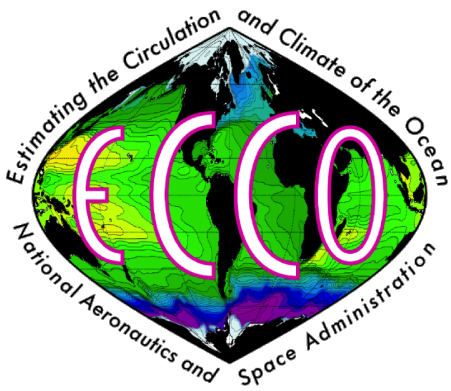


The ECCO Data Specification (ECCO) v4r4 User Guide

The "Estimating the Circulation and Climate of the Ocean" Team

3 June 2023

Documentation User Guide	
Reference:	ECCO_v4r4_user_guide.pdf
Version:	ECCO 4.0 Document **Revision:** 4
Date of issue:	3 June 2023
Document type:	LaTeX Document
Book Captain:	Ian Fenty and Ou Wang
Location:	Jet Propulsion Laboratory/California Institute of Technology
Approved on-line version:	https://podaac.jpl.nasa.gov/ECCO?tab=mission-objectives&sections=about%2Bdata%2Bresources
Development versions in:	www.google.com
Please reference this document as	ECCO Science Team (2022), The ECCO Data Specification (ECCO) 4.0, document revision 4, available from the ECCO Project Office, 2022, pp123.

Please reference this document as:
ECCO Science Team (2022), The ECCO Data Specification (ECCO) version 4.0,
document revision 4, available from the ECCO Project Office, 2022, pp 123.

the front page style is on building process!!!

The Recommended ECCO Data Specification (EDS)

EDS Technical Specifications

Compiled by
the ECCO Science Team 2025

On building process!!!

On building process!!!

1 The ECCO Science Team 2025

On building process!!!

2 Executive Summary

On building process!!!

3 Table of Contents

Contents

4 Figures in this document

List of Figures

5 Tables in this document

List of Tables

6 Acryonyms and abbreviation list

On building process!!!

7 Scope and Content of this Document

On building process!!!

8 Overview of ECCO Data

On building process!!!

9 ECCO Data Filenames and Supporting Conventions

On building process!!!

10 ECCO Data File Structure

On building process!!!

11 Native lat-lon-cap 90 (llc90) Coordinates and Grid Geometry

11.1 Native coordinates GRID_GEOMETRY_ECCO

11.1.1 Overview

This dataset provides geometric parameters for the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. Parameters include areas and lengths of grid cell sides, horizontal and vertical coordinates of grid cell centers and corners, grid rotation angles, and global domain geometry including bathymetry and land/ocean masks.

Table 11.1: Coordinates and Variables in the dataset GRID_GEOMETRY_ECCO

Variables	Description of data variables	Unit
CS	Cosine of tracer grid cell orientation vs geographical north	1
SN	Sine of tracer grid cell orientation vs geographical north	1
rA	Area of tracer grid cell	m2
dxG	Distance between 'southwest' and 'southeast' corners of the tracer grid cell	m
dyG	Distance between 'southwest' and 'northwest' corners of the tracer grid cell	m
Depth	Model seafloor depth below ocean surface at rest	m
rAz	Area of vorticity 'g' grid cell	m2
dxC	Distance between centers of adjacent tracer grid cells in the 'x' direction	m
dyC	Distance between centers of adjacent tracer grid cells in the 'y' direction	m
rAw	Area of 'v' grid cell	m2
rAs	Area of 'u' grid cell	m2
drC	Distance between the centers of adjacent tracer grid cells in the 'z' direction	m
drF	Distance between the upper and lower interfaces of the model grid cell	m
PHrefC	Reference ocean hydrostatic pressure at tracer grid cell center	m2 s-2
PHrefF	Reference ocean hydrostatic pressure at tracer grid cell top/bottom interface	m2 s-2
hFacC	Vertical open fraction of tracer grid cell	1
hFacW	Vertical open fraction of tracer grid cell 'west' face	1
hFacS	Vertical open fraction of tracer grid cell 'south' face	1
maskC	Wet/dry boolean mask for tracer grid cell	–none–
maskW	Wet/dry boolean mask for 'west' face of tracer grid cell	–none–
maskS	Wet/dry boolean mask for 'south' face of tracer grid cell	–none–
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north

Table 11.1: Coordinates and Variables in the dataset GRID_GEOMETRY_ECCO

XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of top/bottom face of tracer grid cell	m
Zu	Depth of bottom face of tracer grid cell	m
Zl	Depth of top face of tracer grid cell	m
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of top and bottom faces of tracer grid cell	–none–

11.1.2 Native coordinates Variable: XC

Table 11.2: Attributes description of the variable 'XC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	XC	Longitude of tracer grid cell center	degrees_east
Description of the variable in Common Data language (CDL)			
float32 XC(tile, j, i) XC: long_name = longitude of tracer grid cell center XC: units = degrees_east XC: coordinate = YC XC XC: bounds = XC_bnds XC: coverage_content_type = coordinate XC: standard_name = longitude			
Comments			
Nonuniform grid spacing			

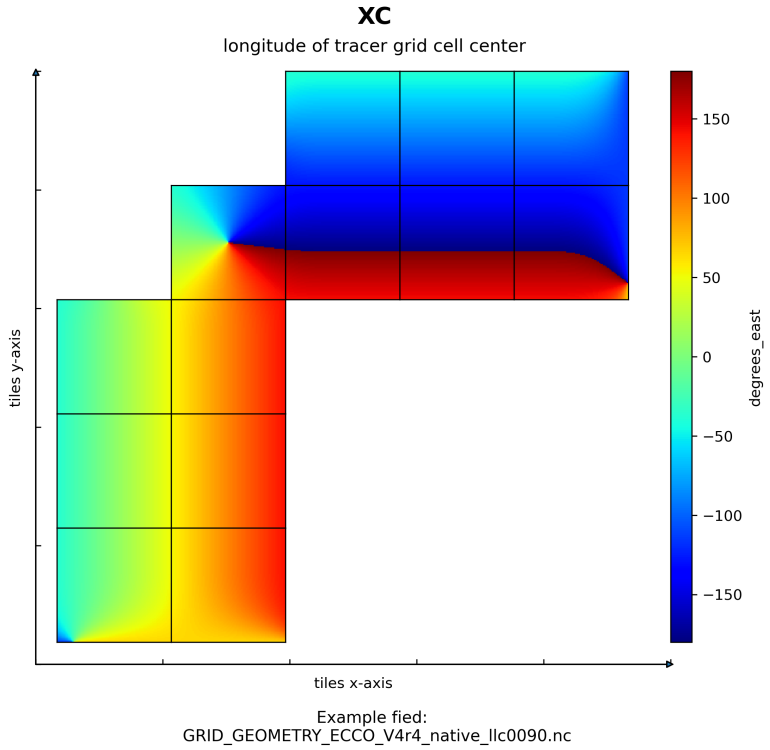


Figure 1: Dataset: GRID_GEOMETRY_ECCO, Variable: XC

11.1.3 Native coordinates Variable: YC

Table 11.3: Attributes description of the variable 'YC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	YC	Latitude of tracer grid cell center	degrees_north
Description of the variable in Common Data language (CDL)			
float32 YC(tile, j, i) YC: long_name = latitude of tracer grid cell center YC: units = degrees_north YC: coordinate = YC XC YC: bounds = YC_bnds YC: coverage_content_type = coordinate YC: standard_name = latitude			
Comments			
Nonuniform grid spacing			

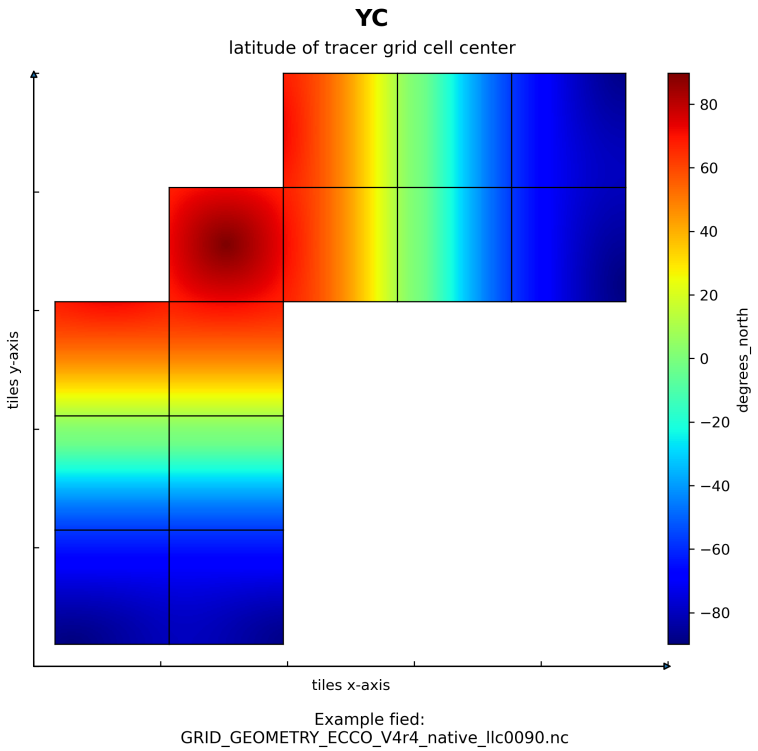


Figure 2: Dataset: GRID_GEOMETRY_ECCO, Variable: YC

11.1.4 Native coordinates Variable: XG

Table 11.4: Attributes description of the variable 'XG' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
Description of the variable in Common Data language (CDL)			
float32 XG(tile, j_g, i_g) XG: long_name = "longitude of southwest corner of tracer grid cell" XG: units = degrees_east XG: coordinate = YG XG XG: coverage_content_type = coordinate XG: standard_name = longitude			
Comments			
Nonuniform grid spacing. note: 'southwest' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm dcoumentation for details.			

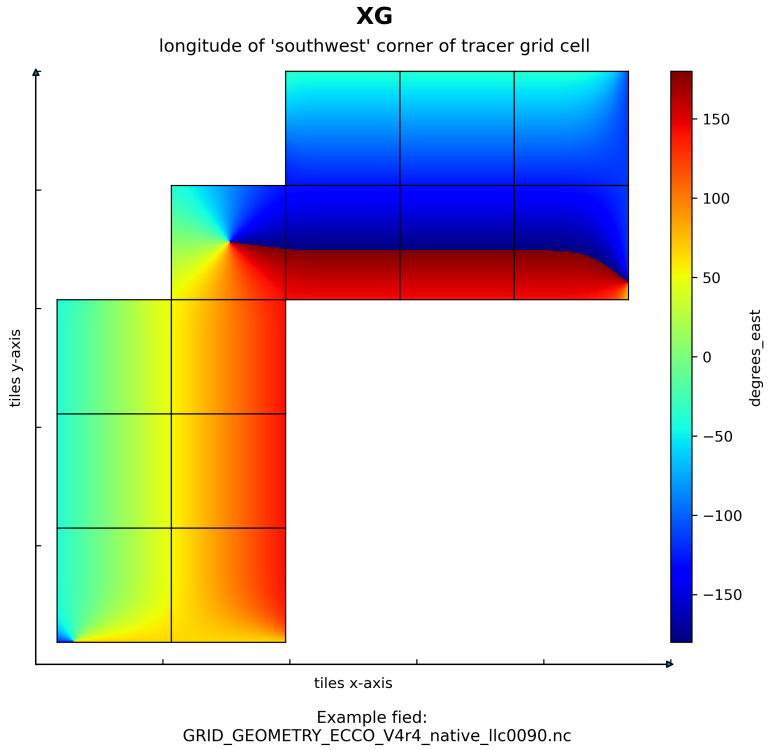


Figure 3: Dataset: GRID_GEOMETRY_ECCO, Variable: XG

11.1.5 Native coordinates Variable: YG

Table 11.5: Attributes description of the variable 'YG' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Description of the variable in Common Data language (CDL)			
float32 YG(tile, j_g, i_g) YG: long_name = "latitude of southwest corner of tracer grid cell" YG: units = degrees_north YG: coordinates = YG XG YG: coverage_content_type = coordinate YG: standard_name = latitude			
Comments			
Nonuniform grid spacing. note: 'southwest' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm dcoumentation for details.			

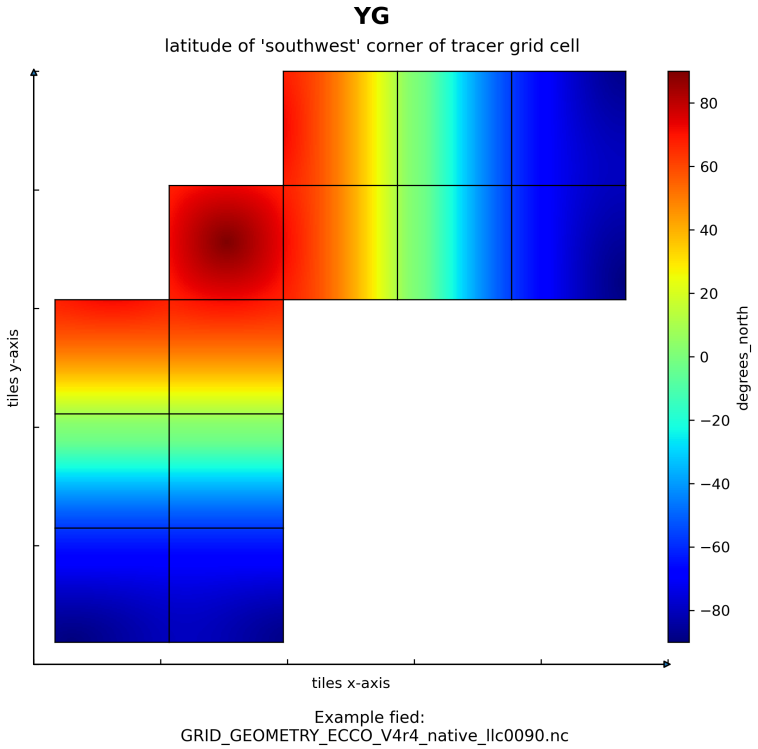


Figure 4: Dataset: GRID_GEOMETRY_ECCO, Variable: YG

11.1.6 Native coordinates Variable: CS

Table 11.6: Attributes description of the variable 'CS' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	CS	Cosine of tracer grid cell orientation vs geographical north	1
Description of the variable in Common Data language (CDL)			
float32 CS(tile, j, i) CS: _FillValue = 9.96921e+36 CS: long_name = cosine of tracer grid cell orientation vs geographical north CS: units = 1 CS: coordinate = YC XC CS: coverage_content_type = modelResult CS: coordinates = YC XC			
Comments			
Cs and sn are required to calculate the geographic (meridional, zonal) components of vectors on the curvilinear model grid. note: for vector r with components r_x and r_y: r_{east} = cs r_x - sn r_y. r_{north} = sn r_x + cs r_y			

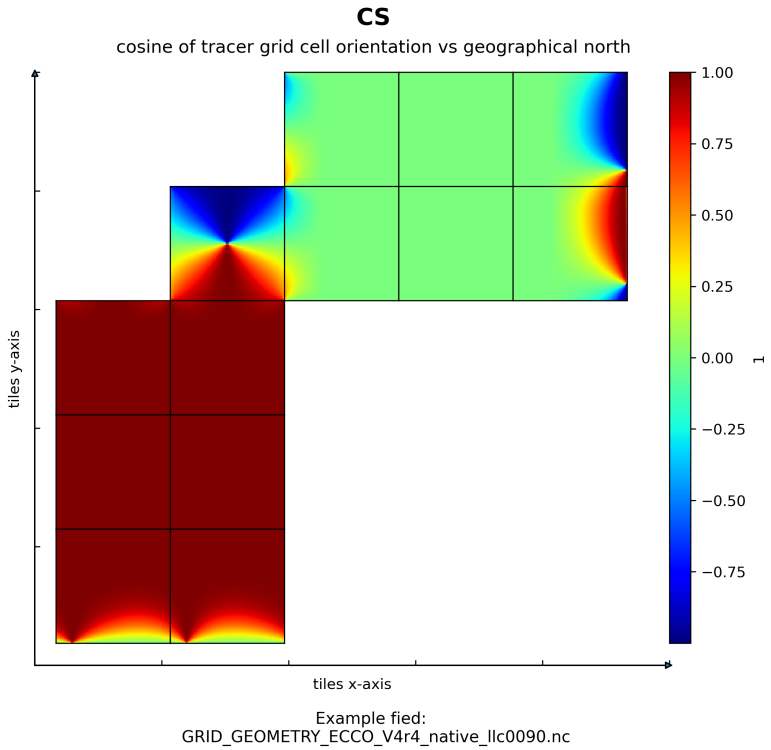


Figure 5: Dataset: GRID_GEOMETRY_ECCO, Variable: CS

11.1.7 Native coordinates Variable: SN

Table 11.7: Attributes description of the variable 'SN' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	SN	Sine of tracer grid cell orientation vs geographical north	1
Description of the variable in Common Data language (CDL)			
float32 SN(tile, j, i) SN: _FillValue = 9.96921e+36 SN: long_name = sine of tracer grid cell orientation vs geographical north SN: units = 1 SN: coordinate = YC XC SN: coverage_content_type = modelResult SN: coordinates = YC XC			
Comments			
Cs and sn are required to calculate the geographic (meridional, zonal) components of vectors on the curvilinear model grid. note: for vector r with components r_x and r_y in local grid directions x and y, the geographical eastward component r_{east} = cs r_x - sn r_y. the geographical northward component r_{north} = sn r_x + cs r_y.			

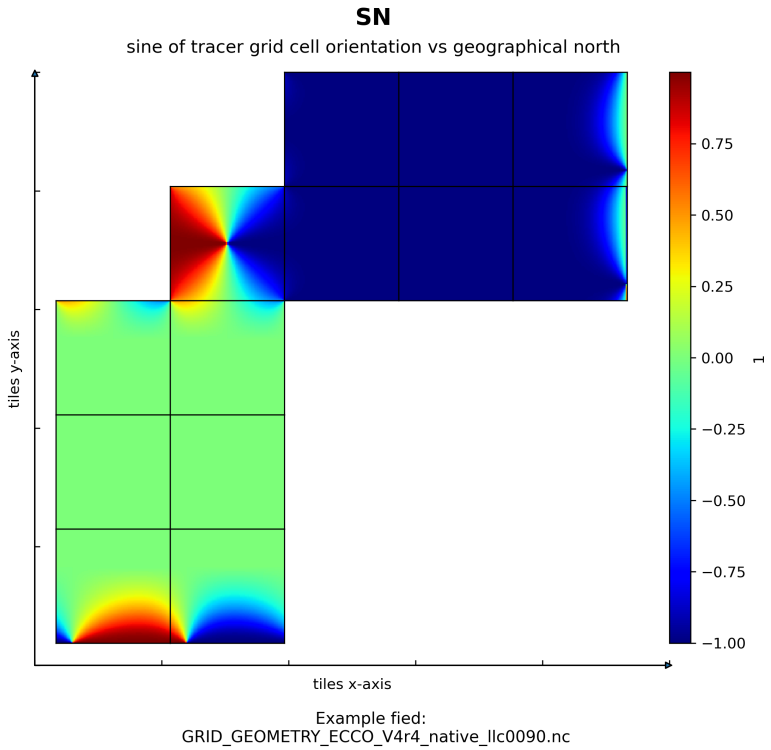


Figure 6: Dataset: GRID_GEOMETRY_ECCO, Variable: SN

11.1.8 Native coordinates Variable: rA

Table 11.8: Attributes description of the variable 'rA' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	rA	Area of tracer grid cell	m2
Description of the variable in Common Data language (CDL)			
float32 rA(tile, j, i) rA: _FillValue = 9.96921e+36 rA: long_name = area of tracer grid cell rA: units = m2 rA: coordinate = YC XC rA: coverage_content_type = modelResult rA: standard_name = cell_area rA: coordinates = YC XC			
Comments			
N/a			

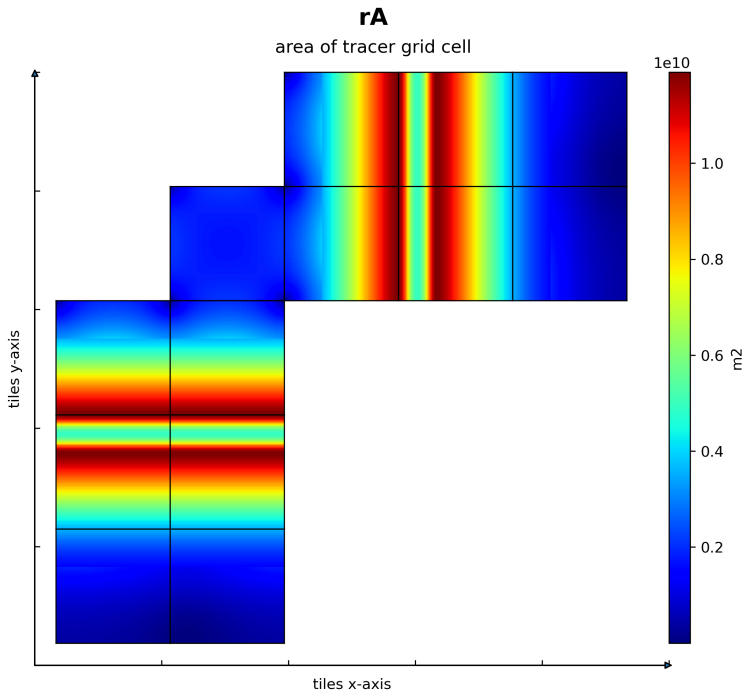


Figure 7: Dataset: GRID_GEOMETRY_ECCO, Variable: rA

11.1.9 Native coordinates Variable: dxG

Table 11.9: Attributes description of the variable 'dxG' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	dxG	Distance between 'southwest' and 'southeast' corners of the tracer grid cell	m
Description of the variable in Common Data language (CDL)			
float32 dxG(tile, j_g, i) dxG: _FillValue = 9.96921e+36 dxG: long_name = "distance between southwest and southeast corners of the tracer grid cell" dxG: units = m dxG: coordinate = YG XC dxG: coverage_content_type = modelResult			
Comments			
Alternatively, the length of 'south' side of tracer grid cell. note: 'south', 'southwest', and 'southeast' do not correspond to geographic orientation but are used for convenience to describe the computational grid. see mitgcm documentation for details.			

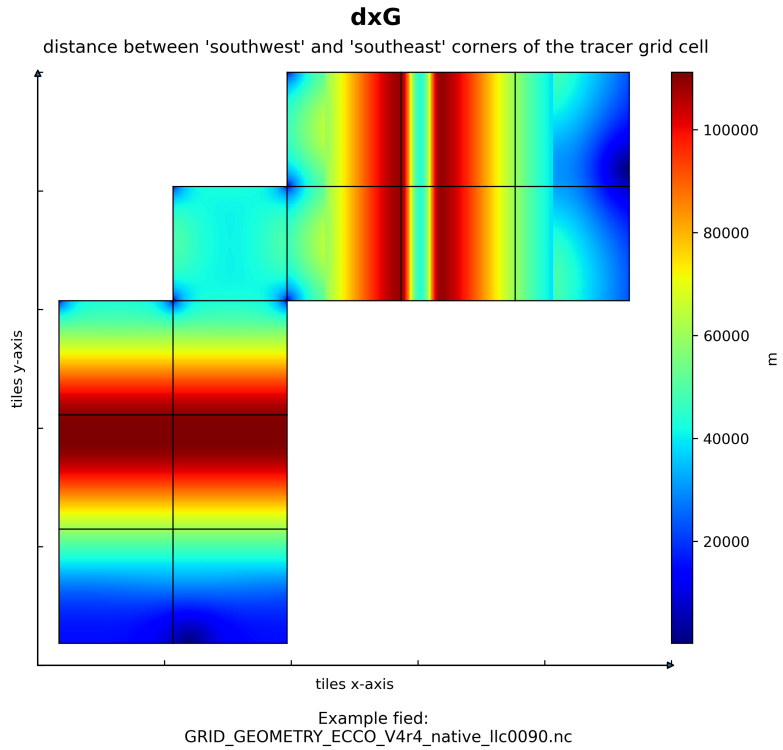


Figure 8: Dataset: GRID_GEOMETRY_ECCO, Variable: dxG

11.1.10 Native coordinates Variable: dyG

Table 11.10: Attributes description of the variable 'dyG' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	dyG	Distance between 'southwest' and 'northwest' corners of the tracer grid cell	m
Description of the variable in Common Data language (CDL)			
float32 dyG(tile, j, i_g) dyG: _FillValue = 9.96921e+36 dyG: long_name = "distance between southwest and northwest corners of the tracer grid cell" dyG: units = m dyG: coordinate = YC XG dyG: coverage_content_type = modelResult			
Comments			
Alternatively, the length of 'west' side of tracer grid cell. note: 'west, 'southwest', and 'northwest' do not correspond to geographic orientation but are used for convenience to describe the computational grid. see mitgcm documentation for details.			

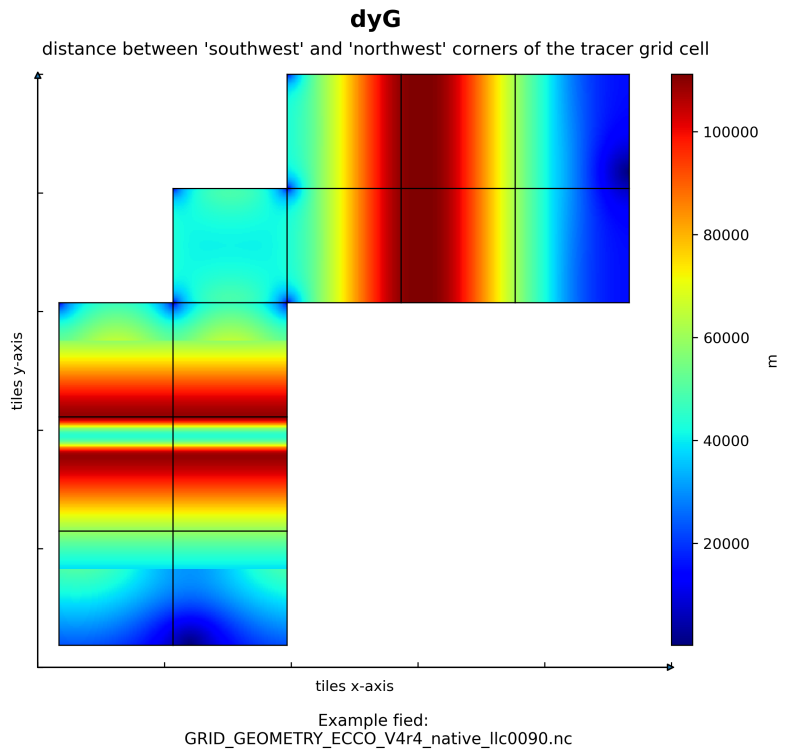


Figure 9: Dataset: GRID_GEOMETRY_ECCO, Variable: dyG

11.1.11 Native coordinates Variable: Depth

Table 11.11: Attributes description of the variable 'Depth' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	Depth	Model seafloor depth below ocean surface at rest	m
Description of the variable in Common Data language (CDL)			
float32 Depth(tile, j, i) Depth: _FillValue = 9.96921e+36 Depth: long_name = model seafloor depth below ocean surface at rest Depth: units = m Depth: coordinate = XC YC Depth: coverage_content_type = modelResult Depth: standard_name = sea_floor_depth_below_geoid Depth: coordinates = YC XC			
Comments			
Model sea surface height (ssh) of 0m corresponds to an ocean surface at rest relative to the geoid. depth corresponds to seafloor depth below geoid. note: the mitgcm used by ecco v4r4 implements 'partial cells' so the actual model seafloor depth may differ from the seafloor depth provided by the input bathymetry file.			

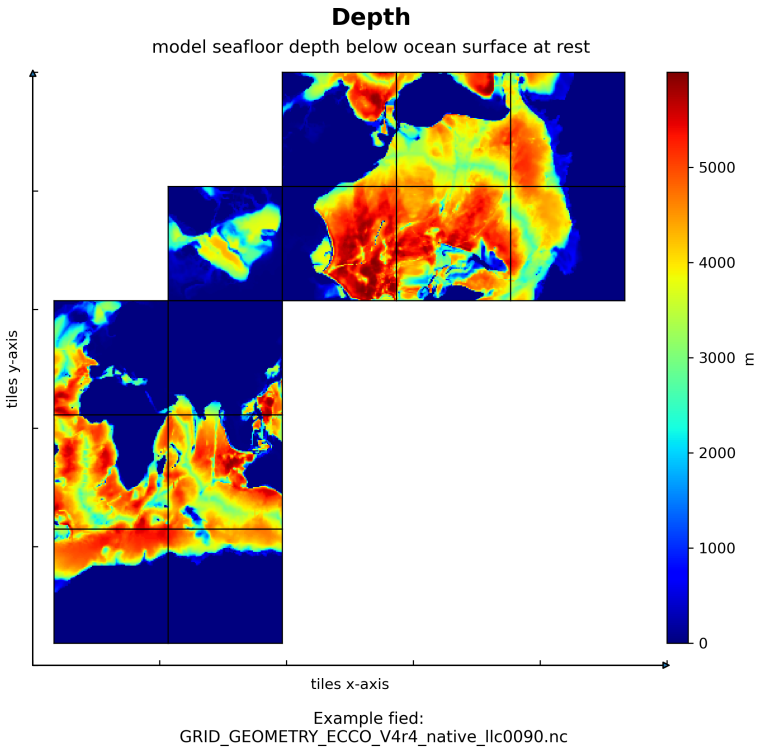


Figure 10: Dataset: GRID_GEOMETRY_ECCO, Variable: Depth

11.1.12 Native coordinates Variable: rAz

Table 11.12: Attributes description of the variable 'rAz' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	rAz	Area of vorticity 'g' grid cell	m2
Description of the variable in Common Data language (CDL)			
float32 rAz(tile, j_g, i_g) rAz: _FillValue = 9.96921e+36 rAz: long_name = "area of vorticity g grid cell" rAz: units = m2 rAz: coordinate = YG XG rAz: coverage_content_type = modelResult rAz: standard_name = cell_area rAz: coordinates = YG XG			
Comments			
Vorticity cells are staggered in space relative to tracer cells, nominally situated on tracer cell corners. vorticity cell (i,j) is located at the 'southwest' corner of tracer grid cell (i, j). note: 'southwest' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

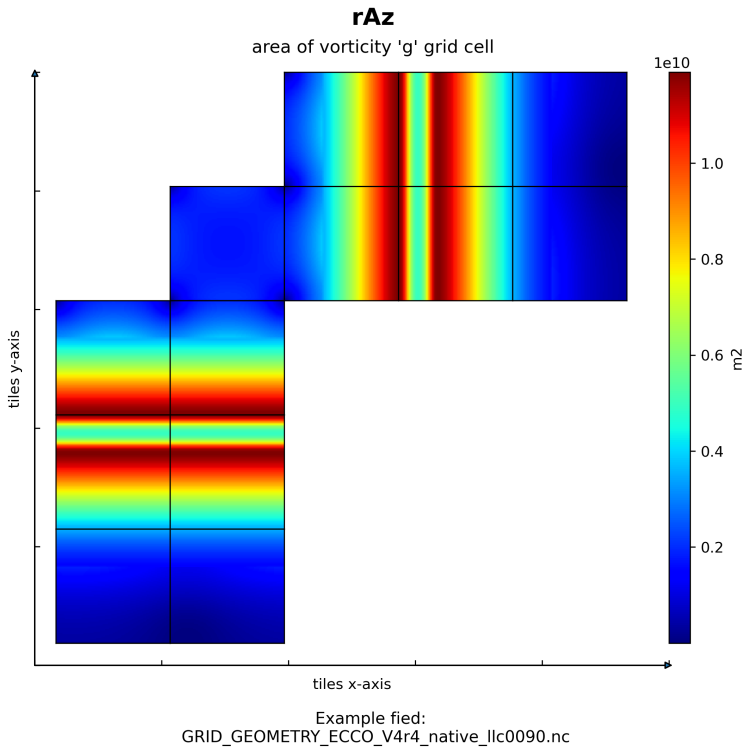


Figure 11: Dataset: GRID_GEOMETRY_ECCO, Variable: rAz

11.1.13 Native coordinates Variable: dxC

Table 11.13: Attributes description of the variable 'dxC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	dxC	Distance between centers of adjacent tracer grid cells in the 'x' direction	m
Description of the variable in Common Data language (CDL)			
float32 dxC(tile, j, i_g) dxC: _FillValue = 9.96921e+36 dxC: long_name = "distance between centers of adjacent tracer grid cells in the x direction" dxC: units = m dxC: coordinate = YC XG dxC: coverage_content_type = modelResult			
Comments			
Alternatively, the length of 'north' side of vorticity grid cells. note: 'north' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

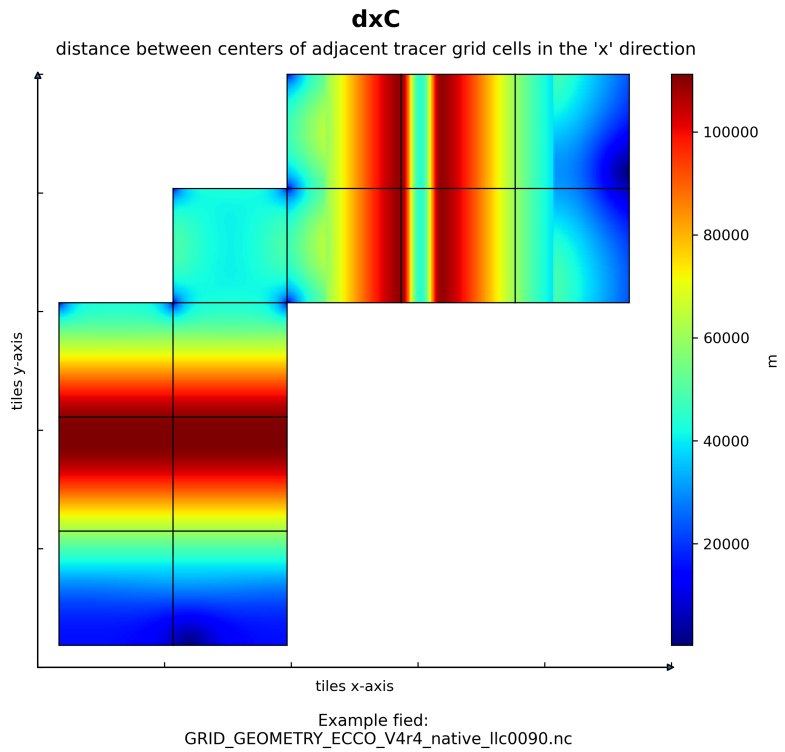


Figure 12: Dataset: GRID_GEOMETRY_ECCO, Variable: dxC

11.1.14 Native coordinates Variable: dyC

Table 11.14: Attributes description of the variable 'dyC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	dyC	Distance between centers of adjacent tracer grid cells in the 'y' direction	m
Description of the variable in Common Data language (CDL)			
float32 dyC(tile, j_g, i) dyC: _FillValue = 9.96921e+36 dyC: long_name = "distance between centers of adjacent tracer grid cells in the y direction" dyC: units = m dyC: coordinate = YG XC dyC: coverage_content_type = modelResult			
Comments			
Alternatively, the length of 'east' side of vorticity grid cells. note: 'east' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

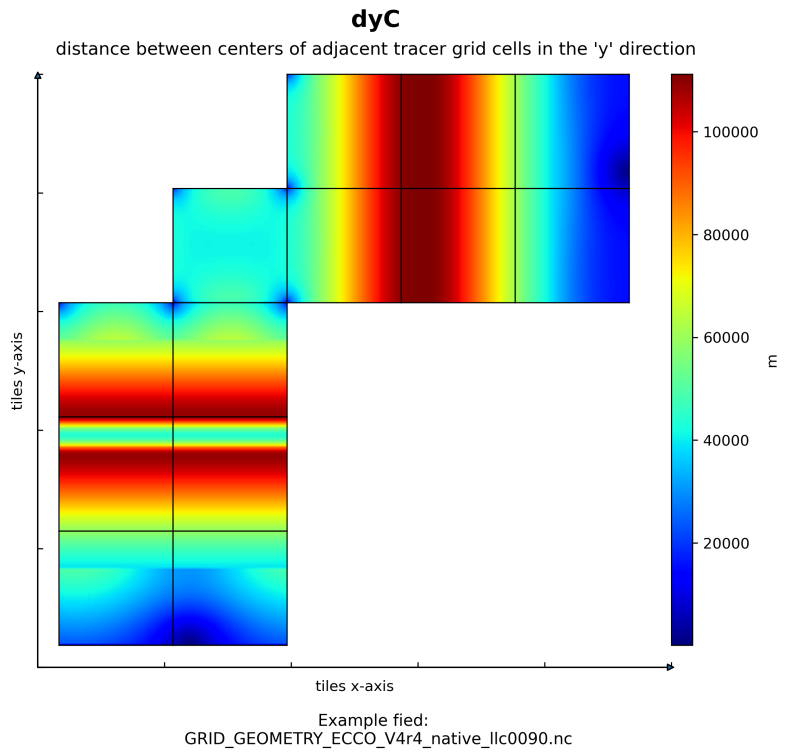


Figure 13: Dataset: GRID_GEOMETRY_ECCO, Variable: dyC

11.1.15 Native coordinates Variable: rAw

Table 11.15: Attributes description of the variable 'rAw' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	rAw	Area of 'v' grid cell	m2
Description of the variable in Common Data language (CDL)			
float32 rAw(tile, j, i_g) rAw: _FillValue = 9.96921e+36 rAw: long_name = "area of v grid cell" rAw: units = m2 rAw: coordinate = YG XC rAw: coverage_content_type = modelResult rAw: standard_name = cell_area			
Comments			
Model 'v' grid cells are staggered in space between adjacent tracer grid cells in the 'x' direction. 'v' grid cell (i,j) is situated at the 'west' edge of tracer grid cell (i, j). note: 'west' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

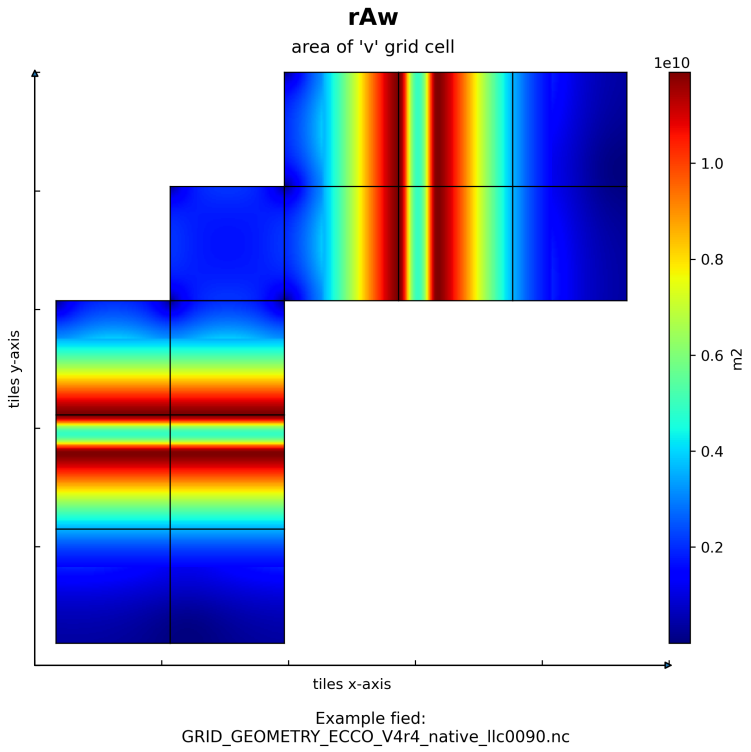


Figure 14: Dataset: GRID_GEOMETRY_ECCO, Variable: rAw

11.1.16 Native coordinates Variable: rAs

Table 11.16: Attributes description of the variable 'rAs' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	rAs	Area of 'u' grid cell	m2
Description of the variable in Common Data language (CDL)			
float32 rAs(tile, j_g, i) rAs: _FillValue = 9.96921e+36 rAs: long_name = "area of u grid cell" rAs: units = m2 rAs: coordinates = YG XC rAs: coverage_content_type = modelResult rAs: standard_name = cell_area			
Comments			
Model 'u' grid cells are staggered in space between adjacent tracer grid cells in the 'y' direction. 'u' grid cell (i,j) is situated at the 'south' edge of tracer grid cell (i, j). note: 'south' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

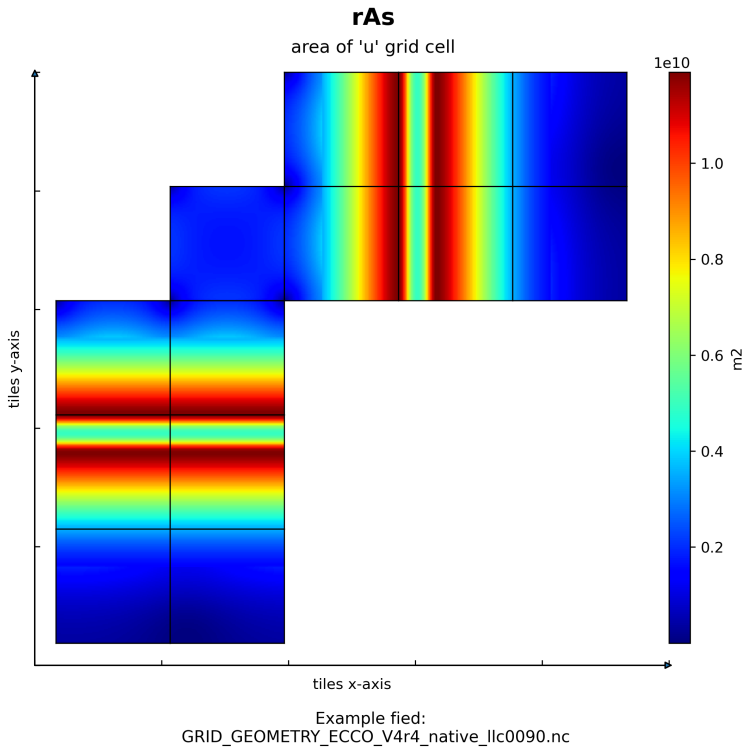


Figure 15: Dataset: GRID_GEOMETRY_ECCO, Variable: rAs

11.1.17 Native coordinates Variable: hFacC

Table 11.17: Attributes description of the variable 'hFacC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	hFacC	Vertical open fraction of tracer grid cell	1
Description of the variable in Common Data language (CDL)			
float32 hFacC(k, tile, j, i) hFacC: _FillValue = 9.96921e+36 hFacC: long_name = vertical open fraction of tracer grid cell hFacC: coverage_content_type = modelResult hFacC: units = 1 hFacC: coordinates = Z YC XC			
Comments			
Tracer grid cells may be fractionally closed in the vertical. the open vertical fraction is hfacc. the model allows for partially-filled cells to represent topographic variations more smoothly (hfacc < 1). completely closed (dry) tracer grid cells have hfacc = 0. note: the model z* coordinate system allows hfacc to vary through time. a time-invariant hfacc field is provided for reference.			

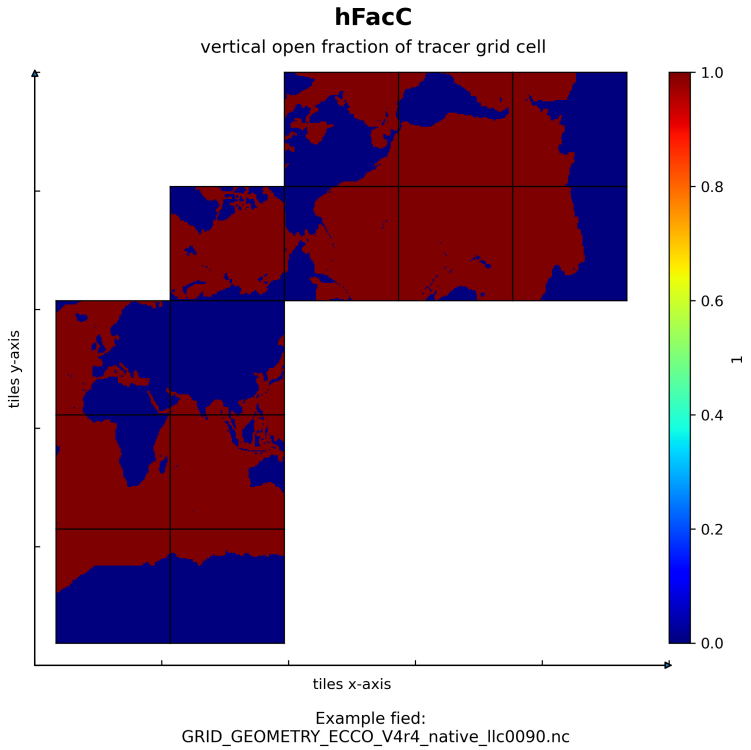


Figure 16: Dataset: GRID_GEOMETRY_ECCO, Variable: hFacC

11.1.18 Native coordinates Variable: hFacW

Table 11.18: Attributes description of the variable 'hFacW' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	hFacW	Vertical open fraction of tracer grid cell 'west' face	1
Description of the variable in Common Data language (CDL)			
float32 hFacW(k, tile, j, i_g) hFacW: _FillValue = 9.96921e+36 hFacW: long_name = "vertical open fraction of tracer grid cell west face" hFacW: coverage_content_type = modelResult hFacW: units = 1 hFacW: coordinates = Z			
Comments			
The 'west' face of tracer grid cells may be fractionally closed in the vertical. the open vertical fraction is hfacw. the model allows for partially-filled cells for smoother representation of seafloor topography. tracer grid cells adjacent in the 'x' direction that are partially closed in the vertical have hfacw < 1. the model z* coordinate system used by the model permits hfacc, and therefore hfacw, to vary through time. a time-invariant hfacw field is provided for reference. note: the term 'west' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

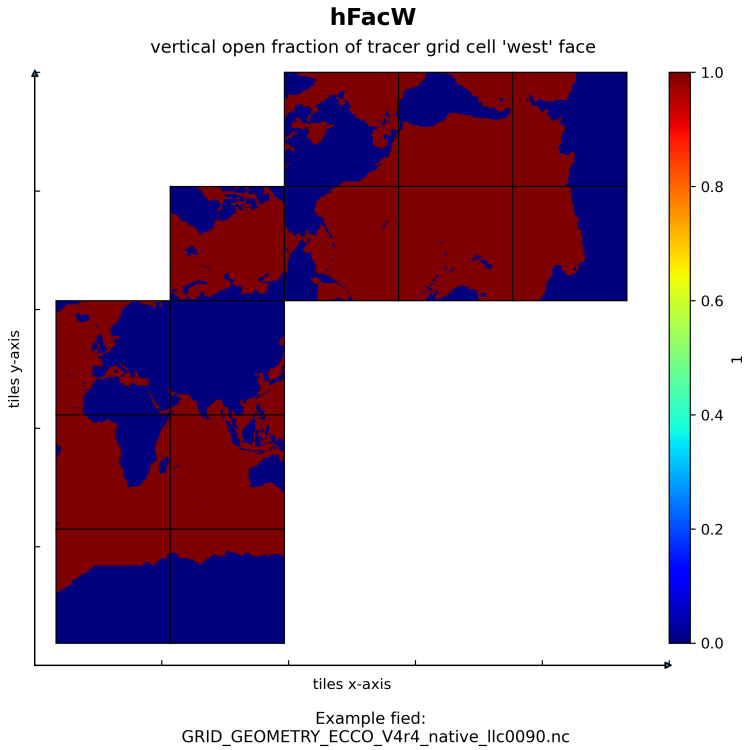


Figure 17: Dataset: GRID_GEOMETRY_ECCO, Variable: hFacW

11.1.19 Native coordinates Variable: hFacS

Table 11.19: Attributes description of the variable 'hFacS' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float32	hFacS	Vertical open fraction of tracer grid cell 'south' face	1
Description of the variable in Common Data language (CDL)			
float32 hFacS(k, tile, j_g, i) hFacS: _FillValue = 9.96921e+36 hFacS: long_name = "vertical open fraction of tracer grid cell south face" hFacS: coverage_content_type = modelResult hFacS: units = 1 hFacS: coordinates = Z			
Comments			
The 'south' face of tracer grid cells may be fractionally closed in the vertical. the open vertical fraction is hfacs. the model allows for partially-filled cells for smoother representation of seafloor topography. tracer grid cells adjacent in the 'y' direction that are partially closed in the vertical have hfacs < 1. the model z* coordinate system used by the model permits hfacc, and therefore hfacs, to vary through time. a time-invariant hfacs field is provided for reference. note: the term 'south' does not correspond to geographic orientation but is used for convenience to describe the computational grid. see mitgcm documentation for details.			

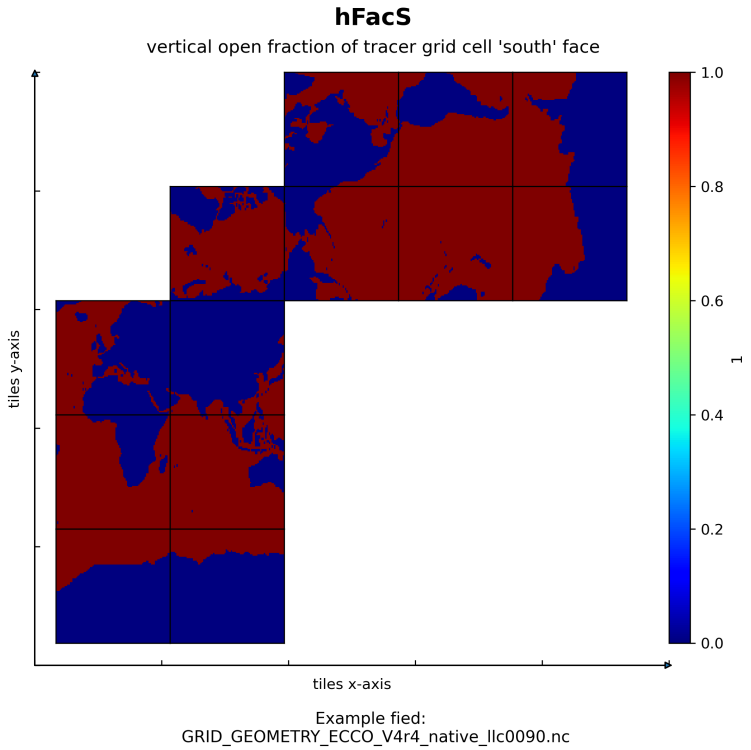


Figure 18: Dataset: GRID_GEOMETRY_ECCO, Variable: hFacS

11.1.20 Native coordinates Variable: maskC

Table 11.20: Attributes description of the variable 'maskC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
bool	maskC	Wet/dry boolean mask for tracer grid cell	N/A
Description of the variable in Common Data language (CDL)			
bool maskC(k, tile, j, i) maskC: _FillValue = 1 maskC: long_name = wet/dry boolean mask for tracer grid cell maskC: coverage_content_type = modelResult maskC: coordinates = Z YC XC			
Comments			
True for tracer grid cells with nonzero open vertical fraction (hfacc > 0), otherwise false. although hfacc can vary though time, cells will never close if starting open and will never open if starting closed: hfacc(i,j,k,t) > 0 for all t, if hfacc(i,j,k,t=0) and hfacc(i,j,k,t) = 0 for all t, if hfacc(i,j,k,t=0) = 0. therefore, maskc is time invariant.			

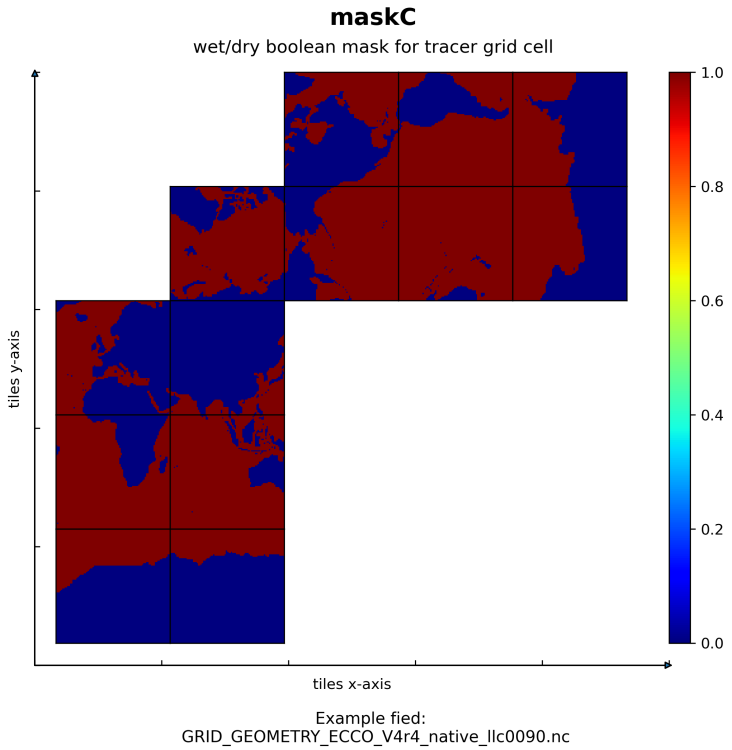


Figure 19: Dataset: GRID_GEOMETRY_ECCO, Variable: maskC

11.1.21 Native coordinates Variable: maskW

Table 11.21: Attributes description of the variable 'maskW' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
bool	maskW	Wet/dry boolean mask for 'west' face of tracer grid cell	N/A
Description of the variable in Common Data language (CDL)			
bool maskW(k, tile, j, i_g) maskW: _FillValue = 1 maskW: long_name = "wet/dry boolean mask for west face of tracer grid cell" maskW: coverage_content_type = modelResult maskW: coordinates = Z			
Comments			
True for grid cells with nonzero open vertical fraction along their 'west' face (hfacw > 0), otherwise false. although hfacw can vary though time, cells will never close if starting open and will never open if starting closed: hfacw(i,j,k,t) > 0 for all t, if hfacw(i,j,k,t=0) and hfacw(i,j,k,t) = 0 for all t, if hfacw(i,j,k,t=0) = 0. therefore, maskw is time invariant. note:			

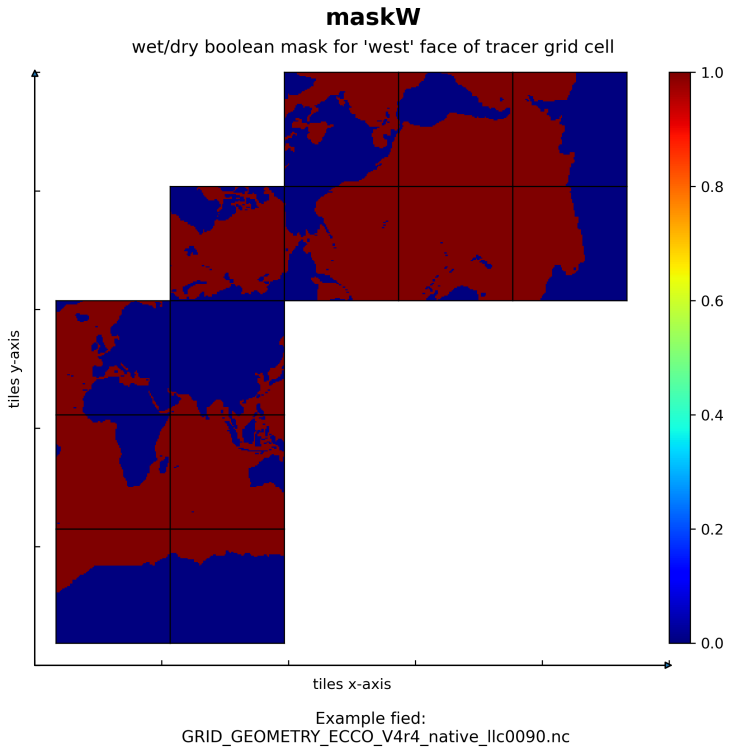


Figure 20: Dataset: GRID_GEOMETRY_ECCO, Variable: maskW

11.1.22 Native coordinates Variable: maskS

Table 11.22: Attributes description of the variable 'maskS' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
bool	maskS	Wet/dry boolean mask for 'south' face of tracer grid cell	N/A
Description of the variable in Common Data language (CDL)			
bool maskS(k, tile, j_g, i) maskS: _FillValue = 1 maskS: long_name = "wet/dry boolean mask for south face of tracer grid cell" maskS: coverage_content_type = modelResult maskS: coordinates = Z			
Comments			
True for grid cells with nonzero open vertical fraction along their 'south' face (hfacs > 0), otherwise false. although hfacs can vary though time, cells will never close if starting open and will never open if starting closed: hfacs(i,j,k,t) > 0 for all t, if hfacs(i,j,k,t=0) and hfacs(i,j,k,t) = 0 for all t, if hfacs(i,j,k,t=0) = 0. therefore, masks is time invariant. note:			

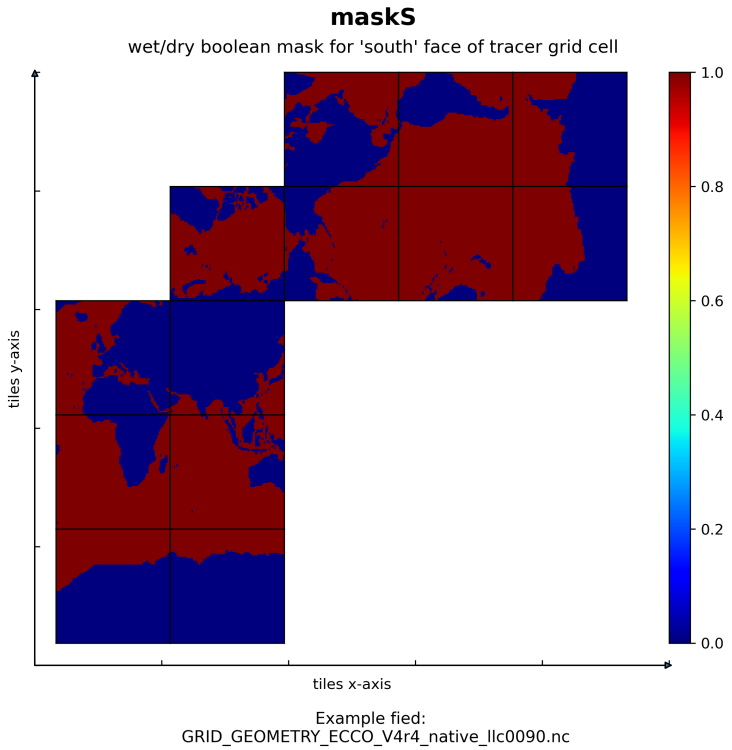


Figure 21: Dataset: GRID_GEOMETRY_ECCO, Variable: maskS

12 Native Dataset Groupings

12.1 Native dataset of ATM_SURFACE_TEMP_HUM_WIND_PRES

12.1.1 Overview

This dataset provides 2D fields of atmosphere surface temperature, humidity, winds, and pressure on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.1: Coordinates and Variables in the dataset ATM_SURFACE_TEMP_HUM_WIND_PRES

Variables	Description of data variables	Unit
EXFatemp	Atmosphere surface (2 m) air temperature	degree_K
EXFaqh	Atmosphere surface (2 m) specific humidity	kg kg-1
EXFuwind	Wind speed at 10m in the model +x direction	m s-1
EXFvwind	Wind speed at 10m in the model +y direction	m s-1
EXFwspee	Wind speed	m s-1
EXFpress	Atmosphere surface pressure	N m-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.1.2 Native Variable: EXFaqh

Table 12.2: Attributes description of the variable 'EXFaqh' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFaqh	Atmosphere surface (2 m) specific humidity	kg kg-1
Description of the variable in Common Data language (CDL)			
float32 EXFaqh(time, tile, j, i) EXFaqh: _FillValue = 9.96921e+36 EXFaqh: long_name = Atmosphere surface (2 m) specific humidity EXFaqh: units = kg kg: 1 EXFaqh: coverage_content_type = modelResult EXFaqh: standard_name = surface_specific_humidity EXFaqh: coordinates = time XC YC EXFaqh: valid_min = : 0.0014020215021446347 EXFaqh: valid_max = 0.03014513850212097			
Comments			
Surface (2 m) specific humidity over open water. note: sum of era-interim surface specific humidity and the control adjustment from ocean state estimation.			

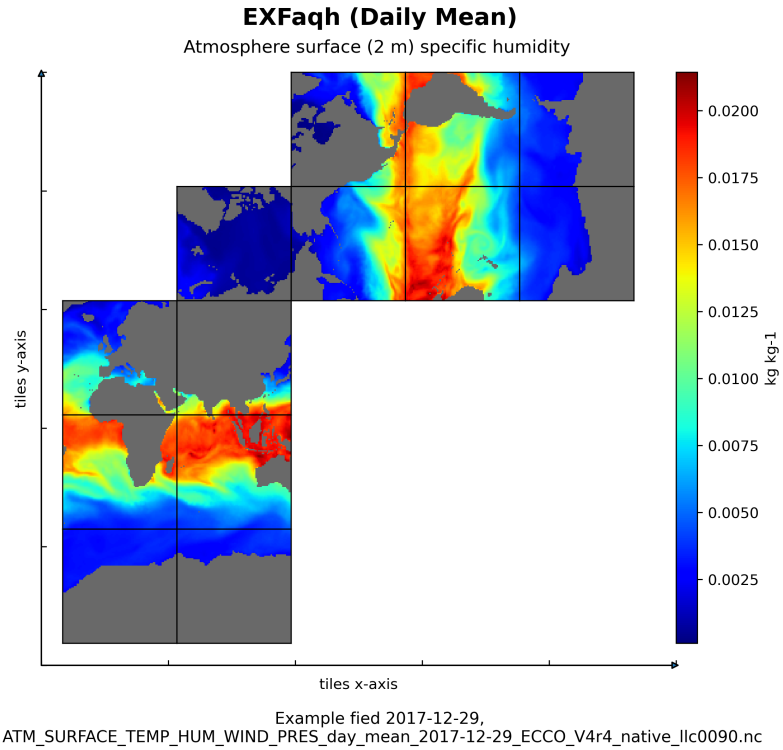


Figure 22: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFaqh

12.1.3 Native Variable: EXFatemp

Table 12.3: Attributes description of the variable 'EXFatemp' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFatemp	Atmosphere surface (2 m) air temperature	degree_K
Description of the variable in Common Data language (CDL)			
float32 EXFatemp(time, tile, j, i) EXFatemp: _FillValue = 9.96921e+36 EXFatemp: long_name = Atmosphere surface (2 m) air temperature EXFatemp: units = degree_K EXFatemp: coverage_content_type = modelResult EXFatemp: standard_name = air_temperature EXFatemp: coordinates = time XC YC EXFatemp: valid_min = 195.37054443359375 EXFatemp: valid_max = 312.8451232910156			
Comments			
Surface (2 m) air temperature over open water. note: sum of era-interim surface air temperature and the control adjustment from ocean state estimation.			

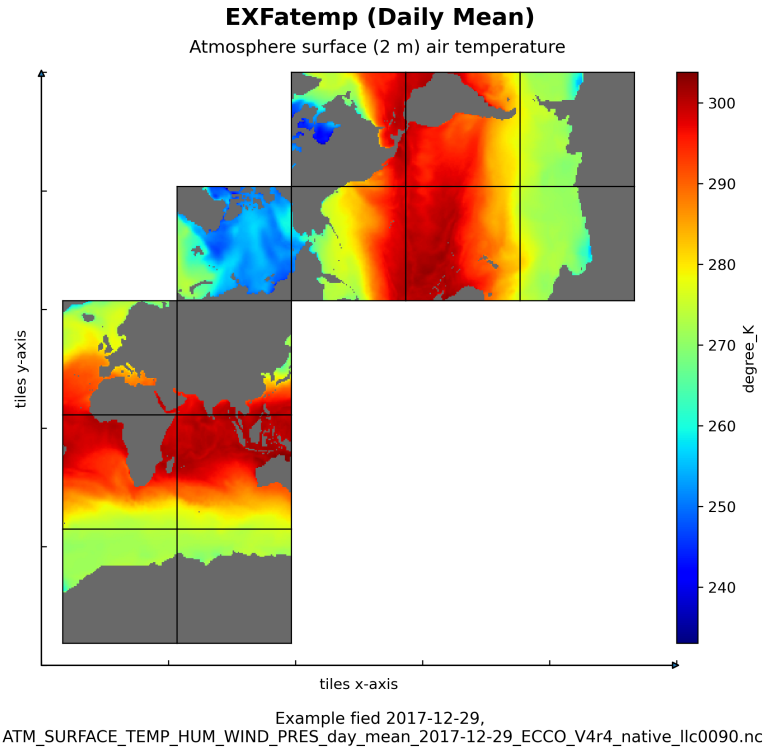


Figure 23: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFatemp

12.1.4 Native Variable: EXFpress

Table 12.4: Attributes description of the variable 'EXFpress' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFpress	Atmosphere surface pressure	N m-2
Description of the variable in Common Data language (CDL)			
float32 EXFpress(time, tile, j, i) EXFpress: _FillValue = 9.96921e+36 EXFpress: long_name = Atmosphere surface pressure EXFpress: units = N m: 2 EXFpress: coverage_content_type = modelResult EXFpress: standard_name = surface_air_pressure EXFpress: coordinates = time XC YC EXFpress: valid_min = 92044.171875 EXFpress: valid_max = 106314.7734375			
Comments			
Atmospheric pressure field at sea level. note: era-interim atmospheric pressure, with air tides removed using a variety of methods. not adjusted by the ocean state estimation.			

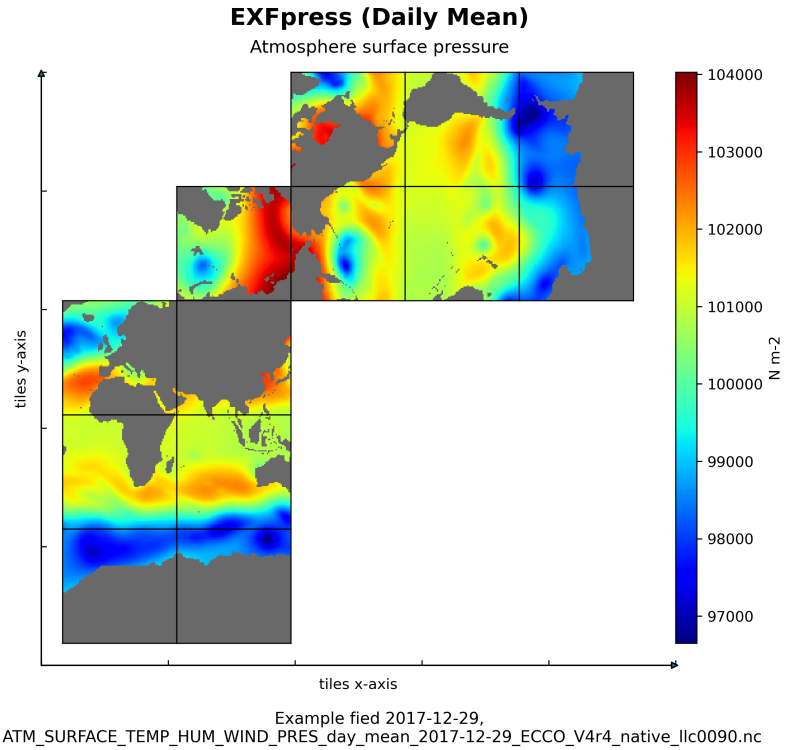


Figure 24: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFpress

12.1.5 Native Variable: EXFuwind

Table 12.5: Attributes description of the variable 'EXFuwind' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFuwind	Wind speed at 10m in the model +x direction	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFuwind(time, tile, j, i) EXFuwind: _FillValue = 9.96921e+36 EXFuwind: long_name = Wind speed at 10m in the model +x direction EXFuwind: units = m s: 1 EXFuwind: coverage_content_type = modelResult EXFuwind: standard_name = x_wind EXFuwind: coordinates = time XC YC EXFuwind: valid_min = : 34.528900146484375 EXFuwind: valid_max = 29.92486572265625			
Comments			
Wind speed at 10m in the +x direction at the tracer cell on the native model grid. note: ecco v4r4 is forced with wind stress (see exftaux) not vector winds converted to wind stress using bulk formulae. exfuwind is calculated by converting wind stress to vector wind using bulk formulae.			

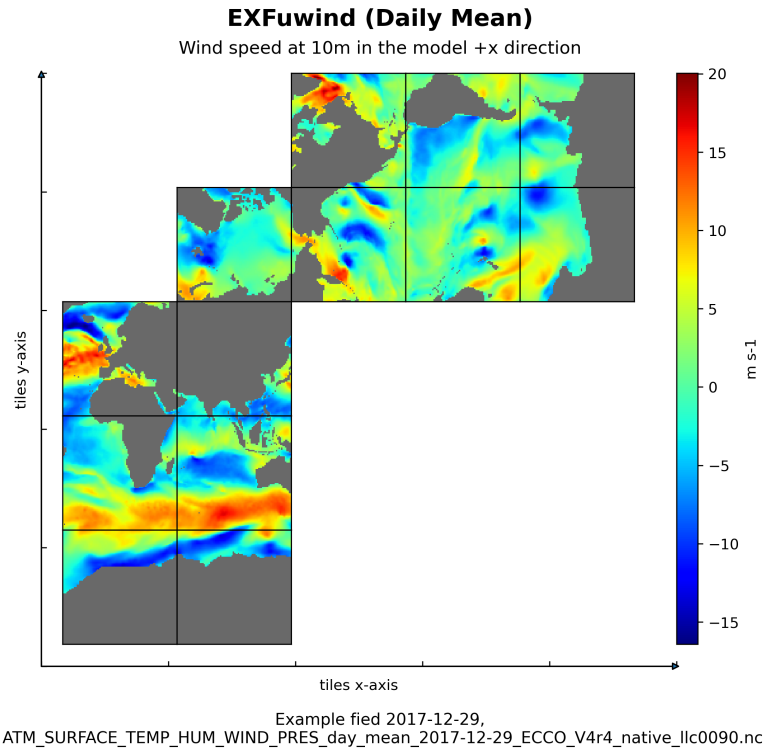


Figure 25: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFuwind

12.1.6 Native Variable: EXFvwind

Table 12.6: Attributes description of the variable 'EXFvwind' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFvwind	Wind speed at 10m in the model +y direction	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFvwind(time, tile, j, i) EXFvwind: _FillValue = 9.96921e+36 EXFvwind: long_name = Wind speed at 10m in the model +y direction EXFvwind: units = m s: 1 EXFvwind: coverage_content_type = modelResult EXFvwind: standard_name = y_wind EXFvwind: coordinates = time XC YC EXFvwind: valid_min = : 27.9254093170166 EXFvwind: valid_max = 45.065101623535156			
Comments			
Wind speed at 10m in the +y direction at the tracer cell on the native model grid. note: ecco v4r4 is forced with wind stress (see exftauy) not vector winds converted to wind stress using bulk formulae. exfvwind is calculated by converting wind stress to vector wind using bulk formulae.			

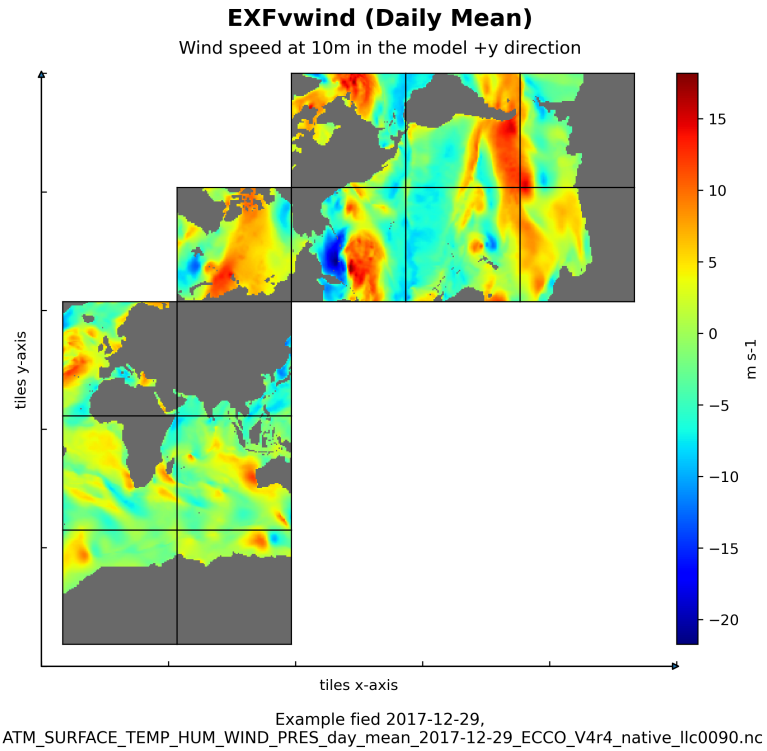


Figure 26: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFvwind

12.1.7 Native Variable: EXFwspee

Table 12.7: Attributes description of the variable 'EXFwspee' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFwspee	Wind speed	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFwspee(time, tile, j, i) EXFwspee: _FillValue = 9.96921e+36 EXFwspee: long_name = Wind speed EXFwspee: units = m s: 1 EXFwspee: coverage_content_type = modelResult EXFwspee: standard_name = wind_speed EXFwspee: coordinates = time XC YC EXFwspee: valid_min = 0.27271032333374023 EXFwspee: valid_max = 45.87086486816406			
Comments			
10-m wind speed magnitude (>= 0) over open water. only used for the calculation of air-sea fluxes using bulk formulae. note: not adjusted by the ocean state estimation and not necesarily consistent with exfuwind and exfvwind because exfuwind and exfvwind are calculated from exftaux and exftauy using bulk formulae. exfwspee != sqrt(exfuwind**2 + exfvwind**2.			

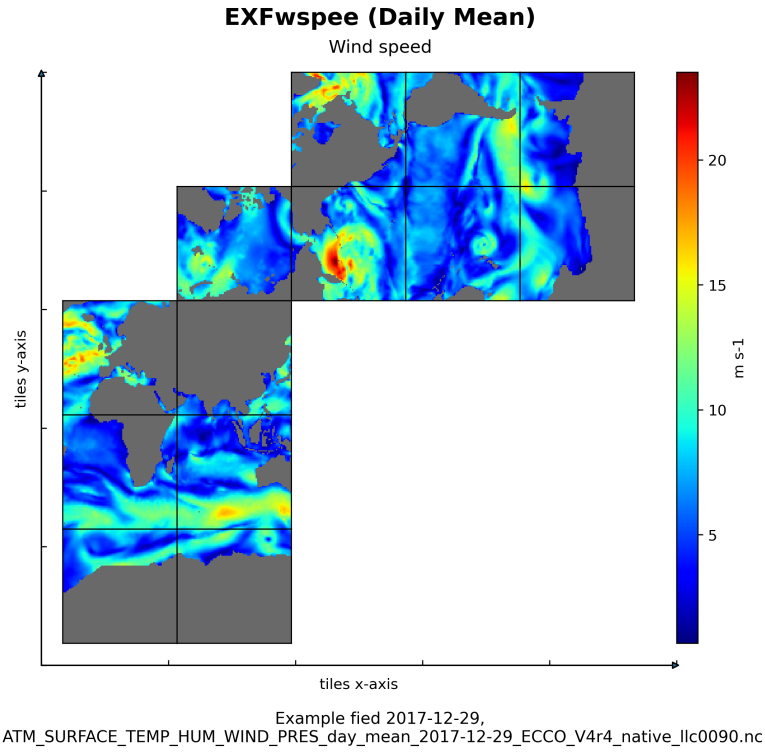


Figure 27: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFwspee

12.2 Native dataset of OCEAN_3D_MIXING_COEFFS

12.2.1 Overview

This dataset provides 3D time-invariant coefficients for the Gent-McWilliams and Redi parameterizations and background vertical diffusivity on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate.

