

THINKING AND ACTING LIKE A SCIENTIST

TEACHER'S GUIDE

How Weather Changes

How does weather of a region vary with the seasons?

GRADE 3

Earth & Space





How Weather Changes

Grade Level/ Content	3/Earth and Space Science
Lesson Summary	In this lesson, students will discover how weather varies with the seasons.
Estimated Time	3, 45-minute class periods (plus 1 week of daily data collection)
Materials	Device with Internet access, Observation Form , outdoor thermometer, rain gauge, other various weather tools, journal
Secondary Resources	www.usclimatedata.com www.weather.gov/climate www.weather.gov www.nasa.gov www.noaa.gov
NGSS Connection	3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
Learning Objectives	<ul style="list-style-type: none"> • Students will develop an investigation plan for collecting daily local weather data. • Students will use secondary resources to collect and represent monthly local weather data. • Students will use secondary resources to collect and represent monthly weather data in another region. • Students will provide evidence of how weather varies with the seasons in two different regions.
Cross-Curricular Project Connections	<ul style="list-style-type: none"> • Take a Little Trip, How Far Will You Go?

How does weather of a region vary with the seasons?

Weather is a combination of temperature, precipitation, humidity, wind, and cloud cover. It reflects the state of the atmosphere on a short-term basis, such as day-to-day or hour-to-hour. Weather varies from region to region. Additionally, the weather of a particular area or region usually varies depending upon the time of the year—often referred to as the season.

While students are likely familiar with the seasons, they may not make the correlation between the gradual changes in the weather over time as a shift between the seasons. In this lesson, students will develop a better understanding of the weather and the seasons for the area in which they live. Additionally, they will learn about weather in other regions and how the weather changes with the seasons in different parts of the world.

Investigation is based on the Van Andel Education Institute (VAEI) Instructional Model for Inquiry-Based Science.

In all investigations:



Students don't know the "answer" they are supposed to get.



Students play a driving role in determining the process for learning.



Teachers and students construct meaning together by journaling.



Students are working as hard as the teacher.

Part 1

INVESTIGATION SETUP

Make sure that students have access to the Internet and reliable weather sites. Each group of students will need the following:

- Device with Internet access
- [Observation Form](#)
- Weather measuring tools (outdoor thermometer, rain gauge, wind vane, anemometer, etc.)
- Journal

Part 2

INVESTIGATION FACILITATION

Before you introduce the investigation question, conduct a mini-investigation (**Messing About**) for students to build knowledge needed to perform the investigation. Ask students: *What can I learn about weather at my school by observing it?*

1
2
3

Investigation Plan

Students design and conduct an investigation to collect weather data for one week.

- Review the materials as a whole class.
- Divide students into teams of 2. Give each team their materials.
- Challenge students to develop an investigation plan for collecting daily weather data: high temperature, low temperature, precipitation, and wind direction.
- Have students write their investigation plan in their journal.
- Review student investigation plans and encourage them to consider things such as time of day for observations. If students are struggling to develop a plan, choose 1–2 student groups to share their investigation plan and discuss as a whole class.

STUDENT ENGAGEMENT

Before students begin designing their investigation plan, have them observe multiple weather measuring tools (rain gauge, outdoor thermometer, anemometer, wind vane, etc.) and ask questions (like: *What do you wonder? What do you think each of these does?*). Have a brief discussion on how these tools are used to collect weather data.



Observation

Students document their observations.

- Have students create a data table to record weather measurements and other observations (Ask questions like: *How does the weather feel? What does the sky look like?*).



Data Analysis

Students make sense of their data by organizing it and representing it visually.

Have students analyze their data. They may wish to use the [Data Analysis](#) prompt as a guide.

- Have students **evaluate** their data for trustworthiness. Ask students:
 - *Are you confident in the data you collected?*
 - *What data do you wonder about?*
- Then, have them analyze their data to find patterns and trends. Students may **organize** and **represent** their data. Have students determine the average temperatures and precipitation for the week. Assist them with the math as needed.
- Compile a class list of averages. Ask students: *Why might there be differences?*
- As a class, **interpret** what the identified patterns and trends mean. Refer back to the opening question: *What can I learn about weather by observing it?*

After completing the **Messing About**, introduce the investigation question.



Question

Introduce the investigation question.

How does weather of a region vary with the seasons?

STUDENT ENGAGEMENT

Have students look outside or, if time and weather permit, take a walk outside. Ask them to think about what they needed to do to go outside. Did they need to put on a coat? Open an umbrella? Take off a sweater? Why? Then, ask them to consider what they would have needed to do six months ago.



