

Today I Learned About Sea Level Rise, Part 2

Description:

Following up on the demonstrations in Today I Learned About Sea Level Rise, Part 1, Dive Deeper assignments lead students to explore data related to the impacts of thermal expansion, land ice melt, storm surge, and high-tide flooding. Teams of students each learn about these topics and bring their learning together in a jigsaw.

Skills & Objectives

SWBAT

- Understand that the burning of fossil fuels is causing a buildup of heat-trapping gases, which is warming the atmosphere and ocean.
- Explain that melting land ice adds to rising seas, while melting sea ice does not.
- Explain that warm water molecules expand, taking up more space.
- Discuss the impacts of sea level rise on the effects of storm surge.
- Explain the concept of high-tide or 'sunny day' flooding.
- Investigate solutions for sea level rise.

Skills

- Observation
- Interactive online models
- Graphing
- Communication

Students Should Already Know That

- In coastal areas, the tide rises and falls in daily, weekly, and monthly patterns.

Standards Alignment:

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes.

CCSS.ELA-LITERACY.RI Informational Texts

CCSS.ELA-LITERACY.RST Science and Technical Subjects

CCSS.ELA-LITERACY.RH History/Social Studies

CCSS.ELA-LITERACY.SL Speaking & Listening

Disciplinary Core Ideas:

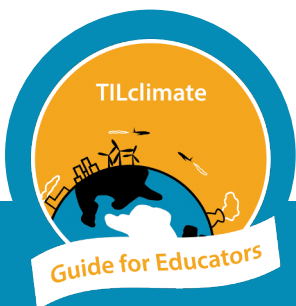
ESS2.A: Earth Materials and Systems

ESS2.D: Weather and Climate

ESS3.B: Natural Hazards

ESS3.C: Human Impacts on Earth Systems

ESS3.D: Global Climate Change



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How To Use These Activities

Pages with the circular “TILclimate Guide for Educators” logo are intended for educators. Simpler pages without the dark band across the top are meant for students.

Each of the included activities is designed to be used as a standalone, in sequence, or integrated within other curriculum needs. A detailed table of contents, on the next page, explains what students will do in each activity.

If students will be doing all four activities in sequence, they may skip the “A Warming Planet” paragraph at the top of each. Otherwise, the activities may be used in a jigsaw, with teams of students each doing just one. The “Each One, Teach One” instructions on page # can then be used to structure a conversation, with groups reshuffled so that each team has a representative from each investigation.

All activities in this set require internet access. They could also be assigned as homework or asynchronous remote work.

A Note About Printing

All student pages are designed to be printable in grayscale, except for the Ocean Heat Content map on page #. A few copies of this page could be printed color for students to share, or the image projected in the classroom.

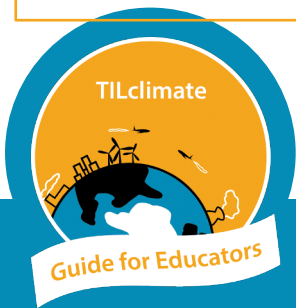
The worksheets do not leave space for students to answer questions. Students may answer these questions in whatever form is the norm for your classroom – a notebook, online form, or something else. This allows you, the teacher, to define what you consider a complete answer.

Engineering Solutions

Two versions of the Engineering Solutions page are provided. One for schools whose nearby city has a climate adaptation plan and one for those who do not. A simple internet search of “{Name of City} Climate Adaptation Plan” should provide a website or PDF document with your nearest city’s plan.

Podcasts in the Classroom: Throughout these Guides for Educators, we invite students to think about how they would share their learning with family and friends. Student-created podcasts are shareable, creative, and have multiple options for embedded assessment. We would love to hear any podcasts or see any other projects you or your students create! Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.

