IS4

Grade Three Instructional Segment 4: Weather Impacts

Students build on their observations of weather patterns from kindergarten, this time focusing on describing these patterns **quantitatively [CCC-3]**. As in kindergarten, their observations begin locally, but the numbers and graphical representations allow them to compare weather patterns from different places across the world. Students also explore the impact of weather-related hazards on their local community and design solutions to minimize the impacts on humans.

GRADE THREE INSTRUCTIONAL SEGMENT 4: WEATHER IMPACTS

Guiding Questions

- What is typical weather in my local region?
- How does it compare to other areas of California and the world?
- What weather patterns are common for different seasons?
- What weather-related hazards are in my region?
- How can we reduce weather-related hazards?

Performance Expectations

Students who demonstrate understanding can do the following:

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 at this grade level 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-ESS3-1. 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 lighting rods.]

3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

3–5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3–5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.*

GRADE THREE INSTRUCTIONAL SEGMENT 4: WEATHER IMPACTS

The bundle of performance expectations above focuses on the following elements from the NRC document *A Framework for K–12 Science Education*:

Highlighted Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
[SEP-1] Asking Questions and Defining Problems [SEP-2] Developing and Using Models [SEP-3] Planning and Carrying Out Investigations [SEP-4] Analyzing and Interpreting Data [SEP-5] Using Mathematics and Computational Thinking [SEP-6] Constructing Explanations (for science) and Designing Solutions (for engineering) [SEP-7] Engaging in Argument from Evidence [SEP-8] Obtaining, Evaluating, and Communicating Information	ESS2.D Weather and Climate ESS3.B: Natural Hazards ETS1.B: Developing Possible Solutions	[CCC-1] Patterns [CCC-2] Cause and Effect: Mechanism and Explanation [CCC-6] Structure and Function

Highlighted California Environmental Principles and Concepts:

Principle II The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.

Principle III Natural systems proceed through cycles that humans depend upon, benefit from and can alter.

Principle IV The exchange of matter between natural systems and human societies affects the long-term functioning of both.

Principle V Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes.

CA CCSS Math Connections: MP.5; 3.MD.3, 4

CA CCSS for ELA/Literacy Connections: W3.1B, W3.8, SL.3.1, SL.3.2, SL.3.3, SL.3.4, RI.3.1, RI.3.3, RI.3.4, RI.3.5, RI.3.7

CA ELD Standards Connections: 3.P1.A.1, 3.P1.A.2, 3.P1.B.5, 3.P1.C.9

The grade three vignette on weather impacts illustrates a sample instructional sequence that fully prepares students to meet most of the performance expectations in this instructional segment. It illustrates how weather observations can be integrated into the curriculum throughout the year and then highlights how students can analyze their data and apply their findings during a focused unit of instruction late in the school year.

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3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

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3–5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3–5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Highlighted Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
[SEP-4] Analyzing and Interpreting Data [SEP-6] Constructing Explanations (for science) and Designing Solutions (for engineering) [SEP-8] Obtaining, Evaluating, and Communicating Information	ESS2.D Weather and Climate ESS3.B: Natural Hazards ETS1.B: Developing Possible Solutions	[CCC-1] Patterns [CCC-2] Cause and Effect: Mechanism and Explanation [CCC-6] Structure and Function

Highlighted California Environmental Principles and Concepts:

Principle II The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.

Principle III Natural systems proceed through cycles that humans depend upon, benefit from and can alter.

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Principle IV The exchange of matter between natural systems and human societies affects the long-term functioning of both.

Principle V Decisions affecting resources and natural systems are complex and involve many factors.

CA CCSS Math Connections: 3.MD.3, 3.MD.4

CA CCSS for ELA/Literacy Connections: W3.1a-b, W3.7, W3.8, SL.3.1, SL.3.2, SL.3.3, SL.3.4, RI.3.1, RI.3.3, RI.3.4, RI.3.5, RI.3.7

CA ELD Standards Connections: 3.P1.A.1, 3.P1.A.2, 3.P1.B.5, 3.P1.C.9

Introduction

This vignette illustrates ways that three-dimensional CA NGSS implementation can be aligned to support the development of environmental literacy and problem solving using the campus as a context for learning. It highlights ways that regular data collection and data analysis help scientists understand the natural world.

How does Weather Impact our Community?

