# Quicklook Arctic Weekly EASE-Grid Sea Ice Motion Vectors, Version 1

## USER GUIDE

**How to Cite These Data**

As a condition of using these data, you must include a citation:

Tschudi, M., W. N. Meier, and J. S. Stewart. 2019. *Quicklook Arctic Weekly EASE-Grid Sea Ice Motion Vectors, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/O0XI8PPYEZJ6. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0748

National Snow and Ice Data Center

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# 1 DATA DESCRIPTION

NOTE: This data set is the Quicklook version of the (final) *Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors* data set. It is designed to fill the gap between annual updates of the final Sea Ice Motion product and the present.

## 1.1 Parameters

The main parameter for this data set is weekly sea ice motion (cm/s). Sea ice motion is divided into along-x (u) and along-y (v) components.

## 1.2 File Information

### 1.2.1 Format

Data are provided in georeferenced netCDF (.nc) format.
PNG (.png) browse images are also included.

### 1.2.2 File Contents

Weekly sea ice motion netCDF file contents are described in Table 1 and represented in Figure 1.

Table 1. Summary of Quicklook Weekly Sea Ice Motion File Contents

| Variable | Description | Units |
|---|---|---|
| u | Along-x component of the sea ice motion (not the eastward velocity) | cm/s |
| v | Along-y component of the sea ice motion (not the northward velocity) | cm/s |
| number_of_observations | Number of contributing files | N/A |
| latitude | Latitude | ° N |
| longitude | Longitude | ° E |
| crs | Coordinate reference system (e.g. EASE-Grid North 25 km) | N/A |
| x | X coordinate | Projected meters |
| y | Y coordinate | Projected meters |
| time | Time of measurement, i.e. the start of the week for this data field | Date |

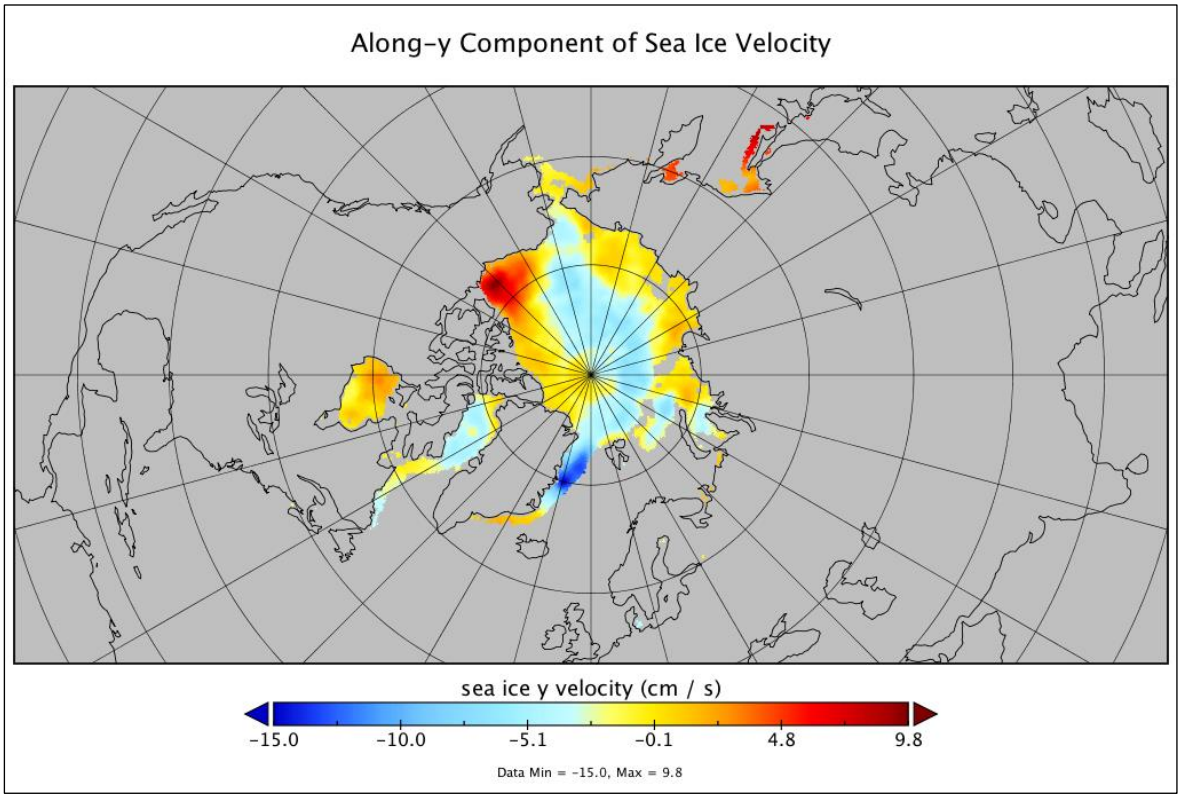


Figure 1. Sample of daily along-y component of sea ice motion from 01 January 2019. Figure produced in the netCDF-visualization software Panoply.

