

# Bringing the Universe to America's Classrooms: Digital Resources for Earth and Space Science

October 9, 2018 1:00 pm EDT

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Rachel Connolly, Director STEM Education  
[rachel\\_connolly@wgbh.org](mailto:rachel_connolly@wgbh.org)



**PBS LearningMedia™**



\*This activity is funded by NASA under cooperative agreement award No. NNX16AD71A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.

# Welcome

2

- How to use this presentation...
- *Bringing the Universe to America's Classrooms* on PBS LearningMedia
- Weather & Climate Resources
- Q&A



**Rachel Connolly**  
Director, STEM Education  
WGBH & PBS  
LearningMedia

[rachel\\_connolly@wgbh.org](mailto:rachel_connolly@wgbh.org)

# WGBH Education

3

Media & Digital  
Assets

+

Instructional  
Design

+

Educational  
Platform



America's  
Classrooms



> 1.6 million registered users, representing 37% of U.S. teachers

2017-2018 school-year monthly averages:

- 1.1 million users (~15% are students)
- 3.6 million page views
- Usage represents 1 in 4 U.S. educators

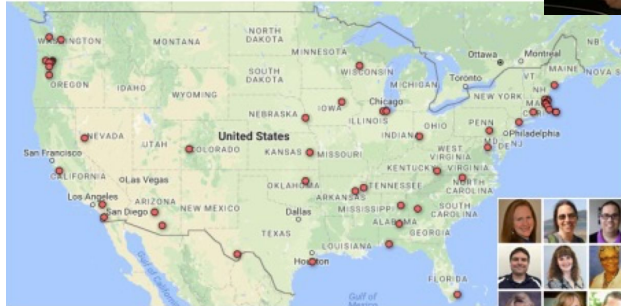
# Bringing the Universe to America's Classrooms

4

Year 3 of a 5-year project funded by NASA under a cooperative agreement



Designing, testing and distributing media-rich resources for K-12 science instruction that are engaging, flexible, and easy to use.



National Teacher Advisors



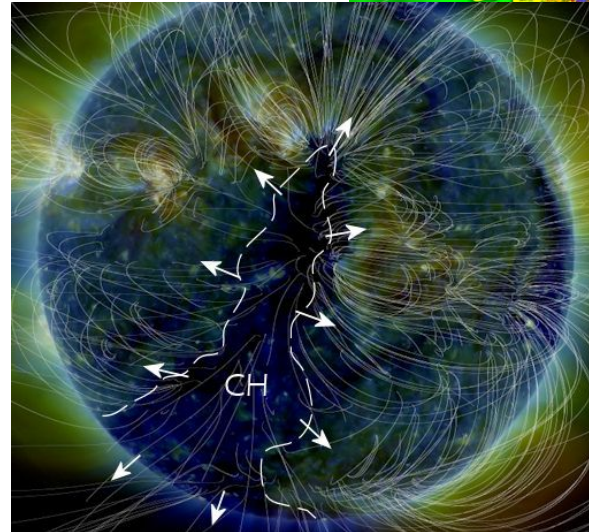
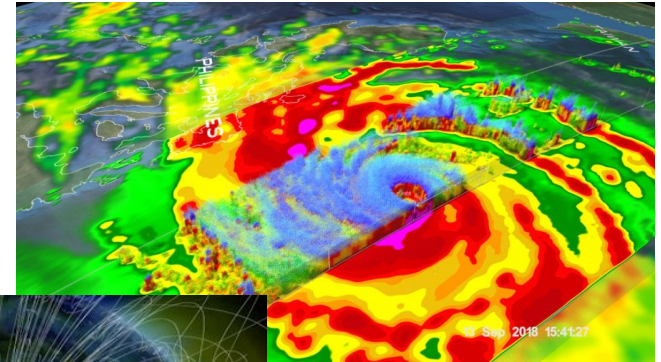
# Scientific practices are increasingly digital...

5

- Asking questions and defining problems
- Developing and **using models**
- Planning and carrying out investigations
- **Analyzing and interpreting data**
- Using mathematics and **computational thinking**
- Constructing explanations and designing solutions
- Engaging in argument from **evidence**
- **Obtaining, evaluating**, and communicating information

A Framework for K-12 Science Education:  
Practices, Crosscutting Concepts, and Core Ideas  
*National Research Council (2012)*

Super Typhoon  
Mangkhut  
approaching the  
Philippines



Massive coronal hole  
on the Sun

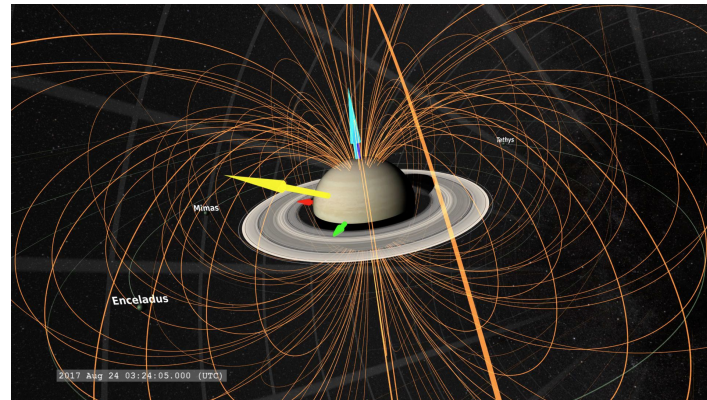


# Experiencing Phenomena with Digital Media

6



Observing Saturn



- 12 collections of almost 200 resources addressing topics in K-12 Earth & Space Science.
- Topics aligned with NGSS Core Ideas and Practices:
  - NEW** Space
    - Earth Systems
    - Story of Earth
    - Weather & Climate
- Supplementary resources that are flexible and adaptable. Support materials include:
  - Background readings, Activities (K-2), Teaching Tips, and Standards alignment.