Table 12.8: Coordinates and Variables in the dataset OCEAN_3D_MIXING_COEFFS_ECCO

Variables	Description of data variables	Unit
DIFFKR	Vertical diffusivity	m2 s-1
KAPGM	Gent-mcwilliams diffusivity	m2 s-1
KAPREDI	Along-isopycnal diffusivity	m2 s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of top/bottom face of tracer grid cell	m
Zu	Depth of bottom face of tracer grid cell	m
Zl	Depth of top face of tracer grid cell	m
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of top and bottom faces of tracer grid cell	–none–

12.2.2 Native Variable: DIFFKR

Table 12.9: Attributes description of the variable 'DIFFKR' from OCEAN_3D_MIXING_COEFFS's dataset.

Storage Type	Variable Name	Description	Unit
float32	DIFFKR	Vertical diffusivity	m2 s-1
Description of the variable in Common Data language (CDL)			
float32 DIFFKR(k, tile, j, i) DIFFKR: _FillValue = 9.96921e+36 DIFFKR: coverage_content_type = modelResult DIFFKR: long_name = Vertical diffusivity DIFFKR: units = m2 s: 1 DIFFKR: valid_min = 1e: 06 DIFFKR: valid_max = 0.0001854995 DIFFKR: coordinates = Z XC YC			
Comments			
Background vertical diffusion coefficient for temperature and salinity. total vertical diffusivity includes background diffusivity plus contributions from the ggl90 vertical mixing and the gent-mcwilliams/redi parameterizations. note: diffkr is a model control variable and has been optimized from a spatially-invariant first-guess value of 1e-5 m2 s-1.			

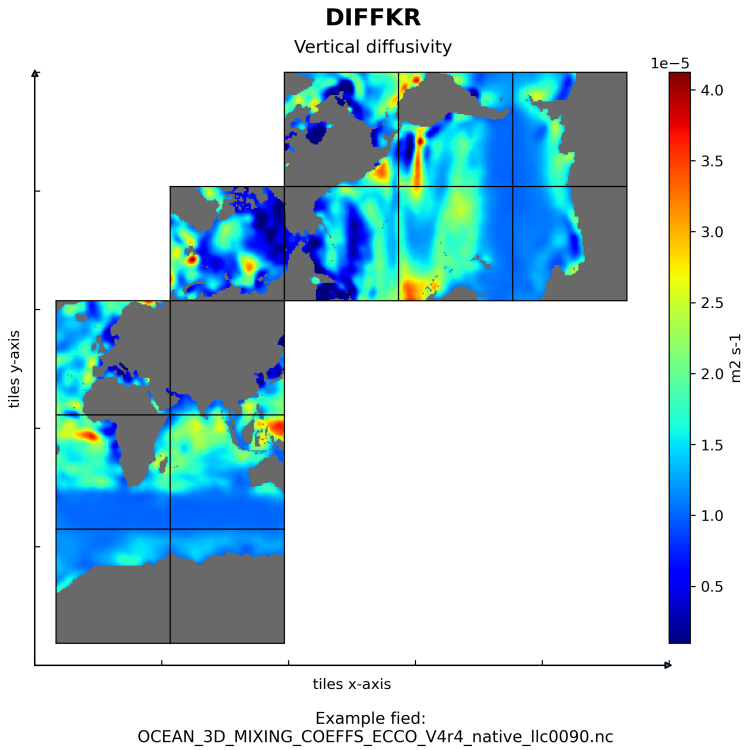


Figure 28: Dataset: OCEAN_3D_MIXING_COEFFS, Variable: DIFFKR

12.2.3 Native Variable: KAPGM

Table 12.10: Attributes description of the variable 'KAPGM' from OCEAN_3D_MIXING_COEFFS's dataset.

Storage Type	Variable Name	Description	Unit
float32	KAPGM	Gent-mcwilliams diffusivity	m2 s-1
Description of the variable in Common Data language (CDL)			
float32 KAPGM(k, tile, j, i) KAPGM: _FillValue = 9.96921e+36 KAPGM: coverage_content_type = modelResult KAPGM: long_name = Gent: McWilliams diffusivity KAPGM: units = m2 s: 1 KAPGM: valid_min = 100.0 KAPGM: valid_max = 10000.0 KAPGM: coordinates = Z XC YC			
Comments			
Gent-mcwilliams diffusivity coefficient as described in gent and mcwilliams (1990, jpo). note: kapgm is a model control variable and has been optimized from a spatially invariant first guess of 1e3 m2 s-1.			

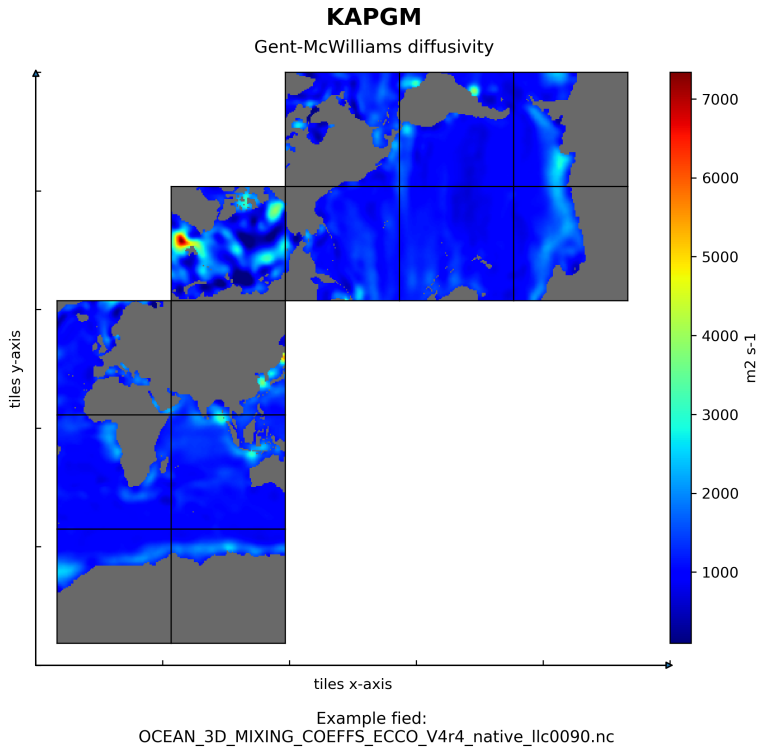


Figure 29: Dataset: OCEAN_3D_MIXING_COEFFS, Variable: KAPGM

12.2.4 Native Variable: KAPREDI

Table 12.11: Attributes description of the variable 'KAPREDI' from OCEAN_3D_MIXING_COEFFS's dataset.

Storage Type	Variable Name	Description	Unit
float32	KAPREDI	Along-isopycnal diffusivity	m2 s-1
Description of the variable in Common Data language (CDL)			
float32 KAPREDI(k, tile, j, i) KAPREDI: _FillValue = 9.96921e+36 KAPREDI: coverage_content_type = modelResult KAPREDI: long_name = Along: isopycnal diffusivity KAPREDI: units = m2 s: 1 KAPREDI: valid_min = 100.0 KAPREDI: valid_max = 10000.0 KAPREDI: coordinates = Z XC YC			
Comments			
Redi along-isopycnal diffusivity coefficient as described in redi (1982, jpo). note: kapredi is a model control variable and has been optimized from a spatially invariant first guess of 1e3 m2 s-1.			

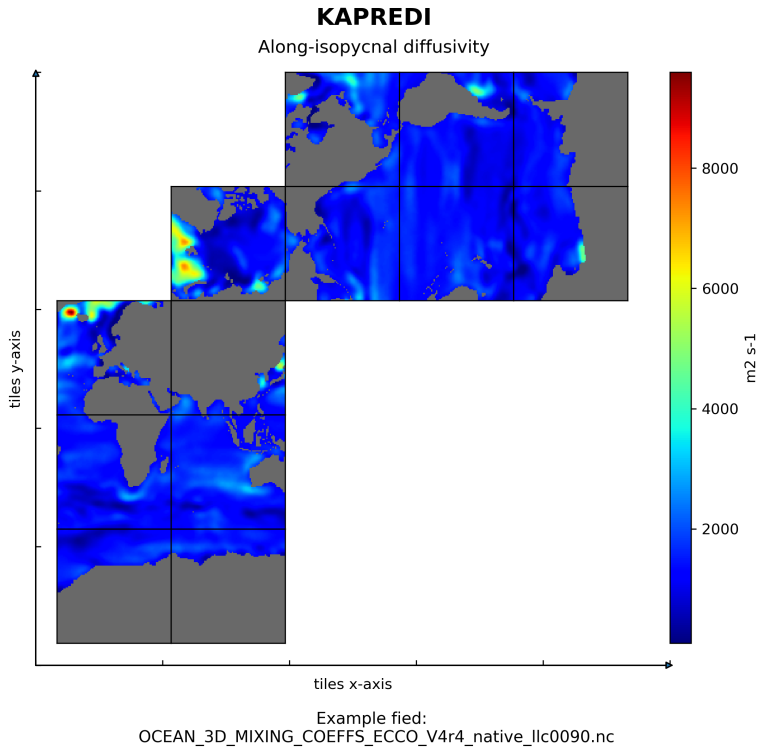


Figure 30: Dataset: OCEAN_3D_MIXING_COEFFS, Variable: KAPREDI

12.3 Native dataset of OCEAN_3D_MOMENTUM_TEND

12.3.1 Overview

This dataset provides three-dimensional ocean momentum tendency on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on

daily-average and monthly-average time resolution.

Table 12.12: Coordinates and Variables in the dataset OCEAN_3D_MOMENTUM_TEND

Variables	Description of data variables	Unit
Um_dPHdx	Momentum tendency in the model +x direction	m s-2
Vm_dPHdy	Momentum tendency in the model +y direction	m s-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.3.2 Native Variable: Um_dPHdx

Table 12.13: Attributes description of the variable 'Um_dPHdx' from OCEAN_3D_MOMENTUM_TEND's dataset.

Storage Type	Variable Name	Description	Unit
float32	Um_dPHdx	Momentum tendency in the model +x direction	m s-2
Description of the variable in Common Data language (CDL)			
float32 Um_dPHdx(time, k, tile, j, i_g) Um_dPHdx: _FillValue = 9.96921e+36 Um_dPHdx: long_name = Momentum tendency in the model +x direction Um_dPHdx: units = m s: 2 Um_dPHdx: mate = Vm_dPHdy Um_dPHdx: coverage_content_type = modelResult Um_dPHdx: coordinates = time Z Um_dPHdx: valid_min = : 0.0010651482734829187 Um_dPHdx: valid_max = 0.0011411579325795174			
Comments			
Momentum tendency in the +x direction due to the hydrostatic pressure gradient at the 'u' face of the native model grid cell . note: the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.			

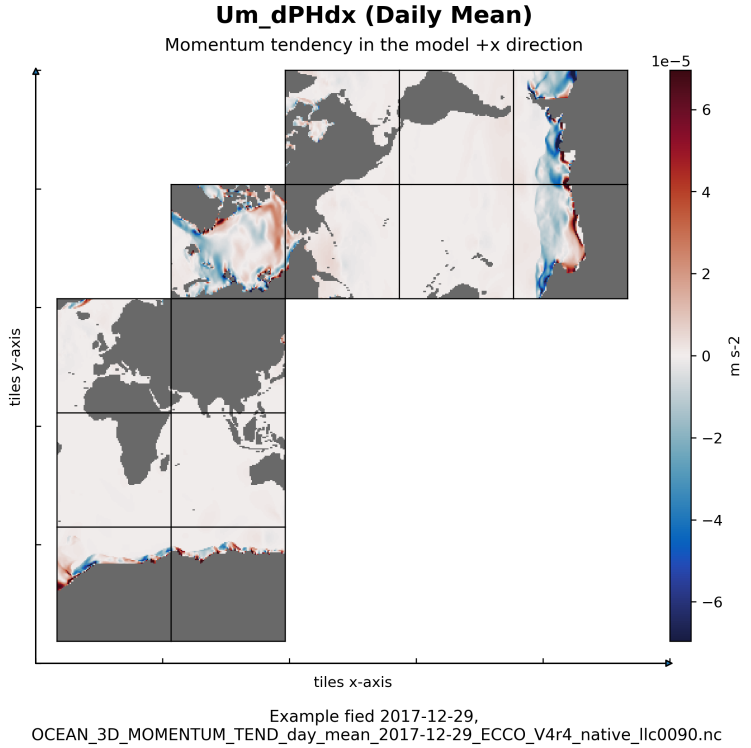


Figure 31: Dataset: OCEAN_3D_MOMENTUM_TEND, Variable: Um_dPHdx

12.3.3 Native Variable: Vm_dPHdy

Table 12.14: Attributes description of the variable 'Vm_dPHdy' from OCEAN_3D_MOMENTUM_TEND's dataset.

Storage Type	Variable Name	Description	Unit
float32	Vm_dPHdy	Momentum tendency in the model +y direction	m s-2
Description of the variable in Common Data language (CDL)			
float32 Vm_dPHdy(time, k, tile, j_g, i) Vm_dPHdy: _FillValue = 9.96921e+36 Vm_dPHdy: long_name = Momentum tendency in the model +y direction Vm_dPHdy: units = m s: 2 Vm_dPHdy: mate = Um_dPHdx Vm_dPHdy: coverage_content_type = modelResult Vm_dPHdy: coordinates = time Z Vm_dPHdy: valid_min = : 0.0015932790702208877 Vm_dPHdy: valid_max = 0.0008858146029524505			
Comments			
Momentum tendency in the +y direction due to the hydrostatic pressure gradient at the 'v' face of the native model grid cell . note: the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.			

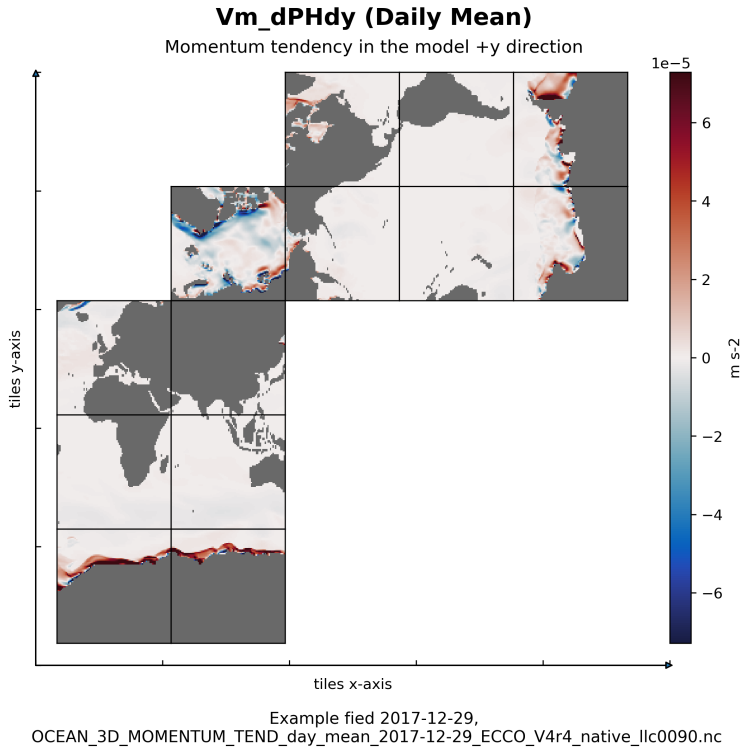


Figure 32: Dataset: OCEAN_3D_MOMENTUM_TEND, Variable: Vm_dPHdy

12.4 Native dataset of OCEAN_3D_SALINITY_FLUX

12.4.1 Overview

This dataset provides three-dimensional ocean salinity fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. ADV*_SLT and DF*_SLT terms are salinity fluxes. oceSPtnd is salt tendency per unit area (g m-2 s-1), not salinity flux.

Table 12.15: Coordinates and Variables in the dataset OCEAN_3D_SALINITY_FLUX

Variables	Description of data variables	Unit
ADVx_SLT	Lateral advective flux of salinity in the model +x direction	1e-3 m3 s-1
DFxE_SLT	Lateral diffusive flux of salinity in the model +x direction	1e-3 m3 s-1
ADVy_SLT	Lateral advective flux of salinity in the model +y direction	1e-3 m3 s-1
DFyE_SLT	Lateral diffusive flux of salinity in the model +y direction	1e-3 m3 s-1
ADVr_SLT	Vertical advective flux of salinity	1e-3 m3 s-1
DFrE_SLT	Vertical diffusive flux of salinity (explicit term)	1e-3 m3 s-1
DFrI_SLT	Vertical diffusive flux of salinity (implicit term)	1e-3 m3 s-1
oceSPtnd	Salt tendency due to the vertical transport of salt in high-salinity brine plumes	g m-2 s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.4.2 Native Variable: ADVr_SLT

Table 12.16: Attributes description of the variable 'ADVr_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVr_SLT	Vertical advective flux of salinity	1e-3 m3 s-1
Description of the variable in Common Data language (CDL)			
float32 ADVr_SLT(time, k_l, tile, j, i) ADVr_SLT: _FillValue = 9.96921e+36 ADVr_SLT: long_name = Vertical advective flux of salinity ADVr_SLT: units = 1e: 3 m3 s: 1 ADVr_SLT: coverage_content_type = modelResult ADVr_SLT: direction = >0 decreases salinity (SALT) ADVr_SLT: coordinates = XC Zl YC time ADVr_SLT: valid_min = : 324149856.0 ADVr_SLT: valid_max = 263294624.0			
Comments			
Vertical advective flux of salinity (salt) in the +z direction through the top 'w' face of the tracer cell on the native model grid. note: in the arakawa-c grid, vertical flux quantities are staggered relative to the tracer cells with indexing such that +advr_slt(i,j,k_l) corresponds to upward +z fluxes through the top 'w' face of the tracer cell at (i,j,k). salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html			

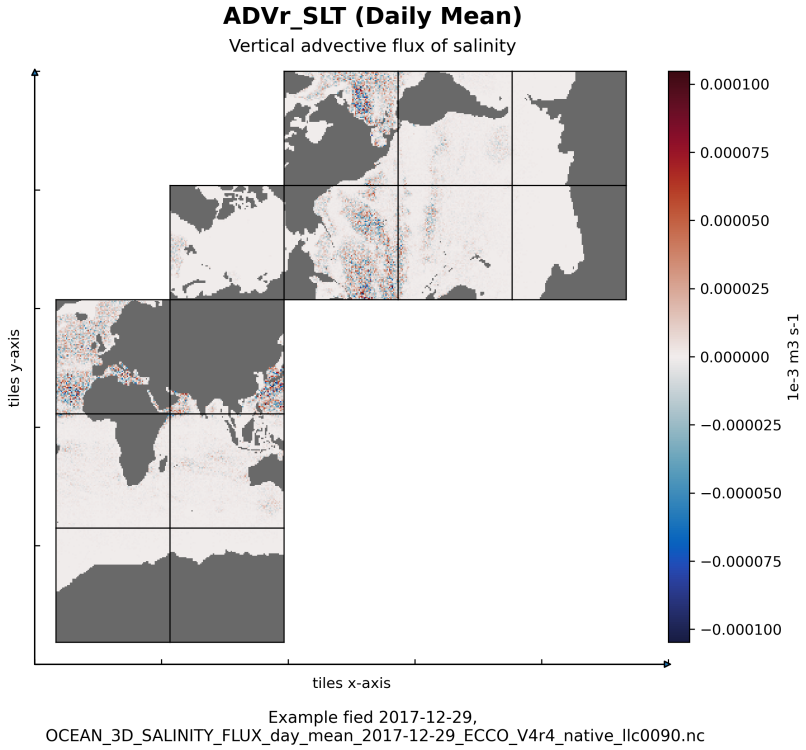


Figure 33: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: ADVr_SLT

12.4.3 Native Variable: ADVx_SLT

Table 12.17: Attributes description of the variable 'ADVx_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVx_SLT	Lateral advective flux of salinity in the model +x direction	1e-3 m3 s-1

Description of the variable in Common Data language (CDL)

```
float32 ADVx_SLT(time, k, tile, j, i_g)
    ADVx_SLT: _FillValue = 9.96921e+36
    ADVx_SLT: long_name = Lateral advective flux of salinity in the model +x direction
    ADVx_SLT: units = 1e: 3 m3 s: 1
    ADVx_SLT: mate = ADVy_SLT
    ADVx_SLT: coverage_content_type = modelResult
    ADVx_SLT: direction = >0 increases salinity (SALT)
    ADVx_SLT: coordinates = Z time
    ADVx_SLT: valid_min = : 181830224.0
    ADVx_SLT: valid_max = 260411296.0
```

Comments

Lateral advective flux of salinity (salt) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advx_slt(i_g,j,k) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html

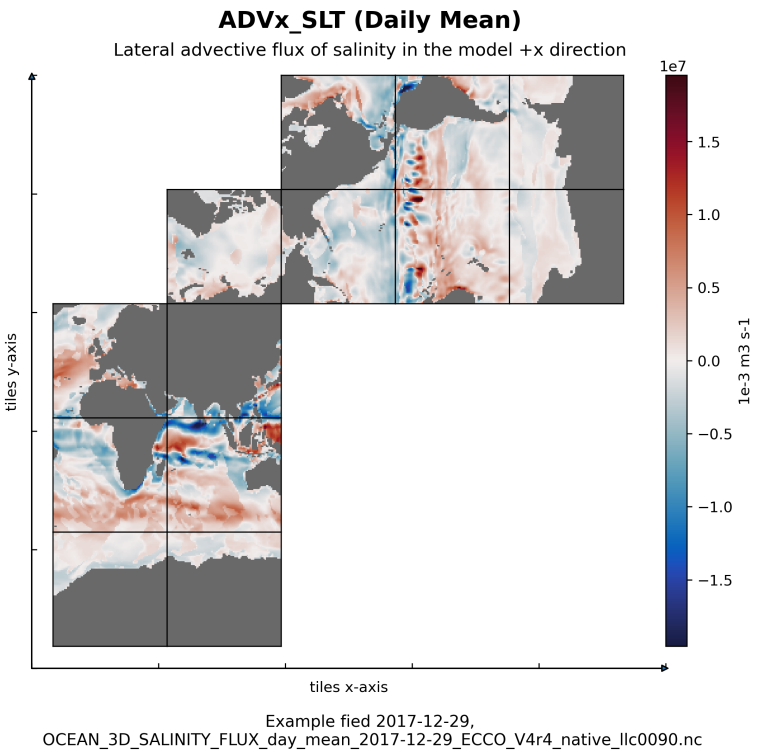


Figure 34: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: ADVx_SLT

12.4.4 Native Variable: ADVy_SLT

Table 12.18: Attributes description of the variable 'ADVy_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVy_SLT	Lateral advective flux of salinity in the model +y direction	1e-3 m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVy_SLT(time, k, tile, j_g, i)
ADVy_SLT: _FillValue = 9.96921e+36
ADVy_SLT: long_name = Lateral advective flux of salinity in the model +y direction
ADVy_SLT: units = 1e: 3 m3 s: 1
ADVy_SLT: mate = ADVx_SLT
ADVy_SLT: coverage_content_type = modelResult
ADVy_SLT: direction = >0 increases salinity (SALT)
ADVy_SLT: coordinates = Z time
ADVy_SLT: valid_min = : 137905760.0
ADVy_SLT: valid_max = 164271664.0

Comments

Lateral advective flux of salinity (salt) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advy_slt(i,j_g,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html

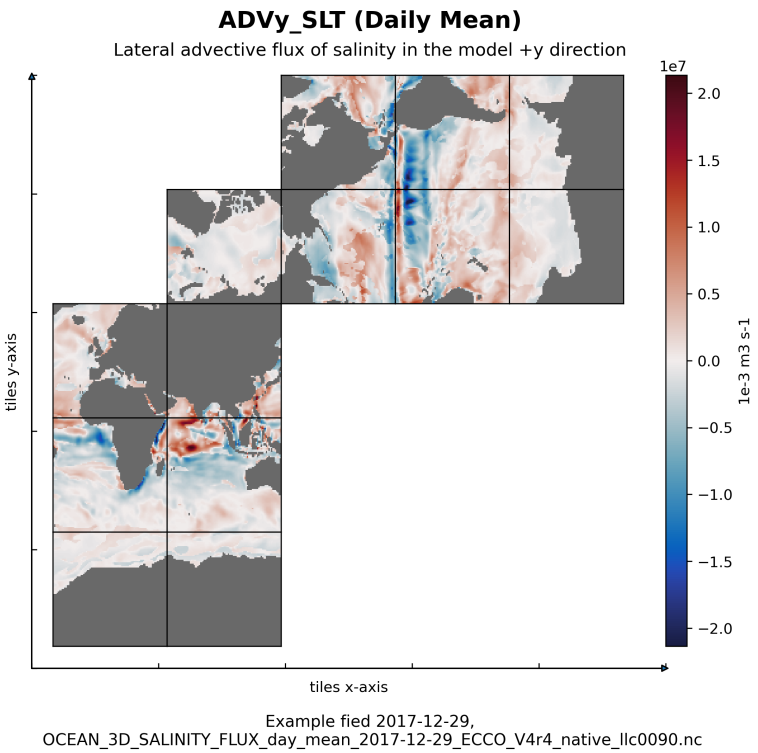


Figure 35: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: ADVy_SLT

12.4.5 Native Variable: DFrE_SLT

Table 12.19: Attributes description of the variable 'DFrE_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFrE_SLT	Vertical diffusive flux of salinity (explicit term)	1e-3 m3 s-1
Description of the variable in Common Data language (CDL)			
float32 DFrE_SLT(time, k_l, tile, j, i) DFrE_SLT: _FillValue = 9.96921e+36 DFrE_SLT: long_name = Vertical diffusive flux of salinity (explicit term) DFrE_SLT: units = 1e: 3 m3 s: 1 DFrE_SLT: coverage_content_type = modelResult DFrE_SLT: direction = >0 decreases salinity (SALT) DFrE_SLT: coordinates = XC Zl YC time DFrE_SLT: valid_min = : 1074719.375 DFrE_SLT: valid_max = 471215.75			
Comments			
The explicit term of the vertical diffusive flux of salinity (salt) in the +z direction through the top 'w' face of the tracer cell on the native model grid. in the ecco v4r4 model, an implicit scheme is used to calculate vertical diffusive tracer fluxes due to background diffusivity and the kwz component of the gm-redi tensor (vertical flux as a function of vertical gradient) while an explicit scheme is used to calculate the vertical diffusive fluxes from the kwx and kwy components of the gm-redi tensor (vertical flux as a function of horizontal gradient). both implicit and explicit components of vertical diffusive flux of salinity are provided. note: in the arakawa-c grid, vertical flux quantities are staggered relative to the tracer cells with indexing such that +dfre_slt(i,j,k_l) corresponds to upward +z fluxes through the top 'w' face of the tracer cell at (i,j,k). salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html			

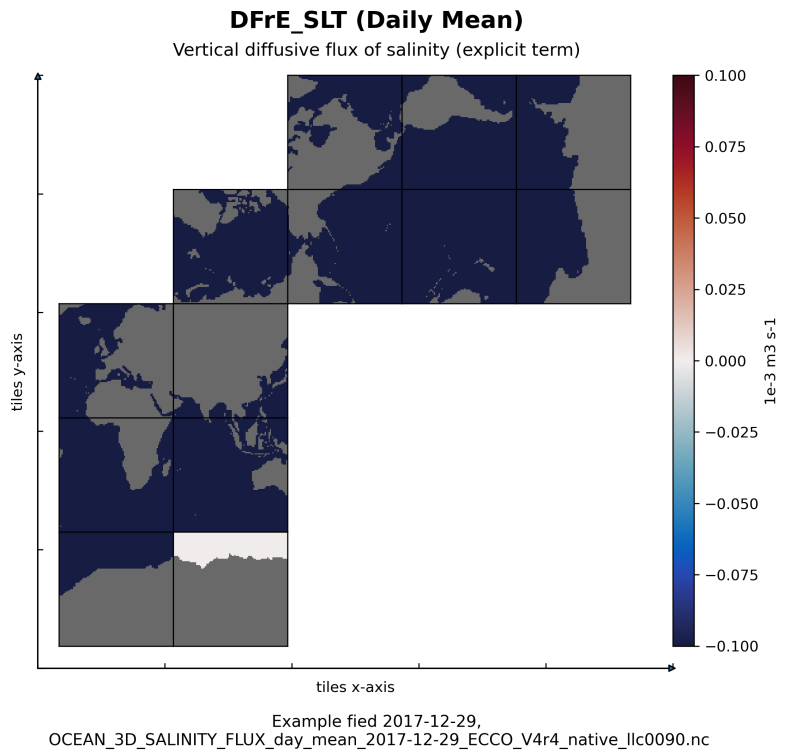


Figure 36: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: DFrE_SLT

12.4.6 Native Variable: DFrI_SLT

Table 12.20: Attributes description of the variable 'DFrI_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFrI_SLT	Vertical diffusive flux of salinity (implicit term)	1e-3 m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFrI_SLT(time, k_l, tile, j, i)
DFrI_SLT: _FillValue = 9.96921e+36
DFrI_SLT: long_name = Vertical diffusive flux of salinity (implicit term)
DFrI_SLT: units = 1e: 3 m3 s: 1
DFrI_SLT: coverage_content_type = modelResult
DFrI_SLT: direction = >0 decreases salinity (SALT)
DFrI_SLT: coordinates = XC Zl YC time
DFrI_SLT: valid_min = : 30609048.0
DFrI_SLT: valid_max = 3197643.0

Comments

The implicit term of the vertical diffusive flux of salinity (salt) in the +z direction through the top 'w' face of the tracer cell on the native model grid. in the ecco v4r4 model, an implicit scheme is used to calculate vertical diffusive tracer fluxes due to background diffusivity and the kwz component of the gm-redi tensor (vertical flux as a function of vertical gradient) while an explicit scheme is used to calculate the vertical diffusive fluxes from the kwx and kwy components of the gm-redi tensor (vertical flux as a function of horizontal gradient). both implicit and explicit components of vertical diffusive flux of salinity are provided. note: in the arakawa-c grid, vertical flux quantities are staggered relative to the tracer cells with indexing such that +dfri_slt(i,j,k_l) corresponds to upward +z fluxes through the top face 'w' of the tracer cell at (i,j,k). salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html

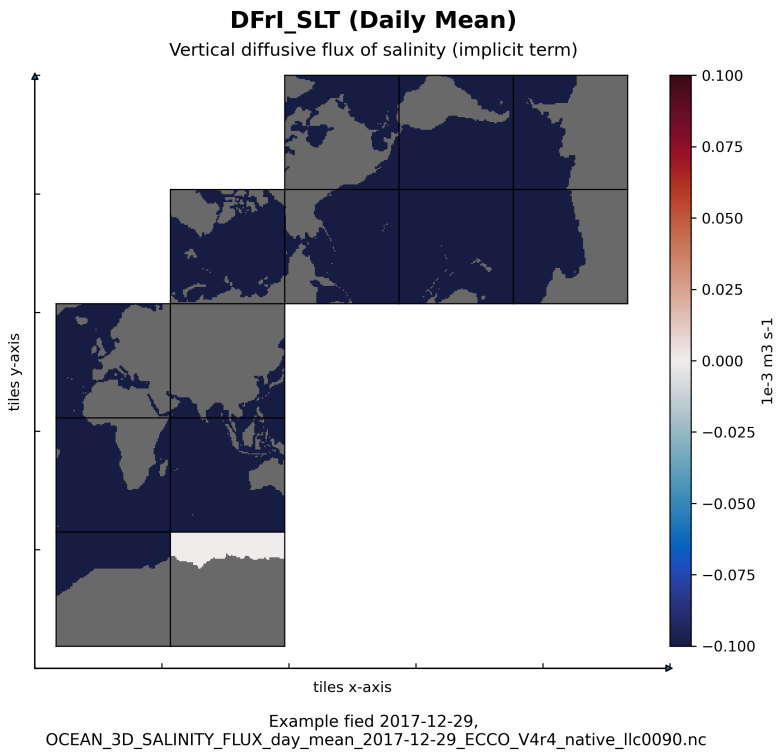


Figure 37: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: DFrI_SLT

12.4.7 Native Variable: DFxE_SLT

Table 12.21: Attributes description of the variable 'DFxE_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFxE_SLT	Lateral diffusive flux of salinity in the model +x direction	1e-3 m3 s-1

Description of the variable in Common Data language (CDL)

```
float32 DFxE_SLT(time, k, tile, j, i_g)
    DFxE_SLT: _FillValue = 9.96921e+36
    DFxE_SLT: long_name = Lateral diffusive flux of salinity in the model +x direction
    DFxE_SLT: units = 1e: 3 m3 s: 1
    DFxE_SLT: mate = DFyE_SLT
    DFxE_SLT: coverage_content_type = modelResult
    DFxE_SLT: direction = >0 increases salinity (SALT)
    DFxE_SLT: coordinates = Z time
    DFxE_SLT: valid_min = : 125908.03125
    DFxE_SLT: valid_max = 192716.484375
```

Comments

Lateral diffusive flux of salinity (salt) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfxe_slt(i_g,j,k) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html

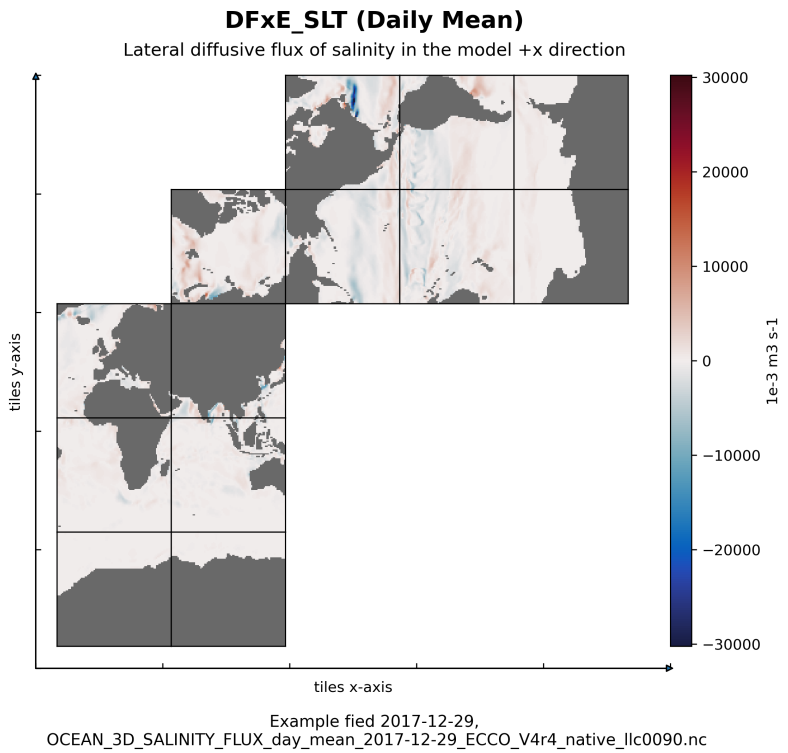


Figure 38: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: DFxE_SLT

12.4.8 Native Variable: DFyE_SLT

Table 12.22: Attributes description of the variable 'DFyE_SLT' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFyE_SLT	Lateral diffusive flux of salinity in the model +y direction	1e-3 m3 s-1

Description of the variable in Common Data language (CDL)

```
float32 DFyE_SLT(time, k, tile, j_g, i)
    DFyE_SLT: _FillValue = 9.96921e+36
    DFyE_SLT: long_name = Lateral diffusive flux of salinity in the model +y direction
    DFyE_SLT: units = 1e: 3 m3 s: 1
    DFyE_SLT: mate = DFxE_SLT
    DFyE_SLT: coverage_content_type = modelResult
    DFyE_SLT: direction = >0 increases salinity (SALT)
    DFyE_SLT: coordinates = Z time
    DFyE_SLT: valid_min = : 114959.2109375
    DFyE_SLT: valid_max = 154227.140625
```

Comments

Lateral diffusive flux of salinity (salt) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfye_slt(i,j_g,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. salinity defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html

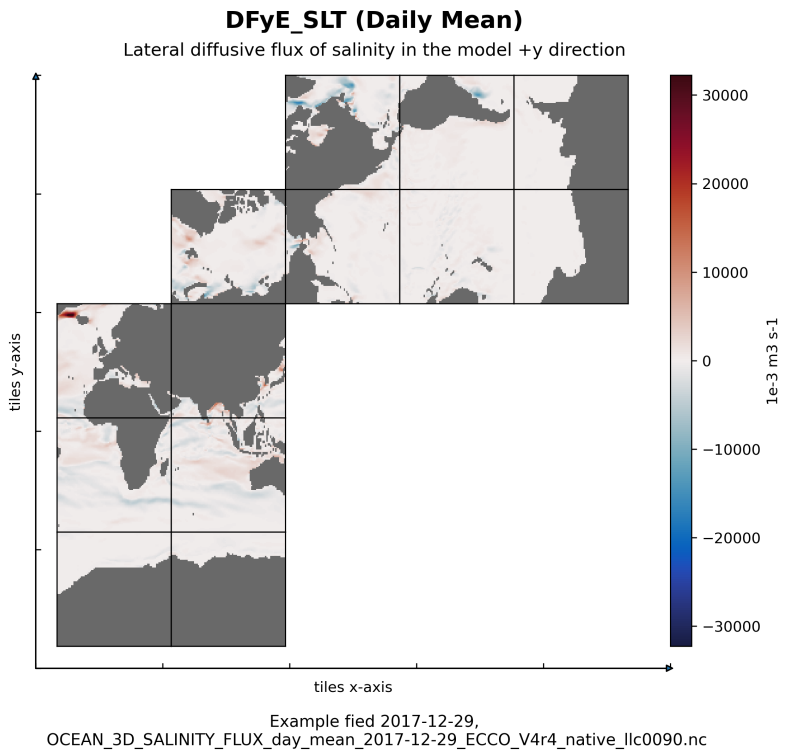


Figure 39: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: DFyE_SLT

12.4.9 Native Variable: oceSPtnd

Table 12.23: Attributes description of the variable 'oceSPtnd' from OCEAN_3D_SALINITY_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceSPtnd	Salt tendency due to the vertical transport of salt in high-salinity brine plumes	g m-2 s-1

Description of the variable in Common Data language (CDL)

float32 oceSPtnd(time, k, tile, j, i)
oceSPtnd: _FillValue = 9.96921e+36
oceSPtnd: long_name = Salt tendency due to the vertical transport of salt in high: salinity brine plumes
oceSPtnd: units = g m: 2 s: 1
oceSPtnd: coverage_content_type = modelResult
oceSPtnd: direction = >0 increases salinity (SALT)
oceSPtnd: coordinates = XC Z YC time
oceSPtnd: valid_min = 0.0
oceSPtnd: valid_max = 0.021119138225913048

Comments

Salt tendency due to the vertical transport of salt in high-salinity brine plumes. note: units are grams of salt per square meter per second, not salinity per square meter per second.

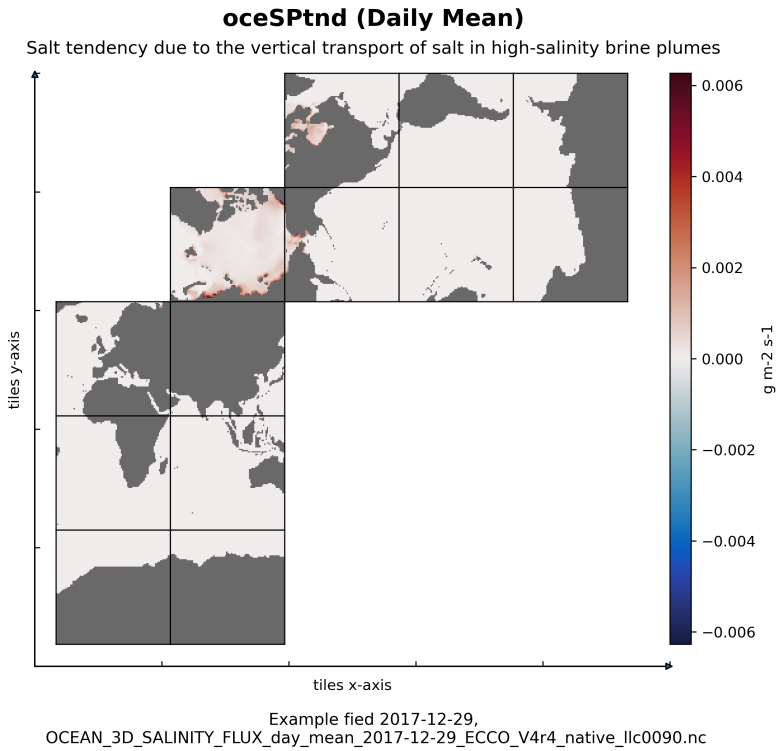


Figure 40: Dataset: OCEAN_3D_SALINITY_FLUX, Variable: oceSPtnd

12.5 Native dataset of OCEAN_3D_TEMPERATURE_FLUX

12.5.1 Overview

This dataset provides three-dimensional ocean potential temperature fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. ADV*_TH and DF*_TH terms are potential temperature fluxes.

Table 12.24: Coordinates and Variables in the dataset OCEAN_3D_TEMPERATURE_FLUX

Variables	Description of data variables	Unit
ADVx_TH	Lateral advective flux of potential temperature in the model +x direction	degree_C m3 s-1
DFxE_TH	Lateral diffusive flux of potential temperature in the model +x direction	degree_C m3 s-1
ADVy_TH	Lateral advective flux of potential temperature in the model +y direction	degree_C m3 s-1
DFyE_TH	Lateral diffusive flux of potential temperature in the model +y direction.	degree_C m3 s-1
ADVr_TH	Vertical advective flux of potential temperature	degree_C m3 s-1
DFrE_TH	Vertical diffusive flux of potential temperature (explicit term)	degree_C m3 s-1
DFrI_TH	Vertical diffusive flux of potential temperature (implicit term)	degree_C m3 s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.5.2 Native Variable: ADVr_TH

Table 12.25: Attributes description of the variable 'ADVr_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVr_TH	Vertical advective flux of potential temperature	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVr_TH(time, k_l, tile, j, i)
ADVr_TH: _FillValue = 9.96921e+36
ADVr_TH: long_name = Vertical advective flux of potential temperature
ADVr_TH: units = degree_C m3 s: 1
ADVr_TH: coverage_content_type = modelResult
ADVr_TH: direction = >0 decreases potential temperature (THETA)
ADVr_TH: coordinates = XC YC time Zl
ADVr_TH: valid_min = : 125094904.0
ADVr_TH: valid_max = 179459344.0

Comments

Vertical advective flux of potential temperature (theta) in the +z direction through the top 'w' face of the tracer cell on the native model grid. note: in the arakawa-c grid, vertical flux quantities are staggered relative to the tracer cells with indexing such that +advr_th(i,j,k_l) corresponds to upward +z fluxes through the top 'w' face of the tracer cell at (i,j,k)

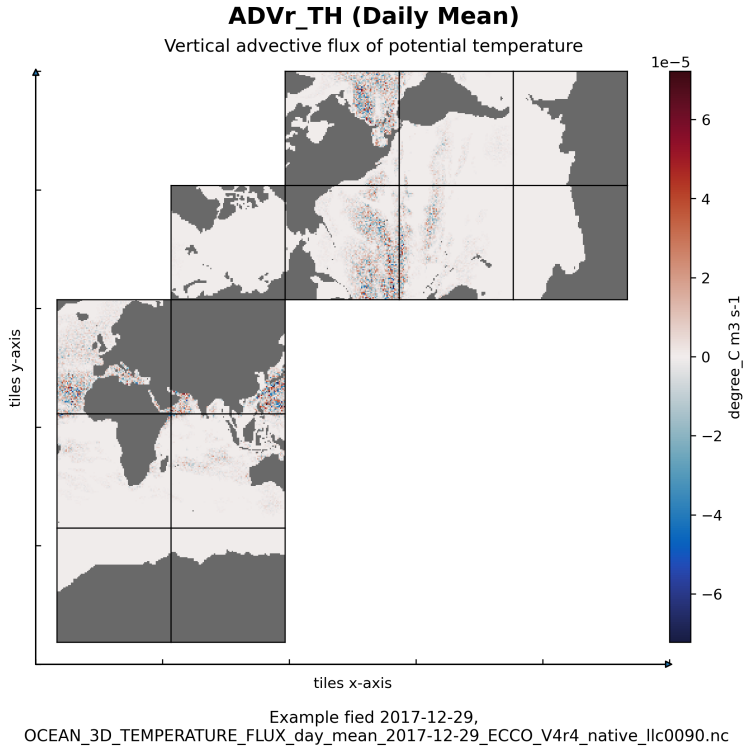


Figure 41: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: ADVr_TH

12.5.3 Native Variable: ADVx_TH

Table 12.26: Attributes description of the variable 'ADVx_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVx_TH	Lateral advective flux of potential temperature in the model +x direction	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVx_TH(time, k, tile, j, i_g)
ADVx_TH: _FillValue = 9.96921e+36
ADVx_TH: long_name = Lateral advective flux of potential temperature in the model +x direction
ADVx_TH: units = degree_C m3 s: 1
ADVx_TH: mate = ADVy_TH
ADVx_TH: coverage_content_type = modelResult
ADVx_TH: direction = >0 increases potential temperature (THETA)
ADVx_TH: coordinates = time Z
ADVx_TH: valid_min = : 38210700.0
ADVx_TH: valid_max = 38049636.0

Comments

Lateral advective flux of potential temperature (theta) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advx_th(i_g,j,k) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's lat-lon-cap (llc) curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

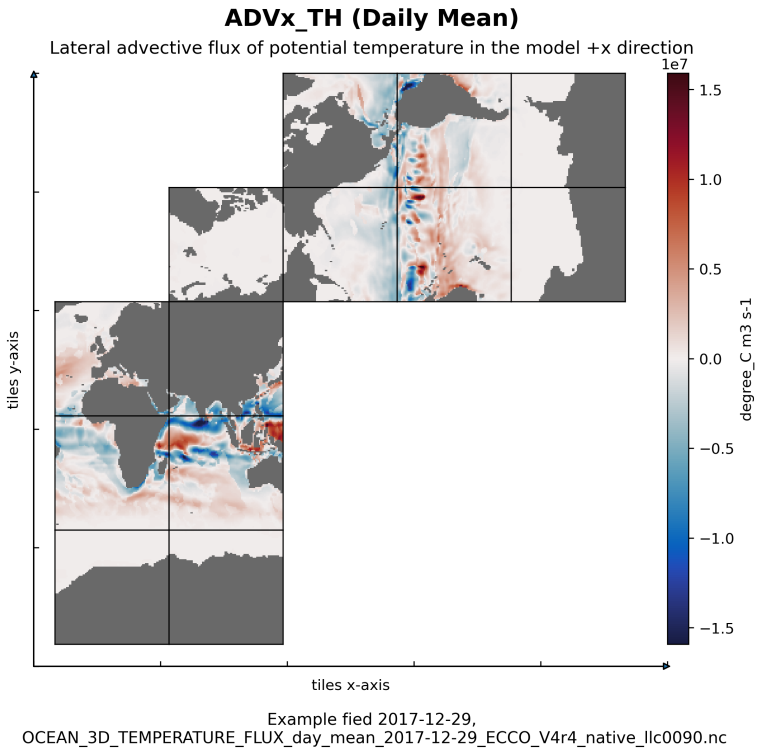


Figure 42: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: ADVx_TH

12.5.4 Native Variable: ADVy_TH

Table 12.27: Attributes description of the variable 'ADVy_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVy_TH	Lateral advective flux of potential temperature in the model +y direction	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVy_TH(time, k, tile, j_g, i)
ADVy_TH: _FillValue = 9.96921e+36
ADVy_TH: long_name = Lateral advective flux of potential temperature in the model +y direction
ADVy_TH: units = degree_C m3 s: 1
ADVy_TH: mate = ADVx_TH
ADVy_TH: coverage_content_type = modelResult
ADVy_TH: direction = >0 increases potential temperature (THETA)
ADVy_TH: coordinates = time Z
ADVy_TH: valid_min = : 43909120.0
ADVy_TH: valid_max = 56347884.0

Comments

Lateral advective flux of potential temperature (theta) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advy_th(i,j_g,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

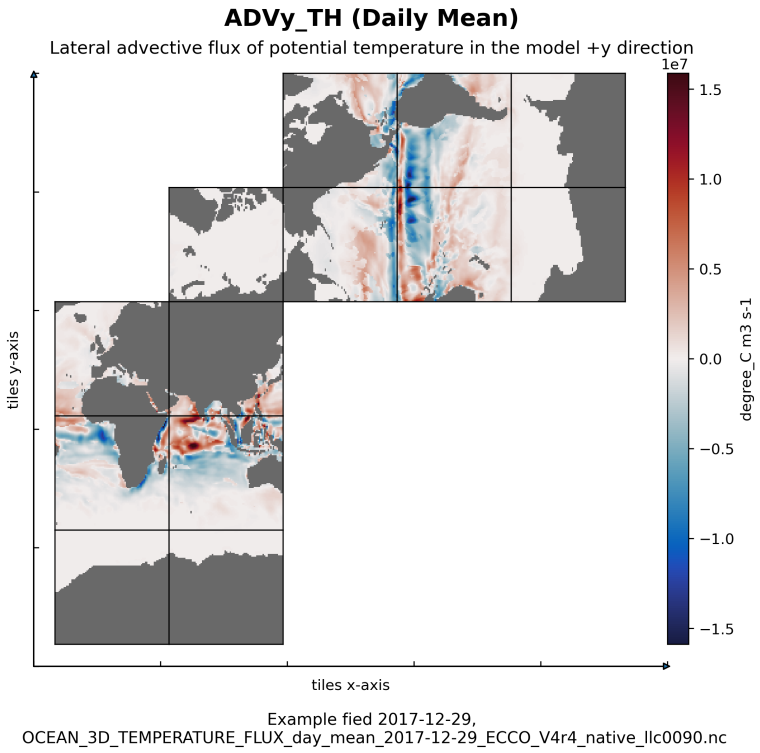


Figure 43: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: ADVy_TH

12.5.5 Native Variable: DFrE_TH

Table 12.28: Attributes description of the variable 'DFrE_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFrE_TH	Vertical diffusive flux of potential temperature (explicit term)	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

```
float32 DFrE_TH(time, k_l, tile, j, i)
    DFrE_TH: _FillValue = 9.96921e+36
    DFrE_TH: long_name = Vertical diffusive flux of potential temperature (explicit term)
    DFrE_TH: units = degree_C m3 s: 1
    DFrE_TH: coverage_content_type = modelResult
    DFrE_TH: direction = >0 decreases potential temperature (THETA)
    DFrE_TH: coordinates = XC YC time Zl
    DFrE_TH: valid_min = : 2632379.75
    DFrE_TH: valid_max = 2659875.25
```

Comments

The explicit term of the vertical diffusive flux of potential temperature (theta) in the +z direction through the top 'w' face of the tracer cell on the native model grid. in the ecco v4r4 model, an implicit scheme is used to calculate vertical diffusive tracer fluxes due to background diffusivity and the kwz component of the gm-redi tensor (vertical flux as a function of vertical gradient) while an explicit scheme is used to calculate the vertical diffusive fluxes from the kwx and kwy components of the gm-redi tensor (vertical flux as a function of horizontal gradient). both implicit and explicit components of vertical diffusive flux of potential temperature are provided. note: in the arakawa-c grid, vertical flux quantities are staggered relative to the tracer cells with indexing such that +dfre_th(i,j,k_l) corresponds to upward +z fluxes through the top 'w' face of the tracer cell at (i,j,k).

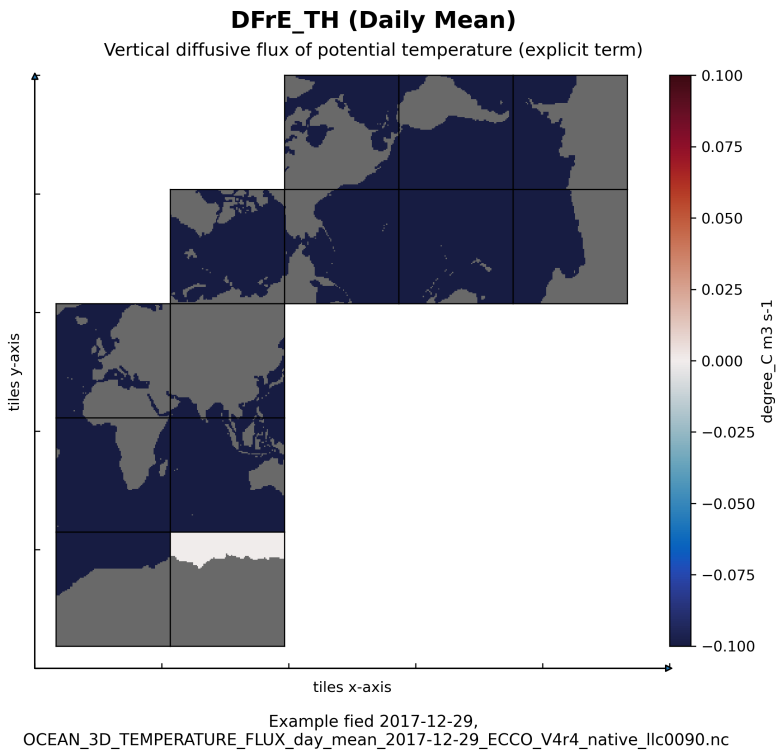


Figure 44: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: DFrE_TH

12.5.6 Native Variable: DFrI_TH

Table 12.29: Attributes description of the variable 'DFrI_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFrI_TH	Vertical diffusive flux of potential temperature (implicit term)	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFrI_TH(time, k_l, tile, j, i)
DFrI_TH: _FillValue = 9.96921e+36
DFrI_TH: long_name = Vertical diffusive flux of potential temperature (implicit term)
DFrI_TH: units = degree_C m3 s: 1
DFrI_TH: coverage_content_type = modelResult
DFrI_TH: direction = >0 decreases potential temperature (THETA)
DFrI_TH: coordinates = XC YC time Zl
DFrI_TH: valid_min = : 104210688.0
DFrI_TH: valid_max = 23574302.0

Comments

The implicit term of the vertical diffusive flux of potential temperature (theta) in the +z direction through the top 'w' face of the tracer cell on the native model grid. in the ecco v4r4 model, an implicit scheme is used to calculate vertical diffusive tracer fluxes due to background diffusivity and the kwz component of the gm-redi tensor (vertical flux as a function of vertical gradient) while an explicit scheme is used to calculate the vertical diffusive fluxes from the kwx and kwy components of the gm-redi tensor (vertical flux as a function of horizontal gradient). both implicit and explicit components of vertical diffusive flux of potential temperature are provided. note: in the arakawa-c grid, vertical flux quantities are staggered relative to the tracer cells with indexing such that +dfri_th(i,j,k_l) corresponds to upward +z fluxes through the top 'w' face of the tracer cell at (i,j,k)

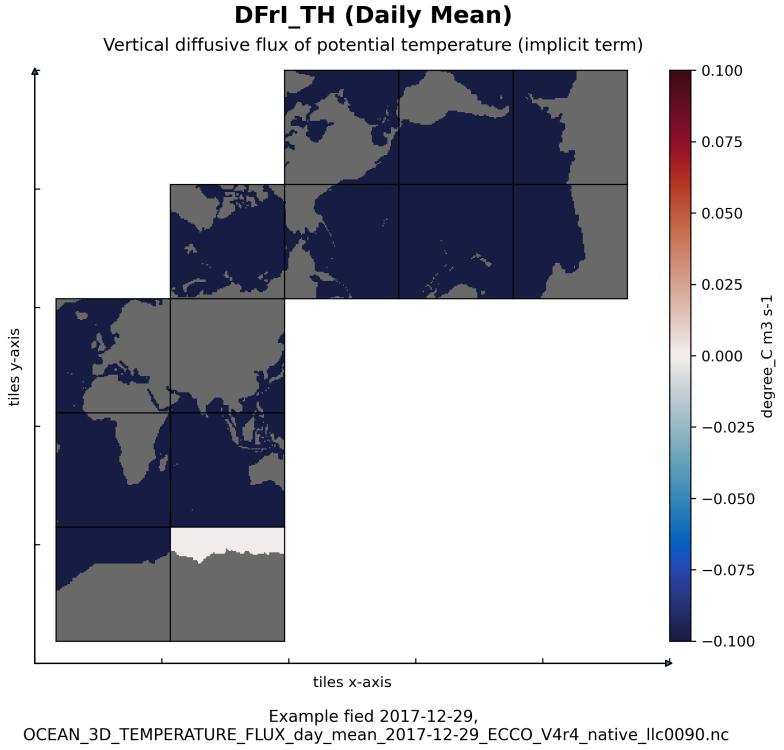


Figure 45: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: DFrI_TH

12.5.7 Native Variable: DFxE_TH

Table 12.30: Attributes description of the variable 'DFxE_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFxE_TH	Lateral diffusive flux of potential temperature in the model +x direction	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFxE_TH(time, k, tile, j, i_g)
DFxE_TH: _FillValue = 9.96921e+36
DFxE_TH: long_name = Lateral diffusive flux of potential temperature in the model +x direction
DFxE_TH: units = degree_C m3 s: 1
DFxE_TH: mate = DFyE_TH
DFxE_TH: coverage_content_type = modelResult
DFxE_TH: direction = >0 increases potential temperature (THETA)
DFxE_TH: coordinates = time Z
DFxE_TH: valid_min = : 582494.125
DFxE_TH: valid_max = 698695.75

Comments

Lateral diffusive flux of potential temperature (theta) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfxe_th(i_g,j,k) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

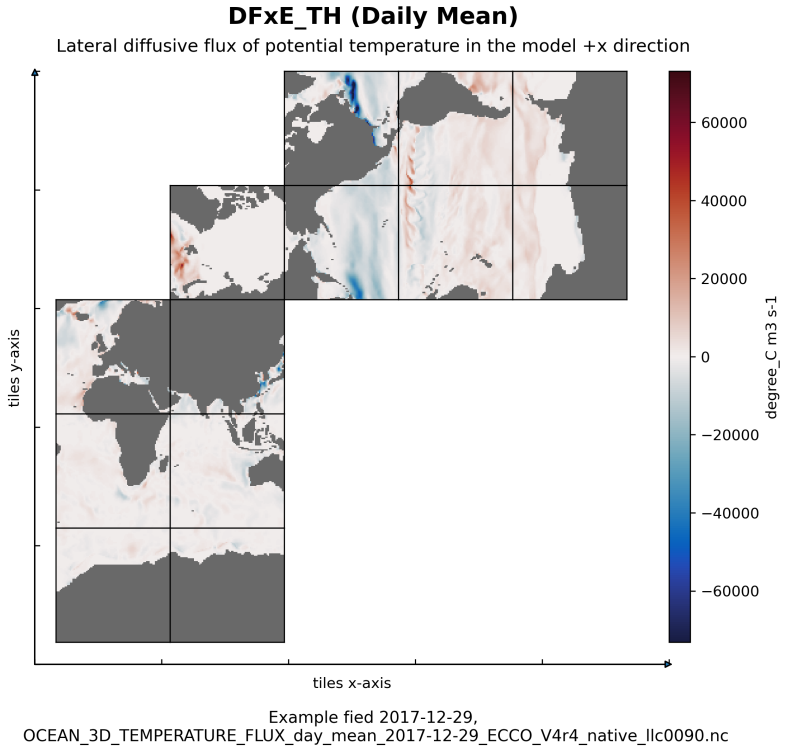


Figure 46: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: DFxE_TH

12.5.8 Native Variable: DFyE_TH

Table 12.31: Attributes description of the variable 'DFyE_TH' from OCEAN_3D_TEMPERATURE_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFyE_TH	Lateral diffusive flux of potential temperature in the model +y direction.	degree_C m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFyE_TH(time, k, tile, j_g, i)
DFyE_TH: _FillValue = 9.96921e+36
DFyE_TH: long_name = Lateral diffusive flux of potential temperature in the model +y direction.
DFyE_TH: units = degree_C m3 s: 1
DFyE_TH: mate = DFxE_TH
DFyE_TH: coverage_content_type = modelResult
DFyE_TH: direction = >0 increases potential temperature (THETA)
DFyE_TH: coordinates = time Z
DFyE_TH: valid_min = : 421044.78125
DFyE_TH: valid_max = 1053781.25

Comments

Lateral diffusive flux of potential temperature (theta) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfye_th(i,j_g,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

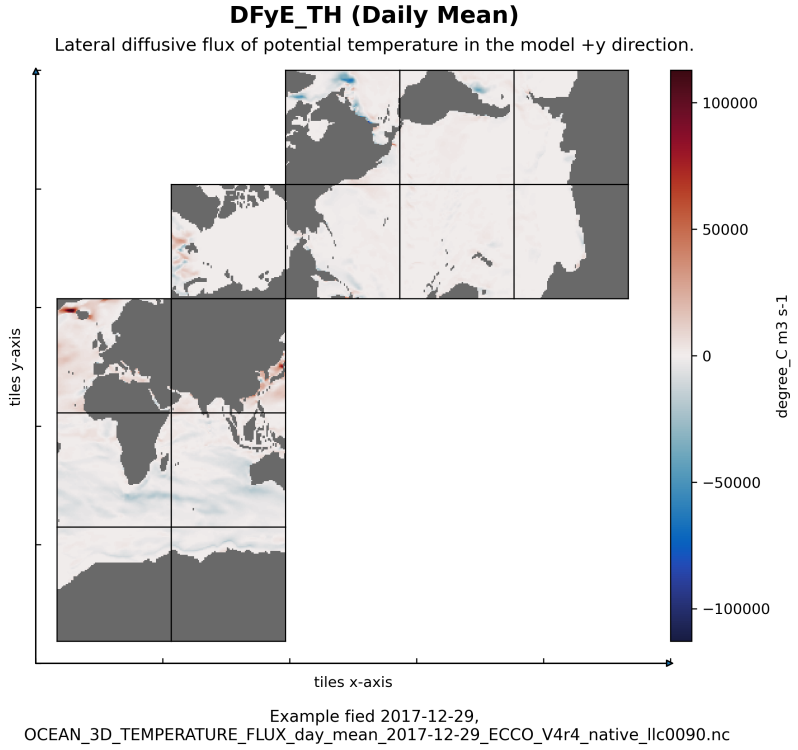


Figure 47: Dataset: OCEAN_3D_TEMPERATURE_FLUX, Variable: DFyE_TH

12.6 Native dataset of OCEAN_3D_VOLUME_FLUX

12.6.1 Overview

This dataset provides three-dimensional ocean volume fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Volume flux in +x direction = UVELMASS drF dyG. Volume flux in +y direction = VVELMASS drF dxG. Volume flux in +z direction = WVELMASS drA.

Table 12.32: Coordinates and Variables in the dataset OCEAN_3D_VOLUME_FLUX

Variables	Description of data variables	Unit
UVELMASS	Horizontal velocity in the model +x direction per unit area of the grid cell 'u' face	m s-1
VVELMASS	Horizontal velocity in the model +y direction per unit area of the grid cell 'v' face	m s-1 m3 m-3
WVELMASS	Grid cell face-averaged vertical velocity in the model +z direction.	m s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.6.2 Native Variable: UVELMASS

Table 12.33: Attributes description of the variable 'UVELMASS' from OCEAN_3D_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	UVELMASS	Horizontal velocity in the model +x direction per unit area of the grid cell 'u' face	m s-1

Description of the variable in Common Data language (CDL)

float32 UVELMASS(time, k, tile, j, i_g)
UVELMASS: _FillValue = 9.96921e+36
UVELMASS: long_name = "Horizontal velocity in the model +x direction per unit area of the grid cell u face"
UVELMASS: units = m s: 1
UVELMASS: mate = VVELMASS
UVELMASS: coverage_content_type = modelResult
UVELMASS: direction = >0 increases volume
UVELMASS: coordinates = Z time
UVELMASS: valid_min = : 2.115365505218506
UVELMASS: valid_max = 2.037726554870605

Comments

Horizontal velocity in the model +x direction averaged over the area of the tracer grid cell 'u' face on the native model grid ('u' grid cell face area = drf dyg). accounts for partial cells (hfacw < 1) and for time-varying grid cell thickness (z* coordinate system). volume flux in +x = uvelmass drf dyg. note: in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +uvelmass(i,j,k) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k). uvelmass can be used for volume flux calculations because it accounts for the grid cell thicknesses variations in the +x direction (hfacw) with time (z* coordinate system). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. see vvelmass and wvelmass

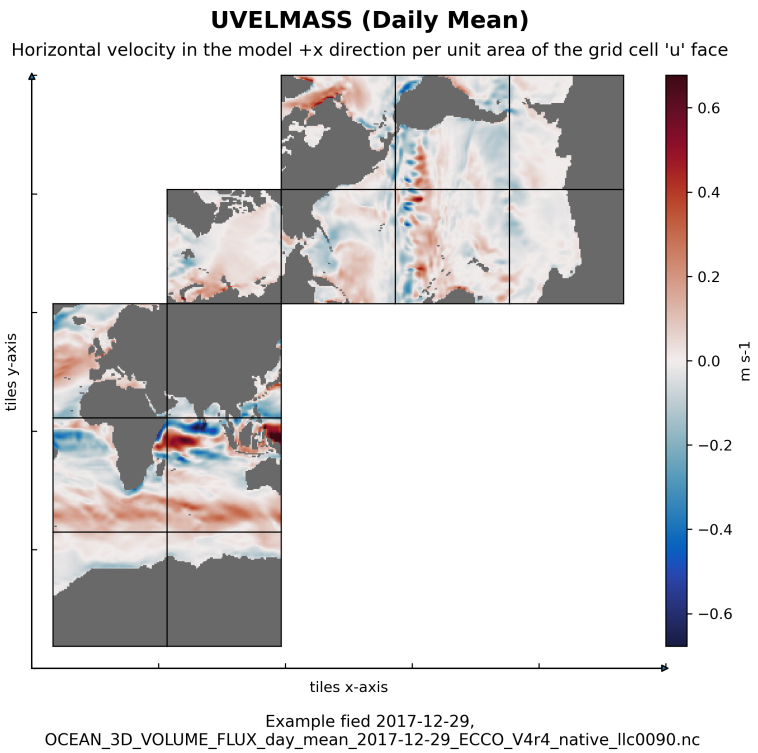


Figure 48: Dataset: OCEAN_3D_VOLUME_FLUX, Variable: UVELMASS

12.6.3 Native Variable: VVELMASS

Table 12.34: Attributes description of the variable 'VVELMASS' from OCEAN_3D_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	VVELMASS	Horizontal velocity in the model +y direction per unit area of the grid cell 'v' face	m s-1 m3 m-3
Description of the variable in Common Data language (CDL)			
float32 VVELMASS(time, k, tile, j_g, i) VVELMASS: _FillValue = 9.96921e+36 VVELMASS: long_name = "Horizontal velocity in the model +y direction per unit area of the grid cell v face" VVELMASS: units = m s: 1 m3 m: 3 VVELMASS: mate = UVELMASS VVELMASS: coverage_content_type = modelResult VVELMASS: direction = >0 increases volume VVELMASS: coordinates = Z time VVELMASS: valid_min = : 1.7897182703018188 VVELMASS: valid_max = 1.9216758012771606			
Comments			
Horizontal velocity in the model +y direction averaged over the area of the tracer grid cell 'v' face on the native model grid ('v' grid cell face area = drf dxg). accounts for partial cells (hfacs < 1) and for time-varying grid cell thickness (z* coordinate system). volume flux in +y = vvelmass drf dxg. note: in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +vvelmass(i,j,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k). vvelmass can be used for volume flux calculations because it accounts for grid cell thicknesses variations in the +y direction (hfacs) with time (z* coordinate system). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. see uvelmass and wvelmass.			

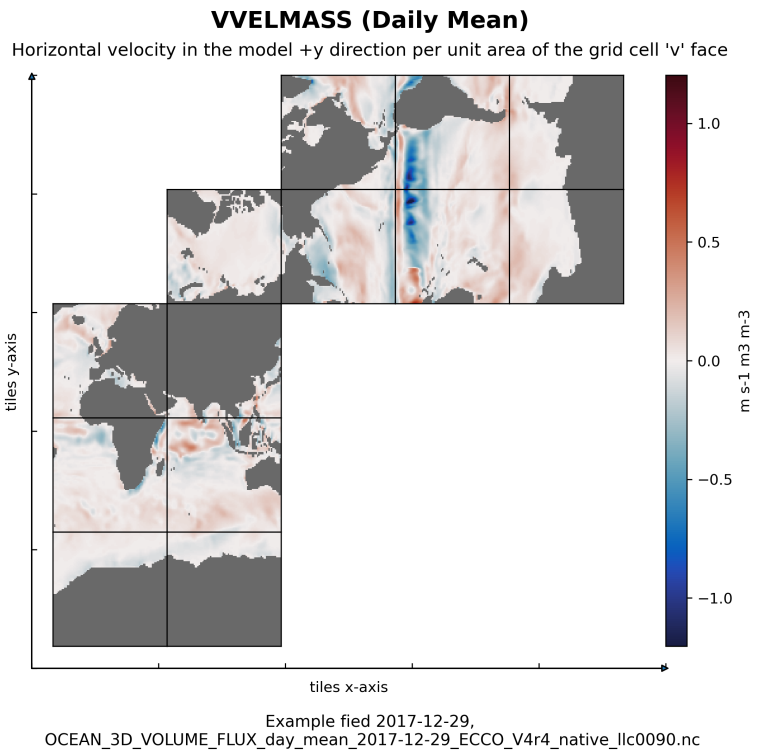


Figure 49: Dataset: OCEAN_3D_VOLUME_FLUX, Variable: VVELMASS

12.6.4 Native Variable: WVELMASS

Table 12.35: Attributes description of the variable 'WVELMASS' from OCEAN_3D_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	WVELMASS	Grid cell face-averaged vertical velocity in the model +z direction.	m s-1

Description of the variable in Common Data language (CDL)

float32 WVELMASS(time, k_l, tile, j, i)
WVELMASS: _FillValue = 9.96921e+36
WVELMASS: long_name = Grid cell face: averaged vertical velocity in the model +z direction.
WVELMASS: units = m s: 1
WVELMASS: coverage_content_type = modelResult
WVELMASS: direction = >0 decreases volume
WVELMASS: standard_name = upward_sea_water_velocity
WVELMASS: coordinates = YC Zl time XC
WVELMASS: valid_min = : 0.0023150660563260317
WVELMASS: valid_max = 0.0016380994347855449

Comments

Vertical velocity in the +z direction at the top 'w' face of the tracer cell on the native model grid. volume flux in +z = wvelmass dra. note: in the arakawa-c grid, vertical velocities are staggered relative to the tracer cells with indexing such that +wvelmass(i,j,k) corresponds to upward +z motion through the top 'w' face of the tracer cell at (i,j,k). unlike uvelmass and vvelmass, wvelmass is not scaled by a time-varying open water fraction because the open water fraction of the 'w' face is always 1, thus wvelmass is identical to wvel.

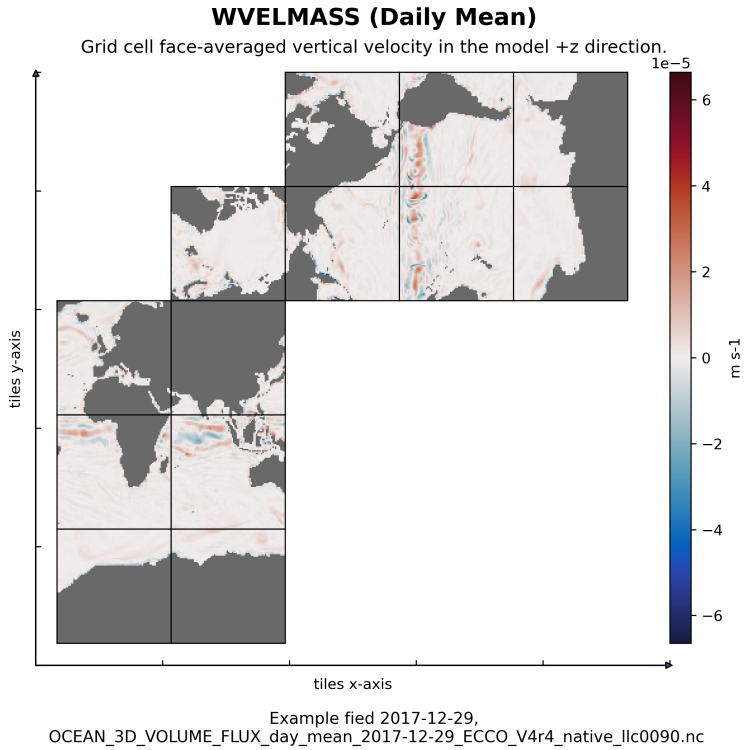


Figure 50: Dataset: OCEAN_3D_VOLUME_FLUX, Variable: WVELMASS

12.7 Native dataset of OCEAN_AND_ICE_SURFACE_FW_FLUX

12.7.1 Overview

This dataset provides 2D fields of ocean and sea-ice surface freshwater fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.36: Coordinates and Variables in the dataset OCEAN_AND_ICE_SURFACE_FW_FLUX

Variables	Description of data variables	Unit
EXFpreci	Precipitation rate	m s-1
EXFevap	Open ocean evaporation rate	m s-1
EXFroff	River runoff	m s-1
SIsnPrcp	Snow precipitation on sea-ice	kg m-2 s-1
EXFempmr	Open ocean net surface freshwater flux from precipitation, evaporation, and runoff	m s-1
oceFWflx	Net freshwater flux into the ocean	kg m-2 s-1
SIatmFW	Net freshwater flux into the open ocean, sea-ice, and snow	kg m-2 s-1
SFLUX	Rate of change of total ocean salinity per m2 accounting for mass fluxes.	g m-2 s-1
SIacSubl	Freshwater flux to the atmosphere due to sublimation-deposition of snow or ice	kg m-2 s-1
SIrsSubl	Residual sublimation freshwater flux	kg m-2 s-1
SIfwThru	Precipitation through sea-ice	kg m-2 s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.7.2 Native Variable: EXFempmr

Table 12.37: Attributes description of the variable 'EXFempmr' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFempmr	Open ocean net surface freshwater flux from precipitation, evaporation, and runoff	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFempmr(time, tile, j, i) EXFempmr: _FillValue = 9.96921e+36 EXFempmr: long_name = Open ocean net surface freshwater flux from precipitation evaporation and runoff EXFempmr: units = m s: 1 EXFempmr: coverage_content_type = modelResult EXFempmr: direction = >0 increases salinity (SALT) EXFempmr: coordinates = YC XC time EXFempmr: valid_min = : 8.299433829961345e: 06 EXFempmr: valid_max = 5.400421514423215e: 07			
Comments			
Net surface freshwater flux from precipitation, evaporation, and runoff per unit area in open water (not covered by sea-ice). excludes freshwater fluxes involving sea-ice and snow. note: calculated as exfevap-exfpreci-exfroff.			

