SASSIE ECCO llc1080 Coupled Sea Ice Ocean Model Version 1 Release 1 User Guide

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1 Introduction

The Salinity and Stratification at the Sea Ice Edge (SASSIE) project is a NASA experiment focused on salinity anomalies in the upper ocean generated by melting sea ice. The SASSIE ocean model simulation was produced by downscaling the global Estimating the Circulation and Climate of the Ocean (ECCO) state estimate from 1/3 to 1/12-degree grid cells. The ECCO v5 Alpha (LLC270) global solution provided initial and boundary conditions and atmospheric forcing. Model ocean and sea-ice state estimates are dynamically and kinematically consistent reconstructions of the three-dimensional time-evolving ocean, sea-ice, and surface atmospheric states. The SASSIE ECCO model dataset consists of daily averages of diagnostic variables for seven years (January 15, 2014 to February 7, 2021).

Additional information about the SASSIE mission is available on the project website (https://salinity.oceansciences.org/sassie.htm) and from Drushka et al. (2024). All SASSIE datasets, including all SASSIE ECCO model datasets and in situ observations from the field campaign, are accessible at https://podaac.jpl.nasa.gov/SASSIE under the “data” tab.

2 Model Setup

2.1 Model Configuration

The SASSIE ECCO model was produced by downscaling an existing 1/3-degree resolution global model, ECCO v5 Alpha, developed by the ECCO consortium (Zhang et al., 2018) to 1/12 degree (see Wood et al., 2024). The SASSIE ECCO model was initialized on 1 January 2014 using instantaneous ocean state data from ECCO v5 Alpha. Boundary conditions for the model were provided by ECCO v5 Alpha, including hourly updates of potential temperature, salinity, ocean velocity, sea ice parameters (area, thickness, velocity), and snow thickness. External forcing conditions were updated every 6 hours and are identical to those used in ECCO v5 Alpha. River runoff was sourced from a compilation of the global climatology generated by Fekete et al. (2002) and was discharged from a surface grid cell. A "sponge" layer was added near the boundaries of the domain, covering 10 grid cells, to help smooth any differences between the boundary inputs and the model's internal solution.

Code used to run the simulation are accessible on Github: https://github.com/mhwood/downscale_ecco_v5/tree/main/configurations/sassie. Unlike ECCO v5 Alpha that uses the Gent-McWilliams/Redi Eddy Parameterization ("GMRedi") (Gent et al., 1995; Gent & Mcwilliams, 1990; Redi, 1982), the SASSIE ECCO model has a sufficiently high spatial resolution to be eddy-permitting where tracers are advected and diffused by eddies that develop throughout the simulation. The simulation was run with a linear free surface and K-profile parameterization (KPP) for vertical mixing (Large et al., 1994). KPP is a scheme that handles unresolved mixing processes in the ocean's surface boundary layer and the interior.

The "available_diagnostics.log" file is provided and lists all possible variables in the model with short descriptions and units. Additionally, extensive documentation and descriptions of the ECCO global ocean state estimate are available at https://ecco-group.org/home.htm.

Table 1. Overview of SASSIE ECCO ocean and sea ice state estimate.

Simulation time coverage	15 January 2014 – 7 February 2021
Domain	Pan-Arctic
Grid and Horizontal Resolution	LLC1080 (1/12 degree)
Vertical Resolution	90 levels (non-uniform spacing)
Temporal Resolution	Daily averages with monthly snapshots
Data Format	NetCDF-4
Variable summary	• Ocean State (temperature, salinity, velocity, sea level, density, hydrostatic pressure), Fluxes (temperature, salt, volume) • Sea-Ice State (concentration, ice and snow thickness, velocity, pressure loading) • Atmosphere Surface State (temperature, humidity, precipitation, pressure, winds, wind stress) • Ocean and Sea-Ice Surface Fluxes (freshwater, heat, and momentum) • Ocean 3D Fluxes (temperature, salinity, volume) • Sea-Ice 2D Fluxes (ice and snow volume)

2.2 Model Grid

SASSIE ECCO LLC1080 V1R1 fields are consolidated onto a single curvilinear grid face focusing on the Arctic domain using fields from the 5 faces of the Lat-Lon-Cap 1080 (LLC1080) native grid used in the original simulation (Figure 1).

