

Unit Summary

How does weather forecasting help to keep people safe?

In this unit of study, students develop an understanding of patterns and variations in local weather and the use of weather forecasting to prepare for and respond to severe weather. The crosscutting concepts of *patterns; cause and effect; interdependence of science, engineering, and technology; and the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions, analyzing and interpreting data, and obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on K-ESS2-1, K-ESS3-2, and K-2-ETS1-1.

Student Learning Objectives

Use and share observations of local weather conditions to describe patterns over time. *[Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.] (K-ESS2-1)*

Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.* *[Clarification Statement: Emphasis is on local forms of severe weather.] (K-ESS3-2)*

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

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Unit Sequence	
Part A: What types of patterns can be observed in local weather conditions?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> Scientists look for patterns and order when making observations about the world. Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. Weather is the combination of sunlight, wind, snow, or rain and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> Observe and use patterns in the natural world as evidence and to describe phenomena. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. Use and share observations of local weather conditions to describe patterns over time. <i>(Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.)</i> <ul style="list-style-type: none"> ✓ Examples of qualitative observations could include descriptions of the weather, such as sunny, cloudy, rainy, and warm. ✓ Examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. ✓ Examples of patterns could include that it is usually cooler in the morning than in the afternoon.

Unit Sequence	
Part B: How does weather forecasting help us to prepare for and respond to severe weather?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> Events have causes that generate observable patterns. People encounter questions about the natural world every day. Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that communities can prepare for and respond to these events. People depend on various technologies in their lives; human life would be very different without technology. Before beginning to design a solution, it is important to clearly understand the problem. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> Observe patterns in events generated by cause-and-effect relationships. Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. Ask questions based on observations to find more information about the designed world. Ask questions to obtain information about the purpose of weather forecasting to prepare for and respond to severe weather. (Emphasis is on local forms of severe weather.) Define a simple problem that can be solved through the development of a

<ul style="list-style-type: none"> • Asking questions, making observations, and gathering information are helpful in thinking about problems. • A situation that people want to change or create can be approached as a problem to be solved through engineering. 	<p>new or improved object or tool.</p> <ul style="list-style-type: none"> • Ask questions, make observations, and gather information about a situation people want to change in order to define a simple problem that can be solved through the development of a new or improved object or tool.
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What It Looks Like in the Classroom

In this unit of study, students are expected to develop an understanding of patterns and variations in local weather and the use of weather forecasting to prepare for and respond to severe weather. Throughout the unit, students will look for patterns and cause-and-effect relationships as they observe and record weather events. Students will have opportunities to ask scientific questions, analyze and interpret data, and communicate their findings to others.

In this unit of study, students learn that problem situations can be solved through engineering, and that in order to design a solution, we must first define the problem. As described in the narrative above, students define problems caused by severe weather events by asking specific questions, making observations, and gathering information that will help them understand the types of problems they might face when severe weather conditions exist in and around their homes, schools, and communities.

In this unit’s progression of learning, students first develop an understanding that patterns in the natural world can be observed and documented, and that, like scientists, they can use these patterns as evidence to describe phenomena and make predictions. In order to observe patterns in weather, kindergartners will learn that weather is the combination of sunlight, wind, precipitation, and temperature in a particular region at a particular time. By observing and recording daily weather events—such as sunny, cloudy, rainy, and windy— students can analyze both qualitative and quantitative data. Recording and analyzing data over time will reveal recognizable weather patterns that can be used to make predictions. Examples of weather patterns may include:

- ✓ Snow and colder temperatures generally occur in the winter.
- ✓ Clouds may bring rain or snow.
- ✓ Rain occurs more often in the spring.
- ✓ Warmer/hotter temperatures occur in the summer.
- ✓ It is generally cooler in the morning and warmer in the afternoon.

At this grade level, it is developmentally appropriate to describe temperature in relative terms; therefore, vocabulary words such as hot, warm, cool, cold, and warmer/cooler should be used to describe temperature, rather than accurately measuring and describing temperature in degrees Celsius.

Students also learn that weather events have causes that generate observable patterns over time, and that these patterns help weather scientists predict severe weather. Kindergartners need opportunities to learn about severe weather, especially those types that tend to occur in the local region in which they live. By using a variety of media and technology, such as computers, radio, and television, and by reading grade-appropriate texts about weather and weather events, students can learn about types of severe weather that are common to their region. In addition, they come to understand that people depend on technology to help us predict and solve problems, and without it, our lives would be very different.

