea-level projections. Remarkable advances in ice-sheet model physics and numerical methods in recent years mean that a number of these models (e.g. the Community Ice Sheet Model, the Ice Sheet System Model, the Elmer Ice Sheet Model) have both sufficient physical accuracy and numerical scalability to be ready for inclusion in ESMs. Unfortunately, the ocean components of ESMs were not designed with ice sheets and ice shelves in mind. In particular, ocean models do not support the dynamic boundaries that result from advancing or retreating ice sheets.

We present our method for simulating dynamic ice-sheet/ocean interaction in a global ocean model, the Parallel Ocean Program (POP). The interface between ice and ocean can is represented either using partial cells (base on Losch 2008) or using a ghost-cell immersed boundary method (GCIBM). The partial cells representation of the ice/ocean interface is relatively easy to implement and has been used to represent ocean bathymetry for more than a decade, but has difficulty with advancing and retreating ice, particularly near grounding lines. Though less proven, the GCIBM represents the boundary implicitly with higher-order accuracy, seamlessly allowing the boundary to advance or retreat through ocean cells. In the near future, the new ice-sheet/ocean interface will be used to couple POP and the Community Ice Sheet Model (CISM) in the Community Earth System Model (CESM).