Pace
Charter School of Hamilton

Science Curriculum
Grade 3

Our Mission

Our mission is to cultivate science learners who have the foundational knowledge to make ethical, scientifically literate decisions and the ability to apply scientific practices in order to contribute to the needs of society and a changing world.

- **Vision**

  We envision a K-12 science experience that supports and challenges every student in their science learning journey. We will:

  - *Capitalize on diversity by reaching and exciting students at all levels and interests by differentiating learning within classrooms and by offering a robust program of studies.*
  - *Emphasize authentic science and engineering practices and leverage the interdisciplinary nature of science with arts, technology, math, reading, and writing.*
  - *Integrate scientific knowledge and 21st century competencies to prepare students to make informed decisions and take action to address real world problems.*

Elementary Science NGSS Grade 3- Weather and Climate

Unit Summary
What is the typical weather near our home? ***How can we protect people from weather-related hazards?*** In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. The crosscutting concepts of *patterns, cause and effect*, and the *influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in a*sking questions and defining problems, analyzing and interpreting data, engaging in argument from evidence*, 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 3-ESS2-1, 3-ESS2-2, 3-ESS3-1, and 3-5-ETS1-1.
Student Learning Objectives
Develop a model using an analogy, to describe how weather and climate are related**.** (**ESS2.D**) *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**
Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* **(3-ESS3-1)**

Quick Links

Unit Sequence	
Part A: *Can we predict the kind of weather that we will see in the spring, summer, autumn, or winter?*	
Concepts	**Formative Assessments**
● Patterns of change can be used to make predictions. ● People record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	*Students who understand the concepts can:* ● Make predictions using patterns of change. ● Represent data in tables, bar graphs, and pictographs to reveal patterns that indicate relationships. ● Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *(Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.)* Examples of data could include: ✓ Average temperature ✓ Precipitation ✓ Wind direction

Part B: *How can climates in different regions of the world be described?*	
Concepts	**Formative Assessments**
● Patterns of change can be used to make predictions. ● Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over years.	*Students who understand the concepts can:* ● Make predictions using patterns of change. ● Obtain and combine information from books and other reliable media to explain phenomena.

Part C: *How can we protect people from natural hazards such as flooding, fast wind, or lightning?*	
Concepts	**Formative Assessments**
● Cause-and-effect relationships are routinely identified, tested, and used to explain change. ● Science affects everyday life. ● People's needs and wants change over time, as do their demands for new and improved technologies. ● A variety of natural hazards result from natural processes (e.g., *flooding, fast wind, or lightning).* ● Humans cannot eliminate natural hazards but can take steps to reduce their impacts. ● Engineers improve technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). ● Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the	*Students who understand the concepts can:* ● Identify and test cause-and-effect relationships to explain change. ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. ● Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. Examples of design solutions to weather-related hazards could include: ✓ Barriers to prevent flooding ✓ Wind-resistant roofs ✓ Lightning rods ● Define a simple design problem that can be solved through the development of an object, tool, process, or system and include several criteria for success and constraints on materials, time, or cost. ● Define a simple design problem reflecting a need or a want that includes specified criteria for

desired features of a solution (criteria). ● Different proposals for solutions can be compared on the basis of how well each one meets the criteria for success or how well each takes the constraints into account.	success and constraints on materials, time, or cost.

What It Looks Like in the Classroom

In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. They notice patterns as they analyze and interpret weather data, and they use this data to determine cause-and-effect relationships. By applying their understanding of weather-related hazards, students make claims about the merit of a design solution that reduces the impacts of such hazards, using evidence to support their claims.

Initially, students learn that scientists record patterns of weather across different times and locations in order to make predictions about future weather conditions. To understand how scientists use weather data, students need time, tools, and resources (both print and digital) to collect weather data. They can use a variety of tools (e.g., thermometers, anemometers, rain gauges) to collect firsthand data and multiple resources (e.g., Weather Bug, NOAA) to gather weather data that has been collected over longer periods of time. Multiple units of measurement (e.g., m, cm, °C, km/hr) should be used when recording weather conditions such as temperature, types and amounts of precipitation, and wind direction and speed. To organize the data they collect, students create graphical displays (bar graphs and pictographs) and tables. Once a sufficient amount of data is collected, students need opportunities to analyze data, looking for patterns of change that can be used to make predictions about typical weather conditions for a particular region and time of year. As they collect and analyze data over time, students learn that certain types of weather tend to occur in a given area and that combinations of weather conditions lead to certain types of weather (e.g., it is always cloudy when it rains or snows, but not all types of clouds bring precipitation).

