

DATASHEET: Arctic Sea Ice Annual September Minimum (1979-2022) Dataset

INTRODUCTION

Dataset Name
Arctic Sea Ice Annual September Minimum in millions of square kilometers (1979-2022)
Datasheet Author
NASA Office of STEM Engagement Note: This datasheet follows the format of the Educator-Facing Datasheet for Derivative Datasets .
Date Datasheet Created
May 2023
Context
<p>This dataset shows annual changes in Arctic sea ice minimum extent from 1979-2022. Sea ice pertains to the study of frozen seawater over the ocean surface. Since 1979, a collection of different satellites (Nimbus 7 (1978-1987) and the Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP) series (1987-present)) has provided a continuous, nearly complete record of Earth's sea ice cover.</p> <p>Sea ice forms in the cold winter months, when seawater freezes into massive blocks of floating ice, then partially melts away in the warm summer months. This cycle repeats every year. In the Arctic, sea ice reaches its maximum extent in March and its minimum extent in September. Scientists can only understand how sea ice is changing by comparing current conditions to long-term averages.</p> <p>Scientists monitor global change through the long-term measurement of sea ice. Sea ice plays an important role in reflecting sunlight back into space, regulating ocean and air temperature, circulating ocean water, and maintaining animal habitats.</p> <p>Global Climate Change: Vital Signs of the Planet: Arctic Sea Ice Minimum Extent Five Facts to Help you Understand Sea Ice Earth Observatory: Sea Ice</p>

1. ORIGIN

Where can the original dataset be found?
National Snow and Ice Data Center Select "Monthly sea ice average extent and area, and rankings" for .xls file. Documentation for Source Data

Users are referred back to the original dataset for the most recent values. The original dataset is duplicated as a tab in "Sept_Arctic_Sealce.xls"

2. METADATA

Column Name	Description
year	4-digit year
month	All rows use 9 for the month of September.
extent (million km ²)	Extent of Arctic sea ice in millions of square kilometers (million km ²). Sea ice extent is the integral sum of the areas of all grid cells (pixel) with at least 15% ice concentration. The value shown is the average of daily observations across the month of September as measured from satellites.
area (million km ²)	Area of Arctic sea ice in millions of square kilometers (million km ²). Sea ice area is the integral sum of the product of ice concentration and area of all grid cells (pixel) with at least 15% ice concentration. The value shown is the average of daily observations across the month of September as measured from satellites.

3. MOTIVATION

For what purpose was the original dataset created?
To create a climate data record of how Arctic sea ice is changing over time.
For what purpose was the derived dataset created?
To simplify the dataset to serve as an entry point for data analysis of Earth system datasets for the K-12 classroom.
Who created the original dataset?
National Snow and Ice Data Center (NSIDC)
Who created the derived dataset?
NASA Office of STEM Engagement
Who funded the creation of the original dataset?
National Snow and Ice Data Center (NSIDC)
Who funded the creation of the derived dataset?
National Aeronautics and Space Administration (NASA)

4. COMPOSITION

What does a row in the dataset represent?

Daily observations of sea ice extent and sea ice area in the Arctic Ocean averaged over the month of September.

How many rows are in the dataset, in total?

44 rows for the 1979-2022 record. Dataset is updated annually.

Does the dataset contain all possible rows or is it a sample of rows from a larger dataset?

All possible rows

If it's a sample, describe your sampling process (random, weighted, etc). Is the sample representative of the larger set (e.g., geographic coverage)?

n/a

5. DERIVATION PROCESS

Who was involved in the data derivation process and how were they compensated?

NASA Office of STEM Engagement

What processes (e.g. cleaning, filtering, labeling) did the derivation process perform?

Columns of statistical and other data were removed from the original dataset so all that remains is the year, month, sea ice extent and sea ice area.

If software was used to perform the derivation, is it available? If so, please point to a link or other access point.

n/a

What information was removed or transformed during derivation that might influence the findings of an analysis (e.g., deleting rows due to missing data, a sampling mechanism that over-samples from a particular group, etc.)?

n/a

6. USES

Are there real-world applications of the dataset that an educator should be aware of?

- Scientific studies to monitor sea ice variability and trends.
- Advance scientific understanding of the Earth's climate system.
- Improve climate models and the ability to predict changes to the Earth's climate system.
- Study of wildlife habitat, ecology, and conservation in the Arctic region.
- Ship navigation in polar seas.

7. EDUCATOR'S GUIDE

Are there recommended subsets to be explored?

NASA studies long term trends and interannual variability in sea ice. All data points are needed to compile a comprehensive time series to better understand these phenomena.
Are there outliers or unusual observations to be pointed out?
Arctic sea ice extent fell at or below 4.0 million square kilometers (1.54 million square miles) in 2012 and 2020. https://earthobservatory.nasa.gov/images/147306/arctic-sea-ice-reaches-second-lowest-extent
Are there any correlations in the derivative dataset to be pointed out?
Correlation between sea ice extent and sea ice area.
Does the data embody any computing or statistical learning goals (e.g., columns have a particular skew, correlations demonstrate Simpson's Paradox, etc.)?
n/a
What potential threats to validity would be worth discussing?
n/a
Suggestions for student activities
<ul style="list-style-type: none"> • Rank the years according to amount of sea ice to see if there are any patterns emerging. • Calculate the rate of decadal decrease of sea ice extent and/or area for the entire dataset. • Compare rate of change in sea ice for 1979-2000 compared to 2000-2021 or per decade.
Additional Datasets
<ul style="list-style-type: none"> • NS&IDC Arctic Sea Ice New & Analysis: Sea_Ice_Index_Monthly_Data_with_Statistics_G02135_v3.0-2 contains sea ice extent and sea ice area monthly averages for both the Arctic and Antarctic.