

Bathymetric influences on Antarctic ice-shelf melt rates

D. N. Goldberg¹, T. A. Smith², S. H. K. Narayanan³, P. Heimbach^{2,4,5}, M. Morlighem⁶

¹School of Geosciences, University of Edinburgh, Edinburgh, United Kingdom

²Oden Institute for Computational Engineering and Sciences, The University of Texas at Austin, Austin, Texas

³Mathematics and Computer Science Division, Argonne National Laboratory

⁴Jackson School of Geosciences, The University of Texas at Austin, Austin, Texas

⁵Institute for Geophysics, The University of Texas at Austin, Austin, Texas

⁶University of California Irvine, Department of Earth System Science, Irvine, California

Introduction

Output datasets are generated from the output of the MITgcm ocean model and its adjoint, in NETCDF format; there are two separate data files, one for our idealised ISOMIP-bump Experiment and one for our realistic Dotson-Crosson ice shelves experiment. The data was created in July and August of 2019.

Processing methodology is described in our main text.

Additional Supporting Information (Files uploaded separately)

Dataset S01.nc

This dataset contains model output from the ISOMIP-bump experiment of Section 3 of the paper, in netcdf format. The file contains the following dimensions and fields:

Dimensions:

- lon longitude, size 50
- lat latitude, size 100
- depth vertical elevation, size 30

Fields:

- double lon(lon); longitude values
- double lat(lat); latitude values
- double depth(depth); depth values (m)
- double temp(depth, lat); zonally averaged temperature (deg C)
- double melt(lon, lat); ice shelf melt rates (kg/m²/s)
- double topo(lon, lat); ice shelf topography (m)

- `double strmfunc(lon, lat);` depth averaged stream function (Sv)
- `double strmfuncR4(lon, lat);` region 4 perturbed stream function
- `double strmfuncR1(lon, lat);` region 4 perturbed stream function
- `double strmfuncR2(lon, lat);` region 4 perturbed stream function
- `double strmfuncR3(lon, lat);` region 4 perturbed stream function
- `double sensitivity(lon, lat);` bathymetric adjoint sensitivity (kg/m-y)

Dataset S02.nc

This dataset contains relevant model output from the Dotson-Crosson experiment of Section 3 of the paper, in netcdf format. The file contains the following dimensions and fields:

Dimensions:

- `X` longitude, size 50
- `Y` latitude, size 100
- `depth` vertical elevation, size 30
- `n_front` index of points across Dotson ice front
- `time` time in months (1 to 12)

Fields:

- `double X(X);` X values (m)
- `double Y(Y);` Y values (m)
- `double depth(depth);` depth values (m)
- `double x_front(n_front);` x values along dotson front (m)
- `double y_front(n_front);` y values along dotson front (m)
- `double month(time);` month values
- `double millan_bathy(X,Y);` processed bathymetry used in ocean model (m)
- `double millan_draft(X,Y);` processed ice topo used in ocean model (m)
- `double strmfunc(X,Y);` depth averaged stream function (Sv)
- `double outflow(n_front,depth);` outflow (cm/s)
- `double avgmelt(X,Y);` melt rate (kg/m/yr)
- `double melt_sensitivity(X,Y);` bathymetric adjoint sensitivity of melt rates (kg/m-y)
- `double vaf_sensitivity(X,Y);` bathymetric adjoint sensitivity of VAF (nondim)
- `double melt(time);` area averaged melt (kg/yr)
- `double delta_star_hfacc(time);` RMS of cell center thickness adjoint sensitivities (kg/yr-m)
- `double delta_star_hfacw(time);` RMS of cell south face thickness adjoint sensitivities (kg/yr-m)
- `double delta_star_hfacw(time);` RMS of cell west face thickness adjoint sensitivities (kg/yr-m)