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Detailed Table of Contents

Page	Title	Description	Time (min)
	Podcast Episode	Students listen to TILclimate: TIL about sea level rise, part 2, either as pre-class work at home or in the classroom. https://climate.mit.edu/podcasts/til-about-sea-level-rise-part-2	10-15
1-3	Land Ice Melt (internet required)	Students read about the effect of land ice vs sea ice on sea level rise. Then they graph relative melt rates of Antarctic and Greenland ice sheets.	20-25
4-6	Thermal Expansion (internet required)	Students read about the effect of warming water on sea level rise. Using the NOAA Sea Level Rise Viewer, they compare flood predictions for various emissions scenarios.	20-25
7-8	Storm Surge (internet required)	Students read about the impact of sea level rise on storm surge. Using the NOAA Coastal Inundation Dashboard, they investigate the effects of historical flood levels and possible impacts of future storms.	20-25
9-10	High-Tide Flooding (internet required)	Students read about high-tide or nuisance flooding as a result of sea level rise. Using the NOAA Sea Level Rise Viewer, they analyze the frequency of flood days in a chosen coastal area.	20-25
11-12	Jigsaw Share (discussion)	If students did the activities in teams or as homework, reshuffle groups to include 'experts' on each topic. Students share their learning and discuss how to share what they learned with others. Then, they discuss and collect solutions to sea level rise.	20-25
13	Engineering Solutions (internet required)	Students investigate case studies of adaptation and mitigation for climate change from around the US. Two versions of this activity are supplied - see note on previous page.	20-25
14	Solutions (discussion)	Collected solutions are sorted into four categories, and then groups or individuals choose one solution to investigate further.	variable



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Land Ice Melt, Thermal Expansion, Storm Surge, High-Tide Flooding, and Solutions

This Educator Guide includes four internet-based investigations and a solutions-oriented wrap-up. Educators may pick and choose among the pieces of the Guide, as suits their class needs.

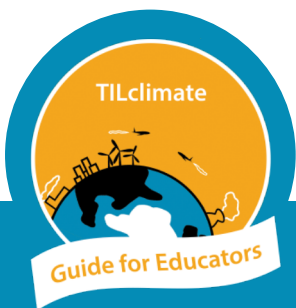
Parts of this Guide may align with the following topics:

- Physical science: Thermal effects on liquids, wave action.
- Life/environmental science: Ocean warming effects on oceanic habitats, sea level rise effects on coastal habitats, human coastal adaptation and change.
- History/social science: History of coastal development and building, governmental and non-governmental solutions to complex problems.
- ELA/literature: Fictional works set in a future with significantly higher sea levels.
- ELA/nonfiction: Understanding and communicating complex scientific topics.

MIT Resources

We recommend the following as resources for your own better understanding of climate change or as depth for student investigations. Specific sections are listed below:

- Climate Science, Risk & Solutions, an interactive introduction to the basics of climate change. <https://climateprimer.mit.edu/>
 - 02 The greenhouse effect and us
 - 06 Predicting climate
 - 08a Sea Level Rise
 - 10 What can we do?
- MIT Climate Portal Explainers are one-page articles describing a variety of climate topics. <https://climate.mit.edu/explainers>
 - Sea Level Rise
 - Coastal Ecosystems and Climate Change
 - Cities and Climate Change
 - Climate Models
 - Hurricanes



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Wrap-Up Discussion Questions

While all climate issues can be difficult to talk about, sea level rise is one of the more immediate effects of climate change and may be more traumatic for students. As you discuss sea level rise in the classroom, keep social-emotional learning in mind. For more on this, read “How to Use TILclimate Educator Guides.”

- Why is sea level changing?
- Why are so many major cities in coastal areas?
- Even if we stopped all carbon dioxide emissions tomorrow, cities around the world would still have to deal with some sea level rise. What are some adaptations to higher tides and storms that communities are using?
- We are all connected to the ocean, even if we do not live on the coast. What are some ways that your life is connected to the ocean every day? (oxygen from algae, shipping goods on ships, seafood to eat, etc.)

Climate Solutions

Climate solutions can be thought of as falling into four co-equal categories. Across all categories, a focus on community-level solutions leads to more effective action. Community-level solutions change decision-making so that the default option for individuals is the one that has the best result for the climate. For example, policies that increase the solar and wind mix in the electric grid, instead of asking homeowners to install solar panels. For more on talking about climate change in the classroom, see “How to Use TILclimate Educator Guides.”

•Energy Shift

How do decision-makers make the switch from carbon-producing energy to carbon-neutral and carbon-negative energy?

•Energy Efficiency

What products and technologies exist to increase energy efficiency, especially in heating and cooling buildings?

•Adaptation

How can we adapt buildings to keep people safe from heat and cold?

•Talk About It

Talking about climate change with friends and family can feel overwhelming. What is one thing you have learned that you could share to start a conversation?

What solutions are the most exciting in your classes? We would love to hear from you or your students! Images, video, or audio of student projects or questions are always welcome. Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.

