Weather & Climate

Topics: Climate, climate change, erosion, weather, weathering

NEW YORK STATE | Department of Environmental Conservation

GRADE LEVEL: Middle School

Big Ideas:

- Weather is short term conditions of the atmosphere.
- Climate is the average daily weather for an extended period of time.
- Weather can change all the time.
- Weather and climate are related but different.
- Wind is a powerful force.
- Water has big role in the Earth's surface processes.
- Weathering, erosion, and deposition act together in a cycle to wear down and build up the earth's surface, consequently these forces shape our landscape.
- Our climate is changing.
- Environmental justice is the fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development and enforcement of environmental laws, regulations, and policies.

Learning Objectives: *students will be able to…*

- Differentiate between weather and climate.
- Collect, organize, and analyze data on various types of weather and climate.
- Model how greenhouse gases influence Earth's temperature.
- Explain the causes and effects of climate change.

New York State Science Learning Standards:

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.
MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Key Understandings:

- Winds, landforms, ocean temperatures and currents are major determinants of local weather patterns.
- Global movements of water and its changes in form are propelled by sunlight and gravity.
- Weather and climate are influenced by interactions involving sunlight, the ocean,

Essential Questions:

- How are climate and weather related?
- How do weather and climate affect our lives?
- How do human activities affect weather and climate?
- How do we know our global climate is changing?
- How have living organisms changed the earth's climate and how have earth's

the atmosphere, ice, landforms, and living things.
- Atmospheric gases affect the air and water temperature at the Earth's surface.
- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over time.
- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of average and extreme weather might happen next.
- Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.
- Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
- How pollution disproportionately affects some communities more than others.

changing climate conditions impacted living organisms?
- What are some of the environmental justice issues and solutions around climate change?

Students will know…

- Weather is the combination of sunlight, wind, snow or rain, humidity, and temperature in a particular region at a particular time.
- Weather changes over time.
- Differences between weather and climate.
- Scientists look for patterns and order when making observations about the world.
- The Sun powers earth's climate, radiating energy at very short wavelengths, predominantly in the visible or near-visible (ultraviolet) part of the spectrum.
- Key vocabulary terms.
- How to measure and analyze weather data.

Vocabulary:

- Albedo: the amount of sunlight (solar radiation) reflected by a surface.
- Carbon: a widely distributed element that forms organic compounds in combination with hydrogen, oxygen, etc., and that occurs in a pure state as diamond and graphite, and in an impure state as charcoal.
- Climate: "average" weather for a given area.
- Climate change: the result of changes in Earth's atmosphere (the layer of gas that surrounds Earth).
- Environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development and enforcement of environmental laws, regulations and policies.
- Erosion: the process by which the surface of the earth gets worn down by forces such as water, wind, or ice.
- Modeling: the act of representing something (usually on a smaller scale).
- Greenhouse gas: a gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause

the greenhouse effect on planets. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.
- Sea level: the level of the sea's surface, used in reckoning the height of geographical features such as hills and as a barometric standard.
- Weather: the set of current atmospheric conditions, including temperature, rainfall, wind, and humidity at any given place.
- Weathering: breaking down of rocks, soils, and minerals as well as wood and artificial materials through contact with Earth's atmosphere, water, and biological organisms.

Learning Plan: We recommend doing these lessons in sequential order; however, they can be done as individual lessons. Lessons have multiple links (videos, songs, diagrams, activities) that can be used at the teacher's discretion depending on class time. Most of these lessons will be done over several class periods.

Pre-assess: What is the difference between weather and climate? Why is our climate changing? Use informational surveys/questionnaires/inventories, K-W-L or I notice/I wonder to assess students' prior knowledge, have students write or draw in response to the essential questions.

Progress Monitoring: Formative assessment and teacher feedback should be ongoing throughout the lessons. Teachers should develop assessments based on their individual class needs. Think-pair share, exit tickets, interactive discussions, questions and listening, informal observations, quizzes and student work samples can all be used.

Lesson 1: What is Climate Change? - Students watch a videos, then develop an understanding of key terms, such as weather and climate, and discuss the causes and impact of climate change. Students analyze short and long-term data and look for patterns and trends.