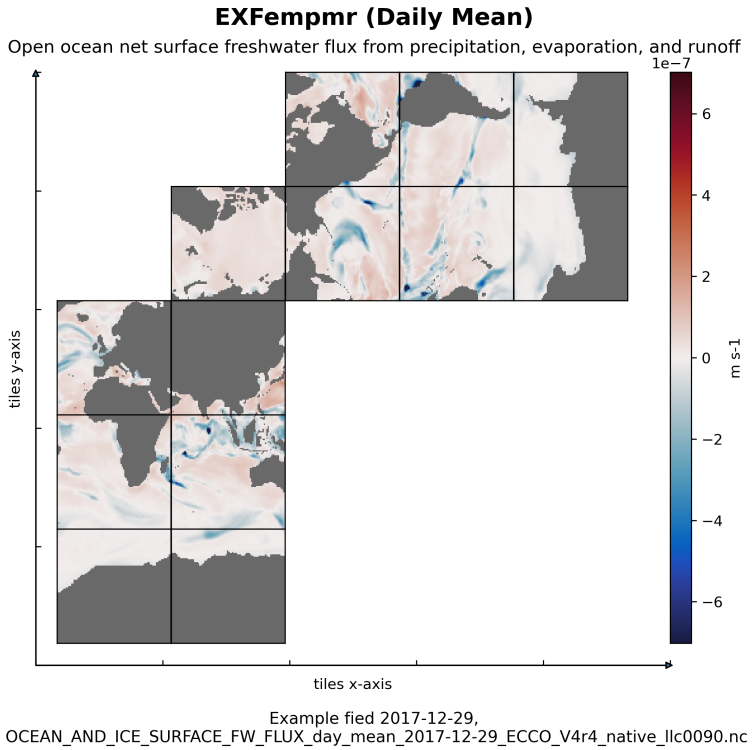


Figure 51: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFempmr

12.7.3 Native Variable: EXFevap

Table 12.38: Attributes description of the variable 'EXFevap' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFevap	Open ocean evaporation rate	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFevap(time, tile, j, i) EXFevap: _FillValue = 9.96921e+36 EXFevap: long_name = Open ocean evaporation rate EXFevap: units = m s: 1 EXFevap: coverage_content_type = modelResult EXFevap: direction = >0 increases salinity (SALT) EXFevap: standard_name = lwe_water_evaporation_rate EXFevap: coordinates = YC XC time EXFevap: valid_min = : 1.0958113705328287e: 07 EXFevap: valid_max = 7.090054623404285e: 07			
Comments			
Evaporation rate per unit area of open water (not covered by sea-ice). note: calculated using the bulk formula following large and yeager (2004) ncar/tn-460+str.			

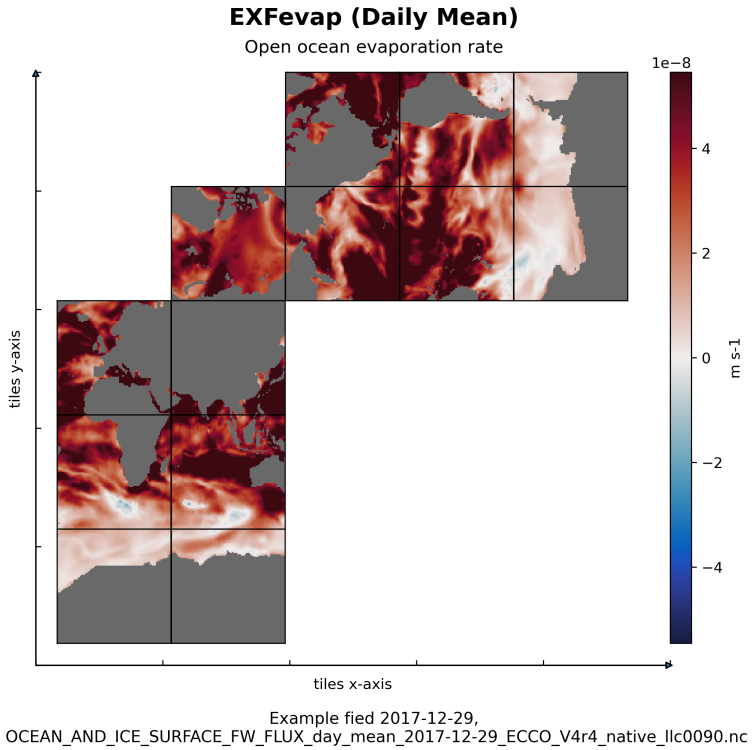


Figure 52: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFevap

12.7.4 Native Variable: EXFpreci

Table 12.39: Attributes description of the variable 'EXFpreci' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFpreci	Precipitation rate	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFpreci(time, tile, j, i) EXFpreci: _FillValue = 9.96921e+36 EXFpreci: long_name = Precipitation rate EXFpreci: units = m s: 1 EXFpreci: coverage_content_type = modelResult EXFpreci: direction = >0 increases salinity (SALT) EXFpreci: standard_name = lwe_precipitation_rate EXFpreci: coordinates = YC XC time EXFpreci: valid_min = : 1.4860395936011628e: 07 EXFpreci: valid_max = 8.317776519106701e: 06			
Comments			
Precipitation rate. note: sum of era-interim precipitation and the control adjustment from ocean state estimation.			

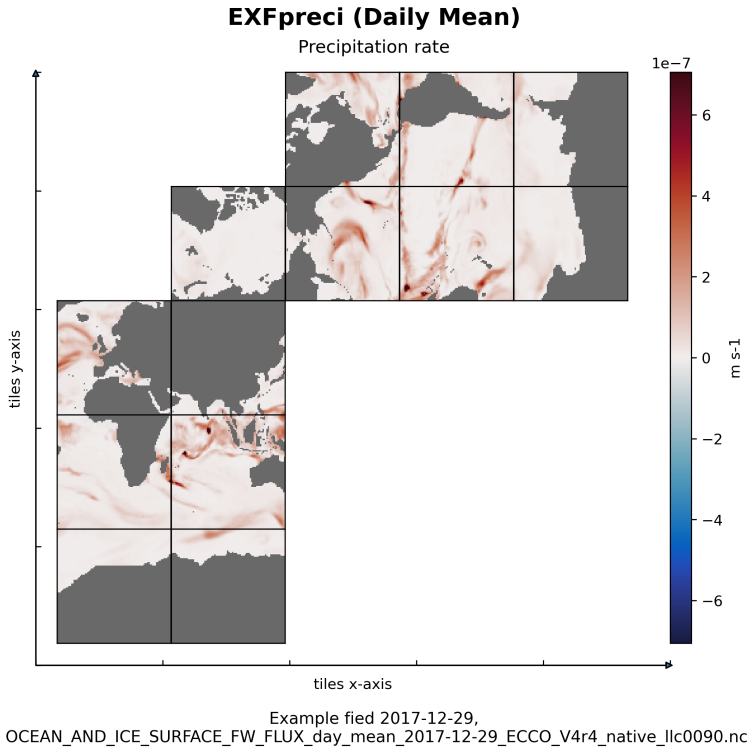


Figure 53: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFpreci

12.7.5 Native Variable: EXFroff

Table 12.40: Attributes description of the variable 'EXFroff' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFroff	River runoff	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFroff(time, tile, j, i) EXFroff: _FillValue = 9.96921e+36 EXFroff: long_name = River runoff EXFroff: units = m s: 1 EXFroff: coverage_content_type = modelResult EXFroff: direction = >0 increases salinity (SALT) EXFroff: standard_name = surface_runoff_flux EXFroff: coordinates = YC XC time EXFroff: valid_min = 0.0 EXFroff: valid_max = 4.185612397122895e: 06			
Comments			
River runoff freshwater flux. note: not adjusted by the optimization.			

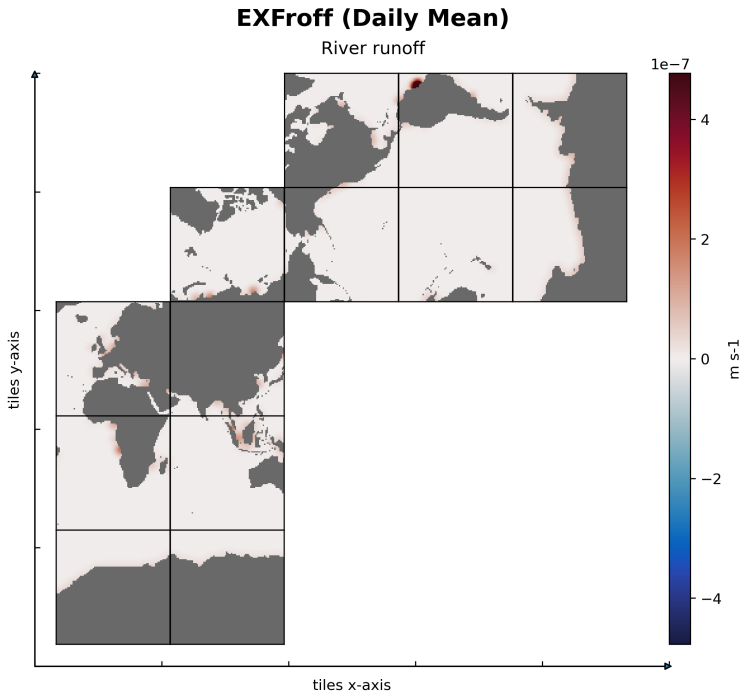


Figure 54: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFroff

12.7.6 Native Variable: SFLUX

Table 12.41: Attributes description of the variable 'SFLUX' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SFLUX	Rate of change of total ocean salinity per m2 accounting for mass fluxes.	g m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SFLUX(time, tile, j, i) SFLUX: _FillValue = 9.96921e+36 SFLUX: long_name = Rate of change of total ocean salinity per m2 accounting for mass fluxes. SFLUX: units = g m: 2 s: 1 SFLUX: coverage_content_type = modelResult SFLUX: direction = >0 increases salinity (SALT) SFLUX: coordinates = YC XC time SFLUX: valid_min = : 0.07353577762842178 SFLUX: valid_max = 0.010607733391225338			
Comments			
The rate of change of total ocean salinity due to freshwater fluxes across the liquid surface and the addition or removal of mass. note: the global area integral of sflux matches the time-derivative of total ocean salinity (psu s-1). unlike ocefwflx, sflux includes the contribution to the total ocean salinity from changing ocean mass (e.g. from the addition or removal of freshwater in ocefwflx).			

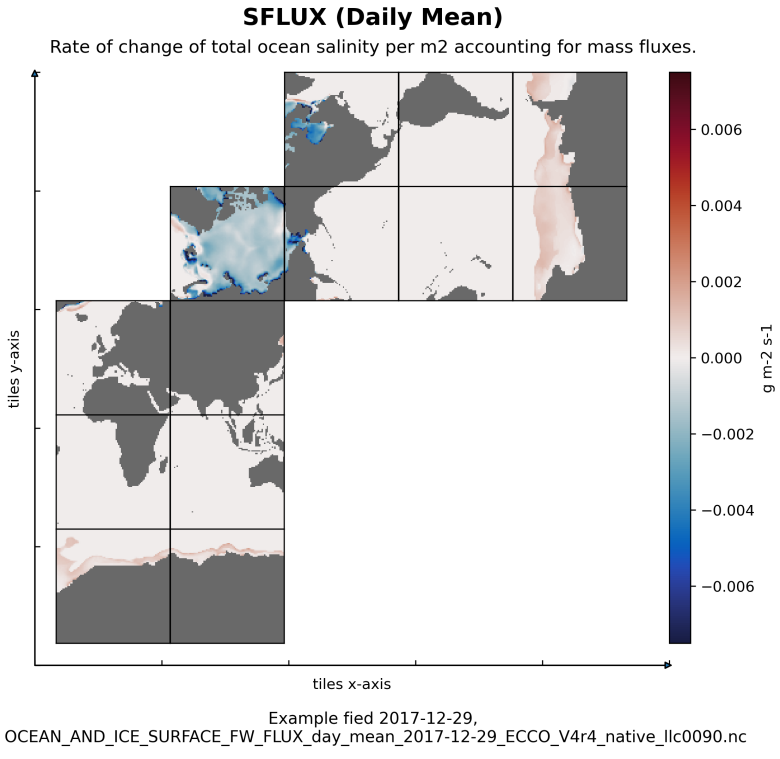


Figure 55: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SFLUX

12.7.7 Native Variable: SIacSubl

Table 12.42: Attributes description of the variable 'SIacSubl' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIacSubl	Freshwater flux to the atmosphere due to sublimation-deposition of snow or ice	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIacSubl(time, tile, j, i) SIacSubl: _FillValue = 9.96921e+36 SIacSubl: long_name = Freshwater flux to the atmosphere due to sublimation: deposition of snow or ice SIacSubl: units = kg m: 2 s: 1 SIacSubl: coverage_content_type = modelResult SIacSubl: direction = >0 decreases snow or sea: ice thickness (HSNOW or HEFF) SIacSubl: standard_name = water_sublimation_flux SIacSubl: coordinates = YC XC time SIacSubl: valid_min = 0.0 SIacSubl: valid_max = 8.154580427799374e: 05			
Comments			
Freshwater flux to the atmosphere due to sublimation-deposition of snow or ice. positive values imply sublimation from ice/snow to vapor, negative values imply deposition from atmospheric moisture			

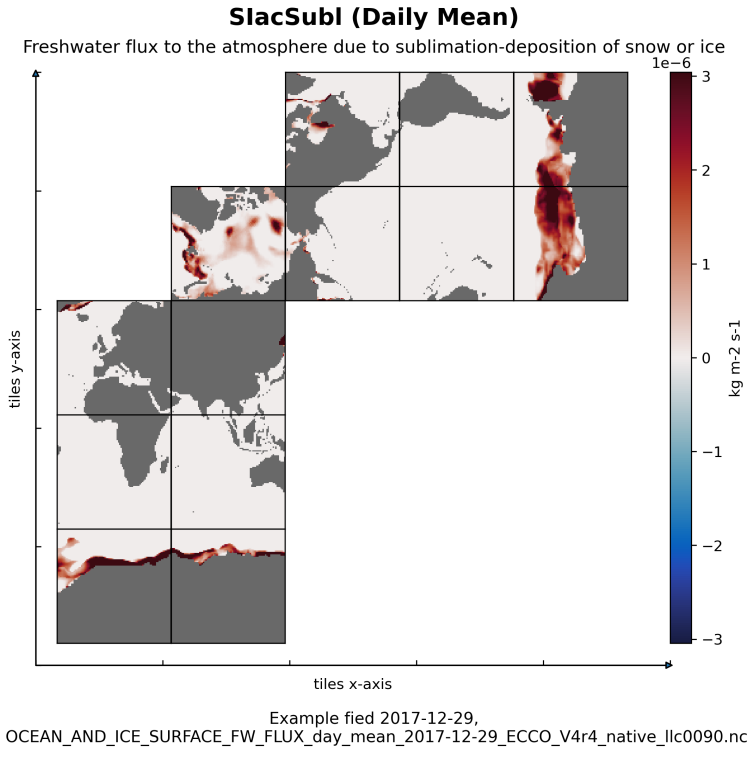


Figure 56: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIacSubl

12.7.8 Native Variable: SIatmFW

Table 12.43: Attributes description of the variable 'SIatmFW' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIatmFW	Net freshwater flux into the open ocean, sea-ice, and snow	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIatmFW(time, tile, j, i) SIatmFW: _FillValue = 9.96921e+36 SIatmFW: long_name = Net freshwater flux into the open ocean sea: ice and snow SIatmFW: units = kg m: 2 s: 1 SIatmFW: coverage_content_type = modelResult SIatmFW: direction = >0 decreases salinity (SALT) SIatmFW: standard_name = surface_downward_water_flux SIatmFW: coordinates = YC XC time SIatmFW: valid_min = : 0.00043017856660299003 SIatmFW: valid_max = 0.008299433626234531			
Comments			
Net freshwater flux into the combined liquid ocean, sea-ice, and snow reservoirs from the atmosphere and runoff. note: freshwater fluxes between the liquid ocean and sea-ice or snow reservoirs do not contribute to siatmfw. siatmfw counts all fluxes to/from the atmosphere that change the total freshwater stored in the combined liquid ocean, sea-ice, and snow reservoirs.			

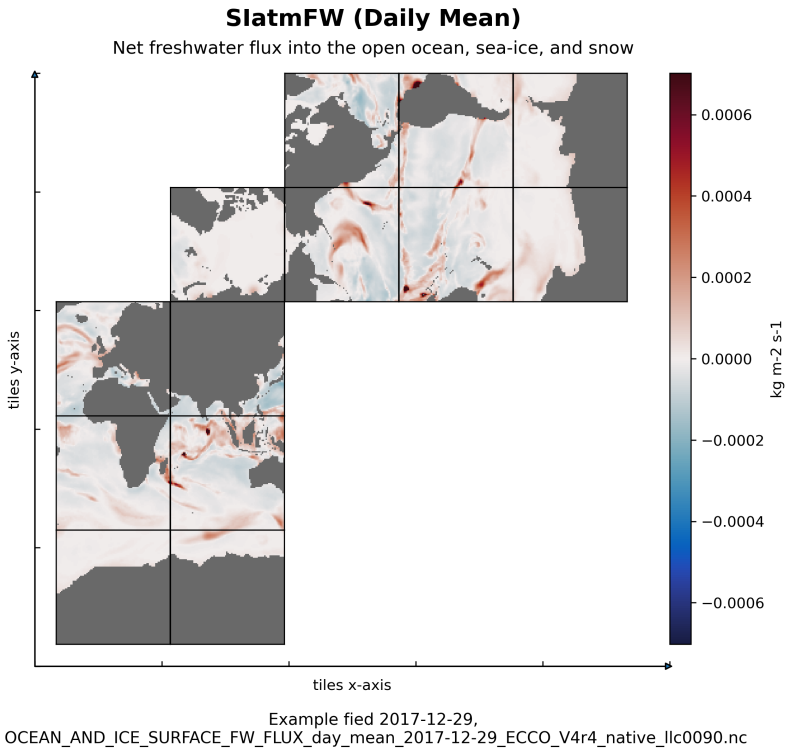


Figure 57: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIatmFW

12.7.9 Native Variable: SIfwThru

Table 12.44: Attributes description of the variable 'SIfwThru' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIfwThru	Precipitation through sea-ice	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIfwThru(time, tile, j, i) SIfwThru: _FillValue = 9.96921e+36 SIfwThru: long_name = Precipitation through sea: ice SIfwThru: units = kg m: 2 s: 1 SIfwThru: coverage_content_type = modelResult SIfwThru: direction = >0 increases ocean volume SIfwThru: coordinates = YC XC time SIfwThru: valid_min = : 1.695218452368863e: 05 SIfwThru: valid_max = 0.0010632629273459315			
Comments			
Precipitation over sea-ice covered regions reaching ocean through sea-ice. note: precipitation over sea-ice covered regions that directly reaches ocean through the sea-ice. it is not due to melt of sea-ice/snow.			

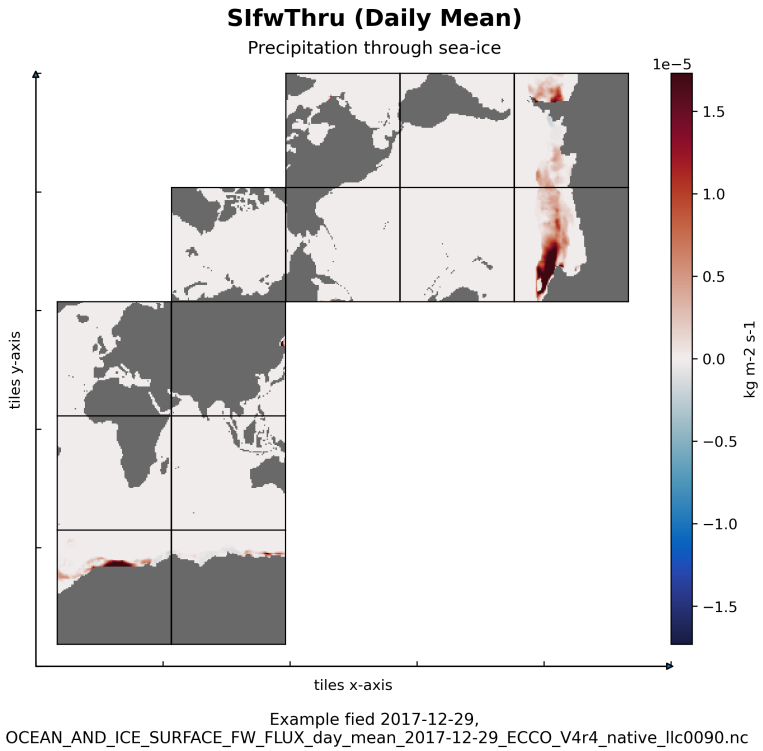


Figure 58: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIfwThru

12.7.10 Native Variable: SIrsSubl

Table 12.45: Attributes description of the variable 'SIrsSubl' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIrsSubl	Residual sublimation freshwater flux	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIrsSubl(time, tile, j, i) SIrsSubl: _FillValue = 9.96921e+36 SIrsSubl: long_name = Residual sublimation freshwater flux SIrsSubl: units = kg m: 2 s: 1 SIrsSubl: coverage_content_type = modelResult SIrsSubl: direction = >0 decreases ocean volume SIrsSubl: coordinates = YC XC time SIrsSubl: valid_min = : 0.0001067528864950873 SIrsSubl: valid_max = 8.640533451398369e: 06			
Comments			
Residual freshwater flux by sublimation to remove water from or add water to ocean. when implied sublimation freshwater flux siacsubl is larger than availabe sea-ice/snow, sirssubl is positive and water is removed from ocean. note: freshwater flux by sublimation that is to remove water from the ocean when it is positive.			

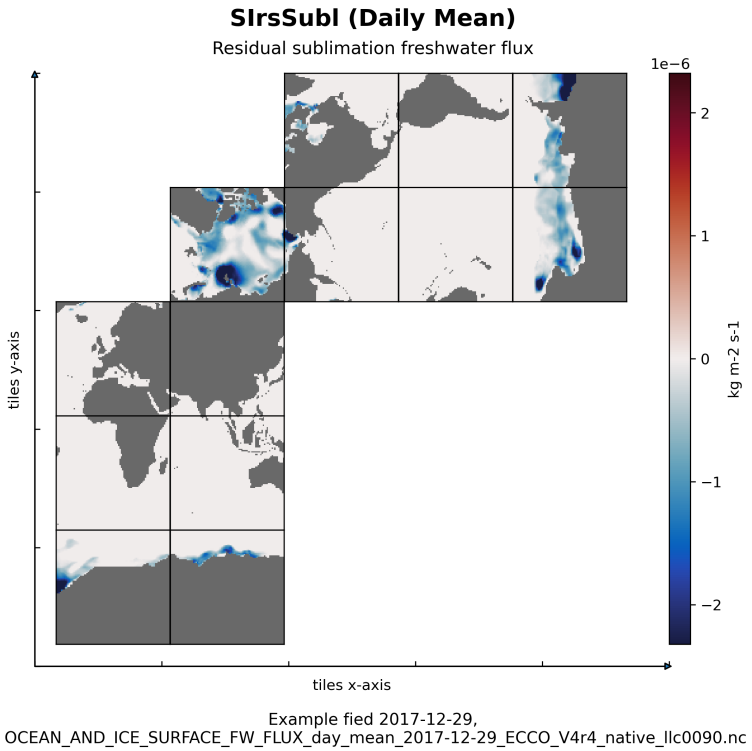


Figure 59: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIrsSubl

12.7.11 Native Variable: SIsnPrcp

Table 12.46: Attributes description of the variable 'SIsnPrcp' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIsnPrcp	Snow precipitation on sea-ice	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIsnPrcp(time, tile, j, i) SIsnPrcp: _FillValue = 9.96921e+36 SIsnPrcp: long_name = Snow precipitation on sea: ice SIsnPrcp: units = kg m: 2 s: 1 SIsnPrcp: coverage_content_type = modelResult SIsnPrcp: direction = >0 increases snow thickness (HSNOW) SIsnPrcp: standard_name = snowfall_flux SIsnPrcp: coordinates = YC XC time SIsnPrcp: valid_min = : 4.334669574745931e: 05 SIsnPrcp: valid_max = 0.00093540205853059 89			
Comments			
Snow precipitation rate over sea-ice, averaged over the entire model grid cell.			

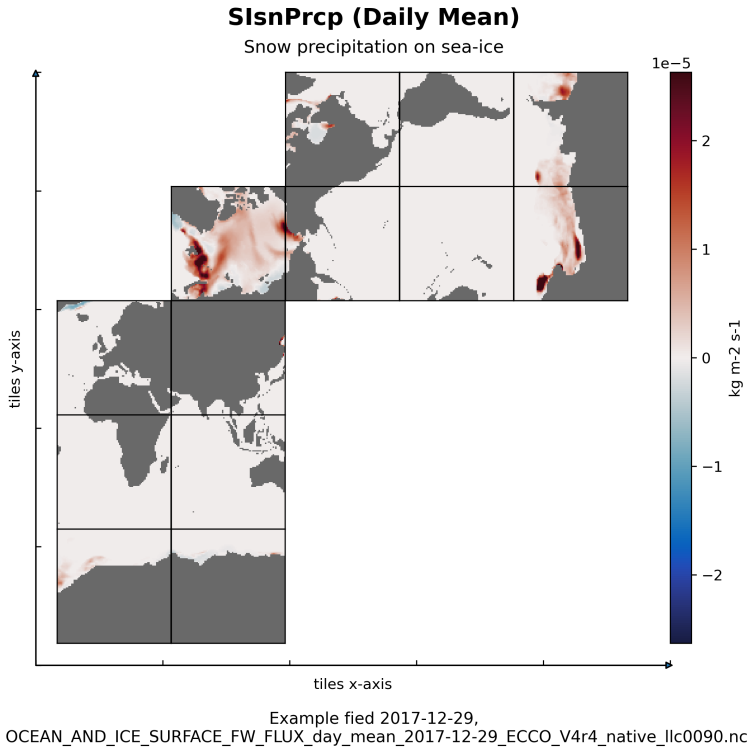


Figure 60: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIsnPrcp

12.7.12 Native Variable: oceFWflx

Table 12.47: Attributes description of the variable 'oceFWflx' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceFWflx	Net freshwater flux into the ocean	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 oceFWflx(time, tile, j, i) oceFWflx: _FillValue = 9.96921e+36 oceFWflx: long_name = Net freshwater flux into the ocean oceFWflx: units = kg m: 2 s: 1 oceFWflx: coverage_content_type = modelResult oceFWflx: direction = >0 decreases salinity (SALT) oceFWflx: standard_name = water_flux_into_sea_water oceFWflx: coordinates = YC XC time oceFWflx: valid_min = : 0.0039149699732661 25 oceFWflx: valid_max = 0.008299433626234531			
Comments			
Net freshwater flux into the ocean including contributions from runoff, evaporation, precipitation, and mass exchange with sea-ice due to melting and freezing and snow melting. note: ocefwflx does not include freshwater fluxes between the atmosphere and sea-ice and snow. the variable 'siatmfw' accounts for freshwater fluxes out of the combined ocean+sea-ice+snow reservoir.			

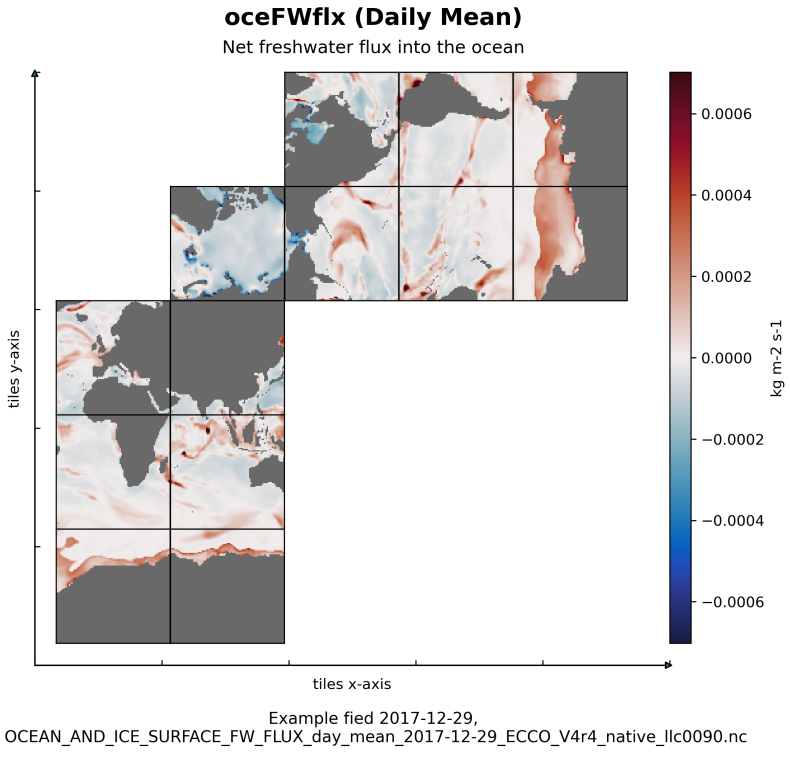


Figure 61: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: oceFWflx

12.8 Native dataset of OCEAN_AND_ICE_SURFACE_HEAT_FLUX

12.8.1 Overview

This dataset provides 2D fields of ocean and sea-ice surface heat fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.48: Coordinates and Variables in the dataset OCEAN_AND_ICE_SURFACE_HEAT_FLUX

Variables	Description of data variables	Unit
EXFhl	Open ocean air-sea latent heat flux	W m-2
EXFhs	Open ocean air-sea sensible heat flux	W m-2
EXFlwdn	Downward longwave radiative flux	W m-2
EXFswdn	Downwelling shortwave radiative flux	W m-2
EXFqnet	Open ocean net air-sea heat flux	W m-2
oceQnet	Net heat flux into the ocean surface	W m-2
SIatmQnt	Net upward heat flux to the atmosphere	W m-2
TFLUX	Rate of change of ocean heat content per m2 accounting for mass fluxes.	W m-2
EXFswnet	Open ocean net shortwave radiative flux	W m-2
EXFlwnet	Net open ocean longwave radiative flux	W m-2
oceQsw	Net shortwave radiative flux across the ocean surface	W m-2
SIaaflux	Conservative ocean and sea-ice advective heat flux adjustment	W m-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.8.2 Native Variable: EXFhl

Table 12.49: Attributes description of the variable 'EXFhl' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFhl	Open ocean air-sea latent heat flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFhl(time, tile, j, i) EXFhl: _FillValue = 9.96921e+36 EXFhl: long_name = Open ocean air: sea latent heat flux EXFhl: units = W m: 2 EXFhl: coverage_content_type = modelResult EXFhl: direction = >0 increases potential temperature (THETA) EXFhl: standard_name = surface_downward_latent_heat_flux EXFhl: coordinates = XC time YC EXFhl: valid_min = : 1772.513671875 EXFhl: valid_max = 273.9528503417969			
Comments			
Air-sea latent heat flux per unit area of open water (not covered by sea-ice). note: calculated from the bulk formula following large and yeager (2004) ncar/tn-460+str.			

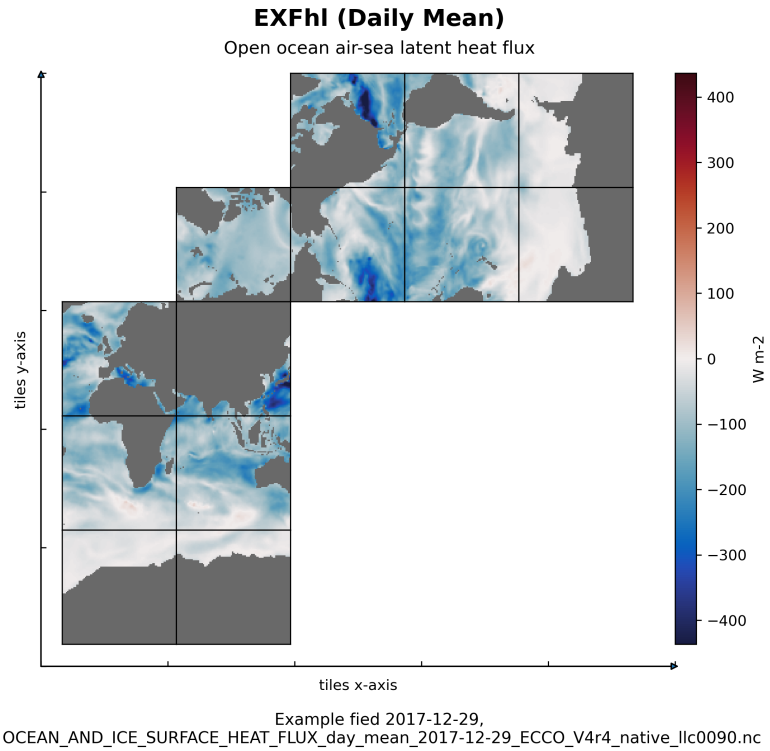


Figure 62: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFhl

12.8.3 Native Variable: EXFhs

Table 12.50: Attributes description of the variable 'EXFhs' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFhs	Open ocean air-sea sensible heat flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFhs(time, tile, j, i) EXFhs: _FillValue = 9.96921e+36 EXFhs: long_name = Open ocean air: sea sensible heat flux EXFhs: units = W m: 2 EXFhs: coverage_content_type = modelResult EXFhs: direction = >0 increases potential temperature (THETA) EXFhs: standard_name = surface_downward_sensible_heat_flux EXFhs: coordinates = XC time YC EXFhs: valid_min = : 2478.766357421875 EXFhs: valid_max = 362.8300476074219			
Comments			
Air-sea sensible heat flux per unit area of open water (not covered by sea-ice). note: calculated from the bulk formula following large and yeager (2004) ncar/tn-460+str.			

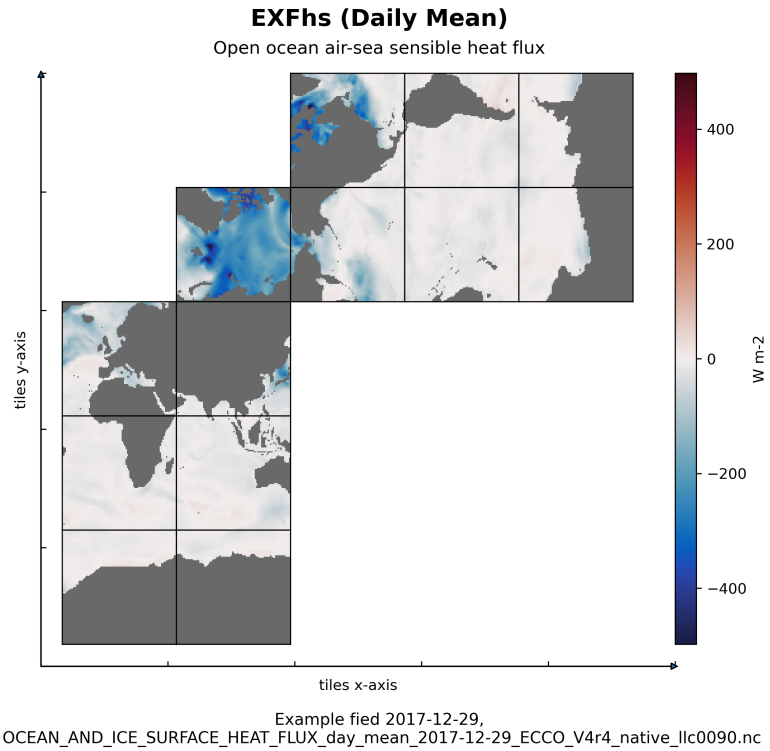


Figure 63: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFhs

12.8.4 Native Variable: EXFlwdn

Table 12.51: Attributes description of the variable 'EXFlwdn' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFlwdn	Downward longwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFlwdn(time, tile, j, i) EXFlwdn: _FillValue = 9.96921e+36 EXFlwdn: long_name = Downward longwave radiative flux EXFlwdn: units = W m: 2 EXFlwdn: coverage_content_type = modelResult EXFlwdn: direction = >0 increases potential temperature (THETA) EXFlwdn: standard_name = surface_downwelling_longwave_flux_in_air EXFlwdn: coordinates = XC time YC EXFlwdn: valid_min = 4.188045501708984 EXFlwdn: valid_max = 513.3919067382812			
Comments			
Downward longwave radiative flux. note: sum of era-interim downward longwave radiation and the control adjustment from ocean state estimation.			

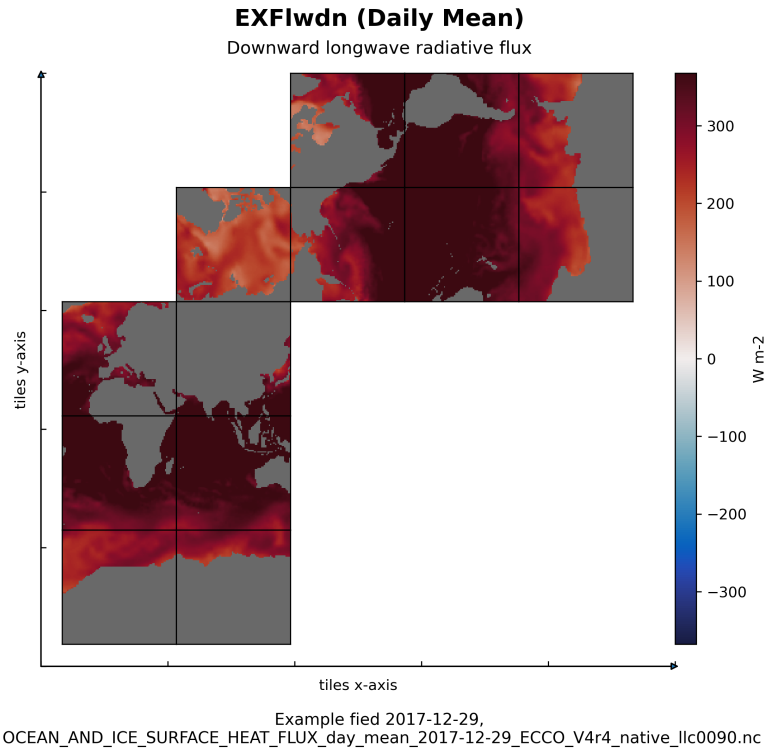


Figure 64: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFlwdn

12.8.5 Native Variable: EXFlwnet

Table 12.52: Attributes description of the variable 'EXFlwnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFlwnet	Net open ocean longwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFlwnet(time, tile, j, i) EXFlwnet: _FillValue = 9.96921e+36 EXFlwnet: long_name = Net open ocean longwave radiative flux EXFlwnet: units = W m: 2 EXFlwnet: coverage_content_type = modelResult EXFlwnet: direction = >0 increases potential temperature (THETA) EXFlwnet: standard_name = surface_net_downward_longwave_flux EXFlwnet: coordinates = XC time YC EXFlwnet: valid_min = : 144.3661346435547 EXFlwnet: valid_max = 293.4114990234375			
Comments			
Net longwave radiative flux per unit area of open water (not covered by sea-ice). note: net longwave radiation over open water calculated from downward longwave radiation (exflwdn) and upward longwave radiation from ocean and sea-ice thermal emission (stefan-boltzman law).			

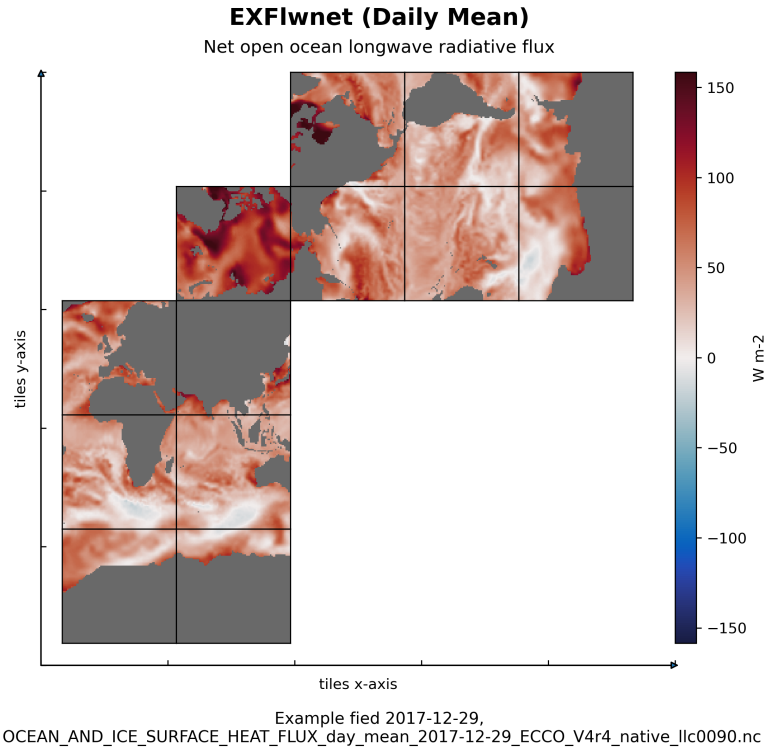


Figure 65: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFlwnet

12.8.6 Native Variable: EXFqnet

Table 12.53: Attributes description of the variable 'EXFqnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFqnet	Open ocean net air-sea heat flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFqnet(time, tile, j, i) EXFqnet: _FillValue = 9.96921e+36 EXFqnet: long_name = Open ocean net air: sea heat flux EXFqnet: units = W m: 2 EXFqnet: coverage_content_type = modelResult EXFqnet: direction = >0 increases potential temperature (THETA) EXFqnet: coordinates = XC time YC EXFqnet: valid_min = : 687.8736572265625 EXFqnet: valid_max = 3408.977783203125			
Comments			
Net air-sea heat flux (turbulent and radiative) per unit area of open water (not covered by sea-ice). note: net upward heat flux over open water, calculated as exflwnet+exfswnet-exflh-exfhs.			

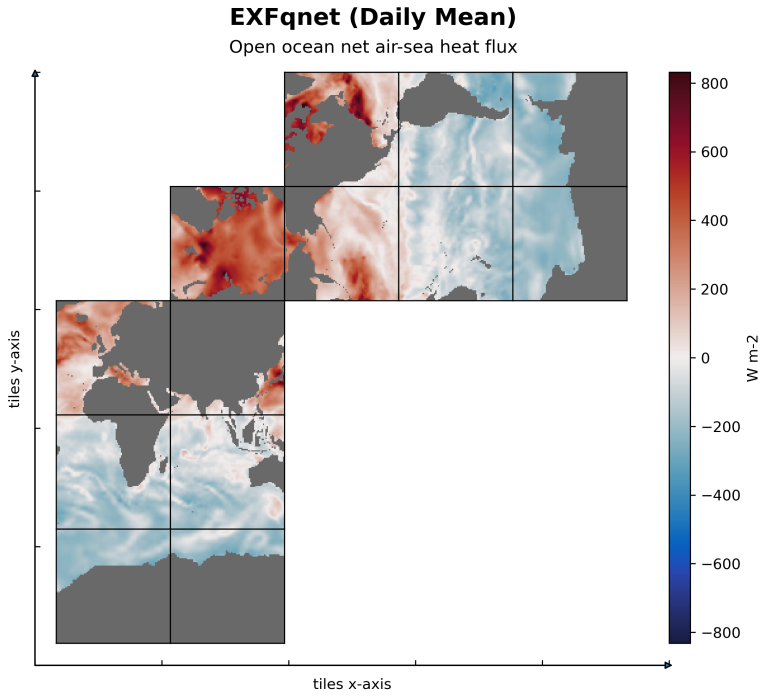


Figure 66: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFqnet

12.8.7 Native Variable: EXFswdn

Table 12.54: Attributes description of the variable 'EXFswdn' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFswdn	Downwelling shortwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFswdn(time, tile, j, i) EXFswdn: _FillValue = 9.96921e+36 EXFswdn: long_name = Downwelling shortwave radiative flux EXFswdn: units = W m: 2 EXFswdn: coverage_content_type = modelResult EXFswdn: direction = >0 increases potential temperature (THETA) EXFswdn: standard_name = surface_downwelling_shortwave_flux_in_air EXFswdn: coordinates = XC time YC EXFswdn: valid_min = : 224.63368225097656 EXFswdn: valid_max = 707.345947265625			
Comments			
Downward shortwave radiative flux. note: sum of era-interim downward shortwave radiation and the control adjustment from ocean state estimation.			

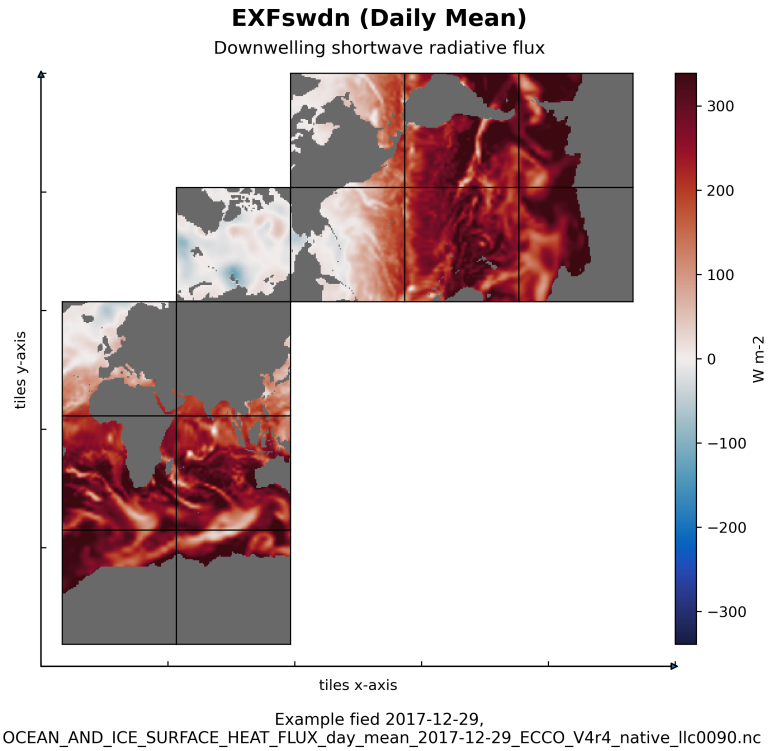


Figure 67: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFswdn

12.8.8 Native Variable: EXFswnet

Table 12.55: Attributes description of the variable 'EXFswnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFswnet	Open ocean net shortwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFswnet(time, tile, j, i) EXFswnet: _FillValue = 9.96921e+36 EXFswnet: long_name = Open ocean net shortwave radiative flux EXFswnet: units = W m: 2 EXFswnet: coverage_content_type = modelResult EXFswnet: direction = >0 increases potential temperature (THETA) EXFswnet: standard_name = surface_net_downward_shortwave_flux EXFswnet: coordinates = XC time YC EXFswnet: valid_min = : 655.6171264648438 EXFswnet: valid_max = 194.18458557128906			
Comments			
Net shortwave radiative flux per unit area of open water (not covered by sea-ice). note: net shortwave radiation over open water calculated from downward shortwave flux (exfswdn) and ocean surface albdeo.			

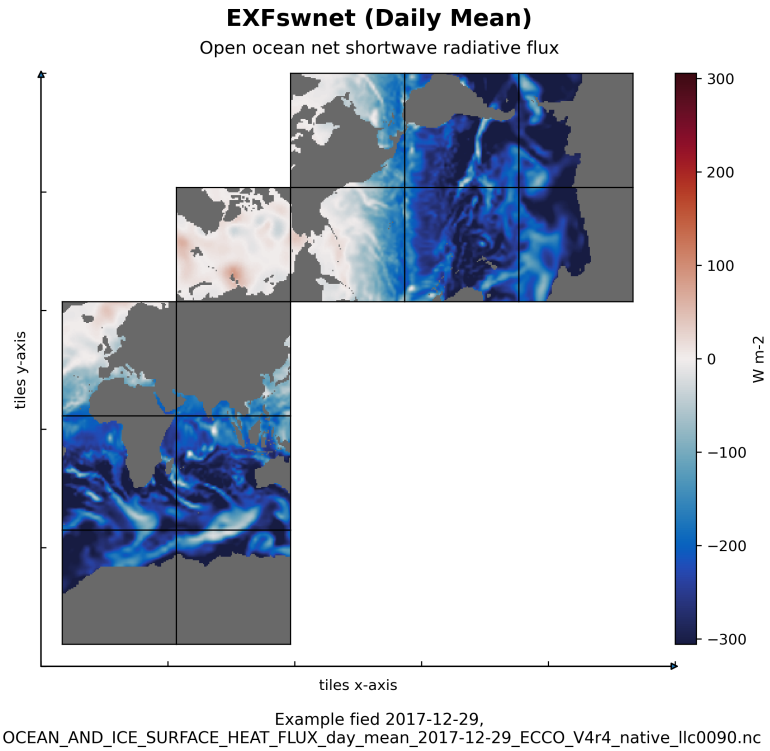


Figure 68: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFswnet

12.8.9 Native Variable: SIaaflux

Table 12.56: Attributes description of the variable 'SIaaflux' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIaaflux	Conservative ocean and sea-ice advective heat flux adjustment	W m-2

Description of the variable in Common Data language (CDL)

float32 SIaaflux(time, tile, j, i)
SIaaflux: _FillValue = 9.96921e+36
SIaaflux: long_name = Conservative ocean and sea: ice advective heat flux adjustment
SIaaflux: units = W m: 2
SIaaflux: coverage_content_type = modelResult
SIaaflux: direction = >0 decrease potential temperature (THETA)
SIaaflux: coordinates = XC time YC
SIaaflux: valid_min = : 16.214622497558594
SIaaflux: valid_max = 50.35451889038086

Comments

Heat flux associated with the temperature difference between sea surface temperature and sea-ice (assume 0 degree c in the model). note: heat flux needed to melt/freeze sea-ice at 0 degc to sea water at the ocean surface (at sea surface temperature), excluding the latent heat of fusion.

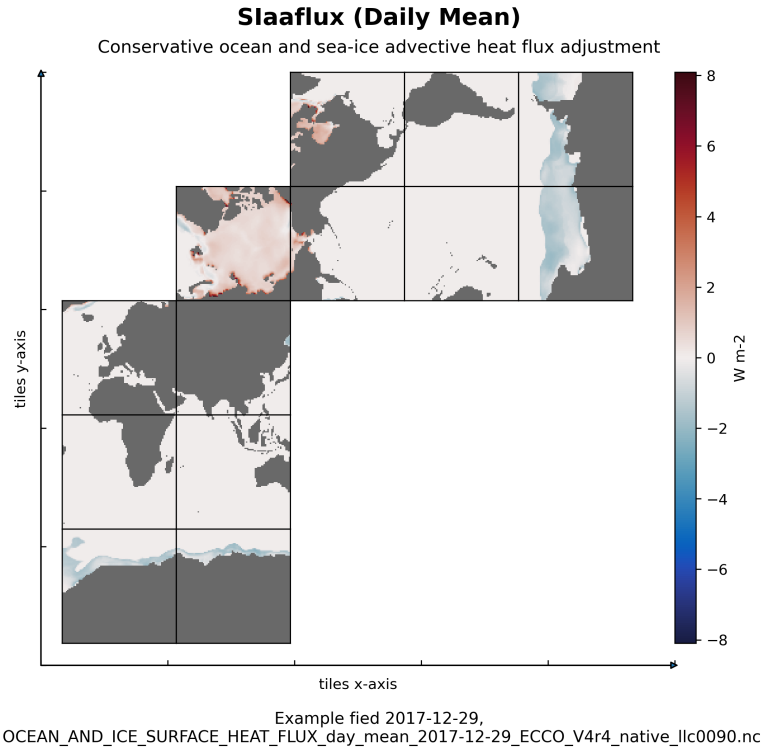


Figure 69: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: SIaaflux

12.8.10 Native Variable: SIatmQnt

Table 12.57: Attributes description of the variable 'SIatmQnt' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIatmQnt	Net upward heat flux to the atmosphere	W m-2
Description of the variable in Common Data language (CDL)			
float32 SIatmQnt(time, tile, j, i) SIatmQnt: _FillValue = 9.96921e+36 SIatmQnt: long_name = Net upward heat flux to the atmosphere SIatmQnt: units = W m: 2 SIatmQnt: coverage_content_type = modelResult SIatmQnt: direction = >0 upward decreases ocean temperature SIatmQnt: standard_name = surface_upward_heat_flux_in_air SIatmQnt: coordinates = XC time YC SIatmQnt: valid_min = : 756.0607299804688 SIatmQnt: valid_max = 1704.7703857421875			
Comments			
Net upward heat flux to the atmosphere across open water and sea-ice or snow surfaces. note: nonzero siatmqnt may not be associated with a change in ocean potential temperature due to sea-ice growth or melting. to calculate total ocean heat content changes use the variable tflux which also accounts for changing ocean mass (e.g. ocefwflx).			

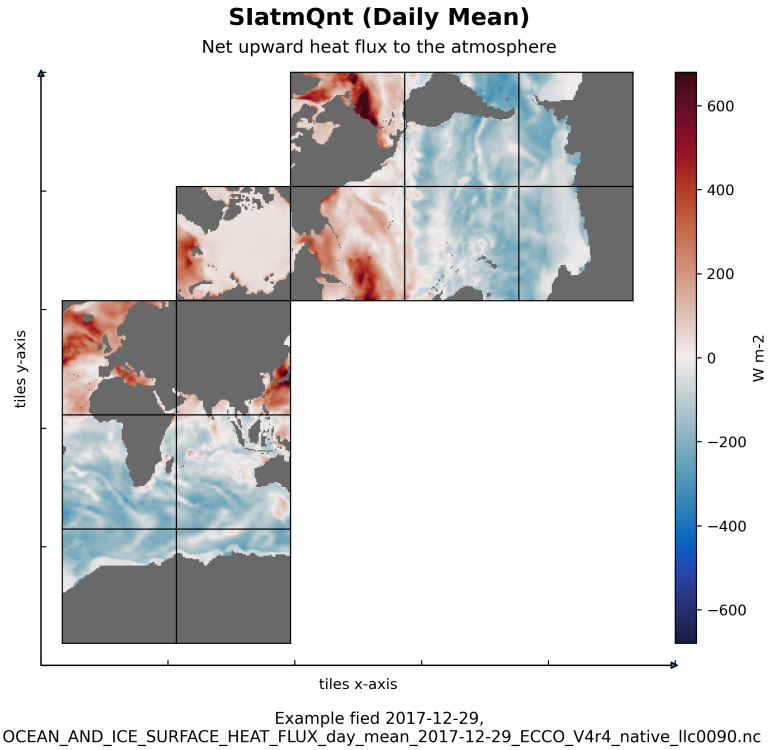


Figure 70: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: SIatmQnt

12.8.11 Native Variable: TFLUX

Table 12.58: Attributes description of the variable 'TFLUX' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	TFLUX	Rate of change of ocean heat content per m2 accounting for mass fluxes.	W m-2

Description of the variable in Common Data language (CDL)

float32 TFLUX(time, tile, j, i)
TFLUX: _FillValue = 9.96921e+36
TFLUX: long_name = Rate of change of ocean heat content per m2 accounting for mass fluxes.
TFLUX: units = W m: 2
TFLUX: coverage_content_type = modelResult
TFLUX: direction = >0 increases potential temperature (THETA)
TFLUX: coordinates = XC time YC
TFLUX: valid_min = : 1713.51220703125
TFLUX: valid_max = 870.3130493164062

Comments

The rate of change of ocean heat content due to heat fluxes across the liquid surface and the addition or removal of mass. . note: the global area integral of tflux and geothermal flux (geothermalflux.bin) matches the time-derivative of ocean heat content (j/s). unlike oceqnet, tflux includes the contribution to the ocean heat content from changing ocean mass (e.g. from ocefwflx).

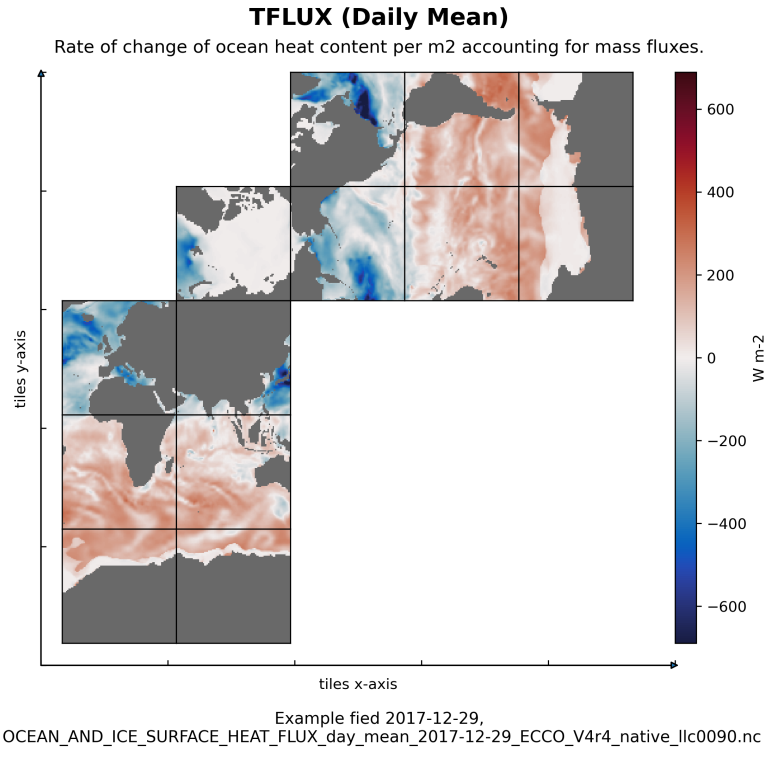


Figure 71: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: TFLUX

12.8.12 Native Variable: oceQnet

Table 12.59: Attributes description of the variable 'oceQnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceQnet	Net heat flux into the ocean surface	W m-2

Description of the variable in Common Data language (CDL)

float32 oceQnet(time, tile, j, i)
oceQnet: _FillValue = 9.96921e+36
oceQnet: long_name = Net heat flux into the ocean surface
oceQnet: units = W m: 2
oceQnet: coverage_content_type = modelResult
oceQnet: direction = >0 increases potential temperature (THETA)
oceQnet: standard_name = surface_downward_heat_flux_in_sea_water
oceQnet: coordinates = XC time YC
oceQnet: valid_min = : 1708.8460693359375
oceQnet: valid_max = 675.3716430664062

Comments

Net heat flux into the ocean surface from all processes: air-sea turbulent and radiative fluxes and turbulent and conductive fluxes between the ocean and sea-ice and snow. note: oceqnet does not include the change in ocean heat content due to changing ocean ocean mass (ocefwflx). mass fluxes from evaporation, precipitation, and runoff (exfempmr) happen at the same temperature as the ocean surface temperature. consequently, empmr does not change ocean surface temperature. conversely, mass fluxes due to sea-ice thickening/thinning and snow melt in the model are assumed to happen at a fixed 0c. consequently, mass fluxes due to phase changes between seawater and sea-ice and snow induce a heat flux when the ocean surface temperaure is not 0c. the variable tflux does include the change in ocean heat content due to changing ocean mass.

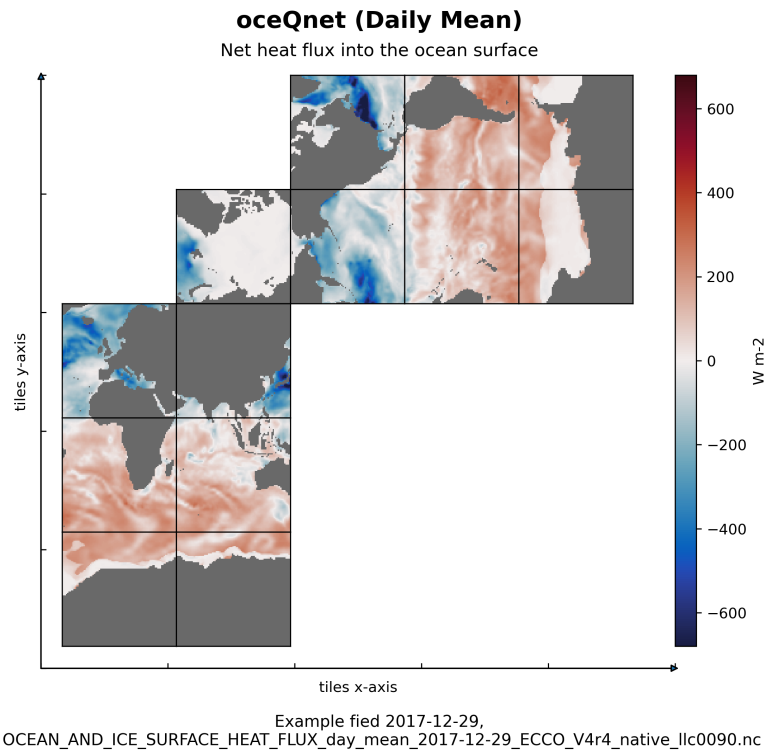


Figure 72: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: oceQnet

12.8.13 Native Variable: oceQsw

Table 12.60: Attributes description of the variable 'oceQsw' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceQsw	Net shortwave radiative flux across the ocean surface	W m-2

Description of the variable in Common Data language (CDL)

float32 oceQsw(time, tile, j, i)
oceQsw: _FillValue = 9.96921e+36
oceQsw: long_name = Net shortwave radiative flux across the ocean surface
oceQsw: units = W m: 2
oceQsw: coverage_content_type = modelResult
oceQsw: direction = >0 increases potential temperature (THETA)
oceQsw: coordinates = XC time YC
oceQsw: valid_min = : 134.39808654785156
oceQsw: valid_max = 655.6171264648438

Comments

Net shortwave radiative flux across the ocean surface. note: shortwave radiation penetrates below the surface grid cell.

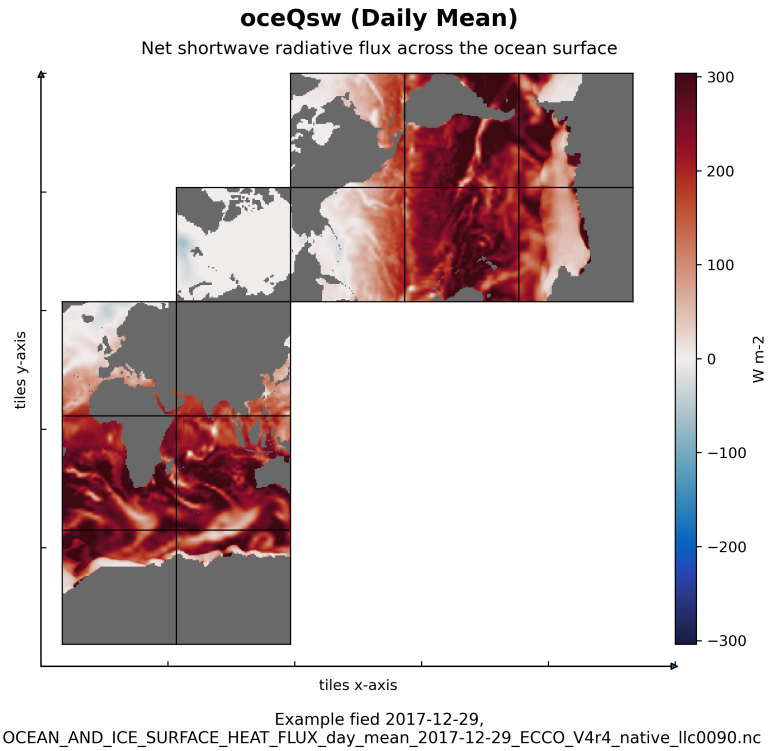


Figure 73: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: oceQsw

12.9 Native dataset of OCEAN_AND_ICE_SURFACE_STRESS

12.9.1 Overview

This dataset provides 2D fields of ocean and sea-ice surface stress on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.61: Coordinates and Variables in the dataset OCEAN_AND_ICE_SURFACE_STRESS

Variables	Description of data variables	Unit
EXFtaux	Wind stress in the model +x direction	N m-2
EXFtauy	Wind stress in the model +y direction	N m-2
oceTAUX	Ocean surface stress in the model +x direction	N m-2
oceTAUY	Ocean surface stress in the model +y direction	N m-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.9.2 Native Variable: EXFtaux

Table 12.62: Attributes description of the variable 'EXFtaux' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFtaux	Wind stress in the model +x direction	N m-2

Description of the variable in Common Data language (CDL)

float32 EXFtaux(time, tile, j, i)
EXFtaux: _FillValue = 9.96921e+36
EXFtaux: long_name = Wind stress in the model +x direction
EXFtaux: units = N m: 2
EXFtaux: coverage_content_type = modelResult
EXFtaux: direction = >0 increases horizontal velocity in the +x direction (UVEL)
EXFtaux: standard_name = surface_downward_x_stress
EXFtaux: coordinates = time YC XC
EXFtaux: valid_min = : 7.474303722381592
EXFtaux: valid_max = 3.7184090614318848

Comments

Wind stress in the +x direction at the tracer cell on the native model grid. note: exftaux is the stress applied to the ice-free ocean surface and sea-ice covered surface. when sea-ice is present, the total stress applied to the ocean surface in the +x direction is not exftaux, but a combination of exftaux wind stress in the open water fraction and a stress from sea-ice in the ice-covered fraction (see ocetaux). exftaux is the sum of era-interim stress and the control adjustment from ocean state estimation.

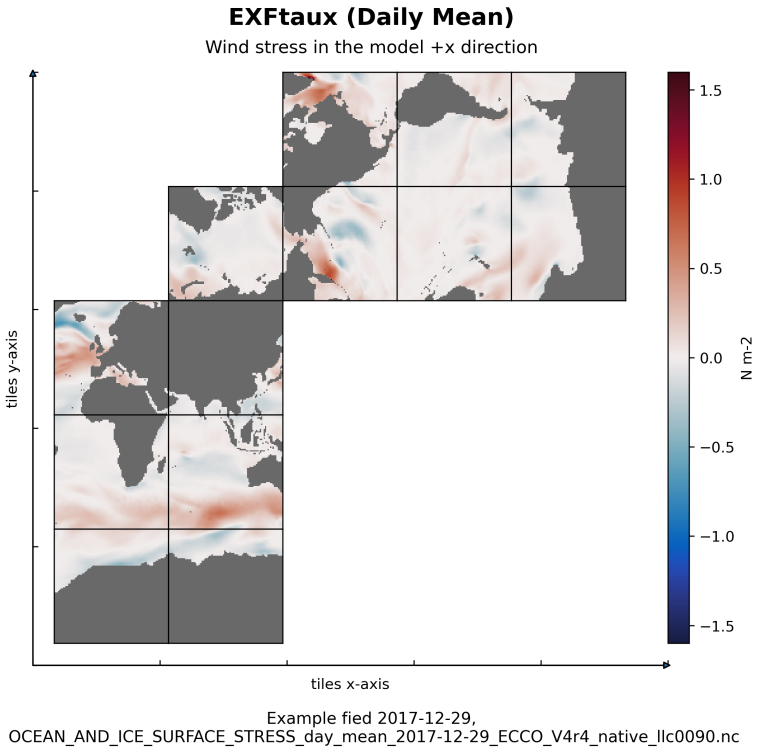


Figure 74: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: EXFtaux

12.9.3 Native Variable: EXFtauy

Table 12.63: Attributes description of the variable 'EXFtauy' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFtauy	Wind stress in the model +y direction	N m-2
Description of the variable in Common Data language (CDL)			
float32 EXFtauy(time, tile, j, i) EXFtauy: _FillValue = 9.96921e+36 EXFtauy: long_name = Wind stress in the model +y direction EXFtauy: units = N m: 2 EXFtauy: coverage_content_type = modelResult EXFtauy: direction = >0 increases horizontal velocity in the +y direction (VVEL) EXFtauy: standard_name = surface_downward_y_stress EXFtauy: coordinates = time YC XC EXFtauy: valid_min = : 3.71972918510437 EXFtauy: valid_max = 3.7044837474823			
Comments			
Wind stress in the +y direction at the tracer cell on the native model grid. note: exftauy is the stress applied to the ice-free ocean surface and sea-ice covered surface. when sea-ice is present, the total stress applied to the ocean surface in the +y direction is not exftauy, but a combination of exftauy wind stress in the open water fraction and a stress from sea-ice in the ice-covered fraction (see ocetauy). exftaux is the sum of era-interim stress and the control adjustment from ocean state estimation.			

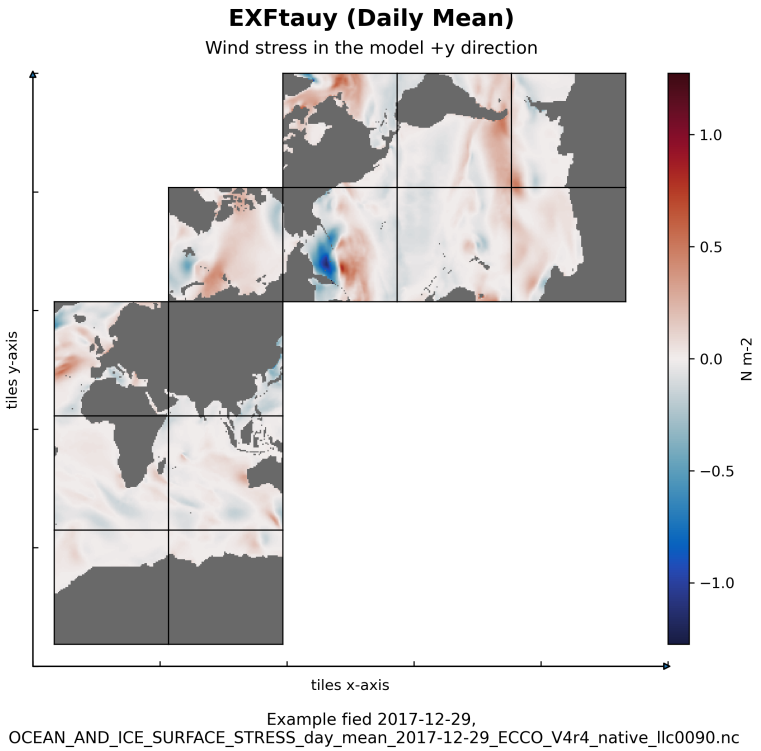


Figure 75: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: EXFtauy

12.9.4 Native Variable: oceTAUX

Table 12.64: Attributes description of the variable 'oceTAUX' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceTAUX	Ocean surface stress in the model +x direction	N m-2

Description of the variable in Common Data language (CDL)

```
float32 oceTAUX(time, tile, j, i_g)
    oceTAUX: _FillValue = 9.96921e+36
    oceTAUX: long_name = Ocean surface stress in the model +x direction
    oceTAUX: units = N m: 2
    oceTAUX: mate = oceTAUY
    oceTAUX: coverage_content_type = modelResult
    oceTAUX: direction = >0 increases horizontal velocity in the +x direction (UVEL)
    oceTAUX: standard_name = downward_x_stress_at_sea_water_surface
    oceTAUX: coordinates = time
    oceTAUX: valid_min = : 2.2317698001861572
    oceTAUX: valid_max = 1.9993581771850586
```

Comments

Ocean surface stress due to wind and sea-ice in the +x direction centered over the 'u' side of the the native model grid. note: in the arakawa-c grid, wind stress acts on horizontal velocities which are staggered relative to the tracer cells with indexing such that +ocetaux(i_g,j) corresponds to +x momentum fluxes at 'u' edge of the tracer cell at (i,j,k=0). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

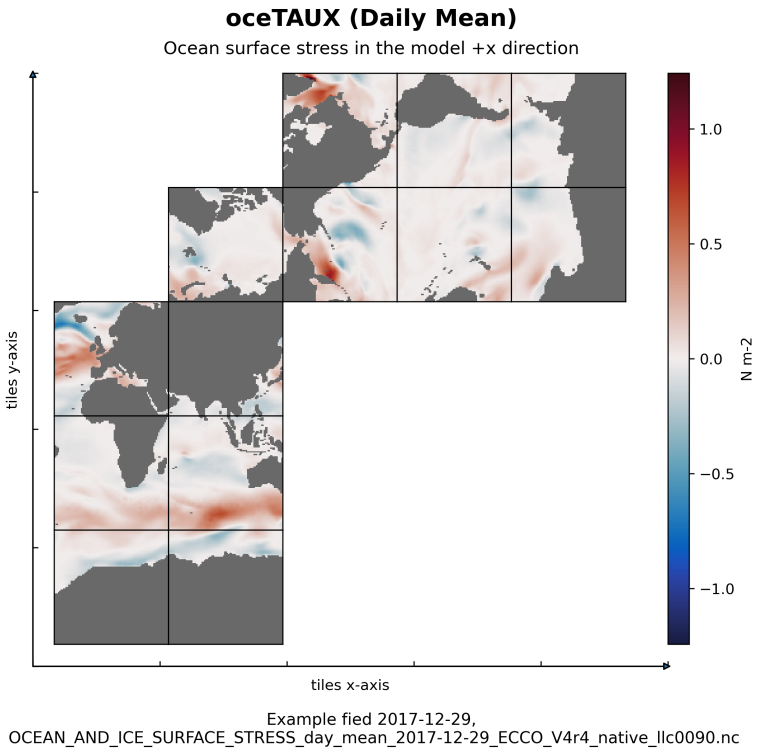


Figure 76: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: oceTAUX

12.9.5 Native Variable: oceTAUY

Table 12.65: Attributes description of the variable 'oceTAUY' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceTAUY	Ocean surface stress in the model +y direction	N m-2

Description of the variable in Common Data language (CDL)

```
float32 oceTAUY(time, tile, j_g, i)
    oceTAUY: _FillValue = 9.96921e+36
    oceTAUY: long_name = Ocean surface stress in the model +y direction
    oceTAUY: units = N m: 2
    oceTAUY: mate = oceTAUX
    oceTAUY: coverage_content_type = modelResult
    oceTAUY: direction = >0 increases horizontal velocity in the +y direction (VVEL)
    oceTAUY: standard_name = downward_y_stress_at_sea_water_surface
    oceTAUY: coordinates = time
    oceTAUY: valid_min = : 2.0606131553649902
    oceTAUY: valid_max = 1.9999693632125854
```

Comments

Ocean surface stress due to wind and sea-ice in the +y direction centered over the 'v' side of the the native model grid. note: in the arakawa-c grid, wind stress acts on horizontal velocities which are staggered relative to the tracer cells with indexing such that +ocetauy(i_g,j) corresponds to +y momentum fluxes at 'v' edge of the tracer cell at (i,j,k=0). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

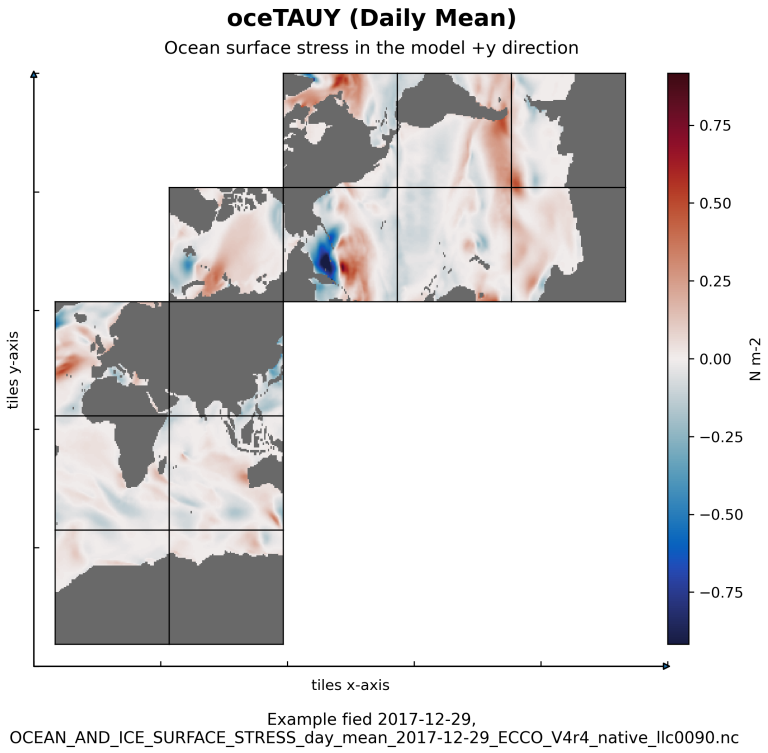


Figure 77: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: oceTAUY

12.10 Native dataset of OCEAN_BOLUS_STREAMFUNCTION

12.10.1 Overview

This dataset provides 3D fields of Gent-McWilliams ocean bolus transport streamfunctions on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.66: Coordinates and Variables in the dataset OCEAN_BOLUS_STREAMFUNCTION

Variables	Description of data variables	Unit
GM_PsiX	Gent-mcwilliams bolus transport streamfunction in the model +x direction	m2 s-1
GM_PsiY	Gent-mcwilliams bolus transport streamfunction in the model +y direction	m2 s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.10.2 Native Variable: GM_PsiX

Table 12.67: Attributes description of the variable 'GM_PsiX' from OCEAN_BOLUS_STREAMFUNCTION's dataset.