Weather is a combination of sunlight, wind, precipitation, and temperature in a particular region at a particular time. Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over the years. After learning to analyze and use data to make weather predictions, students use long-term patterns in weather to describe climates in a variety of regions around the world. To accomplish this, students use books and other reliable media to obtain information and weather data collected over a long period of time for a variety of regions. With guidance, students analyze the available data and information in order to describe the climate (e.g., average temperatures, average precipitation, average amount of sunlight) in each region.

Science affects everyday life. Whenever people encounter problems, engineers use scientific knowledge to develop new technologies or improve existing ones to solve our day-to-day problems.

After studying weather and climate, students investigate how weather-related hazards can be reduced. Students learn that there are a variety of natural hazards that result from severe weather. Severe weather, such as high winds, flooding, severe thunderstorms, tornadoes, hurricanes, ice or snowstorms, dust storms, or drought, has the potential to disrupt normal day-to-day routines and cause damage or even loss of life. While humans cannot eliminate natural hazards, they can take steps to reduce their impact. Students can use trade books and media resources to research types of severe weather hazards and their effects on communities and find examples of how communities solve problems caused by severe weather. As a class, students determine the types of severe weather that are common to the local area and discuss the effects on the community. (Define the problem.) In pairs or small groups, students can research ways that the community reduces the effects of severe weather. (Determine ways in which the problem is solved.) Given criteria, groups can determine how well each solution reduces the effects of severe weather. Groups can also prepare a presentation that

- Describes the solution that the group thinks is best for reducing the effects of a given type of weather hazard,

- Lists evidence to support their thinking, and
- Lists at least one possible constraint, such as materials, time, or cost.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts/Literacy As students engage in the science described in this unit of study, they use books and other reliable media resources to collect weather and climate information for a given region. They compare information found in two different texts and use information to answer questions about weather and climate. To integrate writing, students can take brief notes as they conduct research and sort evidence into provided categories. Opinion pieces and short research projects should be included to build knowledge about weather and climate. *Mathematic* Like literacy, mathematics is integrated in a variety of ways. Students use appropriate tools and units of measure when collecting and recording weather and climate data. They model with mathematics when organizing data into scaled bar graphs, pictographs, and tables. Throughout the unit, students reason abstractly and quantitatively as they analyze and compare weather data. They will use that information to answer questions and solve multistep problems.

Modifications

(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.)

- 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

Prior Learning
Kindergarten Unit 3: Weather ● 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. ● 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.

- Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary)*

Future Learning

Grade 4 Unit 1: Weathering and Erosion

- 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 5: Transfer of Energy

- 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.

Grade 4 Unit 7: Using Engineering Design with Force and Motion Systems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary)*

Grade 5 Unit 5: Earth Systems

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

Connections to Other Units

The Disciplinary Core Ideas in this unit are not related to other units in this grade.

Sample of Open Education Resources

Weather Science content for Kids and Teens: The National Weather Service has several education resources available at this website.

NOAA Education Resources: The National Oceanic and Atmospheric Administration (NOAA) provides education resources at this website.

(Note: Students in grades Kindergarten, 4, and 5 make sense of weather and climate. Each model science unit related to Weather and Climate will include these two websites. Therefore, it is important that teachers of science in these grades to collaborate to prevent redundancy in the K-5 weather and climate curriculum.)

Teacher Professional Learning Resources

Teaching NGSS in Elementary School—Third Grade

Carla Zembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director of Michigan Mathematics and Science Centers Network, Kathy Renfrew, K-5 Science Coordinator for VT Agency of Education and Kimber Hershberger, co-author of "What's Your Evidence?" introduced an overview of the NGSS for Third Grade. The web seminar began with explaining how to unpack the performance expectations. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed.

Visit the resource collection.

Continue discussing this topic in the community forums.

NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence
Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the *NGSS* for K-5th grade. The web seminar focused on the three dimensional learning of the *NGSS*, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

To view related resources, visit the resource collection.
Continue discussing this topic in the community forums.

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. Participants had the opportunity to submit questions and share their feedback in the chat.

Continue the discussion in the community forums.

Appendix A: NGSS and Foundations for the Unit		
Develop a model using an analogy, to describe how weather and climate are related**.** (**ESS2.D**) *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*		
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**		
Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)		
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* **(3-ESS3-1)**		
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**
Planning and Carrying Out Investigations ● Plan and conduct	**ESS2.D: Weather and Climate** ● Scientists record patterns of the weather	**Patterns** ● Patterns of change can be used to make predictions.

investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1) ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2) **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. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	(3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1) --- ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World** ● Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1) --- ***Connections to Nature of Science*** **Science is a Human Endeavor** ● Science affects everyday life. (3-ESS3-1)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2) **RI.3.1** Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2) **RI.3.9** Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-ESS3-1) **W.3.1** Conduct short research projects that build knowledge about a topic. (3-ESS3-1) **W.3.7** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-ESS2-2) **W.3.9**	Reason abstractly and quantitatively. (3-ESS2-1),(3-ESS2-2),(3-ESS3-1) **MP.2** Model with mathematics. (3-ESS2-1),(3-ESS2-2), (3-ESS3-1) **MP.4** Use appropriate tools strategically. (3-ESS2-1) **MP.5** Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-ESS2-1) **3.MD.A.2**

	Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in bar graphs. (3-ESS2-1) **3.MD.B.3**

21st Century Life and Careers/Technology Standards (as applied at grade level):

- Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
- Communicate clearly and effectively and with reason.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Employ valid and reliable research strategies.
- Demonstrate creativity and innovation.
- Apply appropriate academic and technical skills.

Social Studies

Standard 6.1 U.S. History: America in the World. All students will acquire the knowledge and skills to think analytic about how past and present interactions of people, cultures, and the environment shape the American heritage. S knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democr values as productive citizens in local, national, and global communities.

Materials Required for This Unit				
Quantity	**Description**	**Potential Supplier (item #)**	**Estimated Price**	**Lesson #**
1 set per class	Thermometers			2
30 per class	Clear plastic cups (7 oz.)			2
1 per class	Rain gauge			2
1 per class	Anemometer			2
1 per class	Barometer			2
5 sheets per class	Tagboard (12x18 in)			2
1 per student	Fabric (4x6 in rectangles)			2

10 sheets per class	Medium Weight Poster Paper			6
1 per class	Popsicle/Craft Sticks (box of 500)			6
1 per class	Straws (box of 250 or 380)			6
100 per class	Zip ties			6
10 rolls per class	Masking Tape			6
1 per class	Hair Dryer			6
1 per class	Plastic container (approx. 2 ft. x 3 ft.)			6
5 lbs per class	Clay (may modify quantity after pilot)			6
	Budget for purchase of read aloud books during pilot		Not to exceed $250 ** After the pilot, texts will be selected and purchased for each class	unit

Investigation #1: Introduction to Weather and Climate

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 1 in a series of 7 lessons (1 day)**
Brief Lesson Description: In this lesson, students will use pictures to obtain and combine information to describe climates in different regions of the world. They will identify key characteristics in each picture and look for patterns. This lesson will serve as a pre-assessment to determine vocabulary and concepts that students already know and need to know.		
Performance Expectation(s): Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)		
Specific Learning Outcomes: At the end of this lesson students will be able to identify patterns relating to weather conditions. They will also understand that weather varies in different seasons and regions.		
Narrative / Background Information		
Prior Student Knowledge: This lesson will assess students' prior knowledge of weather concepts and vocabulary.		
Science & Engineering Practices: **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● 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. (3-ESS2-1) ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

(3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)		
Possible Preconceptions/Misconceptions: ● Weather and climate are the same thing. ● Seasons are the same throughout the world.		
EVALUATE: **Formative Monitoring (Questioning / Discussion):** What do you observe that might show us a pattern in this photo or photos? Why did you group these pictures together? **Summative Assessment (Quiz / Project / Report):** Students use appropriate vocabulary to describe their findings.		
Elaborate Further / Reflect: Enrichment: Mathematical concepts related to measurement and data.		