- Video: Intro to Climate Change – Watch video and use discussion questions
- How is Earth's Climate Changing Reading and Online Quiz
- Video: Fish and Climate Change
- Investigating Climate Change NYSDEC Conservationist for Kids & Student Worksheet
- Climate Change in my City Student Activity
- Climate Change in the Hudson Valley Student Booklet

Lesson 2: Causes and Effects of Climate Change- Students watch a video, then observe a slide show. Students build a model to gather evidence to support explanations of climate change, and global impacts on their communities.

- Video: Causes and Effects of Climate Change
- Heating it Up: The Chemistry of the Greenhouse Effect slide show
- Causes and Effects of Climate Change Student Activity

- Supplemental: Visualizing and Understanding the Science of Climate Change Lesson plans – There are several resources here that fit nicely into the science of climate change.

Lesson 3: Placing Climate in New York City- Students will understand the local effects of climate change by discussing the short-term impacts and projections for the future.

- Placing Climate Change in NYC Student Activity
- Extensions: Climate Change: Engaging in Action Guide (pg. 86)

Lesson 4: Investigating Sea Level Rise in the Hudson Valley- Students watch a video, then use Scenic Hudson's sea level rise mapper to investigate the potential impacts of sela level rise on their communities. Follow up with an optional field-based lesson.

- Video: Measuring Sea Level Rise
- New York Explores Sea Level Rise: A Field Based Activity

Lesson 5: What is the Future of Earth's Climate? - Students watch a video, then explore and evaluate data showing temperature changes over the past 120 years and data illustrating climate trends over different time scales.

- Video: Three Seconds
- Earth's Changing Climate Student Activity
- What did Earth Look Like? Dinosaur Database Interactive

Lesson 6: Our Footprint, Our Forests, Our Future- Students watch a video, then examine the relationship between climate change and the carbon cycle, identify trends in deforestation and methods of carbon sequestration, and estimate their carbon footprints and identify methods to reduce them.

- Video: Planting trees for a healthier world
- A lesson in Carbon Sequestration Student Activity & Student Worksheet
- Video: I am only, I can't do anything about Climate Change right?

Lesson 7: Environmental Justice- Students examine how pollution disproportionately affects some communities. Students are introduced to the basic concepts of environmental health and environmental justice.

- Video: Climate Justice: Working Together for An Equitable Future
- Environmental Justice & Environmental Health Student Activity
- Analyzing Environmental Justice Student Activity
- Extension: Intro to Climate Justice- Great resources, need to create a free account to access materials

---

Additional Activities:

The Climate Change Mystery Box- Students will demonstrate and describe factors contributing to climate change through and interactive activity.

- Climate Change Symbols Student Activity & Teacher Section
- Main Resource Page

Amazing Albedo- Through an interactive activity, students will measure differences in albedo between light and dark materials.

- Earth's Albedo Student Activity
- Antarctica: Amazing Albedo Activity

The Story is in the Ice- Students analyze, graph, and describe how scientists estimate historical data from ice cores.

- The Story is in the Ice Teacher & Student Activity.
- Main Resource Page.
- Polar Lab: Online Interactive

Teachers: Would you like to visit us at Norrie Point environmental education center, or have an educator visit your classroom in-person or virtually? Contact us to schedule a program: hrteach@dec.ny.gov

Resources:

Websites:

- Climate and Climate Change (NOAA)
- Signs of the Seasons: A New England Phenology Program
- STEM Teaching Tools
- Conservation in a Changing Climate
- What's the Difference between Weather and Climate (NASA)
- Teaching Climate Change- What Educators Should Know and Can Do (AFT)
- ZINN Education Project- Teaching People's History
- NY Climate Change Science Clearinghouse
- Climate Change Curriculum (Groundwork Hudson Valley)
- Climate Change Education: A Model of Justice-Oriented STEM Education
- Young Voices for the Planet
- Celebrating Youth Climate Activists (Scenic Hudson)
- Youth Climate Program (The WILD Center)
- Teaching about Climate and Energy (CLEAN)
- Climate Change Education Module (NYCEP)
- NYC-DEP-Education Curriculum Guide
- Lead with Listening: A Guidebook for Community Conversations on Climate Migration (from the Climigration Network)
- Alliance for Climate Education
- National Science Teaching Association Climate Change
- The Globe Program
- Exploring the Estuary and Climate Change Connection (NOAA)
- What's Good in My Hood: Investigating Urban Communities Student Workbook (NYRP)
- What did Earth Look Like? Dinosaur Database Interactive