Geophysical Research Abstracts
Vol. 21, EGU2019-2769-2, 2019
EGU General Assembly 2019

Detecting and monitoring ice-shelf basal mass balance in Dronning Maud Land, East Antarctica

Sophie Berger (1), Niklas Neckel (1), Veit Helm (1), Nils Dörr (1), Reinhard Drews (2), Frank Pattyn (3), and Olaf Eisen (1)

(1) Glaciology, Alfred Wegener Institute (AWI), Bremerhaven, Germany (sophie.berger@awi.de), (2) Earth System Sciences, University of Tübingen, Tübingen, Germany, (3) Laboratoire de Glaciologie, Université libre de Bruxelles, Brussels, Belgium

Ice shelves control the dynamic mass loss of ice sheets through buttressing. Their integrity also depends on their total mass balance, with the the spatial variability of their basal mass balance (BMB), i.e. the difference between basal refreezing and melting, being an important component. Here, we present an improved technique – based on satellite observations – to capture the small-scale variability in the BMB of ice shelves.

We use mass conservation in a Lagrangian framework based on high-resolution horizontal surface velocities, atmospheric-model surface mass balance and hydrostatic ice-thickness fields (derived from TanDEM-X surface elevation). Spatial derivatives are implemented using the total-variation differentiation, which preserves abrupt changes in flow velocities and their spatial gradients. Such changes may reflect a dynamic response to localized basal melting and should be included in the mass budget.

After successfully developing the technique with TanDEM-X elevations from 2013-2014 for the Roi Baudouin Ice Shelf, Dronning Maud Land, East Antarctica (Fig. 1), we upscaled our results spatially to all ice shelves in Dronning Maud Land that are located between Fimbul and Roi Baudouin ice shelves. The BMB field we produce shows a large-scale pattern in close agreement with previous and studies in coarser resolution. However, our results also indicate that we are in addition able to detect small-scale features in the BMB with unprecedented detail (at a gridding of <50 m).
Beyond the static field of BMB we also investigate temporal changes in the BMB by combining our BMB based on TanDEM-X elevations with coarser BMB based on Cryosat-2 data.