Drawing from the social studies curriculum, Mr. C chose a yearlong theme of community. He worked to tie lessons back to the students' school, their homes, their neighborhood, and their city. Mr. C attempted to integrate science into the theme of community. This worked well for his life science unit about Ecosystems and Interdependence as students investigate local plant and animal communities and their interactions with humans. Mr. C's unit on weather depended on two activities that took place long before the unit began: students made a detailed site map of their schoolyard and collected regular daily weather measurements all year long. These two activities culminated in the spring when students analyzed the data they collected to identify patterns and weather related hazards that they could do something about.

Daily Weather Tracking

Anchor phenomenon: Weather conditions change each day over the course of the year.

Every day at the end of lunch, the students recorded the weather. Was it mostly sunny or cloudy? Windy? Rainy? Some days there was mixed weather, sunny and windy, for example. The class agreed to choose the main weather feature they observed on any mixed weather days. Based on each day's weather report, a student placed a different color dot on the large calendar section of a weather bulletin board Mr. C had created for the school year—yellow for sunny, grey for cloudy, blue for rainy, green for windy, white for foggy, etc. Mr. C taught students to read an outdoor thermometer just outside of the classroom; each week, a different pair of students took turns reading the daily end-of-lunch temperature and recording the data on the calendar. If the temperature was warmer than the day before, students recorded the new temperature in red ink; they used blue ink if it was cooler, and black ink if

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the temperature was the same as the previous day. By the end of the first month of school, the activity became routine and took only a minute or two after lunch recess.

Schoolyard Site Map

Investigative phenomenon: Features like the flow of water, the growth of plants and animals, and the wind patterns all varied by location on the schoolyard.

As part of the yearlong theme of "Community," students created a "Schoolyard Survey Map." They mapped the natural and built features of the campus, identified different ways that various areas of campus were used, noted environmental features like sunny and shady areas of campus, the direction of prevailing winds, and any visible signs of water runoff. Mr. C asked students to record where living things like plants and animals were located and indicated the ways that children used each area of the schoolyard. Students made their own maps and then Mr. C facilitated a class process to compile a larger version of the campus map that remained a key part of his bulletin board all year long. Students referred to their maps whenever interesting events occurred on campus.

Teachable Moments about Interesting Weather Events (Engage)

Investigative phenomenon: The temperature suddenly jumped 10°F in one day.

Occasionally, there was an interesting weather event— a day where the weather changed, or a day that was particularly hot or cold. Mr. C planned for these days by monitoring the weather forecasts and used these phenomena to drive class investigations and discussion. In late September, the temperature suddenly jumped 10 degrees Fahrenheit compared to the previous day. Mr. C asked the class to generate **questions [SEP-1]** about the weather and the impact it had on them. Students wondered: Why is it so hot today? Why am I so sweaty? What's the hottest it's ever been on this day? Where is the hottest place in the world? Using a class set of laptops, students worked individually to quickly try to find answers to these questions. Mr. C asked them to **evaluate the information sources [SEP-8]**: Which Web sites had the best answers to our questions? Which were easiest to use? How do we know if the Web sites are correct? Mr. C also asked, How did the weather affect your day? Students reported that the slide was too hot to use, but that it was really nice to lie down on the grass in the shade. By the end of the day, students answered the questions about the weather, listed ways that it affected their day, and also started bookmarking the most useful Internet sites for finding weather related data. Mr. C added a section to the bottom of the weather bulletin board for "Weather Events" and posted a piece of paper with notes about their hot weather day organized into three sections: "Local Facts" "Effects on People" and "Global Context." Mr. C added red post-it notes to the campus map noting the places where the heat made it difficult to do ordinary activities, that the slide was too hot to use, and that the blacktop was too hot and smelled funny.

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LOCAL FACTS	EFFECTS ON PEOPLE	GLOBAL CONTEXT
• It was 85°F today, 10° hotter than yesterday. • The hottest ever in our city on this day was 91°F in 2010. • The news said they would have a cooling center set up at the public library.	• The slide was too hot to use. • The blacktop made a smell. • I was sweaty. • I felt tired.	• The hottest temperature ever on Earth was 134°F in Death Valley, California on July 10, 2013. • Plants in hot climates have smaller leaves to deal with the heat. • Some big cities get extra hot because all the blacktop makes a heat island.