Storage Type	Variable Name	Description	Unit
float32	GM_PsiX	Gent-mcwilliams bolus transport streamfunction in the model +x direction	m2 s-1
Description of the variable in Common Data language (CDL)			
float32 GM_PsiX(time, k_l, tile, j, i_g) GM_PsiX: _FillValue = 9.96921e+36 GM_PsiX: long_name = Gent: Mcwilliams bolus transport streamfunction in the model +x direction GM_PsiX: units = m2 s: 1 GM_PsiX: mate = GM_PsiY GM_PsiX: coverage_content_type = modelResult GM_PsiX: coordinates = Zl time GM_PsiX: valid_min = : 4.9964470863342285 GM_PsiX: valid_max = 4.963776111602783			
Comments			
Gent-mcwilliams bolus transport streamfunction 'u' component. any comments welcome			

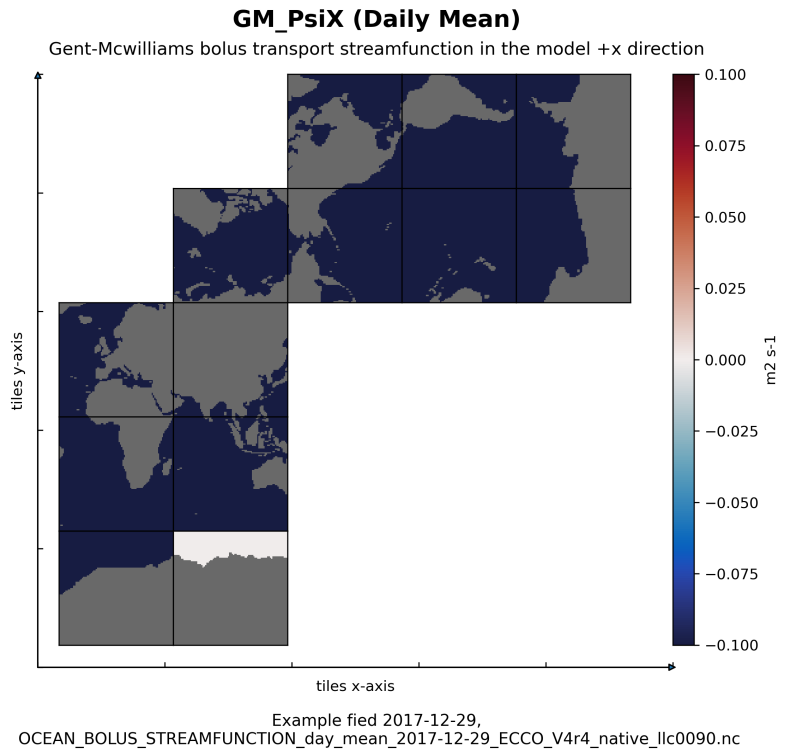


Figure 78: Dataset: OCEAN_BOLUS_STREAMFUNCTION, Variable: GM_PsiX

12.10.3 Native Variable: GM_PsiY

Table 12.68: Attributes description of the variable 'GM_PsiY' from OCEAN_BOLUS_STREAMFUNCTION's dataset.

Storage Type	Variable Name	Description	Unit
float32	GM_PsiY	Gent-mcwilliams bolus transport streamfunction in the model +y direction	m2 s-1
Description of the variable in Common Data language (CDL)			
float32 GM_PsiY(time, k_l, tile, j_g, i) GM_PsiY: _FillValue = 9.96921e+36 GM_PsiY: long_name = Gent: Mcwilliams bolus transport streamfunction in the model +y direction GM_PsiY: units = m2 s: 1 GM_PsiY: mate = GM_PsiX GM_PsiY: coverage_content_type = modelResult GM_PsiY: coordinates = Zl time GM_PsiY: valid_min = : 5.0 GM_PsiY: valid_max = 4.949861526489258			
Comments			
Gent-mcwilliams bolus transport streamfunction 'v' component. any comments welcome			

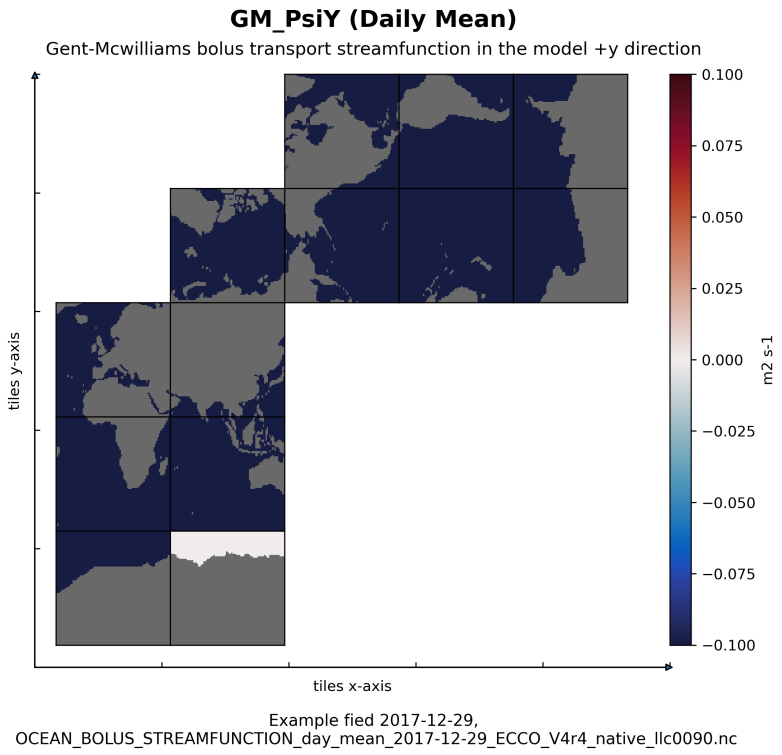


Figure 79: Dataset: OCEAN_BOLUS_STREAMFUNCTION, Variable: GM_PsiY

12.11 Native dataset of OCEAN_BOLUS_VELOCITY

12.11.1 Overview

This dataset provides 3D fields of Gent-McWilliams ocean bolus velocity on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.69: Coordinates and Variables in the dataset OCEAN_BOLUS_VELOCITY

Variables	Description of data variables	Unit
UVELSTAR	Gent-mcwilliams velocity in the model +x direction scaled by time-varying grid cell thickness	m s-1
VVELSTAR	Gent-mcwilliams velocity in the model +y direction scaled by time-varying grid cell thickness	m s-1
WVELSTAR	Gent-mcwilliams velocity in the model +z direction	m s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.11.2 Native Variable: UVELSTAR

Table 12.70: Attributes description of the variable 'UVELSTAR' from OCEAN_BOLUS_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	UVELSTAR	Gent-mcwilliams velocity in the model +x direction scaled by time-varying grid cell thickness	m s-1

Description of the variable in Common Data language (CDL)

float32 UVELSTAR(time, k, tile, j, i_g)
UVELSTAR: _FillValue = 9.96921e+36
UVELSTAR: long_name = Gent: McWilliams velocity in the model +x direction scaled by time: varying grid cell thickness
UVELSTAR: units = m s: 1
UVELSTAR: mate = VVELSTAR
UVELSTAR: coverage_content_type = modelResult
UVELSTAR: standard_name = sea_water_x_velocity_due_to_parameterized_mesoscale_eddies
UVELSTAR: coordinates = Z time
UVELSTAR: valid_min = : 0.7960150241851807
UVELSTAR: valid_max = 0.7762293219566345

Comments

Gent-mcwilliams horizontal velocity in the +x direction at the 'u' face of the tracer cell on the native model grid. note: uvelstar is not a model diagnostic but is calculated offline: uvelstar = -d/dz gm_psix. in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +uvelstar(i_g,j,k) corresponds to +x tracer fluxes through the 'u' face of the tracer cell at (i,j,k). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. see evelstar and nvelstar.

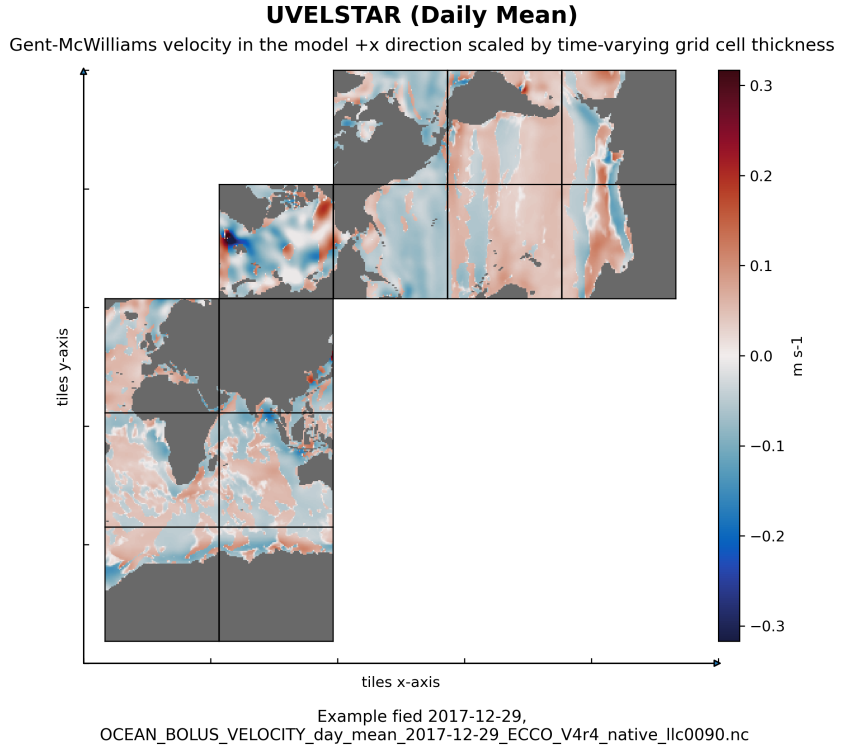


Figure 80: Dataset: OCEAN_BOLUS_VELOCITY, Variable: UVELSTAR

12.11.3 Native Variable: VVELSTAR

Table 12.71: Attributes description of the variable 'VVELSTAR' from OCEAN_BOLUS_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	VVELSTAR	Gent-mcwilliams velocity in the model +y direction scaled by time-varying grid cell thickness	m s-1

Description of the variable in Common Data language (CDL)

float32 VVELSTAR(time, k, tile, j_g, i)
VVELSTAR: _FillValue = 9.96921e+36
VVELSTAR: long_name = Gent: McWilliams velocity in the model +y direction scaled by time: varying grid cell thickness
VVELSTAR: units = m s: 1
VVELSTAR: mate = UVELSTAR
VVELSTAR: coverage_content_type = modelResult
VVELSTAR: standard_name = sea_water_y_velocity_due_to_parameterized_mesoscale_eddies
VVELSTAR: coordinates = Z time
VVELSTAR: valid_min = : 0.8495296239852905
VVELSTAR: valid_max = 0.7200774550437927

Comments

Gent-mcwilliams horizontal velocity in the +y direction at the 'v' face of the tracer cell on the native model grid. note: vvelstar is not a model diagnostic but is calculated offline: vvelstar = -d/dz gm_psiy. in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +vvelstar(i,j_g,k) corresponds to +y tracer fluxes through the 'v' face of the tracer cell at (i,j,k). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. see evelstar and nvelstar.

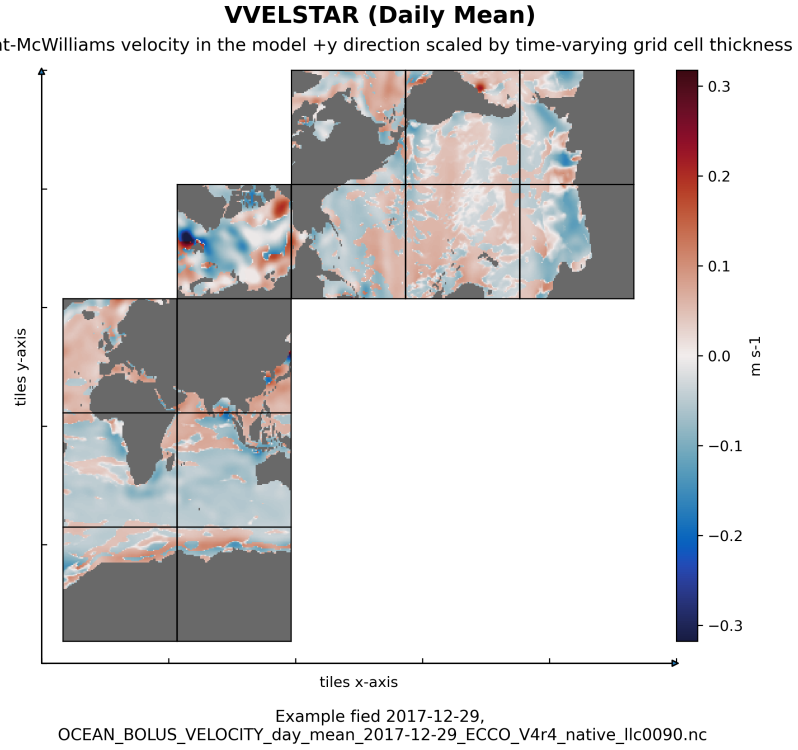


Figure 81: Dataset: OCEAN_BOLUS_VELOCITY, Variable: VVELSTAR

12.11.4 Native Variable: WVELSTAR

Table 12.72: Attributes description of the variable 'WVELSTAR' from OCEAN_BOLUS_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	WVELSTAR	Gent-mcwilliams velocity in the model +z direction	m s-1
Description of the variable in Common Data language (CDL)			
float32 WVELSTAR(time, k_l, tile, j, i) WVELSTAR: _FillValue = 9.96921e+36 WVELSTAR: long_name = Gent: McWilliams velocity in the model +z direction WVELSTAR: units = m s: 1 WVELSTAR: coverage_content_type = modelResult WVELSTAR: direction = >0 decreases volume WVELSTAR: standard_name = upward_sea_water_velocity_due_to_parameterized_mesoscale_eddies WVELSTAR: coordinates = XC YC time Zl WVELSTAR: valid_min = : 0.00037936007720418274 WVELSTAR: valid_max = 0.0004654690856114 03			
Comments			
Gent-mcwilliams vertical bolus velocity in the +z direction at the top 'w' face of the tracer cell on the native model grid. note: in the arakawa-c grid, vertical velocities are staggered relative to the tracer cells with indexing such that +wvelstar(i,j,k_l) corresponds to upward +z motion through the top 'w' face of the tracer cell at (i,j,k).			

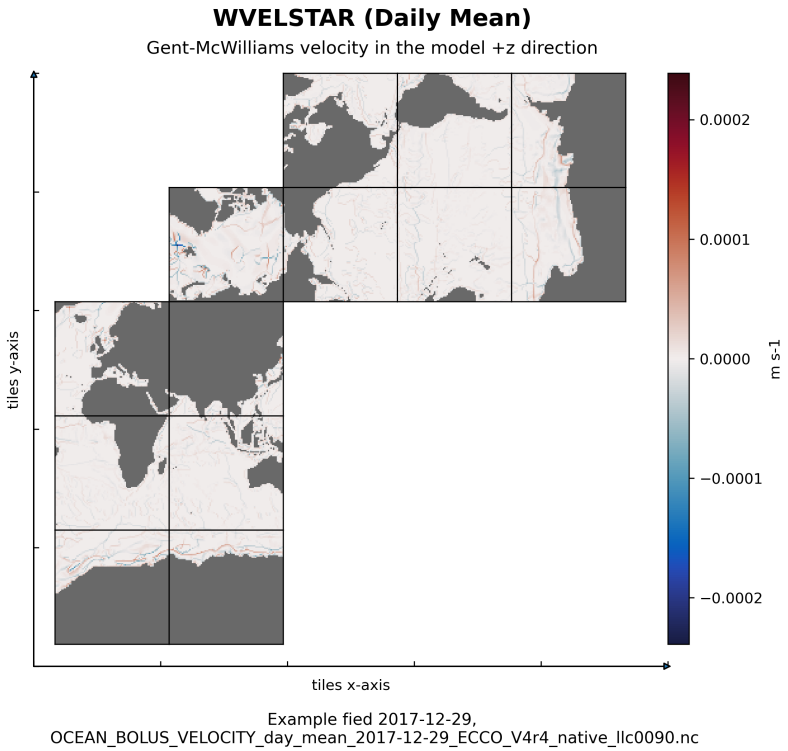


Figure 82: Dataset: OCEAN_BOLUS_VELOCITY, Variable: WVELSTAR

12.12 Native dataset of OCEAN_BOTTOM_PRESSURE

12.12.1 Overview

This dataset provides 2D fields of ocean bottom pressure and model ocean bottom pressure anomaly on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Snapshot data of ocean bottom pressure and model ocean bottom pressure anomaly are also provided. Ocean bottom pressure is provided in three forms: 1) ocean bottom pressure including global mean atmosphereic pressure (OGPGMAP), 2) ocean bottom pressure excluding global mean atmosphereic pressure (OGP), and 3) the model's hydrostatic bottom pressure anomaly before the Greatbatch correction (PHIBOT). Note: the ocean bottom pressure field PHIBOT should not be compared with satellite bottom pressure products (e.g., from GRACE and GRACE-FO), see the variable descriptions of OBP and PHIBOT for more details.

Table 12.73: Coordinates and Variables in the dataset OCEAN_BOTTOM_PRESSURE

Variables	Description of data variables	Unit
OBP	Ocean bottom pressure given as equivalent water thickness	m
OBPGMAP	Ocean bottom pressure given as equivalent water thickness, includes global mean atmospheric pressure	m
PHIBOT	Ocean hydrostatic bottom pressure anomaly	m2 s-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.12.2 Native Variable: OBP

Table 12.74: Attributes description of the variable 'OBP' from OCEAN_BOTTOM_PRESSURE's dataset.

Storage Type	Variable Name	Description	Unit
float32	OBP	Ocean bottom pressure given as equivalent water thickness	m

Description of the variable in Common Data language (CDL)

float32 OBP(time, tile, j, i)
OBP: _FillValue = 9.96921e+36
OBP: long_name = Ocean bottom pressure given as equivalent water thickness
OBP: units = m
OBP: coverage_content_type = modelResult
OBP: coordinates = time XC YC
OBP: valid_min = : 2.544442892074585
OBP: valid_max = 72.1243667602539

Comments

Obp excludes the contribution from global mean atmospheric pressure and is therefore suitable for comparisons with grace data products. obp is calculated as follows. first, we calculate ocean hydrostatic bottom pressure anomaly, phibot, with phibot = p_b/rhoconst - gh(t), where p_b = model ocean hydrostatic bottom pressure, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and h(t) is model depth at time t. then, obp = phibot/g + corrections for i) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh) and ii) global mean atmospheric pressure variations. use obp for comparisons with ocean bottom pressure data products that have been corrected for global mean atmospheric pressure variations. grace data typically are corrected for global mean atmospheric pressure variations. in contrast, ocean bottom pressure gauge data typically are not corrected for global mean atmospheric pressure variations.

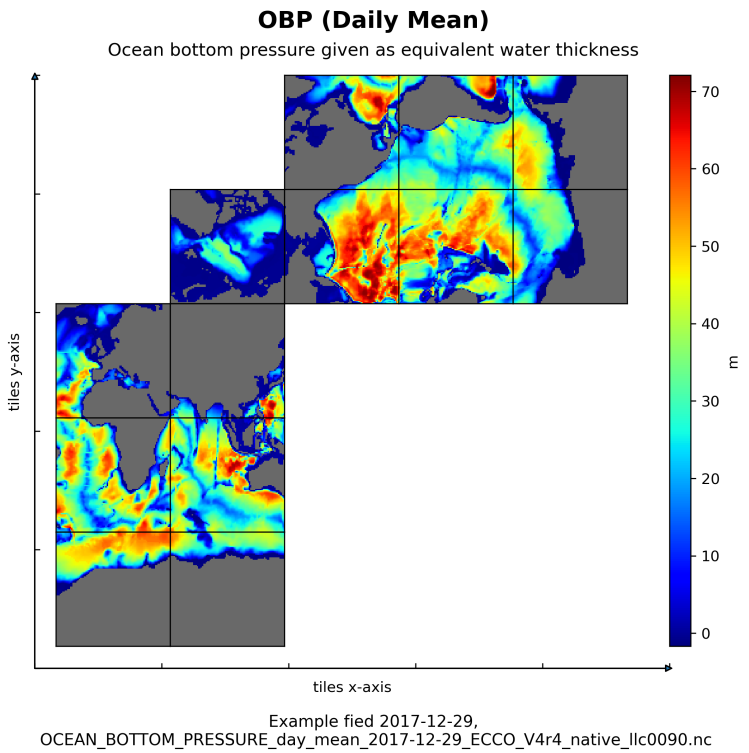


Figure 83: Dataset: OCEAN_BOTTOM_PRESSURE, Variable: OBP

12.12.3 Native Variable: OBPGMAP

Table 12.75: Attributes description of the variable 'OBPGMAP' from OCEAN_BOTTOM_PRESSURE's dataset.

Storage Type	Variable Name	Description	Unit
float32	OBPGMAP	Ocean bottom pressure given as equivalent water thickness, includes global mean atmospheric pressure	m

Description of the variable in Common Data language (CDL)

float32 OBPGMAP(time, tile, j, i)
OBPGMAP: _FillValue = 9.96921e+36
OBPGMAP: long_name = Ocean bottom pressure given as equivalent water thickness includes global mean atmospheric pressure
OBPGMAP: units = m
OBPGMAP: coverage_content_type = modelResult
OBPGMAP: coordinates = time XC YC
OBPGMAP: valid_min = 7.395928859710693
OBPGMAP: valid_max = 82.14805603027344

Comments

Obpgmap includes the contribution from global mean atmospheric pressure and is therefore suitable for comparisons with ocean bottom pressure gauge data products. obpgmap is calculated as follows. first, we calculate ocean hydrostatic bottom pressure anomaly, phibot, with phibot = p_b/rhoconst - gh(t), where p_b = model ocean hydrostatic bottom pressure, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and h(t) is model depth at time t. then, obpgmap= phibot/g + corrections for global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh). use obpgmap for comparisons with ocean bottom pressure data products that have not been corrected for global mean atmospheric pressure variations. grace data typically are corrected for global mean atmospheric pressure variations. in contrast, ocean bottom pressure gauge data typically are not corrected for global mean atmospheric pressure variations.

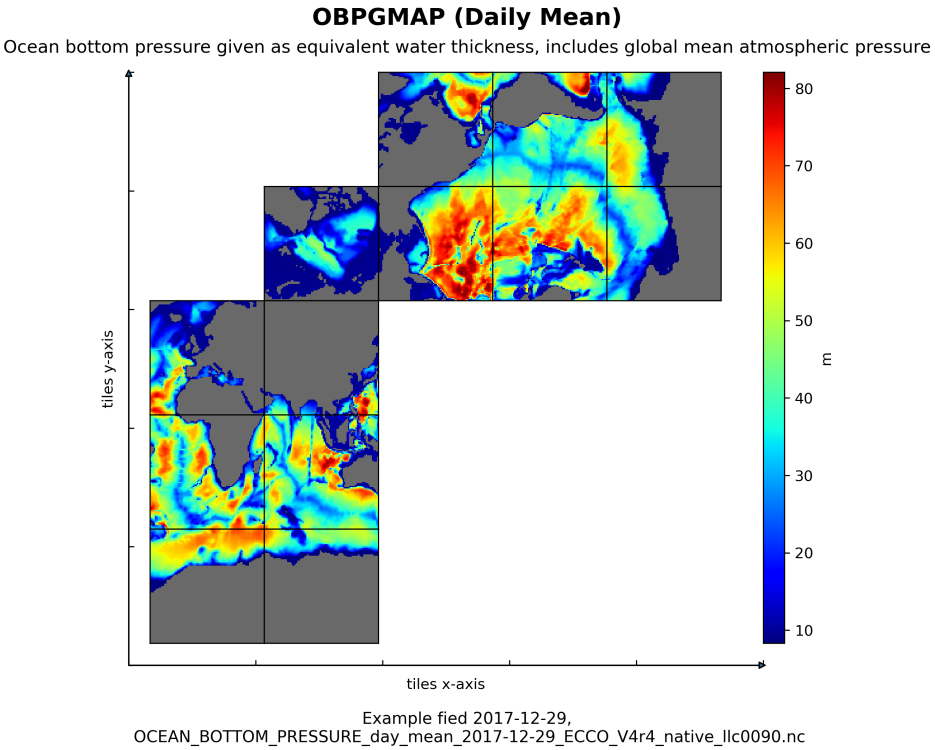


Figure 84: Dataset: OCEAN_BOTTOM_PRESSURE, Variable: OBPGMAP

12.12.4 Native Variable: PHIBOT

Table 12.76: Attributes description of the variable 'PHIBOT' from OCEAN_BOTTOM_PRESSURE's dataset.

Storage Type	Variable Name	Description	Unit
float32	PHIBOT	Ocean hydrostatic bottom pressure anomaly	m2 s-2
Description of the variable in Common Data language (CDL)			
float32 PHIBOT(time, tile, j, i) PHIBOT: _FillValue = 9.96921e+36 PHIBOT: long_name = Ocean hydrostatic bottom pressure anomaly PHIBOT: units = m2 s: 2 PHIBOT: coverage_content_type = modelResult PHIBOT: coordinates = time XC YC PHIBOT: valid_min = 73.01050567626953 PHIBOT: valid_max = 805.7855224609375			
Comments			
Phibot = p_b / rhoconst - g h(t), where p_b = hydrostatic ocean bottom pressure, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and h(t) is model depth at time t. units: p:[kg m-1 s-2], rhoconst:[kg m-3], g:[m s-2], h(t):[m]. note: includes atmospheric pressure loading. phibot accounts for the model's time-varying grid cell thickness (z* coordinate system). phibot is not corrected for global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh), and therefore should not be used for comparisons with ocean bottom pressure data. instead, see obpgmap and obp.			

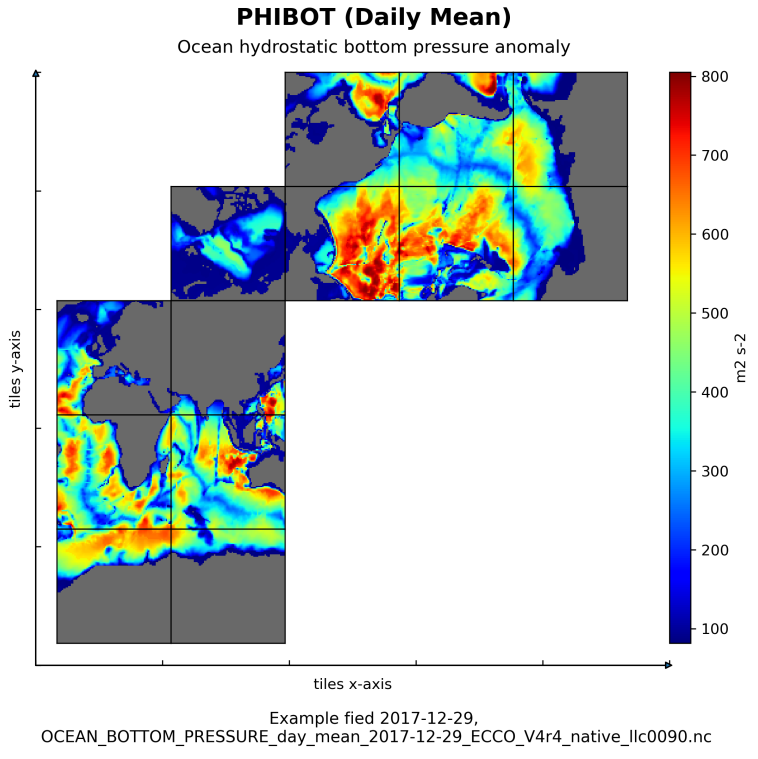


Figure 85: Dataset: OCEAN_BOTTOM_PRESSURE, Variable: PHIBOT

12.13 Native dataset of OCEAN_DENS_STRAT_PRESS

12.13.1 Overview

This dataset provides 3D fields of ocean density, stratification, and hydrostatic pressure on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Hydrostatic pressure is provided in two forms: 1) using constant vertical grid spacing (PHIHYDcR) and 2) using time-varying grid spacing from the model's z* coordinate system (PHIHYD).

Table 12.77: Coordinates and Variables in the dataset OCEAN_DENS_STRAT_PRESS

Variables	Description of data variables	Unit
RHOAnoma	In-situ seawater density anomaly	kg m-3
DRHODR	Density stratification	kg m-3 m-1
PHIHYD	Ocean hydrostatic pressure anomaly	m2 s-2
PHIHYDcR	Ocean hydrostatic pressure anomaly at constant depths	m2 s-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.13.2 Native Variable: DRHODR

Table 12.78: Attributes description of the variable 'DRHODR' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	DRHODR	Density stratification	kg m-3 m-1
Description of the variable in Common Data language (CDL)			
float32 DRHODR(time, k_l, tile, j, i) DRHODR: _FillValue = 9.96921e+36 DRHODR: long_name = Density stratification DRHODR: units = kg m: 3 m: 1 DRHODR: coverage_content_type = modelResult DRHODR: coordinates = YC XC time Zl DRHODR: valid_min = : 0.8687265515327454 DRHODR: valid_max = 0.011617615818977356			
Comments			
Density stratification: d(sigma) d z-1. note: density computations are done with in-situ density. the vertical derivatives of in-situ density and locally-referenced potential density are identical the equation of state is a modified unesco formula by jackett and mcdougall (1995), which uses the model variable potential temperature as input assuming a horizontally and temporally constant pressure of $p_0=-g ho_{0} z$.			

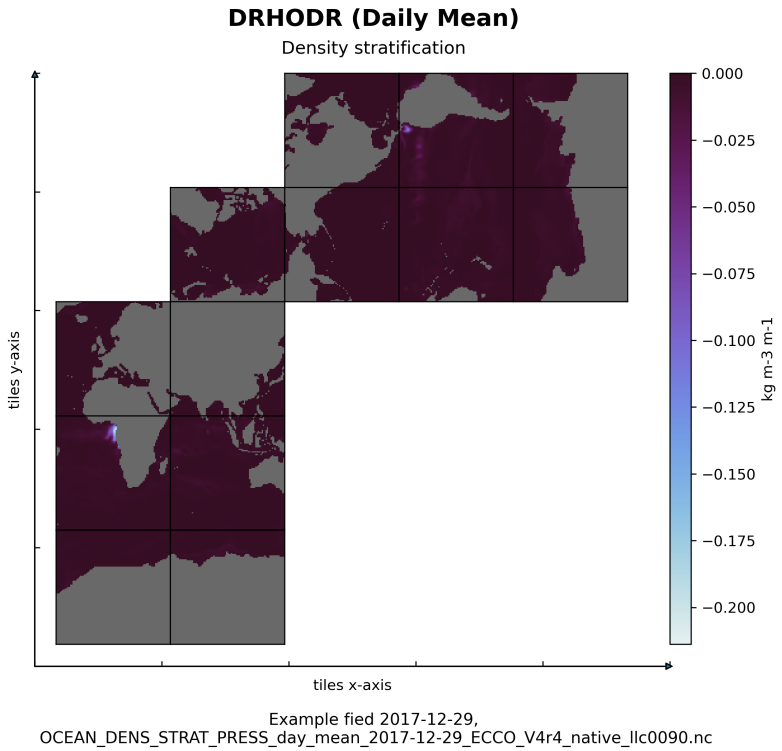


Figure 86: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: DRHODR

12.13.3 Native Variable: PHIHYD

Table 12.79: Attributes description of the variable 'PHIHYD' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	PHIHYD	Ocean hydrostatic pressure anomaly	m2 s-2
Description of the variable in Common Data language (CDL)			
float32 PHIHYD(time, k, tile, j, i) PHIHYD: _FillValue = 9.96921e+36 PHIHYD: long_name = Ocean hydrostatic pressure anomaly PHIHYD: units = m2 s: 2 PHIHYD: coverage_content_type = modelResult PHIHYD: coordinates = YC Z XC time PHIHYD: valid_min = 74.71473693847656 PHIHYD: valid_max = 783.9188232421875			
Comments			
Phihyd = p(k) / rhoconst - g z*(k,t), where p = hydrostatic ocean pressure at depth level k, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and z*(k,t) is model depth at level k and time t. units: p:[kg m-1 s-2], rhoconst:[kg m-3], g:[m s-2], h(t):[m]. note: includes atmospheric pressure loading. quantity referred to in some contexts as hydrostatic pressure anomaly. phibot accounts for the model's time-varying grid cell thickness (z* coordinate system). see phihydcr for hydrostatic pressure potential anomaly calculated using time-invariant grid cell thicknesses. phihyd is not corrected for global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh).			

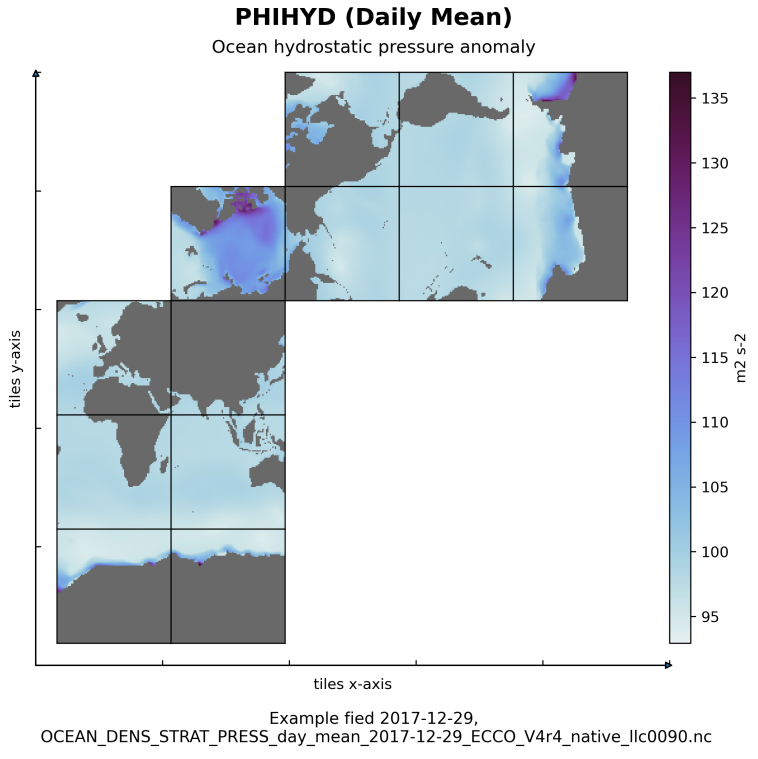


Figure 87: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: PHIHYD

12.13.4 Native Variable: PHIHYDcR

Table 12.80: Attributes description of the variable 'PHIHYDcR' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	PHIHYDcR	Ocean hydrostatic pressure anomaly at constant depths	m2 s-2

Description of the variable in Common Data language (CDL)

float32 PHIHYDcR(time, k, tile, j, i)
PHIHYDcR: _FillValue = 9.96921e+36
PHIHYDcR: long_name = Ocean hydrostatic pressure anomaly at constant depths
PHIHYDcR: units = m2 s: 2
PHIHYDcR: coverage_content_type = modelResult
PHIHYDcR: coordinates = YC Z XC time
PHIHYDcR: valid_min = 73.08939361572266
PHIHYDcR: valid_max = 784.4268188476562

Comments

Phihyd = p(k) / rhoconst - g z(k,t), where p = hydrostatic ocean pressure at depth level k, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and z(k,t) is fixed model depth at level k. units: p:[kg m-1 s-2], rhoconst:[kg m-3], g:[m s-2], h(t):[m]. note: includes atmospheric pressure loading. quantity referred to in some contexts as hydrostatic pressure potential anomaly. phihydcr is calculated with respect to the model's initial, time-invariant grid cell thicknesses. see phihyd for hydrostatic pressure anomaly calculated using model's time-variable grid cell thicknesses (z* coordinate system). phihydcr is is not corrected for global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh).

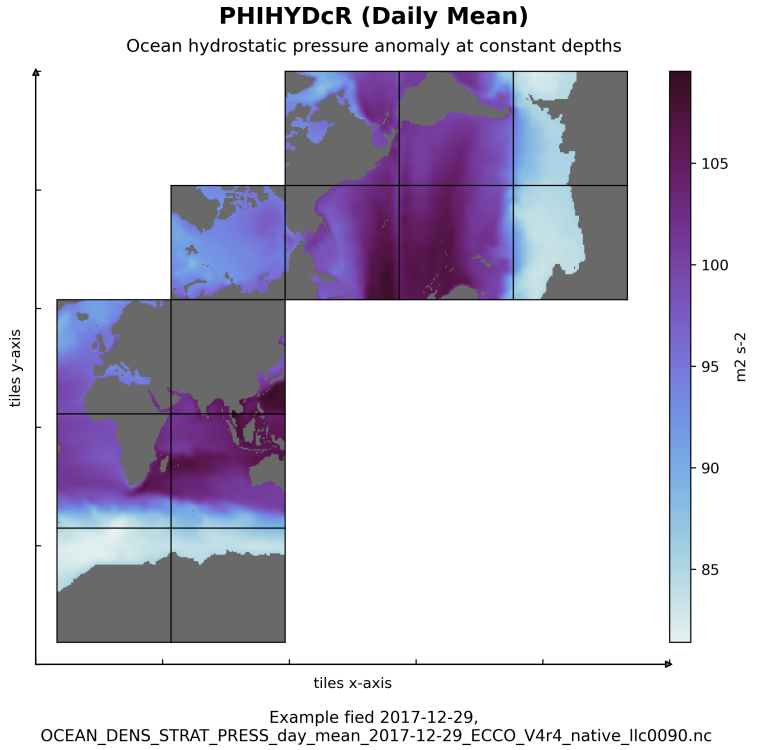


Figure 88: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: PHIHYDcR

12.13.5 Native Variable: RHOAnoma

Table 12.81: Attributes description of the variable 'RHOAnoma' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	RHOAnoma	In-situ seawater density anomaly	kg m-3
Description of the variable in Common Data language (CDL)			
float32 RHOAnoma(time, k, tile, j, i) RHOAnoma: _FillValue = 9.96921e+36 RHOAnoma: long_name = In: situ seawater density anomaly RHOAnoma: units = kg m: 3 RHOAnoma: coverage_content_type = modelResult RHOAnoma: coordinates = YC Z XC time RHOAnoma: valid_min = : 19.919862747192383 RHOAnoma: valid_max = 25.540647506713867			
Comments			
In-situ seawater density anomaly relative to the reference density, rhoconst. rhoconst = 1029 kg m-3			

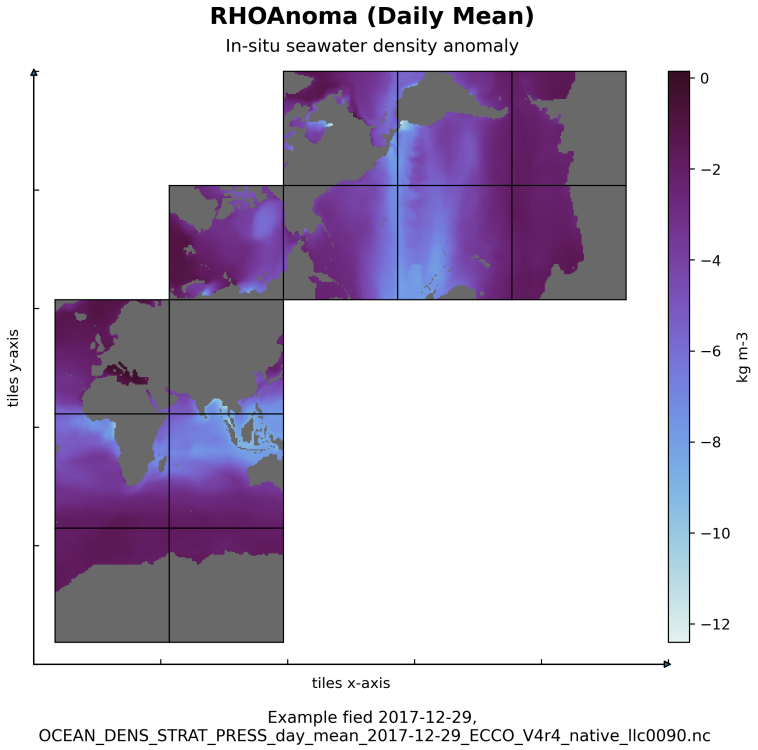


Figure 89: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: RHOAnoma

12.14 Native dataset of OCEAN_MIXED_LAYER_DEPTH

12.14.1 Overview

This dataset provides 2D fields of ocean mixed layer depth on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.82: Coordinates and Variables in the dataset OCEAN_MIXED_LAYER_DEPTH

Variables	Description of data variables	Unit
MXLDEPTH	Mixed-layer depth diagnosed using the temperature difference criterion of kara et al., 2000	m
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.14.2 Native Variable: MXLDEPTH

Table 12.83: Attributes description of the variable 'MXLDEPTH' from OCEAN_MIXED_LAYER_DEPTH's dataset.

Storage Type	Variable Name	Description	Unit
float32	MXLDEPTH	Mixed-layer depth diagnosed using the temperature difference criterion of kara et al., 2000	m

Description of the variable in Common Data language (CDL)

float32 MXLDEPTH(time, tile, j, i)
MXLDEPTH: _FillValue = 9.96921e+36
MXLDEPTH: long_name = Mixed: layer depth diagnosed using the temperature difference criterion of Kara et al.
2000
MXLDEPTH: units = m
MXLDEPTH: coverage_content_type = modelResult
MXLDEPTH: standard_name = ocean_mixed_layer_thickness
MXLDEPTH: coordinates = time XC YC
MXLDEPTH: valid_min = 5.000001430511475
MXLDEPTH: valid_max = 5331.2001953125

Comments

Mixed-layer depth as determined by the depth where waters are first 0.8 degrees celsius colder than the surface. see kara et al. (jgr, 2000). . note: the kara et al. criterion may not be appropriate for some applications. if needed, mixed layer depth can be calculated using different criteria. see vertical density stratification (drhodr) and density anomaly (rhoanoma).

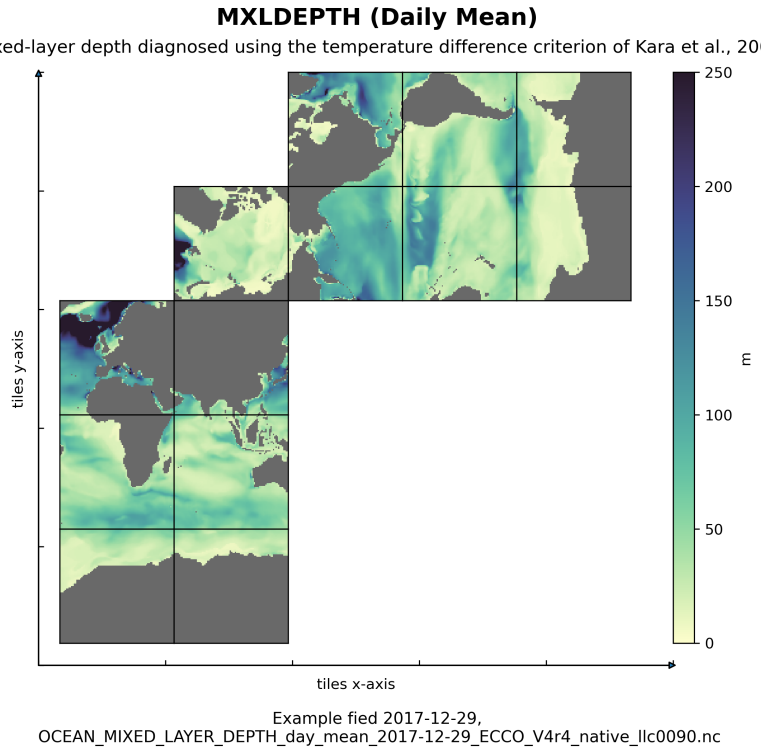


Figure 90: Dataset: OCEAN_MIXED_LAYER_DEPTH, Variable: MXLDEPTH

12.15 Native dataset of OCEAN_TEMPERATURE_SALINITY

12.15.1 Overview

This dataset provides 3D fields of ocean potential temperature and salinity on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Snapshot data of ocean potential temperature and salinity are also provided.

Table 12.84: Coordinates and Variables in the dataset OCEAN_TEMPERATURE_SALINITY

Variables	Description of data variables	Unit
THETA	Potential temperature	degree_C
SALT	Salinity	1e-3
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.15.2 Native Variable: SALT

Table 12.85: Attributes description of the variable 'SALT' from OCEAN_TEMPERATURE_SALINITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	SALT	Salinity	1e-3
Description of the variable in Common Data language (CDL)			
float32 SALT(time, k, tile, j, i) SALT: _FillValue = 9.96921e+36 SALT: long_name = Salinity SALT: units = 1e: 3 SALT: coverage_content_type = modelResult SALT: standard_name = sea_water_salinity SALT: coordinates = YC Z XC time SALT: valid_min = 16.73577880859375 SALT: valid_max = 41.321231842041016			
Comments			
Defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html			

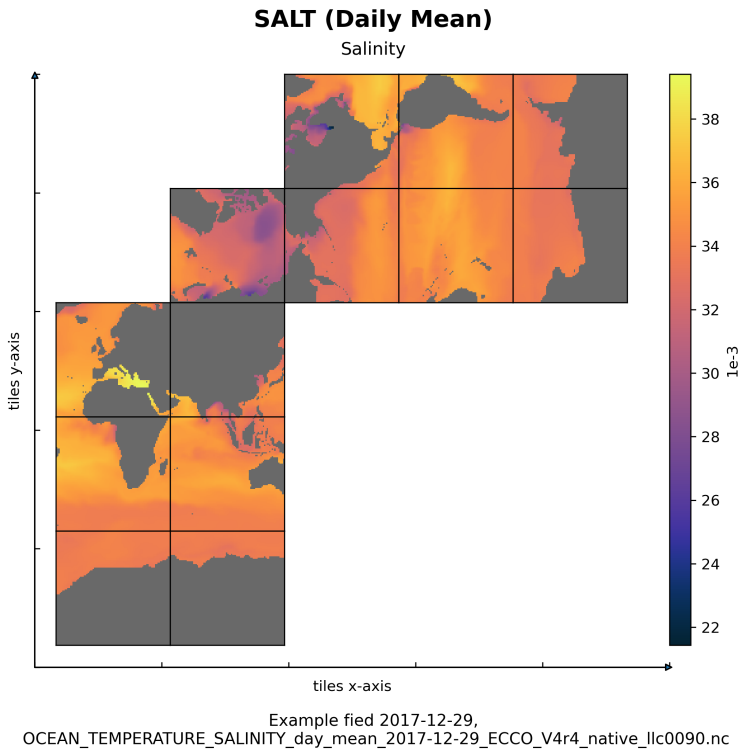


Figure 91: Dataset: OCEAN_TEMPERATURE_SALINITY, Variable: SALT

12.15.3 Native Variable: THETA

Table 12.86: Attributes description of the variable 'THETA' from OCEAN_TEMPERATURE_SALINITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	THETA	Potential temperature	degree_C
Description of the variable in Common Data language (CDL)			
float32 THETA(time, k, tile, j, i) THETA: _FillValue = 9.96921e+36 THETA: long_name = Potential temperature THETA: units = degree_C THETA: coverage_content_type = modelResult THETA: standard_name = sea_water_potential_temperature THETA: coordinates = YC Z XC time THETA: valid_min = : 2.9179372787475586 THETA: valid_max = 36.425140380859375			
Comments			
Sea water potential temperature is the temperature a parcel of sea water would have if moved adiabatically to sea level pressure. note: the equation of state is a modified unesco formula by jackett and mcdougall (1995), which uses the model variable potential temperature as input assuming a horizontally and temporally constant pressure of $p_0=-g ho_{0} z$.			

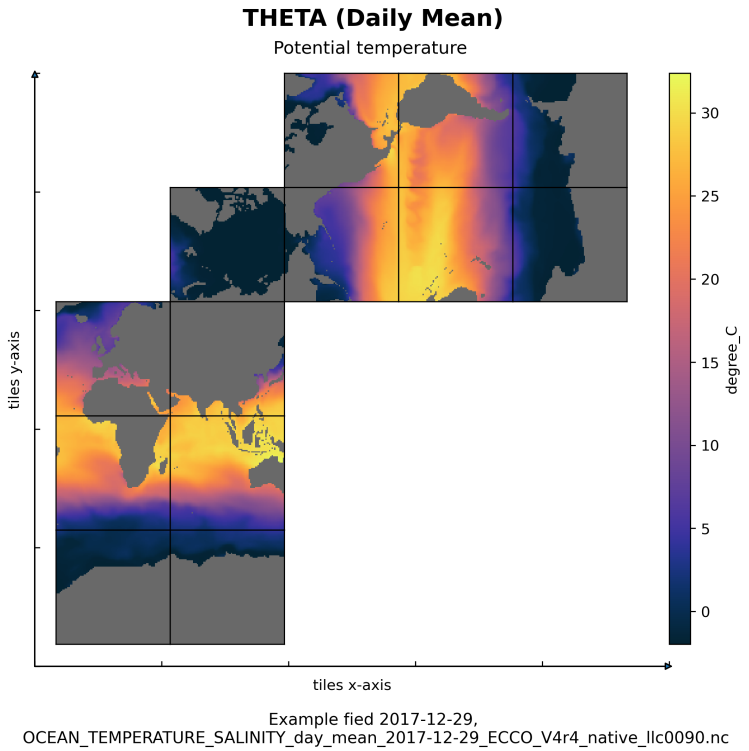


Figure 92: Dataset: OCEAN_TEMPERATURE_SALINITY, Variable: THETA

12.16 Native dataset of OCEAN_VELOCITY

12.16.1 Overview

This dataset provides 3D fields of ocean velocity (3D fields: zonal, meridional and vertical velocity components) on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.87: Coordinates and Variables in the dataset OCEAN_VELOCITY

Variables	Description of data variables	Unit
UVEL	Horizontal velocity in the model +x direction	m s-1
VVEL	Horizontal velocity in the model +y direction	m s-1
WVEL	Vertical velocity	m s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
k	Grid index in z for tracer variables	–none–
k_u	Grid index in z corresponding to the bottom face of tracer grid cells ('w' locations)	–none–
k_l	Grid index in z corresponding to the top face of tracer grid cells ('w' locations)	–none–
k_p1	Grid index in z for variables at 'w' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
Z	Depth of tracer grid cell center	m
Zp1	Depth of tracer grid cell interface	m
Zu	Depth of the bottom face of tracer grid cells	m
Zl	Depth of the top face of tracer grid cells	m
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–
Z_bnds	Depths of tracer grid cell upper and lower interfaces	–none–

12.16.2 Native Variable: UVEL

Table 12.88: Attributes description of the variable 'UVEL' from OCEAN_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	UVEL	Horizontal velocity in the model +x direction	m s-1

Description of the variable in Common Data language (CDL)

float32 UVEL(time, k, tile, j, i_g)
UVEL: _FillValue = 9.96921e+36
UVEL: long_name = Horizontal velocity in the model +x direction
UVEL: units = m s: 1
UVEL: mate = VVEL
UVEL: coverage_content_type = modelResult
UVEL: direction = >0 increases volume
UVEL: standard_name = sea_water_x_velocity
UVEL: coordinates = Z time
UVEL: valid_min = : 2.139253616333008
UVEL: valid_max = 2.038635015487671

Comments

Horizontal velocity in the +x direction at the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +uvel(i_g,j,k) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k). do not use uvel for volume flux calculations because the model's grid cell thicknesses vary with time (z* coordinates); use uvelmass instead. also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. see evel and nvel for zonal and meridional velocity.

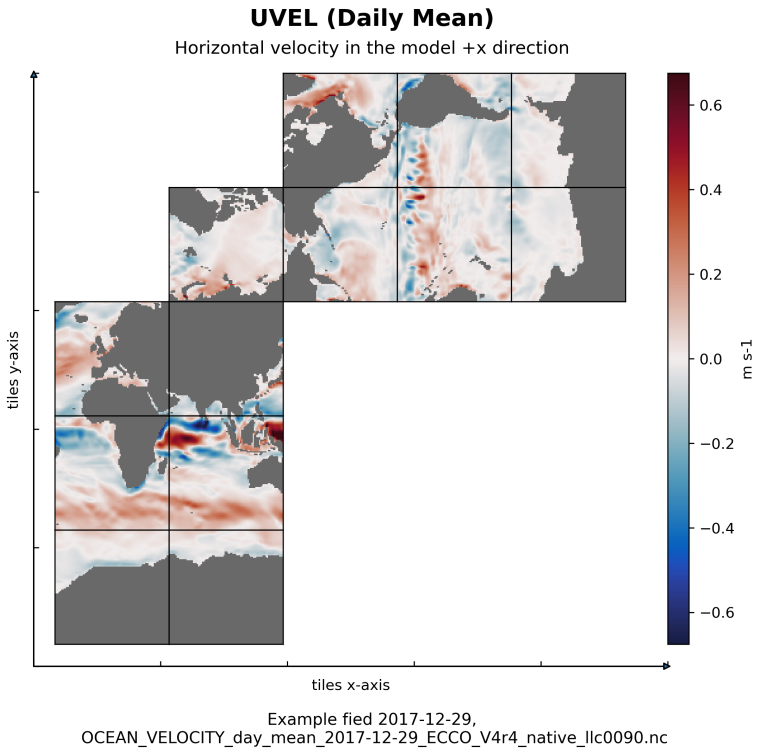


Figure 93: Dataset: OCEAN_VELOCITY, Variable: UVEL

12.16.3 Native Variable: VVEL

Table 12.89: Attributes description of the variable 'VVEL' from OCEAN_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	VVEL	Horizontal velocity in the model +y direction	m s-1

Description of the variable in Common Data language (CDL)

float32 VVEL(time, k, tile, j_g, i)
VVEL: _FillValue = 9.96921e+36
VVEL: long_name = Horizontal velocity in the model +y direction
VVEL: units = m s: 1
VVEL: mate = UVEL
VVEL: coverage_content_type = modelResult
VVEL: direction = >0 increases volume
VVEL: standard_name = sea_water_y_velocity
VVEL: coordinates = Z time
VVEL: valid_min = : 1.7877743244171143
VVEL: valid_max = 1.9089667797088623

Comments

Horizontal velocity in the +y direction at the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +vvel(i,j_g,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k). do not use vvel for volume flux calculations because the model's grid cell thicknesses vary with time (z* coordinates); use vvelmass instead. also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles. see evel and nvel for zonal and meridional velocity.

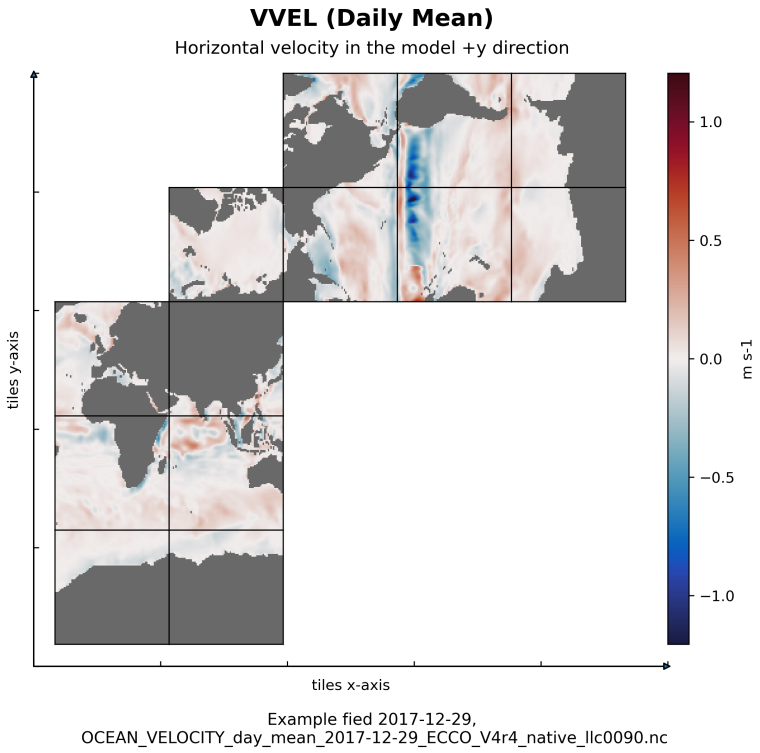


Figure 94: Dataset: OCEAN_VELOCITY, Variable: VVEL

12.16.4 Native Variable: WVEL

Table 12.90: Attributes description of the variable 'WVEL' from OCEAN_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	WVEL	Vertical velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 WVEL(time, k_l, tile, j, i) WVEL: _FillValue = 9.96921e+36 WVEL: long_name = Vertical velocity WVEL: units = m s: 1 WVEL: coverage_content_type = modelResult WVEL: direction = >0 decreases volume WVEL: standard_name = upward_sea_water_velocity WVEL: coordinates = Zl YC time XC WVEL: valid_min = : 0.0023150660563260317 WVEL: valid_max = 0.0016380994347855449			
Comments			
Vertical velocity in the +z direction at the top 'w' face of the tracer cell on the native model grid. note: in the arakawa-c grid, vertical velocities are staggered relative to the tracer cells with indexing such that +wvel(i,j,k_l) corresponds to upward +z motion through the top 'w' face of the tracer cell at (i,j,k). wvel is identical to wvelmass.			

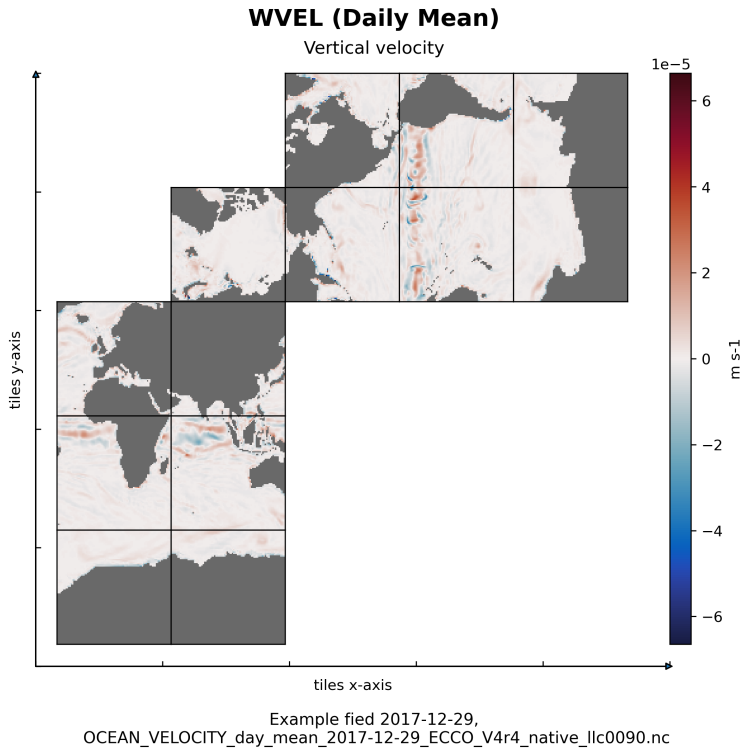


Figure 95: Dataset: OCEAN_VELOCITY, Variable: WVEL

12.17 Native dataset of SEA_ICE_CONC_THICKNESS

12.17.1 Overview

This dataset provides 2D fields of sea-ice and snow concentration, thickness, and pressure loading on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Snapshot data of sea-ice and snow concentration, thickness, and pressure are also provided.

Table 12.91: Coordinates and Variables in the dataset SEA_ICE_CONC_THICKNESS

Variables	Description of data variables	Unit
SIarea	Sea-ice concentration	1
SIheff	Area-averaged sea-ice thickness	m
SIhsnow	Area-averaged snow thickness	m
sIceLoad	Average sea-ice and snow mass per unit area	kg m-2
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.17.2 Native Variable: SIarea

Table 12.92: Attributes description of the variable 'SIarea' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIarea	Sea-ice concentration	1
Description of the variable in Common Data language (CDL)			
float32 SIarea(time, tile, j, i) SIarea: _FillValue = 9.96921e+36 SIarea: long_name = Sea: ice concentration SIarea: units = 1 SIarea: coverage_content_type = modelResult SIarea: standard_name = sea_ice_area_fraction SIarea: coordinates = time YC XC SIarea: valid_min = 0.0 SIarea: valid_max = 0.9700000286102295			
Comments			
Fraction of ocean grid cell covered with sea-ice [0 to 1]. cf standard name table v73: 'area fraction' is the fraction of a grid cell's horizontal area that has some characteristic of interest. it is evaluated as the area of interest divided by the grid cell area. it may be expressed as a fraction, a percentage, or any other dimensionless representation of a fraction. sea ice area fraction is area of the sea surface occupied by sea ice. it is also called 'sea ice concentration'. 'sea ice' means all ice floating in the sea which has formed from freezing sea water, rather than by other processes such as calving of land ice to form icebergs. https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html. defined using cf standard name table v73: 'area fraction' is the fraction of a grid cell's horizontal area that has some characteristic of interest. it is evaluated as the area of interest divided by the grid cell area. it may be expressed as a fraction, a percentage, or any other dimensionless representation of a fraction. sea ice area fraction is area of the sea surface occupied by sea ice. it is also called 'sea ice concentration'. 'sea ice' means all ice floating in the sea which has formed from freezing sea water and precipitation, rather than by other processes such as calving of land ice to form icebergs. https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html			

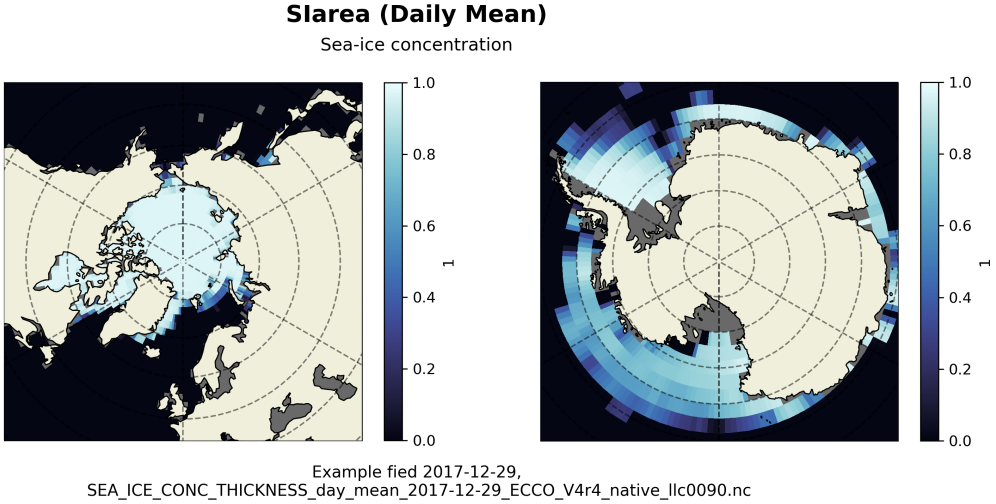


Figure 96: Dataset: SEA_ICE_CONC_THICKNESS, Variable: SIarea

12.17.3 Native Variable: SIheff

Table 12.93: Attributes description of the variable 'SIheff' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIheff	Area-averaged sea-ice thickness	m
Description of the variable in Common Data language (CDL)			
float32 SIheff(time, tile, j, i) SIheff: _FillValue = 9.96921e+36 SIheff: long_name = Area: averaged sea: ice thickness SIheff: units = m SIheff: coverage_content_type = modelResult SIheff: standard_name = sea_ice_thickness SIheff: coordinates = time YC XC SIheff: valid_min = 0.0 SIheff: valid_max = 9.000518798828125			
Comments			
Sea-ice thickness averaged over the entire model grid cell, including open water where sea-ice thickness is zero. note: sea-ice thickness over the ice-covered fraction of the grid cell is siheff/siarea			

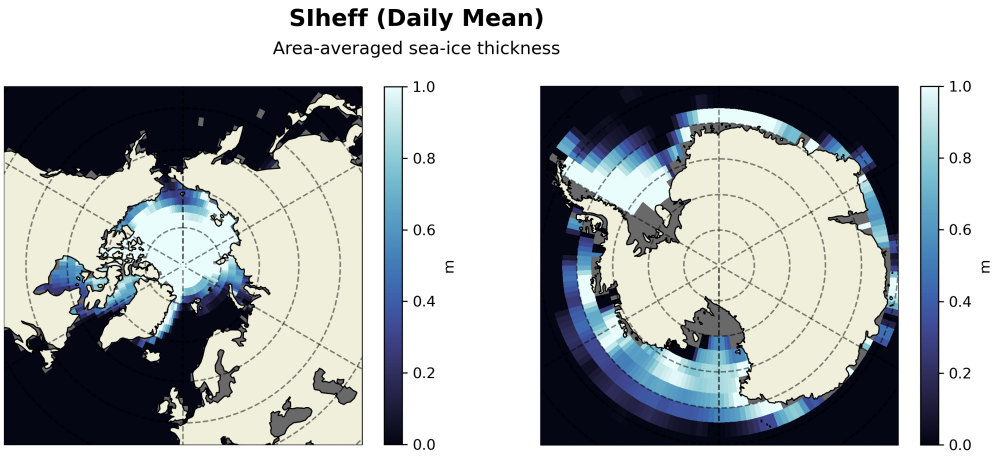


Figure 97: Dataset: SEA_ICE_CONC_THICKNESS, Variable: SIheff

12.17.4 Native Variable: SIhsnow

Table 12.94: Attributes description of the variable 'SIhsnow' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIhsnow	Area-averaged snow thickness	m
Description of the variable in Common Data language (CDL)			
float32 SIhsnow(time, tile, j, i) SIhsnow: _FillValue = 9.96921e+36 SIhsnow: long_name = Area: averaged snow thickness SIhsnow: units = m SIhsnow: coverage_content_type = modelResult SIhsnow: standard_name = surface_snow_thickness SIhsnow: coordinates = time YC XC SIhsnow: valid_min = : 0.0004725505714304745 SIhsnow: valid_max = 2.7013046741485596			
Comments			
Snow thickness averaged over the entire model grid cell, including open water where snow thickness is zero. note: snow thickness over the ice-covered fraction of the grid cell is sihsnow/siarea			

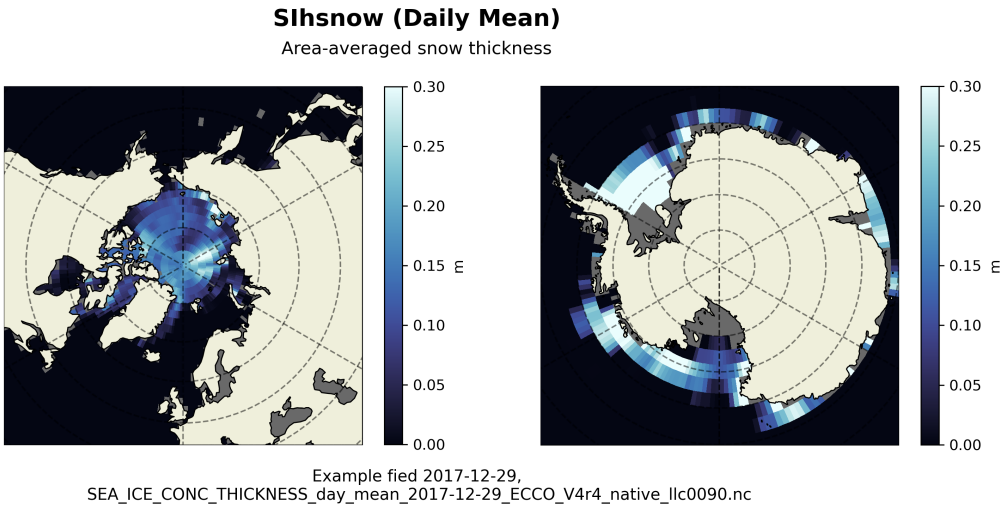


Figure 98: Dataset: SEA_ICE_CONC_THICKNESS, Variable: SIhsnow

12.17.5 Native Variable: sIceLoad

Table 12.95: Attributes description of the variable 'sIceLoad' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	sIceLoad	Average sea-ice and snow mass per unit area	kg m-2
Description of the variable in Common Data language (CDL)			
float32 sIceLoad(time, tile, j, i) sIceLoad: _FillValue = 9.96921e+36 sIceLoad: long_name = Average sea: ice and snow mass per unit area sIceLoad: units = kg m: 2 sIceLoad: coverage_content_type = modelResult sIceLoad: standard_name = sea_ice_and_surface_snow_amount sIceLoad: coordinates = time YC XC sIceLoad: valid_min = : 0.0015558383893221617 sIceLoad: valid_max = 8729.935546875			
Comments			
Total mass of sea-ice and snow in a model grid cell averaged over model grid cell area. note: siceload is used to correct model sea level anomaly, etan, to calculate dynamic sea surface height, ssh, and sea surface height without the inverted barometer (ib correction), sshnoibc. in the model, sea-ice is treated as floating above the sea level with etan tracing the location of the ocean-ice interface. consequently, sea-ice growth in the model lowers etan and sea-ice melting raises etan. dynamic sea surface height is obtained by correcting etan by the weight of ice and snow directly above following archimedes' principle.			