The screenshot shows the PBS Learning Media website interface for the collection "Bringing the Universe to America's Classrooms". At the top is a banner with the title and "PRODUCED BY NOVA". Below the banner is a social media sharing bar. On the left, there is a "Explore Collection" sidebar with a table listing grade bands: Grades K-2, Grades 3-5, Grades 6-8, and Grades 9-12, each with a green plus icon. Below this sidebar is a disclaimer and funding information. The main content area on the right has the title "Bringing the Universe to America's Classrooms" and a description of the digital media resources. It also includes a "Media-rich educational resources featuring:" section with a list of resource types: Images, Interactives, Games, Videos, and Data visualizations. At the bottom of the main area is a collage of images related to space and Earth science, including a globe, a hand holding a small globe, a spiral galaxy, a night landscape with a tree, and a map of Boston. The collage also features the "NOVA" logo and "PRODUCED BY NOVA IN COLLABORATION WITH NASA".

**BRINGING THE UNIVERSE TO AMERICA'S CLASSROOMS**  
PRODUCED BY NOVA

Explore Collection

Grades K-2	+
Grades 3-5	+
Grades 6-8	+
Grades 9-12	+

The material contained in this product is based upon work supported by NASA under cooperative agreement award No. NNX16AD71A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.

Funded By  
**National Aeronautics and Space Administration**

**Bringing the Universe to America's Classrooms**

Explore digital media resources for teaching topics in K-12 earth and space science. These free resources emphasize student engagement with the core ideas and practices of the Next Generation Science Standards and are supported by rich contextual materials.

To get started, click your grade band in the left-hand menu.

Media-rich educational resources featuring:

- Images
- Interactives
- Games
- Videos
- Data visualizations

NOVA  
PRODUCED BY NOVA  
IN COLLABORATION WITH NASA

# Supports for Diverse Learners

8

- Supports for Students with Disabilities Using Assistive Technology
  - A range of accessibility features are included with BUAC resources, including screen reader and keyboard accessibility, image descriptions, closed captioning, NV supports, descriptive video (audio tracks)
- Supports for English Learners 
  - Look for a webinar this fall on *Supporting English Learners in Science with Resources from Bringing the Universe to America's Classrooms*

Contact [Carolyn\\_Jacobs@wgbh.org](mailto:Carolyn_Jacobs@wgbh.org) for further information or assistance



# K-2 Weather & Climate

# K-2 Lesson Plan

10

- What is Weather?
- Standard: ESS2.D: Weather and Climate  
Weather is the combination of sunlight, wind, snow or rain, and temperature in a specific region at a particular time. (K-ESS2-1)
- Students observe the four factors in various types of weather and identify evidence of weather factors in different weather conditions.



## What Is Weather?

Learn how weather is the combination of four factors—temperature, wind, precipitation, and sunlight and clouds—that occur at a given place and time in this lesson plan from WGBH. The mix of factors is changing all the time; therefore, weather conditions are changing all the time. Students can observe the four factors in various types of weather and identify evidence of weather factors in different weather conditions. ...

- Lesson Summary
- Time Allotment
- Learning Objectives
- Prep for Teachers
- Supplies
- Media Resources
- Learning Activities (5E model)

# K-2 Weather: Featured Resources

11

- **Weather Factors**
  - Learn how weather is the combination of four factors—temperature, wind, precipitation, and sunlight and clouds—that occur at a given place and time.
  - Students observe and compare different weather phenomena and identify key characteristics of weather in each video.



Be the first to rate this resource!



PEEP and the Big Wide World: Weather Factors



Explore key characteristics of weather in these short, animated videos from PEEP and the Big Wide World. Each video models observations and descriptions for a common weather condition, including rain, snow, wind, and a sunny day. Students observe and compare different weather phenomena and identify key characteristics of weather in each video.



To view the Background Essay, Student Activity, and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. Click [here](#) for the full collection of resources.



Info

Grades

K-2

Accessibility

Audio  
Description,  
Caption

Permitted Use

Stream,  
Download and  
Share

3 Favorites

232 Views

Credits

Funded By

National  
Aeronautics and  
Space  
Administration



01:48 HD CC



PEEP and the TOO Windy Day

Students can make observations of weather conditions on a windy day and identify evidence of ...



PEEP and the Chilly Dam

Students can make observations of slight changes in temperature in this animated video from PEEP ...



PEEP and the Changing Sky

Students can make observations of changes in sunlight and clouds that happen in this animated ...

# Interactive Lesson





12



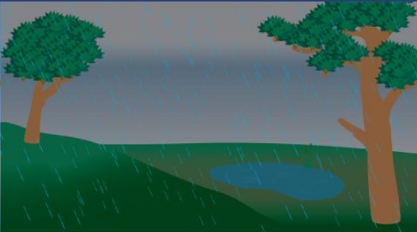

- A Look at Weather Factors

Students observe and identify evidence of changing weather conditions and record factors evident in various types of weather.

### Different Types of Weather

Drag each card to the appropriate space in the diagram.





Find clues in the different types of weather. Drag each child to the type of weather he or she is dressed for.

OK

# Interactive Lesson

13

- Student work captured for easy printing and review
- Glossary

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## A Look at Weather Factors

MENU MY WORK GLOSSARY PAGE 2 OF 9

### What Is Weather?

Weather is a mix of factors that happens in a certain place at a certain time. These include sunlight and clouds, wind, snow or rain, and temperature.

A mix of factors change all the time. The weather changes whenever the mix of factors changes.



#### My Work

- PRINT
- Page 3: Visualize It
- Page 4: Visualize It
- Page 5: Visualize It
- Page 6: Visualize It
- Page 8: Arrange It

Page 4:  
Visualize It

In the Sky Visualize It



BACK TO TOP

Describe the weather in each picture

#### Glossary

##### breeze

A light, soft wind

##### cold

How you feel when the temperature is low

##### gust

A sudden, strong wind

##### meteorologist

##### clouds

Clusters of tiny water droplets or ice crystals that float in the air.

