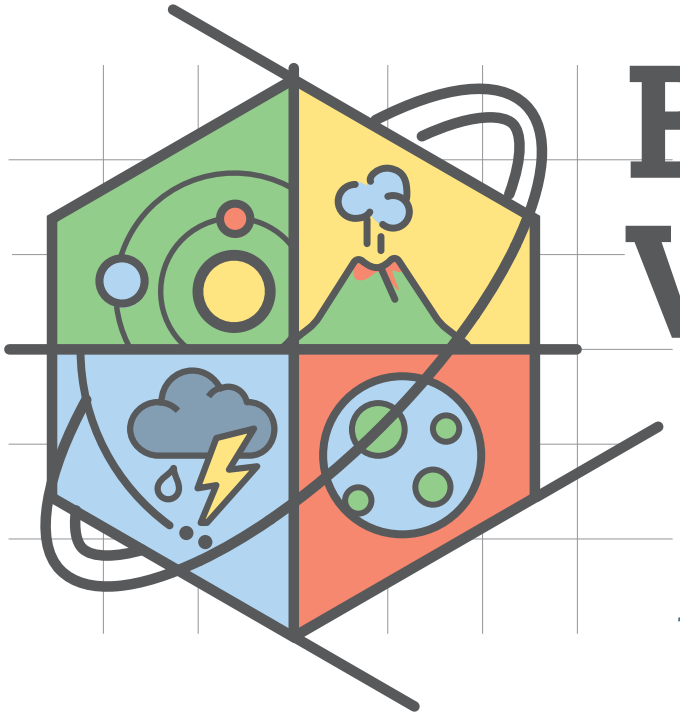

BEYOND WEATHER & CLIMATE

Earth Science for 3rd Grade

STEM

A digital copy of this document is available on the STEM Materials Center website at:
http://web3.esd112.org/stem-initiatives/stem-materials-center/earthkits

STEM
Science
Technology
Engineering
Math

A program of Educational Service District 112 supporting Next Generation Science Standards

UNIT OVERVIEW

This unit was designed to help students (1) develop an understanding of weather through a comparison of weather data from several locations. It uses real data, text, and inquiry to answer the question *How does the weather in the Arctic, Antarctica, and [insert hometown] compare?* And (2) to provide elementary students with the opportunity to investigate how scientists study the Earth's climate. It uses hands-on experiences and nonfiction text to answer the question *How do we learn about Earth's climate?*

Lesson No.	Duration	Standards	Materials Needed	Focus	Assessment Options
1	2 days	3-ESS2-2 RI.3.1 RI.3.9 W.3.9	*Recess at 20 Below* by Cindy Lou Aillaud Internet access World map	**Engage: Introduction to Weather** • Set the Driving Question for this section of the unit: *How does the weather in the Arctic, Antarctica, and [insert hometown] compare?*	Student notebooks Observation of students' participation in class; monitoring notes
1	3 weeks	3-ESS2-1 MP.2/MP.4 MP.5	Vernier Probes to collect local data Delta Science readers Internet access	**Explore: Collect weather data on three locations over several weeks** • Represent data in tables to describe weather in the 3 locations studied.	Science Notebook Data charts Writing prompts
1	5 days	3-ESS2-1 W.3.2/ W.3.4/W.3.7	Internet access *Antarctica: King of Cold* books printed from website	**Explain: Compare patterns in weather data on three locations; make claims for the cause and effects** • Create an informational brochure	Informational brochure

UNIT OVERVIEW (cont.)