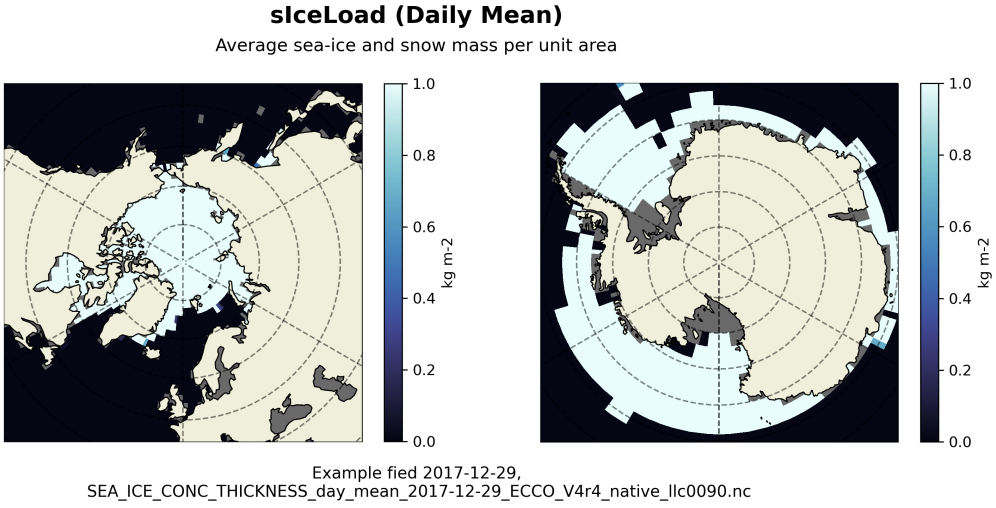


Figure 99: Dataset: SEA_ICE_CONC_THICKNESS, Variable: sIceLoad

12.18 Native dataset of SEA_ICE_HORIZ_VOLUME_FLUX

12.18.1 Overview

This dataset provides 2D fields of sea-ice and snow horizontal volume fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 12.96: Coordinates and Variables in the dataset SEA_ICE_HORIZ_VOLUME_FLUX

Variables	Description of data variables	Unit
ADVxHEFF	Lateral advective flux of sea-ice thickness in the model +x direction	m3 s-1
ADVyHEFF	Lateral advective flux of sea-ice thickness in the model +y direction	m3 s-1
ADVxSNOW	Lateral advective flux of snow thickness in the model +x direction	m3 s-1
ADVySNOW	Lateral advective flux of snow thickness in the model +y direction	m3 s-1
DFxESNOW	Lateral diffusive flux of snow thickness in the model +x direction	m3 s-1
DFyEHEFF	Lateral diffusive flux of sea-ice thickness in the model +y direction.	m3 s-1
DFxEHEFF	Lateral diffusive flux of sea-ice thickness in the model +x direction.	m3 s-1
DFyESNOW	Lateral diffusive flux of snow thickness in the model +y direction	m3 s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.18.2 Native Variable: ADVxHEFF

Table 12.97: Attributes description of the variable 'ADVxHEFF' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVxHEFF	Lateral advective flux of sea-ice thickness in the model +x direction	m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVxHEFF(time, tile, j, i_g)
ADVxHEFF: _FillValue = 9.96921e+36
ADVxHEFF: long_name = Lateral advective flux of sea: ice thickness in the model +x direction
ADVxHEFF: units = m3 s: 1
ADVxHEFF: mate = ADVyHEFF
ADVxHEFF: coverage_content_type = modelResult
ADVxHEFF: direction = >0 increases mean sea: ice thickness (HEFF)
ADVxHEFF: coordinates = time
ADVxHEFF: valid_min = : 151912.28125
ADVxHEFF: valid_max = 107688.7578125

Comments

Lateral advective flux of grid cell mean sea-ice thickness (heff) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advxheff(i_g,j) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k=0). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

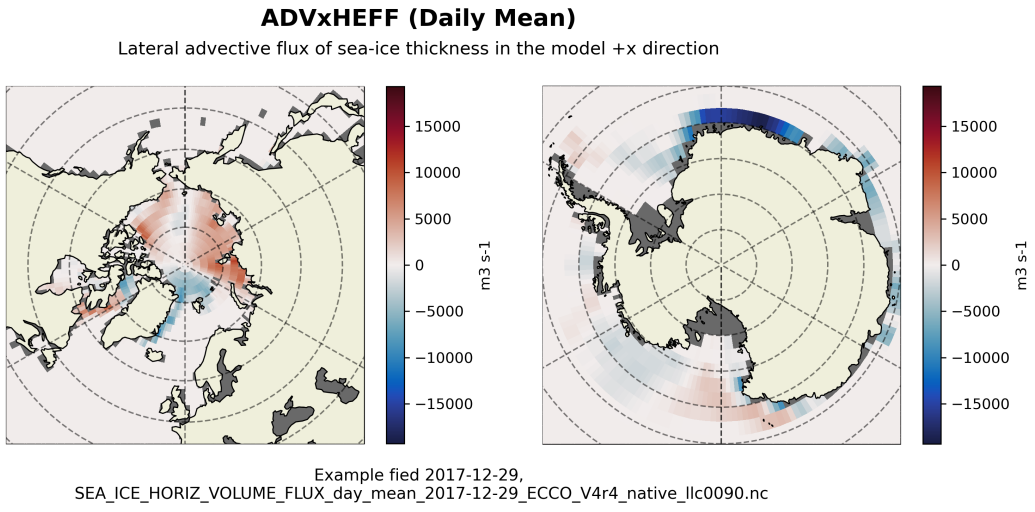


Figure 100: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: ADVxHEFF

12.18.3 Native Variable: ADVxSNOW

Table 12.98: Attributes description of the variable 'ADVxSNOW' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVxSNOW	Lateral advective flux of snow thickness in the model +x direction	m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVxSNOW(time, tile, j, i_g)
ADVxSNOW: _FillValue = 9.96921e+36
ADVxSNOW: long_name = Lateral advective flux of snow thickness in the model +x direction
ADVxSNOW: units = m3 s: 1
ADVxSNOW: mate = ADVySNOW
ADVxSNOW: coverage_content_type = modelResult
ADVxSNOW: direction = >0 increases mean snow thickness (HSNOW)
ADVxSNOW: coordinates = time
ADVxSNOW: valid_min = : 38343.0234375
ADVxSNOW: valid_max = 20385.103515625

Comments

Lateral advective flux of grid cell mean snow thickness (hsnow) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advxsnow(i_g,j) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k=0). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

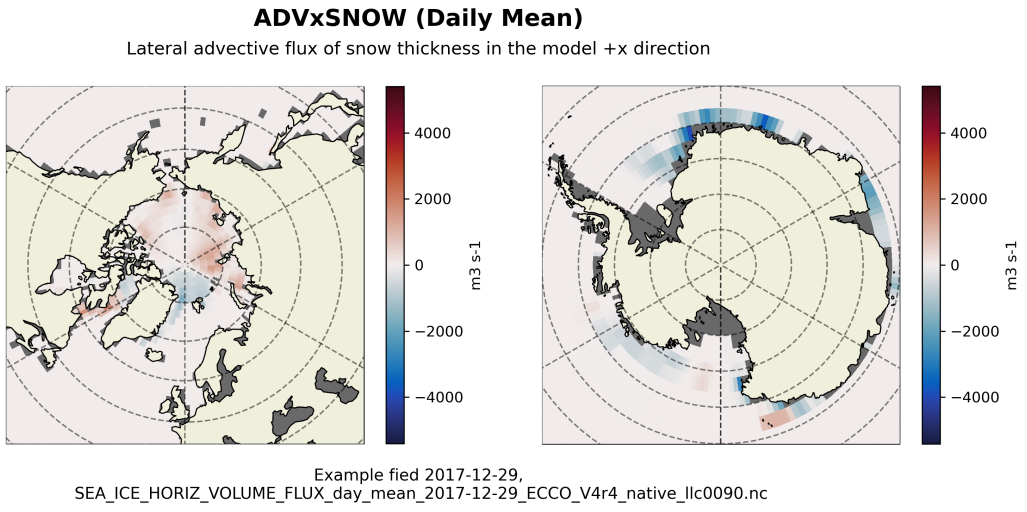


Figure 101: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: ADVxSNOW

12.18.4 Native Variable: ADVyHEFF

Table 12.99: Attributes description of the variable 'ADVyHEFF' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVyHEFF	Lateral advective flux of sea-ice thickness in the model +y direction	m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVyHEFF(time, tile, j_g, i)
ADVyHEFF: _FillValue = 9.96921e+36
ADVyHEFF: long_name = Lateral advective flux of sea: ice thickness in the model +y direction
ADVyHEFF: units = m3 s: 1
ADVyHEFF: mate = ADVxHEFF
ADVyHEFF: coverage_content_type = modelResult
ADVyHEFF: direction = >0 increases mean sea: ice thickness (HEFF)
ADVyHEFF: coordinates = time
ADVyHEFF: valid_min = : 95350.6328125
ADVyHEFF: valid_max = 115755.4375

Comments

Lateral advective flux of grid cell mean sea-ice thickness (heff) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advyheff(i,j_g) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k=0). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

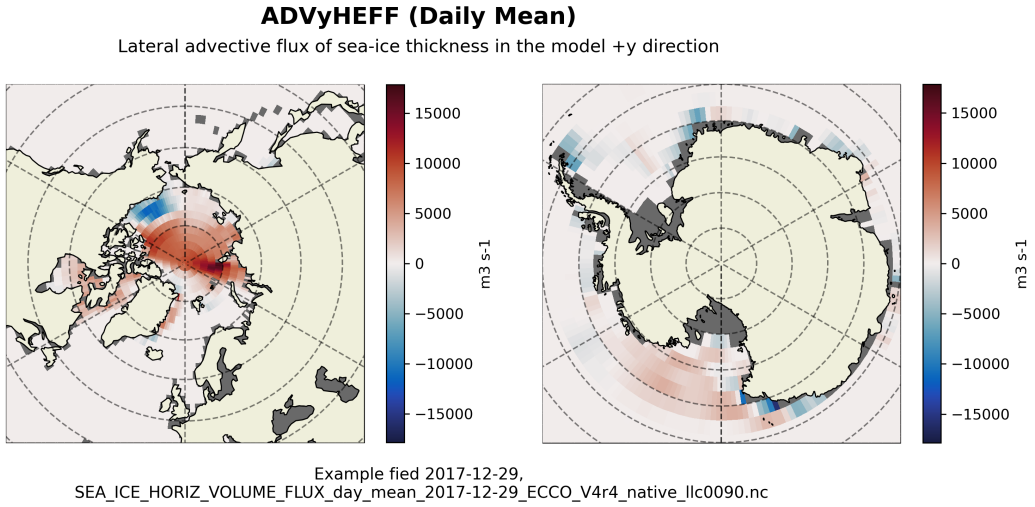


Figure 102: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: ADVyHEFF

12.18.5 Native Variable: ADVySNOW

Table 12.100: Attributes description of the variable 'ADVySNOW' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	ADVySNOW	Lateral advective flux of snow thickness in the model +y direction	m3 s-1

Description of the variable in Common Data language (CDL)

float32 ADVySNOW(time, tile, j_g, i)
ADVySNOW: _FillValue = 9.96921e+36
ADVySNOW: long_name = Lateral advective flux of snow thickness in the model +y direction
ADVySNOW: units = m3 s: 1
ADVySNOW: mate = ADVxSNOW
ADVySNOW: coverage_content_type = modelResult
ADVySNOW: direction = >0 increases mean snow thickness (HSNOW)
ADVySNOW: coordinates = time
ADVySNOW: valid_min = : 30630.552734375
ADVySNOW: valid_max = 27252.87890625

Comments

Lateral advective flux of grid cell mean snow thickness (hsnow) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +advysnow(i,j_g) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k=0). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

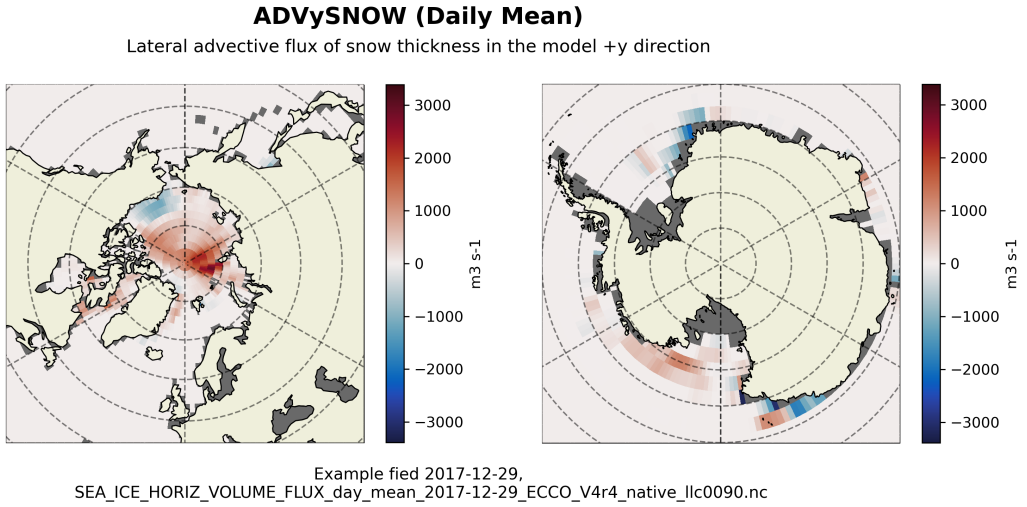


Figure 103: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: ADVySNOW

12.18.6 Native Variable: DFxEHEFF

Table 12.101: Attributes description of the variable 'DFxEHEFF' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFxEHEFF	Lateral diffusive flux of sea-ice thickness in the model +x direction.	m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFxEHEFF(time, tile, j, i_g)
DFxEHEFF: _FillValue = 9.96921e+36
DFxEHEFF: long_name = Lateral diffusive flux of sea: ice thickness in the model +x direction.
DFxEHEFF: units = m3 s: 1
DFxEHEFF: mate = DFyEHEFF
DFxEHEFF: coverage_content_type = modelResult
DFxEHEFF: direction = >0 increases mean sea: ice thickness (HEFF)
DFxEHEFF: coordinates = time
DFxEHEFF: valid_min = : 1444.172607421875
DFxEHEFF: valid_max = 2379.271240234375

Comments

Lateral diffusive flux of grid cell mean sea-ice thickness (heff) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfxeheff(i_g,j) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k=0). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

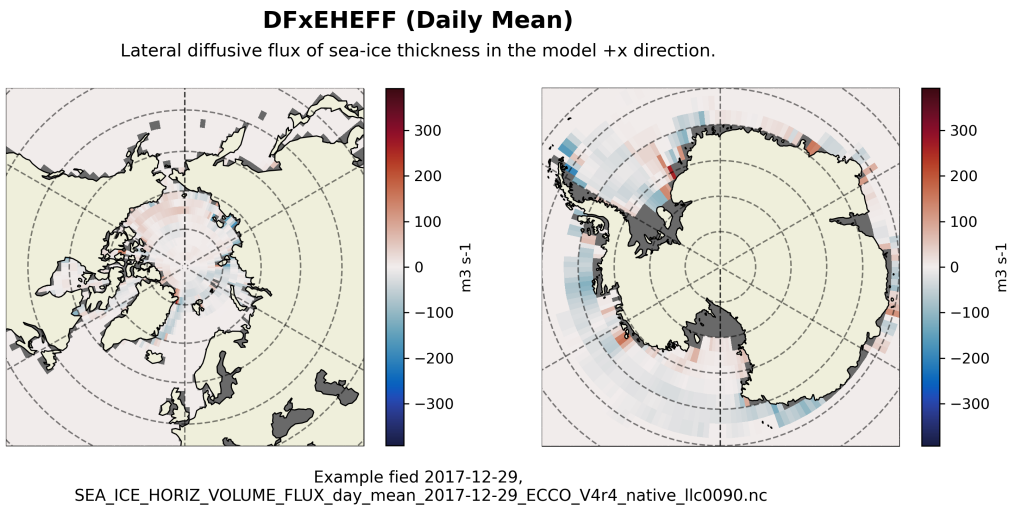


Figure 104: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: DFxEHEFF

12.18.7 Native Variable: DFxESNOW

Table 12.102: Attributes description of the variable 'DFxESNOW' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFxESNOW	Lateral diffusive flux of snow thickness in the model +x direction	m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFxESNOW(time, tile, j, i_g)
DFxESNOW: _FillValue = 9.96921e+36
DFxESNOW: long_name = Lateral diffusive flux of snow thickness in the model +x direction
DFxESNOW: units = m3 s: 1
DFxESNOW: mate = DFyESNOW
DFxESNOW: coverage_content_type = modelResult
DFxESNOW: direction = >0 increases mean snow thickness (HSNOW)
DFxESNOW: coordinates = time
DFxESNOW: valid_min = : 448.1134948730469
DFxESNOW: valid_max = 440.94427490234375

Comments

Lateral diffusive flux of grid cell mean snow thickness (hsnow) in the +x direction through the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfxesnow(i_g,j) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k=0). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

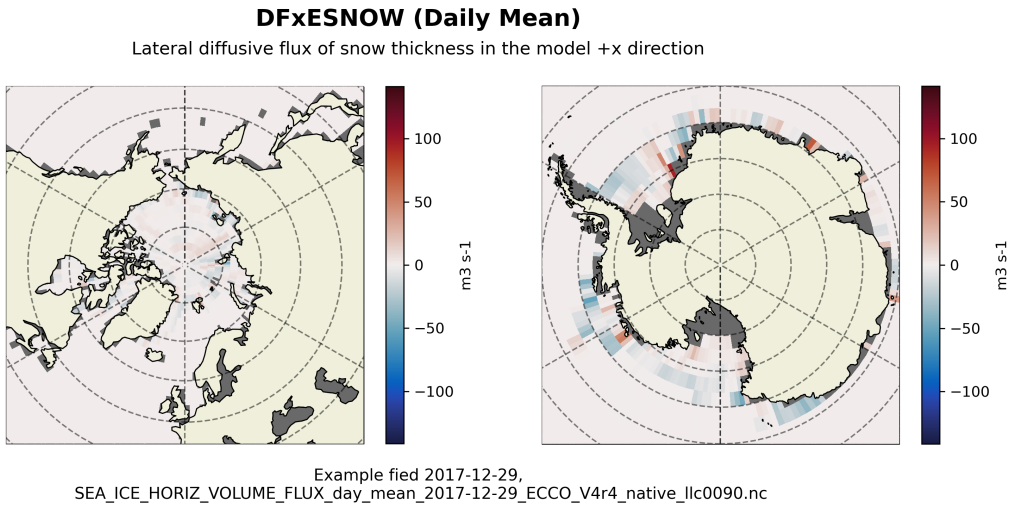


Figure 105: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: DFxESNOW

12.18.8 Native Variable: DFyEHEFF

Table 12.103: Attributes description of the variable 'DFyEHEFF' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFyEHEFF	Lateral diffusive flux of sea-ice thickness in the model +y direction.	m3 s-1

Description of the variable in Common Data language (CDL)

float32 DFyEHEFF(time, tile, j_g, i)
DFyEHEFF: _FillValue = 9.96921e+36
DFyEHEFF: long_name = Lateral diffusive flux of sea: ice thickness in the model +y direction.
DFyEHEFF: units = m3 s: 1
DFyEHEFF: mate = DFxEHEFF
DFyEHEFF: coverage_content_type = modelResult
DFyEHEFF: direction = >0 increases mean sea: ice thickness (HEFF)
DFyEHEFF: coordinates = time
DFyEHEFF: valid_min = : 3078.810791015625
DFyEHEFF: valid_max = 1614.6512451171875

Comments

Lateral diffusive flux of grid cell mean sea-ice thickness (heff) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfyeheff(i,j_g) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k=0). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.

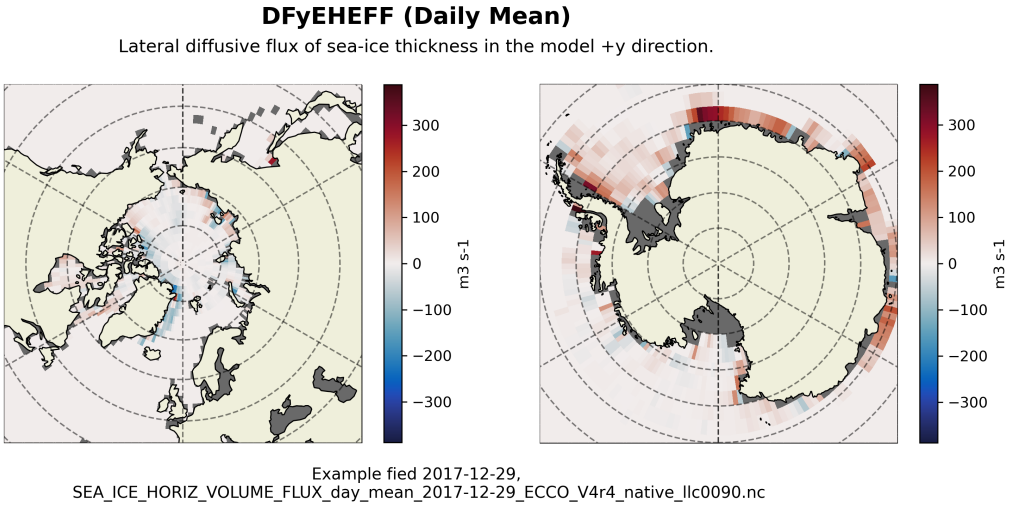


Figure 106: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: DFyEHEFF

12.18.9 Native Variable: DFyESNOW

Table 12.104: Attributes description of the variable 'DFyESNOW' from SEA_ICE_HORIZ_VOLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	DFyESNOW	Lateral diffusive flux of snow thickness in the model +y direction	m3 s-1
Description of the variable in Common Data language (CDL)			
float32 DFyESNOW(time, tile, j_g, i) DFyESNOW: _FillValue = 9.96921e+36 DFyESNOW: long_name = Lateral diffusive flux of snow thickness in the model +y direction DFyESNOW: units = m3 s: 1 DFyESNOW: mate = DFxESNOW DFyESNOW: coverage_content_type = modelResult DFyESNOW: direction = >0 increases mean snow thickness (HSNOW) DFyESNOW: coordinates = time DFyESNOW: valid_min = : 662.0200805664062 DFyESNOW: valid_max = 411.7032470703125			
Comments			
Lateral diffusive flux of grid cell mean snow thickness (hsnow) in the +y direction through the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal flux quantities are staggered relative to the tracer cells with indexing such that +dfyesnow(i,j_g,k) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k=0). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.			

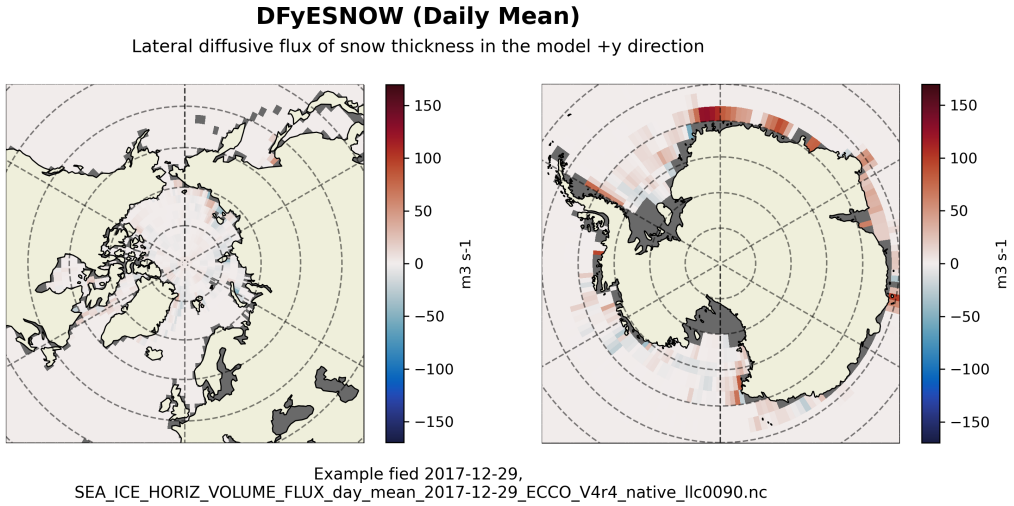


Figure 107: Dataset: SEA_ICE_HORIZ_VOLUME_FLUX, Variable: DFyESNOW

12.19 Native dataset of SEA_ICE_SALT_PLUME_FLUX

12.19.1 Overview

This dataset provides 2D fields of sea-ice salt plume fluxes on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average

and monthly-average time resolution. oceSPflx is salt mass flux per unit area (g m-2 s-1), not salinity flux.

Table 12.105: Coordinates and Variables in the dataset SEA_ICE_SALT_PLUME_FLUX

Variables	Description of data variables	Unit
oceSPflx	Net salt flux into the ocean due to brine rejection	g m-2 s-1
oceSPDep	Salt plume depth	m
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.19.2 Native Variable: oceSPDep

Table 12.106: Attributes description of the variable 'oceSPDep' from SEA_ICE_SALT_PLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceSPDep	Salt plume depth	m
Description of the variable in Common Data language (CDL)			
float32 oceSPDep(time, tile, j, i) oceSPDep: _FillValue = 9.96921e+36 oceSPDep: long_name = Salt plume depth oceSPDep: units = m oceSPDep: coverage_content_type = modelResult oceSPDep: coordinates = time YC XC oceSPDep: valid_min = 5.500708103179932 oceSPDep: valid_max = 5530.31494140625			
Comments			
Depth of parameterized salt plumes formed due to brine rejection during sea-ice formation.			

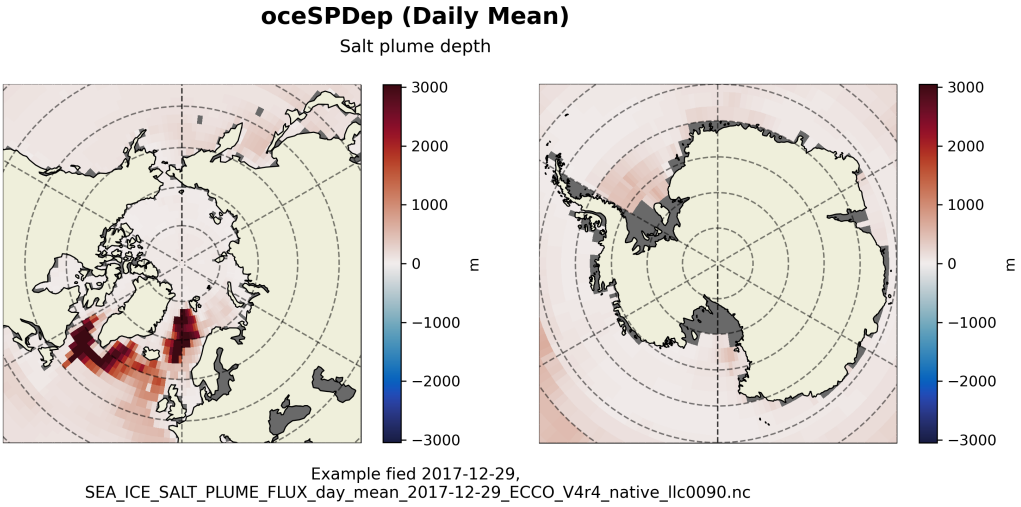


Figure 108: Dataset: SEA_ICE_SALT_PLUME_FLUX, Variable: oceSPDep

12.19.3 Native Variable: oceSPflx

Table 12.107: Attributes description of the variable 'oceSPflx' from SEA_ICE_SALT_PLUME_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceSPflx	Net salt flux into the ocean due to brine rejection	g m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 oceSPflx(time, tile, j, i) oceSPflx: _FillValue = 9.96921e+36 oceSPflx: long_name = Net salt flux into the ocean due to brine rejection oceSPflx: units = g m: 2 s: 1 oceSPflx: coverage_content_type = modelResult oceSPflx: direction = >0 increases salinity (SALT) oceSPflx: coordinates = time YC XC oceSPflx: valid_min = 0.0 oceSPflx: valid_max = 0.058169759809970856			
Comments			
Net salt flux into the ocean due to brine rejection during sea-ice formation. note: units are grams of salt per square meter per second, not salinity per square meter per second.			

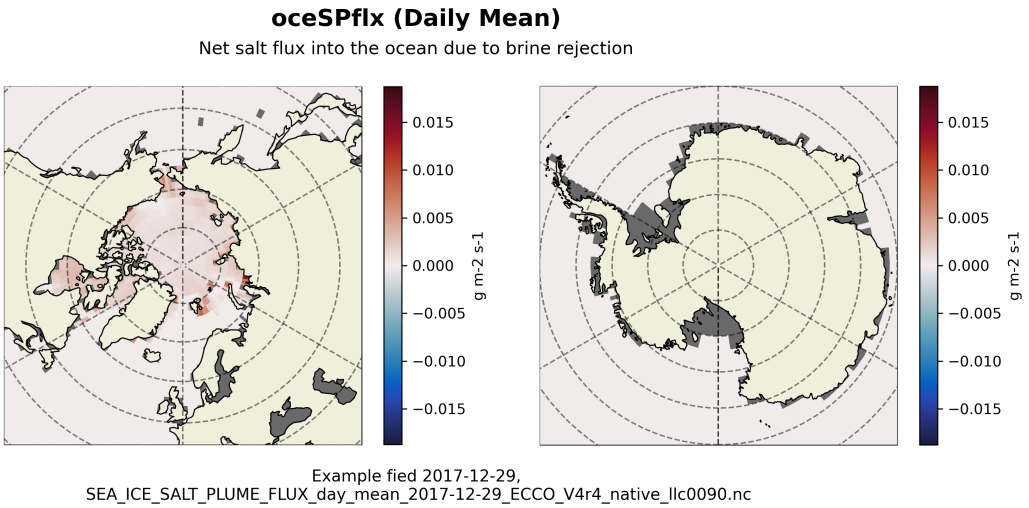


Figure 109: Dataset: SEA_ICE_SALT_PLUME_FLUX, Variable: oceSPflx

12.20 Native dataset of SEA_ICE_VELOCITY

12.20.1 Overview

This dataset provides 2D fields of sea-ice velocity on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Snapshot data of sea-ice velocity are also provided.

Table 12.108: Coordinates and Variables in the dataset SEA_ICE_VELOCITY

Variables	Description of data variables	Unit
SIuice	Sea-ice velocity in the model +x direction	m s-1

Table 12.108: Coordinates and Variables in the dataset SEA_ICE_VELOCITY

SIvice	Sea-ice velocity in the model +y direction	m s-1
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.20.2 Native Variable: SIuice

Table 12.109: Attributes description of the variable 'SIuice' from SEA_ICE_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIuice	Sea-ice velocity in the model +x direction	m s-1
Description of the variable in Common Data language (CDL)			
float32 SIuice(time, tile, j, i_g) SIuice: _FillValue = 9.96921e+36 SIuice: long_name = Sea: ice velocity in the model +x direction SIuice: units = m s: 1 SIuice: mate = SIvice SIuice: coverage_content_type = modelResult SIuice: standard_name = sea_ice_x_velocity SIuice: coordinates = time SIuice: valid_min = : 0.4000000059604645 SIuice: valid_max = 0.4000000059604645			
Comments			
Horizontal sea-ice velocity in the +x direction at the 'u' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +siuice(i_g,j) corresponds to +x fluxes through the 'u' face of the tracer cell at (i,j,k=0). also, the model +x direction does not necessarily correspond to the geographical east-west direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.			

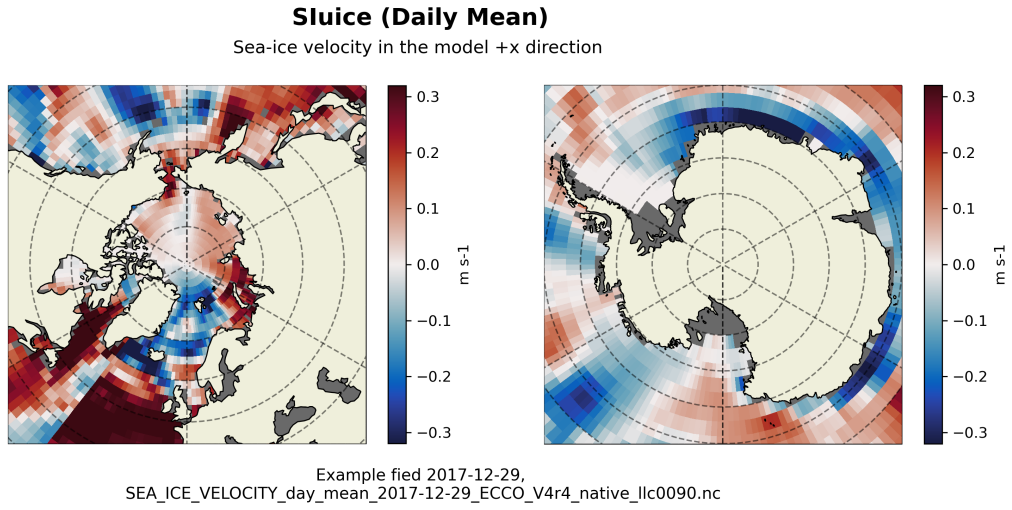


Figure 110: Dataset: SEA_ICE_VELOCITY, Variable: SIuice

12.20.3 Native Variable: SIvice

Table 12.110: Attributes description of the variable 'SIvice' from SEA_ICE_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIvice	Sea-ice velocity in the model +y direction	m s-1
Description of the variable in Common Data language (CDL)			
float32 SIvice(time, tile, j_g, i) SIvice: _FillValue = 9.96921e+36 SIvice: long_name = Sea: ice velocity in the model +y direction SIvice: units = m s: 1 SIvice: mate = SIuice SIvice: coverage_content_type = modelResult SIvice: standard_name = sea_ice_y_velocity SIvice: coordinates = time SIvice: valid_min = : 0.4000000059604645 SIvice: valid_max = 0.4000000059604645			
Comments			
Horizontal sea-ice velocity in the +y direction at the 'v' face of the tracer cell on the native model grid. note: in the arakawa-c grid, horizontal velocities are staggered relative to the tracer cells with indexing such that +sivice(i,j_g) corresponds to +y fluxes through the 'v' face of the tracer cell at (i,j,k=0). also, the model +y direction does not necessarily correspond to the geographical north-south direction because the x and y axes of the model's curvilinear lat-lon-cap (llc) grid have arbitrary orientations which vary within and across tiles.			

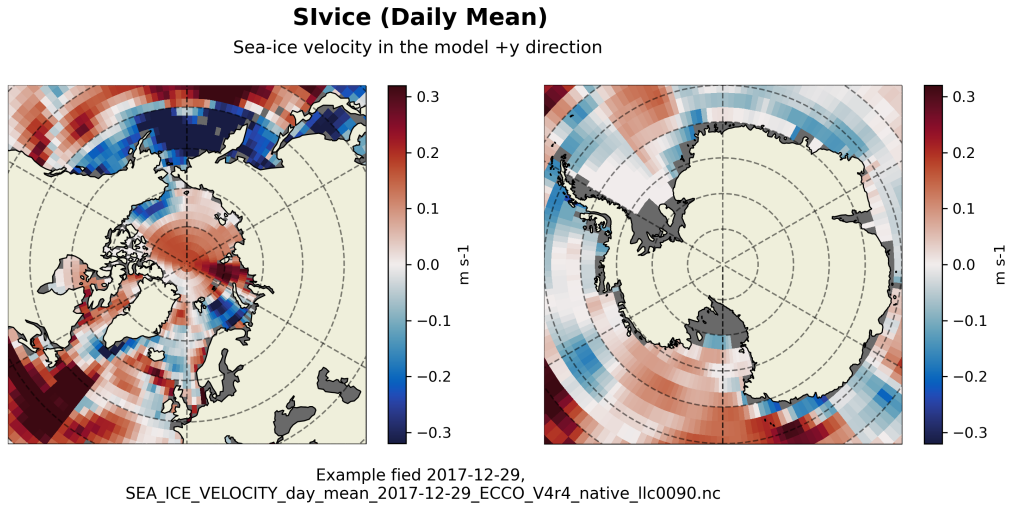


Figure 111: Dataset: SEA_ICE_VELOCITY, Variable: SIvice

12.21 Native dataset of SEA_SURFACE_HEIGHT

12.21.1 Overview

This dataset provides 2D fields of dynamic sea surface height and model sea level anomaly on the lat-lon-cap 90 (llc90) native model grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Snapshot data of dynamic sea surface height and model sea level anomaly are also provided. SSH (dynamic sea surface height) = SSHNOIBC (dynamic sea

surface without the inverse barometer correction) - SSHIBC (inverse barometer correction). The inverted barometer correction accounts for variations in sea surface height due to atmospheric pressure variations. Note: ETAN is model sea level anomaly and should not be compared with satellite altimetery products, see SSH and ETAN for more details.

Table 12.111: Coordinates and Variables in the dataset SEA_SURFACE_HEIGHT

Variables	Description of data variables	Unit
SSH	Dynamic sea surface height anomaly	m
SSHIBC	The inverted barometer (ib) correction to sea surface height due to atmospheric pressure loading	m
SSHNOIBC	Sea surface height anomaly without the inverted barometer (ib) correction	m
ETAN	Model sea level anomaly	m
Coordinates	**Description of data coordinates**	**Unit**
i	Grid index in x for variables at tracer and 'v' locations	–none–
i_g	Grid index in x for variables at 'u' and 'g' locations	–none–
j	Grid index in y for variables at tracer and 'u' locations	–none–
j_g	Grid index in y for variables at 'v' and 'g' locations	–none–
tile	Lat-lon-cap tile index	–none–
time	Center time of averaging period	–none–
XC	Longitude of tracer grid cell center	degrees_east
YC	Latitude of tracer grid cell center	degrees_north
XG	Longitude of 'southwest' corner of tracer grid cell	degrees_east
YG	Latitude of 'southwest' corner of tracer grid cell	degrees_north
time_bnds	Time bounds of averaging period	–none–
XC_bnds	Longitudes of tracer grid cell corners	–none–
YC_bnds	Latitudes of tracer grid cell corners	–none–

12.21.2 Native Variable: ETAN

Table 12.112: Attributes description of the variable 'ETAN' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	ETAN	Model sea level anomaly	m
Description of the variable in Common Data language (CDL)			
float32 ETAN(time, tile, j, i) ETAN: _FillValue = 9.96921e+36 ETAN: long_name = Model sea level anomaly ETAN: units = m ETAN: coverage_content_type = modelResult ETAN: coordinates = YC time XC ETAN: valid_min = : 9.067964553833008 ETAN: valid_max = 2.1783087253570557			
Comments			
Model sea level anomaly without corrections for global mean density (steric) changes, inverted barometer effect, or volume displacement due to submerged sea-ice and snow . note: etan should not be used for comparisons with altimetry data products because etan is not corrected for (a) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh) nor (b) sea level displacement due to submerged sea-ice and snow (see siceload). these corrections are made for the variables ssh and sshnoibc.			

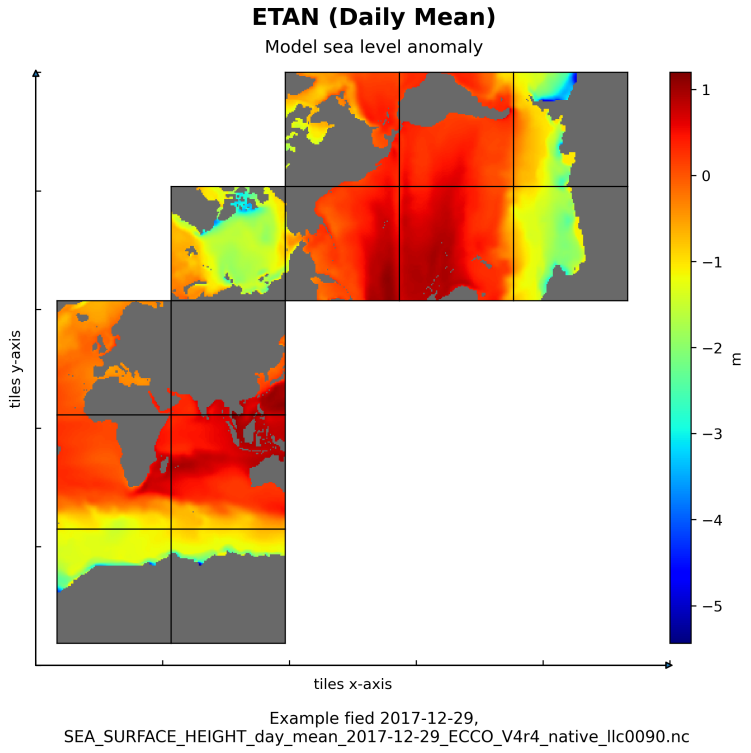


Figure 112: Dataset: SEA_SURFACE_HEIGHT, Variable: ETAN

12.21.3 Native Variable: SSH

Table 12.113: Attributes description of the variable 'SSH' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	SSH	Dynamic sea surface height anomaly	m

Description of the variable in Common Data language (CDL)

float32 SSH(time, tile, j, i)
SSH: _FillValue = 9.96921e+36
SSH: long_name = Dynamic sea surface height anomaly
SSH: units = m
SSH: coverage_content_type = modelResult
SSH: standard_name = sea_surface_height_above_geoid
SSH: coordinates = YC time XC
SSH: valid_min = : 2.4861555099487305
SSH: valid_max = 2.2875382900238037

Comments

Dynamic sea surface height anomaly above the geoid, suitable for comparisons with altimetry sea surface height data products that apply the inverse barometer (ib) correction. note: ssh is calculated by correcting model sea level anomaly etan for three effects: a) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh), b) the inverted barometer (ib) effect (see sshibc) and c) sea level displacement due to sea-ice and snow pressure loading (see siceload). ssh can be compared with the similarly-named ssh variable in previous ecco products that did not include atmospheric pressure loading (e.g., version 4 release 3). use sshnoibc for comparisons with altimetry data products that do not apply the ib correction.

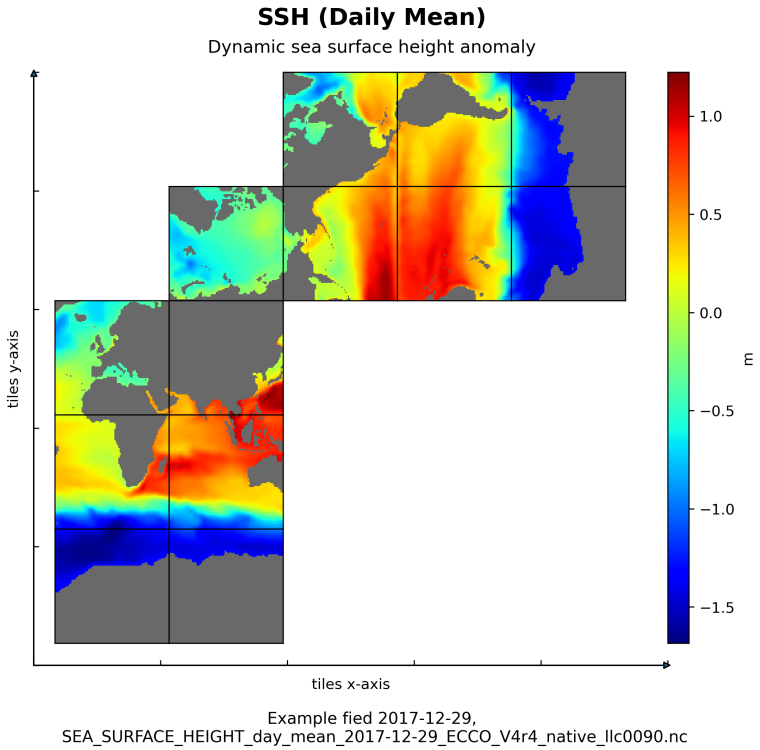


Figure 113: Dataset: SEA_SURFACE_HEIGHT, Variable: SSH

12.21.4 Native Variable: SSHIBC

Table 12.114: Attributes description of the variable 'SSHIBC' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	SSHIBC	The inverted barometer (ib) correction to sea surface height due to atmospheric pressure loading	m

Description of the variable in Common Data language (CDL)

float32 SSHIBC(time, tile, j, i)
SSHIBC: _FillValue = 9.96921e+36
SSHIBC: long_name = The inverted barometer (IB) correction to sea surface height due to atmospheric pressure loading
SSHIBC: units = m
SSHIBC: coverage_content_type = modelResult
SSHIBC: coordinates = YC time XC
SSHIBC: valid_min = : 0.5228679180145264
SSHIBC: valid_max = 0.9044463634490967

Comments

Not an ssh itself, but a correction to model sea level anomaly (etan) required to account for the static part of sea surface displacement by atmosphere pressure loading: ssh = sshnoibc - sshibc. note: use ssh for model-data comparisons with altimetry data products that do apply the ib correction and sshnoibc for comparisons with altimetry data products that do not apply the ib correction.

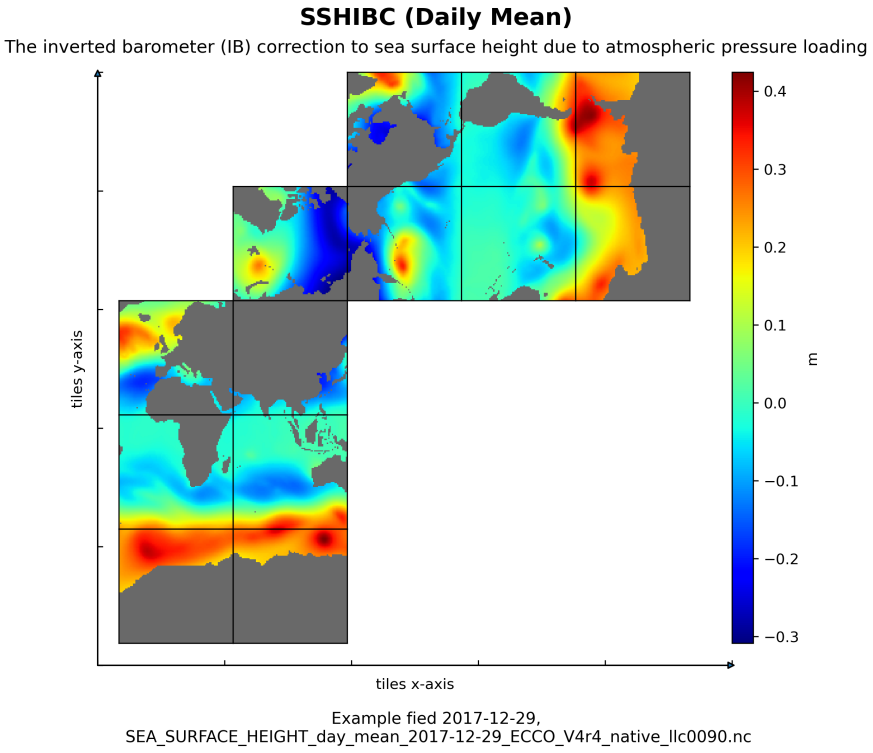


Figure 114: Dataset: SEA_SURFACE_HEIGHT, Variable: SSHIBC

12.21.5 Native Variable: SSHNOIBC

Table 12.115: Attributes description of the variable 'SSHNOIBC' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	SSHNOIBC	Sea surface height anomaly without the inverted barometer (ib) correction	m

Description of the variable in Common Data language (CDL)

float32 SSHNOIBC(time, tile, j, i)
SSHNOIBC: _FillValue = 9.96921e+36
SSHNOIBC: long_name = Sea surface height anomaly without the inverted barometer (IB) correction
SSHNOIBC: units = m
SSHNOIBC: coverage_content_type = modelResult
SSHNOIBC: coordinates = YC time XC
SSHNOIBC: valid_min = : 2.45104718208313
SSHNOIBC: valid_max = 2.2390522956848145

Comments

Sea surface height anomaly above the geoid without the inverse barometer (ib) correction, suitable for comparisons with altimetry sea surface height data products that do not apply the inverse barometer (ib) correction. note: sshnoibc is calculated by correcting model sea level anomaly etan for two effects: a) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh), b) sea level displacement due to sea-ice and snow pressure loading (see siceload). in ecco version 4 release 4 the model is forced with atmospheric pressure loading. sshnoibc does not correct for the static part of the effect of atmosphere pressure loading on sea surface height (the so-called inverse barometer (ib) correction). use ssh for comparisons with altimetry data products that do apply the ib correction.

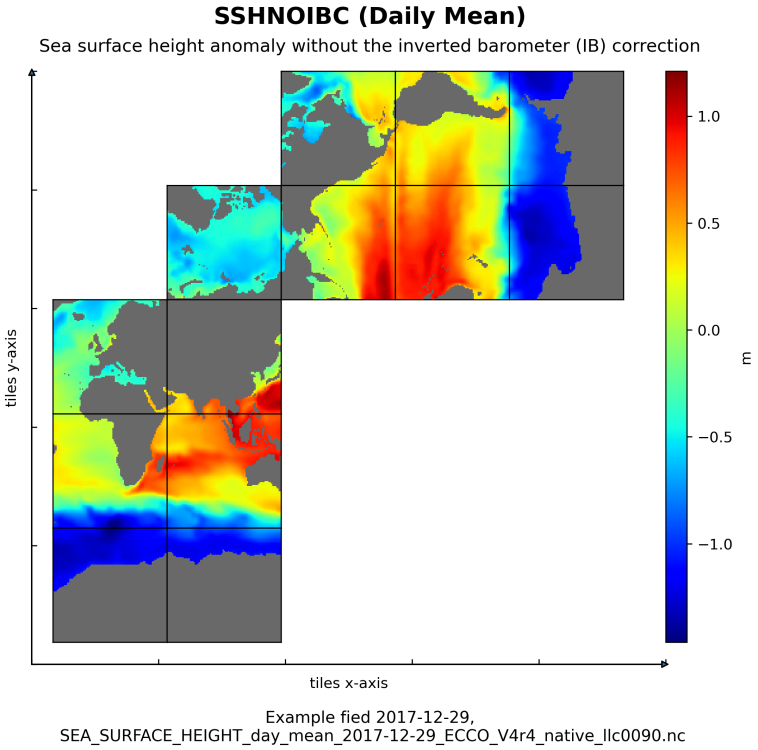


Figure 115: Dataset: SEA_SURFACE_HEIGHT, Variable: SSHNOIBC

13 Lat-Lon Coordinates and Grid Geometry

13.1 Latlon coordinates GRID_GEOMETRY_ECCO

13.1.1 Overview

This dataset provides geometric parameters for the regular 0.5-degree lat-lon grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. Parameters include areas and lengths of grid cell sides, horizontal and vertical coordinates of grid cell centers and corners, and global domain geometry including bathymetry and land/ocean masks.

Table 13.1: Coordinates and Variables in the dataset GRID_GEOMETRY_ECCO

Variables	Description of data variables	Unit
hFacC	Vertical open fraction of grid cell	1
Depth	Model seafloor depth below ocean surface at rest	m
area	Area of lat-lon grid cell	m2
drF	Distance between the upper and lower interfaces of the model grid cell	m
maskC	Wet/dry boolean mask for grid cell	–none–
Coordinates	**Description of data coordinates**	**Unit**
Z	Depth of grid cell center	m
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
latitude_bnds	Latitudes of grid cell edges	–none–
longitude_bnds	Longitudes of grid cell edges	–none–
Z_bnds	Depths of grid cell upper and lower interfaces	–none–

13.1.2 Latlon coordinates Variable: hFacC

Table 13.2: Attributes description of the variable 'hFacC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
float64	hFacC	Vertical open fraction of grid cell	1
Description of the variable in Common Data language (CDL)			
float64 hFacC(Z, latitude, longitude) hFacC: _FillValue = 9.969209968386869e+36 hFacC: coverage_content_type = modelResult hFacC: long_name = vertical open fraction of grid cell hFacC: units = 1			
Comments			
Grid cells may be fractionally closed in the vertical. the open vertical fraction is hfacc. the model allows for partially-filled cells to represent topographic variations more smoothly (hfacc < 1). completely closed (dry) tracer grid cells have hfacc = 0. note: the lat-lon gridded hfacc is spatially-averaged from the hfacc field on the lat-lon-cap (llc90) model native grid. the total ocean volume of the ecco v4r4 lat-lon gridded fields is within 0.05% of the total ocean volume of the native grid fields.			

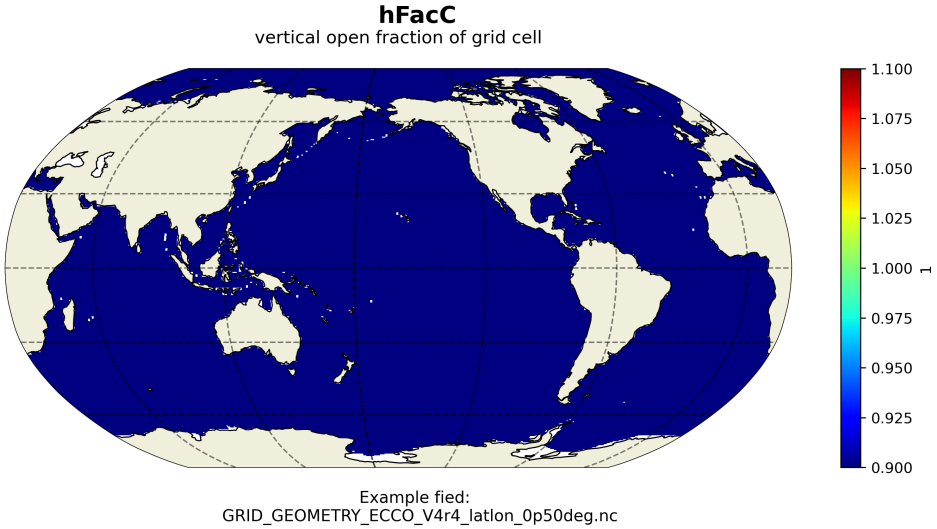


Figure 116: Dataset: GRID_GEOMETRY_ECCO, Variable: hFacC

13.1.3 Latlon coordinates Variable: maskC

Table 13.3: Attributes description of the variable 'maskC' from GRID_GEOMETRY_ECCO's dataset.

Storage Type	Variable Name	Description	Unit
bool	maskC	Wet/dry boolean mask for grid cell	N/A
Description of the variable in Common Data language (CDL)			
bool maskC(Z, latitude, longitude) maskC: _FillValue = 1 maskC: coverage_content_type = modelResult maskC: long_name = wet/dry boolean mask for grid cell			
Comments			
True for grid cells with nonzero open vertical fraction (hfacc > 0), otherwise false.			

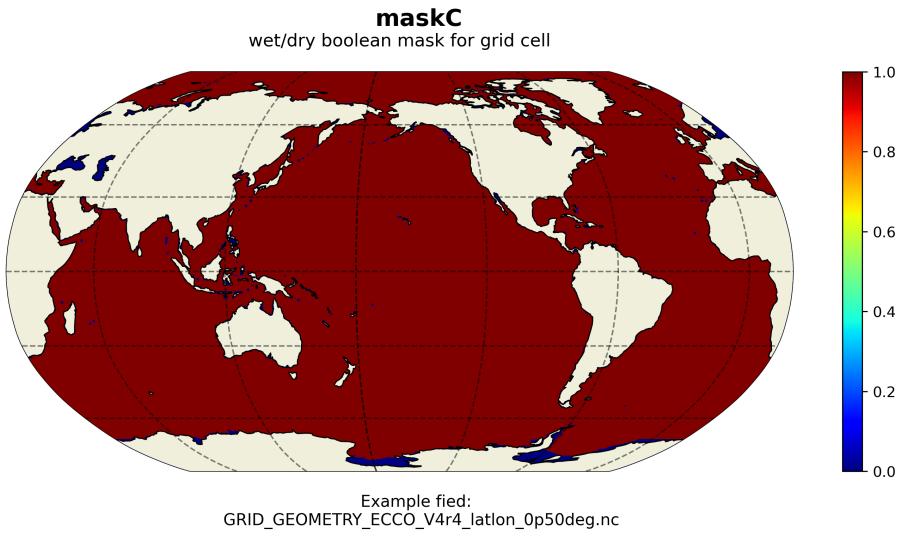


Figure 117: Dataset: GRID_GEOMETRY_ECCO, Variable: maskC

14 Latlon Dataset Groupings

14.1 Latlon dataset of ATM_SURFACE_TEMP_HUM_WIND_PRES

14.1.1 Overview

This dataset provides 2D fields of atmosphere surface temperature, humidity, wind, and pressure interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.1: Coordinates and Variables in the dataset ATM_SURFACE_TEMP_HUM_WIND_PRES

Variables	Description of data variables	Unit
EXFatemp	Atmosphere surface (2 m) air temperature	degree_K
EXFaqh	Atmosphere surface (2 m) specific humidity	kg kg-1
EXFewind	Zonal (east-west) wind speed	m s-1
EXFnwind	Meridional (north-south) wind speed	m s-1
EXFwspee	Wind speed	m s-1
EXFpress	Atmosphere surface pressure	N m-2
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.1.2 Latlon Variable: EXFaqh

Table 14.2: Attributes description of the variable 'EXFaqh' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFaqh	Atmosphere surface (2 m) specific humidity	kg kg-1
Description of the variable in Common Data language (CDL)			
float32 EXFaqh(time, latitude, longitude) EXFaqh: _FillValue = 9.96921e+36 EXFaqh: coverage_content_type = modelResult EXFaqh: long_name = Atmosphere surface (2 m) specific humidity EXFaqh: standard_name = surface_specific_humidity EXFaqh: units = kg kg: 1 EXFaqh: coordinates = time EXFaqh: valid_min = : 0.0014020215021446347 EXFaqh: valid_max = 0.03014513850212097			
Comments			
Surface (2 m) specific humidity over open water. note: sum of era-interim surface specific humidity and the control adjustment from ocean state estimation.			

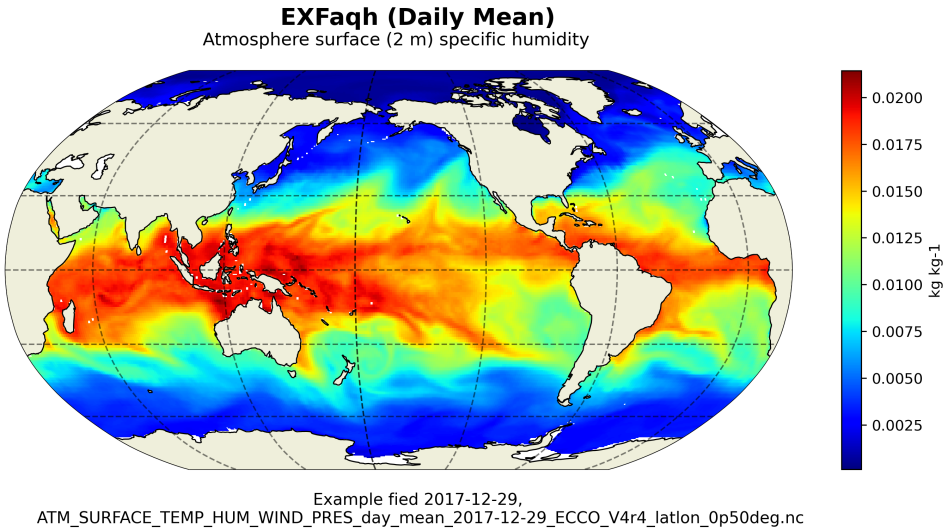


Figure 118: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFaqh

14.1.3 Latlon Variable: EXFatemp

Table 14.3: Attributes description of the variable 'EXFatemp' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFatemp	Atmosphere surface (2 m) air temperature	degree_K
Description of the variable in Common Data language (CDL)			
float32 EXFatemp(time, latitude, longitude) EXFatemp: _FillValue = 9.96921e+36 EXFatemp: coverage_content_type = modelResult EXFatemp: long_name = Atmosphere surface (2 m) air temperature EXFatemp: standard_name = air_temperature EXFatemp: units = degree_K EXFatemp: coordinates = time EXFatemp: valid_min = 195.37054443359375 EXFatemp: valid_max = 312.8451232910156			
Comments			
Surface (2 m) air temperature over open water. note: sum of era-interim surface air temperature and the control adjustment from ocean state estimation.			

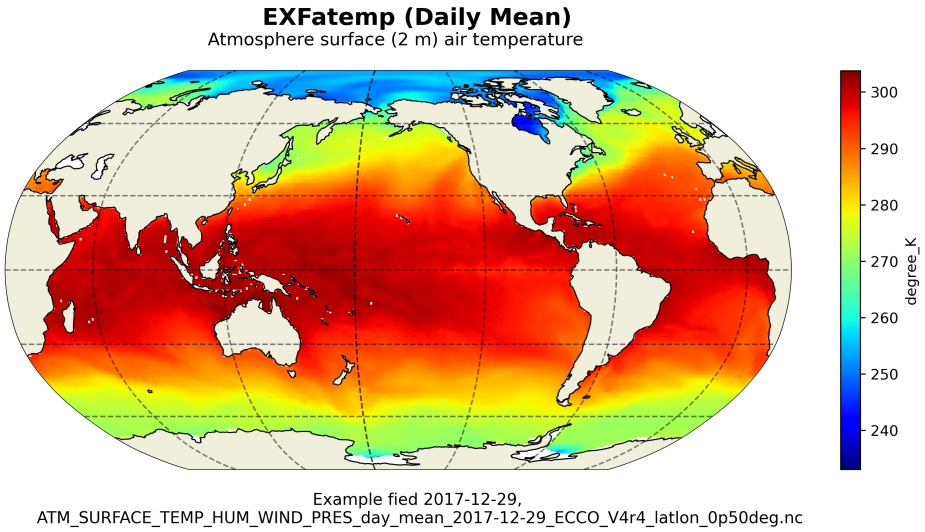


Figure 119: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFatemp

14.1.4 Latlon Variable: EXFewind

Table 14.4: Attributes description of the variable 'EXFewind' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFewind	Zonal (east-west) wind speed	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFewind(time, latitude, longitude) EXFewind: _FillValue = 9.96921e+36 EXFewind: coverage_content_type = modelResult EXFewind: long_name = Zonal (east: west) wind speed EXFewind: standard_name = eastward_wind EXFewind: units = m s: 1 EXFewind: coordinates = time EXFewind: valid_min = : 33.524742126464844 EXFewind: valid_max = 39.48556900024414			
Comments			
Zonal (east-west) component of ocean surface wind. note: exfewind is calculated by interpolating the model's x and y components of wind velocity (exfuwind and exfvwind) to tracer cell centers and then finding the zonal component of the interpolated vectors. ecco v4r4 is forced with wind stress (see exftaux, exftauy), not vector winds + bulk formulae. exfewind is calculated by converting wind stress to vector wind using bulk formulae.			

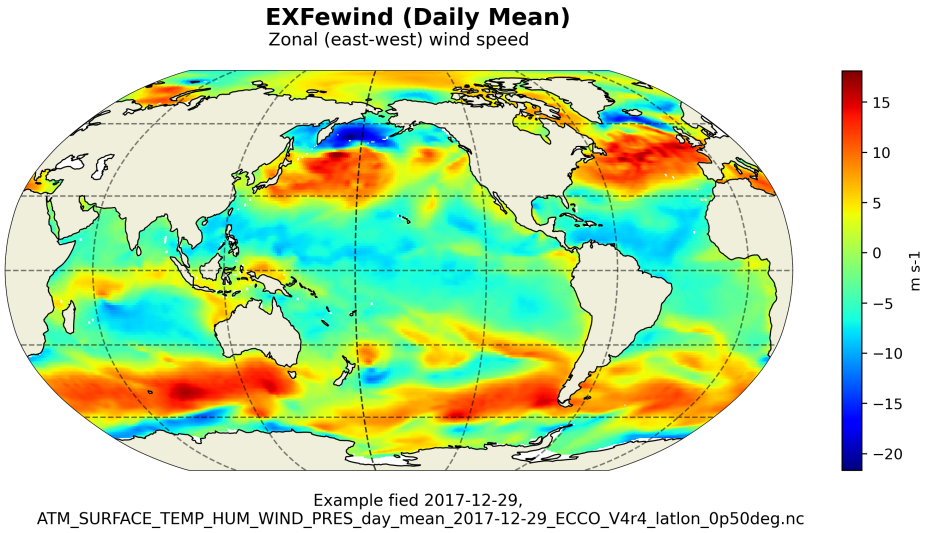


Figure 120: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFewind

14.1.5 Latlon Variable: EXFnwind

Table 14.5: Attributes description of the variable 'EXFnwind' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFnwind	Meridional (north-south) wind speed	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFnwind(time, latitude, longitude) EXFnwind: _FillValue = 9.96921e+36 EXFnwind: coverage_content_type = modelResult EXFnwind: long_name = Meridional (north: south) wind speed EXFnwind: standard_name = northward_wind EXFnwind: units = m s: 1 EXFnwind: coordinates = time EXFnwind: valid_min = : 30.042686462402344 EXFnwind: valid_max = 33.95014190673828			
Comments			
Meridional (north-south) component of ocean surface wind. note: exfnwind is calculated by interpolating the model's x and y components of wind velocity (exfuwind and exfvwind) to tracer cell centers and then finding the meridional component of the interpolated vectors. ecco v4r4 is forced with wind stress (see exftaux, exftauy), not vector winds + bulk formulae. exfnwind is calculated by converting wind stress to vector wind using bulk formulae.			

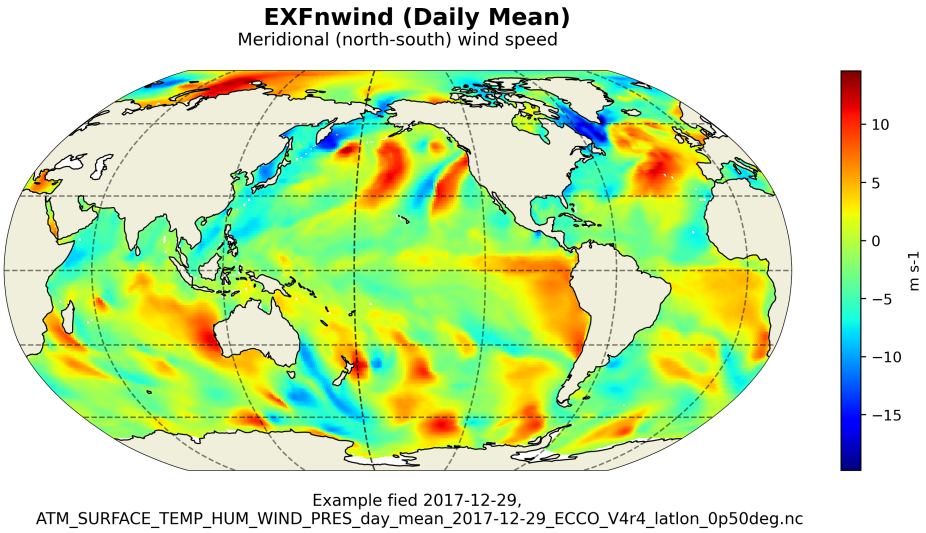


Figure 121: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFnwind

14.1.6 Latlon Variable: EXFpress

Table 14.6: Attributes description of the variable 'EXFpress' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFpress	Atmosphere surface pressure	N m-2
Description of the variable in Common Data language (CDL)			
float32 EXFpress(time, latitude, longitude) EXFpress: _FillValue = 9.96921e+36 EXFpress: coverage_content_type = modelResult EXFpress: long_name = Atmosphere surface pressure EXFpress: standard_name = surface_air_pressure EXFpress: units = N m: 2 EXFpress: coordinates = time EXFpress: valid_min = 92090.3125 EXFpress: valid_max = 106314.7734375			
Comments			
Atmospheric pressure field at sea level. note: era-interim atmospheric pressure, with air tides removed using a variety of methods. not adjusted by the ocean state estimation.			

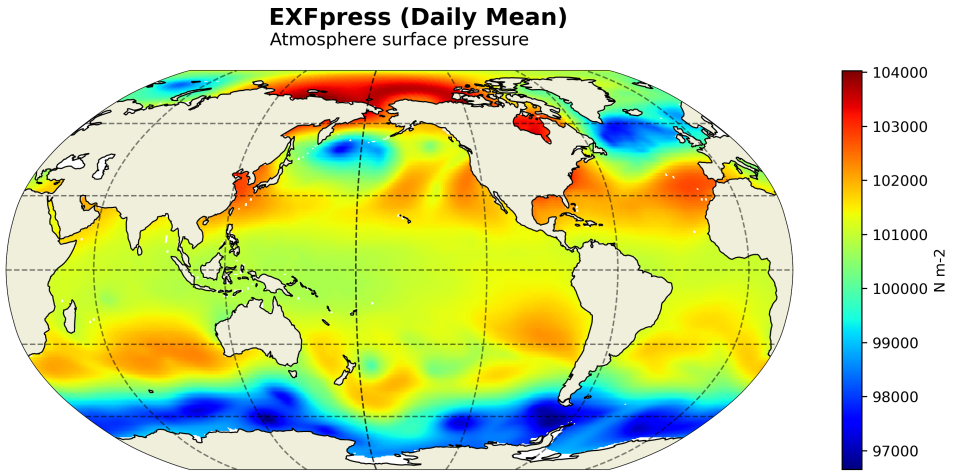


Figure 122: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFpress

14.1.7 Latlon Variable: EXFwspee

Table 14.7: Attributes description of the variable 'EXFwspee' from ATM_SURFACE_TEMP_HUM_WIND_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFwspee	Wind speed	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFwspee(time, latitude, longitude) EXFwspee: _FillValue = 9.96921e+36 EXFwspee: coverage_content_type = modelResult EXFwspee: long_name = Wind speed EXFwspee: standard_name = wind_speed EXFwspee: units = m s: 1 EXFwspee: coordinates = time EXFwspee: valid_min = 0.27271032333374023 EXFwspee: valid_max = 45.87086486816406			
Comments			
10-m wind speed magnitude (>= 0) over open water. only used for the calculation of air-sea fluxes using bulk formulae. note: not adjusted by the ocean state estimation and not necesarily consistent with exfuwind and exfvwind because exfuwind and exfvwind are calculated from exftaux and exftauy using bulk formulae. exfwspee != sqrt(exfuwind**2 + exfvwind**2.			

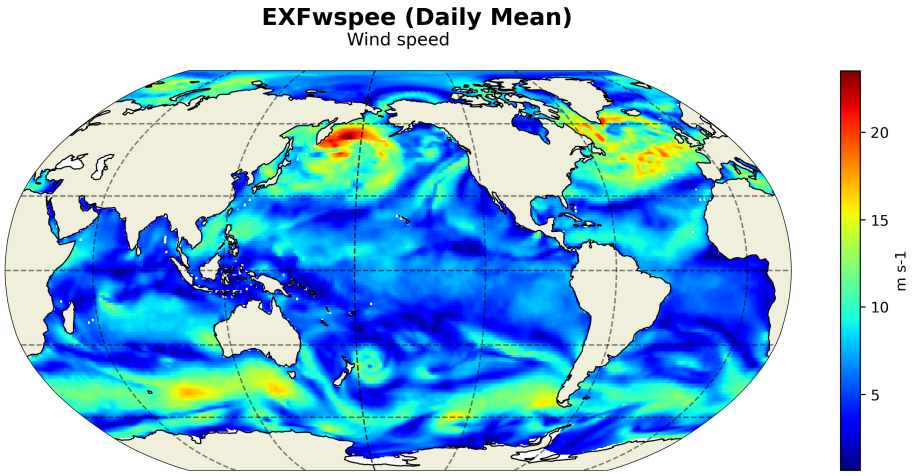


Figure 123: Dataset: ATM_SURFACE_TEMP_HUM_WIND_PRES, Variable: EXFwspee

14.2 Latlon dataset of OCEAN_AND_ICE_SURFACE_FW_FLUX

14.2.1 Overview

This dataset provides 2D fields of ocean and sea-ice surface freshwater fluxes interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.8: Coordinates and Variables in the dataset OCEAN_AND_ICE_SURFACE_FW_FLUX

Variables	Description of data variables	Unit
EXFpreci	Precipitation rate	m s-1
EXFevap	Open ocean evaporation rate	m s-1
EXFroff	River runoff	m s-1
SIsnPrcp	Snow precipitation on sea-ice	kg m-2 s-1
EXFempmr	Open ocean net surface freshwater flux from precipitation, evaporation, and runoff	m s-1
oceFWflx	Net freshwater flux into the ocean	kg m-2 s-1
SIatmFW	Net freshwater flux into the open ocean, sea-ice, and snow	kg m-2 s-1
SFLUX	Rate of change of total ocean salinity per m2 accounting for mass fluxes.	g m-2 s-1
SIacSubl	Freshwater flux to the atmosphere due to sublimation-deposition of snow or ice	kg m-2 s-1
SIrsSubl	Residual sublimation freshwater flux	kg m-2 s-1
SIfwThru	Precipitation through sea-ice	kg m-2 s-1
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.2.2 Latlon Variable: EXFempmr

Table 14.9: Attributes description of the variable 'EXFempmr' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFempmr	Open ocean net surface freshwater flux from precipitation, evaporation, and runoff	m s-1

Description of the variable in Common Data language (CDL)

float32 EXFempmr(time, latitude, longitude)
EXFempmr: _FillValue = 9.96921e+36
EXFempmr: coverage_content_type = modelResult
EXFempmr: direction = >0 increases salinity (SALT)
EXFempmr: long_name = Open ocean net surface freshwater flux from precipitation
evaporation
and runoff
EXFempmr: units = m s: 1
EXFempmr: coordinates = time
EXFempmr: valid_min = : 8.299433829961345e: 06
EXFempmr: valid_max = 5.400421514423215e: 07

Comments

Net surface freshwater flux from precipitation, evaporation, and runoff per unit area in open water (not covered by sea-ice). excludes freshwater fluxes involving sea-ice and snow. note: calculated as exfevap-exfpreci-exfroff.

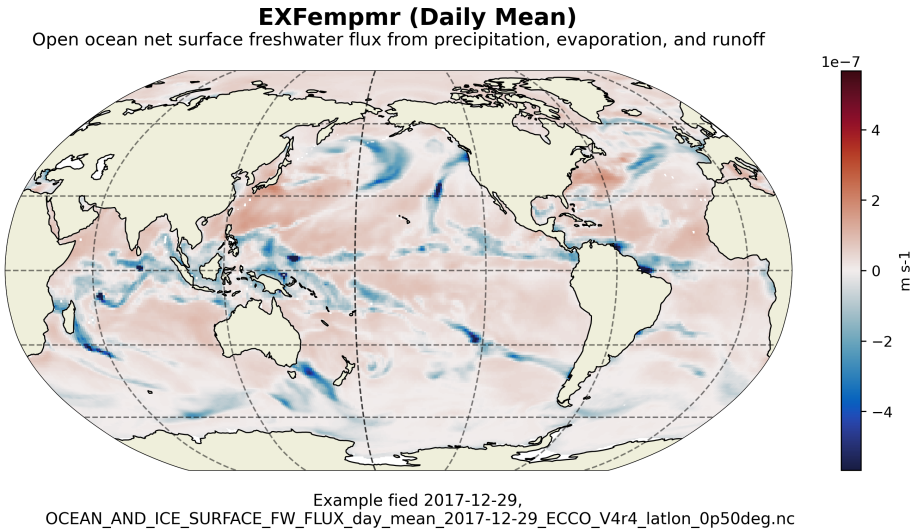


Figure 124: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFempmr

14.2.3 Latlon Variable: EXFevap

Table 14.10: Attributes description of the variable 'EXFevap' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFevap	Open ocean evaporation rate	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFevap(time, latitude, longitude) EXFevap: _FillValue = 9.96921e+36 EXFevap: coverage_content_type = modelResult EXFevap: direction = >0 increases salinity (SALT) EXFevap: long_name = Open ocean evaporation rate EXFevap: standard_name = lwe_water_evaporation_rate EXFevap: units = m s: 1 EXFevap: coordinates = time EXFevap: valid_min = : 1.0958113705328287e: 07 EXFevap: valid_max = 7.090054623404285e: 07			
Comments			
Evaporation rate per unit area of open water (not covered by sea-ice). note: calculated using the bulk formula following large and yeager (2004) ncar/tn-460+str.			

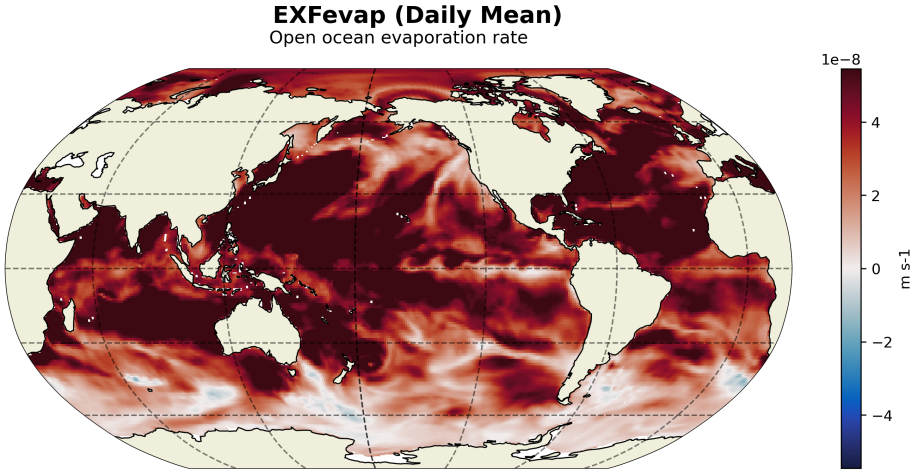


Figure 125: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFevap

14.2.4 Latlon Variable: EXFpreci

Table 14.11: Attributes description of the variable 'EXFpreci' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFpreci	Precipitation rate	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFpreci(time, latitude, longitude) EXFpreci: _FillValue = 9.96921e+36 EXFpreci: coverage_content_type = modelResult EXFpreci: direction = >0 increases salinity (SALT) EXFpreci: long_name = Precipitation rate EXFpreci: standard_name = lwe_precipitation_rate EXFpreci: units = m s: 1 EXFpreci: coordinates = time EXFpreci: valid_min = : 1.4860395936011628e: 07 EXFpreci: valid_max = 8.317776519106701e: 06			
Comments			
Precipitation rate. note: sum of era-interim precipitation and the control adjustment from ocean state estimation.			

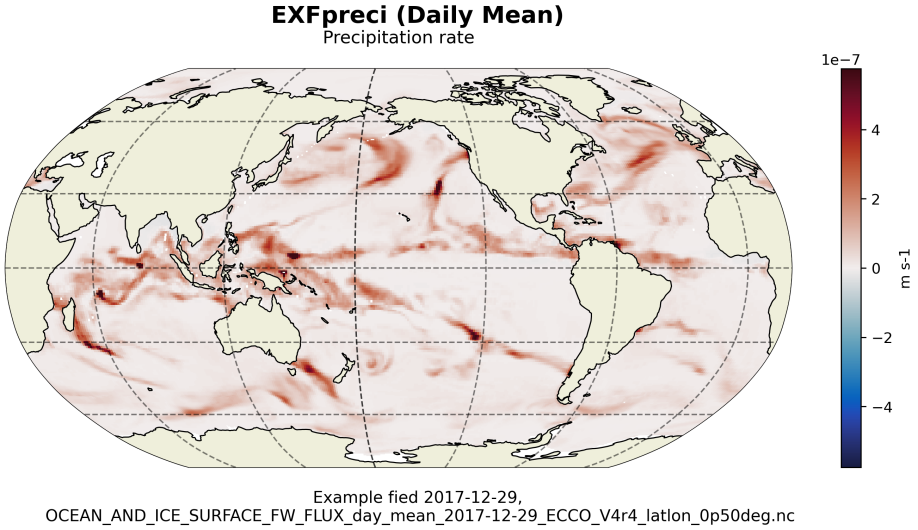


Figure 126: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFpreci

14.2.5 Latlon Variable: EXFroff

Table 14.12: Attributes description of the variable 'EXFroff' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFroff	River runoff	m s-1
Description of the variable in Common Data language (CDL)			
float32 EXFroff(time, latitude, longitude) EXFroff: _FillValue = 9.96921e+36 EXFroff: coverage_content_type = modelResult EXFroff: direction = >0 increases salinity (SALT) EXFroff: long_name = River runoff EXFroff: standard_name = surface_runoff_flux EXFroff: units = m s: 1 EXFroff: coordinates = time EXFroff: valid_min = 0.0 EXFroff: valid_max = 4.185612397122895e: 06			
Comments			
River runoff freshwater flux. note: not adjusted by the optimization.			

