Collecting Weather Data

Strand Interrelationships in Earth/Space Systems
Topic Weather data collection and interpretation
Primary SOL 2.6 The student will investigate and understand basic types, changes, and patterns of weather. Key concepts include
b) the uses and importance of measuring, recording, and interpreting weather data;
c) the uses and importance of tracking weather data over time.
Related SOL 2.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) observations and predictions are made and questions are formed;
c) observations are repeated to ensure accuracy;
e) length, volume, mass, and temperature are measured in metric units and standard English units using the proper tools;
g) conditions that influence a change are identified and inferences are made;
h) data are collected and recorded, and bar graphs are constructed using numbered axes;
m) current applications are used to reinforce science concepts.

Background Information

Weather is the condition of the atmosphere at a given time. Many factors contribute to weather, such as:

- *Temperature:* Temperature is a physical property of matter that quantitatively expresses the common notions of hot and cold.
- *Relative humidity*: The amount of moisture in the atmosphere compared to how much moisture the air can hold at a specific temperature.
- *Wind speed and direction*: Wind is moving air that moves from hot to cold and from high to low pressure.
- *Precipitation*: Rain, snow, sleet, and hail are forms of precipitation that come from clouds.
- *Cloud type and cover*: Clouds are formed when water evaporates from oceans, lakes, and ponds and rises up into colder areas of the atmosphere due to convective or frontal lifting. The water vapor attaches itself to condensation nuclei which could be anything from dust or other tiny particles such as salt or other debris. Once the vapor has been cooled to saturation, water condenses and the cloud becomes visible. A simple classification of clouds divides them into three general categories. These have names based upon the Latin root words that refer to the process of formation and physical structure of the clouds. The first of the three is the cirrus cloud. It is formed at high

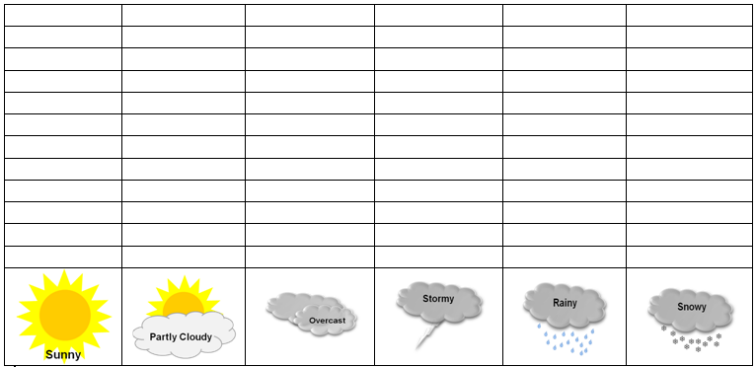
altitudes and occurs mostly in the form of filaments (mare's tail). The next is the stratus cloud, which is mostly sheet-like in structure. The third is the cumulus group, which appears heaped, rolled, and/or rippled.

Second grade concentrates on basic weather observations such as air temperature, precipitation and wind speed.

Weather symbols are used on weather maps as shorthand by meteorologists. There are standard weather symbols that are used around the world. They help meteorologists communicate with other meteorologists about the weather.

Materials

- Weather journals that include weather data collection sheets and prelabeled graphs (sample pages found at the end of the lesson)
- A demonstration thermometer if available
- Thermometers (Celsius and Fahrenheit)
- Rain gauge: to make use a plastic water bottle, marbles or pebbles for in the bottom, permanent marker, and stake to attach the rain gauge to.
- Anemometer
- Weather vane: index card, straw, cardboard paper plate (not a waxed surface), drink cup with a lid from a fast food restaurant, glue, pencil with an eraser, straight pin
- Bubble solution (8 cups of water, ½ cup liquid dishwashing detergent, 3 tsp. light corn syrup or glycerine)
- Paper cups and bubble wands
- Laminated weather calendar and weather symbols
- Chart paper and marker for graph of daily weather types
- Six column chart for each month to build a month graph of the kinds of weather experienced that month – the class version of this chart can be built using chart paper and adding the large symbols found at the end of this lesson