Over the course of the year, Mr. C worked with the students to make plans so they could find quick answers to questions about rain, wind, fog, dew, and by the end of January they had observed each of these phenomena. On March 3, the class was surprised by thunderstorms with hail, leading to a quick investigation and discussion of this unanticipated weather event. By the beginning of April, the class had recorded weather data on the chart for 130 school days, along with notes about the effects of heat, cold, wind, rain, fog, dew, and hail on campus activities. The lesson sequence below describes three weeks in April leading up to Earth Day.

Days 1–3: Looking for Patterns

Students analyzed the data they had collected throughout the school year and produced reports summarizing the weather in each month of the school year.

Day 4: Identifying Seasons

Students used their observations to describe the major characteristics of the four seasons. Using their data, they then made a claim about when each season “begins” and “ends.”

Days 5–6: Which Hazards Affect Our School?

Students identified hazards that affected their school and then engaged in an argument about which hazards were most dangerous and significant at their school.

Day 7: Defining the Problem

Students researched places around the world that experience similar weather problems and found how those communities solve similar problems. Then students returned to the problem they faced at their own school and decided what their overall goal would be. They figured what they would be allowed to change and what was off limits.

Days 8–11: Designing Solutions

Students brainstormed criteria by which they would compare possible solutions; developed a variety of possible solutions; drew diagrams of one solution; shared their diagrams with other students; used their criteria to choose among the solutions; and completed a final design.

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Days 12–14: Final Presentations

Students communicated their design ideas to a group of decision-makers at their school during a formal presentation.

Days 1–3: Looking for Patterns (Explore)

Investigative phenomenon: Some months were particularly foggy while others were particularly sunny.

Even though students had been thinking about the data as they collected it throughout the year, starting in April they began to **analyze all the data [SEP 4]**. Some analysis required **mathematical thinking [SEP-5]** as they compared temperatures and counted days with particular weather features. Whether quantitative or not, students looked for **patterns [CCC-1]** in their weather data. Mr. C led a class discussion, asking students to look for groupings of weather patterns on the chart. Which months were particularly sunny? Which months were foggy? When did temperatures increase or decrease? When did it rain? Next, students identified the most common and most unusual weather events, including the hottest and coolest lunchtime temperatures in the previous seven months. Students found that the days were mostly sunny or foggy with a few rainy days. The most unusual event was the hail on March 3, but other events stood out too, like the five days in a row of heavy rain in January; the strong winds on March 1, 2, and 3 that broke branches on the tree in front of the school; and the day in October when the temperature was over 100 degrees.

Mr. C organized the class into seven groups and each group prepared a report for its assigned month following a template (3-ESS2-1). Each report included a pictograph showing how many days of each weather type were experienced in their assigned month, highest and lowest lunch time temperatures, and answers to the following questions: What was the most common type of weather this month? What were the most unusual weather events this month? What are three ways the weather was beneficial to people this month? What are three ways the weather might have been hazardous to people this month?

Day 4: Identifying Seasons (Explain)

When all the reports were complete, Mr. C lined them up in order on the board at the front of the class. He writes “Fall Equinox—September 22” above the September report, “Winter Solstice—December 21” above the December report and “Spring Equinox—March 20” above the March report. He explained that the fall equinox marks the end of summer and the beginning of fall; that the winter solstice marks the transition from fall to winter; and the spring equinox marks the end of winter and the beginning of spring. He noted that students will learn more about the solstices and equinoxes when they get to the middle grades, but for now, they just need to know that they mark the change of seasons. Working in pairs, students listed key features of each season on a graphic organizer with four quadrants. Then, they reviewed the monthly summaries and the day-to-day records from throughout the year to determine if they they agreed or

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disagreed with the official starting dates for each season. Mr. C drew a timeline above the reports on the board and had each pair of students mark the date they believed each season began and ended. As students marked their dates on the board, students naturally engaged in an **argument from evidence [SEP 7]** by justifying their choices. Mr. C facilitated this discussion with *talk moves* (for an explanation, see chapter 11 on instructional strategies in this framework), prompting students with phrases like, "Tell me more about why you disagree with September 20…" or, "I know you marked December 12, but why do you think that the other group marked January 9?" There was broad agreement that summer weather lasted well into October noting the week with 100-degree temperatures and most groups argued that fall weather did not really start until Halloween when it was too cold and rainy for trick-or-treating. It was difficult for the class to agree on the start date for winter weather. Some students argued that winter started when there were five days of rain in a row in January, but other groups countered that the weather was actually warmer that week than it had been the entire month of December. Mr. C ended the class with a discussion during which students shared their observations about the characteristics of each season and the ways that weather could benefit or harm people.

