

Modeled locations of drifters representing transport of early life stages of Antarctic krill from 2016 to 2019

Website: <https://www.bco-dmo.org/dataset/964861>

Data Type: model results

Version: 1

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Project

» [Conserving the Southern Ocean: Informing the design, implementation and value of protecting the waters around Antarctica](#) (SO Krill Drifters)

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Abstract

This study employed a regional ocean model of the Southern Ocean to study the pathways of Antarctic krill during early life stages. Simulated Lagrangian drifters were embedded within a 5-km horizontal resolution ocean/sea ice/ice shelf Regional Ocean Modeling System circulation model of the Southern Ocean for the period 2016-2019. The drifters include simplistic behavior of the early life stages of krill including the initial descent/ascent cycle, diel vertical migration (DVM), and advection with simulated sea ice velocity, instead of ocean velocity, under certain conditions. Four simulations were run varying different aspects (conditions under which krill were advected with sea ice velocities instead of ocean, details of DVM, details of initial descent/ascent cycle) of the simulated behavior in order to determine the impact on pathways and connectivity. Drifters were released over three separate summer seasons (2016-17, 2017-18, 2018-19) resulting in twelve separate simulation data sets (presented as individual netCDF files within this BCO-DMO dataset).

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Coverage

Location: Southern Ocean

Spatial Extent: Lat:-50 Lon:-90

Temporal Extent: 2016-01-01 - 2019-12-31

Methods & Sampling

Simulated Lagrangian drifters were embedded within a 5-km horizontal resolution ocean/sea ice/ice shelf Regional Ocean Modeling System circulation model of the Southern Ocean for the period 2016-2019. The drifters include simplistic behavior of the early life stages of krill including the initial descent/ascent cycle, diel vertical migration (DVM), and advection with simulated sea ice velocity, instead of ocean velocity, under certain conditions. Four simulations were run varying different aspects (conditions under which krill were advected with sea ice velocities instead of ocean, details of DVM, details of initial descent/ascent cycle) of the simulated behavior in order to determine the impact on pathways and connectivity. Drifters were released over three separate summer seasons (2016-17, 2017-18, 2018-19), resulting in twelve separate simulation data sets (presented as individual netCDF files within this BCO-DMO dataset, See "Data Files" section).

Data Processing Description

The ocean circulation model that the drifters were embedded in that was used for the simulations was exactly the same as in Dinniman et al. (2020, doi: 10.1029/2019JC015736), except that the atmospheric forcing was updated to be from ERA5 (Hersbach et al., 2020, doi:10.1002/qj.3803) and now covers the period 2016-2019.

Model version used: ROMS/TOMS, Version 3.6 (Shchepetkin & McWilliams, 2005)

See "Data Files" for a netCDF file per simulation (80GB per file). Files are in netCDF-4/HDF5 file format using convention CF-1.4. Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

BCO-DMO Processing Description

* Metadata extracted from submitted netCDF files but no changes were made to the files.

* Supplemental file example_header_so_ft.008.d3650.txt added with contents of the header within so_ft.008.d3650.nc. This is so people can view the structure and global attributes before downloading one of the 80GB files.

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Data Files

File
Simulated Lagrangian drifter data (007) filename: so_ft.007.d3650.nc (NetCDF, 79.83 GB) MD5:beda7e644ee7bdb37f8dd82a2a7d99d9 This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2016-2017 release for the Ocean-only simulation. Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').
Simulated Lagrangian drifter data (008) filename: so_ft.008.d3650.nc (NetCDF, 79.83 GB) MD5:3749de54deed3085ea52cfd4016f3067 This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2016-2017 release for the Sea-ice simulation. Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

File

Simulated Lagrangian drifter data (009)

filename: so_ft.009.d3650.nc

(NetCDF, 79.83 GB)
MD5:69a5ec95bc17cdddab976feb726aa12

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2017-2018 release for the Sea-ice simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (010)

filename: so_ft.010.d3650.nc

(NetCDF, 79.83 GB)
MD5:ce46f0c705118da0163f8b7ccc9f409c

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2017-2018 release for the Ocean-only simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (011)

filename: so_ft.011.d3650.nc

(NetCDF, 79.83 GB)
MD5:df6586acb1caae102d63e561c8b1eb50

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2018-2019 release for the Sea-ice simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (012)

filename: so_ft.012.d3650.nc

(NetCDF, 79.83 GB)
MD5:c7afa9057cc35c2773cc7458b8fd6104

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2018-2019 release for the Ocean-only simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (013)

filename: so_ft.013.d3650.nc

(NetCDF, 79.83 GB)
MD5:bf1a1b899a4e61db67a9b64ace66618f

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2016-2017 release for the Modified-DVM simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (014)

filename: so_ft.014.d3650.nc

(NetCDF, 79.83 GB)
MD5:80c181177c43e8e62b43f75c8fab4a48

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2017-2018 release for the Modified-DVM simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

