Unit 5: Weather

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 4**
Length: **8-10 Weeks**
Status: **Published**

Unit Overview

This unit will help students formulate answers to the questions: "What factors interact and influence weather and climate?" and "How do human activities affect Earth systems?" Students will construct and use models to develop an understanding of the factors that control weather and climate. A systems approach is used in order to examine the feedback between systems. For example, energy from the sun is transferred between systems and circulates through the oceans and atmosphere. Students will understand the ways that human activities impact Earth's other systems and use many different practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of their development.

Performance Expectations

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 result in changes in weather conditions.
MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
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-ESS3-5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Three Dimensions

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in 6-8 builds on K-5 experiences and progresses to specifying relationships between variables, clarify arguments and models.

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

Developing and Using Models

Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-ESS2-1), (MS-ESS2-6)
- Develop a model to describe unobservable mechanisms. (MS-ESS2-4)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- 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)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories nd laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)

Disciplinary Core Ideas

ESS2.A: Earth's Materials and Systems

- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and the matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)

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)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

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)
- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

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 human behavior and applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1), (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)

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)
- Stability might be distrubted either by sudden events or sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

Connections to Engineering, Technology, and Applications of Science

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-ESS3-1)

Knowledge, Skills, and Assessment

Essential Insights and Understandings/Guiding Questions	Critical Knowledge and Skills	Recomn
How does water cycle on Earth?	In the water cycle, water moves between land, living things, bodies of water on Earth's surface, and the atmosphere. **Skill: SWBAT...** • **Explain how Earth's water moves through the water cycle.**	**Activity**: Mode observe/investig different stages drives this cycle energy occur th
	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. **Skill: SWBAT...** • **Identify what causes surface currents and explain how surface currents affect climate.** • **Identify the causes of deep currents and describe the effects that deep currents have.**	**Activity:** Corio readings, studer the Earth's rota Coriolis Effect water to move t to the west in th
How does the sun's energy affect Earth's 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. **Skill: SWBAT...** • **Describe the composition of the atmosphere.** • **Explain how the atmosphere is a system.**	**Activity**: Land model for land both land and w analyze their da

Winds are caused by differences in air pressure. The unequal heating of Earth's surface within a small area causes local winds. Global winds are caused by the unequal heating of Earth's surface over a large area.

Skill: SWBAT...

- **Explain how scientists describe and explain winds.**
- **Distinguish between local winds and global winds and identify major global wind belts.**

How do meteorologists predict the weather?

Clouds form when water water in the air condenses to form liquid water or ice crystals. Scientists classify clouds into three main types based on their shape: cirrus, cumulus, and stratus. Clouds are further classified by their altitude. Most precipitation begins in clouds as snow. Thunderstorms and tornadoes form in cumulonimbus clouds. A hurricane begins over warm ocean water as a low-pressure area, or tropical disturbance. Always find proper shelter from storms.

Skill: SWBAT...

- **Explain how clouds form.**
- **Describe the three main types of clouds.**
- **Describe the main kinds of storms and explain how they form.**
- **Describe the measures that can be taken to ensure safety in a storm.**

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The major air masses are classified as maritime or continental and as tropical or polar. The four types of fronts are cold fronts, warm fronts, stationary fronts, and occluded fronts. Cyclones comes with wind and precipitation. An anticyclone causes dry, clear weather.

Skill: SWBAT...

- **Identify the major air masses that affect the weather in North America and describe how they move.**
- **Name the main types of fronts.**
- **Explain the type of weather that is associated with cyclones and anticyclones.**

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Meteorologists use maps, charts, computers, and other technology to prepare weather forecasts. Standard symbols on weather maps show fronts, air pressure, precipitation, and temperature.

Skill: SWBAT...

- **Explain how weather forecasters use observations, data, and technology to predict the weather.**
- **Describe what can be learned from information shown on weather maps.**

What factors affect Earth's climate?

In studying ancient climates, scientists follow an important principle: If plants and animals today need certain conditions to live, then 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 eruptions, and changes in the sun's energy output.

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Skill: SWBAT...

- **Explain the principle that scientists follow in studying ancient climates.**
- **Identify natural factors that can cause climate change.**

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The sun's energy travels to Earth as visible light, infrared radiation, and ultraviolet radiation. Some sunlight is absorbed or reflected by the atmosphere. Some of the energy Earth absorbs is radiated back out as infrared radiation.

Skill: SWBAT...

- **State in what form energy travels from the sun to Earth.**
- **Explain what happens to the sun's energy in the atmosphere and at Earth's surface.**

Many human activities are increasing the level of greenhouse gases in the atmosphere, causing global temperatures to rise. The effects of global warming include melting glaciers, rising sea levels, drought, desertification, changes in the biosphere, and regional changes in temperature. Solutions for limiting global warming include finding clean, renewable sources of energy, being more energy efficient, and removing carbon from fossil fuel emissions.

Skill: SWBAT...

- **Explain how human activities are affecting the**

temperature of the atmosphere.