Days 5–6: Which Hazards Affect Our School? (Explain/Elaborate)

Everyday phenomenon: The school faces certain hazards caused by weather conditions.

Mr. C introduced their next weather project: students would identify the most serious weather-related hazards on campus and design ways to reduce their effects on people, structures, and plants and animals found on the campus. On Earth Day, students would present their designs to the School Site Council as recommendations for improving the health and safety of the campus. He explained that a hazard is a "threat to life, health, property, or the environment" and used the campus map to point out some of the ways that weather events affected student activities during the school year. In groups, students filled in a chart listing common weather phenomena and the potential **effects [CCC-2]** on people, animals, plants, and structures on campus. Before lunch, Mr. C gave the students the assignment of finding a teacher or fifth grader on campus to ask about the most extreme weather events they had ever experienced at school. After lunch, students logged on to the class set of laptops and **obtained information [SEP-8]** from news articles about the most extreme weather events in their community in the last ten years. As the last task of the day, students constructed a written **argument [SEP-7]** responding to the prompt: Identify the top three types of weather events that present hazards on campus and in the local community. What evidence do you have that these types of weather are likely to create hazards on campus?

The next day, working in table groups, students shared their claims about hazardous weather events. Mr. C asked each table to come to a consensus listing the top three types of weather that impact their campus. Most table groups agreed that extremely hot days and very rainy days posed significant hazards. Hot slides burned their skin and sometimes it felt difficult to breathe when they were playing on the blacktop; rainy fields were muddy and slippery

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leading to falls and on really rainy days, streams of water flood off the blacktop washing litter into the gutter and into storm drains. They also noted that both sunny and rainy days were relatively common throughout the school year. There was broad agreement about the top two most significant weather events, but there was disagreement about the third. Many students argued that wind was a problem, noting the time that tree branches came crashing down across the street from the school. Others claimed that dewy/foggy days were hazardous because of limited visibility and slippery ramps and stairs on campus. Several claimed that hail was a significant hazard because it could damage windows, cars, and plants on campus. Many groups seemed to be at an impasse, unable to come to consensus. Mr. C intervened and reminded the entire class that the main goal of this project was to design solutions to weather related hazards, so they might consider which hazards they thought they could do something about. By lunch, every table group reached consensus.

After lunch, Mr. C had each table group report on their discussion and the weather event on which they decided to focus, probing them to describe the **arguments and evidence [SEP-7]** that ended up tipping the group to a consensus. All the table groups listed heat and rain as two of their top three weather types, and there was a nearly even split between wind and hail among table groups as the third type of weather that generated significant hazards.

Before the class ended, Mr. C explained that students would work in teams to design solutions to weather-related hazards. He mentioned that there would be eight teams, two each for heat, rain, wind, and hail. Within each team, students would design solutions to hazards faced on campus. He asked students to list the top two weather types they were interested in addressing and also their top two choices for the group they want to protect: people, buildings, objects, or plants and animals.

Day 7: Defining the Problem (Elaborate)

Everyday problem: How do we reduce the impact of weather hazards?

Keeping student preferences in mind, Mr. C created eight *impact groups* of four to five students, two teams for each weather event (heat, rain, wind, and hail). Each impact group **obtained additional information [SEP-8]** about their weather event and identified the hazards it could create. Then, each impact group **obtained information [SEP-8]** about areas of the planet where their weather hazards were more common to see how people around the world work to reduce weather-related risks (3-ESS2-2). The groups then had to **define the problem [SEP-1]** they were trying to solve by

- identifying their weather event and the potential hazards they were hoping to minimize or prevent;
- defining the criteria they would use to select among their possible solutions;
- describing how they would measure whether or not their design succeeded or failed; and,
- identifying things that they realistically thought they would be allowed to change and what things would not be possible.