- Copy of the student version of the six-column chart for each student
- Compass

Vocabulary

clouds, cold, cool, degrees Celsius, degrees Fahrenheit, freezing, hot, meteorologist, monitor, overcast, partly cloudy, rain gauge, rainy, snowy, sunny, symbol, temperature, thermometer, tool, warm, weather, weather instrument

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Lesson Preparations

Before you begin weather data collection, make sure that you have all the needed weather data collection tools in place. You will need a Celsius thermometer, a Fahrenheit thermometer, a rain gauge, an anemometer, and a weather vane. You may include other weather data collection tools if they are available. If you do not have the rain gauge or the weather vane, directions to construct them follow. (If desired, you can also have your students build their own rain gauges and weather vanes to take home.) Instruct students on the purpose and the use of each weather data collection tool before you begin the weather data collection.

1. *Precipitation Explorations*
    a. *Rain Gauge:* You can make a rain gauge out of a plastic water bottle.
        1. Remove the cap.
        2. Cut the top off the bottle and invert the top into the bottle.
        3. Put marbles or pebbles in the bottom if the bottom is not flat.
        4. Measure and put a mark at each inch going up the bottle. Be sure to use a permanent magic marker.
        5. Attach the rain gauge to a stake.
        6. Plan to place the rain gauge in an area of the schoolyard where it is away from trees and building roofs, but is still accessible to your students.
    b. When you are ready to use the rain gauge, instruct the students on its use.
        1. Call students to the rug. Ask: “What kind of weather do clouds sometimes bring with them? What do the clouds look like when there is rain?”
        2. Tell students that sometimes clouds bring more rain or snow than at other times. Show the students the rain gauge. Ask: “How do you think a rain gauge works?” Point out the measuring lines on the gauge. Explain, if needed, that the rain gauge collects falling rain. As more rain falls, the water level increases. The scale on the gauge shows the amount of rain that has fallen.
        3. Tell the students that the class meteorologist will put the rain gauge outside if he or she thinks it might rain. After the rain event the class meteorologist will bring the rain gauge in to show the class. The amount of rain collected will be recorded and then the class meteorologist will dump

the collected rainwater. Ask, *"Why would we need to dump the collected rain water?"*

2. Wind Explorations
    a. Exploring Air
        1. Invite students to the large group area. Pour some bubble solution into a cup. Hold up a bubble wand and the bubble solution. Ask students if they know what this is and how to use it. Blow a bubble and ask, "What is inside a bubble? Can you see it? What is outside a bubble? Can you see it? What causes the bubbles to move?" Tell the students that although they cannot see air, they can use bubbles to see how the air is moving. Tell the students that each will get a cup and a bubble wand so that they can go outside to search for moving air.
        2. Take the students outside. Before distributing the bubble solution and wands, ask students to feel the air on their faces and hands. Ask them to predict where the bubbles will move. Give the class specific boundaries and remind students not to blow bubbles on each other. Distribute the bubble solution and wands and have the students explore how the air moves their bubbles. Focus observations in small groups by asking questions like, "How can you use bubbles to show where air is moving the fastest? How can you use bubbles to show where air is moving the slowest? How can you use bubbles to show how air moves through trees?"
        3. After ten minutes, tell students that it is time to return to the classroom. Collect materials and clean up.
    b. Wind Speed
        1. Gather the students in the large group area and ask, "What is wind?" Allow students to share answers and then confirm that wind is moving air. Next ask, "Is the wind blowing today? How can we tell how fast the wind is blowing?" Allow for student answers. Tell students that meteorologists have a scale that they use to help them describe how hard the wind is blowing. The scale is:
            a. No leaf movement = calm.
            b. Leaf movement = gentle breeze.
            c. Small branches and leaves moving = moderate breeze.
            d. Tell students to copy this information into their weather journal.
        2. Measuring wind speed
            a. Bring out the class anemometer already made. Tell students that meteorologists also use this tool to determine how fast the wind is

moving. It is called an anemometer. Write the word on the board and give students practice in pronouncing the word.

b. Next show students the wind source such as a fan or hair dryer. Demonstrate how the anemometer works by directing your wind source at the tool. Tell students to count how many times the anemometer turns in ten seconds by counting each time the cup with the black mark comes around. Each time the counter cup comes around the anemometer has made one turn. Start with a slow setting.

c. Compare the number of anemometer turns from the different speed settings. Ask, "What determines how fast the anemometer turns? If we take the anemometer outside, what will happen if there is a gentle breeze? What will happen if there is a strong breeze?"

d. Take the class and the anemometer outside. Ask "Can you see the wind moving anything? Are the clouds moving? Use your wind scale to decide how strong the wind is today. How strong does the wind have to be to make the anemometer move?"

