
My NASA Data - Lesson Plans

How to Calculate Sea Ice Changes Videos

Grade Band

- 3-5
- 6-8
- 9-12

Sphere(s)

- [Cryosphere](#)

Phenomenon

- [Changes in Snow and Ice Extent](#)

NGSS Disciplinary Core Ideas

- [ESS2A: Earth Materials and Systems](#)

Science and Engineering Practices

- [Asking Questions and Defining Problems](#)
- [Developing and Using Models](#)
- [Analyzing and Interpreting Data](#)
- [Using Mathematics and Computational Thinking](#)

NGSS Crosscutting Concepts

- [Scale, Proportion, and Quantity](#)
- [Stability and Change](#)

NGSS Performance Expectation

- [MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.](#)
- [MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.](#)
- [HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.](#)

Common Core Math

- [CC.4.MD.4 Represent and interpret data. Make a line plot to display a data set of measurements in fractions of a unit \(\$\frac{1}{2}\$, \$\frac{1}{4}\$, \$\frac{1}{8}\$ \). Solve problems involving addition and subtraction of fractions by using information presented in line plots. For example](#)
- [CC.5.MD.2 Represent and interpret data. Make a line plot to display a data set of measurements in fractions of a unit \(\$\frac{1}{2}\$, \$\frac{1}{4}\$, \$\frac{1}{8}\$ \). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example,](#)
- [CC.6.RP.3c Find a percent of a quantity as a rate per 100 \(e.g., 30% of a quantity means \$\frac{30}{100}\$ times the quantity\); solve problems involving finding the whole given a part and the percent.](#)
- [CC.6.SP.5 Summarize and describe distributions. Summarize numerical data sets in relation to their context.](#)
- [CC.9-12.S.ID.1 Summarize, represent, and interpret data on a single count or measurement variable. Represent data with plots on the real number line \(dot plots, histograms, and box plots\).*](#)
- [CC.9-12.S.ID.2 Summarize, represent, and interpret data on a single count or measurement variable. Use statistics appropriate to the shape of the data distribution to compare center \(median, mean\) and spread \(interquartile range, standard deviation\) of tw](#)
- [CC.9-12.S.ID.3 Summarize, represent, and interpret data on a single count or measurement variable. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points \(outliers\).*](#)
- [CC.9-12.S.ID.4 Summarize, represent, and interpret data on a single count or measurement variable. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data s](#)
- [CC.9-12.S.ID.4 Summarize, represent, and interpret data on a single count or measurement variable. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data s](#)

Related Resources

- [Calculating Sea Ice Coverage](#)
- [Determining Trends in Yearly Average Sea Ice Extents](#)
- [Determining Trends in Sea Ice Extent Monthly Derivations](#)

Key Vocabulary

- [linear fit](#)
- [trend](#)
- [Average](#)
- [percent](#)
- [line graph](#)
- [line plot](#)
- [best fit line](#)
- [deviation](#)

Purpose

This series of videos highlights how NASA Climate Scientists use mathematics to solve everyday problems. These educational videos illustrate how math is used in satellite data analysis. The videos, filmed at NASA's Goddard Space Flight Center in Greenbelt, Maryland, feature senior climate scientist Claire Parkinson. In the videos, Parkinson explains how the Arctic and Antarctic sea ice covers are measured from satellite data and how math is used to determine trends in the data.

"These videos are for people interested in understanding something about how scientists use satellite data to learn about changes in the Earth system, especially changes in sea ice coverage," Parkinson said.

Learning Objectives

- This video showcases how scientists use percents and line plots to interpret distribution of sea ice.

Essential Questions

- How do scientists know that sea ice has changed?
- How does sea ice change over the seasons throughout the year?
- How does sea ice change over the scale of years?
- How is math used as a tool to understand these patterns?

Technology Requirements

- Teacher computer/projector only

Background Information

NASA controls more than 17 Earth-observing satellites. Some collect data about sea ice coverage in various areas around the world. Scientists use this information to compare the ice covers over time and to calculate trends.

"The satellite data have given us a tremendous record of sea ice changes since the late 1970s," Parkinson said. "In the Arctic, sea ice coverage has declined significantly; but in the Antarctic, sea ice coverage has actually increased somewhat, although by much less than the decreases in the Arctic."

Parkinson said math is not only used to analyze sea ice concentrations. "One of the amazing aspects of math is how widely it can be applied," she said. "The same techniques shown in the videos for sea ice coverage can be used in all sorts of applications, not just in Earth sciences but in a wide range of studies."

Parkinson has been a climatologist at Goddard for 36 years. She authored a number of books on climate and developed a computer model of sea ice. Parkinson primarily researches polar sea ice and how the changes in sea ice relate to broader issues of global climate change.

Procedure

Video 1: Calculating Sea Ice Coverage

Key ideas:

- Percent aerial coverage of sea ice (A.K.A. sea ice concentration)
- Line graphs (plots) of the percent of sea ice over seasonal cycles.

Video 2: Determining Trends in Yearly Average Sea Ice Extents <https://youtu.be/5ZpIZ2i0qCQ>**Key ideas:**

- Use plots to interpret trends to ask how has sea ice has changed over time
- Create yearly averages
- Apply linear least squares fit line (best fit line)

Video 3: Determining Trends in Sea Ice Extent Monthly Derivations**Key ideas:**

- Create monthly deviations to a single cycle of data
- Plot data positive and negative values