File

Simulated Lagrangian drifter data (015)

filename: so_ft.015.d3650.nc

(NetCDF, 79.83 GB)
MD5:81445588da9959a5f681a63a8d17884b

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2016-2017 release for the Embryo-size simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (016)

filename: so_ft.016.d3650.nc

(NetCDF, 79.83 GB)
MD5:25bb24feeabef73964e2b469543dc14d

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2017-2018 release for the Embryo-size simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (017)

filename: so_ft.017.d3650.nc

(NetCDF, 79.83 GB)
MD5:823fa0a14ae8b6df333d07fb7f1535da

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2018-2019 release for the Modified-DVM simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

Simulated Lagrangian drifter data (018)

filename: so_ft.018.d3650.nc

(NetCDF, 79.83 GB)
MD5:1c72254f20f4acb16023a338bc6325f6

This file is one of twelve netCDF files in this dataset. Each file contains separate simulation data from drifters released over three separate summer seasons (2016-17, 2017-18, 2018-19). This file is the 2018-2019 release for the Embryo-size simulation.

Examples of global attributes and parameter descriptions added as supplemental file "example_header_so_ft.008.d3650.txt" (results of 'ncdump -h so_ft.008.d3650.nc').

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Supplemental Files

File

Example netCDF header

filename: example_header_so_ft.008.d3650.txt

(Plain Text, 11.95 KB)
MD5:6183db2d4b98180908d5492e8900cd78

Example netCDF header. Results of 'ncdump -h so_ft.008.d3650.nc' which shows the header information for that file including parameter information included and the cf convention used.

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Related Publications

Dinniman, M. S., St-Laurent, P., Arrigo, K. R., Hofmann, E. E., & Dijken, G. L. (2020). Analysis of iron sources in Antarctic continental shelf waters. *Journal of Geophysical Research: Oceans*. doi:10.1029/2019jc015736

<https://doi.org/10.1029/2019JC015736>

Methods

Hersbach, H., Bell, B., Berrisford, P., Hirahara, S., Horányi, A., Muñoz-Sabater, J., Nicolas, J., Peubey, C., Radu, R., Schepers, D., Simmons, A., Soci, C., Abdalla, S., Abellan, X., Balsamo, G., Bechtold, P., Biavati, G., Bidlot, J., Bonavita, M., ... Thépaut, J. (2020). The ERA5 global reanalysis. *Quarterly Journal of the Royal Meteorological*

Society, 146(730), 1999–2049. Portico. <https://doi.org/10.1002/qj.3803>
Methods

Shchepetkin, A. F., & McWilliams, J. C. (2005). The regional oceanic modeling system (ROMS): a split-explicit, free-surface, topography-following-coordinate oceanic model. *Ocean Modelling*, 9(4), 347–404.
<https://doi.org/10.1016/j.ocemod.2004.08.002>
Software

Sylvester, Z.T., Dinniman, M.S., Thorpe, S.E., Bernard, K.S., and Brooks, C.M. (n.d.). Modelled Connectivity of Antarctic Krill Spawning and Nursery Grounds along the Western Antarctic Peninsula. Submitted to *Marine Ecology Progress Series*.
Results

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Conserving the Southern Ocean: Informing the design, implementation and value of protecting the waters around Antarctica (SO Krill Drifters)

Coverage: Antarctic waters

This interdisciplinary research proposal seeks to inform the design and implementation of Southern Ocean marine protected areas (MPAs), while also providing new tools to highlight the global value of MPAs. The research proposed falls broadly across two themes: connectivity and ecosystem services.

Major data gaps remain in our understanding of the life history of Antarctic toothfish (*Dissostichus mawsoni*) and Antarctic krill (*Euphausia superba*), including around life history connectivity (Hanchet et al. 2015; Conroy et al. 2020). Connectivity refers to the movement of species across space and time, including migration pathways, foraging regions, and dispersal corridors. In the context of MPAs, understanding how a species moves through its life history can inform designing MPAs that ensures protection of the species (Balbar and Metaxas 2019) and can also reveal spillover effects, e.g., if fish protected in the boundaries of the MPA are the source for outside areas open to fishing (Roberts et al. 2001). Connectivity of krill and toothfish remains largely unknown and yet is critically important to ensure proper protection and efficacy of an MPA.

This project is supported by Pew Charitable Trusts Grant (35806) to the University of Colorado

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Funding

Funding Source	Award
Pew Charitable Trusts (Pew)	35806

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