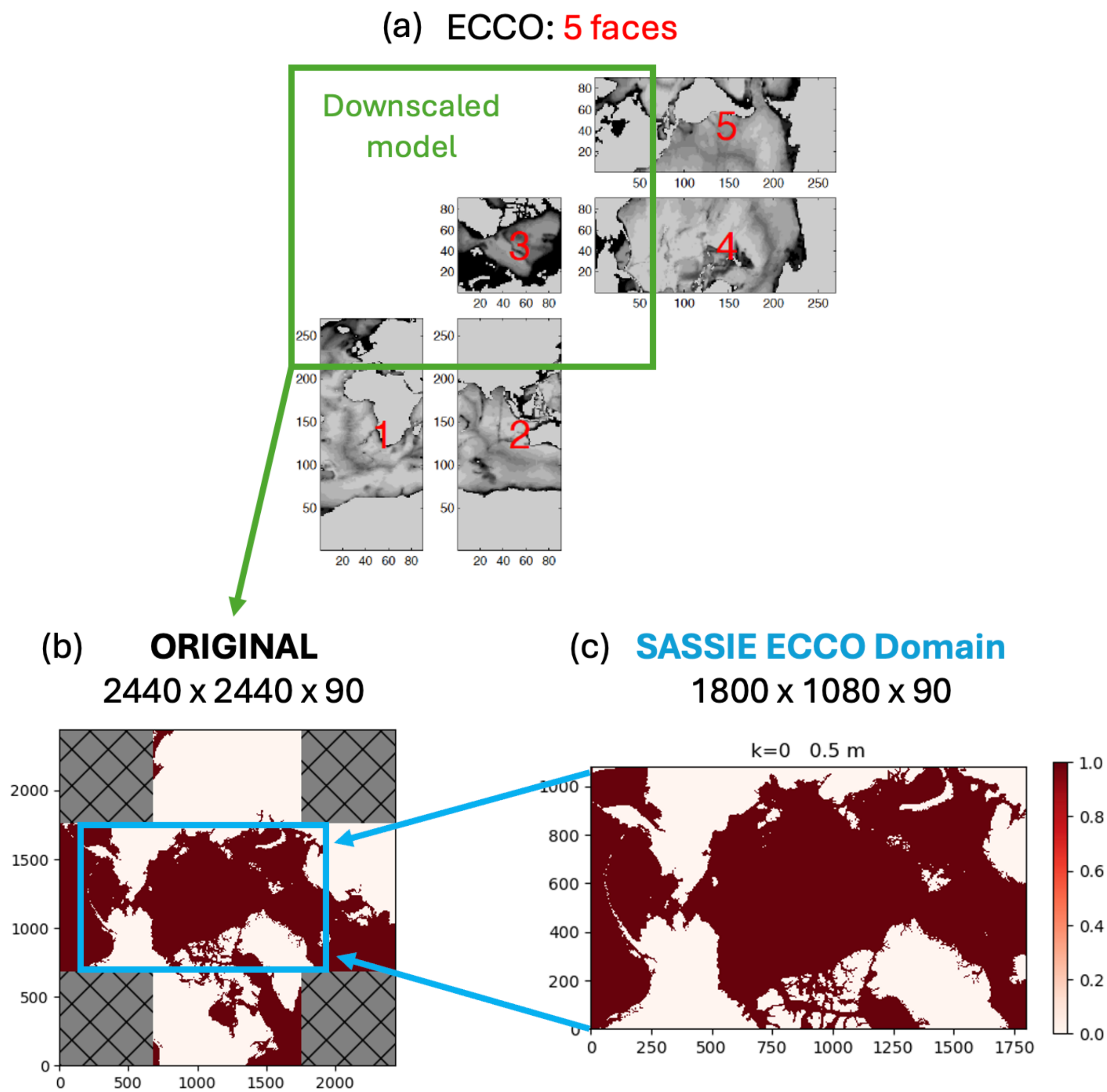

Figure 1. (a) Five faces that comprise the ECCO ocean state estimate from Forget et al. (2015) with a green box outlining the boundaries of the downscaled SASSIE ECCO model (llc1080). (b) Native grid of the entire downscaled model stitched together from the 5 tiles with a blue outline denoting the final pan-Arctic SASSIE ECCO domain (c) with dimensions [1800 x 1080 x 90].