2	1 day	3-ESS2-2	Internet access	**Elaborate: Introduce Climate** • Set the driving questions for this section of the unit: *What is the relationship between weather and climate?*	Observation
2	4-5 days	3-ESS2-2 RI.3.1 W.3.7 W.3.9	Delta Science readers Internet access	**Evaluate: Students engage in a research project to identify and describe different climate zones in different regions in the world.**	Rubric to evaluate research project
3	5 days	3-ESS3-1 ETS1-1 ETS1-2 ETS1-3	White paper Construction paper Straws Craft sticks Cloth pieces Clay Beans Tape Plastic wrap Waxed paper String Foil Cups Cardboard bases Push pins Fan	**Engineering Integration: Construct and Test Roofs for Different Climates** • Students complete the engineering design process to develop a solution that minimizes the impacts of hazards related to weather and climate	Design product

LESSON 1: Weather

Strategy: Engage

Introduction to Weather

Materials Needed

Recess at 20 Below by Cindy Lou Aillaud

Internet access

World map

Begin by showing a clip of a weather forecast from the local news. Elicit responses from students about why weather forecasts are important.

Read *Recess at 20 Below* by Cindy Lou Aillaud aloud. There is a YouTube video of students reading the book aloud at https://www.youtube.com/watch?v=fzVo70rY_IQ

The book invites readers into the school day of students in Delta Junction, Alaska—including going outdoors for recess at 20 below zero! Allow plenty of time for students to examine the photographs and react to the text as you read. You can make the experience more concrete by displaying the types of winter clothing and gear that the students wear on a daily basis.

Student conversation around the text should naturally turn to comparison between the weather and students' experience in Delta Junction and the weather and experiences in their hometown; if it doesn't, use purposeful questioning to move the conversation in this direction. Locate Delta Junction on a map, if you haven't done so already. Locate the Arctic Circle (the southern border of the Arctic region) and ask students to predict what the weather might be like even farther north than Delta Junction, Alaska.

Locate Antarctica on a map, and ask students to predict what the weather would be like there. Next, read selections from the Exploratorium's *Ice Stories: Dispatches from Polar Scientists* website. There are several online journal entries, video and audio dispatches that students can engage with to gather information on Antarctic weather.

Finally, introduce the driving question: **How does the weather in the Arctic, Antarctica, and [insert hometown] compare?** Post the question in a visible location for the remainder of the unit. Begin documenting in the notebook some details about weather in each of the 3 locations.

LESSON 1: Weather (cont.)

Strategy: Explore

Collect weather data on three locations over several weeks

Ask students to use their prior knowledge of weather to determine what data to collect (temperature, precipitation, wind speed, humidity).

Develop with the class a graphic organizer to record data. You will need to collect data on all 3 locations: your town, Artic Circle (use Delta Junction, AK) and Antarctica (use McMurdo Station). Discuss with the class what type of weather data is important to collect (temp, precipitation, wind speed, cloud cover, etc.)/ Make predictions about what the weather will be like in each location. Designate a place to record the accuracy of predictions.

Students can collect local weather data using the Vernier probes. Read pages 16-17 in the Delta Science Reader and introduce each probe and demonstrate safe usage of each. Data should be collected and recorded daily. Discuss where you should collect the local weather data, and the time of day to collect. (Be sure to move away from the building so as not to block any wind or precipitation, and take temperature readings in a shady spot.)

Designate a time to discuss the local weather data and the data from Delta Junction and McMurdo.

POSSIBLE EXTENSION

Students can create their own weather data collection tools and compare the reliability of each to the scientific probes. See the article Weather Stations: Teaching the Science and Technology Standard for information about creating simple weather tools.

Students should be guided to analyze their data, represent it graphically, and make comparisons between the weather data for the various locations.

Materials Needed

Vernier Probes: temperature, anemometer, barometer

Delta Science readers

Internet access

LESSON 1: Weather (cont.)

Strategy: Explain

Compare patterns in weather data on three locations; make claims for the cause and effects

Materials Needed

Internet access

Antarctica: King of Cold books printed from website

In this phase, students will develop an understanding of how and why weather differs between the two polar regions, as well as between the polar regions and their hometown.

Geography is of course a factor, and the effect of latitude and proximity to the equator should be discussed. The animation *Why is it cold at the poles?* introduces students to three reasons why the poles receive less solar radiation than the equator (and are therefore colder): the distance the rays travel before reaching Earth, the angle at which the rays strike Earth, and the high albedo (ability to reflect light) of the ice that covers much of the polar regions.