### 1.2.3 Browse Image File Contents

One browse image displaying weekly sea ice motion is provided for every week of data. Figure 2 contains a sample browse image.

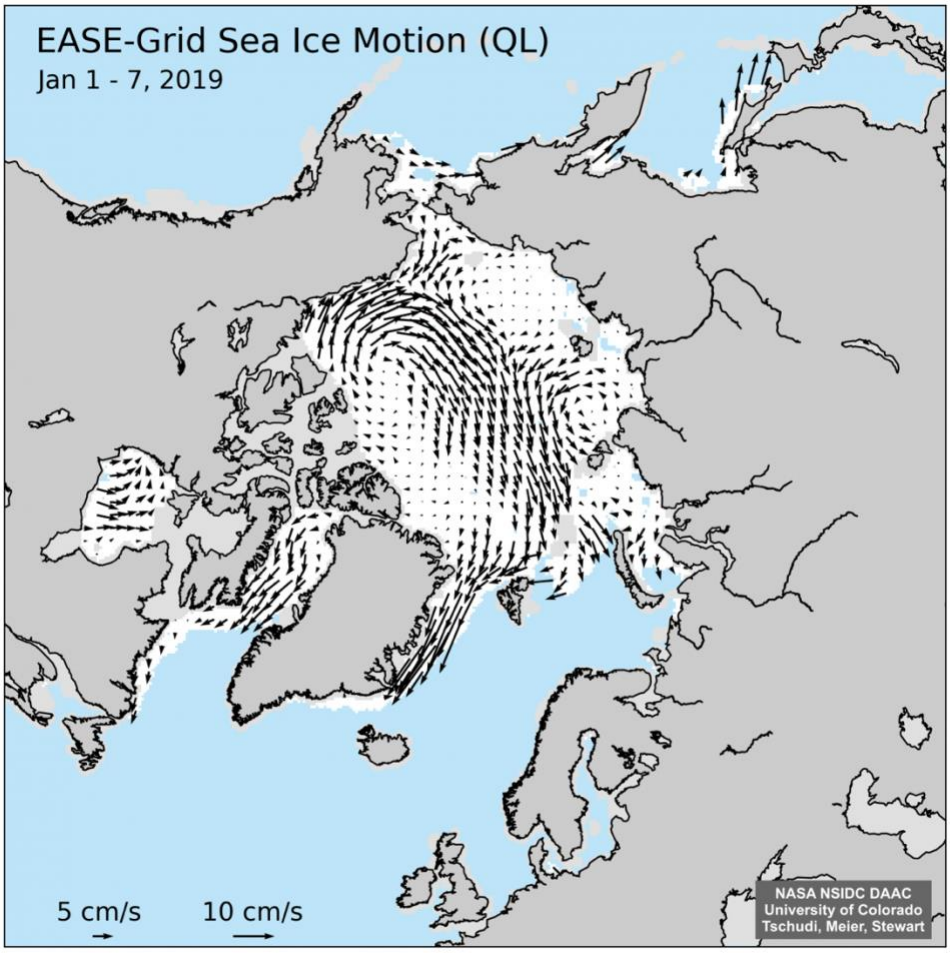


Figure 2. Sample browse image displaying sea ice motion for the week of 01 January to 07 January 2019.

### 1.2.4 Directory Structure

Data are available for download via HTTPS; the link is accessible through the "Download Data" tab.

### 1.2.5 Naming Convention

The data files are named according to the following convention and as described in Table 2:

`icemotion_weekly_hh_rrrr_<start-date>_<end-date>_ql.ext`

Example:

```
icemotion_weekly_nh_25km_20190101_20190415_ql.nc
icemotion_weekly_nh_25km_20190101_20190107_ql.png
```

Table 2. Data File Naming Convention

| Variable | Description |
|---|---|
| weekly | Indicates that the file contains weekly sea ice motion vectors |
| hh | Hemisphere (nh = Northern, sh = Southern) |
| rrrr | Resolution of data (e.g. 25 km) |
| <start-date> | First day of data coverage, in 4-digit year, 2-digit month, 2-digit day format |
| <end-date> | Last day of data coverage, in 4-digit year, 2-digit month, 2-digit day format |
| ql | Indicates that the file is part of the *Quicklook Arctic Weekly EASE-Grid Sea Ice Motion Vectors* product |
| ext | Extension; .nc for netCDF file or .png for browse images |

### 1.2.6 File Size

The netCDF file size varies, from approximately 0.5 to 20.0 MB, depending on how many weeks of data are included in the file.