In order to apply their learning, students need opportunities to ask questions about weather forecasting and how it can help us prepare for and respond to different types of severe weather. When kindergartners ask questions, make observations, gather weather information, and look for patterns of change in the weather, it prepares them to think about how to best prepare for and respond to local severe weather. As part of this unit of study, students are challenged to investigate how people prepare for and solve problems caused by severe weather. With adult guidance, students should define weather problems by asking questions, making

observations, and gathering information about severe weather situations. Some questions students might want to consider include the following:

- ✓ What kinds of severe weather events tend to occur in New Jersey (e.g., thunderstorms, hurricanes, flooding, snow storms)?
- ✓ What do people do in response to these types of severe weather events?
- ✓ What kinds of tools can people use to solve problems caused by severe weather conditions (e.g., umbrellas, sandbags, salt, gravel, shovels, snow blowers)?
- ✓ What other solutions might people use for problems caused by severe weather (e.g., closing schools and businesses; sending out emergency workers to restore utilities; sending out early warnings; stockpiling food, water, and other supplies; having a portable generator)?
- ✓ What kinds of problems would we face if we had a lot of rain in a short period of time?
- ✓ What problems might we have if our community experienced flooding?
- ✓ What kinds of problems might occur if strong winds caused damage (e.g., knocked over trees, damaged power lines, damaged homes and businesses)?
- ✓ What kinds of precautions do people take during a hurricane? A tornado? A Nor'easter? Why?

Connecting with English Language Arts/literacy and Mathematics

English Language Arts

With adult support, students use trade books (read-alouds, big books) to learn about and discuss severe weather. Strategies, such as Think-Pair-Share, can be used to encourage students to think about information from books and to use that information to ask and answer questions about key details. With guidance, students use online media resources to view examples of severe weather. They can ask questions in order to understand how severe weather affects people and communities and to determine how communities prepare for and respond to severe weather.

Mathematics

With adult support, students measure and record various types of weather (e.g., rainfall or snow amounts, relative temperature at different times of the day and over a period of time). They mathematically represent real-world information by organizing their data into simple weather charts and graphs. Kindergarteners attend to the meaning of various quantities using a variety of units of measure and use counting to analyze data and determine patterns in charts and graphs. By using media resources, students explore how weather scientists represent real-world weather data with picture representations, charts, and graphs. They can use this information to think about how weather scientists use tools to collect and record weather data in order to determine patterns of change. Students will attend to the meaning of various quantities used in simple weather charts and graphs, both from classroom observations and from media sources, by counting and comparing severe weather data with daily weather data (e.g., relative amounts of rainfall, snowfall). By analyzing data from weather graphs and charts, young students begin to understand how severe weather affects people and communities and that weather scientists play an important role in predicting severe weather conditions.

Modifications
<p><i>(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)</i></p> <ul style="list-style-type: none"> • Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Use project-based science learning to connect science with observable phenomena. • Structure the learning around explaining or solving a social or community-based issue. • Provide ELL students with multiple literacy strategies. • Collaborate with after-school programs or clubs to extend learning opportunities. • Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Research on Student Learning
N/A

Future Learning
<p>Grade 2 Unit 5: Changes to Earth’s Land</p> <ul style="list-style-type: none"> • Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. • Wind and water can change the shape of the land. <p>Grade 3 Unit 1: Weather and Climate</p> <ul style="list-style-type: none"> • 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. • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. • A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

Grade 4 Unit 1: Weather and Climate

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Grade 4 Unit 2: Earth Processes

- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

Connections to Other Units

N/A

Sample of Open Education Resources

[Watching Weather](#): Students will make their own weather station consisting of actual and simplified versions of real weather equipment. The weather station will consist of a thermometer and a student-made weather vane. They will use that equipment to make observations about the local weather.

[Weather Patterns](#): This lesson is the first in a two-part series on the weather. The study of the weather in these early years is important because it can help students understand that some events in nature have a repeating pattern. It also is important for students to study the earth repeatedly because they take years to acquire the knowledge that they need to complete the picture. The full picture requires the introduction of such concepts as temperature, the water cycle, and other related concepts. In the second activity, *What's the Season*, students identify the seasonal patterns in temperature and precipitation.

[Weather Walks](#): Students learn about weather by taking walks during various weather conditions over the course of time. Walks take place during sunny, rainy, windy, or snowy conditions. The lesson is divided into four sections with activities assigned to each of the weather conditions being observed. Suggested activities include appropriate investigations to help students observe and describe weather phenomenon through first hand experiences.

[Science- Weather](#): This is a free interactive learning activity designed for individual students and can easily be used as a whole class interactive whiteboard activity. This particular title explores weather in relationship to season and temperature. Students learn to use a thermometer as a tool for recording temperature and identify the four seasons through measurable changes in the thermometer readings.