The dimensions for the pan-Arctic domain are [1800x1080x90]. The horizontal grid resolution ranges from 0.4 to 5.7 km (mean 3.8 km) with increasing resolution at higher latitudes. Area of grid cells range from 0.3 to 35 km^2 (mean 15 km^2). The model has 90 vertical levels that are nonuniformly spaced with grid cell thicknesses ranging from 1 m at the surface (0.5 m deep) to 480 m at the deepest level (6,760 m) (Figure 2). An example model snapshot of surface salinity is provided in Figure 3.

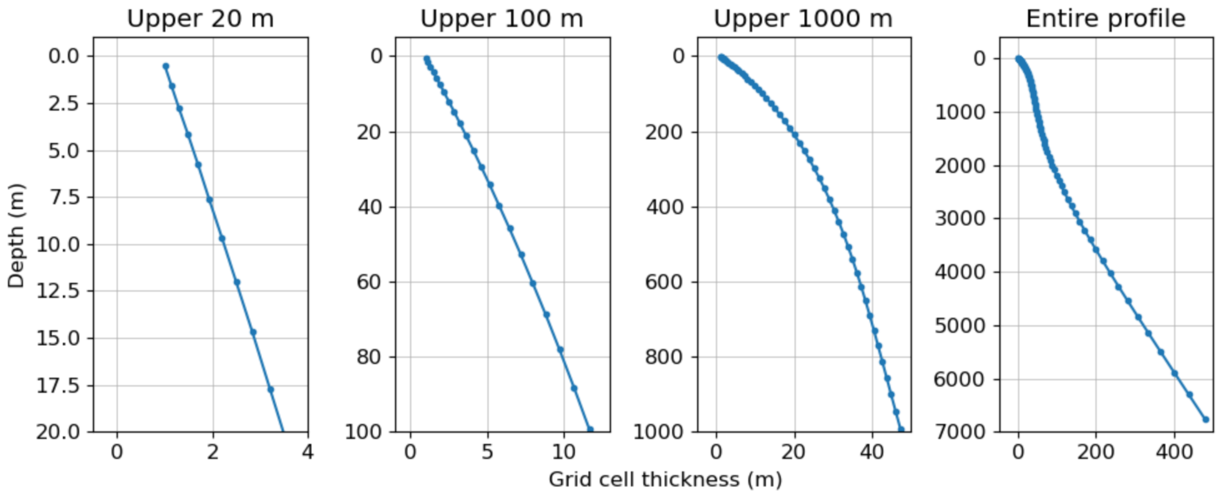

Figure 2. Vertical grid resolution with nonuniform spacing. Spatial resolution with grid cell thicknesses that range from

