1-D vertical mixing/biogeochemical Regional Ocean Modeling System (ROMS) output of October 2010 - March 2011 of the Amundsen Sea Polynya, modeled at twelve bloom stations.

Website: https://www.bco-dmo.org/dataset/765252
Data Type: model results
Version: 1
Version Date: 2019-04-18

Project
» Collaborative Research: Investigating the Role of Mesoscale Processes and Ice Dynamics in Carbon and Iron Fluxes in a Changing Amundsen Sea (INSPIRE) (INSPIRE)

Contributors	Affiliation	Role
Yager, Patricia L.	University of Georgia (UGA)	Principal Investigator
Sherrell, Robert M.	Rutgers University	Co-Principal Investigator
Oliver, Hilde	University of Georgia (UGA)	Contact
Biddle, Mathew	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
1-D vertical mixing/biogeochemical Regional Ocean Modeling System (ROMS) output of October 2010 - March 2011 of the Amundsen Sea Polynya, modeled at twelve bloom stations. Data are 3-hourly averages, and saved in NetCDF files. In the NetCDF files, data are distributed over a 6x6 grid with 30 depths (ranging from the surface down to 210 m, with higher resolution near the surface). ocean_avg.nc files are the standard model output, while files named ocean_avg_sensitivity_lowWW.nc are from runs using a lower winter water initial dissolved iron concentration.

Table of Contents

Coverage

Spatial Extent: **N**:-72.74 **E**:-112 **S**:-73.97 **W**:-118.03
Temporal Extent: 2010-10-01 - 2011-03-29

Dataset Description

1-D vertical mixing/biogeochemical Regional Ocean Modeling System (ROMS) output of October 2010 - March 2011 of the Amundsen Sea Polynya, modeled at twelve bloom stations. Data are 3-hourly averages, and saved in NetCDF files. In the NetCDF files, data are distributed over a 6x6 grid with 30 depths (ranging from the surface down to 210 m, with higher resolution near the surface). ocean_avg.nc files are the standard model output, while files named ocean_avg_sensitivity_lowWW.nc are from runs using a lower winter water initial dissolved iron concentration.

This dataset includes the following model parameters:

averaged time since initialization, background vertical mixing coefficient for momentum, background vertical mixing coefficient for tracers, bathymetry at RHO-points, bottom roughness, coagulation rate, Coriolis parameter at RHO-points, curvilinear coordinate metric in ETA, curvilinear coordinate metric in XI, detrital sinking rate, detritus remineralization rate, disaggregation rate, domain length in the ETA-direction, domain length in the XI-direction, empirical Fe:C coefficient, empirical Fe:C power, Fe:C ratio, free-surface nudging/relaxation inverse time scale, grid type logical switch, inverse half-saturation for phytoplankton NO3 uptake, iron remineralization rate, iron scavenging rate on large POM, iron scavenging rate on small POM, iron uptake timescale, Ivlev constant for zooplankton grazing, large detritus sinking rate, latitude of PSI-points, latitude of RHO-points, latitude of U-points, latitude of V-points, light attenuation due to phytoplankton, light attenuation due to sea water, linear drag coefficient, longitude of PSI-points, longitude of RHO-points, longitude of U-points, longitude of V-points, mass point sources and sink activation switch, mean density used in Boussinesq approximation, momentum point sources and sink activation switch, nitrate uptake rate, number of iterations to achieve convergence, number of long time-steps, number of short time-steps, number of time-steps between history records, number of time-steps between restart records, number of time-steps between the creation of average files, number of time-steps between the creation of history files, number of time-steps between time-averaged records, photosynthetically available radiation fraction, phytoplankton initial slope of the P-I curve, phytoplankton mortality rate to the detritus pool, phytoplankton mortality rate to the Nitrogen pool, phytoplankton sinking rate, Power-law shape barotropic filter parameter, quadratic drag coefficient, rate of large detritus nitrogen re-mineralization, S-coordinate at RHO-points, S-coordinate at W-points, S-coordinate bottom control parameter, S-coordinate parameter, critical depth, S-coordinate stretching curves at RHO-points, S-coordinate stretching curves at W-points, S-coordinate surface/bottom layer width, S-coordinate surface control parameter, sea surface height climatology processing switch, size of long time-steps, size of short time-steps, slipperiness parameter, starting time-step for accumulation of time-averaged fields, surface roughness, time-averaged available dissolved iron concentration, time-averaged detritus concentration, time-averaged free-surface, time-averaged iron on large particulate organic matter, time-averaged iron on small particulate organic matter, time-averaged large fraction nitrogen detritus concentration, time-averaged net latent heat flux, time-averaged net longwave radiation flux, time-averaged net sensible heat flux, time-averaged nitrate concentration, time-averaged phytoplankton, associated iron concentration, time-averaged phytoplankton concentration, time-averaged potential temperature, time-averaged salinity, time-averaged solar shortwave radiation flux, time-averaged surface net heat flux, time-averaged surface net salt flux, (E-P)*SALT, time-averaged surface u-wind component, time-averaged surface v-wind component, time-averaged temperature vertical diffusion coefficient, time-averaged u-volume flux, time-averaged vertical momentum component, time-averaged v-volume flux, time-averaged zooplankton concentration, time stamp assigned to model initilization, tracer climatology nudging activation switch, tracer climatology processing switch, tracer point sources and sink activation switch, Tracers nudging/relaxation inverse time scale, vertical terrain-following stretching function, vertical terrain-following transformation equation, zooplankton excretion efficiency to detritus pool, zooplankton excretion efficiency to Nitrogen pool, zooplankton grazing rate, zooplankton half-saturation constant for ingestion, zooplankton mortality rate to the detritus pool, zootoplankton mortality rate to the Nitrogen pool, 2D momentum climatology nudging activation switch, 2D momentum climatology processing switch, 2D momentum nudging/relaxation inverse time scale, 3D momentum climatology nudging activation switch, 3D momentum climatology processing switch, 3D momentum nudging/relaxation inverse time scale