Investigation #2: Measuring Weather

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 2 in a series of 7 lessons (2 days)**
Brief Lesson Description: Students will learn how to use weather tools to gather weather data, such as temperature, precipitation and wind speed/direction.		
Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1)		
Specific Learning Outcomes: At the end of these lessons, students will be able to use instruments to obtain weather data. *How is temperature measured? (thermometer) *How is wind measured? (anemometer) *How are rain and snow measured? (rain gauge)		
Prior Student Knowledge: Students will know definitions of temperature, wind, and precipitation. Students will know that weather varies in different seasons and regions.		
Science & Engineering Practices: **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● 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. (3-ESS2-1)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2)
Possible Preconceptions/Misconceptions: ● Confusion of Fahrenheit and Celsius ● There is no way to measure rain, wind, and snow. ● Wind direction is determined by where the wind is blowing towards.		
EVALUATE: **Formative Monitoring (Questioning / Discussion):** Day 1: Observation of how groups choose to report their data (various learning styles) Day 2: Class discussion on using weather tools to obtain weather data, students' findings as recorded in		

notebooks.
Elaborate Further / Reflect: Enrichment: Effectively and appropriately use weather tools (anemometer, thermometer, barometer, wind vane) and understand their impact.

Investigation #3: Representing Weather Data

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 3 in a series of 7 lessons (1 day)**
Brief Lesson Description: In this lesson, students will use weather data, using this information to identify weather patterns and make a claim.		
Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1)		
Specific Learning Outcomes: By the end of this lesson, students will be able to present data in various ways, such as graphs, tables, and charts.		
Narrative / Background Information		
Prior Student Knowledge: Children have looked at and interpreted data in previous years of school. They have also been exposed to graphs and charts in books they have read. Students' knowledge of graphing, data collection, and data analysis may need to be expanded.		
Science & Engineering Practices: **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● 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. (3-ESS2-1)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)
Possible Preconceptions/Misconceptions: ● Graphs are only used during math class. ● Students may not read graphs correctly.		

LESSON PLAN – 5-E Model

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

Post the following data in the front of the room. Tell students, "This is an organized chart that contains information. What do you notice/think/see?" Turn and talk.

"This isn't the only way to show information. How else could we represent this information?" (Data can be represented in graphs)

Average Temperatures in Grand Rapids, MI From January Through July	
January	25 Degrees F
February	35 Degrees F
March	40 Degrees F
April	50 Degrees F
May	55 Degrees F
June	65 Degrees F
July	70 Degrees F

EXPLAIN: Concepts Explained and Vocabulary Defined:

Model using this information to create a bar graph. Discuss how this visual helps you understand weather patterns and why you would use it.

Vocabulary: bar graph, title, chart, scale, data, labels

ELABORATE: Applications and Extensions:

Students will use accurate weather data (gathered previously from various areas) to create a chart, table, and/or graph. Using this information, they will explain the significance of these representations.

EVALUATE:

Formative Monitoring (Questioning / Discussion): Teacher observation, question and discussion effectively communicating understanding of data.

Elaborate Further / Reflect: Enrichment: Students use a variety of graphs to demonstrate similar data. Students understand average temperature.

Investigation #4: Weather vs. Climate

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 4 in a series of 7 lessons (1-2 day)**
Brief Lesson Description: In this lesson, students will learn the difference between weather and climate. Students will also learn the 6 major climate zones.		

Performance Expectation(s): 3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.		
Specific Learning Outcomes: At the end of the lesson, students will be able to differentiate between the terms weather and climate. Students will also be able to identify different climates regions of the world.		
Narrative / Background Information		
Prior Student Knowledge: Students have knowledge of basic weather conditions (temperature, precipitation, wind) and understand that weather is different around the world.		
Science & Engineering Practices: **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2)
Possible Preconceptions/Misconceptions: ● Weather is the same all over the world. ● Weather and climate are the same thing. ● Students may also not be aware of climate zones.		
EVALUATE: **Formative Monitoring (Questioning / Discussion):** Teacher observation and question and discussion		
Elaborate Further / Reflect: Enrichment: Climate Zones/Biomes – Studyjams Video: http://studyjams.scholastic.com/studyjams/jams/science/ecosystems/biomes.htm		

