Geophysical Research Abstracts
Vol. 12, EGU2010-813, 2010
EGU General Assembly 2010

Stress transmission across grounding lines and marine ice sheet instability

David Docquier, Faezeh M. Nick, Laura Perichon, and Frank Pattyn

Laboratoire de Glaciologie, Département des Sciences de la Terre et de l'Environnement, Université Libre de Bruxelles, Brussels, Belgium (david.docquier@ulb.ac.be / +32 2 650 22 27)

The stability of marine ice sheets is largely controlled by the dynamic behaviour of the grounding line, i.e., the contact of the bottom of the ice sheet resting on the bedrock with the ocean water. Marine ice sheet instability implies that an ice sheet on a downward sloping bedrock towards the interior will never find stable equilibria, hence leading to ice sheet collapse, unless an upward slope is reached (Schoof, 2007). The latter study shows that steady state solutions using a boundary layer theory for ice flux are in very close agreement with numerical resolutions that resolve the transition zone. However, the time dependent response of grounding line migration is not predicted by this theory. Precise knowledge of this response is essential for assessing the short term impact of accelerated ice discharge on sea level rise.

Here we present the results of MISMIP-type (Marine Ice Sheet Model Intercomparison Project) experiments with different sets of numerical flowline models (fixed and moving grid) that solve the stress field in the transition zone according to different approximations to the Stokes equations. These models include shallow-ice (SIA0), shallow-shelf (L1L2) and higher-order (LMLa) approximations, and combinations of these types. All experiments are run at different spatial resolutions and for different sizes of the transition zone (high to low friction). The comparison of several stress approximants allows us to evaluate which stress components in the flow direction are important to the general behaviour of grounding line migration.