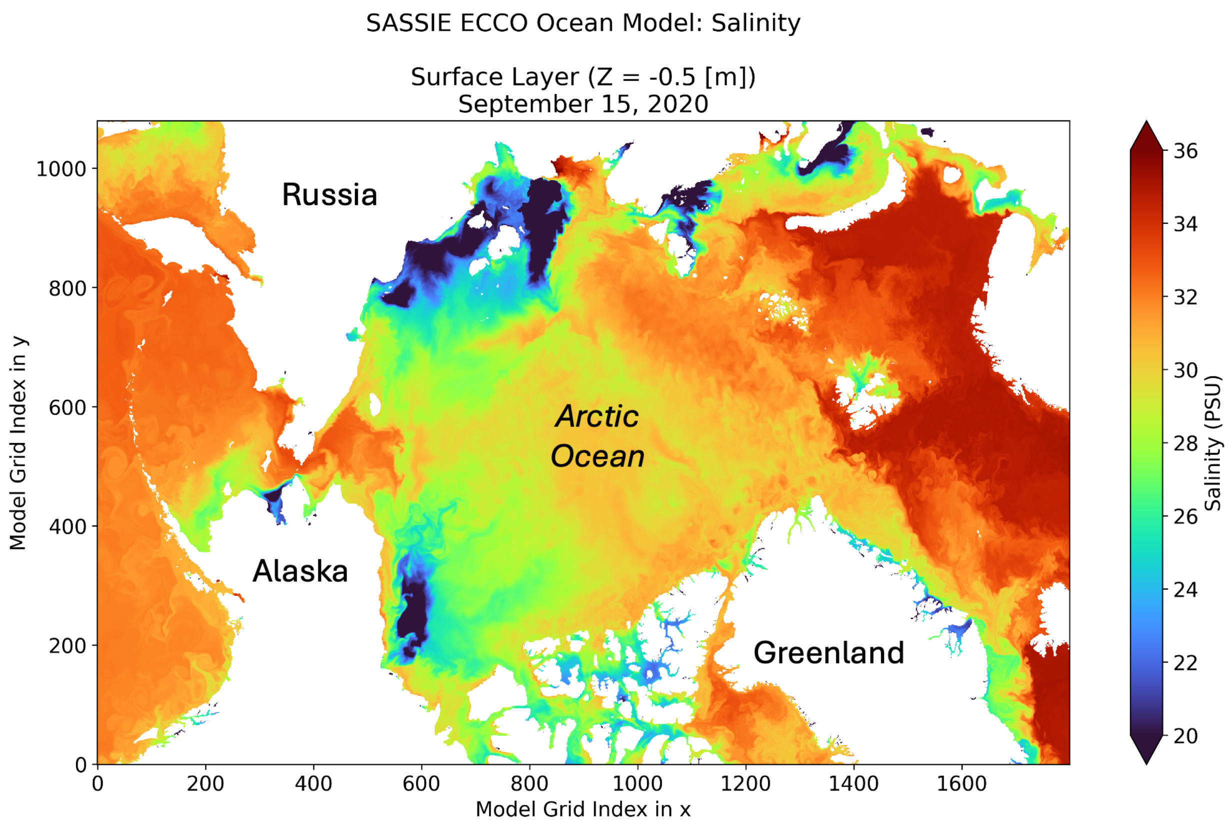

Figure 3. Example daily snapshot showing surface salinity for September 15, 2020 from the SASSIE ECCO ocean model.

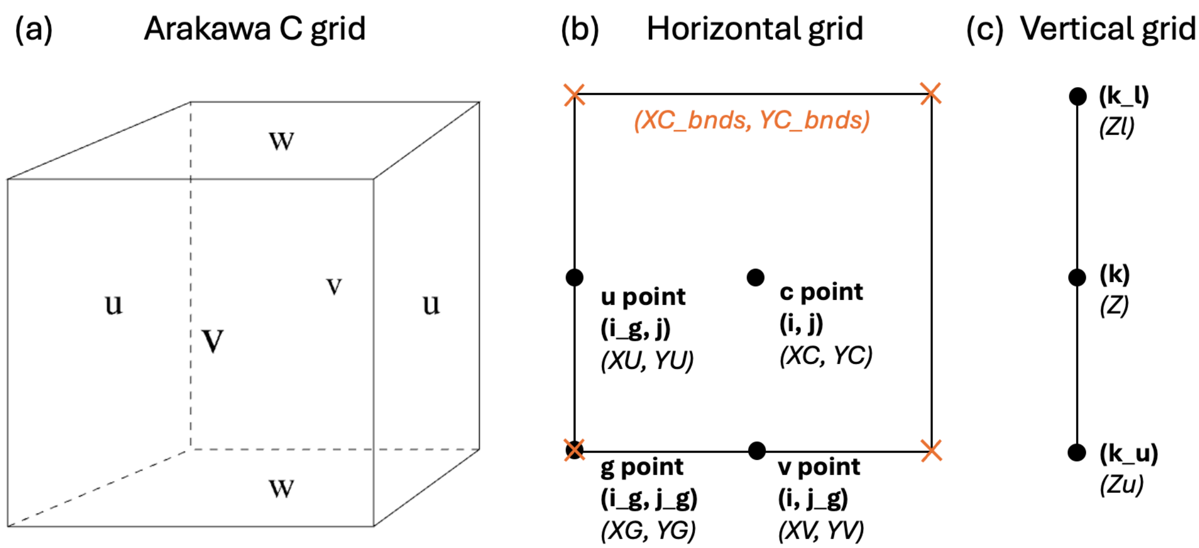

Figure 4. (a) Three-dimensional spacing of velocity components on the Arakawa C grid. The horizontal (b) and vertical (c) grids include dimension coordinates labeled with their corresponding geolocation coordinates (shown in italics).

