Model output of the hydrographic properties, velocity, and diagnostic terms from a West Antarctic Peninsula model with a simulation covering 2006-2012

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Project
» Collaborative Research: The Impact of Oceanic Forcing on the Melting of West Antarctic Peninsula Glaciers (West Antarctic Melting)

Contributors	Affiliation	Role
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Abstract
Model output of the hydrographic properties, velocity, and diagnostic terms from a West Antarctic Peninsula model. These data were published in Wang et al. (2022).

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Coverage

Spatial Extent: **N**:-59.7396 **E**:-52.8476 **S**:-66.296 **W**:-67.4993
Temporal Extent: 2006 - 2012

Methods & Sampling

The model outputs are from a high-resolution (1.5 km) numerical model - Regional Ocean Modeling System (ROMS), including dynamic sea-ice and static ice shelves. The model simulation covers the period 2006-2012 and is forced by atmospheric output from the Antarctic Mesoscale Prediction System and ERA-Interim. More details of the model simulation can be found in Graham et al. (2016). The model outputs list here cover the period from December/02/2007 – November/31/2009.

ROMS version used: ROMSv3.6. Information on ROMS model can be found at: https://www.myroms.org/wiki/

The dataset includes eleven sets of data files (netcdf, data). See "Data Files" section for access.

1. Model grid file (sub_grid.nc) that contains the model grid information for the specific region.
2. The varinfo.dat specifies the information about the input/output rules for the model.
3. Model output of the simulated potential temperature (temp.nc) for the specific region. The file contains daily average of potential temperature.
4. Model output of the simulated salinity (salt.nc) for the specific region. The file contains daily average of

salinity.
5. Model output of the simulated velocity (u.nc) for the specific region. The file contains daily average of u-velocity.
6. Model output of the simulated velocity (v.nc) for the specific region. The file contains daily average of v-velocity.
7. Model output of the diagnostic (temp_rate.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, time rate of change.
8. Model output of the diagnostic (temp_hdiff.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, horizontal diffusion term.
9. Model output of the diagnostic (temp_vdiff.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, vertical diffusion term.
10. Model output of the diagnostic (temp_xadv.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, horizontal XI-advection term.
11. Model output of the diagnostic (temp_yadv.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, horizontal ETA-advection term.
12. Model output of the diagnostic (temp_vadv.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, vertical-advection term.

Data Processing Description

The sub_grid.nc is the subset of the model grid. The other netcdf files are the daily average outputs from model simulation. We extracted the properties and diagnostic fields of the research area and compressed into the netcdf files.

BCO-DMO data manager processing notes:
* Supplied netcdf files attached to "Data Files" section, no modifications made. Additional metadata added from the .nc headers using "ncdump -h."

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Data Files

File

Model grid file (sub_grid.nc)

filename: sub_grid.nc

(Octet Stream, 26.22 MB)
MD5:ba2c42aefebaf6a45534f8a9d82f9eb4

Model grid file (sub_grid.nc) that contains the model grid information for the specific region.

```
// global attributes:
		:type = "GRID file" ;
		:history = "Wed Jan 19 15:20:10 2022: ncks -d xi_rho,929,1374 -d eta_rho,300,548 -d xi_u,929,1373 -d eta_u,300,548 -d xi_v,929,1374 -d
eta_v,300,547 -d xi_psi,929,1373 -d eta_psi,300,547 in.nc -o out2.nc\n",
			"/net/storage2/jgraham/WAP/WAP_1k/GRID/WAP_1k_grid_r36_smooth.nc with 4 km interpolated west bry." ;
		:NCO = "netCDF Operators version 4.9.3-alpha02 (Homepage = http://nco.sf.net, Code = http://github.com/nco/nco)" ;
}
```

Parameter information:

```
angle,"angle between XI-axis and EAST","radians"
dmde,"ETA-derivative of inverse metric factor pm","meter"
dndx,"XI-derivative of inverse metric factor pn","meter"
el,"basin length in the ETA-direction","meter"
f,"Coriolis parameter at RHO-points","second-1"
h,"model bathymetry at RHO-points","meter"
hraw,"Working bathymetry at RHO-points","meter"
lat_psi,"latitute of PSI-points","degree_north"
lat_rho,"latitute of RHO-points","degree_north"
lat_u,"latitute of U-points","degree_north"
lat_v,"latitute of V-points","degree_north"
lon_psi,"longitude of PSI-points","degree_east"
lon_rho,"longitude of RHO-points","degree_east"
lon_u,"longitude of U-points","degree_east"
lon_v,"longitude of V-points","degree_east"
mask_psi,"mask on PSI-points","nondimensional"
mask_rho,"mask on RHO-points","nondimensional"
mask_u,"mask on U-points","nondimensional"
mask_v,"mask on V-points","nondimensional"
pm,"curvilinear coordinate metric in XI","meter-1"
pn,"curvilinear coordinate metric in ETA","meter-1"
raw_mask,"*unsmoothed* mask on rho-points","nondimensional"
spherical,"grid type logical switch",""
xl,"basin length in the XI-direction","meter"
x_psi,"X-location of PSI-points","meter"
x_rho,"X-location of RHO-points","meter"
x_u,"X-location of U-points","meter"
x_v,"X-location of V-points","meter"
y_psi,"Y-location of PSI-points","meter"
y_rho,"Y-location of RHO-points","meter"
y_u,"Y-location of U-points","meter"
y_v,"Y-location of V-points","meter"
zice_raw,"*unsmoothed* zice on rho-points","meters, relative to sea level"
zice,"zice on rho-points","meters, relative to sea level"
```