Students may also have noticed that Antarctica, especially at the South Pole, is much colder than the Arctic. Read the Feature Story *Antarctica: King of Cold* to discover why. The text is available at three reading levels (K-1, 2-3, and 4-5) and in three formats (text-only, illustrated book, and electronic book).

Students will create an informational brochure for residents of their town planning to travel to either the Arctic or Antarctica. Along with some general information about the region, the brochure should contain weather information by month or season, an explanation of the differences in weather between their hometown and the selected region, and suggestions for appropriate clothing. The lesson *All About Our Town: Using Brochures to Teach Informational Writing* can be modified for use in this context.

A sample writing prompt for students might read:

> *You are a tour guide who specializes in expeditions to the polar regions (the Arctic and Antarctica). You are working with a group from [insert name of your town] to help them prepare for an upcoming trip to either the Arctic or Antarctica. Write an informational brochure that describes the region,*

LESSON 1: Weather (cont.)

Strategy: Explain (cont.)

focuses on typical weather (by month or season), and gives packing suggestions. Make sure to explain why the weather is different from that in [insert name of your town].

Students should select either the Arctic or Antarctica for their brochures. While they are writing, they should have access to all materials and data used throughout the unit. You may also wish to bring in samples of informational brochures from different states or tourist locations to serve as reference material. This can be an individual or group activity.

Strategy: Expand

Ideally, student questions will drive this phase of the unit. However, teachers might plan to expand the unit in the following ways:

- Introduce the topic of climate change. The issue Climate Change and the Polar Regions provides a wealth of resources for dealing with this subject with elementary students.

As climate change is not assessed at this grade level, it is the teacher's discretion to pursue additional activities.

Strategy: Evaluate

FORMATIVE ASSESSMENT

Formative assessment is conducted throughout the unit. For example:

- Observation of students as they create their informational brochures will provide insight into their mastery of the science content as well as their ability to write in this genre. Work with students as needed to clarify and reteach concepts.

SUMMATIVE ASSESSMENT

The informational brochures created by students during the Explain phase serve as the summative assessment for this unit, demonstrating their ability to answer the question: ***How does the weather in the Arctic, Antarctica, and [insert hometown] compare?***

Brochures can be assessed with a rubric that includes criteria for science content, writing, and visual representations of information.

How Lesson 1 Supports Next Generation Science Standards

3-ESS2 Earth's Systems

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

Peformance Expectation	**Connections to Classroom Activity** *Students:*
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	• Collect weather data from different areas. • Use tables and charts to organize data. • Identify and describe patterns of weather conditions across seasons and locations. • Use patterns to predict typical weather conditions expected during a particular season in their hometown and in different locations.
SCIENCE & ENGINEERING PRACTICES	
Analyzing and Interpreting Data	• Represent data in tables and graphical displays in their informational brochures.
DISCIPLINARY CORE IDEAS	
ESS2.D • Weather and Climate	• Record patterns of the weather across different times and areas so they can make predictions about what weather might happen next.
CROSSCUTTING CONCEPTS	
Patterns	• Use patterns in local and global weather conditions to make predictions.

LESSON 2: Studying the Earth's Climate

Strategy: Engage

Introduce climate

Materials Needed
Internet access
Science notebooks

Read the first page of the Feature Story *How Do We Study Climate?* to students. You can also access this as an illustrated book or e-book by scrolling down on the page.

Draw an outline of two suitcases on the board. Label one suitcase Antarctica and the other Hawaii. Ask students to name the types of clothing they would pack for either trip. Write their ideas inside the outlines of the suitcases. Ask students to explain their thinking. How do they know what types of clothes to pack? When students tell you that it is cold in Antarctica and warm in Hawaii, explain that what they are talking about is weather. Patterns of weather make up a region's climate. Weather can change from hour to hour, but climate remains relatively stable for long periods of time. Use the definition provided in the Feature Story to introduce the term to students.

Print out World Maps from http://nationalgeographic.org/education/mapping/outline-map/ for each student. Have students color and label the world map, using their own terms to describe what climate regions exist across the globe (do not correct these maps—have students keep them in their science notebooks).