The SASSIE ECCO model uses the same native grid geometry as MITgcm: a staggered Arakawa C grid (Figure 4). In this configuration, dimension coordinates are staggered in three-dimensional space within each grid cell. Tracer variables (e.g., temperature and salinity) are defined at the center of the grid cell (c point), while velocity and flux quantities are defined on the four lateral faces of the cell (u, v, and w points). Each dimension coordinate on the native model grid (e.g., *i, j, k*) is associated with a corresponding spatial latitude, longitude, and depth coordinate (e.g., *XC, YC, Z*). For additional information about the Arakawa C grid, see ECCO and MITgcm documentation (https://ecco-v4-python-tutorial.readthedocs.io/ECCO_v4_Coordinates_and_Dimensions_of_ECCOv4_NetCDF_files.html).

Each model dataset includes dimension coordinates with associated auxiliary spatial coordinates. All model geometric parameters are provided in the "Geometry" file (Short name: SASSIE_ECCO_L4_GEOMETRY_LLC1080GRID_V1R1). 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.

3 NetCDF File Format

All model fields are provided in netCDF-4 file format on the LLC native model grid. Appendix A and the accompanying text document "sassie-ecco_v1r1_nctiles_varlist.txt" provides a summary of all the netCDF collections and the data variables contained in each.

Each collection has a single netCDF file for each daily mean or monthly snapshot with the following file name formats, respectively:

[SHORT NAME]_day_mean_[YYYY-MM-DD]_SASSIE_ECCO_V1R1_native_llc1080.nc
[SHORT NAME]_month_snap_[YYYY-MM-DD]_SASSIE_ECCO_V1R1_native_llc1080.nc

Since model fields for the whole time series are large in size (individual 3D fields ~600 GB, 2D fields ~50 GB), it is highly recommended to access and work with these datasets in the cloud (e.g., Amazon Web Services EC2 instances).

Code used to process the LLC1080 binary output into the final 1800x1080 SASSIE domain in netCDF format is available at: https://github.com/NASA-SASSIE/SASSIE-model (see the "process model granules" directory).

4 Contact

For questions about access to the data product please email podaac@podaac.jpl.nasa.gov or visit the PO.DAAC forum. For questions about the data product itself please email Marie Zahn at marie.j.zahn@jpl.nasa.gov.

5 Citation

This research was conducted by the Jet Propulsion Laboratory, managed by the California Institute of Technology under a contract with the National Aeronautics and Space Administration. Use of these data should be cited as follows:

To cite a specific data collection (see Appendix A for dataset name and DOI):

> Zahn, M. J., M. Wood, I. Fenty, S. Fournier. 2026. **[INSERT DATASET NAME]**. V1R1. PO.DAAC, CA, USA. Dataset accessed **[YYYY-MM-DD]** at **[INSERT DATASET DOI LINK]**

To cite the model, inclusive of all data collections:

> Zahn, M. J., M. Wood, I. Fenty, S. Fournier. 2026. SASSIE ECCO llc1080 Coupled Sea Ice Ocean Model (Version 1 Release 1). PO.DAAC, CA, USA. Dataset accessed **[YYYY-MM-DD]** at https://doi.org/10.5067/SEL1D-DUG11

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7 Appendix A

Below are the variables in the SASSIE ECCO v1r1 output that can be downloaded as daily averages and monthly snapshots on the native LLC1080 grid. The supplemental file "sassie-ecco_v1r1_nctiles_varlist.txt" also provides the full list of collections and data variables. The format is as follows:

Dataset Name
Short Name
DOI: [DOI link]
Variable Name Description (units)

LIST OF SASSIE ECCO MODEL COLLECTIONS AND DATA VARIABLES:

SASSIE ECCO Ocean Bottom Pressure and Sea Surface Height - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_OBP_SSH_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-OBP11

ETAN	Model sea level anomaly, without corrections for global mean density changes, inverted barometer effect, or volume displacement due to submerged sea-ice and snow (m)
PHIBOT	Ocean hydrostatic bottom pressure anomaly (m^2/s^2)