##### factor

Something that contributes to the weather (temperature, wind, snow or rain, sunlight and clouds).

##### hot

How you feel when the temperature is high

##### rain



# K-2 Weather: Classroom Implementation

14

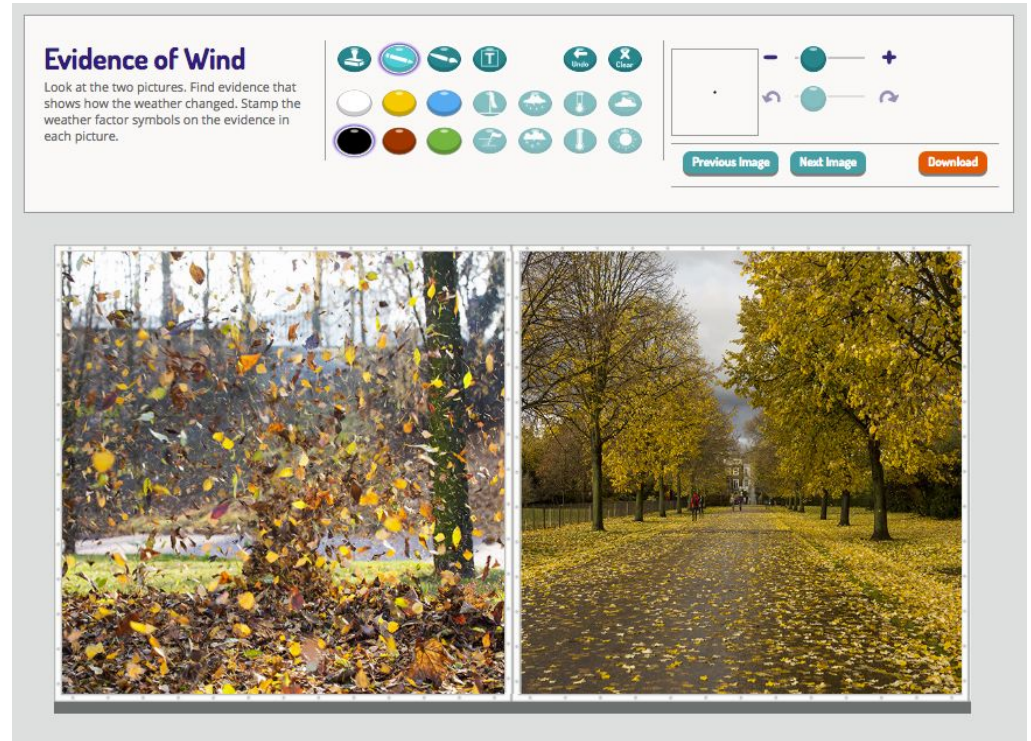
- Anny's class
- Adaptations for English Learners



# K-2 Weather: Featured Resources

## ■ Evidence of Weather

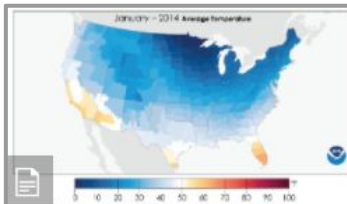
- Observe and annotate various images of weather phenomena in this interactive drawing tool.
- Students can observe weather conditions and document evidence of weather that happened earlier in the day.



# 3-5 Weather & Climate

# 3-5 Lesson Plan

- Investigating Monthly Temperatures and Precipitation
- Standard: ESS2.D: Weather and Climate  
Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)
- Students analyze and interpret weather data to support claims about patterns of temperature and precipitation across select months in different seasons and locations.



## Investigating Monthly Temperatures and Precipitation

Students analyze and interpret weather data to support claims about patterns of temperature and precipitation across select months in different seasons and locations. This lesson plan, produced by WGBH, includes maps of average monthly temperature and total monthly precipitation based on data snapshot maps produced by the National Oceanic and Atmospheric Administration (NOAA). The lesson incorporates the 5E instructional model to help students...

- Lesson Summary
- Time Allotment
- Learning Objectives
- Prep for Teachers
- Supplies
- Media Resources
- Learning Activities (5E model)

# Interactive Lesson

18

- Seasonal Temperature and Precipitation Variations
- Students learn about typical weather conditions that define seasons in the United States as they read about aspects of weather and **interpret average monthly temperature and total monthly precipitation maps.**

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## Seasonal Temperature and Precipitation Variations

MENU MY WORK GLOSSARY PAGE 1 OF 7

### Picturing Seasonal Weather

Weather changes daily, but people can expect certain typical weather conditions during each season. Weather conditions affect how people dress and often the activities they plan. You have been experiencing weather every day of your life. Therefore, you can easily predict how you will dress and how you might play with a friend outdoors during each season.

January - 2013 Total Precipitation

0 1 2 3 4 5 6 7 8 inches



# 3-5 Weather & Climate: Featured Resources

19

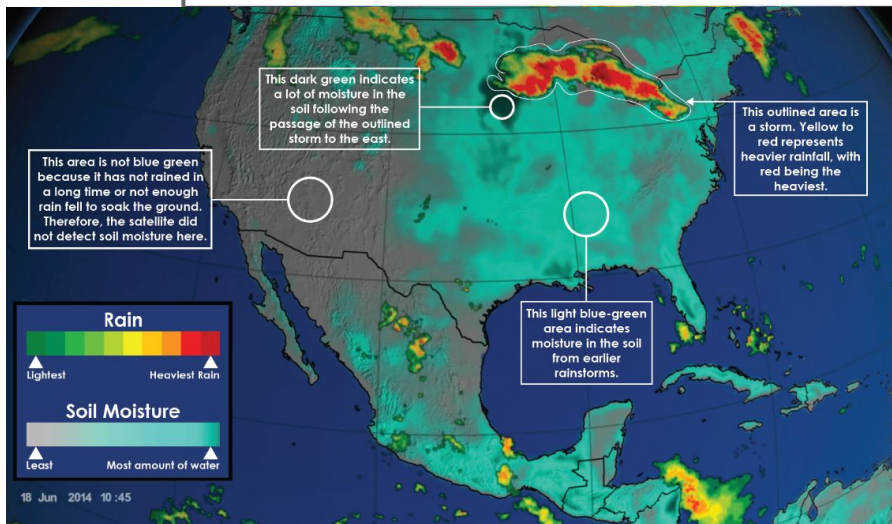
- **North American Monsoon Weather Pattern**
- Learn how weather is the combination of four factors—temperature, wind, precipitation, and sunlight and clouds—that occur at a given place and time.
- Students observe and compare different weather phenomena and identify key characteristics of weather in each video.