Investigation #5- Extreme Weather

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 5 in a series of 7 lessons (4-5 days)**
Brief Lesson Description: In this lesson, students will be introduced to what constitutes an extreme weather event, how they come about, how they affect people and how to prepare for them.		
Performance Expectation(s): Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* (3-ESS3-1)		
Specific Learning Outcomes: SWBA to identify extreme weather phenomena and the related hazard that humans should be prepared for.		
Narrative / Background Information		
Prior Student Knowledge: Students know that precipitation, wind, and temperature make up weather. Students also know that there are different climate zones around the world, which have their own weather patterns. Students may know that extreme weather affect people.		
Science & Engineering Practices: **Planning and Carrying Out Investigations** ● Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data**	**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. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)		
Possible Preconceptions/Misconceptions: There is no need or way to prepare for extreme weather conditions. Humans can control extreme weather conditions. Some students might not be aware that certain types of hazardous weather typically happen in certain areas of the world. Some students may not be able to differentiate between extreme weather events and seismic events (earthquakes, tsunamis, volcanoes).		
EVALUATE: **Formative Monitoring (Questioning / Discussion):** Students will seek appropriate tools for investigation and cooperative group work **Summative Assessment (Quiz / Project / Report):** Students share their findings via a presentation method of their choice. Presentation meets the expectation using a rubric defined.		
Elaborate Further / Reflect: Enrichment:		

Investigation #6: Engineering for Extreme Weather

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 6 in a series of 7 lessons (3-4 days)**
Brief Lesson Description: In this lesson, students will use what they know to design a prototype solution to limit damage from wind and water.		
Performance Expectation(s): Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* (3-ESS3-1)		
Specific Learning Outcomes: Students will be able to design a solution to reduce the impacts of a weather-related hazard.		
Narrative / Background Information		
Prior Student Knowledge: Students know various types of extreme weather events and understand that extreme weather conditions can impact humans.		

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Planning and Carrying Out Investigations ● Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**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. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	**Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1) ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World** ● Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1)
Possible Preconceptions/Misconceptions: ● No structure can withstand an extreme weather event. ● It is not necessary to prepare for extreme weather.		
EVALUATE: **Formative Monitoring (Questioning / Discussion):** Questioning techniques, observation of group work and materials selected. **Summative Assessment (Quiz / Project / Report):** Reflection on improvement made on structural design.		
Elaborate Further / Reflect: Enrichment:		

Investigation #7: Weather Report

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Lesson # 7 in a series of 7 lessons (3 days)**
Brief Lesson Description: Students will create a weather report using meteorological data to report accurately. This should include Typical weather of the region, leading into extreme weather conditions and safety recommendations.		
Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1)		
Specific Learning Outcomes: At the end of this lesson, students will be able to create a weather report using data from tables and graphical displays to describe weather conditions expected during a particular season.		
Narrative / Background Information		

Prior Student Knowledge:
Students have an understanding of weather, climate, and extreme weather events, as well as how to prepare for those events. Students know the difference between extreme weather and weather.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Planning and Carrying Out Investigations ● Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**ESS2.D: Weather and Climate** ● 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. (3-ESS2-1) ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2) **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. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	**Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

Possible Preconceptions/Misconceptions:
A variety of extreme weather conditions can exist in one area.
People can not prepare for extreme weather.

EVALUATE:

Formative Monitoring (Questioning / Discussion): Observations, questioning, progress of report, cooperative group work

Summative Assessment (Quiz / Project / Report): Students completed weather reports and presentation is made in a meaningful way.