SASSIE ECCO Atmosphere Surface Temperature, Humidity, and Wind - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_ATM_STATE_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-ATM11

EXFatemp	Atmosphere surface (2 m) air temperature (degK)
EXFaqh	Atmosphere surface (2 m) specific humidity (kg/kg)
EXFuwind	Wind speed at 10m in the model +x direction (m/s)
EXFvwind	Wind speed at 10m in the model +y direction (m/s)

SASSIE ECCO Ocean and Sea-Ice Surface Stress - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_STRESS_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-STR11

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, due to wind and sea-ice (N/m^2)
oceTAUY	Ocean surface stress in the model +y direction, due to wind and sea-ice (N/m^2)

SASSIE ECCO Ocean and Sea-Ice Surface Heat Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_HEAT_FLUX_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-HEA11

EXFhl	Open ocean air-sea latent heat flux, >0 increases theta (W/m^2)
EXFhs	Open ocean air-sea sensible heat flux, >0 increases theta (W/m^2)
EXFlwdn	Downward longwave radiative flux, >0 increases theta (W/m^2)
EXFswdn	Downwelling shortwave radiative flux, >0 increases theta (W/m^2)
EXFqnet	Open ocean net air-sea heat flux, >0 decreases theta (W/m^2)
oceQnet	Net heat flux into the ocean surface, >0 increases theta (W/m^2)
SIatmQnt	Net upward heat flux to the atmosphere, >0 decreases theta (W/m^2)
TFLUX	Rate of change of ocean heat content per m^2 accounting for mass (e.g. freshwater) fluxes, >0 increases theta (W/m^2)
EXFswnet	Open ocean net shortwave radiative flux, >0 decreases theta (W/m^2)
EXFlwnet	Net open ocean longwave radiative flux, >0 decreases theta (W/m^2)
oceQsw	Net shortwave radiative flux across the ocean surface, >0 increases theta (W/m^2)
WTHMASS	Vertical Mass-Weight Transport of Potential Temperature (degK m/s))
SIqnet	Ocean surface heat flux (turbulent and radiative) (W/m^2)
SIqsw	Ocean surface shortwave radiation (W/m^2)
SItflux	Rate of change of ocean heat content per m2 accounting for mass fluxes, including sea ice (W/m^2)
SIqneto	Open ocean part of ocean surface heat flux (SIqnet) (W/m^2)
SIqneti	Ice covered part of ocean surface heat flux (SIqnet) (W/m^2)

SASSIE ECCO Ocean and Sea-Ice Surface Freshwater Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_FRESH_FLUX_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-FRE11

EXFpreci	Precipitation rate, >0 decreases salinity (m/s)
EXFevap	Open ocean evaporation rate, >0 increases salinity (m/s)
EXFroff	River runoff, >0 decreases salinity (m/s)
EXFempmr	Open ocean net surface freshwater flux from precipitation, evaporation, and runoff, >0 increases salinity (m/s)
oceFWflx	Net freshwater flux into the ocean, >0 decreases salinity (kg/(m^2 s))
SIatmFW	Net freshwater flux from atmosphere & land (kg/(m^2 s))
SFLUX	Rate of change of total ocean salinity per m^2 accounting for mass fluxes, >0 increases salinity (g/(m^2 s))
WSLTMASS	Vertical Mass-Weight Transport of Salinity (g/kg m/s))
SIfwSubl	Potential sublimation freshwater flux (kg/m^2/s)
SIacSubl	Actual sublimation freshwater flux (kg/m^2/s)
SIrsSubl	Residual sublimation freshwater flux (kg/m^2/s)

SASSIE ECCO Sea-Ice and Snow Concentration, Thickness, and Velocity - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_SEA_ICE_CONC_THICK_VEL_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-ICO11

SIarea	Sea-ice concentration (fraction between 0 and 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)
SIuice	Sea-ice velocity in the model +x direction (m/s)
SIvice	Sea-ice velocity in the model +y direction (m/s)

SASSIE ECCO Sea-Ice and Snow Horizontal Volume and Area Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_SEA_ICE_VOL_AREA_FLUX_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-SIH11