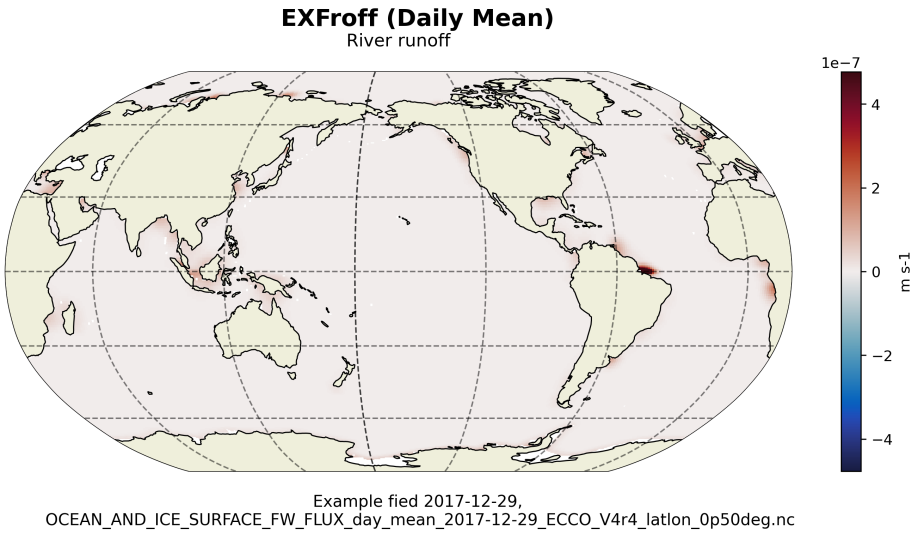


Figure 127: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: EXFroff

14.2.6 Latlon Variable: SFLUX

Table 14.13: Attributes description of the variable 'SFLUX' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SFLUX	Rate of change of total ocean salinity per m2 accounting for mass fluxes.	g m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SFLUX(time, latitude, longitude) SFLUX: _FillValue = 9.96921e+36 SFLUX: coverage_content_type = modelResult SFLUX: direction = >0 increases salinity (SALT) SFLUX: long_name = Rate of change of total ocean salinity per m2 accounting for mass fluxes. SFLUX: units = g m: 2 s: 1 SFLUX: coordinates = time SFLUX: valid_min = : 0.06244903802871704 SFLUX: valid_max = 0.010570422746241093			
Comments			
The rate of change of total ocean salinity due to freshwater fluxes across the liquid surface and the addition or removal of mass. note: the global area integral of sflux matches the time-derivative of total ocean salinity (psu s-1). unlike ocefwflx, sflux includes the contribution to the total ocean salinity from changing ocean mass (e.g. from the addition or removal of freshwater in ocefwflx).			

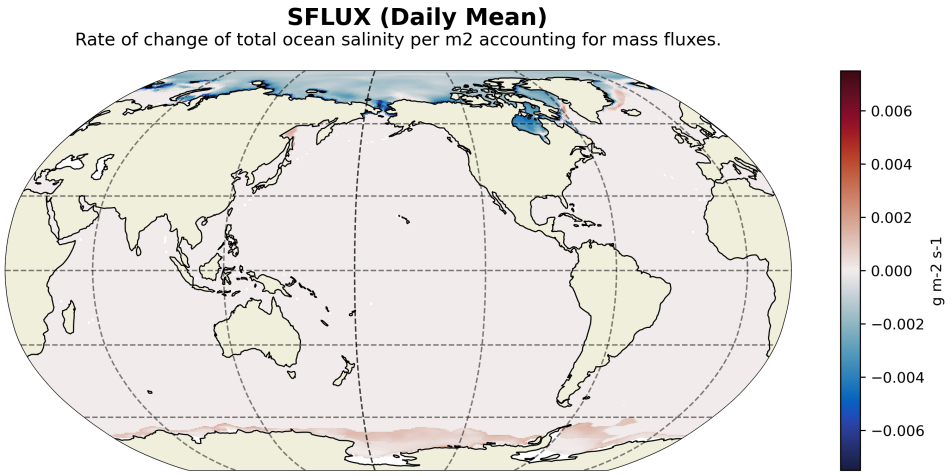


Figure 128: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SFLUX

14.2.7 Latlon Variable: SIacSubl

Table 14.14: Attributes description of the variable 'SIacSubl' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIacSubl	Freshwater flux to the atmosphere due to sublimation-deposition of snow or ice	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIacSubl(time, latitude, longitude) SIacSubl: _FillValue = 9.96921e+36 SIacSubl: coverage_content_type = modelResult SIacSubl: direction = >0 decreases snow or sea: ice thickness (HSNOW or HEFF) SIacSubl: long_name = Freshwater flux to the atmosphere due to sublimation: deposition of snow or ice SIacSubl: standard_name = water_sublimation_flux SIacSubl: units = kg m: 2 s: 1 SIacSubl: coordinates = time SIacSubl: valid_min = 0.0 SIacSubl: valid_max = 7.735946564935148e: 05			
Comments			
Freshwater flux to the atmosphere due to sublimation-deposition of snow or ice. positive values imply sublimation from ice/snow to vapor, negative values imply deposition from atmospheric moisture			

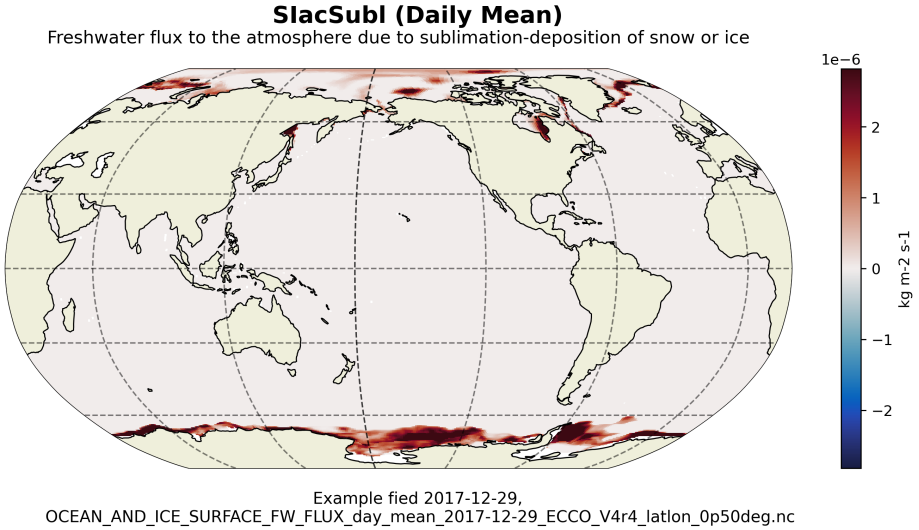


Figure 129: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIacSubl

14.2.8 Latlon Variable: SIatmFW

Table 14.15: Attributes description of the variable 'SIatmFW' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIatmFW	Net freshwater flux into the open ocean, sea-ice, and snow	kg m-2 s-1

Description of the variable in Common Data language (CDL)

float32 SIatmFW(time, latitude, longitude)
SIatmFW: _FillValue = 9.96921e+36
SIatmFW: coverage_content_type = modelResult
SIatmFW: direction = >0 decreases salinity (SALT)
SIatmFW: long_name = Net freshwater flux into the open ocean
sea: ice
and snow
SIatmFW: standard_name = surface_downward_water_flux
SIatmFW: units = kg m: 2 s: 1
SIatmFW: coordinates = time
SIatmFW: valid_min = : 0.00043017856660299003
SIatmFW: valid_max = 0.008299433626234531

Comments

Net freshwater flux into the combined liquid ocean, sea-ice, and snow reservoirs from the atmosphere and runoff. note: freshwater fluxes between the liquid ocean and sea-ice or snow reservoirs do not contribute to siatmfw. siatmfw counts all fluxes to/from the atmosphere that change the total freshwater stored in the combined liquid ocean, sea-ice, and snow reservoirs.

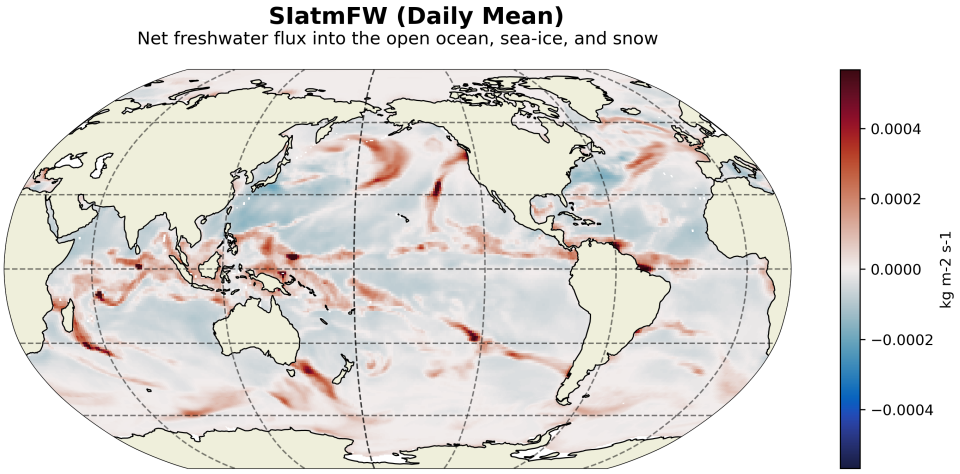


Figure 130: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIatmFW

14.2.9 Latlon Variable: SIfwThru

Table 14.16: Attributes description of the variable 'SIfwThru' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIfwThru	Precipitation through sea-ice	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIfwThru(time, latitude, longitude) SIfwThru: _FillValue = 9.96921e+36 SIfwThru: coverage_content_type = modelResult SIfwThru: direction = >0 increases ocean volume SIfwThru: long_name = Precipitation through sea: ice SIfwThru: units = kg m: 2 s: 1 SIfwThru: coordinates = time SIfwThru: valid_min = : 1.695218452368863e: 05 SIfwThru: valid_max = 0.0010632629273459315			
Comments			
Precipitation over sea-ice covered regions reaching ocean through sea-ice. note: precipitation over sea-ice covered regions that directly reaches ocean through the sea-ice. it is not due to melt of sea-ice/snow.			

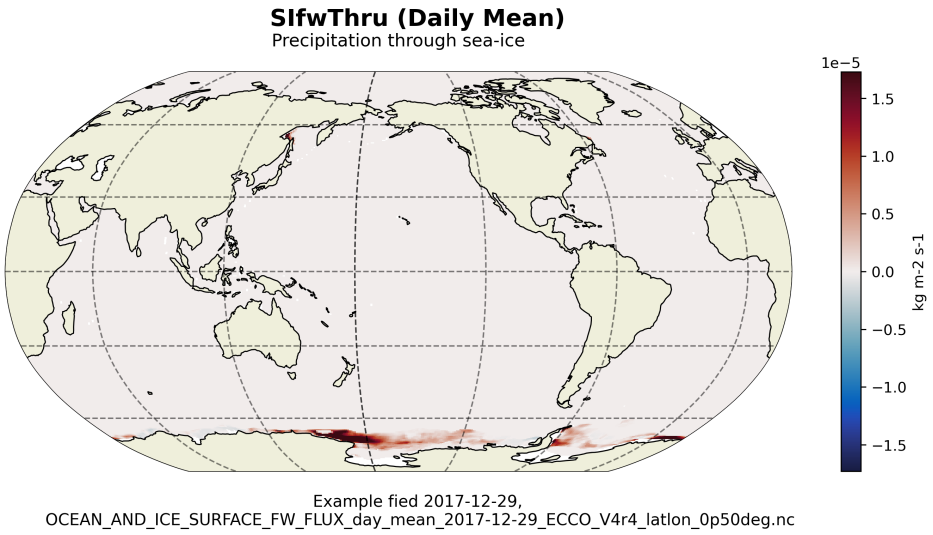


Figure 131: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIfwThru

14.2.10 Latlon Variable: SIrsSubl

Table 14.17: Attributes description of the variable 'SIrsSubl' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIrsSubl	Residual sublimation freshwater flux	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIrsSubl(time, latitude, longitude) SIrsSubl: _FillValue = 9.96921e+36 SIrsSubl: coverage_content_type = modelResult SIrsSubl: direction = >0 decreases ocean volume SIrsSubl: long_name = Residual sublimation freshwater flux SIrsSubl: units = kg m: 2 s: 1 SIrsSubl: coordinates = time SIrsSubl: valid_min = : 0.0001067528864950873 SIrsSubl: valid_max = 8.640533451398369e: 06			
Comments			
Residual freshwater flux by sublimation to remove water from or add water to ocean. when implied sublimation freshwater flux siacsubl is larger than availabe sea-ice/snow, sirssubl is positive and water is removed from ocean. note: freshwater flux by sublimation that is to remove water from the ocean when it is positive.			

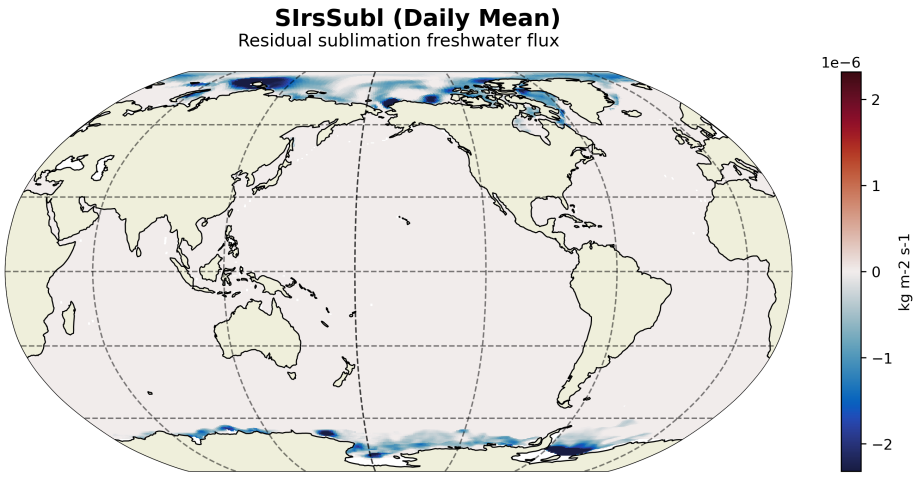


Figure 132: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIrsSubl

14.2.11 Latlon Variable: SIsnPrcp

Table 14.18: Attributes description of the variable 'SIsnPrcp' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIsnPrcp	Snow precipitation on sea-ice	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 SIsnPrcp(time, latitude, longitude) SIsnPrcp: _FillValue = 9.96921e+36 SIsnPrcp: coverage_content_type = modelResult SIsnPrcp: direction = >0 increases snow thickness (HSNOW) SIsnPrcp: long_name = Snow precipitation on sea: ice SIsnPrcp: standard_name = snowfall_flux SIsnPrcp: units = kg m: 2 s: 1 SIsnPrcp: coordinates = time SIsnPrcp: valid_min = : 4.334669574745931e: 05 SIsnPrcp: valid_max = 0.00093540205853059 89			
Comments			
Snow precipitation rate over sea-ice, averaged over the entire model grid cell.			

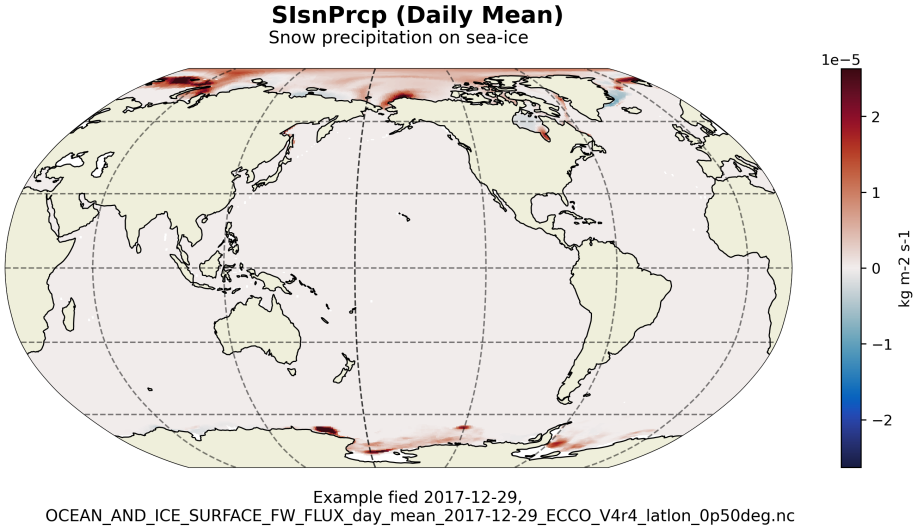


Figure 133: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: SIsnPrcp

14.2.12 Latlon Variable: oceFWflx

Table 14.19: Attributes description of the variable 'oceFWflx' from OCEAN_AND_ICE_SURFACE_FW_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceFWflx	Net freshwater flux into the ocean	kg m-2 s-1
Description of the variable in Common Data language (CDL)			
float32 oceFWflx(time, latitude, longitude) oceFWflx: _FillValue = 9.96921e+36 oceFWflx: coverage_content_type = modelResult oceFWflx: direction = >0 decreases salinity (SALT) oceFWflx: long_name = Net freshwater flux into the ocean oceFWflx: standard_name = water_flux_into_sea_water oceFWflx: units = kg m: 2 s: 1 oceFWflx: coordinates = time oceFWflx: valid_min = : 0.0033125500194728374 oceFWflx: valid_max = 0.008299433626234531			
Comments			
Net freshwater flux into the ocean including contributions from runoff, evaporation, precipitation, and mass exchange with sea-ice due to melting and freezing and snow melting. note: ocefwflx does not include freshwater fluxes between the atmosphere and sea-ice and snow. the variable 'siatmfw' accounts for freshwater fluxes out of the combined ocean+sea-ice+snow reservoir.			

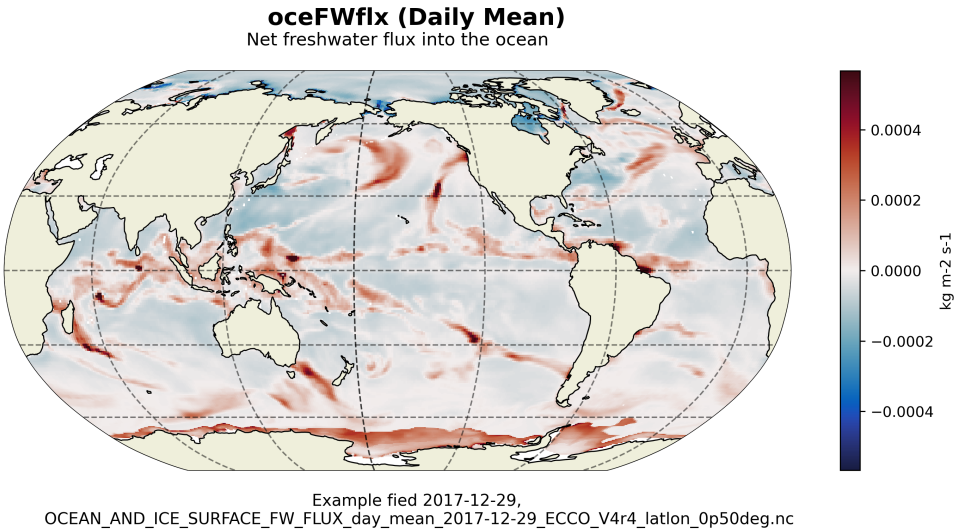


Figure 134: Dataset: OCEAN_AND_ICE_SURFACE_FW_FLUX, Variable: oceFWflx

14.3 Latlon dataset of OCEAN_AND_ICE_SURFACE_HEAT_FLUX

14.3.1 Overview

This dataset provides 2D fields of ocean and sea-ice surface heat fluxes interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.20: Coordinates and Variables in the dataset OCEAN_AND_ICE_SURFACE_HEAT_FLUX

Variables	Description of data variables	Unit
EXFhl	Open ocean air-sea latent heat flux	W m-2
EXFhs	Open ocean air-sea sensible heat flux	W m-2
EXFlwdn	Downward longwave radiative flux	W m-2
EXFswdn	Downwelling shortwave radiative flux	W m-2
EXFqnet	Open ocean net air-sea heat flux	W m-2
oceQnet	Net heat flux into the ocean surface	W m-2
SIatmQnt	Net upward heat flux to the atmosphere	W m-2
TFLUX	Rate of change of ocean heat content per m2 accounting for mass fluxes.	W m-2
EXFswnet	Open ocean net shortwave radiative flux	W m-2
EXFlwnet	Net open ocean longwave radiative flux	W m-2
oceQsw	Net shortwave radiative flux across the ocean surface	W m-2
SIaaflux	Conservative ocean and sea-ice advective heat flux adjustment	W m-2
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.3.2 Latlon Variable: EXFhl

Table 14.21: Attributes description of the variable 'EXFhl' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFhl	Open ocean air-sea latent heat flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFhl(time, latitude, longitude) EXFhl: _FillValue = 9.96921e+36 EXFhl: coverage_content_type = modelResult EXFhl: direction = >0 increases potential temperature (THETA) EXFhl: long_name = Open ocean air: sea latent heat flux EXFhl: standard_name = surface_downward_latent_heat_flux EXFhl: units = W m: 2 EXFhl: coordinates = time EXFhl: valid_min = : 1772.513671875 EXFhl: valid_max = 273.9528503417969			
Comments			
Air-sea latent heat flux per unit area of open water (not covered by sea-ice). note: calculated from the bulk formula following large and yeager (2004) ncar/tn-460+str.			

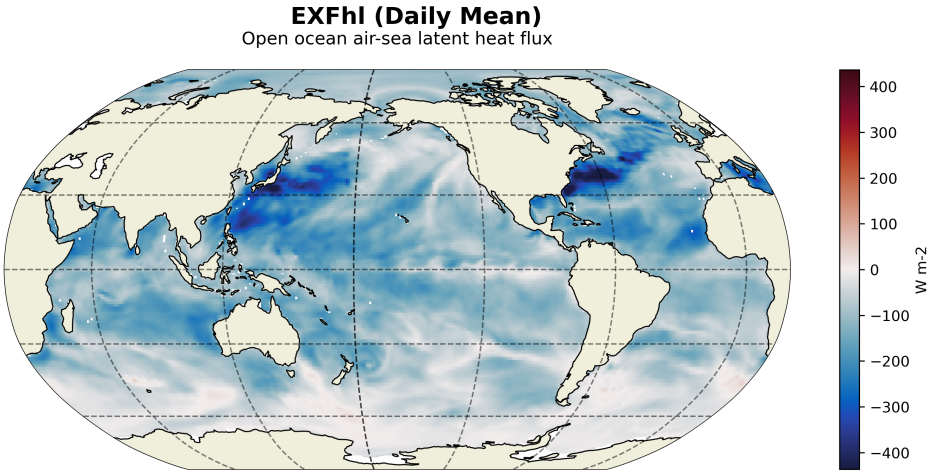


Figure 135: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFhl

14.3.3 Latlon Variable: EXFhs

Table 14.22: Attributes description of the variable 'EXFhs' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFhs	Open ocean air-sea sensible heat flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFhs(time, latitude, longitude) EXFhs: _FillValue = 9.96921e+36 EXFhs: coverage_content_type = modelResult EXFhs: direction = >0 increases potential temperature (THETA) EXFhs: long_name = Open ocean air: sea sensible heat flux EXFhs: standard_name = surface_downward_sensible_heat_flux EXFhs: units = W m: 2 EXFhs: coordinates = time EXFhs: valid_min = : 2478.766357421875 EXFhs: valid_max = 357.0105895996094			
Comments			
Air-sea sensible heat flux per unit area of open water (not covered by sea-ice). note: calculated from the bulk formula following large and yeager (2004) ncar/tn-460+str.			

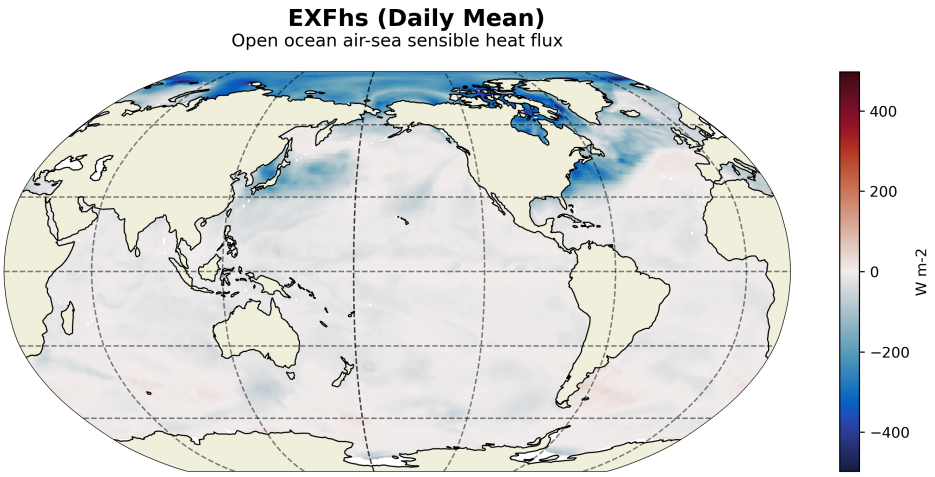


Figure 136: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFhs

14.3.4 Latlon Variable: EXFlwdn

Table 14.23: Attributes description of the variable 'EXFlwdn' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFlwdn	Downward longwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFlwdn(time, latitude, longitude) EXFlwdn: _FillValue = 9.96921e+36 EXFlwdn: coverage_content_type = modelResult EXFlwdn: direction = >0 increases potential temperature (THETA) EXFlwdn: long_name = Downward longwave radiative flux EXFlwdn: standard_name = surface_downwelling_longwave_flux_in_air EXFlwdn: units = W m: 2 EXFlwdn: coordinates = time EXFlwdn: valid_min = 4.188045501708984 EXFlwdn: valid_max = 513.3919067382812			
Comments			
Downward longwave radiative flux. note: sum of era-interim downward longwave radiation and the control adjustment from ocean state estimation.			

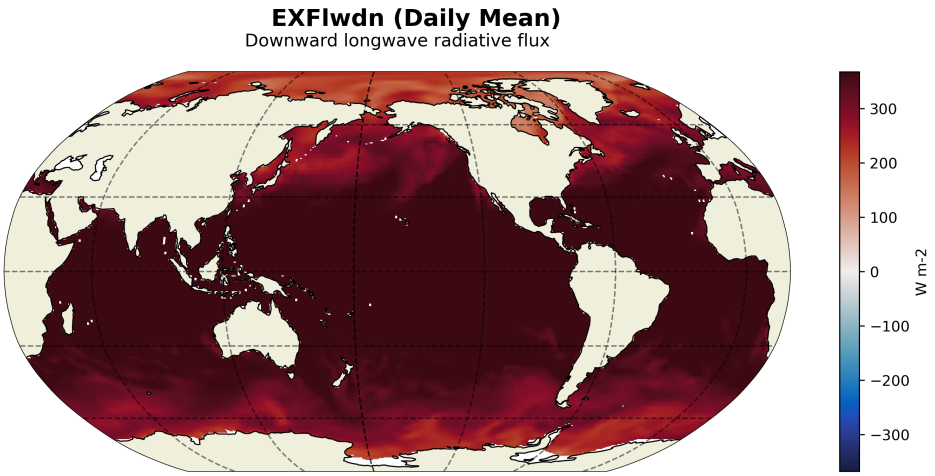


Figure 137: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFlwdn

14.3.5 Latlon Variable: EXFlwnet

Table 14.24: Attributes description of the variable 'EXFlwnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFlwnet	Net open ocean longwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFlwnet(time, latitude, longitude) EXFlwnet: _FillValue = 9.96921e+36 EXFlwnet: coverage_content_type = modelResult EXFlwnet: direction = >0 increases potential temperature (THETA) EXFlwnet: long_name = Net open ocean longwave radiative flux EXFlwnet: standard_name = surface_net_downward_longwave_flux EXFlwnet: units = W m: 2 EXFlwnet: coordinates = time EXFlwnet: valid_min = : 144.3661346435547 EXFlwnet: valid_max = 293.4114990234375			
Comments			
Net longwave radiative flux per unit area of open water (not covered by sea-ice). note: net longwave radiation over open water calculated from downward longwave radiation (exflwdn) and upward longwave radiation from ocean and sea-ice thermal emission (stefan-boltzman law).			

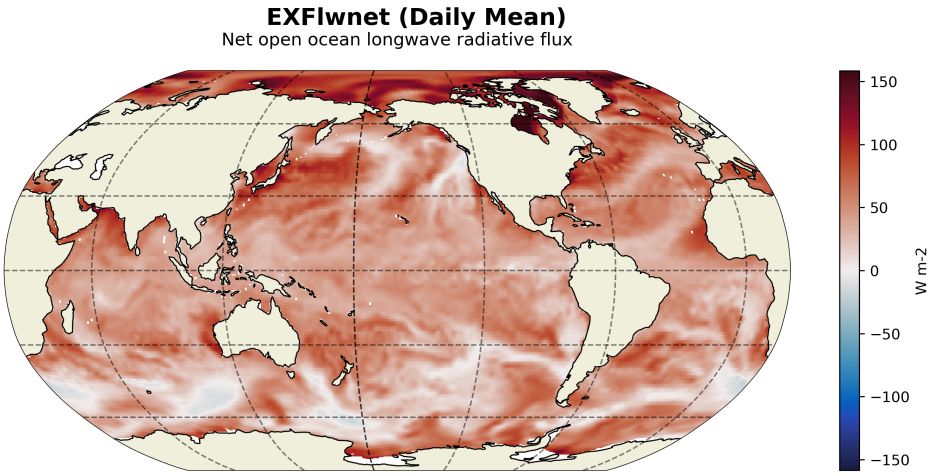


Figure 138: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFlwnet

14.3.6 Latlon Variable: EXFqnet

Table 14.25: Attributes description of the variable 'EXFqnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFqnet	Open ocean net air-sea heat flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFqnet(time, latitude, longitude) EXFqnet: _FillValue = 9.96921e+36 EXFqnet: coverage_content_type = modelResult EXFqnet: direction = >0 increases potential temperature (THETA) EXFqnet: long_name = Open ocean net air: sea heat flux EXFqnet: units = W m: 2 EXFqnet: coordinates = time EXFqnet: valid_min = : 687.8736572265625 EXFqnet: valid_max = 3408.977783203125			
Comments			
Net air-sea heat flux (turbulent and radiative) per unit area of open water (not covered by sea-ice). note: net upward heat flux over open water, calculated as exflwnet+exfswnet-exflh-exfhs.			

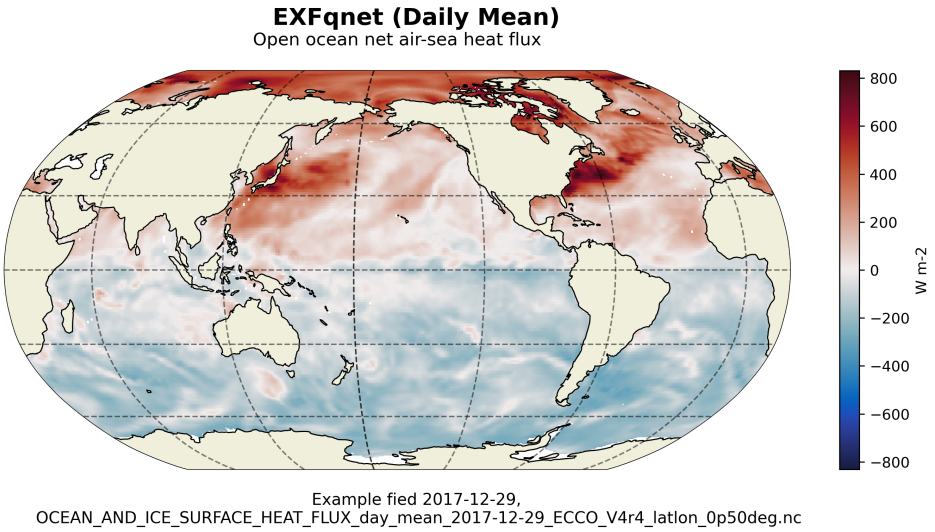


Figure 139: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFqnet

14.3.7 Latlon Variable: EXFswdn

Table 14.26: Attributes description of the variable 'EXFswdn' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFswdn	Downwelling shortwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFswdn(time, latitude, longitude) EXFswdn: _FillValue = 9.96921e+36 EXFswdn: coverage_content_type = modelResult EXFswdn: direction = >0 increases potential temperature (THETA) EXFswdn: long_name = Downwelling shortwave radiative flux EXFswdn: standard_name = surface_downwelling_shortwave_flux_in_air EXFswdn: units = W m: 2 EXFswdn: coordinates = time EXFswdn: valid_min = : 224.63368225097656 EXFswdn: valid_max = 707.345947265625			
Comments			
Downward shortwave radiative flux. note: sum of era-interim downward shortwave radiation and the control adjustment from ocean state estimation.			

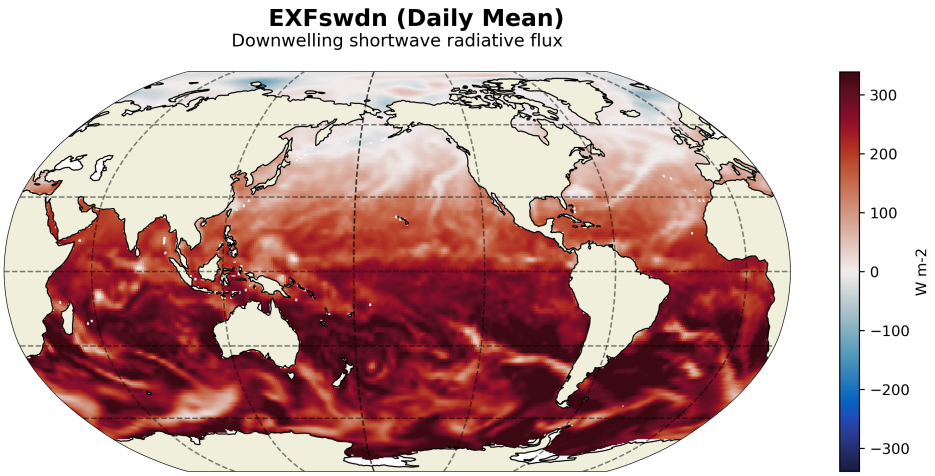


Figure 140: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFswdn

14.3.8 Latlon Variable: EXFswnet

Table 14.27: Attributes description of the variable 'EXFswnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFswnet	Open ocean net shortwave radiative flux	W m-2
Description of the variable in Common Data language (CDL)			
float32 EXFswnet(time, latitude, longitude) EXFswnet: _FillValue = 9.96921e+36 EXFswnet: coverage_content_type = modelResult EXFswnet: direction = >0 increases potential temperature (THETA) EXFswnet: long_name = Open ocean net shortwave radiative flux EXFswnet: standard_name = surface_net_downward_shortwave_flux EXFswnet: units = W m: 2 EXFswnet: coordinates = time EXFswnet: valid_min = : 655.6171264648438 EXFswnet: valid_max = 193.89297485351562			
Comments			
Net shortwave radiative flux per unit area of open water (not covered by sea-ice). note: net shortwave radiation over open water calculated from downward shortwave flux (exfswdn) and ocean surface albdeo.			

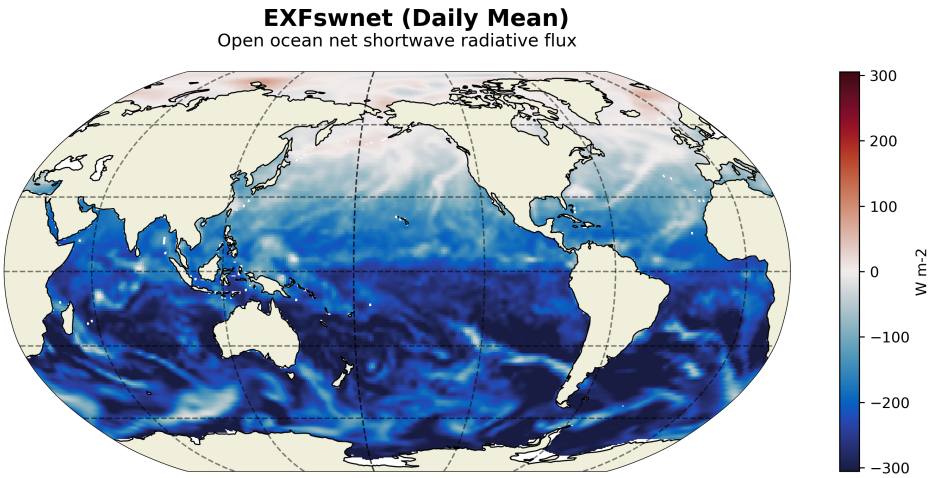


Figure 141: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: EXFswnet

14.3.9 Latlon Variable: SIaaflux

Table 14.28: Attributes description of the variable 'SIaaflux' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIaaflux	Conservative ocean and sea-ice advective heat flux adjustment	W m-2

Description of the variable in Common Data language (CDL)

float32 SIaaflux(time, latitude, longitude)
SIaaflux: _FillValue = 9.96921e+36
SIaaflux: coverage_content_type = modelResult
SIaaflux: direction = >0 decrease potential temperature (THETA)
SIaaflux: long_name = Conservative ocean and sea: ice advective heat flux adjustment
SIaaflux: units = W m: 2
SIaaflux: coordinates = time
SIaaflux: valid_min = : 16.214622497558594
SIaaflux: valid_max = 50.35451889038086

Comments

Heat flux associated with the temperature difference between sea surface temperature and sea-ice (assume 0 degree c in the model). note: heat flux needed to melt/freeze sea-ice at 0 degc to sea water at the ocean surface (at sea surface temperature), excluding the latent heat of fusion.

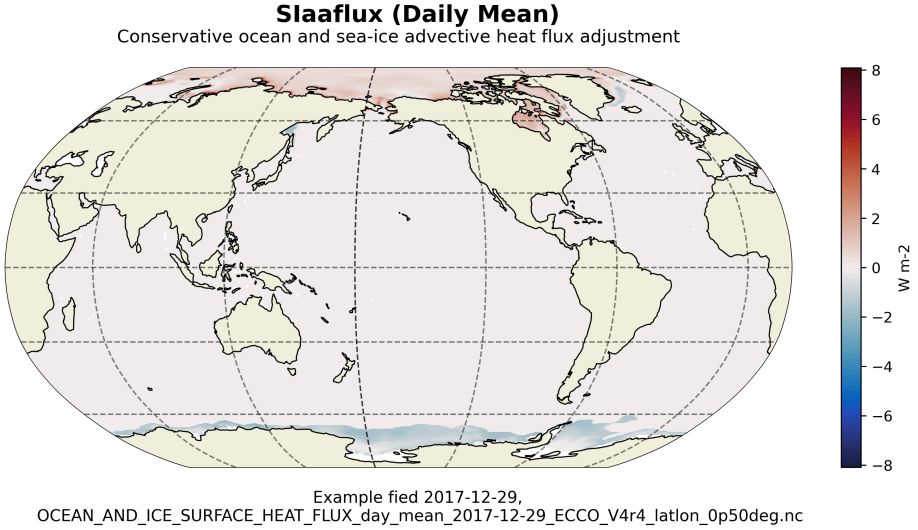


Figure 142: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: SIaaflux

14.3.10 Latlon Variable: SIatmQnt

Table 14.29: Attributes description of the variable 'SIatmQnt' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIatmQnt	Net upward heat flux to the atmosphere	W m-2
Description of the variable in Common Data language (CDL)			
float32 SIatmQnt(time, latitude, longitude) SIatmQnt: _FillValue = 9.96921e+36 SIatmQnt: coverage_content_type = modelResult SIatmQnt: direction = >0 upward decreases ocean temperature SIatmQnt: long_name = Net upward heat flux to the atmosphere SIatmQnt: standard_name = surface_upward_heat_flux_in_air SIatmQnt: units = W m: 2 SIatmQnt: coordinates = time SIatmQnt: valid_min = : 756.0607299804688 SIatmQnt: valid_max = 1704.7703857421875			
Comments			
Net upward heat flux to the atmosphere across open water and sea-ice or snow surfaces. note: nonzero siatmqnt may not be associated with a change in ocean potential temperature due to sea-ice growth or melting. to calculate total ocean heat content changes use the variable tflux which also accounts for changing ocean mass (e.g. ocefwflx).			

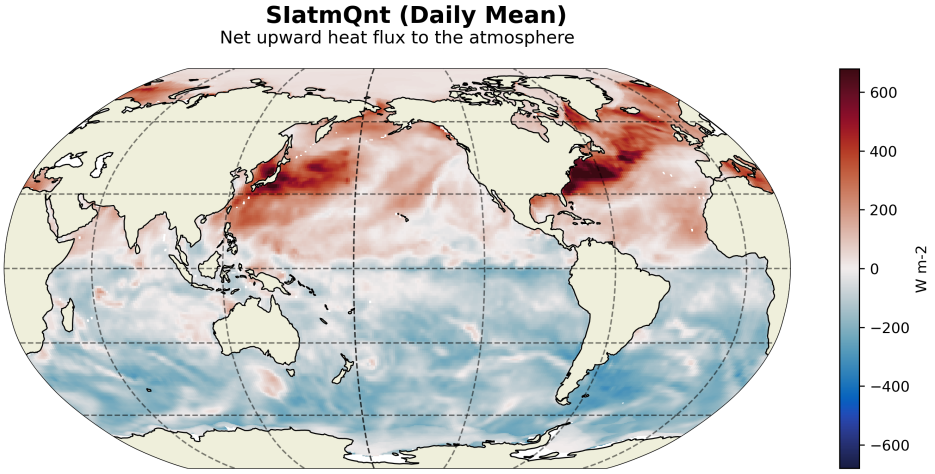


Figure 143: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: SIatmQnt

14.3.11 Latlon Variable: TFLUX

Table 14.30: Attributes description of the variable 'TFLUX' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	TFLUX	Rate of change of ocean heat content per m2 accounting for mass fluxes.	W m-2

Description of the variable in Common Data language (CDL)

float32 TFLUX(time, latitude, longitude)
TFLUX: _FillValue = 9.96921e+36
TFLUX: coverage_content_type = modelResult
TFLUX: direction = >0 increases potential temperature (THETA)
TFLUX: long_name = Rate of change of ocean heat content per m2 accounting for mass fluxes.
TFLUX: units = W m: 2
TFLUX: coordinates = time
TFLUX: valid_min = : 1713.51220703125
TFLUX: valid_max = 870.3130493164062

Comments

The rate of change of ocean heat content due to heat fluxes across the liquid surface and the addition or removal of mass. . note: the global area integral of tflux and geothermal flux (geothermalflux.bin) matches the time-derivative of ocean heat content (j/s). unlike oceqnet, tflux includes the contribution to the ocean heat content from changing ocean mass (e.g. from ocefwflx).

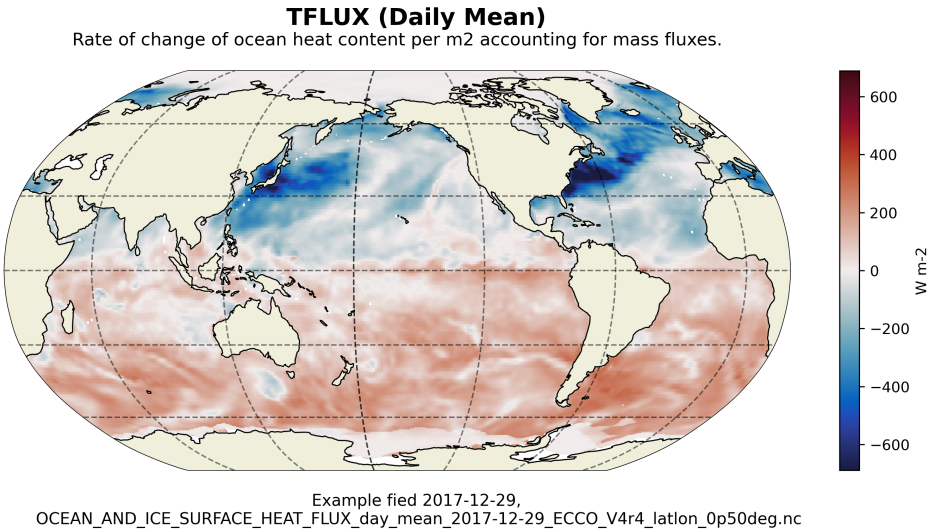


Figure 144: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: TFLUX

14.3.12 Latlon Variable: oceQnet

Table 14.31: Attributes description of the variable 'oceQnet' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceQnet	Net heat flux into the ocean surface	W m-2

Description of the variable in Common Data language (CDL)

float32 oceQnet(time, latitude, longitude)
oceQnet: _FillValue = 9.96921e+36
oceQnet: coverage_content_type = modelResult
oceQnet: direction = >0 increases potential temperature (THETA)
oceQnet: long_name = Net heat flux into the ocean surface
oceQnet: standard_name = surface_downward_heat_flux_in_sea_water
oceQnet: units = W m: 2
oceQnet: coordinates = time
oceQnet: valid_min = : 1708.8460693359375
oceQnet: valid_max = 675.3716430664062

Comments

Net heat flux into the ocean surface from all processes: air-sea turbulent and radiative fluxes and turbulent and conductive fluxes between the ocean and sea-ice and snow. note: oceqnet does not include the change in ocean heat content due to changing ocean ocean mass (ocefwflx). mass fluxes from evaporation, precipitation, and runoff (exfempmr) happen at the same temperature as the ocean surface temperature. consequently, empmr does not change ocean surface temperature. conversely, mass fluxes due to sea-ice thickening/thinning and snow melt in the model are assumed to happen at a fixed 0c. consequently, mass fluxes due to phase changes between seawater and sea-ice and snow induce a heat flux when the ocean surface temperaure is not 0c. the variable tflux does include the change in ocean heat content due to changing ocean mass.

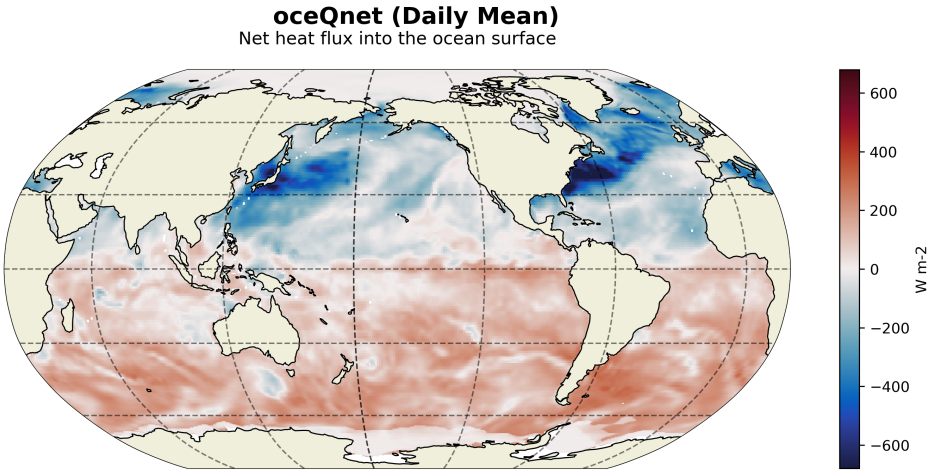


Figure 145: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: oceQnet

14.3.13 Latlon Variable: oceQsw

Table 14.32: Attributes description of the variable 'oceQsw' from OCEAN_AND_ICE_SURFACE_HEAT_FLUX's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceQsw	Net shortwave radiative flux across the ocean surface	W m-2
Description of the variable in Common Data language (CDL)			
float32 oceQsw(time, latitude, longitude) oceQsw: _FillValue = 9.96921e+36 oceQsw: coverage_content_type = modelResult oceQsw: direction = >0 increases potential temperature (THETA) oceQsw: long_name = Net shortwave radiative flux across the ocean surface oceQsw: units = W m: 2 oceQsw: coordinates = time oceQsw: valid_min = : 134.39808654785156 oceQsw: valid_max = 655.6171264648438			
Comments			
Net shortwave radiative flux across the ocean surface. note: shortwave radiation penetrates below the surface grid cell.			

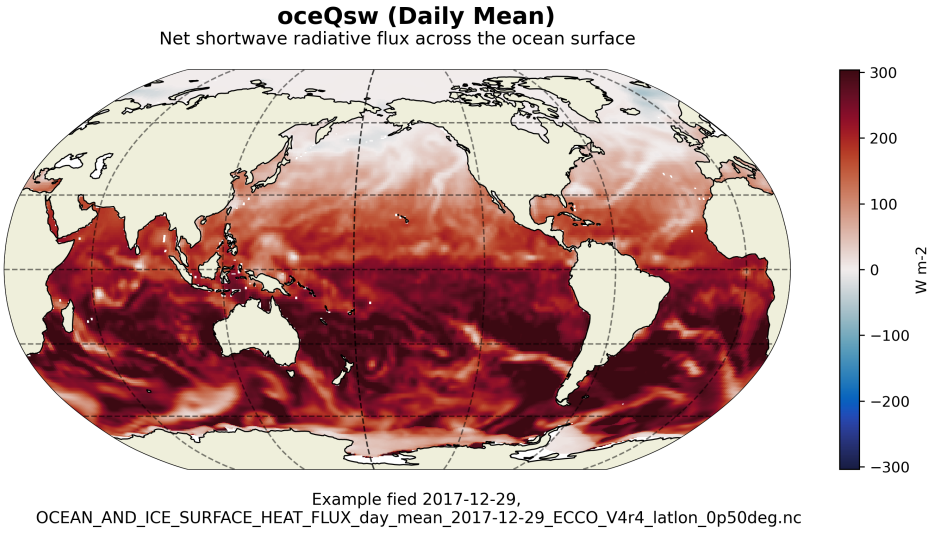


Figure 146: Dataset: OCEAN_AND_ICE_SURFACE_HEAT_FLUX, Variable: oceQsw

14.4 Latlon dataset of OCEAN_AND_ICE_SURFACE_STRESS

14.4.1 Overview

This dataset provides 2D fields of ocean and sea-ice surface stress interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.33: Coordinates and Variables in the dataset OCEAN_AND_ICE_SURFACE_STRESS

Variables	Description of data variables	Unit
EXFtaue	Zonal (east-west) wind stress	N m-2
EXFtaun	Meridional (north-south) wind stress	N m-2
oceTAUE	Zonal (east-west) ocean surface stress	N m-2
oceTAUN	Meridional (north-south) ocean surface stress	N m-2
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.4.2 Latlon Variable: EXFtaue

Table 14.34: Attributes description of the variable 'EXFtaue' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFtaue	Zonal (east-west) wind stress	N m-2

Description of the variable in Common Data language (CDL)

float32 EXFtaue(time, latitude, longitude)
EXFtaue: _FillValue = 9.96921e+36
EXFtaue: coverage_content_type = modelResult
EXFtaue: direction = >0 increases eastward velocity (EVEL)
EXFtaue: long_name = Zonal (east: west) wind stress
EXFtaue: standard_name = surface_downward_eastward_stress
EXFtaue: units = N m: 2
EXFtaue: coordinates = time
EXFtaue: valid_min = : 3.1686902046203613
EXFtaue: valid_max = 3.284827709197998

Comments

Zonal (east-west) component of wind stress. note: exftaue is the zonal wind stress applied to the ocean and sea-ice. when sea-ice is present, the total zonal stress applied to the ocean surface is not exftaue, but a combination of the wind stress in the open water fraction (exftaue) and a stress from sea-ice in the ice-covered fraction (see oc-etaue). exftaue is calculated by interpolating the model's x and y components of wind stress (exftaux and exftauy) to tracer cell centers and then finding the zonal component of the interpolated vectors. it is not recommended to use exftaue and exftaun for momentum budget calculations because interpolating exftaux and exftauy from the model grid to the lat-lon grid introduces errors. for momentum fluxes to the ocean surface see ocetaux and ocetauy.

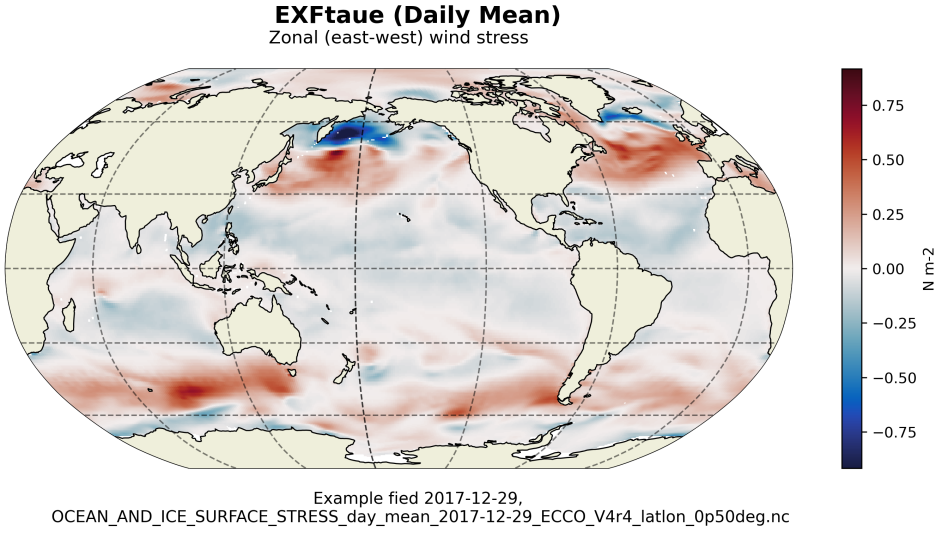


Figure 147: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: EXFtaue

14.4.3 Latlon Variable: EXFtaun

Table 14.35: Attributes description of the variable 'EXFtaun' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	EXFtaun	Meridional (north-south) wind stress	N m-2
Description of the variable in Common Data language (CDL)			
float32 EXFtaun(time, latitude, longitude) EXFtaun: _FillValue = 9.96921e+36 EXFtaun: coverage_content_type = modelResult EXFtaun: direction = >0 increases northward velocity (NVEL) EXFtaun: long_name = Meridional (north: south) wind stress EXFtaun: standard_name = surface_downward_northward_stress EXFtaun: units = N m: 2 EXFtaun: coordinates = time EXFtaun: valid_min = : 4.111213207244873 EXFtaun: valid_max = 6.878159523010254			
Comments			
Meridional (north-south) component of wind stress. note: exftaun is the stress applied to the ocean and sea-ice. when sea-ice is present, the total meridional stress applied to the ocean surface is not exftaun, but a combination of the wind stress in the open water fraction (exftaun) and a stress from sea-ice in the ice-covered fraction (see ocetaun). exftaun is calculated by interpolating the model's x and y components of wind stress (exftaux and exftauy) to tracer cell centers and then determining the meridional component of the interpolated vectors. it is not recommended to use exftaue and exftaun for momentum budget calculations because interpolating exftaux and exftauy from the model grid to the lat-lon grid introduces errors. for momentum fluxes to the ocean surface see ocetaux and ocetauy.			

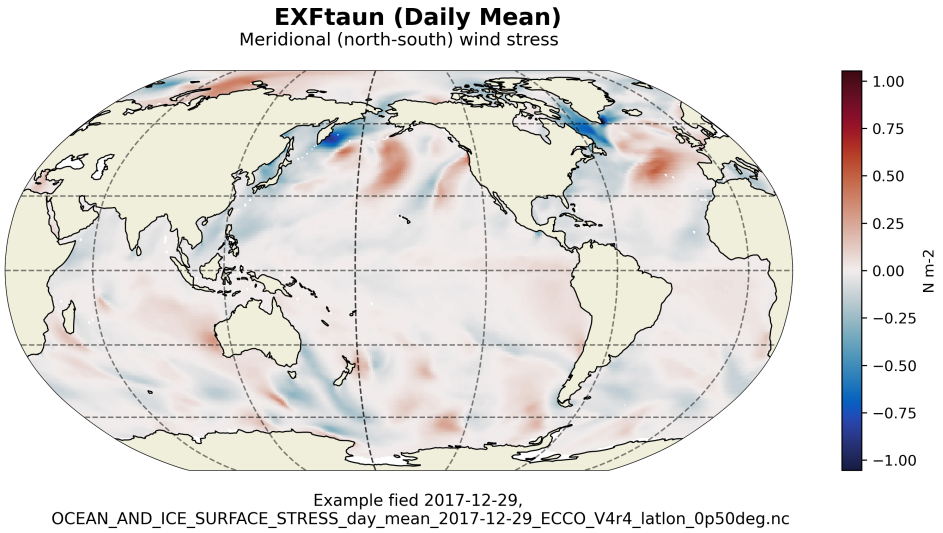


Figure 148: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: EXFtaun

14.4.4 Latlon Variable: oceTAUE

Table 14.36: Attributes description of the variable 'oceTAUE' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceTAUE	Zonal (east-west) ocean surface stress	N m-2
Description of the variable in Common Data language (CDL)			
float32 oceTAUE(time, latitude, longitude) oceTAUE: _FillValue = 9.96921e+36 oceTAUE: coverage_content_type = modelResult oceTAUE: direction = >0 increases eastward velocity (EVEL) oceTAUE: long_name = Zonal (east: west) ocean surface stress oceTAUE: standard_name = surface_downward_eastward_stress oceTAUE: units = N m: 2 oceTAUE: coordinates = time oceTAUE: valid_min = : 2.058817148208618 oceTAUE: valid_max = 2.000103712081909			
Comments			
Zonal (east-west) component of ocean surface stress due to wind and sea-ice. note: ocetaue is calculated by interpolating the model's x and y components of ocean surface stress (ocetaux and ocetauy) to tracer cell centers and then finding the zonal component of the interpolated vectors.			

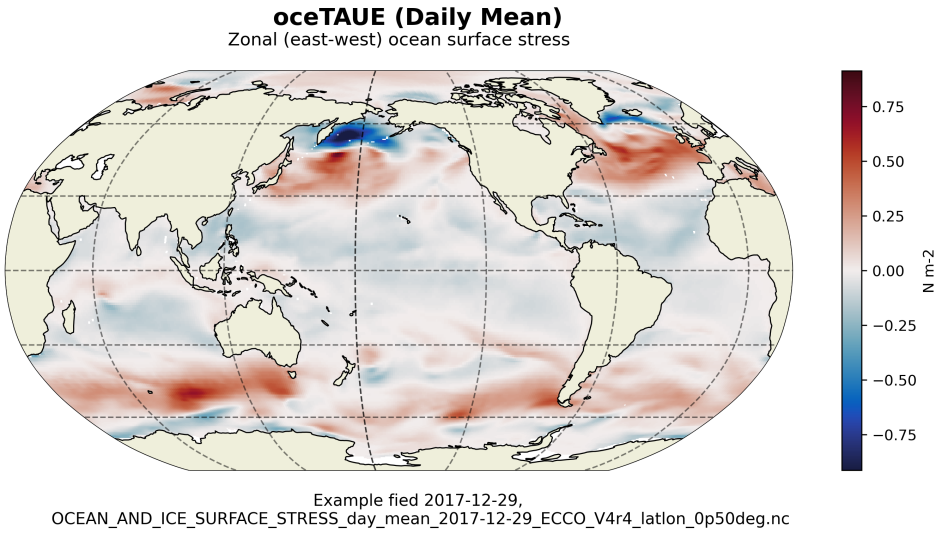


Figure 149: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: oceTAUE

14.4.5 Latlon Variable: oceTAUN

Table 14.37: Attributes description of the variable 'oceTAUN' from OCEAN_AND_ICE_SURFACE_STRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	oceTAUN	Meridional (north-south) ocean surface stress	N m-2
Description of the variable in Common Data language (CDL)			
float32 oceTAUN(time, latitude, longitude) oceTAUN: _FillValue = 9.96921e+36 oceTAUN: coverage_content_type = modelResult oceTAUN: direction = >0 increases northward velocity (NVEL) oceTAUN: long_name = Meridional (north: south) ocean surface stress oceTAUN: standard_name = surface_downward_northward_stress oceTAUN: units = N m: 2 oceTAUN: coordinates = time oceTAUN: valid_min = : 2.4036266803741455 oceTAUN: valid_max = 2.019313097000122			
Comments			
Meridional (north-south) component of ocean surface stress due to wind and sea-ice. note: ocetaun is calculated by interpolating the model's x and y components of ocean surface stress (ocetaux and ocetauy) to tracer cell centers and then finding the meridional component of the interpolated vectors.			

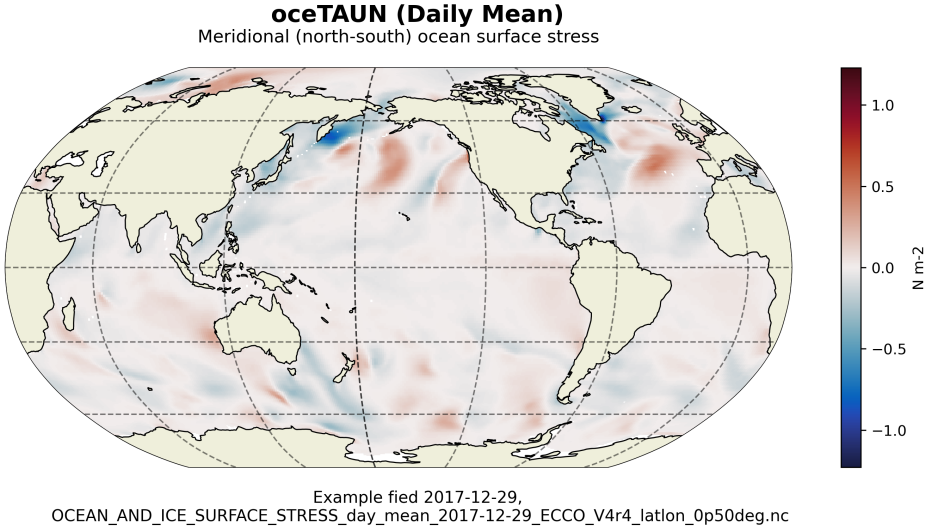


Figure 150: Dataset: OCEAN_AND_ICE_SURFACE_STRESS, Variable: oceTAUN

14.5 Latlon dataset of OCEAN_BOLUS_VELOCITY

14.5.1 Overview

This dataset provides 3D fields of Gent-McWilliams ocean bolus velocity interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.38: Coordinates and Variables in the dataset OCEAN_BOLUS_VELOCITY

Variables	Description of data variables	Unit
EVELSTAR	Gent-mcwilliams zonal (east-west) bolus velocity	m s-1
NVELSTAR	Gent-mcwilliams meridional (north-south) bolus velocity	m s-1
WVELSTAR	Gent-mcwilliams vertical bolus velocity	m s-1
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
Z	Depth of grid cell center	m
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–
Z_bnds	Depths of grid cell upper and lower interfaces	–none–

14.5.2 Latlon Variable: EVELSTAR

Table 14.39: Attributes description of the variable 'EVELSTAR' from OCEAN_BOLUS_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	EVELSTAR	Gent-mcwilliams zonal (east-west) bolus velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 EVELSTAR(time, Z, latitude, longitude) EVELSTAR: _FillValue = 9.96921e+36 EVELSTAR: coverage_content_type = modelResult EVELSTAR: long_name = Gent: McWilliams zonal (east: west) bolus velocity EVELSTAR: standard_name = eastward_sea_water_velocity_due_to_parameterized_mesoscale_eddies EVELSTAR: units = m s: 1 EVELSTAR: coordinates = time Z EVELSTAR: valid_min = : 0.5832233428955078 EVELSTAR: valid_max = 0.7810457944869995			
Comments			
Zonal (east-west) component of the gent-mcwilliams bolus ocean velocity. note: evelstar is calculated by interpolating the model's x and y components of gm bolus ocean velocity (uvelstar and vvelstar) to tracer cell centers and then finding the zonal components of the interpolated vectors. one should take care when interpreting bolus velocities interpolated from the ecco native model grid because interpolating from the model grid to the lat-lon grid introduces errors. some closed buget calculations require bolus velocity terms on the native model grid.			

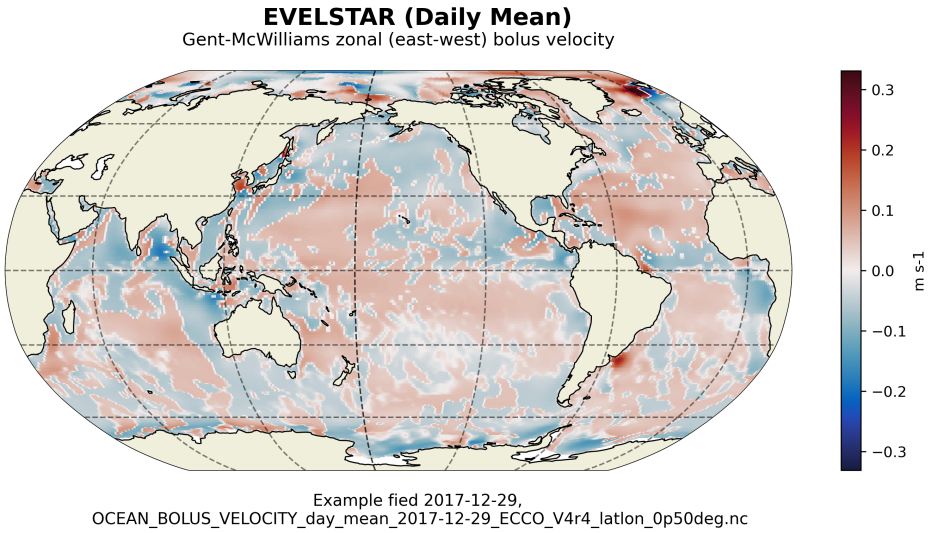


Figure 151: Dataset: OCEAN_BOLUS_VELOCITY, Variable: EVELSTAR

14.5.3 Latlon Variable: NVELSTAR

Table 14.40: Attributes description of the variable 'NVELSTAR' from OCEAN_BOLUS_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	NVELSTAR	Gent-mcwilliams meridional (north-south) bolus velocity	m s-1

Description of the variable in Common Data language (CDL)

float32 NVELSTAR(time, Z, latitude, longitude)
NVELSTAR: _FillValue = 9.96921e+36
NVELSTAR: coverage_content_type = modelResult
NVELSTAR: long_name = Gent: McWilliams meridional (north: south) bolus velocity
NVELSTAR: standard_name = northward_sea_water_velocity_due_to_parameterized_mesoscale_eddies
NVELSTAR: units = m s: 1
NVELSTAR: coordinates = time Z
NVELSTAR: valid_min = : 0.6472858190536499
NVELSTAR: valid_max = 0.6751338243484497

Comments

Meridional (north-south) component of the gent-mcwilliams bolus ocean velocity. note: nvelstar is calculated by interpolating the model's x and y components of gm bolus ocean velocity (uvelstar and vvelstar) to tracer cell centers and then finding the meridional components of the interpolated vectors. one should take care when interpreting bolus velocities interpolated from the ecco native model grid because interpolating from the model grid to the lat-lon grid introduces errors. some closed buget calculations require bolus velocity terms on the native model grid

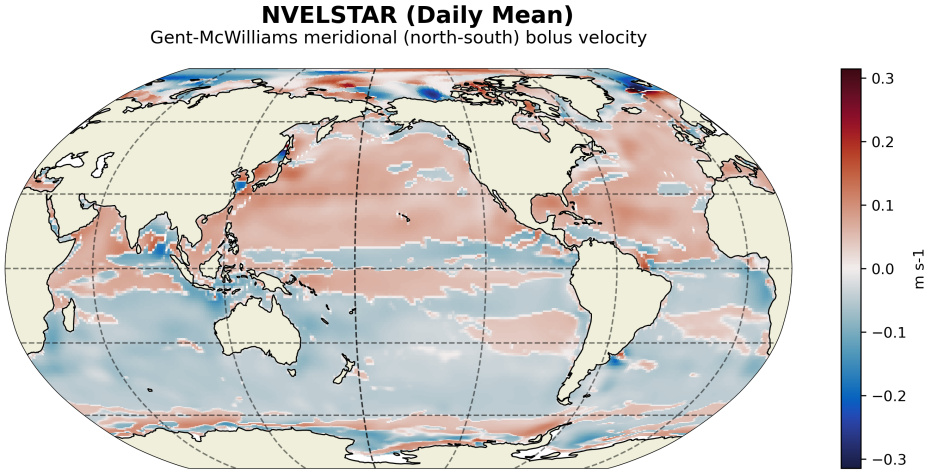


Figure 152: Dataset: OCEAN_BOLUS_VELOCITY, Variable: NVELSTAR

14.5.4 Latlon Variable: WVELSTAR

Table 14.41: Attributes description of the variable 'WVELSTAR' from OCEAN_BOLUS_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	WVELSTAR	Gent-mcwilliams vertical bolus velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 WVELSTAR(time, Z, latitude, longitude) WVELSTAR: _FillValue = 9.96921e+36 WVELSTAR: coverage_content_type = modelResult WVELSTAR: direction = >0 decreases volume WVELSTAR: long_name = Gent: McWilliams vertical bolus velocity WVELSTAR: standard_name = upward_sea_water_velocity_due_to_parameterized_mesoscale_eddies WVELSTAR: units = m s: 1 WVELSTAR: coordinates = time Z WVELSTAR: valid_min = : 0.00037936007720418274 WVELSTAR: valid_max = 0.00040190346771851 18			
Comments			
Vertical component of the gent-mcwilliams bolus ocean velocity. note: in the arakawa-c grid used in ecco v4r4, vertical velocities are staggered relative to the tracer cell centers with values at the top and bottom faces of each grid cell.			

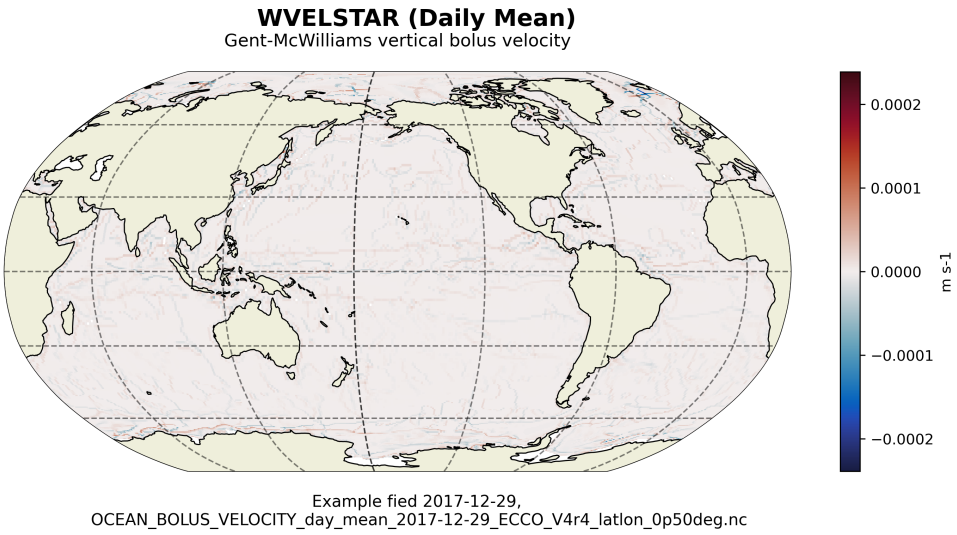


Figure 153: Dataset: OCEAN_BOLUS_VELOCITY, Variable: WVELSTAR

14.6 Latlon dataset of OCEAN_BOTTOM_PRESSURE

14.6.1 Overview

This dataset provides 2D fields of ocean bottom pressure interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. Ocean bottom pressure given in equivalent water thickness excluding (OBP) and including (OBPGMAP) the contribution from global mean atmospheric pressure.

Table 14.42: Coordinates and Variables in the dataset OCEAN_BOTTOM_PRESSURE

Variables	Description of data variables	Unit
OBP	Ocean bottom pressure given as equivalent water thickness	m
OBPGMAP	Ocean bottom pressure given as equivalent water thickness, includes global mean atmospheric pressure	m
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.6.2 Latlon Variable: OBP

Table 14.43: Attributes description of the variable 'OBP' from OCEAN_BOTTOM_PRESSURE's dataset.

Storage Type	Variable Name	Description	Unit
float32	OBP	Ocean bottom pressure given as equivalent water thickness	m
Description of the variable in Common Data language (CDL)			
float32 OBP(time, latitude, longitude) OBP: _FillValue = 9.96921e+36 OBP: coverage_content_type = modelResult OBP: long_name = Ocean bottom pressure given as equivalent water thickness OBP: units = m OBP: coordinates = time OBP: valid_min = : 2.544442892074585 OBP: valid_max = 72.1243667602539			
Comments			
Obp excludes the contribution from global mean atmospheric pressure and is therefore suitable for comparisons with grace data products. obp is calculated as follows. first, we calculate ocean hydrostatic bottom pressure anomaly, phibot, with phibot = p_b/rhoconst - gh(t), where p_b = model ocean hydrostatic bottom pressure, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and h(t) is model depth at time t. then, obp = phibot/g + corrections for i) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh) and ii) global mean atmospheric pressure variations. use obp for comparisons with ocean bottom pressure data products that have been corrected for global mean atmospheric pressure variations. grace data typically are corrected for global mean atmospheric pressure variations. in contrast, ocean bottom pressure gauge data typically are not corrected for global mean atmospheric pressure variations.			

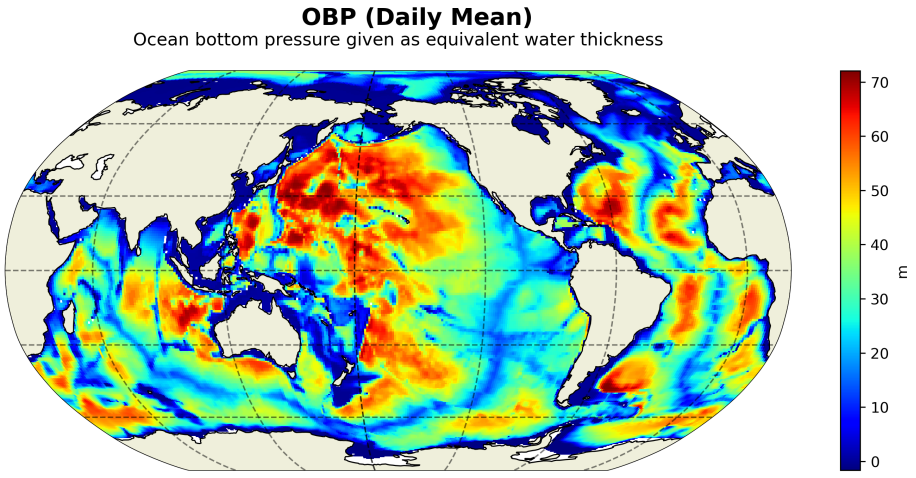


Figure 154: Dataset: OCEAN_BOTTOM_PRESSURE, Variable: OBP

14.6.3 Latlon Variable: OBPGMAP

Table 14.44: Attributes description of the variable 'OBPGMAP' from OCEAN_BOTTOM_PRESSURE's dataset.

Storage Type	Variable Name	Description	Unit
float32	OBPGMAP	Ocean bottom pressure given as equivalent water thickness, includes global mean atmospheric pressure	m

Description of the variable in Common Data language (CDL)

float32 OBPGMAP(time, latitude, longitude)
OBPGMAP: _FillValue = 9.96921e+36
OBPGMAP: coverage_content_type = modelResult
OBPGMAP: long_name = Ocean bottom pressure given as equivalent water thickness includes global mean atmospheric pressure
OBPGMAP: units = m
OBPGMAP: coordinates = time
OBPGMAP: valid_min = 7.395928859710693
OBPGMAP: valid_max = 82.14805603027344

Comments

Obpgmap includes the contribution from global mean atmospheric pressure and is therefore suitable for comparisons with ocean bottom pressure gauge data products. obpgmap is calculated as follows. first, we calculate ocean hydrostatic bottom pressure anomaly, phibot, with phibot = p_b/rhoconst - gh(t), where p_b = model ocean hydrostatic bottom pressure, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and h(t) is model depth at time t. then, obpgmap= phibot/g + corrections for global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh). use obpgmap for comparisons with ocean bottom pressure data products that have not been corrected for global mean atmospheric pressure variations. grace data typically are corrected for global mean atmospheric pressure variations. in contrast, ocean bottom pressure gauge data typically are not corrected for global mean atmospheric pressure variations.