Elaborate Further / Reflect: Enrichment:

NGSS ONLINE RESOURCES

General Information:

1. "Lab Before Blab" - Conducting investigations before explanations. Other PBS education videos are also instructive. (http://www.thirteen.org/programs/pbs-newshour/lab-before-blab-lights-upelementary-school-science-1392155837/)

2. NJDOE model curricula: a framework of suggested topic sequences, course outlines, guiding questions, links to videos, etc. (http://www.state.nj.us/education/modelcurriculum/sci/)

3. The National Science Teachers Association website. For members and non-members, NGSS resources, conferences, webinars, books, free downloads, videos. (http://www.nsta.org/)

4. Free NGSS digital copies and ancillary materials, videos, curriculum ideas, embedded assessment unit plans. (www.nextgenscience.org)

5. NGSS Evidence Statements downloadable for every K-12 Performance Expectation. Also: videos and other free materials. (http://nextgenscience.org/evidence-statements)

6. Videos, lessons, NGSS information, and more. (http://www.teachingchannel.org/)

Instruction:

1. Brief summaries of STEM Teaching Tools that encapsulate the practices of NGSS reform. (http://stemteachingtools.org/tools)

2. PD strategies for NGSS. (http://www.cesa4.k12.wi.us/cms_files/resources/NGSS%20Professional%20Development%20Strategies.pdf.)

3. TERC provides online PD programs as part of their Inquiry Project for grades 3-5. The strategies for supporting productive science discourse in the classroom are applicable for higher grades as well. Online materials for the Talk Moves and Talk Science approaches are downloadable. (http://inquiryproject.terc.edu/)

4. Study Jams from Scholastic. Interactive science activities. (https://www.scholastic.com/teachers/activities/teaching-content/matter-9-studyjams-interactive-science-sctivities/

Assessment:

1. Developing assessments for the NGSS. It addresses K-12 including AP courses, explains the research on assessment providing examples, resources, unit outlines, rubrics, and examples of student responses. (http://www.nap.edu/catalog.php?record_id=18409)

2. NAEP interactive assessment tasks for elementary, middle, and high school, with scoring and analyses of student responses. (http://www.nationsreportcard.gov/science_2009/)

3. "Below you will find links to released test items for the New Jersey Student Learning Assessment-Science. Please know that the middle and high school assessments are said to be comprehensive, incorporating standards from physical, life, and earth/space sciences." (April 2018, Bergen County)
http://www.state.nj.us/education/aps/cccs/science/assessment.htm
https://nj.testnav.com/client/index.html#login?username=LGN))5710830&password=YTDEKPMW
http://ct.portal.airast.org/

4. "The URL below is being shared with you by Mike Heinz, Science Coordinator, NJDOE. The link contains the raw drafts of the science assessment tasks that counties have contributed to. **These are in DRAFT form**. They need to be reviewed, formatted, and field tested. This is a compilation of the assessment collaborations that were done since August 2017. When sharing with your teachers, please be sure to indicate that these are **draft tasks**; they have neither been reviewed nor vetted.

Teachers **may** want to use them as formative assessment tasks that are **not graded**. Student performance will provide the teacher with some data about how well the task performs without imopacting a student's grade. And of course, Mike would appreciate your feedback about the appropriateness and applicability of each task so that continuous improvements may be made." (March 2018, Bergen County) (https://tinyurl.com/draftstasksnj1)

Phenomena:

1. Finding phenomena for lessons, investigations, and/or units can be found at **https://thewonderofscience.com/phenomenal/**

2. Finding phenomena for lessons, investigations, and/or units can be found at **www.ngssphenomena.com**

CER: Claims – Evidence - Reasoning

1. Audi Commercial "Alien": Is the little girl's father an alien? Watch the video: make a claim, provide evidence, and offer reasons. (http://www.youtube.com/watch?v=89uJz_us4PM)

Authentic Data:

1. MY NASA DATA (MND)'s tools allow access real NASA Earth Science data. Through the use of MND's Live Access Server (LAS) data viewer, one can create a variety of charts, plots, and graphs to explore Earth systems and answer research questions. MY NASA DATA offers a large number of lesson plans, tools, and resources. (https://mynasadata.larc.nasa.gov/)
2. With NOAA's Data in the Classroom, students use real-time ocean data to explore today's environmental issues and develop problem-solving skills employed by scientists. Classroom-ready activities are available. (https://dataintheclassroom.noaa.gov/)
3. US Geological Survey (USGS) Real-time Data. USGS scientists gather information through periodicor continuous measurement in the field to provide a view of current conditions. (https://www.usgs.gov/products/data-and-tools/real-time-data)