Introduce the driving question: **How are weather and climate related?**

LESSON 2: Studying the Earth's Climate (cont.)

Strategy: Explore

Climate postcards activity

Locate the Climate Postcards activity at https://scied.ucar.edu/activity/10899/print-all

Note that the introduction is very similar to the Engage phase listed above. Teachers can choose to omit this section.

Part 1: Exploring Climate Zones – students work in pairs to interpret information from 5 climate graphs. (1 class period)

Part 2: Grandma's Postcards – Copy and cut out the postcards. Provide a set to each small group of students. They will use their understanding of patterns of climate to determine each of grandma's travel locations.

Materials Needed

Worksheets 1 and 2 from Climate Postcards

Rulers

Climate graphs

Postcards from Grandma

Map of Climate Zones

(All of the above available at link web site linked on left.)

Strategy: Explain

Research a climate zone

There are five (or six) climate zones in the world: **tropical, dry (arid), mild (temperate), continental (cool), polar** and **high elevation (alpine)**. Within each zone are further distinctions that indicate a more specific type of climate.

Note for teacher: please be sure not to confuse climate zone with biome. The types of plants that live in an area typically define a biome; for example, conifer trees characteristic of the taiga biome usually are part of the continental climate zone.

Materials Needed

Access to the Internet

http://oceanservice.noaa.gov/education/pd/oceans_weather_climate/media/climate_zones.swf

Books on climate

LESSON 2: Studying the Earth's Climate (cont.)

Strategy: Explain (cont.)

Divide students into 5-6 groups and assign (or allow to choose) a climate zone for each. Students will use internet and other media resources to gather information on their climate zone. Groups should present their information to the class in a manner which you and your students decide.

Characteristics of climate zones that should be represented in the presentations include:

- Location indicated on a map
- Average temperature
- Average precipitation
- Description of seasons
- Typical weather associated with climate zone
- Optional: type of biome associated with the zone

Map of climate zones: http://nationalgeographic.org/archive/xpeditions/activities/08/popup/climate.html

Strategy: Expand

Ideally, this phase is determined by student questions throughout the unit. Some possibilities for further exploration include:

- Asking questions about the local climate that can be answered through data collection and research
- Learning about past climates and how scientists study past climates
- Participating in real data projects about weather and climate

https://scied.ucar.edu/climate

LESSON 2: Studying the Earth's Climate (cont.)

Strategy: Evaluate

FORMATIVE ASSESSMENT

Formative assessment is conducted throughout the unit. For example:

- Observation of students' participation in class activities throughout the unit will provide insight into their current understanding and engagement with the topic.
- Listening to students as they determine importance while reading the Feature Story will help determine how much support they need with this comprehension strategy.

SUMMATIVE ASSESSMENT

Students' work for the final assignment serves as summative assessment for the unit. Student work can be assessed with a rubric that includes criteria for scientific accuracy, use of vocabulary, and overall quality of work.

How Lesson 2 Supports Next Generation Science Standards

3-ESS2 Earth's Systems

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

Peformance Expectation	**Connections to Classroom Activity** *Students:*
3-ESS2-1 Obtain and combine information to describe climates in different regions of the world.	• Engage in a research project to obtain, evaluate and communicate information about how patterns of weather over long periods of time determine the climate of a region of the world.
SCIENCE & ENGINEERING PRACTICES	
Obtaining, Evaluating and Communicating Information	• Use information from books and other reliable media to explain the patterns of climate zones in different regions of the world.
DISCIPLINARY CORE IDEAS	
ESS2.D	• Describe climate as a range of an area's typical weather conditions and the extent to which those conditions vary over years.
CROSSCUTTING CONCEPTS	
Patterns	• Use patterns to make predictions about climate zones in different regions of the world.

LESSON 3: Roofs for Different Climates

Strategy: Define

Solve an engineering design problem

Now that students have had the opportunity to engage in learning on weather and climate, they will use this knowledge to solve an engineering design problem, using the activity Construct and Test Roofs for Different Climates from TeachEngineering.org.

