Geophysical Research Abstracts
Vol. 12, EGU2010-3951, 2010
EGU General Assembly 2010

The effect of sea-level rise on the stress regime of the Brunt and Riiser-Larsen ice shelves

Thomas Kleiner (1), Angelika Humbert (2), Manfred Lange (1,3)

(1) Institute for Geophysics, University of Muenster, Germany, (2) Institute of Geophysics, Klimacampus, University of Hamburg, Germany, (3) Energy, Environment and Water Research Center, The Cyprus Institute, Nicosia, Cyprus

Ice rises and rumples act as pinning points along the ice front of ice shelves. The smaller these grounded areas are, the more likely they are getting afloat in case of a sea level rise. The Brunt Ice Shelf is an unbounded ice shelf situated along Caird Coast (East Antarctica) that is confined by a small ice rise, the McDonald Ice Rumples. Along the ice front and in the interior of the adjacent Riiser-Larsen Ice Shelf a number of small ice rises and a mixed ice-rise/ice-rumple feature exists.

In this study we assume, that these grounded zones are highly affected by future sea-level rise. In order to investigate the response of the ice shelf to decreased and vanishing pinning in the Brunt and Riiser-Larsen ice shelves we apply various geometric settings to the full-Stokes finite difference model TIM-FD^3 and perform diagnostic simulations. TIM-FD^3 is a numerical thermo-dynamical ice flow model, developed at the University of Muenster, that solves the full-Stokes equations, the heat transfer equation and ice thickness evolution equation in three-dimensions on a 1 km grid scale. We compare the resulting stress field, principal deformation rates and axis to the present day situation.

In addition to these diagnostic simulations, we perform prognostic simulations in which a surface temperature forcing is prescribed and the corresponding sea level rise is used to reduce the grounded area. The reduction of the area depends strongly on the bedrock topography of the grounded area. As measurements of the bedrock topography do not exist, we assume different shapes of the bedrock topography based on measurements of the bedrock topography of ice rises located at other ice shelves. We investigate the effect of the shape of the bedrock topography on the size of the grounded area and subsequently the effect of the size on the computed stress regime.