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Days 8–11: Designing Solutions (Elaborate/Evaluate)

Next, each impact group identified one hazard related to their weather event that they wanted to address and began brainstorming ways to solve it. Over the course of a week, Mr. C dedicated at least an hour a day for group work to **develop solutions [SEP-6]**. By the end of the week, each impact group completed a labeled diagram of a design to reduce hazards on campus, which served as a **pictorial model [SEP-2]** of how the **structure of their design solution would help accomplish a specific function [CCC-6]**. One impact group proposed a shade structure over the slide to keep it cool on sunny days, another impact group designed a bio-swale to keep litter out of the storm drain to protect animals, a third impact group imagined a wind fence around the garden and planned to tie every flower to a stake to protect it from the wind.

Mr. C convened both impact groups that worked on the same weather event to share the hazards that they identified and discuss the possible effects of their hazard on people, structures, plants, and/or animals. Each team then identified the engineering solution they developed to minimize or avoid the hazard and gives the other group feedback using a "+/-/delta" protocol to identify the strengths and weaknesses they saw in each other's designs while also offering suggestions for improvements (3–5-ETS1-2). The impact groups made effective engineering **arguments [SEP-7]** based on their team discussions.

Each of the impact groups made a brief presentation about its hazard and engineering design solution. Mr. C told the students that they could comment on each other's solutions, especially as they related to the hazards that they worked on. For example, the wind impact group mentioned that they were worried that the shade structure proposed by the heat impact group might blow away in a heavy wind. They suggested that the heat impact group cement it deep into the ground. Based on feedback from this session, Mr. C asked students to refine and improve their designs. Students created new diagrams or other representations of their proposed solutions.

Days 12–14: Final Presentations (Evaluate)

Students next prepared for their presentation to the School Site Council, a group of parents, teachers, and the principal that makes decisions about the school campus. Each impact group had six minutes to share its design for reducing a weather related hazard on campus, meaning that each impact group gets just two minutes to **communicate [SEP-8]** how its design would reduce the effects of their hazard. Mr. C told them that the adults were excited to hear about the students' ideas for improving the campus, but there was no guarantee that they would adopt any of their suggestions. He told the students that many factors go into these important decisions (EP&C V). Mr. C provided a template presentation that ensured students clearly defined their hazard, presented evidence that the hazard existed on campus, and backed up their claim that their design would reduce the hazard (3-ESS3-1). He then provided class time for students to practice and get feedback to improve their presentations.

On Earth Day, students dressed up for their presentations to the School Site Council. Each impact group presented its design idea and asked the council to implement it before the next

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school year. At the end of the day, Mr. C hosted a small celebration of students' efforts, presenting each impact group with a "Keepers of the Earth" certificate he designed for them. Mr. C was very proud of the students' efforts and hoped that the council would support at least one of their proposals. The next week the School Site Council announced that they had allocated funds to build a shade structure over the slide to keep it cool on sunny days. While most students were happy that an idea from their class was adopted, a few were disappointed that their own ideas were not selected. Attuned to this disappointment, Mr. C obtained permission for students to implement three other designs on their own. Later in the year, the class worked together to build a wind fence around the garden, to plant trees near the black top to provide shade and block the wind, and to build an insect habitat to protect insects from hail.

Vignette Debrief

SEPs. On days 1–4, students **analyzed their weather data [SEP-4]** looking for **trends and patterns [CCC-1]** . On day 4, Mr. C provided students an opportunity to engage in an **argument using evidence [SEP-7]** when they considered when each season began and ended. The argument was an authentic scientific discussion because there is no obvious correct answer. Instead, any answer that can be justified by the data is valid. When scientists make new discoveries, these sorts of discussions with other scientists may be the only way that they can verify their discoveries. On day 14, students engaged in a different kind of authentic **argument [SEP-7]** as part of their final presentations. In this case, they were trying to convince decision-makers that their engineering design was an effective solution to a problem.

Days 5–14 included portions of the engineering design process. While students **defined the problem [SEP-1]** on day 5, **developed solutions [SEP 6]** on days 6–8, and optimized their solutions during day 8, they never actually built, tested, or improved their designs using the results of scientific tests. In this case, the process of optimizing their engineering designs was limited to peer review of the initial designs. This example illustrated how effective engineering lessons could focus on parts of the engineering design cycle and did not need to encompass the entire cycle to be successful.