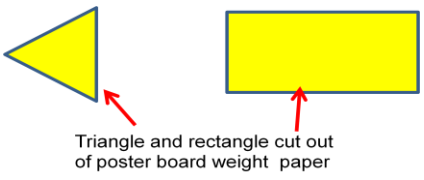
e. Return to the classroom. Tell the students to draw a picture and write about the day's weather in their weather journal.

c. Wind Direction

1. Make a weather vane to find wind direction.

a. Materials: drink straw, index card to cut out arrow head and rectangle for the tail, small drink cup from a fast food restaurant with a lid, cardboard paper plate (not waxed), enough pebbles to fill the drink cup, white glue, straight pin, sharpened pencil that has an eraser on one end, marker and straight edge

b. First make the arrow for your weather vane.



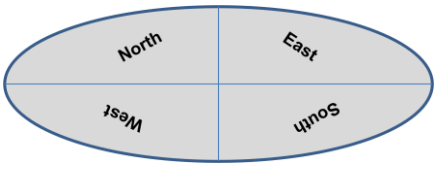
i. Cut a slit in each end of the drink straw.

ii. Cut out a triangle and a rectangle out of the index card.

iii. Slide the arrow into the slit on the straw. Slide the rectangle into the slit on the other end of the straw for the tail.

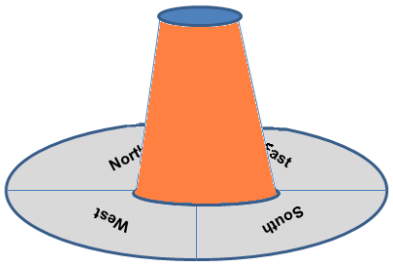
iv. If needed, you can add a small amount of glue to hold the arrow and tail in place.

c. Make the stand for your weather vane.



i. Turn the paper plate over to write on the bottom.

ii. Draw lines to divide the bottom into four equal pie shapes.



iii. Write North in one "piece of pie", South in the opposite, then East and West.

iv. Fill the drink cup with pebbles, put the lid on it, turn it over, and glue it by the lid in the middle of the paper plate.

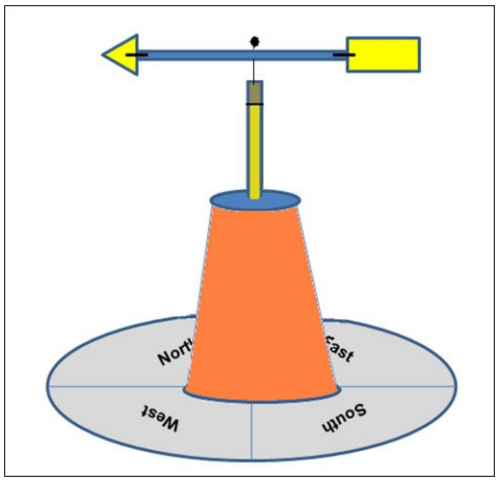
v. You may tape the lid to the cup if needed.

d. Finish the weather vane.

i. Push the sharpened end of the pencil through the bottom of the drink cup. Push it into the pebbles as far as you can.

ii. Push the straight pin through the middle of the drink straw arrow that you created and put the end of the pin through the eraser of the pencil.

iii. Your weather vane is now ready to use.