Model input/output rules and info

filename: varinfo.dat

(Octet Stream, 174.63 KB)
MD5:ad291dc462db321a58529a7cf9475264

The varinfo.dat specifies the information about the input/output rules for the model.

Model output of the diagnostic (temp_hdiff.nc)

filename: temp_hdiff.nc

(Octet Stream, 16.24 GB)
MD5:60dac844ba4d1b9c6b36be3581ab1445

Model output of the diagnostic (temp_hdiff.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, horizontal diffusion term.

File information from "ncdump -h temp_hdiff.nc"

```
netcdf temp_hdiff {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp_hdiff(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp_hdiff:long_name = "potential temperature, horizontal diffusion term" ;
		temp_hdiff:time = "ocean_time" ;
		temp_hdiff:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

File

Model output of the diagnostic (temp_rate.nc)

filename: temp_rate.nc

(Octet Stream, 16.24 GB)
MD5:d8a31882e5a9f407cfb2ad136ad4b775

Model output of the diagnostic (temp_rate.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, time rate of change.

File information from "ncdump -h temp_rate.nc "

```
netcdf temp_rate {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp_rate(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp_rate:long_name = "potential temperature, time rate of change" ;
		temp_rate:time = "ocean_time" ;
		temp_rate:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

Model output of the diagnostic (temp_vadv.nc)

filename: temp_vadv.nc

(Octet Stream, 16.24 GB)
MD5:c757f3fbd17f3611f5d5ea751ad98087

Model output of the diagnostic (temp_vadv.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, vertical-advection term.

File information from "ncdump -h temp_vadv.nc"

```
netcdf temp_vadv {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp_vadv(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp_vadv:long_name = "potential temperature, vertical advection term" ;
		temp_vadv:time = "ocean_time" ;
		temp_vadv:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

Model output of the diagnostic (temp_vdiff.nc)

filename: temp_vdiff.nc

(Octet Stream, 16.24 GB)
MD5:d0277d111d4da84f3450f4d1427487b8

Model output of the diagnostic (temp_vdiff.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, vertical diffusion term.

File information from "ncdump -h temp_vdiff.nc"

```
netcdf temp_vdiff {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp_vdiff(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp_vdiff:long_name = "potential temperature, vertical diffusion term" ;
		temp_vdiff:time = "ocean_time" ;
		temp_vdiff:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

File

Model output of the diagnostic (temp_xadv.nc)

filename: temp_xadv.nc

(Octet Stream, 16.24 GB)
MD5:c9adc6dc4cd3417e7bf022c850f5e0fc

Model output of the diagnostic (temp_xadv.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, horizontal XI-advection term.

File information from "ncdump -h temp_xadv.nc"

```
netcdf temp_xadv {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp_xadv(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp_xadv:long_name = "potential temperature, horizontal XI-advection term" ;
		temp_xadv:time = "ocean_time" ;
		temp_xadv:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

Model output of the diagnostic (temp_yadv.nc)

filename: temp_yadv.nc

(Octet Stream, 16.24 GB)
MD5:943c126cf7f1bc62087e8d13fdef21b7

Model output of the diagnostic (temp_yadv.nc) for the specific region. The file contains daily average of diagnostic field: potential temperature, horizontal ETA-advection term.

File information from "ncdump -h temp_yadv.nc"

```
netcdf temp_yadv {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp_yadv(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp_yadv:long_name = "potential temperature, horizontal ETA-advection term" ;
		temp_yadv:time = "ocean_time" ;
		temp_yadv:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
```

Model output of the simulated potential temperature (temp.nc)

filename: temp.nc

(Octet Stream, 16.24 GB)
MD5:1c1a76e665029ef4e4d7603178389400

Model output of the simulated potential temperature (temp.nc) for the specific region. The file contains daily average of potential temperature.

File information from "ncdump -h temp.nc"

```
netcdf temp {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double temp(ocean_time, s_rho, eta_rho, xi_rho) ;
		temp:long_name = "time-averaged potential temperature" ;
		temp:time = "ocean_time" ;
		temp:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

File

Model output of the simulated salinity (salt.nc)

filename: salt.nc

(Octet Stream, 16.24 GB)
MD5:fedb4585bd29e42feb7d391cbe5c7aff

Model output of the simulated salinity (salt.nc) for the specific region. The file contains daily average of salinity.