## North American Monsoon Weather Pattern

Learn about the North American Monsoon, a typical weather pattern that occurs seasonally in parts of the United States and Mexico, with this visualization from NASA. The visualization shows how storms develop, evolve, and move across North America as well as how levels of soil moisture change in response to the precipitation. The interaction between the two variables is illustrated through colors that represent the amounts and types of precipitation and levels of soil moisture. An annotated image that helps students interpret the visualization is included.



To view the Background Essay and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. Click [here](#) for the full collection of resources.



### North American Monsoon Weather Pattern

This NASA visualization tracks a seasonal weather pattern known as the North American Monsoon,

### Precipitation and Soil Moisture Data Descriptions: Annotated ...

This image from a NASA visualization describes the two datasets represented—precipitation and soil

# 3-5 Earth's Systems: Featured Resources

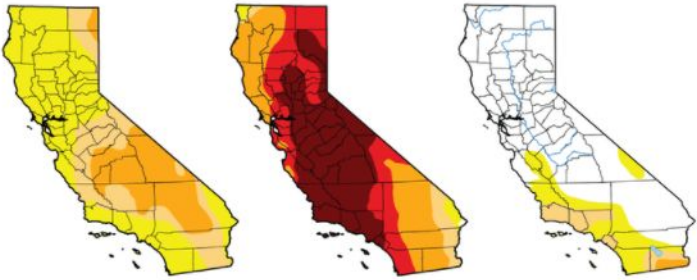
20

- Drought Affect California's Water Availability
- Learn about changes in water availability in California from 2013 to 2017 with this gallery of maps, satellite images, and photographs.
- The NASA satellite images of changing snowpack levels on the Sierra Nevada and the photographs of Folsom Lake water levels provide **observational evidence of drought conditions** in the state.

## Drought Affects California's Water Availability

Learn about changes in water availability in California from 2013 to 2017 with this gallery of maps, satellite images, and photographs. The maps, based on data from the National Drought Mitigation Center, use colors to convey reductions in the availability of freshwater as a result of drought conditions in the state. The maps consider freshwater, including surface water (e.g., rivers, lakes, and reservoirs), aquifers, and soil moisture. The NASA satellite images of changing snowpack levels on the Sierra Nevada and the photographs of Folsom Lake water levels provide observational evidence of drought conditions in the state.

To view the Background Essay and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. Click [here](#) for the full collection of resources.

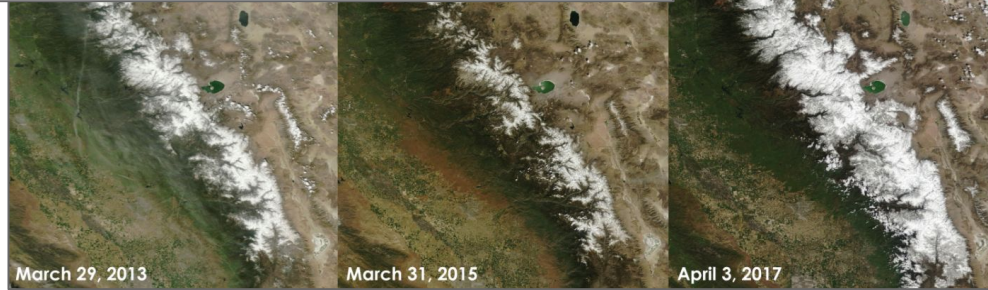
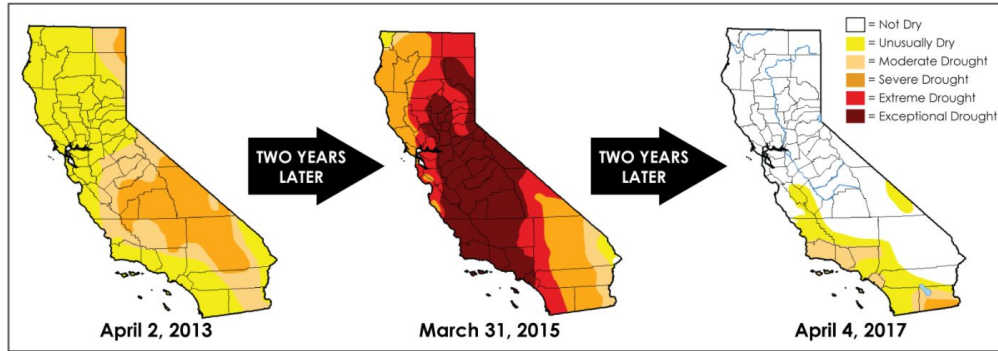


**April 2013      March 2015      April 2017**

- ▶ **Maps of California's Drought Conditions in ...**  
These maps communicate the level of drought across California in April 2013, March 2015, and ...
- ▶ **Snowpack Changes in the Sierra Nevada Mountains ...**  
These NASA satellite images contrast snowpack levels on the Sierra Nevada. The images, taken by ...
- ▶ **Folsom Lake Marina in 2013, 2015, and ...**  
This composite image of the Folsom Lake Marina shows how drought conditions affected water levels

# Drought Affect California's Water Availability

21



# 6-8 Weather & Climate

# 6-8 Lesson Plan

## Regional Patterns of Climate: Pacific Northwest

- Students use media to explore and **investigate how factors** such as landforms, proximity to the ocean, and wind circulation **affect regional climate**.
- Standard: ESS2.D: Weather and Climate  
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)



### Regional Patterns of Climate: Pacific Northwest

Explore how factors such as wind patterns, landforms, and geographic location near the ocean influence regional climate in this lesson plan from WGBH. Learn how rain shadows form through an interactive lesson. Watch animated data visualizations of wind patterns and make connections between atmospheric circulation and climate. Analyze and interpret temperature and precipitation data of different cities to explore how proximity to the ocean influences...