2. In the large group, show students the weather vane you have made. Ask if they know what it is. Identify the weather vane as a tool meteorologists use to determine wind direction. Ask, "Have you seen a weather vane? Where did you see it? What did it look like? What are weather vanes used for? What happens to the weather vane when the wind is blowing it?" Tell students you are going to use your wind source (fan or hair dryer) again to demonstrate how the weather vane works. Have a student hold the weather vane and blow on the weather vane with the wind source. Ask, "What does the weather vane show you about the wind? Which direction does it point to when the wind is blowing? Do you remember how to use the compass to find north, south, east, and west?
3. If you would like for students to make their own weather vane, have them return to their tables. Have one student from each group get the materials from the materials station. Assemble the weather vanes step-by-step together or you can write the instructions on the board to help students remember how to assemble the weather vanes. Allow students to use hair dryers to test their weather vanes.
4. Take the class outdoors. Using a compass, orient the students to north, south, east, and west. Use the weather vane(s) to determine from which direction the wind is blowing and then use the compass points to identify the direction from which the wind is blowing.
5. If clouds are present, have students put their weather vanes down and watch the clouds move. Ask, "What makes clouds move? Looking at the clouds, which direction do you think the wind is coming from? Do clouds move with the wind or against it?" After class discussion, tell students to hold their weather vanes high to confirm the direction from which the wind is blowing. Ask students to think about the bubbles they blew a few days ago. Ask, "How can you use bubbles to tell the wind direction? Are there any other objects around that can help us find the wind direction?
6. Return to the class.

3. Measuring Temperature
    a. Call students to the large group area. Ask the students to close their eyes and think about how the air felt when they were last outside. Ask, What do you remember about how the air felt? Was the air hot or cold? Allow students the opportunity to talk about the idea that what feels warm to one person might feel cool to another. Explain that even though we can't see air, we can feel how cold or hot air is. Temperature describes how cold or hot the air is.

b. Show students a thermometer. Ask if they know what it is. Discuss what the lines and numbers mean. Explain that a thermometer is a weather instrument meteorologists use to measure temperature in degrees Celsius or degrees Fahrenheit. Demonstrate how to read room temperature.
c. Tell students that thermometers can be used to measure the temperature of other things also. Have two containers of water, one warm and one cool. Allow students to feel the water with their fingers and establish that one container contains warm water, while the other contains cool water. Ask, "What do you think will happen to the red line in the thermometer when it is placed in the cool water? In the warm water?
d. Place the thermometer in the cool water and establish that the red line goes down in the cool water. Next place the thermometer in the warm water and establish that the red line goes up in the warm water because the temperature is warmer. Dry off the thermometer and allow it to return to room temperature.
e. Before going outdoors, ask students to predict whether it is colder or warmer outdoors compared to the classroom. Also ask the students to predict what will happen to the red line on the thermometer. Read the room temperature. Then take the class and the thermometer to an outside area. Read the outside temperature. Ask the students if the outside temperature is warmer or colder than the classroom or indoor temperature. Relate to whether the red line in the thermometer rose or fell. Have students predict what will happen to the red line in the thermometer when they go back into the classroom. Return to the classroom.
f. When students are back indoors and gathered in the large group area and read the indoor temperature on the thermometer. Ask, "Did the red line move up or down when we came indoors? Is it warmer or colder inside?

4. Watching Clouds
    a. Call students to the large group area and ask: "Suppose there was a person who had never seen a cloud. How would you describe a cloud to them?" Listen to the students' descriptions. Then ask, "Do all clouds look the same?" Allow students to give more cloud descriptions.
    b. Discuss the changes in the weather that they notice with the different types of clouds.
    c. Return to seats or small groups.

Introduction – Weather Data Collection

The data collection for this activity should take a minimum of one month, but can extend throughout the year.

1. Gather the class as a large group. Tell students they are going to study the weather as scientists do by making real observations and recording information. Ask students the

questions *"Where do you find weather? What does air have to do with weather?"* Listen to student answers, encourage answers that relate air to weather. Tell students they will be going outside to feel the air and to check the weather.

2. Ask the students *"What are some of the instruments we might use to gather weather data?"* (The list should include: a thermometer, a weather vane, and a rain gauge.)
3. Ask students what a person who studies the weather would be called. Explain to the students that they are going to have an opportunity to be a meteorologist.