Methods & Sampling

We use the 1-D ROMS/biogeochemical model at twelve ASPIRE bloom stations from 1 October 2010 through 31 March 2011 (6 months). These stations are the same as those considered by Yager et al. (2016), except for Station 68, a sea ice-covered station on the shelf break that we did not include since it was far from the polynya. The 1-D model uses a 9-minute time step and represents the upper 210 m of the water column with 30 vertical levels. The model vertical resolution is highest in the surface layer (2 – 4 m resolution in the top 25 m), and lowest in the bottom layer (maximum of 15.5 m resolution at 210 m). The model physics evolve over time according to vertical mixing and surface forcing.

The biogeochemical model used in this study is a modified version of the iron-, light- and nitrate-limited NPZD model developed by Fiechter et al. (2009) for ROMS in the Gulf of Alaska. Phytoplankton growth is determined by a maximum specific rate and a multiplicative function of iron, nitrate, and light availability relative to saturating values. The model considers the cycles of both nitrogen and iron, allowing for explicit iron and nitrate limitation on the rate of nutrient uptake using Michaelis-Menten kinetics.

Data Processing Description

BCO-DMO Processing Notes:
- served the zip package

[table of contents | back to top]

Data Files

File
1-D vertical mixing/biogeochemical ROMS model output filename: Oliver_BCO-DMO.zip (ZIP Archive (ZIP), 56.02 MB) MD5:e504211d6983b3d0a523d89609cbb22c

AttSW,light attenuation due to sea water,meter-1

AttPhy,light attenuation due to phytoplankton,meter2 millimole_N-1

PhyIS,phytoplankton initial slope of the P-I curve,meter2 watt-1

Vm_NO3,nitrate uptake rate,day-1

PhyMRD,phytoplankton mortality rate to the detritus pool,day-1

PhyMRN,phytoplankton mortality rate to the Nitrogen pool,day-1

K_NO3,inverse half-saturation for phytoplankton NO3 uptake,meter3 millimole-1

K_Phy,zooplankton half-saturation constant for ingestion,millimole_N2 m-6

ZooGR,zooplankton grazing rate,day-1

ZooMRD,zooplankton mortality rate to the detritus pool,day-1

ZooMRN,zootoplankton mortality rate to the Nitrogen pool,day-1

DetRR,detritus remineralization rate,day-1

LDeRRN,rate of large detritus nitrogen re-mineralization,day-1

CoagR,coagulation rate,m3 mmol_N-1 day-1

wPhy,phytoplankton sinking rate,m day-1

wDet,detrital sinking rate,m day-1

wLDet,large detritus sinking rate,m day-1

FeRR,iron remineralization rate,day-1

FeScav_s,iron scavenging rate on small POM,meter3 millimole_N-1 day-1

FeScav_l,iron scavenging rate on large POM,meter3 millimole_N-1 day-1

h,bathymetry at RHO-points,meter

lon_rho,longitude of RHO-points,degree_east

lat_rho,latitude of RHO-points,degree_north

ocean_time,averaged time since initialization,seconds since 2001-01-01 00:00:00

zeta,time-averaged free-surface,meter

w,time-averaged vertical momentum component,meter second-1

temp,time-averaged potential temperature,Celsius

salt,time-averaged salinity,

NO3,time-averaged nitrate concentration,millimole_N03 meter-3

phytoplankton,time-averaged phytoplankton concentration,millimole_nitrogen meter-3