- Lesson Summary
- Time Allotment
- Learning Objectives
- Prep for Teachers
- Supplies
- Media Resources
- Learning Activities (5E model)



# Interactive Lesson

24

- Mountains and Rain Shadows


Students explore how climate conditions can be completely different on either side of a mountain range.

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## Mountains and Rain Shadows

☰ MENU MY WORK PAGE 1 OF 9 >


### Mountain Landscapes



If you could hike up one side of a tall mountain range and then hike down the other side, you would find that the air temperature, precipitation, and vegetation patterns are very different on each side. In this lesson, you will be able to observe what those patterns are and how atmospheric flow and landforms such as mountains interact to produce differences in regional climate.



Watch this video to see how drastically different the landscape can be on either side of a mountain range. The video shows Mt. Hood in Oregon as one might see it from the west (the first half of the video) and from the east (the second half of the video). Why do you think the landscape is so different?



# Interactive Lesson

25

- Student work captured for easy printing and review

- Interactive tools enable direct student engagement with media

Bringing the Universe to America's Classrooms

## Mountains and Rain Shadows

MENU MY WORK PAGE 9 OF 9

### Make Your Own Model: Mountain Weather

From evidence provided through videos, photos, data tables, and graphs, you have seen how drastically different conditions on the two sides of a mountain range can be. You have learned about the formation of a rain shadow. Now you will demonstrate your understanding of lesson concepts via a model.

tools provided to create your own model illustrating the connection between mountains and rain shadows. Use the labels indicating the steps in the formation of a rain shadow. This is how to get started.

**Visualize It!**

REVIEW DRAWING

**My Work**

Page 9: Visualize It

Mountain Weather Model

BACK TO TOP

## Global Precipitation

- Learn about patterns in global precipitation with this gallery of data visualizations.

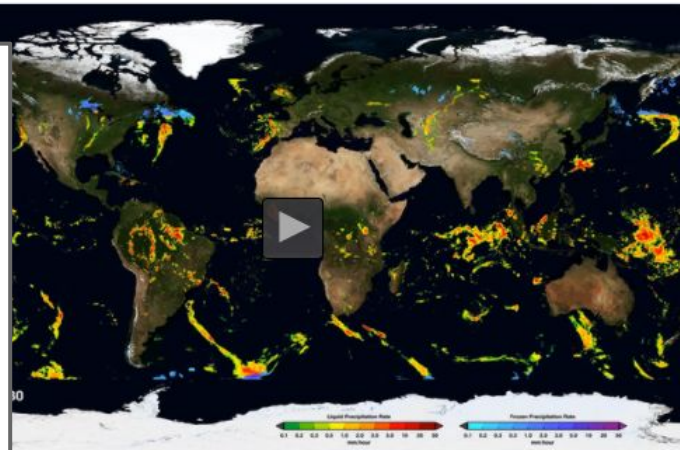
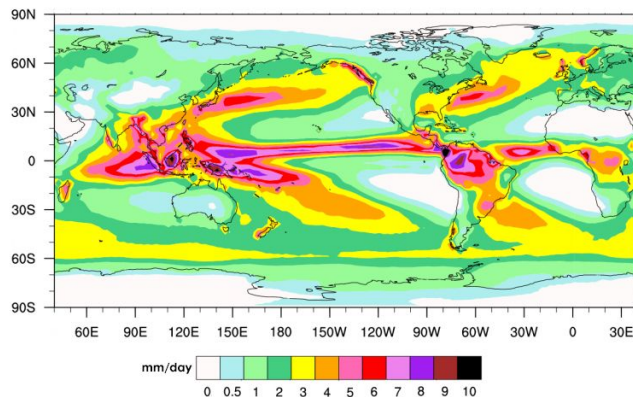
### Global Precipitation

Learn about patterns in global precipitation with this gallery of data visualizations. The animation shows the distribution of precipitation around the world using rainfall and snowfall rates from NASA's Integrated Multi-satellite Retrievals for GPM data product (IMERG); it also shows water vapor data from the Goddard Earth Observing System Model (GOES). The map of global annual mean precipitation from 1979 through 2010 illustrates worldwide patterns in precipitation.

To view the Background Essay and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. [Click here](#) for the full collection of resources.



### Annual Mean Precipitation (1979–2010)



#### ▶ IMERG Global Precipitation Rates

This animation shows precipitation rates across the globe from 4/1/2014 through 9/30 ...

#### ▶ Global Annual Mean Precipitation

This map shows global annual mean precipitation from 1979 through 2010.

# 6-8 Weather & Climate: Featured Resources

27

## The Sun Heats Earth

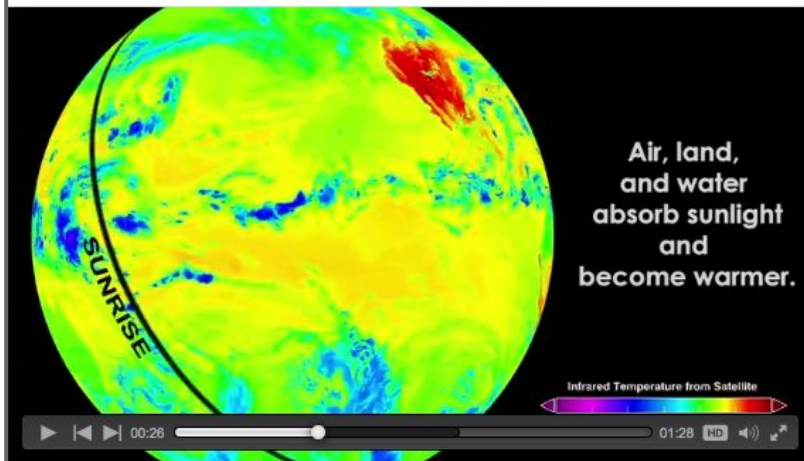
- Observe how the Sun heats parts of Earth differently with these videos from NASA.
- Stimulate student curiosity and interest about how solar heating of Earth relates to its rotation and tilt.