Browse images are approximately 0.5 - 2.0 MB.

## 1.3 Spatial Information

### 1.3.1 Coverage

Weekly sea ice motion data are gridded on the Northern and Southern polar EASE Grids, as illustrated in Figure 3.

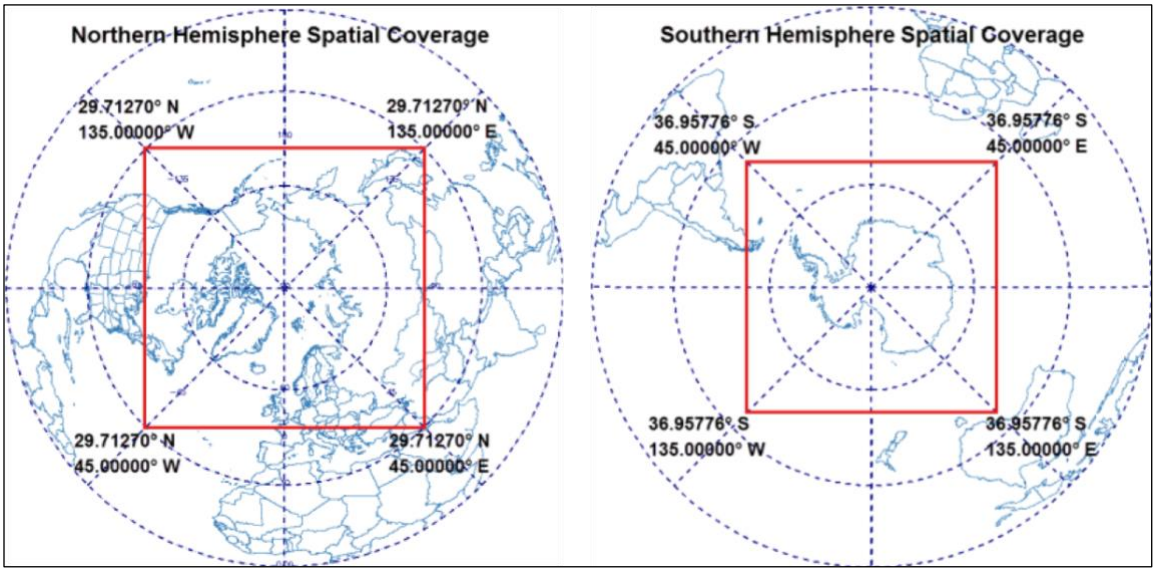


Figure 3. Spatial coverage map for the Northern Hemisphere (left) and Southern Hemisphere (right).

### 1.3.2 Resolution

Weekly sea ice motions are provided at a resolution of 25 km.

### 1.3.3 Geolocation

Data utilize the Northern and Southern 25 km EASE-Grid projections, details of which are described in the tables below. More details on EASE-Grid can be found on the EASE Grids website.

Table 3. Geolocation Details for the Northern EASE-Grid

| | |
|---|---|
| **Geographic coordinate system** | N/A |
| **Projected coordinate system** | NSIDC EASE-Grid North |
| **Longitude of true origin** | 0 |
| **Latitude of true origin** | 90 |
| **Scale factor at longitude of true origin** | N/A |
| **Datum** | N/A |
| **Ellipsoid/spheroid** | International 1924 Authalic Sphere |
| **Units** | meter |
| **False easting** | 0 |
| **False northing** | 0 |
| **EPSG code** | 3408 |
| **PROJ4 string** | +proj=laea +lat_0=90 +lon_0=0 +x_0=0 +y_0=0 +a=6371228 +b=6371228 +units=m +no_defs |
| **Reference** | http://epsg.io/3408 |

Table 4. Grid Details for the Northern EASE-Grid

| | |
|---|---|
| **Grid cell size (x, y pixel dimensions)** | 25067.5 projected meters (x)<br>25067.5 projected meters (y) |
| **Number of rows** | 361 |
| **Number of columns** | 361 |
| **Geolocated lower left point in grid** | 29.71270° N, 45.00000° W |
| **Nominal gridded resolution** | 25 km by 25 km |
| **Grid rotation** | N/A |
| **ulxmap – x-axis map coordinate of the outer edge of the upper-left pixel** | -4524683.8 |
| **ulymap – y-axis map coordinate of the outer edge of the upper-left pixel** | +4524683.8 |