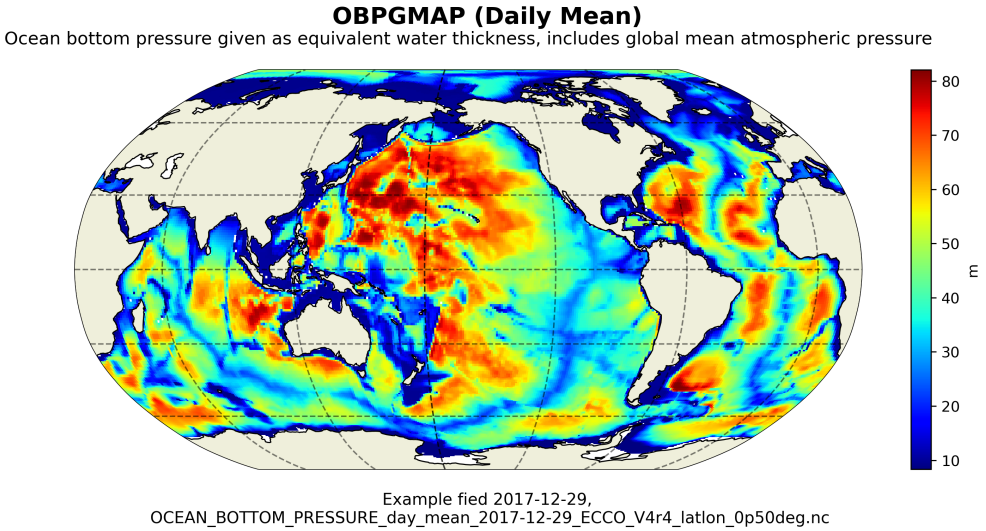


Figure 155: Dataset: OCEAN_BOTTOM_PRESSURE, Variable: OBPGMAP

14.7 Latlon dataset of OCEAN_DENS_STRAT_PRESS

14.7.1 Overview

This dataset provides 3D fields of ocean density, stratification, and hydrostatic pressure interpolated to a regular0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.45: Coordinates and Variables in the dataset OCEAN_DENS_STRAT_PRESS

Variables	Description of data variables	Unit
RHOAnoma	In-situ seawater density anomaly	kg m-3
DRHODR	Density stratification	kg m-3 m-1
PHIHYD	Ocean hydrostatic pressure anomaly	m2 s-2
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
Z	Depth of grid cell center	m
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–
Z_bnds	Depths of grid cell upper and lower interfaces	–none–

14.7.2 Latlon Variable: DRHODR

Table 14.46: Attributes description of the variable 'DRHODR' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	DRHODR	Density stratification	kg m-3 m-1
Description of the variable in Common Data language (CDL)			
float32 DRHODR(time, Z, latitude, longitude) DRHODR: _FillValue = 9.96921e+36 DRHODR: coverage_content_type = modelResult DRHODR: long_name = Density stratification DRHODR: units = kg m: 3 m: 1 DRHODR: coordinates = time Z DRHODR: valid_min = : 0.8687265515327454 DRHODR: valid_max = 0.011617615818977356			
Comments			
Density stratification: d(sigma) d z-1. note: density computations are done with in-situ density. the vertical derivatives of in-situ density and locally-referenced potential density are identical the equation of state is a modified unesco formula by jackett and mcdougall (1995), which uses the model variable potential temperature as input assuming a horizontally and temporally constant pressure of $p_0=-g ho_{0} z$.			

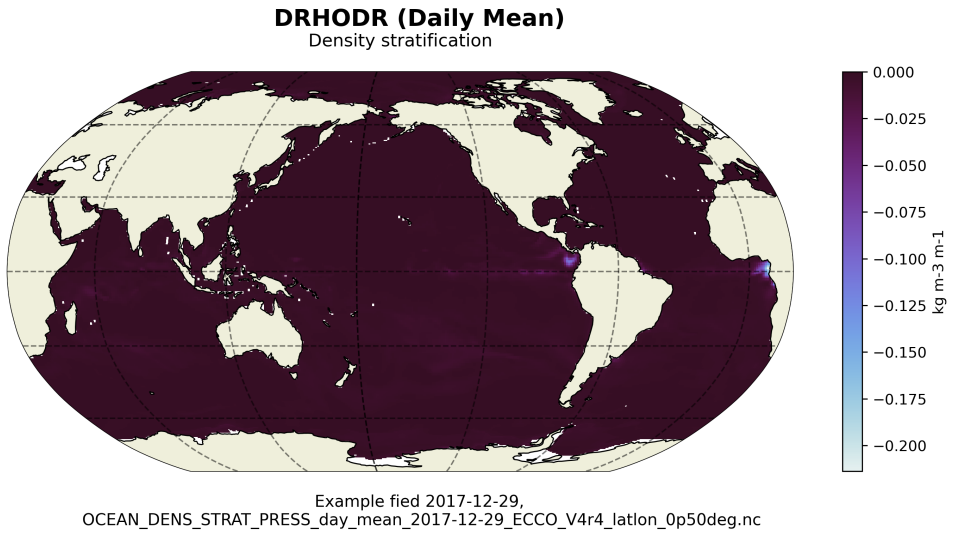


Figure 156: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: DRHODR

14.7.3 Latlon Variable: PHIHYD

Table 14.47: Attributes description of the variable 'PHIHYD' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	PHIHYD	Ocean hydrostatic pressure anomaly	m2 s-2
Description of the variable in Common Data language (CDL)			
float32 PHIHYD(time, Z, latitude, longitude) PHIHYD: _FillValue = 9.96921e+36 PHIHYD: coverage_content_type = modelResult PHIHYD: long_name = Ocean hydrostatic pressure anomaly PHIHYD: units = m2 s: 2 PHIHYD: coordinates = time Z PHIHYD: valid_min = 74.71473693847656 PHIHYD: valid_max = 783.9188232421875			
Comments			
Phihyd = p(k) / rhoconst - g z*(k,t), where p = hydrostatic ocean pressure at depth level k, rhoconst = reference density (1029 kg m-3), g is acceleration due to gravity (9.81 m s-2), and z*(k,t) is model depth at level k and time t. units: p:[kg m-1 s-2], rhoconst:[kg m-3], g:[m s-2], h(t):[m]. note: includes atmospheric pressure loading. quantity referred to in some contexts as hydrostatic pressure anomaly. phibot accounts for the model's time-varying grid cell thickness (z* coordinate system). see phihydcr for hydrostatic pressure potential anomaly calculated using time-invariant grid cell thicknesses. phihyd is not corrected for global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh).			

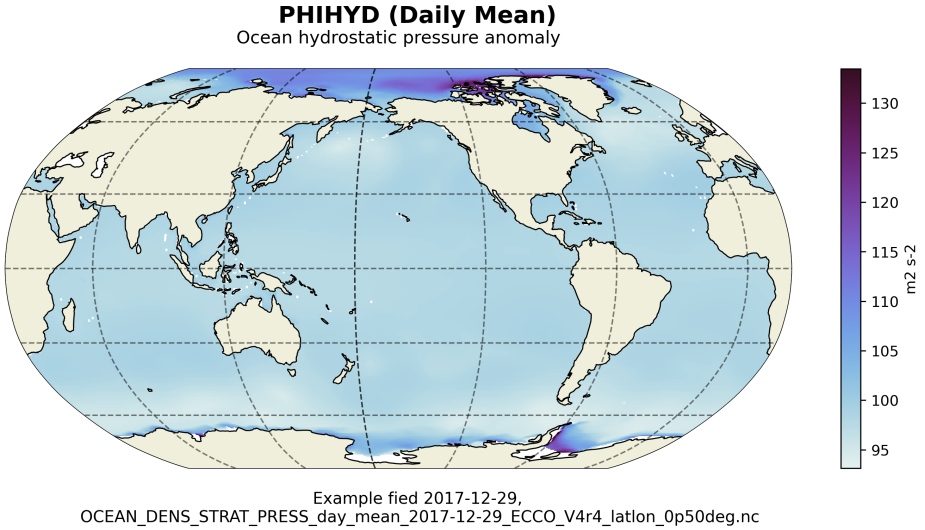


Figure 157: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: PHIHYD

14.7.4 Latlon Variable: RHOAnoma

Table 14.48: Attributes description of the variable 'RHOAnoma' from OCEAN_DENS_STRAT_PRESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	RHOAnoma	In-situ seawater density anomaly	kg m-3
Description of the variable in Common Data language (CDL)			
float32 RHOAnoma(time, Z, latitude, longitude) RHOAnoma: _FillValue = 9.96921e+36 RHOAnoma: coverage_content_type = modelResult RHOAnoma: long_name = In: situ seawater density anomaly RHOAnoma: units = kg m: 3 RHOAnoma: coordinates = time Z RHOAnoma: valid_min = : 19.919862747192383 RHOAnoma: valid_max = 25.540647506713867			
Comments			
In-situ seawater density anomaly relative to the reference density, rhoconst. rhoconst = 1029 kg m-3			

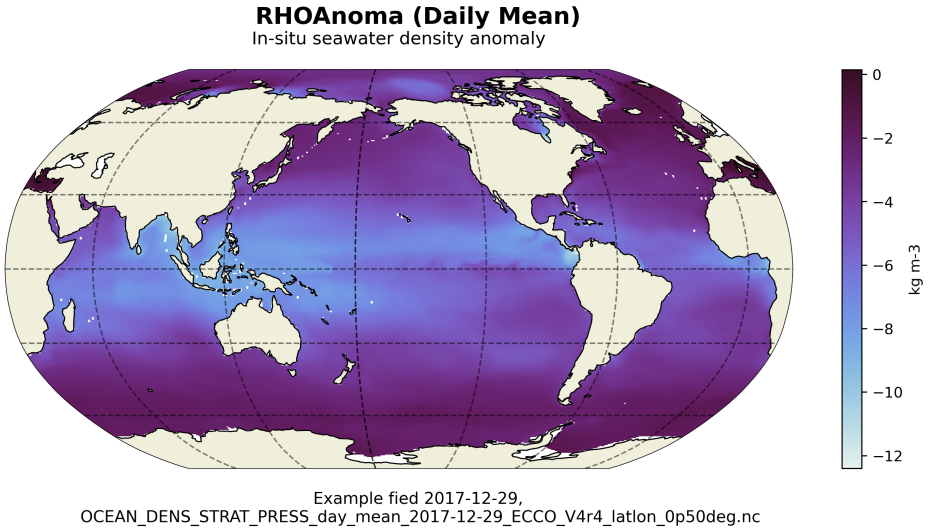


Figure 158: Dataset: OCEAN_DENS_STRAT_PRESS, Variable: RHOAnoma

14.8 Latlon dataset of OCEAN_MIXED_LAYER_DEPTH

14.8.1 Overview

This dataset provides 2D fileds of ocean mixed layer depth interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.49: Coordinates and Variables in the dataset OCEAN_MIXED_LAYER_DEPTH

Variables	Description of data variables	Unit
MXLDEPTH	Mixed-layer depth diagnosed using the temperature difference criterion of kara et al., 2000	m

Table 14.49: Coordinates and Variables in the dataset OCEAN_MIXED_LAYER_DEPTH

Coordinates	Description of data coordinates	Unit
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.8.2 Latlon Variable: MXLDEPTH

Table 14.50: Attributes description of the variable 'MXLDEPTH' from OCEAN_MIXED_LAYER_DEPTH's dataset.

Storage Type	Variable Name	Description	Unit
float32	MXLDEPTH	Mixed-layer depth diagnosed using the temperature difference criterion of kara et al., 2000	m
Description of the variable in Common Data language (CDL)			
float32 MXLDEPTH(time, latitude, longitude) MXLDEPTH: _FillValue = 9.96921e+36 MXLDEPTH: coverage_content_type = modelResult MXLDEPTH: long_name = Mixed: layer depth diagnosed using the temperature difference criterion of Kara et al. 2000 MXLDEPTH: standard_name = ocean_mixed_layer_thickness MXLDEPTH: units = m MXLDEPTH: coordinates = time MXLDEPTH: valid_min = 5.000001430511475 MXLDEPTH: valid_max = 5331.2001953125			
Comments			
Mixed-layer depth as determined by the depth where waters are first 0.8 degrees celsius colder than the surface. see kara et al. (jgr, 2000). . note: the kara et al. criterion may not be appropriate for some applications. if needed, mixed layer depth can be calculated using different criteria. see vertical density stratification (drhodr) and density anomaly (rhoanoma).			

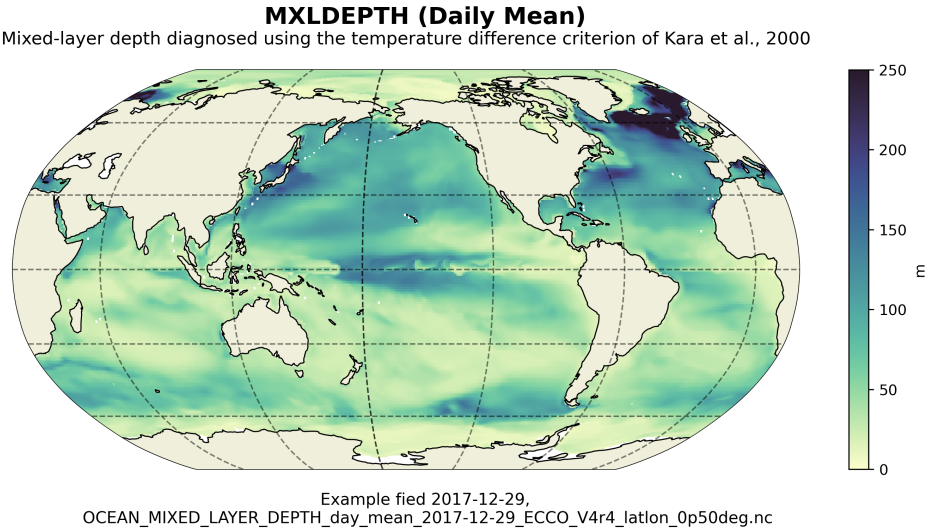


Figure 159: Dataset: OCEAN_MIXED_LAYER_DEPTH, Variable: MXLDEPTH

14.9 Latlon dataset of OCEAN_TEMPERATURE_SALINITY

14.9.1 Overview

This dataset provides 3D fields of ocean potential temperature and salinity interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on

daily-average and monthly-average time resolution.

Table 14.51: Coordinates and Variables in the dataset OCEAN_TEMPERATURE_SALINITY

Variables	Description of data variables	Unit
THETA	Potential temperature	degree_C
SALT	Salinity	1e-3
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
Z	Depth of grid cell center	m
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–
Z_bnds	Depths of grid cell upper and lower interfaces	–none–

14.9.2 Latlon Variable: SALT

Table 14.52: Attributes description of the variable 'SALT' from OCEAN_TEMPERATURE_SALINITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	SALT	Salinity	1e-3
Description of the variable in Common Data language (CDL)			
float32 SALT(time, Z, latitude, longitude) SALT: _FillValue = 9.96921e+36 SALT: coverage_content_type = modelResult SALT: long_name = Salinity SALT: standard_name = sea_water_salinity SALT: units = 1e: 3 SALT: coordinates = time Z SALT: valid_min = 16.73577880859375 SALT: valid_max = 41.321231842041016			
Comments			
Defined using cf convention 'sea water salinity is the salt content of sea water, often on the practical salinity scale of 1978. however, the unqualified term 'salinity' is generic and does not necessarily imply any particular method of calculation. the units of salinity are dimensionless and the units attribute should normally be given as 1e-3 or 0.001 i.e. parts per thousand.' see https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html			

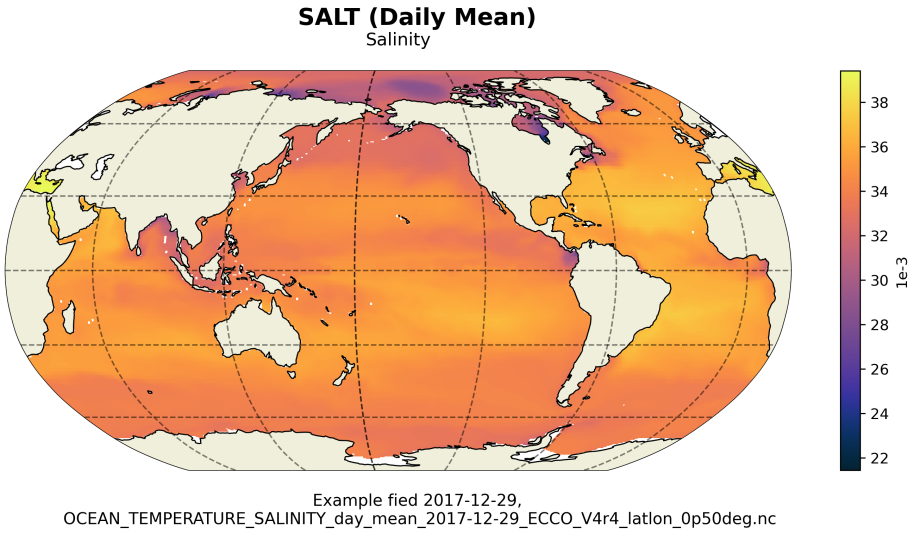


Figure 160: Dataset: OCEAN_TEMPERATURE_SALINITY, Variable: SALT

14.9.3 Latlon Variable: THETA

Table 14.53: Attributes description of the variable 'THETA' from OCEAN_TEMPERATURE_SALINITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	THETA	Potential temperature	degree_C
Description of the variable in Common Data language (CDL)			
float32 THETA(time, Z, latitude, longitude) THETA: _FillValue = 9.96921e+36 THETA: coverage_content_type = modelResult THETA: long_name = Potential temperature THETA: standard_name = sea_water_potential_temperature THETA: units = degree_C THETA: coordinates = time Z THETA: valid_min = : 2.9179372787475586 THETA: valid_max = 36.425140380859375			
Comments			
Sea water potential temperature is the temperature a parcel of sea water would have if moved adiabatically to sea level pressure. note: the equation of state is a modified unesco formula by jackett and mcdougall (1995), which uses the model variable potential temperature as input assuming a horizontally and temporally constant pressure of $p_0=-g ho_{0} z$.			

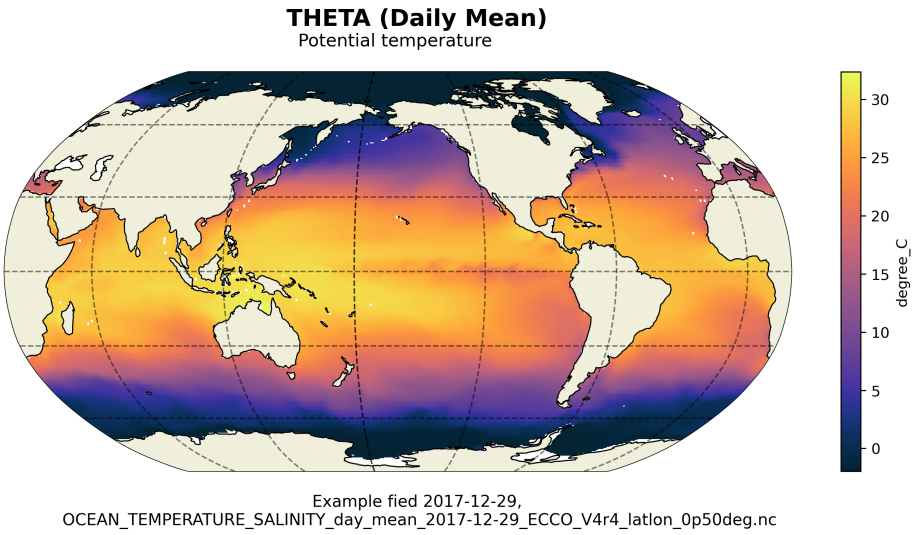


Figure 161: Dataset: OCEAN_TEMPERATURE_SALINITY, Variable: THETA

14.10 Latlon dataset of OCEAN_VELOCITY

14.10.1 Overview

This dataset provides 3D fields of ocean velocity interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.54: Coordinates and Variables in the dataset OCEAN_VELOCITY

Variables	Description of data variables	Unit
EVEL	Zonal (east-west) velocity	m s-1
NVEL	Meridional (north-south) velocity	m s-1
WVEL	Vertical velocity	m s-1
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
Z	Depth of grid cell center	m
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–
Z_bnds	Depths of grid cell upper and lower interfaces	–none–

14.10.2 Latlon Variable: EVEL

Table 14.55: Attributes description of the variable 'EVEL' from OCEAN_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	EVEL	Zonal (east-west) velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 EVEL(time, Z, latitude, longitude) EVEL: _FillValue = 9.96921e+36 EVEL: coverage_content_type = modelResult EVEL: long_name = Zonal (east: west) velocity EVEL: standard_name = eastward_sea_water_velocity EVEL: units = m s: 1 EVEL: coordinates = Z time EVEL: valid_min = : 1.746832251548767 EVEL: valid_max = 1.948591947555542			
Comments			
Zonal (east-west) component of ocean velocity. note: evel is calculated by interpolating the model's x and y components of ocean velocity (uvel and vvel)to tracer cell centers and then finding the zonal component of the interpolated vectors. it is not recommended to use evel and nvel for volume budget calculations because interpolating uvel and vvel from the model grid to the lat-lon grid introduces errors. perform volume budget calculations with uvelmass and vvelmass on the native model grid.			

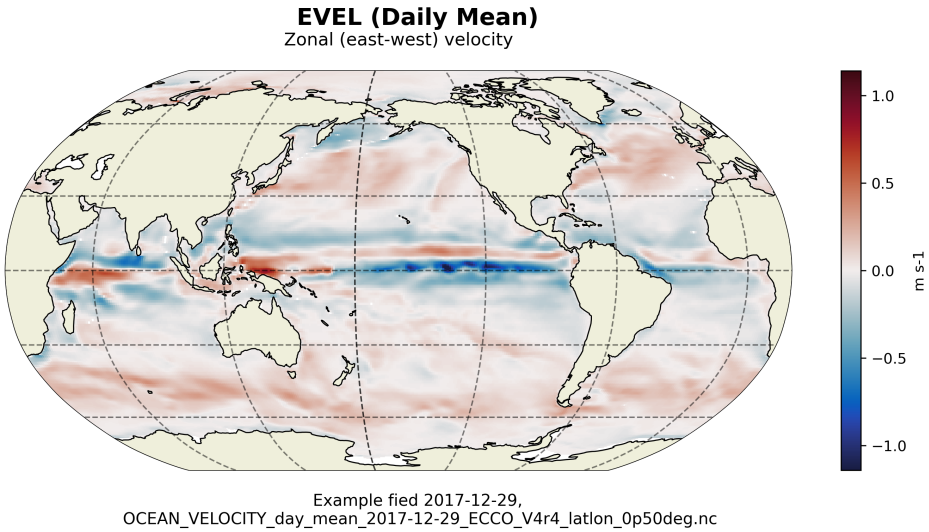


Figure 162: Dataset: OCEAN_VELOCITY, Variable: EVEL

14.10.3 Latlon Variable: NVEL

Table 14.56: Attributes description of the variable 'NVEL' from OCEAN_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	NVEL	Meridional (north-south) velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 NVEL(time, Z, latitude, longitude) NVEL: _FillValue = 9.96921e+36 NVEL: coverage_content_type = modelResult NVEL: long_name = Meridional (north: south) velocity NVEL: standard_name = northward_sea_water_velocity NVEL: units = m s: 1 NVEL: coordinates = Z time NVEL: valid_min = : 1.2522369623184204 NVEL: valid_max = 2.0500051975250244			
Comments			
Meridional (north-south) component of ocean velocity. note: nvel is calculated by interpolating the model's x and y components of ocean velocity (uvel and vvel) to tracer cell centers and then finding the meridional component of the interpolated vectors. it is not recommended to use evel and nvel for volume budget calculations because interpolating uvel and vvel from the model grid to the lat-lon grid introduces errors. perform volume budget calculations with uvelmass and vvelmass on the native model grid.			

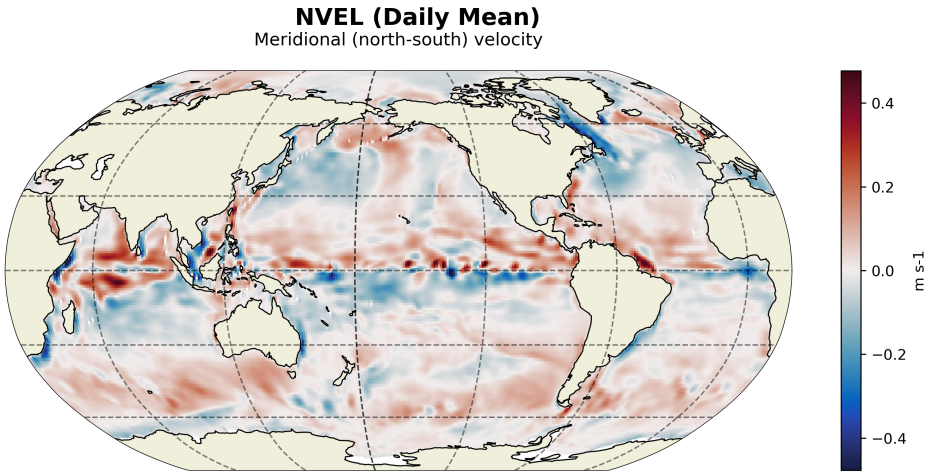


Figure 163: Dataset: OCEAN_VELOCITY, Variable: NVEL

14.10.4 Latlon Variable: WVEL

Table 14.57: Attributes description of the variable 'WVEL' from OCEAN_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	WVEL	Vertical velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 WVEL(time, Z, latitude, longitude) WVEL: _FillValue = 9.96921e+36 WVEL: coverage_content_type = modelResult WVEL: direction = >0 decreases volume WVEL: long_name = Vertical velocity WVEL: standard_name = upward_sea_water_velocity WVEL: units = m s: 1 WVEL: coordinates = Z time WVEL: valid_min = : 0.0023150660563260317 WVEL: valid_max = 0.0016380994347855449			
Comments			
Vertical velocity in the +z direction at the top face of the grid cell. note: in the arakawa-c grid used in ecco v4r4, vertical velocities are staggered relative to the tracer cell centers with values at the top and bottom faces of each grid cell.			

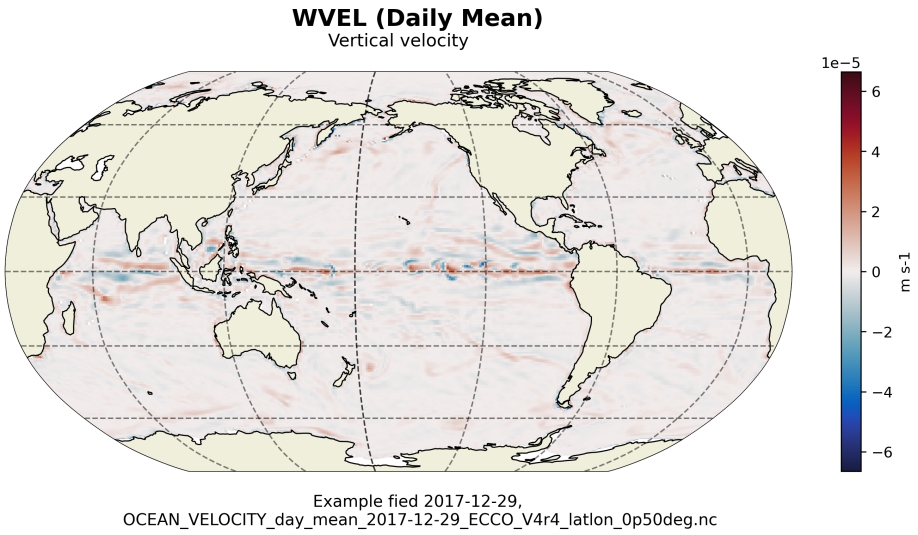


Figure 164: Dataset: OCEAN_VELOCITY, Variable: WVEL

14.11 Latlon dataset of SEA_ICE_CONC_THICKNESS

14.11.1 Overview

This dataset provides 2D fields of sea-ice and snow concentration and thickness interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.58: Coordinates and Variables in the dataset SEA_ICE_CONC_THICKNESS

Variables	Description of data variables	Unit
SIarea	Sea-ice concentration	1
SIheff	Area-averaged sea-ice thickness	m
SIhsnow	Area-averaged snow thickness	m
sIceLoad	Average sea-ice and snow mass per unit area	kg m-2
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.11.2 Latlon Variable: SIarea

Table 14.59: Attributes description of the variable 'SIarea' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIarea	Sea-ice concentration	1
Description of the variable in Common Data language (CDL)			
float32 SIarea(time, latitude, longitude) SIarea: _FillValue = 9.96921e+36 SIarea: coverage_content_type = modelResult SIarea: long_name = Sea: ice concentration SIarea: standard_name = sea_ice_area_fraction SIarea: units = 1 SIarea: coordinates = time SIarea: valid_min = 0.0 SIarea: valid_max = 0.9700000286102295			
Comments			
Fraction of ocean grid cell covered with sea-ice [0 to 1]. cf standard name table v73: 'area fraction' is the fraction of a grid cell's horizontal area that has some characteristic of interest. it is evaluated as the area of interest divided by the grid cell area. it may be expressed as a fraction, a percentage, or any other dimensionless representation of a fraction. sea ice area fraction is area of the sea surface occupied by sea ice. it is also called 'sea ice concentration'. 'sea ice' means all ice floating in the sea which has formed from freezing sea water, rather than by other processes such as calving of land ice to form icebergs. https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html. defined using cf standard name table v73: 'area fraction' is the fraction of a grid cell's horizontal area that has some characteristic of interest. it is evaluated as the area of interest divided by the grid cell area. it may be expressed as a fraction, a percentage, or any other dimensionless representation of a fraction. sea ice area fraction is area of the sea surface occupied by sea ice. it is also called 'sea ice concentration'. 'sea ice' means all ice floating in the sea which has formed from freezing sea water and precipitation, rather than by other processes such as calving of land ice to form icebergs. https://cfconventions.org/data/cf-standard-names/73/build/cf-standard-name-table.html			

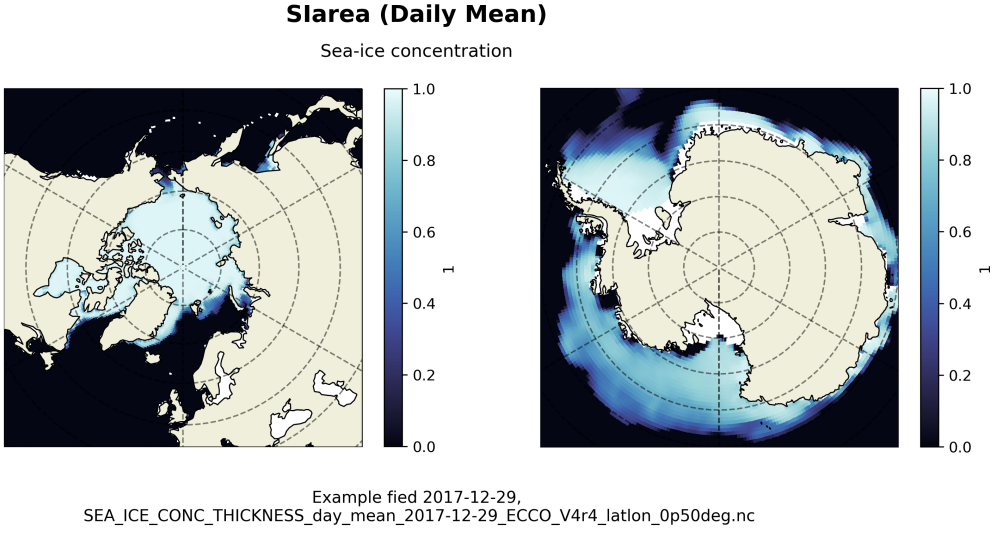


Figure 165: Dataset: SEA_ICE_CONC_THICKNESS, Variable: SIarea

14.11.3 Latlon Variable: SIheff

Table 14.60: Attributes description of the variable 'SIheff' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIheff	Area-averaged sea-ice thickness	m
Description of the variable in Common Data language (CDL)			
float32 SIheff(time, latitude, longitude) SIheff: _FillValue = 9.96921e+36 SIheff: coverage_content_type = modelResult SIheff: long_name = Area: averaged sea: ice thickness SIheff: standard_name = sea_ice_thickness SIheff: units = m SIheff: coordinates = time SIheff: valid_min = 0.0 SIheff: valid_max = 9.000518798828125			
Comments			
Sea-ice thickness averaged over the entire model grid cell, including open water where sea-ice thickness is zero. note: sea-ice thickness over the ice-covered fraction of the grid cell is siheff/siarea			

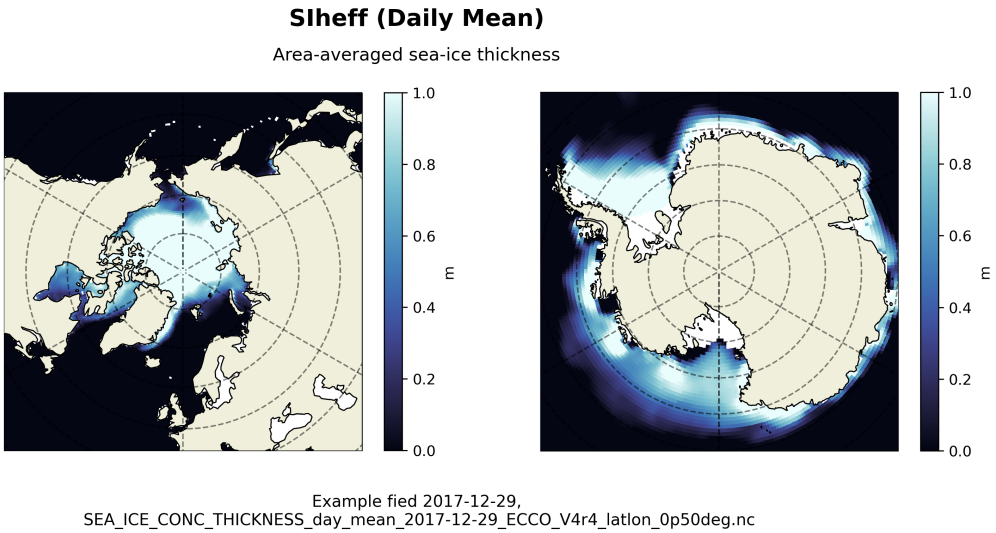


Figure 166: Dataset: SEA_ICE_CONC_THICKNESS, Variable: SIheff

14.11.4 Latlon Variable: SIhsnow

Table 14.61: Attributes description of the variable 'SIhsnow' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIhsnow	Area-averaged snow thickness	m
Description of the variable in Common Data language (CDL)			
float32 SIhsnow(time, latitude, longitude) SIhsnow: _FillValue = 9.96921e+36 SIhsnow: coverage_content_type = modelResult SIhsnow: long_name = Area: averaged snow thickness SIhsnow: standard_name = surface_snow_thickness SIhsnow: units = m SIhsnow: coordinates = time SIhsnow: valid_min = : 0.0004725505714304745 SIhsnow: valid_max = 2.5671639442443848			
Comments			
Snow thickness averaged over the entire model grid cell, including open water where snow thickness is zero. note: snow thickness over the ice-covered fraction of the grid cell is sihsnow/siarea			

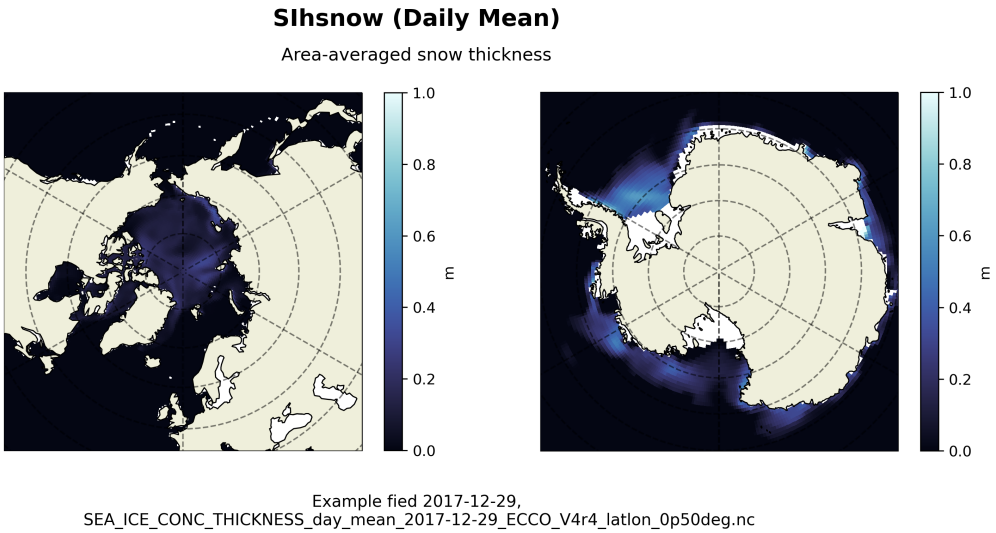


Figure 167: Dataset: SEA_ICE_CONC_THICKNESS, Variable: SIhsnow

14.11.5 Latlon Variable: sIceLoad

Table 14.62: Attributes description of the variable 'sIceLoad' from SEA_ICE_CONC_THICKNESS's dataset.

Storage Type	Variable Name	Description	Unit
float32	sIceLoad	Average sea-ice and snow mass per unit area	kg m-2
Description of the variable in Common Data language (CDL)			
float32 sIceLoad(time, latitude, longitude) sIceLoad: _FillValue = 9.96921e+36 sIceLoad: coverage_content_type = modelResult sIceLoad: long_name = Average sea: ice and snow mass per unit area sIceLoad: standard_name = sea_ice_and_surface_snow_amount sIceLoad: units = kg m: 2 sIceLoad: coordinates = time sIceLoad: valid_min = : 0.0015558383893221617 sIceLoad: valid_max = 8729.935546875			
Comments			
Total mass of sea-ice and snow in a model grid cell averaged over model grid cell area. note: siceload is used to correct model sea level anomaly, etan, to calculate dynamic sea surface height, ssh, and sea surface height without the inverted barometer (ib correction), sshnoibc. in the model, sea-ice is treated as floating above the sea level with etan tracing the location of the ocean-ice interface. consequently, sea-ice growth in the model lowers etan and sea-ice melting raises etan. dynamic sea surface height is obtained by correcting etan by the weight of ice and snow directly above following archimedes' principle.			

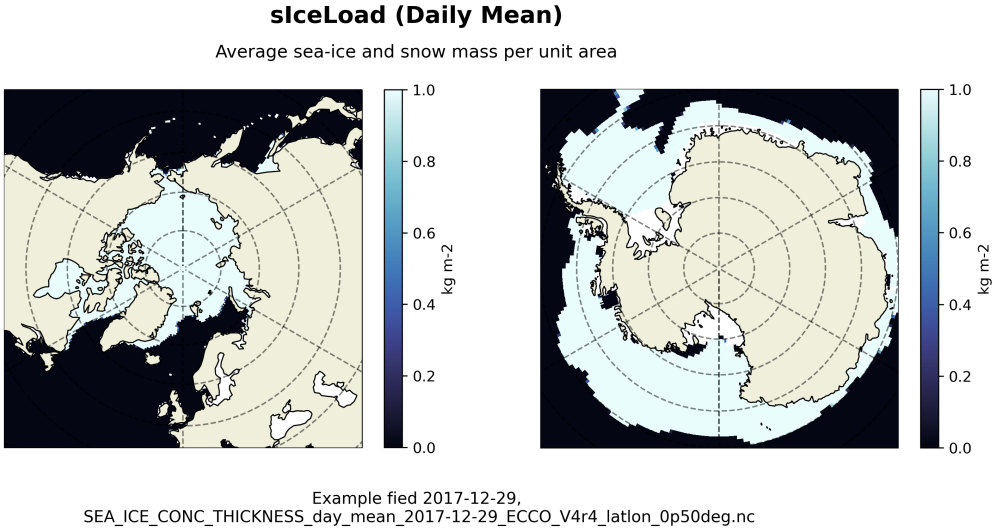


Figure 168: Dataset: SEA_ICE_CONC_THICKNESS, Variable: sIceLoad

14.12 Latlon dataset of SEA_ICE_VELOCITY

14.12.1 Overview

This dataset provides 2D fields of sea-ice velocity interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 14.63: Coordinates and Variables in the dataset SEA_ICE_VELOCITY

Variables	Description of data variables	Unit
SIeice	Zonal (east-west) sea-ice velocity	m s-1
SInice	Meridional (north-south) sea-ice velocity	m s-1
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.12.2 Latlon Variable: SIeice

Table 14.64: Attributes description of the variable 'SIeice' from SEA_ICE_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	SIeice	Zonal (east-west) sea-ice velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 SIeice(time, latitude, longitude) SIeice: _FillValue = 9.96921e+36 SIeice: coverage_content_type = modelResult SIeice: long_name = Zonal (east: west) sea: ice velocity SIeice: standard_name = eastward_sea_ice_velocity SIeice: units = m s: 1 SIeice: coordinates = time SIeice: valid_min = : 0.5656854510307312 SIeice: valid_max = 0.5656854510307312			
Comments			
Zonal (east-west) componet of sea-ice velocity. note: mask with siarea to remove nonzero values where ice is absent. sieice is calculated by interpolating the model's x and y components of sea-ice velocity (siuice and sivice) to tracer cell centers and then finding the zonal component of the interpolated vectors. it is not recommended to use siuice and sivice for sea-ice volume budget calculations because interpolating siuice and sivice from the model grid to the lat-lon grid introduces errors. perform sea-ice mass budget calculations with advxheff, advyheff, dfxheff, and dfyheff on the native model grid.			

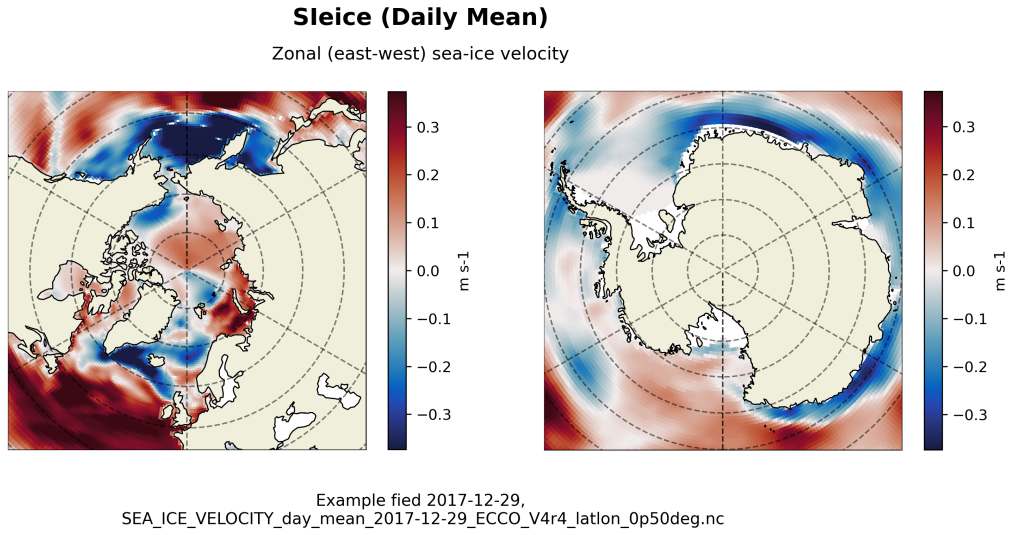


Figure 169: Dataset: SEA_ICE_VELOCITY, Variable: SIeice

14.12.3 Latlon Variable: SInice

Table 14.65: Attributes description of the variable 'SInice' from SEA_ICE_VELOCITY's dataset.

Storage Type	Variable Name	Description	Unit
float32	SInice	Meridional (north-south) sea-ice velocity	m s-1
Description of the variable in Common Data language (CDL)			
float32 SInice(time, latitude, longitude) SInice: _FillValue = 9.96921e+36 SInice: coverage_content_type = modelResult SInice: long_name = Meridional (north: south) sea: ice velocity SInice: standard_name = northward_sea_ice_velocity SInice: units = m s: 1 SInice: coordinates = time SInice: valid_min = : 0.5615208148956299 SInice: valid_max = 0.5656854510307312			
Comments			
Meridional (north-south) component of sea-ice velocity. note: mask with siarea to remove nonzero values where ice is absent. sinice is calculated by interpolating the model's x and y components of sea-ice velocity (siuice and sivice) to tracer cell centers and then finding the meridional component of the interpolated vectors. it is not recommended to use siuice and sivice for sea-ice volume budget calculations because interpolating siuice and sivice from the model grid to the lat-lon grid introduces errors. perform sea-ice mass budget calculations with advxheff, advyheff, dfxheff, and dfyheff on the native model grid.			

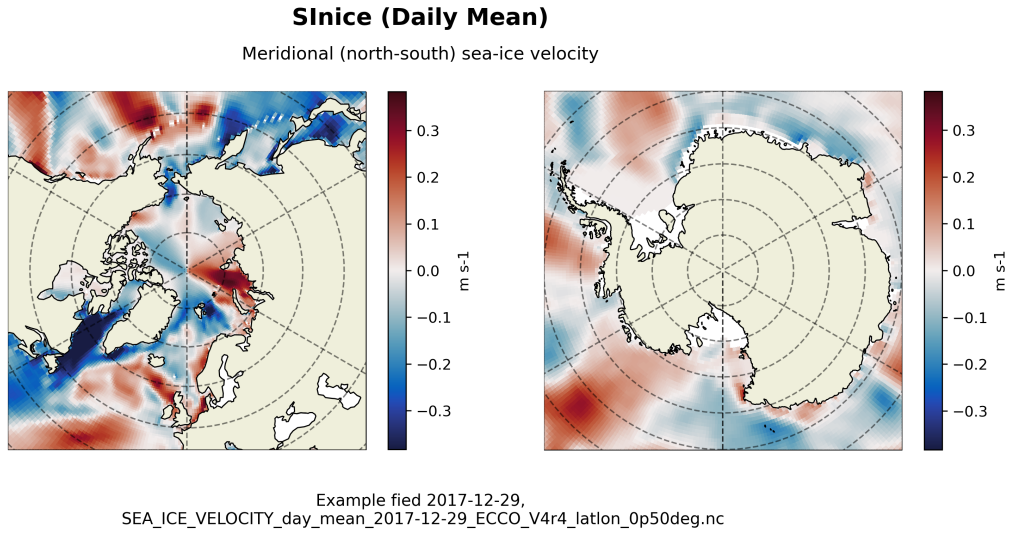


Figure 170: Dataset: SEA_ICE_VELOCITY, Variable: SInice

14.13 Latlon dataset of SEA_SURFACE_HEIGHT

14.13.1 Overview

This dataset provides 2D fields of dynamic sea surface height interpolated to a regular 0.5-degree grid from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution. SSH (dynamic sea surface height) = SSHNOIBC (dynamic sea surface without

the inverse barometer correction) - SSHIBC (inverse barometer correction). The inverted barometer correction accounts for variations in sea surface height due to atmospheric pressure variations.

Table 14.66: Coordinates and Variables in the dataset SEA_SURFACE_HEIGHT

Variables	Description of data variables	Unit
SSH	Dynamic sea surface height anomaly	m
SSHIBC	The inverted barometer (ib) correction to sea surface height due to atmospheric pressure loading	m
SSHNOIBC	Sea surface height anomaly without the inverted barometer (ib) correction	m
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–
latitude	Latitude at grid cell center	degrees_north
longitude	Longitude at grid cell center	degrees_east
time_bnds	Time bounds of averaging period	–none–
latitude_bnds	Latitude bounds grid cells	–none–
longitude_bnds	Longitude bounds grid cells	–none–

14.13.2 Latlon Variable: SSH

Table 14.67: Attributes description of the variable 'SSH' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	SSH	Dynamic sea surface height anomaly	m
Description of the variable in Common Data language (CDL)			
float32 SSH(time, latitude, longitude) SSH: _FillValue = 9.96921e+36 SSH: coverage_content_type = modelResult SSH: long_name = Dynamic sea surface height anomaly SSH: standard_name = sea_surface_height_above_geoid SSH: units = m SSH: coordinates = time SSH: valid_min = : 2.4861555099487305 SSH: valid_max = 2.2875382900238037			
Comments			
Dynamic sea surface height anomaly above the geoid, suitable for comparisons with altimetry sea surface height data products that apply the inverse barometer (ib) correction. note: ssh is calculated by correcting model sea level anomaly etan for three effects: a) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh), b) the inverted barometer (ib) effect (see sshibc) and c) sea level displacement due to sea-ice and snow pressure loading (see siceload). ssh can be compared with the similarly-named ssh variable in previous ecco products that did not include atmospheric pressure loading (e.g., version 4 release 3). use sshnoibc for comparisons with altimetry data products that do not apply the ib correction.			

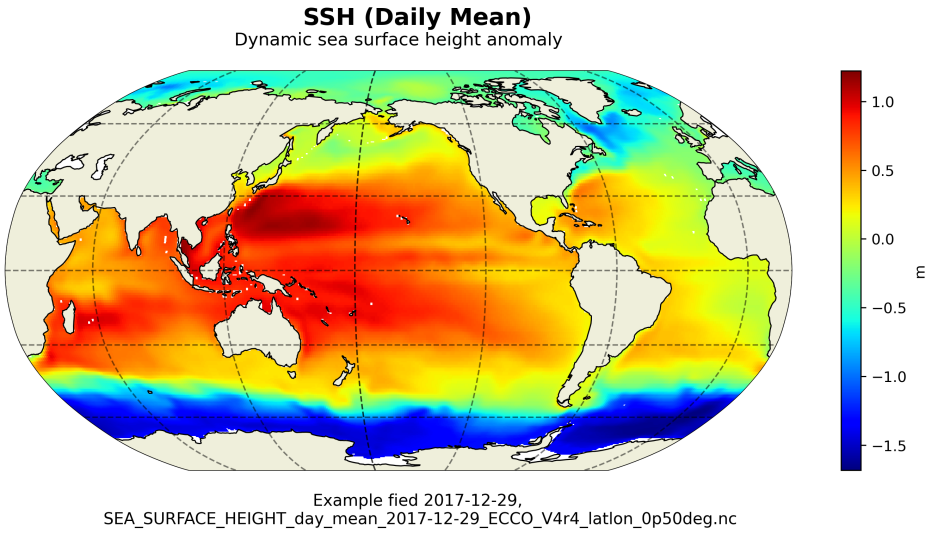


Figure 171: Dataset: SEA_SURFACE_HEIGHT, Variable: SSH

14.13.3 Latlon Variable: SSHIBC

Table 14.68: Attributes description of the variable 'SSHIBC' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	SSHIBC	The inverted barometer (ib) correction to sea surface height due to atmospheric pressure loading	m

Description of the variable in Common Data language (CDL)

float32 SSHIBC(time, latitude, longitude)
SSHIBC: _FillValue = 9.96921e+36
SSHIBC: coverage_content_type = modelResult
SSHIBC: long_name = The inverted barometer (IB) correction to sea surface height due to atmospheric pressure loading
SSHIBC: units = m
SSHIBC: coordinates = time
SSHIBC: valid_min = : 0.5228679180145264
SSHIBC: valid_max = 0.8955588340759277

Comments

Not an ssh itself, but a correction to model sea level anomaly (etan) required to account for the static part of sea surface displacement by atmosphere pressure loading: ssh = sshnoibc - sshibc. note: use ssh for model-data comparisons with altimetry data products that do apply the ib correction and sshnoibc for comparisons with altimetry data products that do not apply the ib correction.

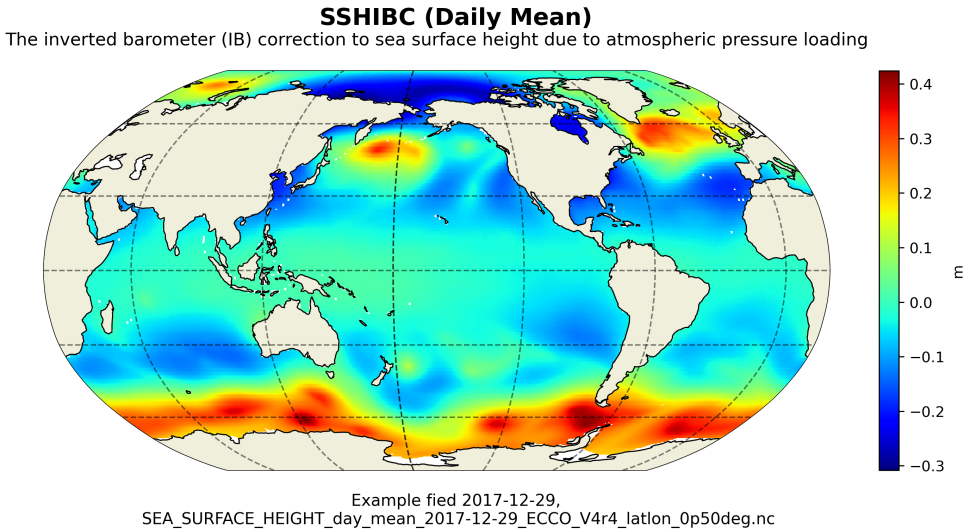


Figure 172: Dataset: SEA_SURFACE_HEIGHT, Variable: SSHIBC

14.13.4 Latlon Variable: SSHNOIBC

Table 14.69: Attributes description of the variable 'SSHNOIBC' from SEA_SURFACE_HEIGHT's dataset.

Storage Type	Variable Name	Description	Unit
float32	SSHNOIBC	Sea surface height anomaly without the inverted barometer (ib) correction	m

Description of the variable in Common Data language (CDL)

float32 SSHNOIBC(time, latitude, longitude)
SSHNOIBC: _FillValue = 9.96921e+36
SSHNOIBC: coverage_content_type = modelResult
SSHNOIBC: long_name = Sea surface height anomaly without the inverted barometer (IB) correction
SSHNOIBC: units = m
SSHNOIBC: coordinates = time
SSHNOIBC: valid_min = : 2.45104718208313
SSHNOIBC: valid_max = 2.2390522956848145

Comments

Sea surface height anomaly above the geoid without the inverse barometer (ib) correction, suitable for comparisons with altimetry sea surface height data products that do not apply the inverse barometer (ib) correction. note: sshnoibc is calculated by correcting model sea level anomaly etan for two effects: a) global mean steric sea level changes related to density changes in the boussinesq volume-conserving model (greatbatch correction, see stergloh), b) sea level displacement due to sea-ice and snow pressure loading (see siceload). in ecco version 4 release 4 the model is forced with atmospheric pressure loading. sshnoibc does not correct for the static part of the effect of atmosphere pressure loading on sea surface height (the so-called inverse barometer (ib) correction). use ssh for comparisons with altimetry data products that do apply the ib correction.

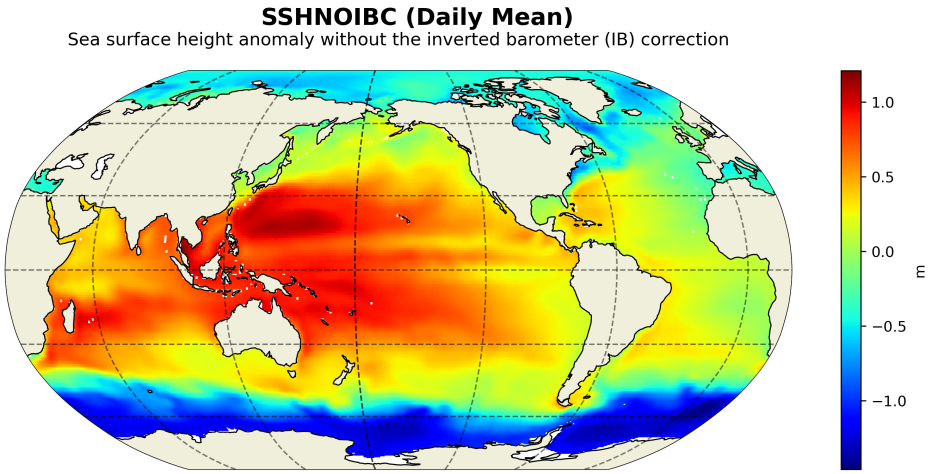


Figure 173: Dataset: SEA_SURFACE_HEIGHT, Variable: SSHNOIBC

15 1-D Dataset Groupings

15.1 1D dataset of GLOBAL_MEAN_ATM_SURFACE_PRES

15.1.1 Overview

This dataset provides a 1D field of global mean atmospheric surface pressure over the ocean and sea-ice from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on instantaneous hourly, daily-average and monthly-average time resolution.

Table 15.1: Coordinates and Variables in the dataset GLOBAL_MEAN_ATM_SURFACE_PRES

Variables	Description of data variables	Unit
Pa_global	Global mean atmospheric surface pressure over the ocean and sea-ice	N m-2
Coordinates	**Description of data coordinates**	**Unit**
time	Snapshot time	–none–

15.1.2 1D Variable: Pa_global

Table 15.2: Attributes description of the variable 'Pa_global' from GLOBAL_MEAN_ATM_SURFACE_PRES's dataset.

Storage Type	Variable Name	Description	Unit
float64	Pa_global	Global mean atmospheric surface pressure over the ocean and sea-ice	N m-2
Description of the variable in Common Data language (CDL)			
float64 Pa_global(time) Pa_global: _FillValue = 9.969209968386869e+36 Pa_global: coverage_content_type = modelResult Pa_global: long_name = Global mean atmospheric surface pressure over the ocean and sea: ice Pa_global: standard_name = air_pressure_at_sea_level Pa_global: units = N m: 2 Pa_global: valid_min = 100873.14755283327 Pa_global: valid_max = 101257.45252296235 Pa_global: coordinates = time			
Comments			
N/a			

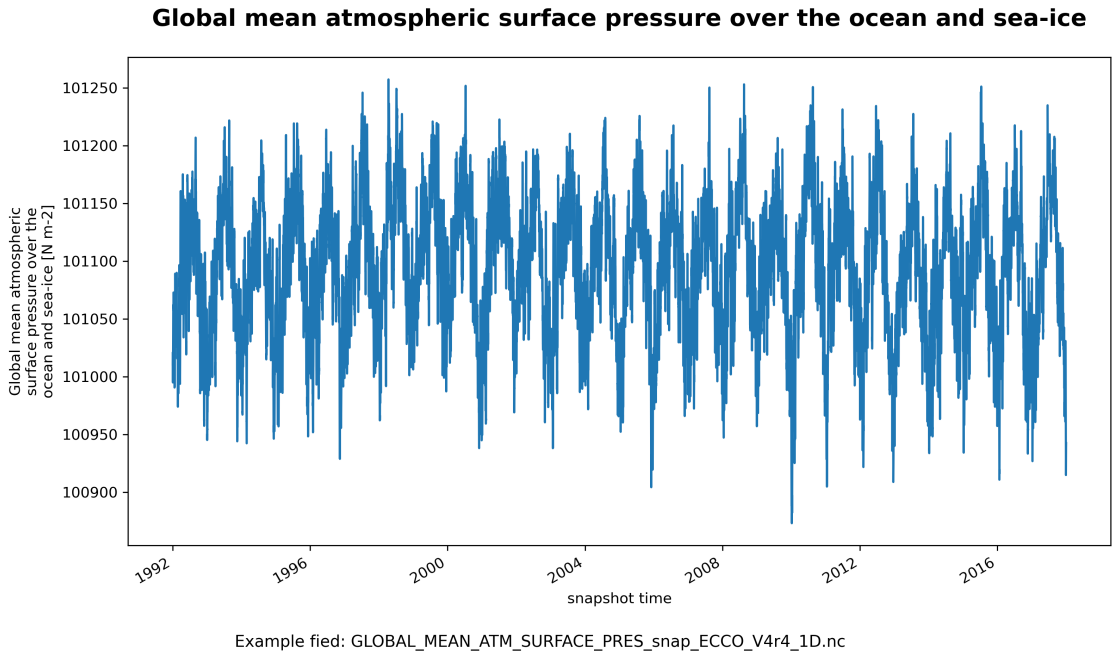


Figure 174: Dataset: GLOBAL_MEAN_ATM_SURFACE_PRES, Variable: Pa_global

15.2 1D dataset of GLOBAL_MEAN_SEA_LEVEL

15.2.1 Overview

This dataset provides a 1D field of global mean sea level anomalies including barystatic and sterodynamic terms from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on daily-average and monthly-average time resolution.

Table 15.3: Coordinates and Variables in the dataset GLOBAL_MEAN_SEA_LEVEL

Variables	Description of data variables	Unit
global_mean_barystatic_sea_level_anomaly	Global mean of barystatic sea level anomaly	m
global_mean_sea_level_anomaly	Global mean of dynamic ssh	m
global_mean_sterodynamic_sea_level_anomaly	Global mean of sterodynamic sea level anomaly	m
Coordinates	**Description of data coordinates**	**Unit**
time	Center time of averaging period	–none–

15.2.2 1D Variable: global_mean_barystatic_sea_level_anomaly

Table 15.4: Attributes description of the variable 'global_mean_barystatic_sea_level_anomaly' from GLOBAL_MEAN_SEA_LEVEL's dataset.

Storage Type	Variable Name	Description	Unit
float32	global_mean_barystatic_sea_level_anomaly	Global mean of barystatic sea level anomaly	m

Description of the variable in Common Data language (CDL)

float32 global_mean_barystatic_sea_level_anomaly(time)
global_mean_barystatic_sea_level_anomaly: _FillValue = 9.96921e+36
global_mean_barystatic_sea_level_anomaly: coverage_content_type = modelResult
global_mean_barystatic_sea_level_anomaly: long_name = Global mean of barystatic sea level anomaly
global_mean_barystatic_sea_level_anomaly: standard_name =
global_mean_barystatic_sea_level_anomaly: units = m
global_mean_barystatic_sea_level_anomaly: valid_min = : 0.045110904
global_mean_barystatic_sea_level_anomaly: valid_max = 0.043493364
global_mean_barystatic_sea_level_anomaly: coordinates = time

Comments

Global mean barystatic sea level anomaly due to changes in total ocean mass. note: eccov4 uses a volume-conserving boussinesq formulation of the mitgcm with a free-surface boundary condition with real freshwater flux forcing. changes in ocean mass due to evaporation, precipitation, runoff, and sea-ice growth/melt are reflected in model sea level. however, as a consequence of the boussinsq formulation, changes to seawater density due to net buoyancy fluxes (e.g., global mean surface heating/cooling) do not change model sea level anomaly (etan) via seawater expansion/contraction. changes in global ocean density therefore induce a spurious change in model ocean bottom pressure (phibot) via 'virtual mass fluxes'. the 'greatbatch correction' is a time varying, globally-uniform correction to account for changes in global mean density in boussinesq models. this correction is used to calculate dynamic sea surface height (ssh) and ocean bottom pressure (obp). importantly, there is no dynamical significance to the greatbatch correction but it is required to account for steric changes in global sea level. see greatbatch, 1994. j. of geophys. res. oceans, doi.org/10.1029/94jc00847

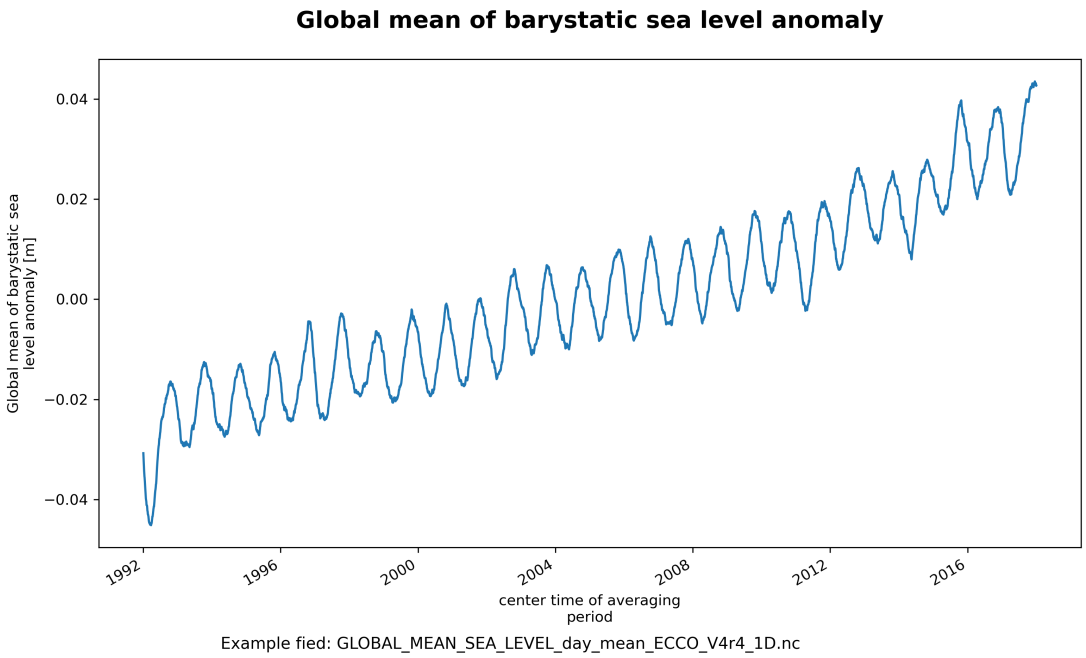


Figure 175: Dataset: GLOBAL_MEAN_SEA_LEVEL, Variable: global_mean_barystatic_sea_level_anomaly

15.2.3 1D Variable: global_mean_sea_level_anomaly

Table 15.5: Attributes description of the variable 'global_mean_sea_level_anomaly' from GLOBAL_MEAN_SEA_LEVEL's dataset.

Storage Type	Variable Name	Description	Unit
float32	global_mean_sea_level_anomaly	Global mean of dynamic ssh	m

Description of the variable in Common Data language (CDL)

float32 global_mean_sea_level_anomaly(time)
global_mean_sea_level_anomaly: _FillValue = 9.96921e+36
global_mean_sea_level_anomaly: coverage_content_type = modelResult
global_mean_sea_level_anomaly: long_name = Global mean of dynamic SSH
global_mean_sea_level_anomaly: standard_name =
global_mean_sea_level_anomaly: units = m
global_mean_sea_level_anomaly: valid_min = : 0.055836163
global_mean_sea_level_anomaly: valid_max = 0.05520557
global_mean_sea_level_anomaly: coordinates = time

Comments

Global mean of dynamic sea level anomaly, equivalent to global mean sea level change. note: eccov4 uses a volume-conserving boussinesq formulation of the mitgcm with a free-surface boundary condition with real fresh-water flux forcing. changes in ocean mass due to evaporation, precipitation, runoff, and sea-ice growth/melt are reflected in model sea level. however, as a consequence of the boussinsq formulation, changes to seawater density due to net buoyancy fluxes (e.g., global mean surface heating/cooling) do not change model sea level anomaly (etan) via seawater expansion/contraction. changes in global ocean density therefore induce a spurious change in model ocean bottom pressure (phibot) via 'virtual mass fluxes'. the 'greatbatch correction' is a time varying, globally-uniform correction to account for changes in global mean density in boussinesq models. this correction is used to calculate dynamic sea surface height (ssh) and ocean bottom pressure (obp). importantly, there is no dynamical significance to the greatbatch correction but it is required to account for steric changes in global sea level. see greatbatch, 1994. j. of geophys. res. oceans, doi.org/10.1029/94jc00847

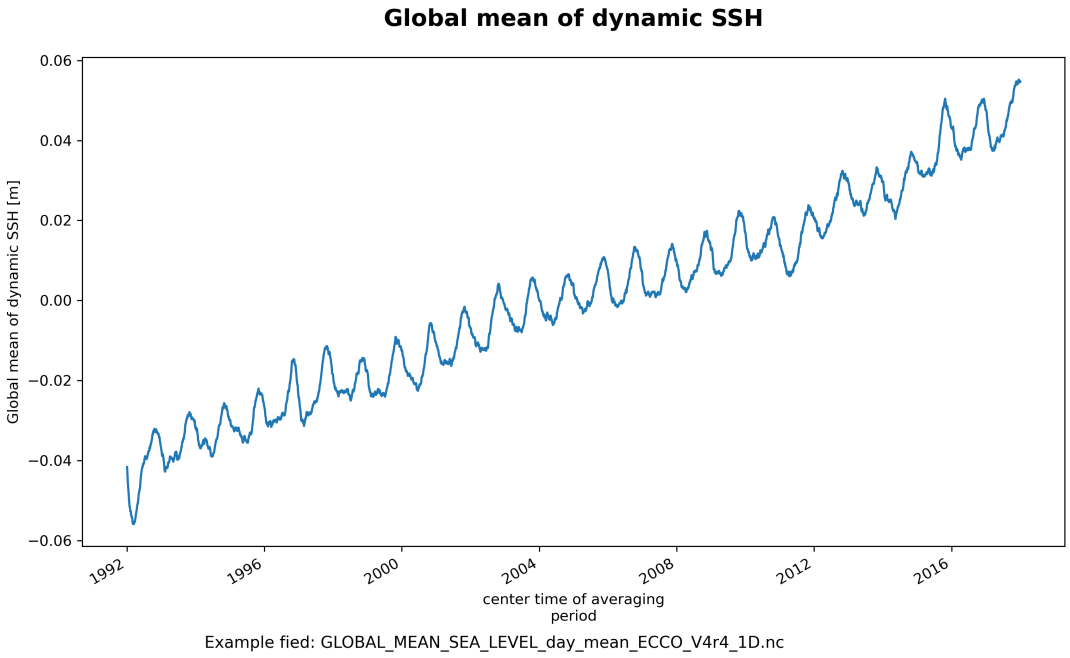


Figure 176: Dataset: GLOBAL_MEAN_SEA_LEVEL, Variable: global_mean_sea_level_anomaly

15.2.4 1D Variable: global_mean_sterodynamic_sea_level_anomaly

Table 15.6: Attributes description of the variable 'global_mean_sterodynamic_sea_level_anomaly' from GLOBAL_MEAN_SEA_LEVEL's dataset.

Storage Type	Variable Name	Description	Unit
float64	global_mean_sterodynamic_sea_level_anomaly	Global mean of sterodynamic sea level anomaly	m
Description of the variable in Common Data language (CDL)			
float64 global_mean_sterodynamic_sea_level_anomaly(time) global_mean_sterodynamic_sea_level_anomaly: _FillValue = 9.969209968386869e+36 global_mean_sterodynamic_sea_level_anomaly: coverage_content_type = modelResult global_mean_sterodynamic_sea_level_anomaly: long_name = Global mean of sterodynamic sea level anomaly global_mean_sterodynamic_sea_level_anomaly: standard_name = global_mean_sterodynamic_sea_level_anomaly: units = m global_mean_sterodynamic_sea_level_anomaly: valid_min = : 0.017658796143049296 global_mean_sterodynamic_sea_level_anomaly: valid_max = 0.017642477223663407 global_mean_sterodynamic_sea_level_anomaly: coordinates = time			
Comments			
Steric sea level anomaly associated with seawater expansion/contraction due to density changes. note: eccov4 uses a volume-conserving boussinesq formulation of the mitgcm with a free-surface boundary condition with real freshwater flux forcing. changes in ocean mass due to evaporation, precipitation, runoff, and sea-ice growth/melt are reflected in model sea level. however, as a consequence of the boussinsq formulation, changes to seawater density due to net buoyancy fluxes (e.g., global mean surface heating/cooling) do not change model sea level anomaly (etan) via seawater expansion/contraction. changes in global ocean density therefore induce a spurious change in model ocean bottom pressure (phibot) via 'virtual mass fluxes'. the 'greatbatch correction' is a time varying, globally-uniform correction to account for changes in global mean density in boussinesq models. this correction is used to calculate dynamic sea surface height (ssh) and ocean bottom pressure (obp). importantly, there is no dynamical significance to the greatbatch correction but it is required to account for steric changes in global sea level. see greatbatch, 1994. j. of geophys. res. oceans, doi.org/10.1029/94jc00847			

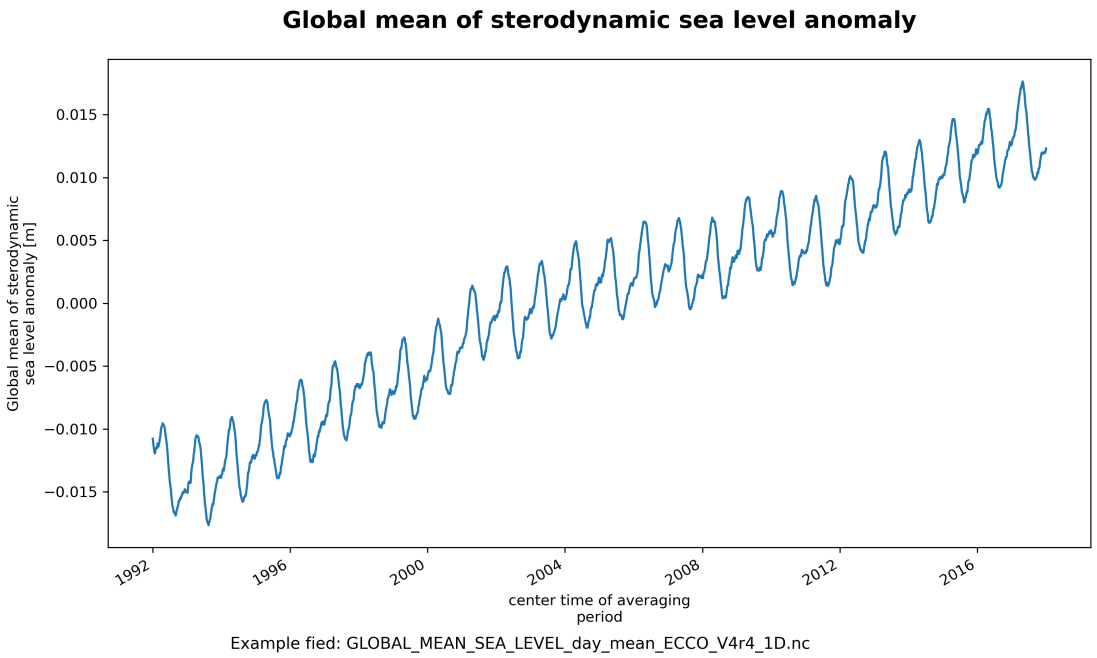


Figure 177: Dataset: GLOBAL_MEAN_SEA_LEVEL, Variable: global_mean_sterodynamic_sea_level_anomaly

15.3 1D dataset of SBO_CORE_PRODUCTS

15.3.1 Overview

This dataset provides a 1D field of the core products of the IERS Special Bureau for the Oceans from the ECCO Version 4 Release 4 (V4r4) ocean and sea-ice state estimate. The dataset is provided on instantaneous hourly snapshot aas well as daily-average and monthly-average time resolution. Dataset fields include core products of the IERS Special Bureau for the Oceans (https://euler.jpl.nasa.gov/sbo/sbo_home.html), including ocean angular momentum (OAM), center of mass (COM) and global ocean mass, calculated using the basic formulation of Gross et al. (2000). Further details on the available fields are provided in Quinn et al. (2019).