### The Sun Heats Earth

Observe how the Sun heats parts of Earth differently with these videos from NASA. Satellite and ground-based measurements show infrared measurements, surface air temperature, and sea surface temperature. In the first video, see the globe rotate into sunlight and observe the temperatures of the land, sea, and air over several days. In the second video, see the same data on a flat map of the world. Areas near the equator are warmest and there is a greater temperature difference between day and night on land compared to the oceans.



To view the Background Essay and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. Click [here](#) for the full collection of resources.



#### The Sun Heats Earth: Rotating Globe

In the first video, see a spherical view of Earth rotate into sunlight and observe ...

#### The Sun Heats Earth: Flat Map

In the second video, see the effect of sunlight on Earth over several days and ...

# 9-12 Weather & Climate

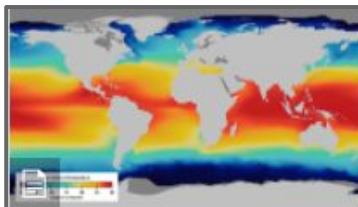


# 9-12 Lesson Plan

## The Ocean and Climate: Heat Redistribution

- ESS2.A: Earth Materials and Systems

The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, **ocean circulation**, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4)



### The Ocean and Climate: Heat Redistribution

Students explore how unequal heating of Earth's surface by the Sun drives global ocean circulation patterns in this media-rich lesson plan from WGBH. Through an interactive lesson and data visualizations from NASA, students investigate how phenomena such as surface winds and ocean water density are involved in large-scale ocean circulation patterns and heat transport, with a focus on the Atlantic Ocean. They are also introduced to other elements of...

- Lesson Summary
- Time Allotment
- Learning Objectives
- Prep for Teachers
- Supplies
- Media Resources
- Learning Activities (5E model)

- Students explore how unequal heating of Earth's surface by the Sun drives global ocean circulation patterns.

# Interactive Lesson

30

- Ocean Circulation in the North Atlantic

Students are introduced to factors influencing global ocean circulation, with a focus on the significant North Atlantic region. Through data visualizations from NASA, students investigate how factors such as sea surface temperature, density, winds, and various types of ocean flows interact in the transport of heat from equatorial regions northwards in the North Atlantic.

Bringing the Universe to America's Classrooms

## Ocean Circulation in the North Atlantic

≡ MENU

📁 MY WORK

PAGE 1 OF 11 >

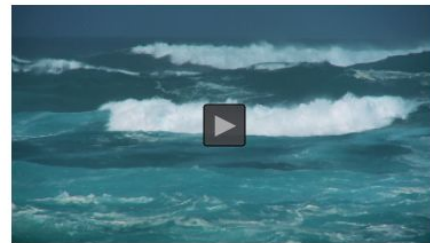
### The Fluid Ocean

If you've been to the beach, or a rocky coast, you have probably seen the ebb and flow of tides and the power of waves as they crash along the shore. The vast waters of the world's ocean are in perpetual motion, and play a critical role in redistributing energy and maintaining Earth's climate. Covering over 70 percent of the planet and with an average depth of 12,100 feet (3,688 meters), the reach of this fluid medium is truly wide, and deep.

Global ocean circulation is very complex, and involves many interconnected components at various scales. One of the key components is the meridional overturning circulation (MOC), which describes the movement of ocean waters at different latitudes and depths averaged over long periods of time. (*Meridional* means along a longitude line, or along the north-south axis.)

In this lesson, you will explore videos that show atmospheric and ocean processes, and investigate how these processes contribute to the overturning circulation, with a focus on the North Atlantic.

Play the video to get a general sense of the motion and power of the ocean.



Produced by



# Interactive Lesson

31

- Student work captured for easy printing and review

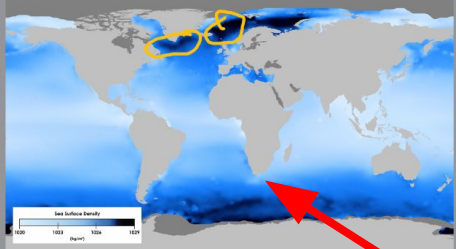
## Bringing the Universe to America's Classrooms

# Ocean Circulation in the North Atlantic

MENUMY WORKPAGE 7 OF 11

## Sea Surface Density

INSTRUCTIONS



Sea Surface Density

of seawater is affected by both its temperature and its salinity. Water with a higher density is denser than water with a lower salt concentration, and colder seawater. Density determines whether something—be it a solid object or a fluid—will sink. High density waters will sink, and become the deep bottom waters of the ocean.

Map showing the global sea surface density over a long time. Focus on the Atlantic Ocean and on the density data in this map. Which regions or areas of the ocean do you think the water will sink? Click Visualize It to begin.

**Visualize It!**

**REVIEW DRAWING**

MY WORK

PRINT

Page 2: Notes

Page 3: Notes

Page 4: Notes

Page 5: Chart It

Page 7: Visualize It

Page 9: Notes

Chart It

Use the following table to take notes on the general patterns you notice.

