Geophysical Research Abstracts
Vol. 17, EGU2015-11608, 2015
EGU General Assembly 2015

Ice-shelf channel evolution in Antarctic ice shelves

Reinhard Drews, Sophie Berger, Lionel Favier, and Frank Pattyn
Université Libre de Bruxelles, Glaciology, CP160/3, Brussels, Belgium (rdrews@ulb.ac.be)

Ice shelves buttress the continental ice flux and facilitate ice–ocean interactions. They are often intersected by longitudinally elongated channels in which basal melting is significantly enhanced. Recent studies highlighted that this type of channelized melting impacts the buttressing strength of ice shelves and hence imprints the mass flux from the Antarctic continent.

Here, the channel evolution is investigated from a glaciological perspective, using a full Stokes model and geophysical data from three consecutive field seasons on Roi Baudouin Ice Shelf (RBIS), Antarctica. The RBIS contains numerous channels, incising the ice shelf by more than half the ice thickness. The modeling confirms (1) that basal melting as a feasible mechanism for the channel creation, albeit channels may also advect without melting for many tens of kilometers. The mere existence of channels is not a sufficient criteria to infer channelized melting at that location; (2) channels can be out of hydrostatic equilibrium depending on their width and the upstream melt history. This implies that inverting surface elevation for ice thickness in those areas is erroneous. Corresponding observational evidence for the channels at RBIS is presented by comparing the hydrostatic-ice thickness from GPS measurements with the ice thickness measured by ground-penetrating radar; (3) the simulations show that channelized melting imprints the flowfield characteristically, and can cause enhanced horizontal shearing across channels. This is exemplified for a channel at RBIS where the velocity anomaly is found in different sets of satellite-derived surface velocities, as well as in ground-based GPS measurements. This opens up the possibility to classify channelized melting from space, an important step towards incorporating these effects in ice–ocean models.