File information from "ncdump -h salt.nc"

```
netcdf salt {
dimensions:
	xi_rho = 446 ;
	eta_rho = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double salt(ocean_time, s_rho, eta_rho, xi_rho) ;
		salt:long_name = "time-averaged salinity" ;
		salt:time = "ocean_time" ;
		salt:coordinates = "lon_rho lat_rho s_rho ocean_time" ;
}
```

Model output of the simulated velocity (u.nc)

filename: u.nc

(Octet Stream, 16.24 GB)
MD5:795fd2838cf32444e96264889a1e5d6f

Model output of the simulated velocity (u.nc) for the specific region. The file contains daily average of u-velocity.

file information from "ncdump -h u.nc"

```
netcdf u {
dimensions:
	xi_u = 445 ;
	eta_u = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double u(ocean_time, s_rho, eta_u, xi_u) ;
		u:long_name = "time-averaged u-momentum component" ;
		u:time = "ocean_time" ;
		u:coordinates = "lon_u lat_u s_rho ocean_time" ;
}
```

Model output of the simulated velocity (v.nc)

filename: v.nc

(Octet Stream, 16.24 GB)
MD5:0e2189e0beba669341a296d180f243bd

Model output of the simulated velocity (v.nc) for the specific region. The file contains daily average of v-velocity.

File information from "ncdump -h v.nc"

```
netcdf v {
dimensions:
	xi_v = 446 ;
	eta_v = 249 ;
	s_rho = 24 ;
	ocean_time = 800 ;
variables:
	double v(ocean_time, s_rho, eta_v, xi_v) ;
		v:long_name = "time-averaged v-momentum component" ;
		v:time = "ocean_time" ;
		v:coordinates = "lon_v lat_v s_rho ocean_time" ;
}
```

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Related Publications

Graham, J. A., Dinniman, M. S., & Klinck, J. M. (2016). Impact of model resolution for on-shelf heat transport along the West Antarctic Peninsula. Journal of Geophysical Research: Oceans, 121(10), 7880–7897. doi:10.1002/2016jc011875 https://doi.org/10.1002/2016JC011875
Methods

Wang, X., Moffat, C., Dinniman, M. S., Klinck, J. M., Sutherland, D. A., & Aguiar-González, B. (2022). Variability and Dynamics of Along-Shore Exchange on the West Antarctic Peninsula (WAP) Continental Shelf. Journal of Geophysical Research: Oceans, 127(2). Portico. https://doi.org/10.1029/2021jc017645 https://doi.org/10.1029/2021JC017645

Results

WikiROMS (2016,Dec) Wiki ROMS: Tools. Accessed November 20th, 2020. Available from https://www.myroms.org/wiki/Tools
Methods

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: The Impact of Oceanic Forcing on the Melting of West Antarctic Peninsula Glaciers (West Antarctic Melting)

Coverage: West Antarctic Peninsula

NSF Award Abstract:
The Western Antarctic Peninsula is the fastest-warming region in the Southern Hemisphere and observations show widespread retreat of glaciers and ice sheets in this region over the 20th century. The Antarctic Peninsula is an area of growing importance internationally for scientific research, species and ecosystem conservation, tourism, shipping, and US national interests in Antarctica. The future melting of ice along the West Antarctic Peninsula is of importance to the regional freshwater budget, ocean circulation, and ecosystems in this biologically active region. Regional and global projections of sea level rise indicate the West Antarctic Peninsula must be included in decadal scale projections as the contribution to global sea level is at present equal in magnitude to the West Antarctic Ice Sheet component. This study will examine the role that the ocean is playing presently - and what role it might play in the future - in the melting of ice along the West Antarctic Peninsula.

This proposal aims to understand the impact of the ocean structure and dynamics on the melting of West Antarctic Peninsula glaciers using a combination of high-resolution models and historic data. The project focuses on (i) the importance that shelf circulation processes - driven for example by wind and buoyancy forcing and by the exchange with the Antarctic Circumpolar Current, and modulated by the complex bottom topography - have on the melting of glaciers, relative to that circulation driven by the melting glacier itself, (ii) the impact of the distinct differences in ocean properties and circulation dynamics along the coast, with particular emphasis in differences between Bransfield Strait and the shelf to the south, and (iii) the competition of wind- and buoyancy-modulated exchange between the open ocean and the shelf and the transport and mixing processes on the shelf in determining the vertical structure of the nearshore thermal forcing, and its impact on glacier melting.

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Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1703310

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