Suggested Resources

www.ck12.org

Water Cycle

- http://www.ck12.org/biology/Water-Cycle/

Surface Ocean Currents

- http://www.ck12.org/earth-science/Surface-Ocean-Currents/

Deep Ocean Currents

- http://www.ck12.org/earth-science/Deep-Ocean-Currents/

Composition of the Atmosphere

- http://www.ck12.org/earth-science/Composition-of-the-Atmosphere/lesson/Composition-of-the-Atmosphere-MS-ES/

Local Winds

- http://www.ck12.org/earth-science/Local-Winds/

Global Wind Belts

- http://www.ck12.org/earth-science/Global-Wind-Belts/

Coriolis Effect

- http://www.ck12.org/earth-science/Coriolis-Effect/

Clouds

- http://www.ck12.org/earth-science/Clouds/

Air Masses

- http://www.ck12.org/earth-science/Air-Masses/

Weather Fronts

- http://www.ck12.org/earth-science/Weather-Fronts/

Blizzards

- http://www.ck12.org/earth-science/Blizzards/

Thunderstorms

- http://www.ck12.org/earth-science/Thunderstorms/

Hurricanes

- http://www.ck12.org/earth-science/Hurricanes/

Tornadoes

- http://www.ck12.org/earth-science/Tornadoes/

Predicting Weather

- http://www.ck12.org/earth-science/Predicting-Weather/

Global Climate Change

- http://www.ck12.org/biology/Global-Climate-Change/

Climate Change in Earth History

- http://www.ck12.org/earth-science/Climate-Change-in-Earth-History/

Greenhouse Effect

- http://www.ck12.org/earth-science/Greenhouse-Effect/

Technology Integration

ck12 Flexbook

Chromebooks

iPads

Cellular Devices

Internet

SmartBoard

Differentiation

Differentiation for special education:

- General modifications may include:
  - Modifications & accommodations as listed in the student's IEP
  - Assign a peer to help keep student on task
  - Modified or reduced assignments
  - Reduce length of assignment for different mode of delivery
  - Increase one-to-one time
  - Working contract between you and student at risk
  - Prioritize tasks
  - Think in concrete terms and provide hands-on-tasks
  - Position student near helping peer or have quick access to teacher
  - Anticipate where needs will be
  - Break tests down in smaller increments

- Content specific modifications may include:
  - address misconceptions relating to earth's atmosphere and weather
  - pre-generated graphs
  - mathematical formulas provided
  - teach with visuals
  - scale models
  - lab demonstrations

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan
  - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: water cycle, evaporation, transpiration, precipitation, current, Coriolis effect, climate, weather, atmosphere, water vapor, wind, local winds, sea breeze, land breeze, global winds, latitude, air mass, tropical air mass, polar air mass, maritime air mass, continental air mass, jet stream, front, occluded front, cyclone, anticyclone, storm, thunderstorm, lightening, hurricane, storm surge, tornado, evacuate, meteorologist, isobar, isotherm

Differentiation to extend learning for gifted students may include:

- **Drinking Ancient Water** Write a brief "History of a Drop of Water", a fanciful story tracing a single drop of water from some time and place in the past to the present day school water fountain.
- **Wind Vanes** Research how a wind vane works and what constraints there are on designs so that they are attractive and function correctly.
- **Winds and Airplanes** Research why airline companies would have a special interest in knowing about global winds and on flight times on long-distance flights to see if East-to-West flights have different

times than West-to-East flights.

- **Names of Global Winds** Research the names of global winds, such as trade winds, horse latitudes, and doldrums.
- **Cloud Shapes** Research nonscientific names of some cloud shapes, such as thunderhead, mackerel scales, or mares' tails.
- **The Jet Stream** Investigate the jet stream and plot its normal course on a map.
- **Coriolis Force** Investigate the Coriolis force and how it affects cyclones and anticyclones.
- **Rocky Mountain Thunderstorms** Investigate the geography of the Front Range of the Rockies and explain why summer thunderstorms occur frequently.
- **Hurricane Katrina** Research the devastation caused by Katrina. How many kilometers of coastline were changed? How many houses were destroyed? How many people were displaced?
- **Safety Posters** Create safety posters for the two most likely storms in the area addressing what should be done if one of these storms is approaching the school when in school.
- **Map Making** Research what the weather was on a day an important event happened in their lives then create a local weather map that shows the weather conditions on that day.
- **Year Without Summer** Research the unusual weather in New England and northern Europe during 1816, the "year without a summer", to gather facts and figures, as well as descriptions and stories about weather conditions then summarize what was learned.
- **Heating Your Home** Explore the role that radiation from the sun plays in heating homes. Students should consider whether the sun's radiation makes some rooms warmer in the morning or in the afternoon, and how opening and closing curtains or blinds affects the room's temperature.
- **Photographic Evidence** Using online resources, find pairs of photos that show how melting glaciers have changed particular landscapes over the past several decades and describe the changes in the landscapes.

21st Century Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.