Geophysical Research Abstracts
Vol. 20, EGU2018-8360, 2018
EGU General Assembly 2018

Simulations of the Antarctic Ice Sheet using a new sub-shelf basal melt parametrization based on buoyant meltwater plumes

Werner Lazeroms (1), Adrian Jenkins (2), Hilmar Gudmundsson (2), and Roderik van de Wal (1)

(1) Institute for Marine and Atmospheric research Utrecht (IMAU), Utrecht University, Utrecht, Netherlands, (2) British Antarctic Survey, Natural Enviroment Research Council, Cambridge, United Kingdom

Oceanic basal melting contributes significantly to mass loss from the Antarctic Ice Sheet. Therefore, an adequate description of the basal melt rates is required in order to perform accurate simulations of the Antarctic Ice Sheet and the associated possible sea-level rise.

We provide a systematic derivation of a new basal melt parameterization from a 1-D buoyant plume model. The resulting parameterization is an analytical expression that combines a non-linear ocean temperature sensitivity with an inherent geometry dependence, described by the grounding-line depth and the local slope under the ice shelf. For the application to realistic ice-shelf geometries, the model contains an algorithm that determines effective values for the grounding-line depth and basal slope in any point beneath an ice shelf.

The basal melt model is used to force the ice-dynamical ice sheet model IMAU-ICE. Ocean temperature sensitivity runs of IMAU-ICE with the new parametrization are performed using an effective ocean temperature field as reference. This reference field has been constructed from observational data with the purpose of matching (area-averaged) melt rates from the model with observed present-day melt rates.

The resulting 2-D fields of basal melt rates show a typical spatial pattern with high melt rates occurring near the grounding line and possible refreezing near the ice-shelf front. These large-scale features are also found in observations. The transient runs shed light on the stability of the Antarctica Ice Sheet influenced by this type of oceanic forcing.