Personal Knowledge

Students capture what they already know about weather and seasons.

- Engage students in thinking about the area where they live. What do they know about the weather and seasons of the area?
- Encourage students to think about other areas that they may have seen on the news or in television shows. For example, have they seen images of a blizzard? Does that area have blizzards all year or does that area sometimes have warm weather?

COLLABORATION

Conduct an *Alphabet Knowledge* to ensure all students participate. Have a group of 3–4 students write each letter of the alphabet on a large piece of paper. Tell them to write a word or short phrase that connects to weather and seasons for each letter of the alphabet. Discuss this list as a class.



Secondary Knowledge

Students use secondary sources to collect average weather information for different cities.

- Use these resources (or other reliable sites) for students to obtain the average weather information for different cities.

www.usclimatedata.com
www.weather.gov/climate
www.weather.gov

www.nasa.gov
www.noaa.gov



Investigation Plan

Students use secondary sources to collect monthly weather data for their local area and an assigned city.

- Review the secondary sources as a whole class. Provide students with examples of how they can access the data using the websites provided.
- Divide students into teams of 2. Give each team their materials and have each team choose a different city. Cities should be in different climate regions from within the Northern Hemisphere.



Observation

Students document their findings.

- Ask students to record the data they collect using the [Observation Form](#). They should record data for their home city (or closest city for which there is data) and their chosen city.
- Using the secondary sources provided, have students record the monthly average high temperature, average low temperature, and average precipitation for their local area and chosen city on the **Observation Form**.

OBSERVATION FORM HOW WEATHER CHANGES			
My city: _____			NAME: _____ DATE: _____
Month	Average High Temperature	Average Low Temperature	Average Precipitation
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
Different City: _____			
Month	Average High Temperature	Average Low Temperature	Average Precipitation
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

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Observation Form

Part 3

INVESTIGATION ANALYSIS AND DEVELOPMENT OF CLAIM



Data Analysis

Students make sense of their data by organizing it and representing it visually.

Have students analyze their data. They may wish to use the [Data Analysis](#) prompt as a guide.

- Have students **evaluate** their data for trustworthiness. Ask students:
 - Are you confident in the data?
 - What data do you wonder about?
 - Do you think the source of the data is trustworthy?

Continued

- Then, have them analyze their data to find patterns and trends.
- They may **organize** their data if necessary. Have students **represent** their data. (Example: Bar chart of average high temperature, average low temperature, average precipitation for their local and chosen cities).
- Have students **interpret** what the identified patterns or trends mean.
 - Have students review their monthly data (both local and for their chosen city) and determine which months are in which season of the year for that area.
- Ensure they have enough data that it can be used as evidence to support a claim.

CRITICAL THINKING

Have students decide how to represent their data. Guide them as needed in determining the most effective representation. Ask questions such as: *Would that be clear to someone from another team?* and *Does your representation help you answer your question?*



Secondary Knowledge

Students use secondary knowledge to understand how weather varies with the seasons.

Share what you know about seasonal weather change. You may want to include a video or book for the students to read. This information will be used in the reasoning portion of their explanation.



Explanation

Students write a claim and provide evidence and reasoning to support it.

- Have students use what they've discovered from their analyzed data to write an explanation that answers their investigation question. Students may wish to use the [Explanation](#) prompt as a guide. Have them write their explanation in their journal.
- Have students develop a **Claim** to answer the question: How does weather of a region vary with the seasons?
- Then, have them add **Evidence** (the analyzed data) to support their claim.
- Finally, have them add **Reasoning** to their claim. Reasoning should include the information obtained from this investigation as well as science principles they have learned.

Claim

We claim that weather changes from day to day and that, over time, the weather averages out into seasonal shifts for a region.

Evidence

For our local region we found that during December to February, the average high and low temperatures were the lowest and precipitation was the highest. This is winter. The average high and low temperatures were highest from July to September and the precipitation was the lowest. This is summer. We saw this same pattern in our chosen city, however, the average temperatures in winter were not as low and the average temperatures in summer were higher.

Continued

Reasoning

Investigation: For our daily local weather investigation, we collected data for 7 days and then averaged those values. We then compared them with the values obtained by others in our class. We collected monthly weather data for both our local region and our chosen city from a reliable website.

Science: We learned from our class discussion that weather changes from day to day and that different seasons can be identified by the shifting in weather patterns in a particular area.

- Once the explanation is written, have students discuss their results using a [Present and Defend](#).