ADVxHEFF	Lateral advective flux of sea-ice thickness in the model +x direction (m^3/s)
ADVyHEFF	Lateral advective flux of sea-ice thickness in the model +y direction (m^3/s)
ADVxSNOW	Lateral advective flux of snow thickness in the model +x direction (m^3/s)
ADVySNOW	Lateral advective flux of snow thickness in the model +y direction (m^3/s)
ADVxAREA	Lateral advective flux of sea-ice area in the model +x direction (m^2/m^2 m^2/s)
ADVyAREA	Lateral advective flux of sea-ice area in the model +y direction (m^2/m^2 m^2/s)

SASSIE ECCO Sea-Ice and Snow Horizontal Volume and Area Tendencies - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_SEA_ICE_VOL_AREA_TEND_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-ICH11

SIdAbATO	Potential sea ice concentration rate of change by open ocean atmospheric flux (m^2/m^2/s)
SIdAbATC	Potential sea ice concentration rate of change by atmospheric flux over ice (m^2/m^2/s)
SIdAbOCN	Potential sea ice concentration rate of change by ocean-ice flux (m^2/m^2/s)
SIdA	Net sea ice concentration rate of change (m^2/m^2/s)
SIheffPT	Area-averaged sea-ice thickness (SIheff) preceeeding thermodynamic growth/melt (m)
SIhsnoPT	Area-averaged snow thickness (SIhsnow) preceeeding thermodynamic growth/melt (m)

SASSIE ECCO KPP Boundary Layer Depth - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_KPP_BOUNDARY_LAYER_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-HBL11

KPPhbl	KPP boundary layer depth, bulk Ri criterion (m)

SASSIE ECCO Ocean Velocity - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_OCN_VEL_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-OVE11

UVEL	Horizontal velocity in the model +x direction (m/s)
VVEL	Horizontal velocity in the model +y direction (m/s)
WVEL	Vertical velocity (m/s)

SASSIE ECCO Ocean Temperature and Salinity - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_TEMP_SALINITY_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-OTS11

THETA	Potential temperature, i.e., temperature of water parcel at sea level pressure (degC)
SALT	Salinity (1e-3, or parts per thousand)

SASSIE ECCO Ocean Density and Hydrostatic Pressure - Daily Mean llc1080 Grid (Version 1 Release 1)

Short Name: SASSIE_ECCO_L4_DENS_PRESS_LLC1080GRID_DAILY_V1R1

DOI: https://doi.org/10.5067/SEL1D-ODE11

RHOAnoma	In-situ seawater density anomaly (kg/m^3)
PHIHYD	Ocean hydrostatic pressure anomaly (m^2/s^2)

SASSIE ECCO Ocean Three-Dimensional Volume Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)

Short Name: SASSIE_ECCO_L4_OCN_3D_VOL_FLUX_LLC1080GRID_DAILY_V1R1

DOI: https://doi.org/10.5067/SEL1D-3VF11

UVELMASS	Horizontal velocity in the model +x direction per unit area of the grid cell 'u' face (m/s)
VVELMASS	Horizontal velocity in the model +y direction per unit area of the grid cell 'v' face (m/s)
WVELMASS	Grid cell face-averaged vertical velocity in the model +z direction (m/s)

SASSIE ECCO Ocean Three-Dimensional Potential Temperature Advective Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)

Short Name: SASSIE_ECCO_L4_OCN_3D_TEMP_ADV_FLUX_LLC1080GRID_DAILY_V1R1

DOI: https://doi.org/10.5067/SEL1D-3TA11

ADVx_TH	Lateral advective flux of potential temperature in the model +x direction (degC m^3/s)
ADVy_TH	Lateral advective flux of potential temperature in the model +y direction (degC m^3/s)
ADVr_TH	Vertical advective flux of potential temperature (degC m^3/s)

SASSIE ECCO Ocean Three-Dimensional Potential Temperature Diffusive Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)

Short Name: SASSIE_ECCO_L4_OCN_3D_TEMP_DIFF_FLUX_LLC1080GRID_DAILY_V1R1

DOI: https://doi.org/10.5067/SEL1D-3TD11

DFrI_TH	Vertical diffusive flux of potential temperature, implicit term (degC m^3/s)
KPPg_TH	KPP non-local flux of potential temperature (degC m^3/s)

SASSIE ECCO Ocean Three-Dimensional Salinity Advective Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)