Table 15.7: Coordinates and Variables in the dataset SBO_CORE_PRODUCTS

Variables	Description of data variables	Unit
xoamc	X-comp of oceanic angular momentum due to currents	kg m2 s-1
yoamc	Y-comp of oceanic angular momentum due to currents	kg m2 s-1
zoamc	Z-comp of oceanic angular momentum due to currents	kg m2 s-1
xoamp	X-comp of oceanic angular momentum due to pressure	kg m2 s-1
yoamp	Y-comp of oceanic angular momentum due to pressure	kg m2 s-1
zoamp	Z-comp of oceanic angular momentum due to pressure	kg m2 s-1
mass	Ocean mass	kg
xcom	X-comp of center-of-mass of ocean	m
ycom	Y-comp of center-of-mass of ocean	m
zcom	Z-comp of center-of-mass of ocean	m
sboarea	Surface area of oceans	m2
xoamc_si	X-comp of oceanic angular momentum due to sea-ice motion	kg m2 s-1
yoamc_si	Y-comp of oceanic angular momentum due to sea-ice motion	kg m2 s-1
zoamc_si	Z-comp of oceanic angular momentum due to sea-ice motion	kg m2 s-1
mass_si	Sea-ice mass	kg

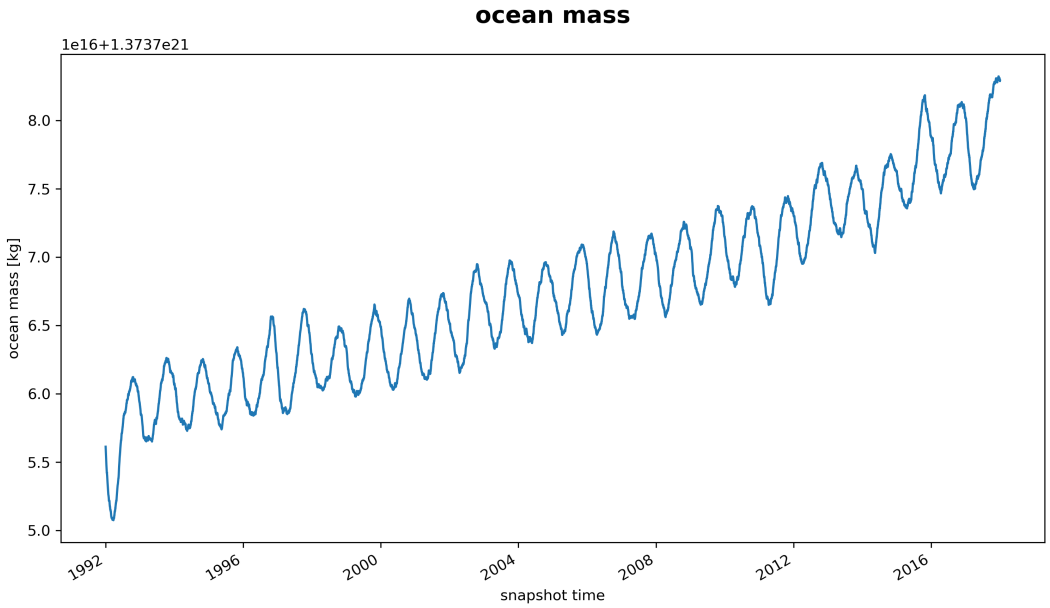
Table 15.7: Coordinates and Variables in the dataset SBO_CORE_PRODUCTS

xoamp_fw	X-comp of oceanic angular momentum due to freshwater flux	kg m2 s-1
yoamp_fw	Y-comp of oceanic angular momentum due to freshwater flux	kg m2 s-1
zoamp_fw	Z-comp of oceanic angular momentum due to freshwater flux	kg m2 s-1
mass_fw	Mass due to freshwater flux	kg
xcom_fw	X-comp of center-of-mass of freshwater flux	m
ycom_fw	Y-comp of center-of-mass of freshwater flux	m
zcom_fw	Z-comp of center-of-mass of freshater flux	m
mass_gc	Mass due to the greatbatch correction	kg
xoamp_dsl	X-comp of oceanic angular momentum due to pressure based on dynamic (ib-corrected) sea level	kg m2 s-1
yoamp_dsl	Y-comp of oceanic angular momentum due to pressure based on dynamic (ib-corrected) sea level	kg m2 s-1
zoamp_dsl	Z-comp of oceanic angular momentum due to pressure based on dynamic (ib-corrected) sea level	kg m2 s-1
Coordinates	**Description of data coordinates**	**Unit**
time	Snapshot time	–none–

15.3.2 1D Variable: mass

Table 15.8: Attributes description of the variable 'mass' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	mass	Ocean mass	kg
Description of the variable in Common Data language (CDL)			
float64 mass(time) mass: _FillValue = 9.969209968386869e+36 mass: coverage_content_type = modelResult mass: long_name = ocean mass mass: units = kg mass: valid_min = 1.3737507447512265e+21 mass: valid_max = 1.3737832079900274e+21 mass: coordinates = time			
Comments			
N/a			



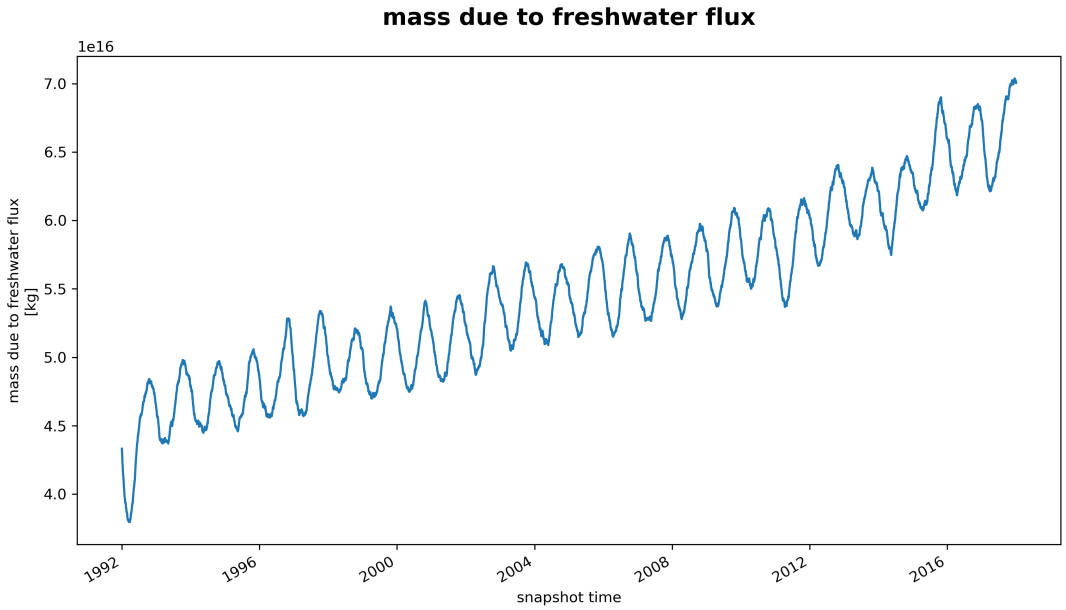
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 178: Dataset: SBO_CORE_PRODUCTS, Variable: mass

15.3.3 1D Variable: mass_fw

Table 15.9: Attributes description of the variable 'mass_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	mass_fw	Mass due to freshwater flux	kg
Description of the variable in Common Data language (CDL)			
float64 mass_fw(time) mass_fw: _FillValue = 9.969209968386869e+36 mass_fw: coverage_content_type = modelResult mass_fw: long_name = mass due to freshwater flux mass_fw: units = kg mass_fw: valid_min = 3.7929380693921944e+16 mass_fw: valid_max = 7.0392619494226936e+16 mass_fw: coordinates = time			
Comments			
N/a			



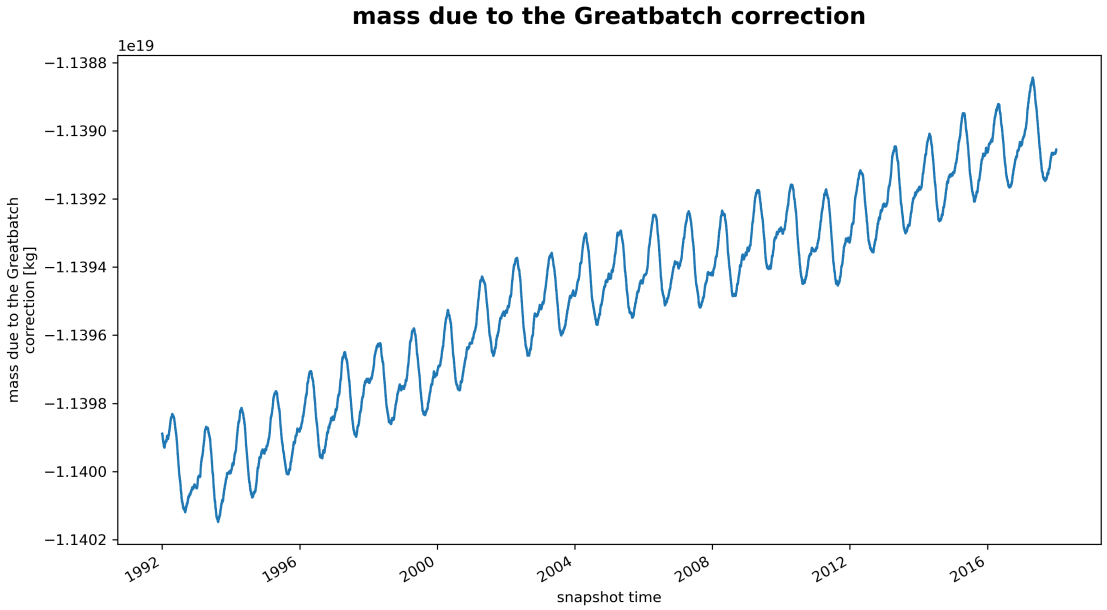
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 179: Dataset: SBO_CORE_PRODUCTS, Variable: mass_fw

15.3.4 1D Variable: mass_gc

Table 15.10: Attributes description of the variable 'mass_gc' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	mass_gc	Mass due to the greatbatch correction	kg
Description of the variable in Common Data language (CDL)			
float64 mass_gc(time) mass_gc: _FillValue = 9.969209968386869e+36 mass_gc: coverage_content_type = modelResult mass_gc: long_name = mass due to the Greatbatch correction mass_gc: units = kg mass_gc: valid_min = : 1.140148294309558e+19 mass_gc: valid_max = : 1.1388436906537843e+19 mass_gc: coordinates = time			
Comments			
N/a			



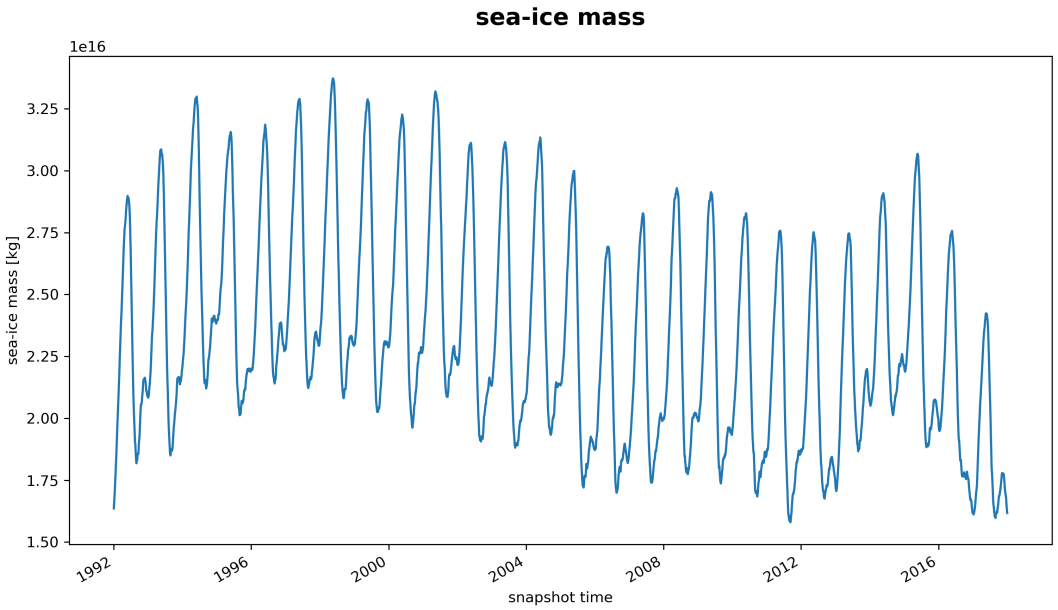
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 180: Dataset: SBO_CORE_PRODUCTS, Variable: mass_gc

15.3.5 1D Variable: mass_si

Table 15.11: Attributes description of the variable 'mass_si' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	mass_si	Sea-ice mass	kg
Description of the variable in Common Data language (CDL)			
float64 mass_si(time) mass_si: _FillValue = 9.969209968386869e+36 mass_si: coverage_content_type = modelResult mass_si: long_name = sea: ice mass mass_si: units = kg mass_si: valid_min = 1.5801085624300974e+16 mass_si: valid_max = 3.372421224523182e+16 mass_si: coordinates = time			
Comments			
N/a			



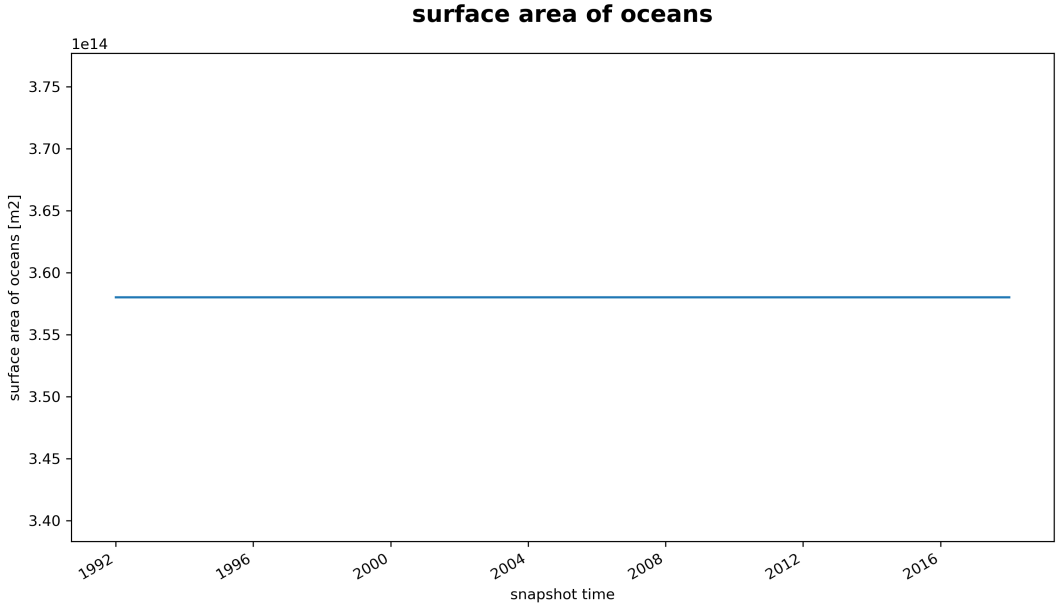
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 181: Dataset: SBO_CORE_PRODUCTS, Variable: mass_si

15.3.6 1D Variable: sboarea

Table 15.12: Attributes description of the variable 'sboarea' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	sboarea	Surface area of oceans	m2
Description of the variable in Common Data language (CDL)			
float64 sboarea(time) sboarea: _FillValue = 9.969209968386869e+36 sboarea: coverage_content_type = modelResult sboarea: long_name = surface area of oceans sboarea: units = m2 sboarea: valid_min = 358013861149443.5 sboarea: valid_max = 358013861149443.5 sboarea: coordinates = time			
Comments			
Note: ocean surface area is constant but provided as time series for convenience			



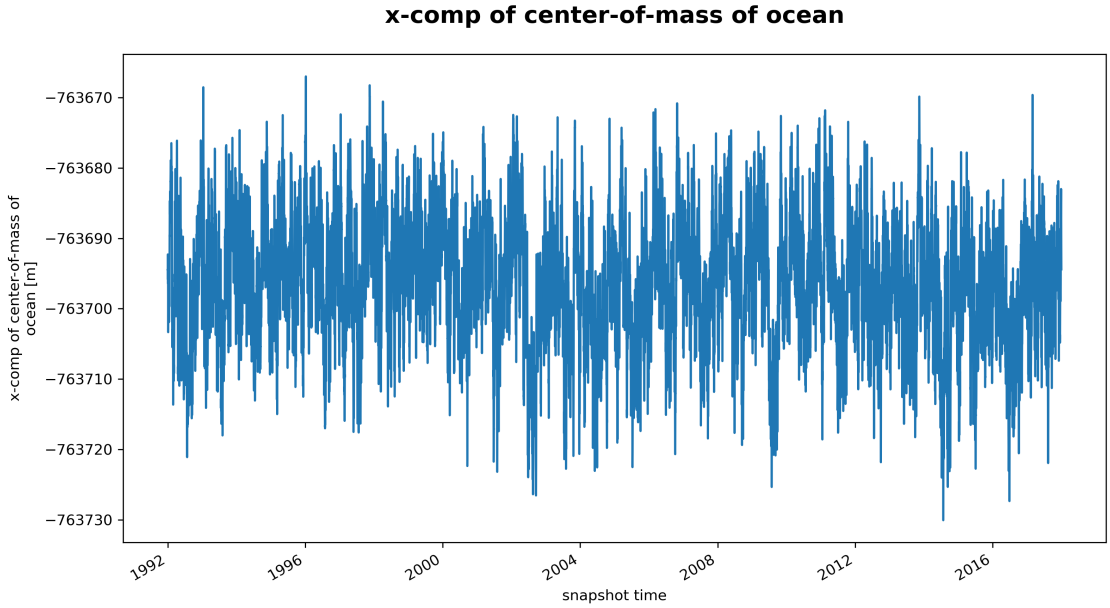
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 182: Dataset: SBO_CORE_PRODUCTS, Variable: sboarea

15.3.7 1D Variable: xcom

Table 15.13: Attributes description of the variable 'xcom' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xcom	X-comp of center-of-mass of ocean	m
Description of the variable in Common Data language (CDL)			
float64 xcom(time) xcom: _FillValue = 9.969209968386869e+36 xcom: coverage_content_type = modelResult xcom: long_name = x: comp of center: of: mass of ocean xcom: units = m xcom: valid_min = : 763730.0399730895 xcom: valid_max = : 763667.0104211655 xcom: coordinates = time			
Comments			
N/a			



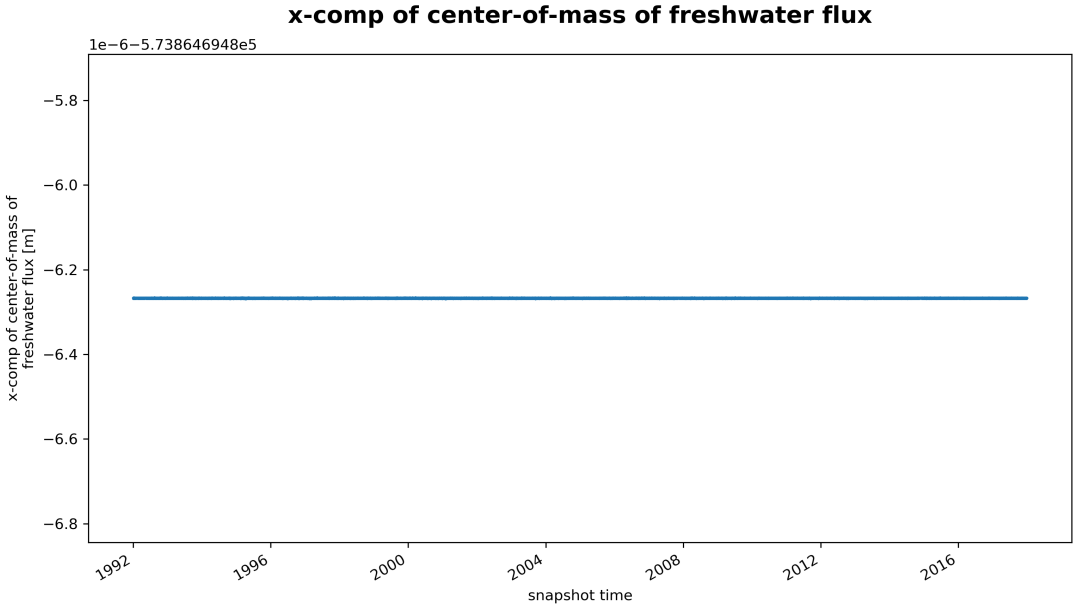
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 183: Dataset: SBO_CORE_PRODUCTS, Variable: xcom

15.3.8 1D Variable: xcom_fw

Table 15.14: Attributes description of the variable 'xcom_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xcom_fw	X-comp of center-of-mass of freshwater flux	m
Description of the variable in Common Data language (CDL)			
float64 xcom_fw(time) xcom_fw: _FillValue = 9.969209968386869e+36 xcom_fw: coverage_content_type = modelResult xcom_fw: long_name = x: comp of center: of: mass of freshwater flux xcom_fw: units = m xcom_fw: valid_min = : 573864.6948562702 xcom_fw: valid_max = : 573864.6948562652 xcom_fw: coordinates = time			
Comments			
N/a			



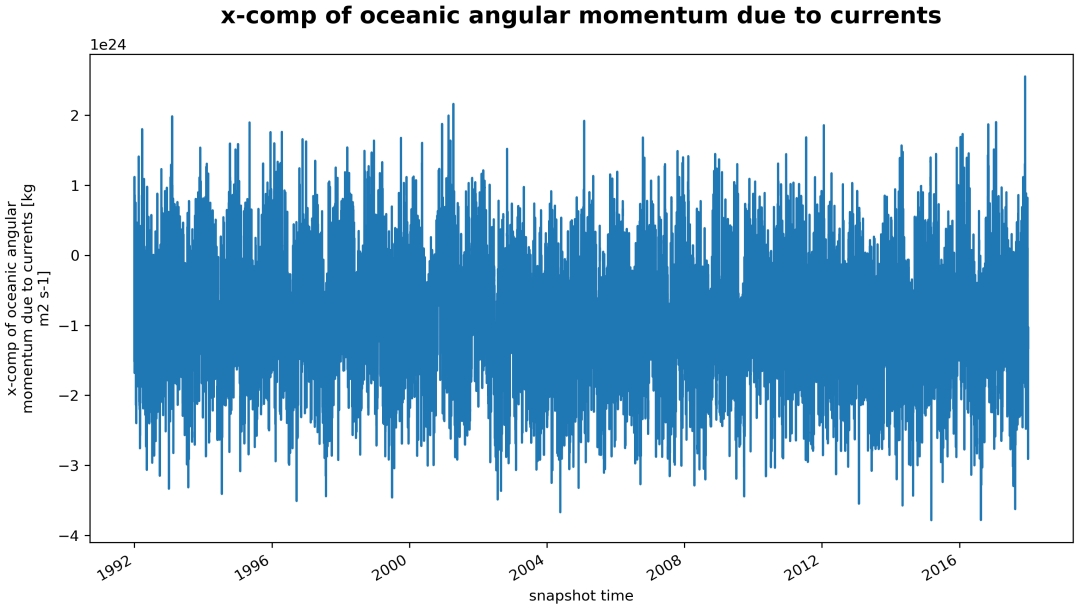
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 184: Dataset: SBO_CORE_PRODUCTS, Variable: xcom_fw

15.3.9 1D Variable: xoamc

Table 15.15: Attributes description of the variable 'xoamc' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xoamc	X-comp of oceanic angular momentum due to currents	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 xoamc(time) xoamc: _FillValue = 9.969209968386869e+36 xoamc: coverage_content_type = modelResult xoamc: long_name = x: comp of oceanic angular momentum due to currents xoamc: units = kg m2 s: 1 xoamc: valid_min = : 3.783733447704127e+24 xoamc: valid_max = 2.555331552045857e+24 xoamc: coordinates = time			
Comments			
N/a			



Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 185: Dataset: SBO_CORE_PRODUCTS, Variable: xoamc

15.3.10 1D Variable: xoamc_si

Table 15.16: Attributes description of the variable 'xoamc_si' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xoamc_si	X-comp of oceanic angular momentum due to sea-ice motion	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 xoamc_si(time) xoamc_si: _FillValue = 9.969209968386869e+36 xoamc_si: coverage_content_type = modelResult xoamc_si: long_name = x: comp of oceanic angular momentum due to sea: ice motion xoamc_si: units = kg m2 s: 1 xoamc_si: valid_min = : 9.76342837969224e+21 xoamc_si: valid_max = 1.3721188892065168e+22 xoamc_si: coordinates = time			
Comments			
N/a			

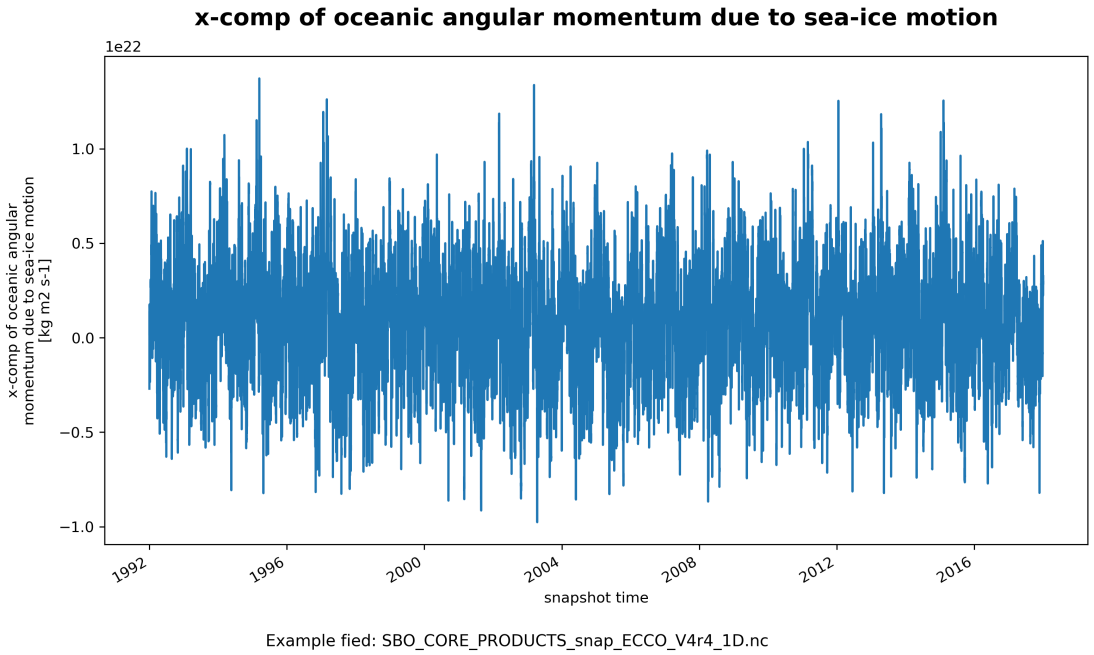


Figure 186: Dataset: SBO_CORE_PRODUCTS, Variable: xoamc_si

15.3.11 1D Variable: xoamp

Table 15.17: Attributes description of the variable 'xoamp' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xoamp	X-comp of oceanic angular momentum due to pressure	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 xoamp(time) xoamp: _FillValue = 9.969209968386869e+36 xoamp: coverage_content_type = modelResult xoamp: long_name = x: comp of oceanic angular momentum due to pressure xoamp: units = kg m2 s: 1 xoamp: valid_min = 1.3543642768158851e+29 xoamp: valid_max = 1.3546098666231897e+29 xoamp: coordinates = time			
Comments			
N/a			

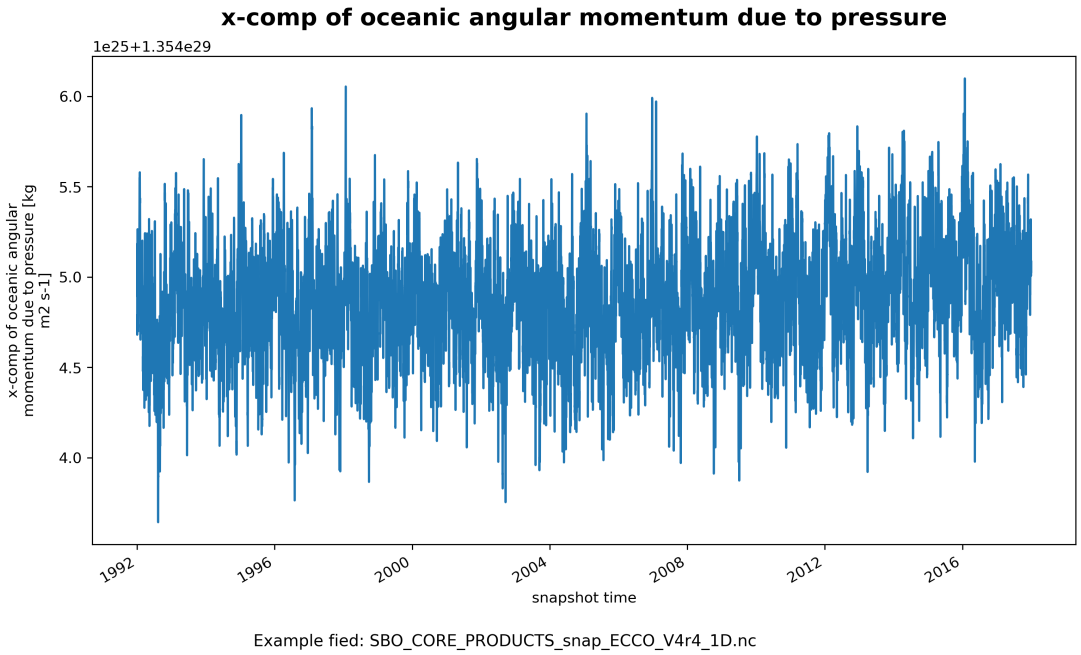


Figure 187: Dataset: SBO_CORE_PRODUCTS, Variable: xoamp

15.3.12 1D Variable: xoamp_dsl

Table 15.18: Attributes description of the variable 'xoamp_dsl' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xoamp_dsl	X-comp of oceanic angular momentum due to pressure based on dynamic (ib-corrected) sea level	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 xoamp_dsl(time) xoamp_dsl: _FillValue = 9.969209968386869e+36 xoamp_dsl: coverage_content_type = modelResult xoamp_dsl: long_name = x: comp of oceanic angular momentum due to pressure based on dynamic (IB: corrected) sea level xoamp_dsl: units = kg m2 s: 1 xoamp_dsl: valid_min = 1.354440386439953e+29 xoamp_dsl: valid_max = 1.3545518352698056e+29 xoamp_dsl: coordinates = time			
Comments			
N/a			

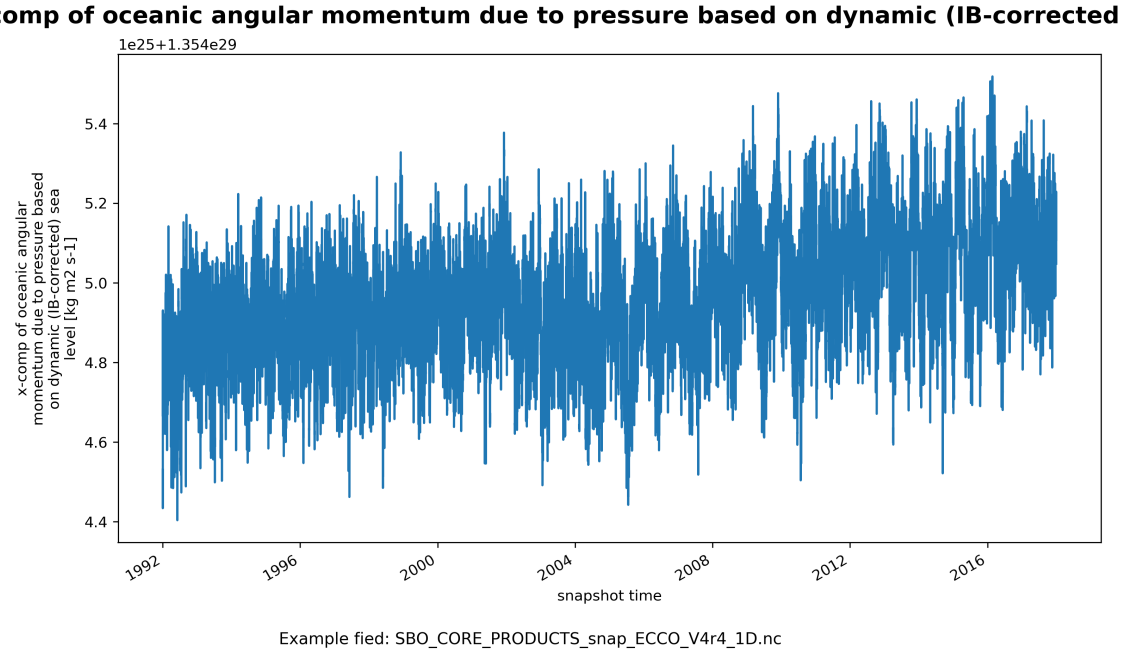
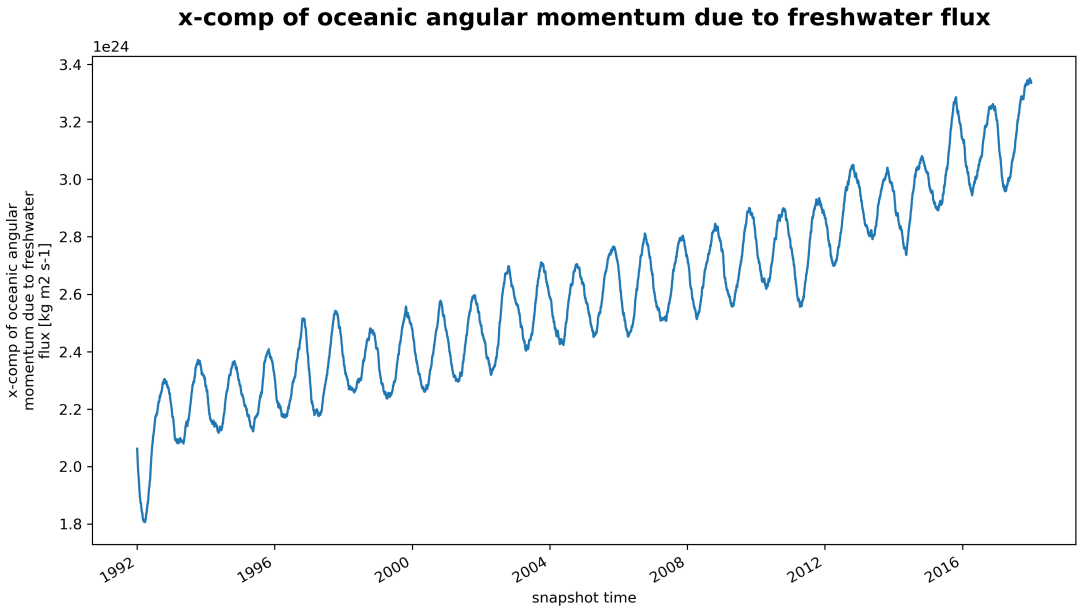


Figure 188: Dataset: SBO_CORE_PRODUCTS, Variable: xoamp_dsl

15.3.13 1D Variable: xoamp_fw

Table 15.19: Attributes description of the variable 'xoamp_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	xoamp_fw	X-comp of oceanic angular momentum due to freshwater flux	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 xoamp_fw(time) xoamp_fw: _FillValue = 9.969209968386869e+36 xoamp_fw: coverage_content_type = modelResult xoamp_fw: long_name = x: comp of oceanic angular momentum due to freshwater flux xoamp_fw: units = kg m2 s: 1 xoamp_fw: valid_min = 1.805799644912138e+24 xoamp_fw: valid_max = 3.351358892803656e+24 xoamp_fw: coordinates = time			
Comments			
N/a			



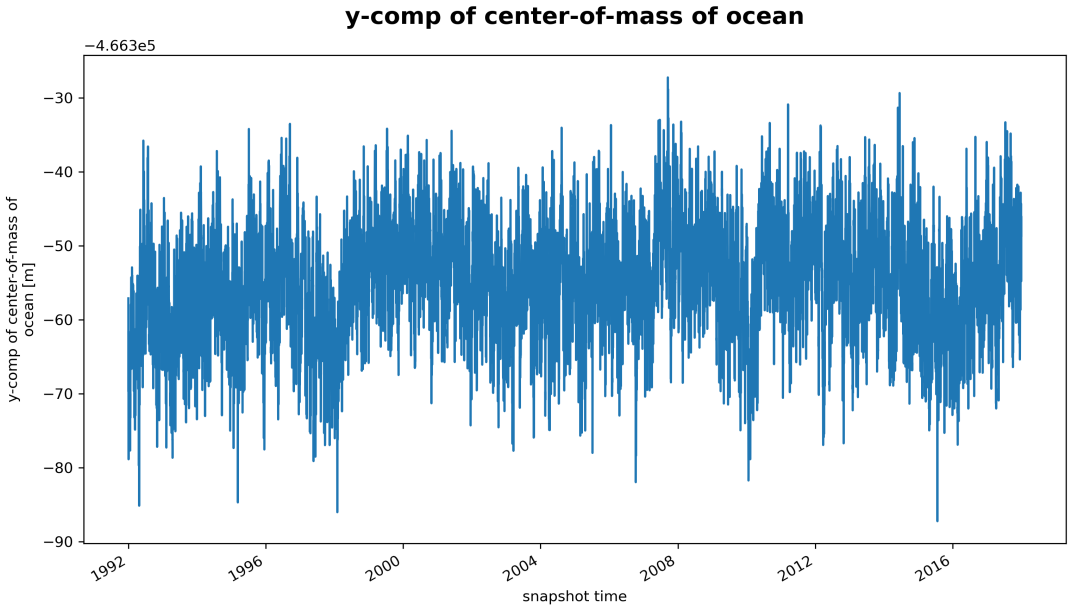
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 189: Dataset: SBO_CORE_PRODUCTS, Variable: xoamp_fw

15.3.14 1D Variable: ycom

Table 15.20: Attributes description of the variable 'ycom' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	ycom	Y-comp of center-of-mass of ocean	m
Description of the variable in Common Data language (CDL)			
float64 ycom(time) ycom: _FillValue = 9.969209968386869e+36 ycom: coverage_content_type = modelResult ycom: long_name = y: comp of center: of: mass of ocean ycom: units = m ycom: valid_min = : 466387.24450374383 ycom: valid_max = : 466327.21844756586 ycom: coordinates = time			
Comments			
N/a			



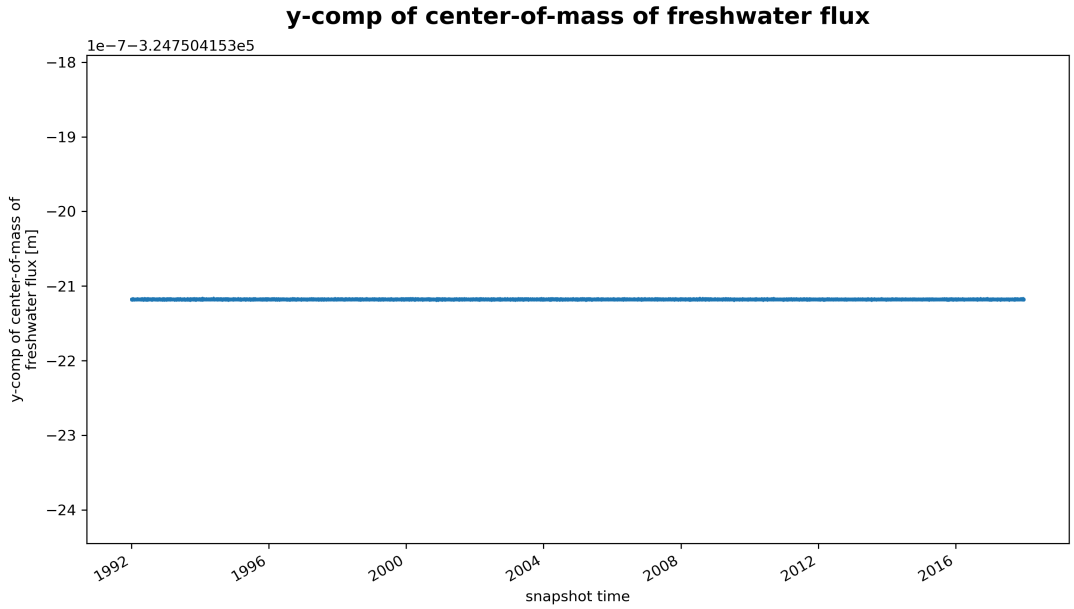
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 190: Dataset: SBO_CORE_PRODUCTS, Variable: ycom

15.3.15 1D Variable: ycom_fw

Table 15.21: Attributes description of the variable 'ycom_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	ycom_fw	Y-comp of center-of-mass of freshwater flux	m
Description of the variable in Common Data language (CDL)			
float64 ycom_fw(time) ycom_fw: _FillValue = 9.969209968386869e+36 ycom_fw: coverage_content_type = modelResult ycom_fw: long_name = y: comp of center: of: mass of freshwater flux ycom_fw: units = m ycom_fw: valid_min = : 324750.41529212013 ycom_fw: valid_max = : 324750.4152921157 ycom_fw: coordinates = time			
Comments			
N/a			



Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 191: Dataset: SBO_CORE_PRODUCTS, Variable: ycom_fw

15.3.16 1D Variable: yoamc

Table 15.22: Attributes description of the variable 'yoamc' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	yoamc	Y-comp of oceanic angular momentum due to currents	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 yoamc(time) yoamc: _FillValue = 9.969209968386869e+36 yoamc: coverage_content_type = modelResult yoamc: long_name = y: comp of oceanic angular momentum due to currents yoamc: units = kg m2 s: 1 yoamc: valid_min = : 2.19249690136359e+24 yoamc: valid_max = 4.179441018940977e+24 yoamc: coordinates = time			
Comments			
N/a			

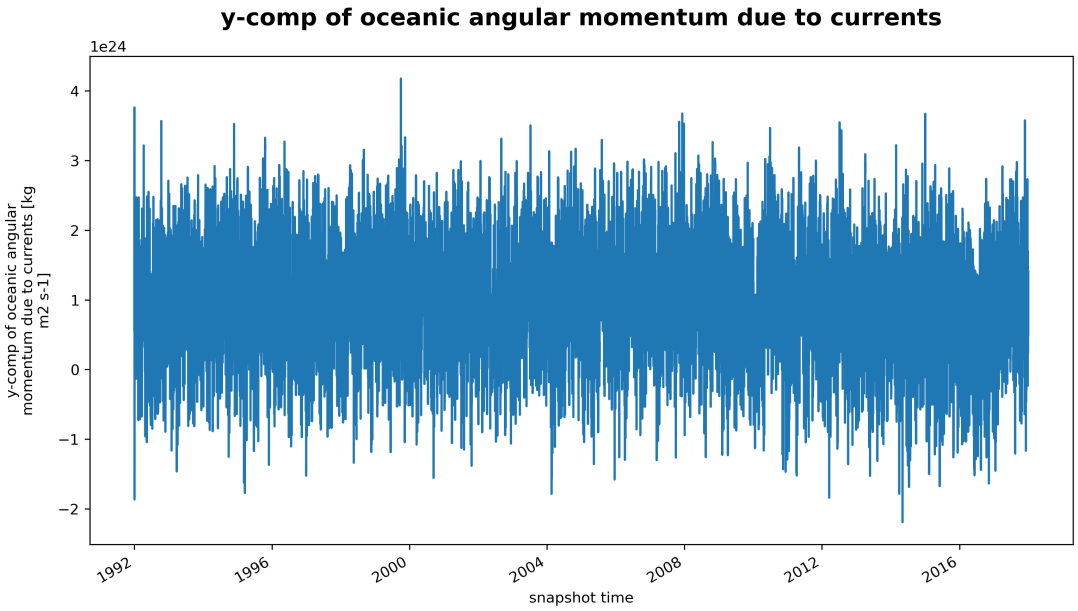
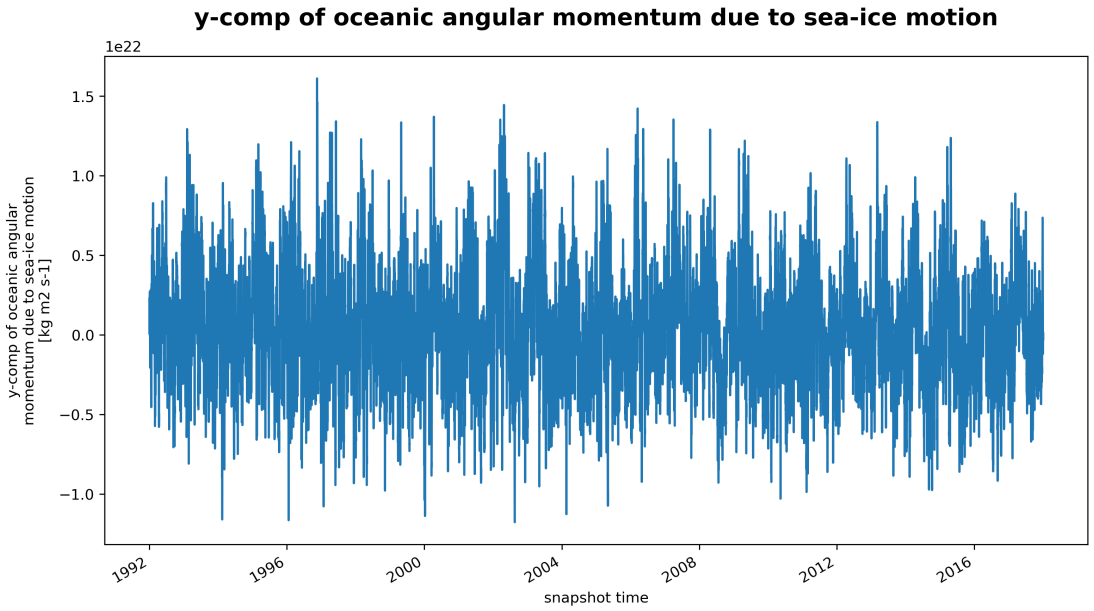


Figure 192: Dataset: SBO_CORE_PRODUCTS, Variable: yoamc

15.3.17 1D Variable: yoamc_si

Table 15.23: Attributes description of the variable 'yoamc_si' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	yoamc_si	Y-comp of oceanic angular momentum due to sea-ice motion	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 yoamc_si(time) yoamc_si: _FillValue = 9.969209968386869e+36 yoamc_si: coverage_content_type = modelResult yoamc_si: long_name = y: comp of oceanic angular momentum due to sea: ice motion yoamc_si: units = kg m2 s: 1 yoamc_si: valid_min = : 1.176556337395274e+22 yoamc_si: valid_max = 1.6107851446370722e+22 yoamc_si: coordinates = time			
Comments			
N/a			



Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 193: Dataset: SBO_CORE_PRODUCTS, Variable: yoamc_si

15.3.18 1D Variable: yoamp

Table 15.24: Attributes description of the variable 'yoamp' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	yoamp	Y-comp of oceanic angular momentum due to pressure	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 yoamp(time) yoamp: _FillValue = 9.969209968386869e+36 yoamp: coverage_content_type = modelResult yoamp: long_name = y: comp of oceanic angular momentum due to pressure yoamp: units = kg m2 s: 1 yoamp: valid_min = 1.0476388397938864e+29 yoamp: valid_max = 1.0478581623131764e+29 yoamp: coordinates = time			
Comments			
N/a			

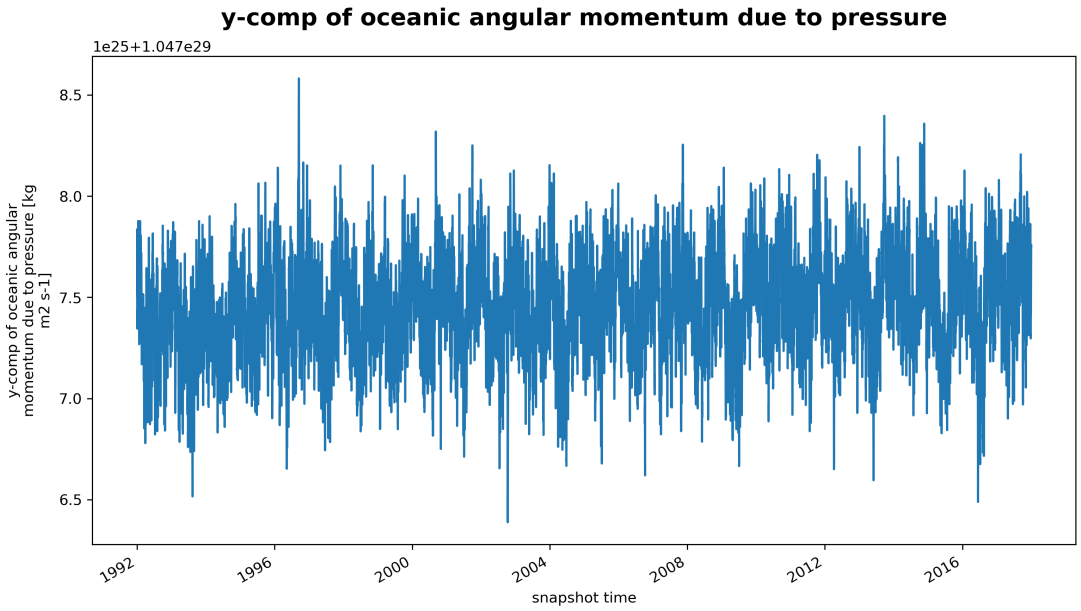


Figure 194: Dataset: SBO_CORE_PRODUCTS, Variable: yoamp

15.3.19 1D Variable: yoamp_dsl

Table 15.25: Attributes description of the variable 'yoamp_dsl' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	yoamp_dsl	Y-comp of oceanic angular momentum due to pressure based on dynamic (ib-corrected) sea level	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 yoamp_dsl(time) yoamp_dsl: _FillValue = 9.969209968386869e+36 yoamp_dsl: coverage_content_type = modelResult yoamp_dsl: long_name = y: comp of oceanic angular momentum due to pressure based on dynamic (IB: corrected) sea level yoamp_dsl: units = kg m2 s: 1 yoamp_dsl: valid_min = 1.0476994334049981e+29 yoamp_dsl: valid_max = 1.0478187262074598e+29 yoamp_dsl: coordinates = time			
Comments			
N/a			

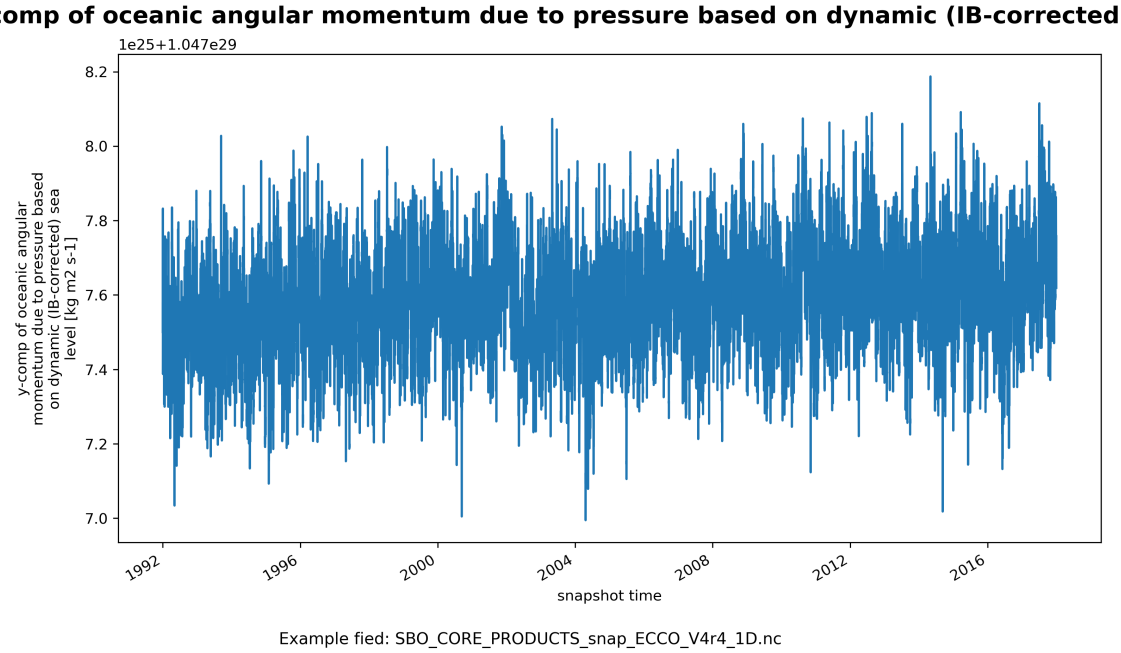


Figure 195: Dataset: SBO_CORE_PRODUCTS, Variable: yoamp_dsl

15.3.20 1D Variable: yoamp_fw

Table 15.26: Attributes description of the variable 'yoamp_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	yoamp_fw	Y-comp of oceanic angular momentum due to freshwater flux	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 yoamp_fw(time) yoamp_fw: _FillValue = 9.969209968386869e+36 yoamp_fw: coverage_content_type = modelResult yoamp_fw: long_name = y: comp of oceanic angular momentum due to freshwater flux yoamp_fw: units = kg m2 s: 1 yoamp_fw: valid_min = 2.6255410225894626e+24 yoamp_fw: valid_max = 4.872705717529432e+24 yoamp_fw: coordinates = time			
Comments			
N/a			

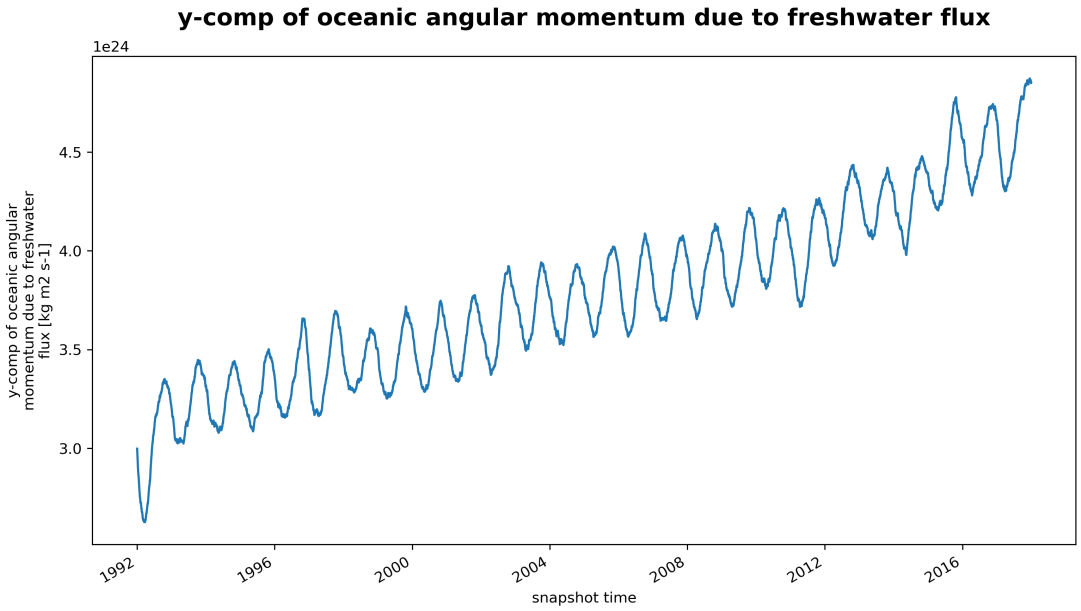
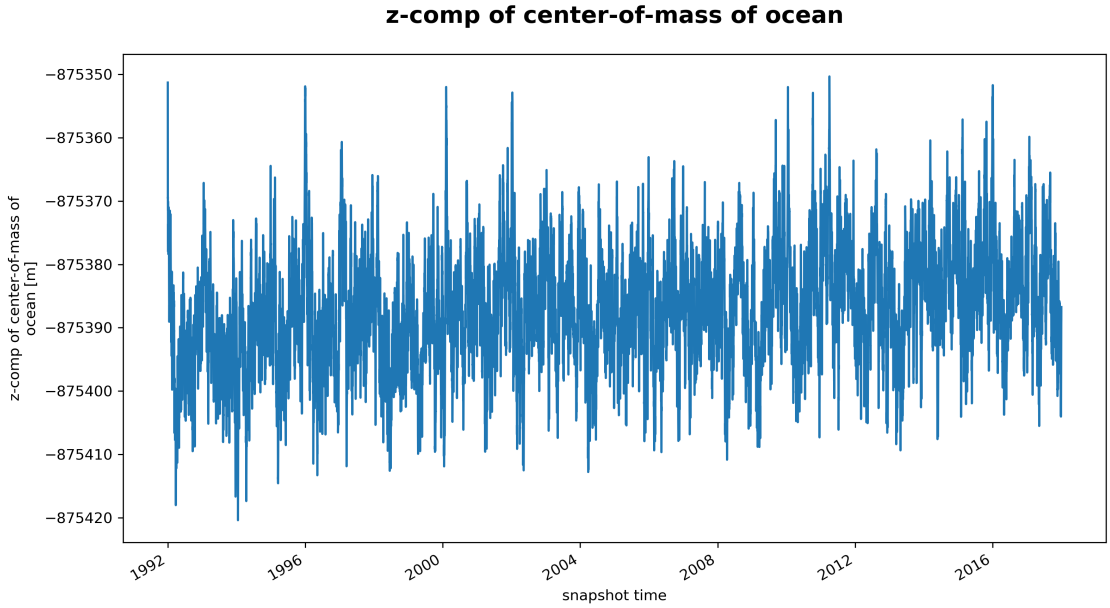


Figure 196: Dataset: SBO_CORE_PRODUCTS, Variable: yoamp_fw

15.3.21 1D Variable: zcom

Table 15.27: Attributes description of the variable 'zcom' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zcom	Z-comp of center-of-mass of ocean	m
Description of the variable in Common Data language (CDL)			
float64 zcom(time) zcom: _FillValue = 9.969209968386869e+36 zcom: coverage_content_type = modelResult zcom: long_name = z: comp of center: of: mass of ocean zcom: units = m zcom: valid_min = : 875420.3898804963 zcom: valid_max = : 875350.3238026679 zcom: coordinates = time			
Comments			
N/a			



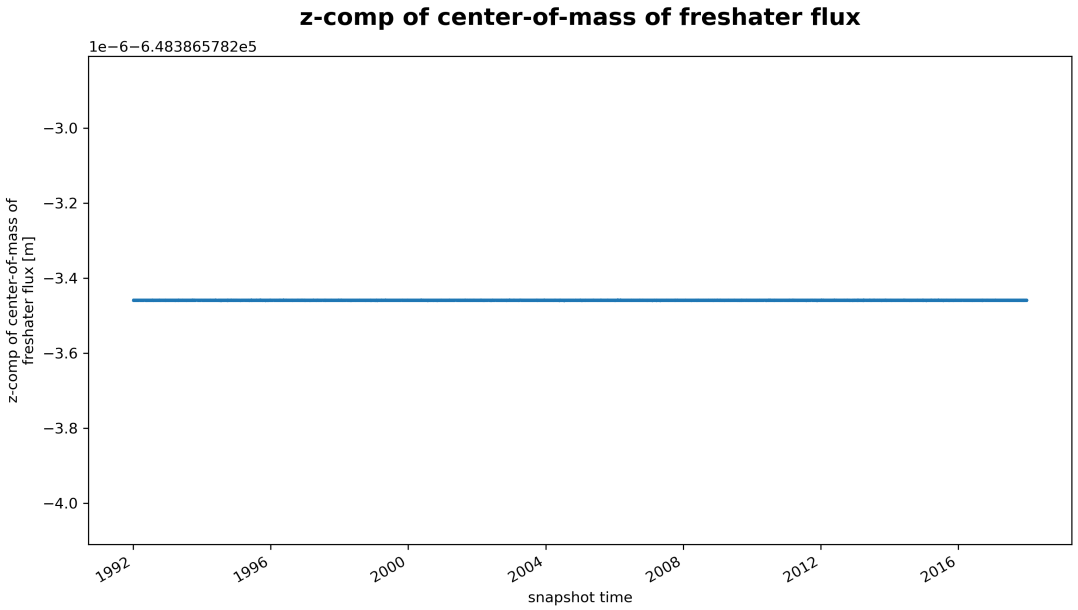
Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 197: Dataset: SBO_CORE_PRODUCTS, Variable: zcom

15.3.22 1D Variable: zcom_fw

Table 15.28: Attributes description of the variable 'zcom_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zcom_fw	Z-comp of center-of-mass of freshater flux	m
Description of the variable in Common Data language (CDL)			
float64 zcom_fw(time) zcom_fw: _FillValue = 9.969209968386869e+36 zcom_fw: coverage_content_type = modelResult zcom_fw: long_name = z: comp of center: of: mass of freshater flux zcom_fw: units = m zcom_fw: valid_min = : 648386.5781734617 zcom_fw: valid_max = : 648386.5781734567 zcom_fw: coordinates = time			
Comments			
N/a			



Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 198: Dataset: SBO_CORE_PRODUCTS, Variable: zcom_fw

15.3.23 1D Variable: zoamc

Table 15.29: Attributes description of the variable 'zoamc' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zoamc	Z-comp of oceanic angular momentum due to currents	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 zoamc(time) zoamc: _FillValue = 9.969209968386869e+36 zoamc: coverage_content_type = modelResult zoamc: long_name = z: comp of oceanic angular momentum due to currents zoamc: units = kg m2 s: 1 zoamc: valid_min = 7.331764457927521e+24 zoamc: valid_max = 2.207264300276968e+25 zoamc: coordinates = time			
Comments			
N/a			

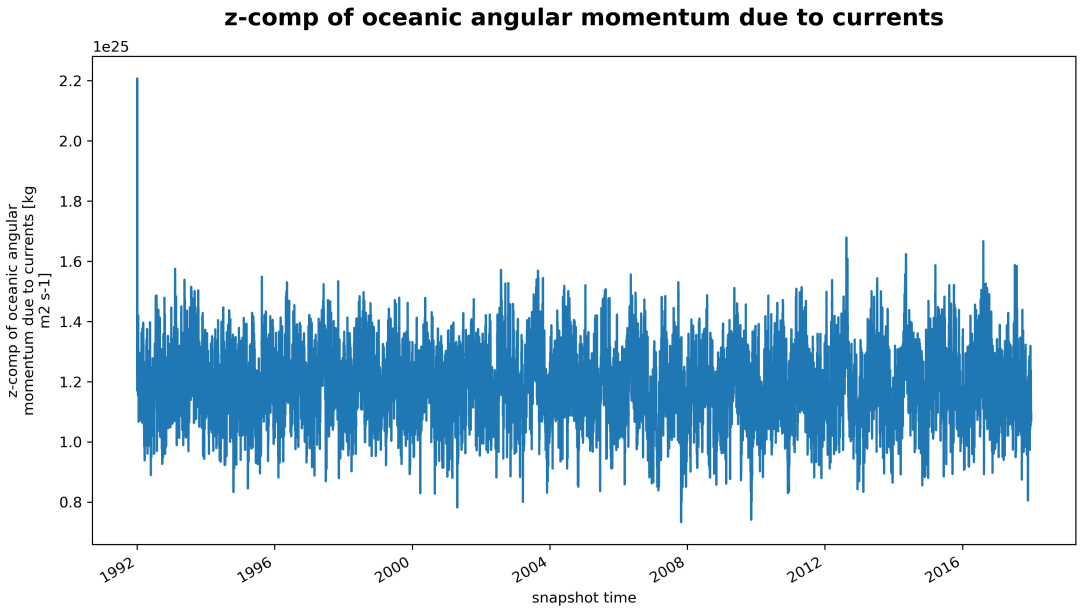
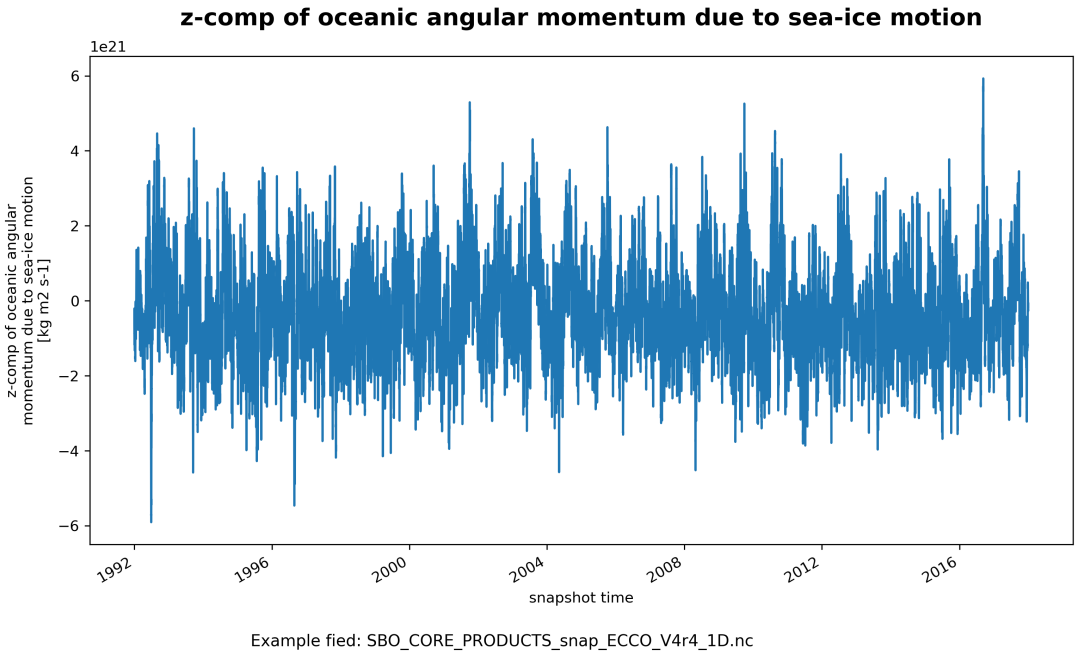


Figure 199: Dataset: SBO_CORE_PRODUCTS, Variable: zoamc

15.3.24 1D Variable: zoamc_si

Table 15.30: Attributes description of the variable 'zoamc_si' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zoamc_si	Z-comp of oceanic angular momentum due to sea-ice motion	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 zoamc_si(time) zoamc_si: _FillValue = 9.969209968386869e+36 zoamc_si: coverage_content_type = modelResult zoamc_si: long_name = z: comp of oceanic angular momentum due to sea: ice motion zoamc_si: units = kg m2 s: 1 zoamc_si: valid_min = : 5.909426721868294e+21 zoamc_si: valid_max = 5.930388258256482e+21 zoamc_si: coordinates = time			
Comments			
N/a			



Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 200: Dataset: SBO_CORE_PRODUCTS, Variable: zoamc_si

15.3.25 1D Variable: zoamp

Table 15.31: Attributes description of the variable 'zoamp' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zoamp	Z-comp of oceanic angular momentum due to pressure	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 zoamp(time) zoamp: _FillValue = 9.969209968386869e+36 zoamp: coverage_content_type = modelResult zoamp: long_name = z: comp of oceanic angular momentum due to pressure zoamp: units = kg m2 s: 1 zoamp: valid_min = 2.927645942668479e+30 zoamp: valid_max = 2.9277200254389854e+30 zoamp: coordinates = time			
Comments			
N/a			

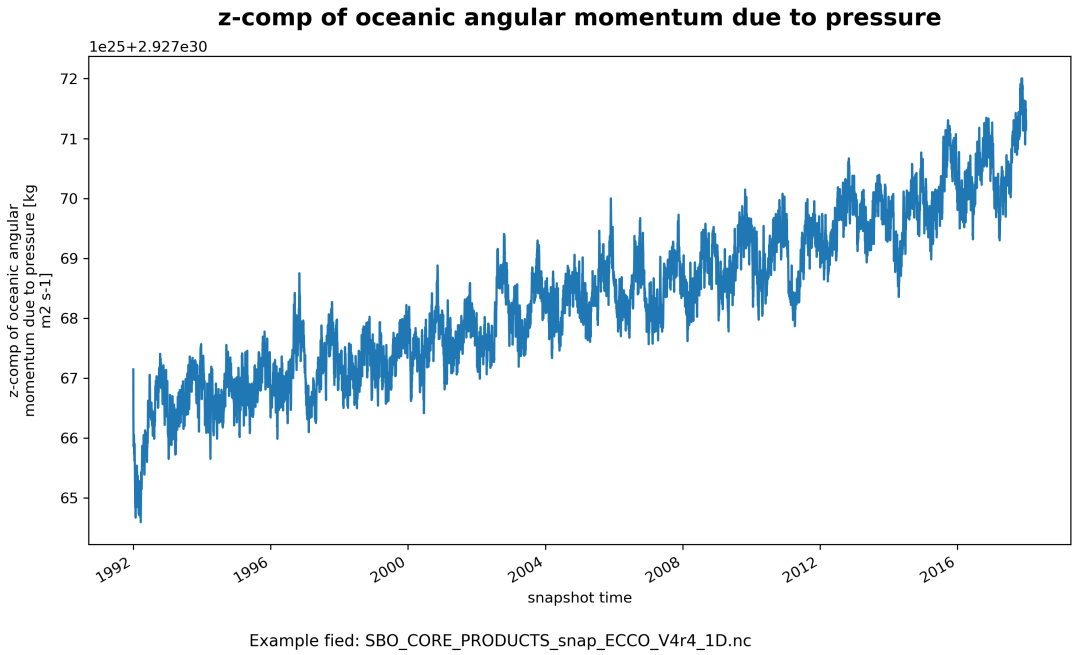


Figure 201: Dataset: SBO_CORE_PRODUCTS, Variable: zoamp

15.3.26 1D Variable: zoamp_dsl

Table 15.32: Attributes description of the variable 'zoamp_dsl' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zoamp_dsl	Z-comp of oceanic angular momentum due to pressure based on dynamic (ib-corrected) sea level	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 zoamp_dsl(time) zoamp_dsl: _FillValue = 9.969209968386869e+36 zoamp_dsl: coverage_content_type = modelResult zoamp_dsl: long_name = z: comp of oceanic angular momentum due to pressure based on dynamic (IB: corrected) sea level zoamp_dsl: units = kg m2 s: 1 zoamp_dsl: valid_min = 2.9276609546728614e+30 zoamp_dsl: valid_max = 2.9277328440911863e+30 zoamp_dsl: coordinates = time			
Comments			
N/a			

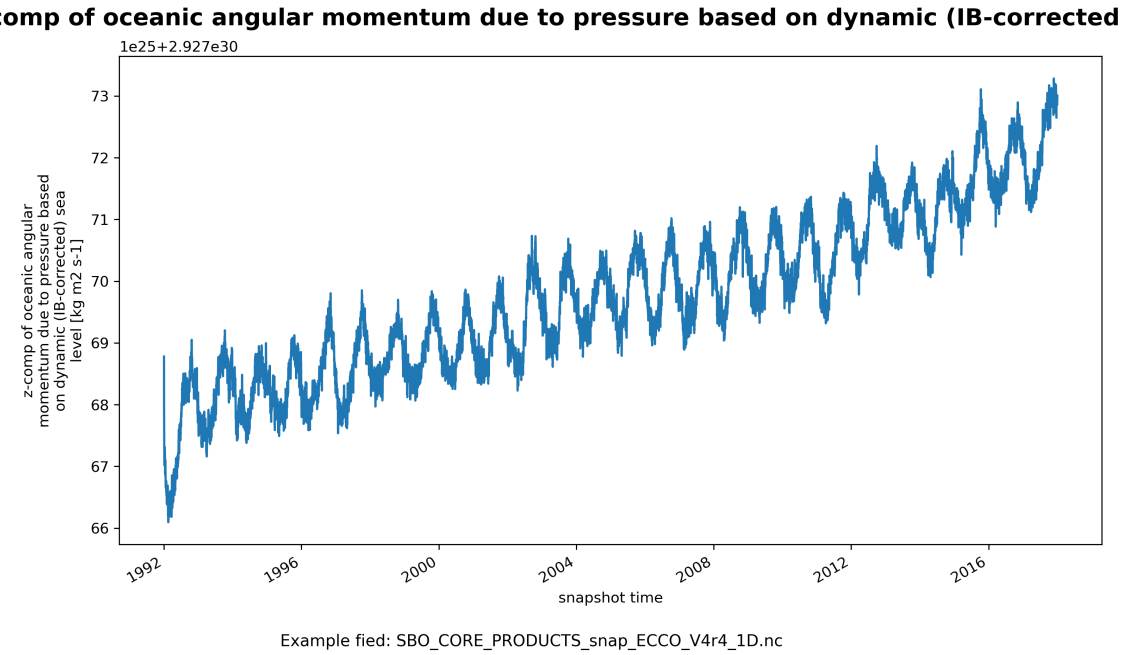
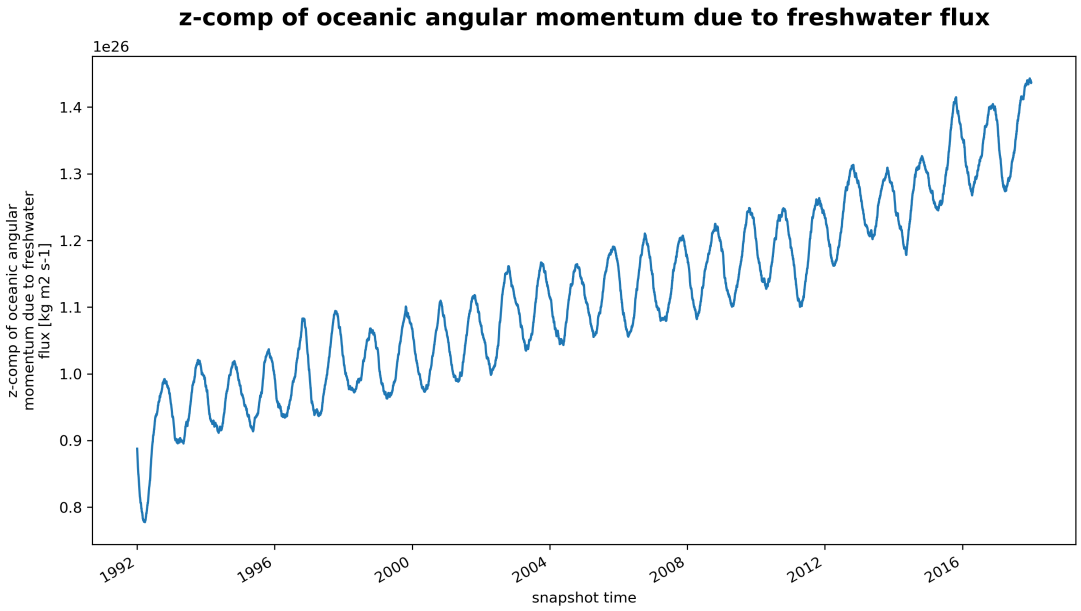


Figure 202: Dataset: SBO_CORE_PRODUCTS, Variable: zoamp_dsl

15.3.27 1D Variable: zoamp_fw

Table 15.33: Attributes description of the variable 'zoamp_fw' from SBO_CORE_PRODUCTS's dataset.

Storage Type	Variable Name	Description	Unit
float64	zoamp_fw	Z-comp of oceanic angular momentum due to freshwater flux	kg m2 s-1
Description of the variable in Common Data language (CDL)			
float64 zoamp_fw(time) zoamp_fw: _FillValue = 9.969209968386869e+36 zoamp_fw: coverage_content_type = modelResult zoamp_fw: long_name = z: comp of oceanic angular momentum due to freshwater flux zoamp_fw: units = kg m2 s: 1 zoamp_fw: valid_min = 7.774584605728723e+25 zoamp_fw: valid_max = 1.442874536478883e+26 zoamp_fw: coordinates = time			
Comments			
N/a			



Example fied: SBO_CORE_PRODUCTS_snap_ECCO_V4r4_1D.nc

Figure 203: Dataset: SBO_CORE_PRODUCTS, Variable: zoamp_fw

How to find out more about ECCO:

The final page style is on building process!!!