DISCOURSE

Have students conduct a [Present and Defend](#) to develop presentation skills as well as audience participation. Research teams present a summary of their investigation to the class. The class analyzes the information presented and asks clarifying questions, challenges and/or supports the arguments made, and even presents alternative explanations as appropriate. Research teams defend their explanation with evidence and reasoning. If students are doing the same investigation plan, choose 1 or 2 groups to share.



Evaluation

Students reflect on the investigation.

Ask students:

- *How confident are you in your results?*
- *What question would you like to pursue next?*

Part 4

INVESTIGATION ASSESSMENT AND EXTENSION



Application

Students demonstrate understanding of weather and seasons by applying their learning in other contexts.

- Ask students to compare the average values they calculated in the **Messing About** week of local observations to the values that are typical for this month. Ask: *Why might these be the same or why might they be different?*
- Now that students understand weather and seasons and how they vary from place to place, ask them to consider when is the least desirable time to be in their “home” area and where might be a desirable place to go at that time of year. *(If their “home” area is bitterly cold in the winter (i.e., the month of January), they might select an area that has more pleasant temperatures that month.)*

Assessment

Students provide a(n):

- graphical representation describing typical weather conditions expected during a particular season.
- explanation (**claim, evidence, and reasoning**) of how weather varies with the seasons in two different regions.

Take This Lesson Across the Curriculum

Take a Little Trip

Many people like to take trips or vacations to different parts of the country or the world. If you are traveling to a different region from where you live, you need to know what the weather is typically like at that time of year so that you can plan your activities and your wardrobe. In this project, you and your students will plan and promote a trip to a location you choose.

Reading/Language Arts	Math	Science	Social Studies
<p>Travel Brochure</p> <p>Create a travel brochure to let everyone know about the trip. Include details such as where and when the trip will be, average high and low temperatures for the area at the time of year you are going, and a list of what things you might do while you are there.</p> <p>CCSS.ELA-LITERACY.W.3.2</p>	<p>Timing is Everything</p> <p>After choosing a place to travel, it is important to pick the correct time to travel. Find the average high temperature, low temperature, and amount of precipitation for each month in the area you are traveling to. Then, use the information to select the best month of the year for travel.</p> <p>CCSS.MATH.CONTENT.3.MD.B.3</p>	<p>How Weather Changes</p> <p>We need to know what the weather is typically like for the specific month in which we will be traveling.</p> <p>NGSS: 3-ESS2-1</p>	<p>What To Do?</p> <p>Whenever you travel to a new or different area, it is fun to get out and explore the things that make the region unique or different from where you live. Use maps, satellite images, and photographs to create a list of locations to visit that are interesting because of the area's geography.</p> <p>NCSS: D2.Geo.2.3-5</p>

How Far Will You Go?

Visiting other areas on vacations can be fun. But, would you like to live in another area? Besides the weather and seasons, what other things would you need to think about? In this project, students consider factors other than weather in the selection of an area in which to live.

Reading/Language Arts	Math	Science	Social Studies
<p>Tell Me Why</p> <p>You say you want to move to another area. What are your reasons? What makes you think you would like it there? What do you know about the area? Write an opinion piece on why you think your chosen location would be a good place to live. Include reasons that support your opinion, such as desirable weather conditions all year, or a lower cost of living.</p> <p>CCSS.ELA-LITERACY.W.3.1</p>	<p>What Does It Cost?</p> <p>In addition to the weather, you also need to think about what it will cost to live in a new area. Every major city in the world has a "Cost-of-Living Index." This tells you how expensive it is to live there. Find the cost-of-living index value for your city (or the nearest large city) and for the city to which you would like to move. Which is larger? Where does each rank in the world?</p> <p>CCSS.MATH.CONTENT.3.MD.B.3</p>	<p>How Weather Changes</p> <p>We need to know what the weather is like all year if we are going to move to a different area. Find out the average high and low temperatures and the average precipitation for each month of the year in an area to which you think you want to move.</p> <p>NGSS: 3-ESS2-1</p>	<p>Should We Stay or Should We Go?</p> <p>We know what the weather is like where we live and have learned about the cost of living. We have also learned about the weather and cost of living in many other areas. Where would be the best place to live? Deliberate with classmates and reach a decision as a group.</p> <p>NCSS: D2.Civ.9.3-5</p>

For additional lessons or to customize this lesson, go to www.nexgeninquiry.org.



Empowering Teachers. Engaging Students.

OBSERVATION FORM

HOW WEATHER CHANGES

NAME: _____

DATE: _____

My city: _____

Month	Average High Temperature	Average Low Temperature	Average Precipitation
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Different City: _____

Month	Average High Temperature	Average Low Temperature	Average Precipitation
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			