Polar Ice melt and Sea Level Rise



Antarctic Ice Sheet (Visualization from NASA's mission Operation IceBridge dataset BEDMAP2)

By Lea Fortmann and Penny Rowe with funding from the National Science Foundation.

Learning Objectives and Module Overview

In this module you will explore:

- Why is sea level rising and how are polar regions contributing?
- What is storm surge and how will it affect us?
- How should we prepare?



From Climate Central (https://www.climatecentral.org/outreach/alertarchive/2017/2017SeaLevelCM-TVM.html)

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Learning Objectives and Module Overview

Learning Objectives:

- Learn about how melting ice in polar regions contributes to sea level rise.
- Gain **computational skills** through calculating and graphing in Microsoft Excel.
- Learn about the **Economics** concepts of marginal damage and calculating costs under uncertainty.
- Formulate a policy recommendation for how adapt to sea level rise in your region.

Sea level is rising:

- As ocean water warms, it expands, so the oceans are taking up more volume.
- Polar ice is melting.

Warmer water takes up a greater volume



When water warms, the molecules move faster, and it expands to take up more space.

Polar Ice is melting



North Pole



South Pole

Polar Ice is melting



North Pole

- Arctic
- Polar bears



- Antarctic
- Penguins

Polar Ice is melting





Introduction: Greenland Melt



Greenland Ice Sheet (Image from NASA's scientific visualization studio)

- The Greenland ice sheet is melting.
- Contributes 20% of sea level rise
- Could raise sea level 6 feet by 2100.
- Would displace 187 million people.

Polar Ice is melting





West Antarctica

- Land ice is melting, and
- Glaciers are sliding into the sea and melting.
- Could raise sea level >3 feet by 2100.
- Irreversible.
- Timing unclear.



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Ice shelf video (Guardian)

URL: https://www.theguardian.com/world/video/2017/jul/12/vast-icebergsplits-from-antarctic-ice-shelf-video-explainer (<2 minutes)

Ice shelf video (National Geographic)

URL: https://video.nationalgeographic.com/video/magazine/0000015c-d022d1cb-a7fd-d4ffc11f0000 (4 minutes)

Pause for Analysis 1: Think about or discuss the following with a partner:

- 1. What are the two main causes of sea level rise?
- 2. How does the breakup of ice shelves contribute to sea level rise?

Homework

Changes in sea levels are expected to be relatively gradual, taking place over hundreds of years. However, there is much uncertainty in the timing and extent of future sea level rise. Ultimately, it will depend on how fast ice melts in the polar regions, including the Arctic in the north and Antarctic in the south. Cities need to start preparing for these coming changes now. Determining the best course of action from a policy and urban planning perspective is challenging.

Read this article from the Scientific American and be prepared to discuss it.

How is World Sea Level Rise Driven by Melting Arctic Ice?

(URL: https://www.scientificamerican.com/article/how-is-worldwide-sealevel-rise-driven-by-melting-arctic-ice/)



The Larsen Ice Shelf is situated along the northeastern coast of the Antarctic Peninsula, one of the fastestwarming places on the planet. Image Credit: NASA Earth Observatory image by Jesse Allen, using Landsat data from the U.S. Geological Survey.