1. Describe the general temperature of currents near the equator.	they are warm
2. Describe the general temperature of currents near poles.	cold
3. What is the general pattern of current flow and temperature within the Atlantic basin?	around
4. What inferences can you make about how heat is transferred from the equator to the poles?	from equator to pole

BACK TO TOP

- Interactive tools enable direct student engagement with media

## Global Ocean Currents

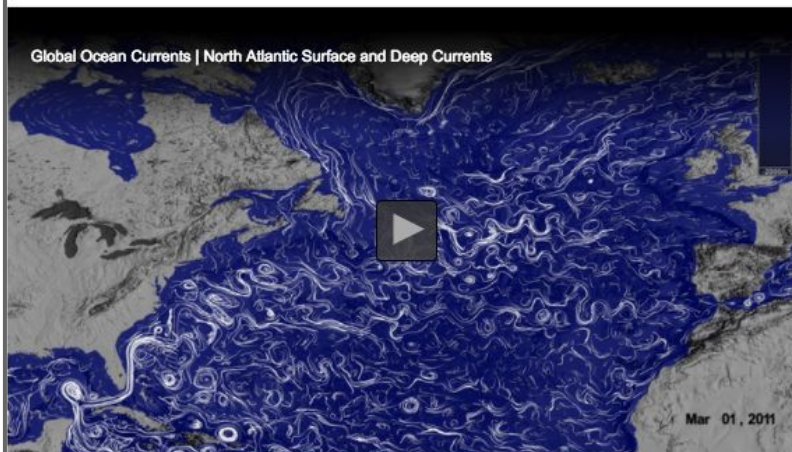
- Observe simulated ocean flows at the surface and at 2000m below the surface with these visualizations from NASA.

### Global Ocean Currents

Observe simulated ocean flows at the surface and at 2000m below the surface with these visualizations from NASA. Global ocean circulation is a complex system of ocean surface currents, deep currents, gyres, and eddies. In these visualizations, white lines indicate the flow of ocean currents over several years. Circulation patterns and eddies are clearly visible in the ocean surface currents because surface currents are relatively fast compared to deeper currents. Below the surface, the chaotic and complex motions are slower and harder to discern. A close-up view of the North Atlantic highlights the differences between the surface currents and the currents at depth. A global view shows larger patterns in ocean currents.



To view the Background Essay and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. Click [here](#) for the full collection of resources.



#### ▶ North Atlantic Surface and Deep Currents

This video provides a close-up view of the ocean surface currents and currents at 2000m ...

#### ▶ North Atlantic Surface and Deep Currents | High ...

This high-resolution video provides a close-up view of the ocean surface currents and currents at ...

#### ▶ Global Ocean Surface Currents and Deep Currents

This video shows a global view of ocean surface currents and flows at a depth ...



## Sea Surface Temperature, Salinity, and Density

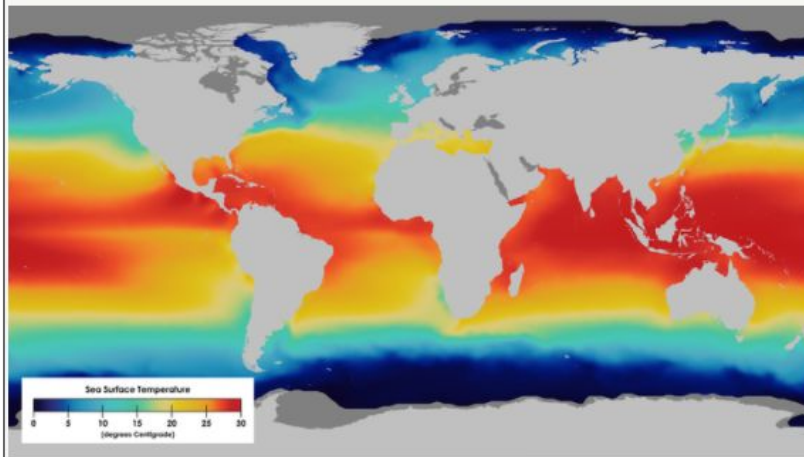
- Explore patterns in sea surface temperature, salinity, and density in these images adapted from NASA. Ocean water properties are influenced by many factors, such as heating from the Sun, Earth's rotation, currents, winds, rainfall, rivers, and sea ice.

### Sea Surface Temperature, Salinity, and Density

Explore patterns in sea surface temperature, salinity, and density in these images adapted from NASA. Ocean water properties are influenced by many factors, such as heating from the Sun, Earth's rotation, currents, winds, rainfall, rivers, and sea ice. The first image shows the long-term average of sea surface temperature, with red representing warmer temperatures and blue representing colder temperatures. The second image shows the long-term average of sea surface salinity, with white representing higher salinity and dark regions representing lower salinity. The third image shows the long-term average of sea surface density, with light blue representing lower density and dark blue representing higher density.



To view the Background Essay and Teaching Tips for this media gallery, go to Support Materials below. This resource was developed through WGBH's Bringing the Universe to America's Classrooms project, in collaboration with NASA. Click [here](#) for the full collection of resources.



#### ▶ Sea Surface Temperature

This is a global map of average Sea Surface Temperature (SST).

#### ▶ Sea Surface Salinity

This is a global map of average Sea Surface Salinity (SSS).