zooplankton,time-averaged zooplankton concentration,millimole_nitrogen meter-3

detritus,time-averaged detritus concentration,millimole_nitrogen meter-3

File
phytoplanktonFe,"time-averaged phytoplankton, associated iron concentration",micromole_iron meter-3
iron,time-averaged available dissolved iron concentration,micromole_iron meter-3
iron_on_small_POM,time-averaged iron on small particulate organic matter,micromole_iron meter-3
iron_on_large_POM,time-averaged iron on large particulate organic matter,micromole_iron meter-3
LdetritusN,time-averaged large fraction nitrogen detritus concentration,millimole_nitrogen meter-3
Huon,time-averaged u-volume flux,meter3 second-1
Hvom,time-averaged v-volume flux,meter3 second-1
AKt,time-averaged temperature vertical diffusion coefficient,meter2 second-1
Uwind,time-averaged surface u-wind component,meter second-1
Vwind,time-averaged surface v-wind component,meter second-1
shflux,time-averaged surface net heat flux,watt meter-2
ssflux,"time-averaged surface net salt flux, (E-P)*SALT",meter second-1
latent,time-averaged net latent heat flux,watt meter-2
sensible,time-averaged net sensible heat flux,watt meter-2
lwrad,time-averaged net longwave radiation flux,watt meter-2
swrad,time-averaged solar shortwave radiation flux,watt meter-2
disag,disaggregation rate,m3 mmol_N-1 day-1

[table of contents | back to top]

Related Publications

Fiechter, J., Moore, A. M., Edwards, C. A., Bruland, K. W., Di Lorenzo, E., Lewis, C. V. W., … Hedstrom, K. (2009). Modeling iron limitation of primary production in the coastal Gulf of Alaska. Deep Sea Research Part II: Topical Studies in Oceanography, 56(24), 2503–2519. doi:10.1016/j.dsr2.2009.02.010
Methods

Yager, P., Sherrell, R., Stammerjohn, S., Ducklow, H., Schofield, O., Ingall, E., … van Dijken, G. (2016). A carbon budget for the Amundsen Sea Polynya, Antarctica: Estimating net community production and export in a highly productive polar ecosystem. Elementa: Science of the Anthropocene, 4, 000140. doi:10.12952/journal.elementa.000140
Methods

[table of contents | back to top]

Parameters

Parameters for this dataset have not yet been identified

[table of contents | back to top]

Deployments

NBP1005

Website	https://www.bco-dmo.org/deployment/58154
Platform	RVIB Nathaniel B. Palmer
Start Date	2010-11-26
End Date	2011-01-16
Description	Expedition by the USAP RV Nathaniel B. Palmer during austral summer 2010-11 to sampled the Amundsen Sea Polynya during the Amundsen Sea Polynya International Research Expedition (ASPIRE). Also identified as OSO 2010-11 (Oden Southern Ocean – two vessel operation 2010-11) The US Research Icebreaker Nathaniel B. Palmer was joined by the Swedish Icebreaker Oden for a two-vessel expedition to the Amundsen Sea. Scientists on the Palmer focused on understanding the climate-sensitive dynamics of the open water region, known as a "polynya." Oden scientists investigated the sea ice ecosystem nearby. The aim of both groups was to improve our understanding of how climate change will impact this important ecosystem. Note R2R Link takes user to Marine Geoscience Data System (MGDS):NBP1005NBP1005A Data at MGDS were available as NBP1005 and NBP1005A. The data are from the same expedition and are combined in BCO-DMO into the one deployment - NBP1005. Nathaniel B. Palmer Systems and Specifications

[table of contents | back to top]

Project Information

Collaborative Research: Investigating the Role of Mesoscale Processes and Ice Dynamics in Carbon and Iron Fluxes in a Changing Amundsen Sea (INSPIRE) (INSPIRE)

Coverage: The study area is the continental shelf of the Amundsen Sea, Antarctica, 71-75S, 100-130W.

The Amundsen Sea, in the remote Pacific sector of the Southern Ocean, is one of the least well studied Antarctic continental shelf regions. It shares characteristics in common with other Antarctic ice shelf regions, but exhibits unique aspects also. The Amundsen Sea Polynya (ASP), an open region at the base of several of the terminal glaciers draining the West Antarctic Ice sheet exhibits: 1) large intrusions of heat delivered from the warming modified circumpolar deep water (mCDW) rising up onto the continental shelf, 2) the fastest melting ice sheets in Antarctica, 3) the most productive coastal polynya (161 g C m-2) together with a significant atmospheric CO2 sink, and 4) some of the most rapidly declining regions of seasonal off-shore sea ice on Earth.

Following on from an earlier oceanographic field program, the Amundsen Sea Polynya International Research Expedition (ASPIRE; 2011), this study seeks to better synthesize and model the relative contributions of both physical ocean-ice linkages and biological production and carbon export terms and to compare these with other circumpolar Antarctic regions. A central feature will be the use of a regionally coupled physical-biogeochemical model to follow the dynamics of the large phytoplankton blooms that occur annually in the Amundsen Sea Polyna. This study will provides a means to locate the Amundsen Sea properties along the continuum of Antarctic ice shelf systems, and to understand how these system might change in response to climate change.

Pedagogical techniques will be used to provide educational outreach for three distinct target populations: secondary students, pre-service science teachers, and in-service science teachers. Partnerships will be developed with science teacher educators to implement the STEM career-development lessons in undergraduate and graduate level science teacher education courses.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443657
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443604
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443315
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443569

[table of contents | back to top]