Table 5. Geolocation Details for the Southern EASE-Grid

| | |
|---|---|
| **Geographic coordinate system** | N/A |
| **Projected coordinate system** | NSIDC EASE-Grid South |
| **Longitude of true origin** | 0 |
| **Latitude of true origin** | 90 |
| **Scale factor at longitude of true origin** | N/A |
| **Datum** | N/A |
| **Ellipsoid/spheroid** | International 1924 Authalic Sphere |
| **Units** | Meter |
| **False easting** | 0 |
| **False northing** | 0 |
| **EPSG code** | 3409 |
| **PROJ4 string** | +proj=laea +lat_0=-90 +lon_0=0 +x_0=0 +y_0=0 +a=6371228 +b=6371228 +units=m +no_defs |
| **Reference** | http://epsg.io/3409 |

Table 6. Grid Details for the Southern EASE-Grid

| | |
|---|---|
| **Grid cell size (x, y pixel dimensions)** | 25067.5 projected meters (x)<br>25067.5 projected meters (y) |
| **Number of rows** | 321 |
| **Number of columns** | 321 |
| **Geolocated lower left point in grid** | 36.95776° S, 135.00000° W |
| **Nominal gridded resolution** | 25 km by 25 km |
| **Grid rotation** | N/A |
| **ulxmap – x-axis map coordinate of the outer edge of the upper-left pixel** | -4023333.8 |
| **ulymap – y-axis map coordinate of the outer edge of the upper-left pixel** | +4023333.8 |

## 1.4 Temporal Information

### 1.4.1 Coverage

Data coverage varies and changes with time. This data set begins the week after the last day of data in the *Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors, Version 4* product and is extended approximately monthly. When the *Polar Pathfinder Daily 25 km EASE-Grid Sea Ice*

*Motion Vectors* data set is extended, this quicklook product is updated at the same time, or shortly afterwards, so that the two data sets do not overlap.

The current coverage begins 01 January 2020.

### 1.4.2 Resolution

Weekly

# 2 DATA ACQUISITION AND PROCESSING

## 2.1 Background

This data set is the quicklook version of the *Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors, Version 4* data set. Users should refer to the *Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors, Version 4* user guide for more information.

## 2.2 Acquisition

This data product is derived from four input data sources, described below.

### 2.2.1 Buoy Input Data

This input data derived sea ice motion vectors from International Arctic Buoy Program (IABP) C buoy position data. IABP provides buoy location information through satellite tracking of buoys placed on sea ice. Several buoy locations are determined each day and corresponding sea ice motions are calculated. Sea ice motion estimates from buoys are very accurate, but they are limited since the numbers and locations of buoys are driven by cost and logistics. In addition, buoys have not been placed on ice in the Eastern Arctic.

IABP buoy locations are generally provided every 12 hours: at noon and at midnight Greenwich Mean Time (GMT). This sea ice motion product uses 24-hour motion estimates from the IABP. For example, the IABP motion estimate for a buoy at noon on 01 January 2010 is derived by taking the difference of the buoy's location at noon on 02 January 2010 and its location at noon on 01 January 2010 and then dividing by 24 hours. The intervening midnight location value is not factored into the noon-to-noon 24-hour motion estimate. Similarly, the IABP motion estimate for midnight is calculated the same way, ignoring the intervening noon location information. Therefore, each buoy generally has two independent, 24-hour motion estimates: one for midnight and one for noon. The noon-time and midnight buoy vectors were averaged together to provide one buoy-derived sea ice motion per day.

For more information the buoy input data, please refer to Brown and Kerut (1978) or the IABP website.

### 2.2.2 NCEP/NCAR Wind Input Data

This input data derived sea ice motion vectors from the NCEP/NCAR Reanalysis wind data set. The data, called U-wind and V-wind at 10 m, are available from the NOAA Earth System Research Laboratory (ESRL) Physical Sciences Division (PSD).

For more information on the NCEP/NCAR input data, please refer to Kistler et al. (2000).