Which roof style best reduces the impact of the weather-related hazard associated with each climate?

Pose the problem that students must design and build a roof for a home that is most suitable to a climate of their choice. Groups of students (3-4) will choose the climate that they are designing their roof to suit.

In the design phase, students will decide on the climate they are designing for (can be the same as previous lesson), determine the weather related hazards associated with that climate, and define what the criteria for success and constraints that they must observe. This discussion is best held as a class, with students helping to determine criteria and constraints. They should keep a T-chart in their science notebooks to record this information for their climate.

Groups should spend time researching the characteristics of their chosen climate, as well as brainstorming possible solutions to the problem. Use the notebooks to record research as well as sketches for design solutions.

Materials Needed

- Internet access
- Books on climate
- Science notebooks

LESSON 3: Roofs for Different Climates (cont.)

Strategy: Design

In the design phase, students will have access to the materials provided, plus any others that the teacher feels are appropriate. Allow 2-3 class periods for the building phase. Students should record any changes they make to their designs in their notebooks, along with reflections on why the changes were important to the success of the solution.

Once the models are completed, test each house according to the procedures suggested in the lesson plan. (For a hurricane, use a strong fan from the custodian in your building.) As each house is tested, students should record 3 strengths and 3 areas for improvement to the design solution in their notebooks. Lead a discussion on which designs best met the criteria, while working within the constraints.

Strategy: Optimize

Have each group trade with another. Allow 1 class period for groups to evaluate their house model, and make changes to the design (you can have them write or list changes, but actually making the adjustments more closely mimics the engineering design process). Test the new models, using the same criteria as the initial test.

Strategy: Expand

Ideally, student questions will drive this phase of the unit. However, teachers might plan to expand the unit in the following ways:

- Homes for different parts of Washington state.

Materials Needed

White paper
Construction paper
Straws
Craft sticks
Cloth pieces
Clay
Beans
Tape
Plastic wrap
Waxed paper
String
Foil
Cups
Cardboard bases
Push pins
Coins, weights (ice)
Hair dryer (wind)
Strainer (rain)

LESSON 3: Roofs for Different Climates (cont.)

Strategy: Evaluate

FORMATIVE ASSESSMENT

Formative assessment is conducted throughout the unit. For example:

- Observation of students as they work in groups will provide insight into their mastery of the science content as well as their ability to work collaboratively.

SUMMATIVE ASSESSMENT

Have students write, using a Claims-Evidence-Reasoning-(Rebuttal) format a response to the question: **Which roof style best reduced the impact of the weather-related hazard associated with each climate?** (Alternatively, students can choose one climate to analyze in light of this question.) Students should list in their evidence: the weather hazard, the problems caused by the weather hazard, how the design solution addressed the problem. They should also cite how the solution meets the criteria and constraints (reasoning), and list the possible risks that would be associated with this solution in reality.

Materials Needed

Rubric for roof design – based on criteria and constraints for each climate zone

Rubric for C-E-R

How Lesson 3 Supports Next Generation Science Standards

3-ESS2 Earth's Systems

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

Peformance Expectation	**Connections to Classroom Activity** *Students:*
3-ESS2-1 Make a claim about the merits of a design solution that reduces the impact of a weather-related hazard.	• Engage in a complete engineering design cycle to design and test a solution to a weather-related problem. • Make a claim about the best solution to a problem by citing evidence about how it meets the criteria and constraints of the problem.
SCIENCE & ENGINEERING PRACTICES	
Engaging in Argument from Evidence	• Develop a claim, supported by evidence from testing, to support the best design solution to a problem. • Critiques the solutions of others by citing relevant evidence about the design, the criteria and the constraints of the problem.
DISCIPLINARY CORE IDEAS	
ESS3.B • Natural Hazards	• A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
CROSSCUTTING CONCEPTS	
Cause and Effect	• Relationships between causes and effect of materials selected and design of the solution are identified, tested and used to explain change.