[About the Weather](#): This lesson is about using local weather to make observations, measure, collect, and record data to describe patterns over time. Students will count types of outdoor clothing worn by classmates and use the data to look for patterns in weather over months and seasons.

Teacher Professional Learning Resources**Connections Between Practices in NGSS, Common Core Math, and Common Core ELA**

The presenter was Sarah Michaels from Clark University. In this seminar Dr. Michaels talked about connecting the scientific and engineering practices described in A Framework for K–12 Science Education with the Common Core State Standards in Mathematics and English Language Arts.

[Weather and Climate Basics](#); This is a resource from the National Center for Atmospheric Research and the National Science Foundation that explains the basics of weather and climate. This article is designed as background information for the teacher.

[Earth and Sky: Grades K-4](#): SciGuides are a collection of thematically aligned lesson plans, simulations, and web-based resources for teachers to use with their students centered on standards-aligned science concepts. "We all live under the same big sky." Since the beginning of time, humans have been intrigued by the objects in our sky and beyond. Take a voyage into space science where you will travel through the Internet to connect your classroom with content and activities designed to teach concepts related to these objects and changes in the sky over time.

NGSS Core Ideas: Earth's Systems

The presenter was Jill Wertheim from National Geographic Society. The program featured strategies for teaching about Earth science concepts that answer questions such as "What regulates weather and climate?" and "What causes earthquakes and volcanoes?"

Dr. Wertheim began the presentation by introducing a framework for thinking about content related to Earth systems. She then showed learning progressions for each concept within the Earth's Systems disciplinary core idea and shared resources and strategies for addressing student preconceptions. Dr. Wertheim also talked about changes in the way NGSS addresses these ideas compared to previous common approaches.

Continue the discussion in the [community forums](#).

Appendix A: NGSS and Foundations for the Unit

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Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.* *[Clarification Statement: Emphasis is on local forms of severe weather.] (K-ESS3-2)*

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

The performance expectations above were developed using the following elements from the NRC document [A Framework for K-12 Science Education](#):

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-ESS2-1) <p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the designed world. (K-ESS3-2) Ask questions based on observations to find more information about the natural and/or designed world(s). Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) <p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. (K-ESS3-2) 	<p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. (K-ESS2-1) <p>ESS3.B: Natural Hazards</p> <ul style="list-style-type: none"> Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. (K-ESS3-2) <p>ETS1.A: Defining and Delimiting an Engineering Problem</p> <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) 	<p>Patterns</p> <ul style="list-style-type: none"> Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (K-ESS2-1) <p>Cause and Effect</p> <ul style="list-style-type: none"> Events have causes that generate observable patterns. (K-ESS3-2) <p>-----</p> <p style="text-align: center;">Connections to Nature of Science</p> <p>Science Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Scientists look for patterns and order when making observations about the world. (K-ESS2-1) <p>-----</p> <p style="text-align: center;">Connections to Engineering, Technology, and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> People encounter questions about the natural

	<ul style="list-style-type: none"> Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1) 	<p>world every day. (K-ESS3-2)</p> <p>Influence of Engineering, Technology, and Science on Society and the Natural World</p> <ul style="list-style-type: none"> People depend on various technologies in their lives; human life would be very different without technology. (K-2-ETS1-1)
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English Language Arts	Mathematics
<p>Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-ESS2-1) W.K.7</p> <p>With prompting and support, ask and answer questions about key details in a text. (K-ESS3-2) RI.K.1</p> <p>Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-ESS3-2) SL.K.3</p> <p>Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (K-2-ETS1-1) RI.2.1</p> <p>With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-1) W.2.6</p> <p>Recall information from experiences or gather information from provided sources to answer a question. (K-2-ETS1-1) W.2.8</p>	<p>Reason abstractly and quantitatively. (K-ESS2-1),(K-2-ETS1-1) MP.2</p> <p>Model with mathematics. (K-ESS2-1),(K-ESS3-2),(K-2-ETS1-1) MP.4</p> <p>Use appropriate tools strategically. (K-2-ETS1-1) MP.5</p> <p>Counting and Cardinality (K-ESS3-2) K.CC</p> <p>Know number names and the count sequence. (K-ESS2-1) K.CC.A</p> <p>Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. (K-ESS2-1) K.MD.A.1</p> <p>Classify objects into given categories; count the number of objects in each category and sort the categories by count. (K-ESS2-1) K.MD.B.3</p> <p>Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (K-2-ETS1-1) 2.MD.D.10</p>