Short Name: SASSIE_ECCO_L4_OCN_3D_SALINITY_ADV_FLUX_LLC1080GRID_DAILY_V1R1

DOI: https://doi.org/10.5067/SEL1D-3SA11

ADVx_SLT	Lateral advective flux of salinity in the model +x direction (1e-3 m^3/s)
ADVy_SLT	Lateral advective flux of salinity in the model +y direction (1e-3 m^3/s)
ADVr_SLT	Vertical advective flux of salinity (1e-3 m^3/s)

SASSIE ECCO Ocean Three-Dimensional Salinity Diffusive Fluxes - Daily Mean llc1080 Grid (Version 1 Release 1)

Short Name: SASSIE_ECCO_L4_OCN_3D_SALINITY_DIFF_FLUX_LLC1080GRID_DAILY_V1R1

DOI: https://doi.org/10.5067/SEL1D-3SD11

DFrI_SLT	Vertical diffusive flux of salinity, implicit term (1e-3 m^3/s)
KPPg_SLT	KPP non-local flux of salinity (g/kg m^3/s)

SASSIE ECCO KPP Mixing Diagnostics - Daily Mean llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_KPP_DIAGS_LLC1080GRID_DAILY_V1R1
DOI: https://doi.org/10.5067/SEL1D-KPP11

KPPdiffS	Vertical diffusion coefficient for salt & tracers (m^2/s)
KPPviscA	KPP vertical eddy viscosity coefficient (m^2/s)
KPPghatK	Ratio of KPP non-local (salt) flux relative to surface-flux (unitless)
KPPRi	Bulk Richardson number (unitless)
KPPdVsq	Shear relative to surface (V(ksrf)-V(k))**2 (m^2/s^2)

SASSIE ECCO Ocean Bottom Pressure and Sea Surface Height - Snapshot llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_OBP_SSH_LLC1080GRID_SNAPSHOT_V1R1
DOI: https://doi.org/10.5067/SEL1S-OBP11

ETAN	Model sea level anomaly, without corrections for global mean density changes, inverted barometer effect, or volume displacement due to submerged sea-ice and snow (m)
PHIBOT	Ocean hydrostatic bottom pressure anomaly (m^2/s^2)

SASSIE ECCO Sea-Ice and Snow Concentration, Thickness, and Velocity - Snapshot llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_SEA_ICE_CONC_THICK_VEL_LLC1080GRID_SNAPSHOT_V1R1
DOI: https://doi.org/10.5067/SEL1S-ICO11

SIarea	Sea-ice concentration (fraction between 0 and 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)
SIuice	Sea-ice velocity in the model +x direction (m/s)
SIvice	Sea-ice velocity in the model +y direction (m/s)

SASSIE ECCO Ocean Temperature and Salinity - Snapshot llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_TEMP_SALINITY_LLC1080GRID_SNAPSHOT_V1R1
DOI: https://doi.org/10.5067/SEL1S-OTS11

THETA	Potential temperature, i.e., temperature of water parcel at sea level pressure (degC)
SALT	Salinity (1e-3, or parts per thousand)

SASSIE ECCO Geometry Parameters - llc1080 Grid (Version 1 Release 1)
Short Name: SASSIE_ECCO_L4_GEOMETRY_LLC1080GRID_V1R1
DOI: https://doi.org/10.5067/SEL1S-GEO11

CS	Cosine of tracer grid cell orientation vs geographical north
SN	Sine of tracer grid cell orientation vs geographical north
rAc	Area of tracer grid cell (m^2)
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 (m^2)
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 (m^2)

rAs	Area of 'u' grid cell (m^2)
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 (m^2/s^2)
PHrefF	Reference ocean hydrostatic pressure at tracer grid cell top/bottom interface (m^2/s^2)
hFacC	Vertical open fraction of tracer grid cell
hFacW	Vertical open fraction of tracer grid cell 'west' face
hFacS	Vertical open fraction of tracer grid cell 'south' face
maskC	Wet/dry boolean mask for tracer grid cell
maskW	Wet/dry boolean mask for 'west' face of tracer grid cell
maskS	Wet/dry boolean mask for 'south' face of tracer grid cell
mask_basin	0/1 land-ocean mask with filled wet grid cells that are not connected to ocean