

# Unit 3b Weather and Climate

Content Area: **Science**  
Course(s): **Science 7**  
Time Period: **Marking Period 3**  
Length: **MP 3**  
Status: **Published**

## Essential Questions

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- How does fresh water cycle on Earth?
- What causes ocean currents?
- How does the sun's energy affect Earth's atmosphere?
- How do meteorologists predict weather?
- What factors affect Earth's climate?
- How is Earth's weather produced?
- How is climate different from weather?

## Big Ideas

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- Earth's land, water, air and life forms a system.
- Human activities can change earth's land, water, air and life.
- Water circulates through earth's crust, ocean, and atmosphere in the water cycle.
- Weather and climate are the result of the interactions among earth's water, its atmosphere and the sun's heating of Earth's surface.

## Cross-Curricular Integration

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### Integration Area: Language Arts

W.6.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Activity:

Students will write CERs (Claim, Evidence & Reason) on Climate Change. Students will be able to convey their thinking and decision making in written form.

- Students will be answering the question, "What are the contributors of climate change?"
- Students provide evidence that supports their claim.
- Students will then write a reasoning that explains what their claim is, state knowledge they have on the topic, evidence to prove their topic, and close their reasoning with their claim again.

## **Integration Area: Language Arts**

WHST 6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

RST 6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

RST 6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST 6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

RST 6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Activity:

Weather: Explain both the greenhouse effect and the theory of global warming. Do you believe there is a relationship between the greenhouse effect and global warming? Use at least three sources of evidence to support your claim. What impact, if any, does global warming have on your life? Be sure to include at least two relevant examples from your personal experience. What impact do these two things have on your life? Write an explanatory essay that uses fact, details and examples to explain each theory and their relationship to each other.

## **Chapter 6: Percents**

7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

## **Science and Engineering Practices**

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### **Asking Questions and Defining Problems**

- Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)

### **Developing and Using Models**

- Develop and use a model to describe phenomena. (MS-ESS2-6)

### **Planning and Carrying Out Investigations**

- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test

design solutions under a range of conditions. (MS-ESS2-5)

### **CSDT Technology Integration**

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8.1.8.A.1 Demonstrate knowledge of a real world problem using digital tools.

8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results.

Activity:

Students record the weather outside on a spreadsheet, using materials created in the classroom or provided by the STEM lab and compare them to reports of previous years. The data from the previous years will be researched from internet sources. The data from this year and the data from 20, 40, 60, 80, and 100 years ago will be placed on a table and will also require a creation of a graph indicating temperatures over the years. Students will explain how the climate has changed over the course of 100 years.

### **Enduring Understandings**

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#### **MS. Earth's Systems**

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-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation for the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

#### **MS. Earth and Human Activity**

MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

### **Disciplinary Core Ideas**

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)

- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

### ESS3.D: Global Climate Change

- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

## Crosscutting Concepts

### Stability and Change

Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

(MS-ESS3-5)

### Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

### Systems and System Models

Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

### Energy and Matter

Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

## Focus Areas

### Fresh Water

- All living things need water in order to carry out their body processes. In addition, many living things

live in water.

- Most of the Earth's surface water – roughly 97 percent – is salt water found in oceans. Only 3 percent is fresh water.
- In the water cycle, water moves between land, living things, bodies of water on Earth's surface, and the atmosphere.

## **The Oceans**

- Surface currents are driven mainly by winds. A surface current warms or cools the air above it, affecting the climate of the land near the coast.
- Deep currents are caused by differences in the density of ocean water. They move and mix water around the world and carry cold water from the poles toward the equator.

## **The Atmosphere**

- Earth's atmosphere consists of nitrogen, oxygen, carbon dioxide, water vapor, and other gases, as well as particles of liquids and solids.
- Events in one part of the atmosphere affect other parts of the atmosphere.
- Air pressure decreases as altitude increases. As air pressure decreases, so does density.
- Scientists divide Earth's atmosphere into four main layers according to changes in temperature.
- Earth's weather occurs in the troposphere. The stratosphere contains the ozone layer.
- Heat is transferred in three ways: convection, conduction and radiation.
- Winds are caused by differences in air pressure.

## **Weather, Climate and Climate Change**

- Weather is what conditions of the atmosphere are over a short period of time, and climate is how the atmosphere "behaves" over relatively long periods of time.
- Meteorologists use maps, charts, computers, and other technology to prepare weather forecasts.
- Scientists classify climates according to two major factors: temperature and precipitation.
- The six main climate regions are tropical, rainy, dry, temperate marine, temperate continental, polar and highlands.
- In studying ancient climates, scientists follow an important principle: If plants and animals today need certain conditions to live, than similar plants and animals in the past also required those conditions.
- Possible explanations for major climate changes include movement of continents, variations in the position of Earth relative to the sun, major volcanic eruption, and changes in the sun's energy output.
- Many human activities are increasing the level of greenhouse gases in the atmosphere, causing global temperatures to rise.
- Global warming refers only to the Earth's rising surface temperature, while climate change includes warming and the "side effects" of warming—like melting glaciers, heavier rainstorms, or more frequent drought. Said another way, global warming is one symptom of the much larger problem of human-caused climate change.
- Solutions for limiting global warming include finding clean, renewable sources of energy, being more energy efficient, and removing carbon from fossil fuel emissions.
- Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
- Multiple solutions often exist to solve a problem.
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
- Digital technology and data can be leveraged by communities to address effects of climate change.
- Sources of information are evaluated for accuracy and relevance when considering the use of

information.

## **Energy and Matter**

(MS-ESS2-4) Within a natural or designed system, the transfer of energy drives the motion and/or recycling of matter.

## **Creativity and Innovation**

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.

9.4.8.CI.2: Repurpose an existing resource in an innovative way.

9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas.

9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.

## **Critical Thinking and Problem-Solving**

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective.

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.

9.4.8.CT.3: Compare past problem-solving solutions to local, national or global issues and analyze the factors that led to a positive or negative outcome.

## **Digital Citizenship**

9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).

## **Information and Media Library**

9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change.

## **6-8 Engineering Design**

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

## **Core Ideas**

### ETS1.A: Defining and Delimiting Engineering Problems

- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

### ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

### ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

## **Crosscutting Concepts**

### **Influence of Science, Engineering, and Technology on Society and the Natural World**

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural

resources, and economic conditions. (MS-ETS1-1)

\*See Appendix E for Cross Content

## **Resources**

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**Savvas Interactive Science - Water and Atmosphere - 2016**

### **Scientific Inquiry**

MS-ESS2-4     *Water Cycle in a Jar*

MS-ESS2-5     *Weather Scope Real Time Data*

MS- ESS3-5     *Which Location is Best for Me*