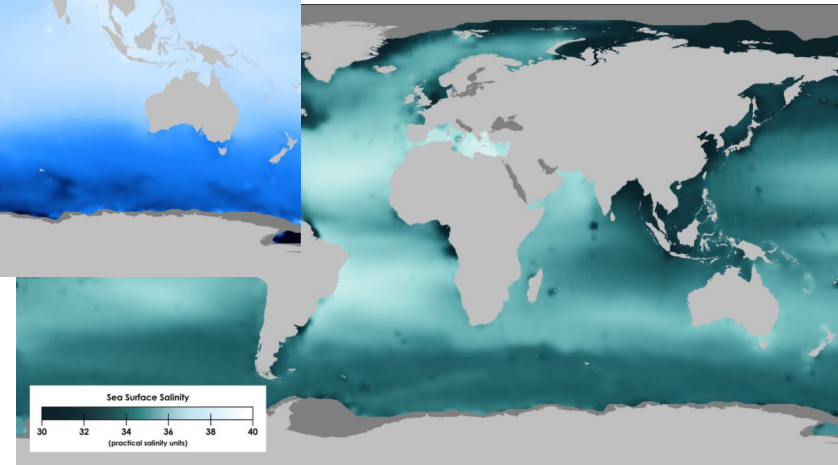
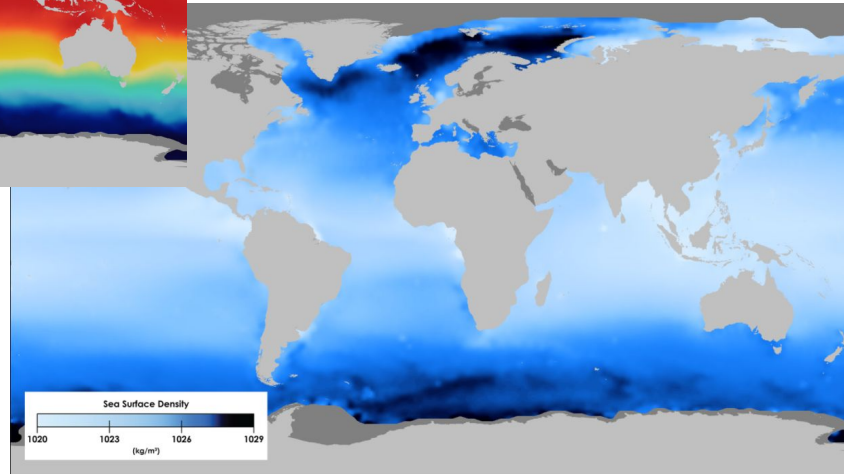
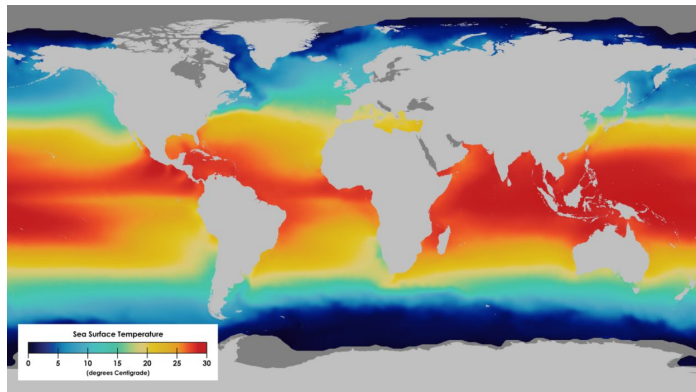
#### ▶ Sea Surface Density

This is a global map of average Sea Surface Density (SSD).



# 9-12 Weather & Climate: Featured Resources

34



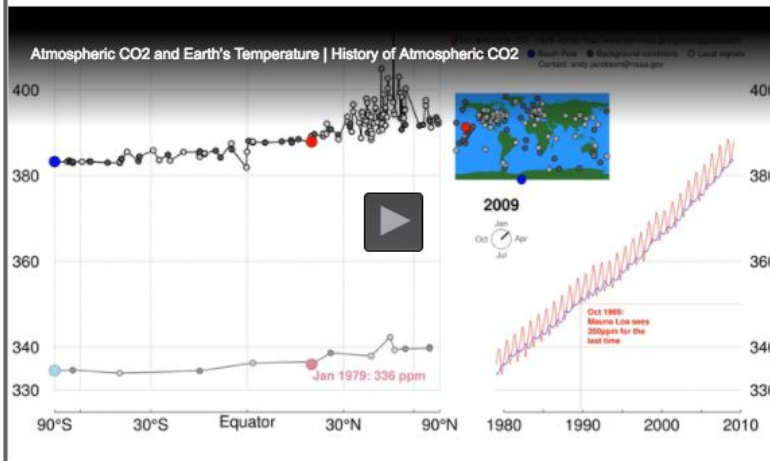
## Atmospheric CO<sub>2</sub> and Earth's Temperature

- Learn how the amount of carbon dioxide in Earth's atmosphere has changed over time and how it affects Earth's temperature.

### Atmospheric CO<sub>2</sub> and Earth's Temperature

Learn how the amount of carbon dioxide in Earth's atmosphere has changed over time and how it affects Earth's temperature. The first video, from the National Oceanic and Atmospheric Administration (NOAA), uses multiple datasets to graphically show the changing level of atmospheric CO<sub>2</sub> from 800,000 years ago until 2016. A graph from the National Academy of Sciences shows the historical record of Earth's temperature and CO<sub>2</sub> levels from Antarctic (Vostok) ice core data. In the second video, from NASA, climate scientist Peter Hildebrand explains that although atmospheric CO<sub>2</sub> levels have lagged behind temperature changes historically, that is no longer the case. Since the Industrial Age, rising CO<sub>2</sub> levels are driving temperature changes.

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#### History of Atmospheric CO<sub>2</sub>

This video uses multiple datasets to graphically show the changing level of atmospheric CO<sub>2</sub> from ...



#### Relationship between Earth's Temperature and Atmospheric ...

This graph shows the historical record of Earth's temperature and CO<sub>2</sub> levels from the ...



#### Lagging CO<sub>2</sub>

In this video, climate scientist Peter Hildebrand explains that although CO<sub>2</sub> levels have lagged behind ...

# Webinar Series

36

*Two remain in a series of three. Links to register in slide notes.*

- **Engaging Students in Science Practices with Digital Media**
  - **All grades**
    - *Wednesday, October 10, 2018 7:00:00 PM EDT*
- **Integrating Digital Media into Earth and Space Curriculum**
  - **All grades**
    - *Monday, October 15, 2018 7:00:00 PM EDT*

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37



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# Thank You!

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Questions?  
[rachel\\_connolly@wgbh.org](mailto:rachel_connolly@wgbh.org)



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