DCIs. On days 1–4, students focused on weather and climate (ESS2.D). Students noticed weather patterns in kindergarten, but in grade three they advance to recording the patterns and using them to predict future weather. They also generalized these patterns into a statement about an area's climate. (See appendix 1 for the progression). The second half of the lesson sequence related the natural weather processes to humans as one example of a natural hazard (ESS3.B). Students recognized that they could not stop the natural process but they could take steps to minimize its impact on people.

CCCs. Days 1–4 of the vignette had a strong focus on **data analysis [SEP-4]** during which students identified **patterns [CCC-1]** in a long series of weather data they collected themselves. Mr. C did not stop when students had identified the pattern, rather he asked them to interpret the patterns in terms of the four seasons, and then asked them to return to the specific data and see how well it matched up with the general pattern they had observed.

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This cycle reflected a common theme in science when scientists move fluidly back and forth between data and generalizations. Scientists often use data to make generalizations, but anomalies (situations where specific data contradict the general pattern) can often lead to new discoveries or refinements to scientific models. In this third-grade lesson, students were only expected to recognize and describe patterns because they were not able to gather sufficient data to explain what caused the patterns.

EP&Cs. A major theme of these lessons was the interplay between natural weather phenomena and their impacts on people (EP&C II). Mr. C emphasized these relationships on each of the interesting weather days throughout the school year, and they worked to minimize these impacts during the design challenge starting on day 5. Several of the impact groups focused on the direct impacts on people and buildings/things that people created). Another impact group focused on the impacts of weather on the natural environment and how humans could diminish these impacts (EP&C III). Since these projects related to weather, a number of the solutions might alter the flow of water (EP&Cs II, IV). Teachers can emphasize these environmental connections both to the relevant impact groups and during whole class discussions.

CA CCSS Connections to English Language Arts and Mathematics: Throughout the lesson sequence, students researched weather patterns. They evaluated which Web sites provided the most accurate information. The students developed written arguments in groups about the top three weather hazards on their campus and provided evidence to support their arguments. They also developed and delivered a presentation to the School Site Council with design solutions to mitigate the weather hazards. Throughout the lesson sequence, students were recording weather data. They analyzed the data to identify weather patterns and anomalies.

This vignette was written by Mena Parmar and Nate Ivy of the Alameda County Office of Education.

Resources:

U.S. Fish and Wildlife Service. 2016. "Create a Schoolyard Site Survey Map." In *2016 Living Schoolyard Activity* Guide—California Edition, edited by Sharon Danks. Green Schoolyards. America. https://www.cde.ca.gov/ci/sc/cf/ch4.asp#link3

The performance expectations 3-ESS2-1 and 3-ESS2-2 use two synonymous terms to discuss the same concept: "typical weather conditions during a particular season" and *climate*. Seeing these terms, teachers can realize the usefulness of the shorthand label of climate, but rather than frontloading the term climate at the beginning of the instructional segment or year, teachers can introduce it after students have collected the years' worth of weather data and begun to recognize patterns in their observations. The difference between the terms *weather* and *climate* is that weather is the *actual* conditions at a specific time and place whereas climate refers to the *typical* conditions that can be expected in a given location at a particular time or season. While the actual conditions of the atmosphere change all the time (*weather*), there are certain typical weather patterns that repeat each day or each year at each location on Earth. For example, it almost never snows in San Francisco or Los Angeles, but it does snow every year in the mountains near Lake Tahoe and Big Bear, short drives from those cities. Snow usually only comes during the winter season in California's mountains, but other places on Earth, like Antarctica, receive snow year-round. Weather and climate are shaped by complex interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. Grade three students do not yet have the foundation to understand these processes. Instead, they **analyze and interpret [SEP-4]** **data tables and graphs [SEP-5]** to compare the climate in different cities. First students must learn to **obtain climate information [SEP-8]** from Web sites. Then they can demonstrate their ability to **evaluate and compare climate information [SEP-8]** from different regions, by creating travel brochures or packing lists for travel to different locations around the globe (3-ESS2-2).

Opportunities for Mathematics Connections

Students can construct a simple climatograph, a standard chart that combines a bar showing monthly precipitation with a line graph of average temperatures. Every student can create a climatograph for a different city or region and then place it on the wall beside a picture of habitat commonly found in that region. Then, they can compare cities. How much more rain falls in the rainforest of Brazil than the desert of Southern California? How much hotter is it in Sacramento than San Francisco during June?