### 2.2.3 Passive Microwave Input Data

The passive microwave input data come from two different passive microwave products, both available for download from the National Snow and Ice Data Center Distributed Active Archive Center (NSIDC DAAC). Sea ice concentration inputs, used to mask areas of “ice” and “no ice,” come from the Near-Real-Time DMSP SSMIS Daily Polar Gridded Sea Ice Concentrations, Version 1 data set. Brightness temperature inputs, used to estimate sea ice motion, come from the Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures, Version 1 data set. Both the sea ice concentration and brightness temperature data are derived from passive microwave sensors. For more information on these sensors, users should refer to the SMMR, SSM/I, and SSMIS Sensors Summary.

## 2.3 Processing

Note: The general processing steps for this data set mirror those of the Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors, Version 4 data set and are described below.

1. **Compute the Sea Ice Motion Fields**
   A sea ice mask, derived from Near-Real-Time DMSP SSMIS Daily Polar Gridded Sea Ice Concentrations, Version 1 data set, is used to restrict all independent sea ice motion estimates to ice-covered ocean. Detailed information about the methods used to compute sea ice motion from input data sources can be found on the Measuring Sea Ice Motion from Various Sources document.
2. **Grid the Input Data to the 25 km EASE-Grid**
   Each of the input sea ice motion estimates are mapped to the output grid (e.g. Northern Hemisphere 25 km EASE-Grid).
3. **Merge the Sea Ice Motion Fields**
   Input sea ice motion estimates are combined to produce the daily sea ice motion product. Daily sea ice motion is a source- and distance-weighted optimal interpolation of the 15 highest-weighted input sea ice motion vectors. See Tschudi et al. (2019) for more details.
4. **Calculate Daily Error Values**

The input vectors from the individual input sources (NCEP/NCAR, SSM/I, SSMIS, SMMR, AMSR-E, and AVHRR) are weighted separately based upon cross-correlations with buoy vectors. The optimal interpolation uses these weights, along with their distances from the location being estimated, to obtain the final error variance. If the closest input vector was greater than 1250 km, then a value of 1000 is added to this variable. Because interpolation was applied to a surface map from passive microwave data, coastlines may contain false ice. In this case, the third variable was assigned a negative value to allow users to remove these vectors near coastlines (within 25 km). For example, a value of -1035 indicates all of the following conditions: the vector was near a coastline, the nearest sampled vector was further than 1250 km, and the vector had a standard deviation (σ) of 3.5 and an estimated error variance ($\sigma^2$) of 12.25.

5. **Compute Weekly Fields**
   Weekly sea ice motion was computed from the daily gridded sea ice motion data for both the northern and southern polar regions. Weekly sea ice motion is an average of all the daily sea ice motions calculated for that week. At least four out of seven days were needed to compute the weekly mean.

## 2.4 Quality, Errors, and Limitations

### 2.4.1 Data Quality

The *number_of_observations* field provides a means of characterizing data quality. The more days that contributed to calculating the weekly sea ice motion vector in a given grid cell, the higher the data quality.

### 2.4.2 Limitations

The passive-microwave-derived sea ice motion estimates are based on changes in brightness temperatures over consecutive days. The methods used to generate these input vectors requires fairly large areas of open ocean. As a result, ice motion cannot be calculated in regions of mixed land and ocean coverage, such as the Canadian Archipelago. The absence of sea ice motion estimates in such locations does not imply the absence of ice in these locations. Near-coast ocean grid cells where no ice age is calculated is encoded with a value of 21 in the data field, to distinguish it from land-covered grid cells, which have a value of 20.

# 3 RELATED DATA SETS

Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors
EASE-Grid Sea Ice Age
Quicklook Arctic Weekly EASE-Grid Sea Ice Age

# 4 CONTACTS AND ACKNOWLEDGMENTS

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# 5 REFERENCES

Brown, W. P. and E. G. Kerut. 1978. Air droppable RAMS (ADRAMS) buoys. *AIDJEX Bulletin,* 40, 21-29.

Kistler, R., William C., Suranjana S., Glenn W., John W., Eugenia K., Muthuvel C., et al. 2001. The NCEP–NCAR 50–Year Reanalysis: Monthly Means CD–ROM and Documentation. *Bulletin of the American Meteorological Society* 82 (2): 247–67. doi:10.1175/1520-0477(2001)082<0247:TNNYRM>2.3.CO;2.

Tschudi, M.A., W.N. Meier, and J.S. Stewart, 2020. An enhancement to sea ice motion and age products at the National Snow and Ice Data Center (NSIDC). *The Cryosphere*, 14,1519-1536. https://doi.org/10.5194/tc-14-1519-2020

# 6 DOCUMENT INFORMATION

## 6.1 Publication Date

11 March 2019

## 6.2 Date Last Updated

30 September 2020