CA CCSSM: 3.MD.3, 4; MP.5

Teachers should emphasize the connection that climate is one of the physical factors in an environment that determines the types of plants and animals that live in a particular region (California's History–Social Science standards call upon students to learn about the ecosystems near where they live). Students can compare climate information to information about different habitats, including looking at the global distribution of biomes. *Playing the Same Role* by the California Education and the Environment Initiative (see https://www.cde.ca.gov/ci/sc/cf/ch4.asp#link4) includes extensive resources that students can use to examine the interconnections between climate and the distribution of Earth's biomes. Students might notice important **patterns [CCC 1]** such as the banding of specific biomes at different latitudes and differences between the biomes along the coast versus the interior of some continents (including distinct bands along the coast). Each of these **patterns [CCC 1]** is evidence of specific phenomena, though students should not be expected to construct explanations of what causes these patterns until the middle grades (MS-ESS2-6) (figure 4.7). They should be able to **ask questions [SEP 1]** about whether or not areas with similar biomes also have similar climate conditions and then **investigate [SEP-3]** using their climate data to find the answers.

Figure 4.7. Climate Affects Ecosystems

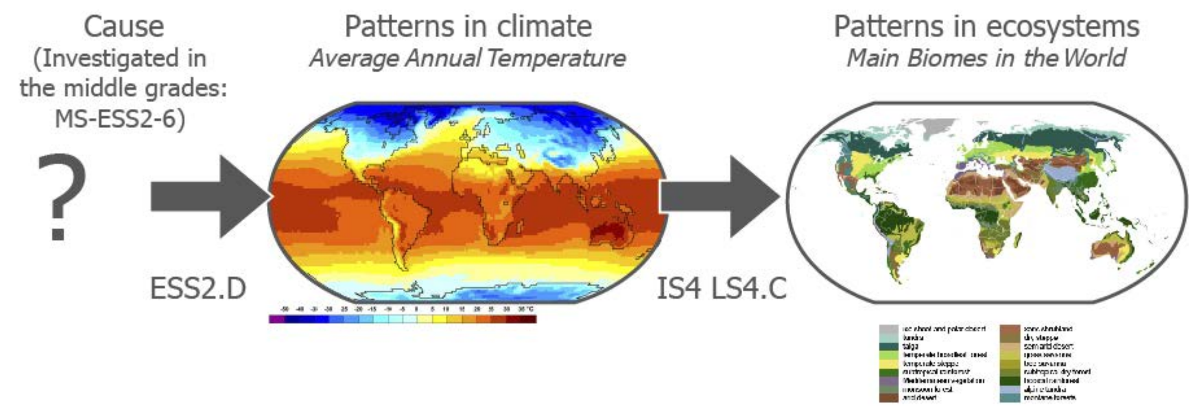

Illustration by M. d'Alessio with images from Department of Geography, University of Oregon 2000[1] and Koistinen 2007.
Long description of Figure 4.7.

The CA NGSS emphasize students' ability to describe the differences between the climate characteristics of the different locations on Earth. However, they do not require that students know the names of any of Earth's biomes. A focus on such terminology could distract from the real goal of honing students' ability to make observations, recognize **patterns [CCC-1]** in those observations, **ask questions [SEP-1]** about what might be **causing [CCC-2]** them, and then **engage in arguments from evidence [SEP-7]**.

Opportunities for ELA/ELD Connections

For additional background information from different sources that addresses weather and climate issues, students can investigate the Climate Kids, NASA's Eye on the Earth Web site, https://www.cde.ca.gov/ci/sc/cf/ch4.asp#link6

Students can also compare important points and details from different informational texts, such as *Climates* by Theresa Alberti, *The Magic School Bus and the Climate Challenge* by Joanna Cole, and *Climate Maps* by Ian F. Mahaney.

CA CCSS for ELA/Literacy Standards: RI.3.3, 7, 9, W.3.10
CA ELD Standards: ELD.PI.3.6, 11

1. The source of this material is the COMET® Web site at https://www.cde.ca.gov/ci/sc/cf/ch4.asp#link5 of the University Corporation for Atmospheric Research (UCAR), sponsored in part through cooperative agreement(s) with the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce (DOC). ©1997-2016 University Corporation for Atmospheric Research. All Rights Reserved.