Procedures

1. Take the students outside. Have students close their eyes and feel the air on their faces. After a minute, have the students open their eyes to look at the sky. Ask; "How does the air feel? Can you feel the air moving? Do you see anything that tells you that the air is moving? What kind of weather do you see?" Explain that when people talk about the conditions of the air outside, they are usually talking about the weather. When you have finished the discussion, return to the classroom.
2. Gather the class as a large group. Add the word meteorologist to a class word bank. Explain that a meteorologist is a person who studies weather. Ask, "What are some words we use to describe the weather?" As students offer words or phrases, record them in the word bank. Ask students, "Why it is important to record and track weather?" Help students to relate recording weather data and tracking that weather to what they observe being done by television meteorologists.
3. Discuss with the students the observation skills they will use. Discuss some of the observations they will be able to make each day without any instruments. Discuss the weather tools they will use – thermometer, rain gauge, and weather vane.
4. Give each student a weather journal. (You may use one made for each student using the pages at the end of the lesson, or you can have them use a blank spiral notebook.)
5. Discuss the data the students will gather each day. Explain that the class will also keep a class record for each day.
6. Collect the weather data for the first few days together.
7. Introduce the weather symbols that they will use for their weather data collection. Explain that one way meteorologists record information about the weather is with symbols. Show each of the symbols found at the end of the lesson and have them help you read the word on each symbol. Tell them:
    a. Sunny weather is when it's bright and sunny with few or no clouds.
    b. Partly cloudy weather is when it's sunny but there are lots of clouds in the sky.
    c. Overcast weather is when the sky is gray and cloudy, but it's not raining or snowing.
    d. Rainy weather is when it's cloudy and raining, drizzling, or snowing outside.
    e. Stormy weather is when there are extreme weather conditions such as severe thunderstorms, hurricane, tornado, or northeaster.

   f. Snowy weather is when it is cold enough for the precipitation to change from rain to snow. (You can include icy precipitation such as freezing rain or sleet in this symbol.)
8. Show students the class calendar. Explain that they are going to use the calendar as a class to keep track of the different kinds of weather each day. Write the month and year on the top and the numbers for the days on the calendar.
9. Ask, "What kind of weather are we having today?" When students agree on what kind of weather it is, choose the symbol that represents the weather. Ask a student to show you today's date on the calendar. Show the class how to choose a symbol and tape it to the calendar on the appropriate date. You should be able to still see the date on the calendar.
10. Tell students that each of them will be able to be the meteorologist for the day. It will be the responsibility of the meteorologist to monitor the weather and record the appropriate symbol on the class calendar to show each day's weather condition.
11. Show the students the six-column graph that will also be updated daily. (You will do this as a class and students will also do this in their weather journals.) Explain that they will not only put the weather symbol on the class monthly calendar, they will also record the date the particular weather occurred on the chart in the correct weather type column each day. At the end of the month they will be able to tell how many days during the month it was sunny or overcast or the other weather types. Explain to them that this chart will help us determine the weather type patterns for the month – thus observing weather patterns over time.
12. Review with students that scientists often keep journals to record their observations. Each student will be recording the day's weather in their own weather journal. Discuss the differences between personal and scientific journals. The students will be observing the weather so for example, if it is raining or overcast outside, students should draw and describe rain and gray skies. They should not add a rainbow or a picture of the sun if they did not observe it.
13. Model the journal entry on the board (or chart paper). Students will draw a picture of the day's weather in the box, and write a few words that describe the weather. Ask, "Why should we include today's date? How would you describe today's weather? What would you draw to show today's weather?" Use students' responses to model a journal entry that includes many clues about the day's weather. Erase the model version so that students will make their own versions.
14. Have students return to their desks and record the date, draw a picture, and write words on the page in their weather journal to describe today's weather.
15. Add any new words to the class word bank.

16. Model how to collect the daily weather data for the first few days and then allow students to individually collect the weather data and make their daily weather journal entry when they arrive in the classroom each morning.

Assessment

- **Questions**
    - What does a meteorologist do?
    - What is the difference between personal journals and scientific journals?
    - After the first rain or snow, have students write the date in Air and Weather Journals, draw a picture to show what the weather is on that day, and write about weather condition, the temperature, cloud types, and use of the rain gauge to measure how much precipitation has fallen.

Extensions and Connections (for all students)

- Graph the number of days for each of the conditions on the weather calendar.

Strategies for Differentiation

- Group and display vocabulary words into categories. To further differentiate, illustrations of each word could be provided.
- Prior to going outside, turn on a table fan at different speeds to demonstrate the term *moving air* to simulate wind and weather.
- Prior to discussing the term *meteorologist,* show a weather forecast (refer back to this forecast for questioning and discussion of weather symbols).
- Place a corresponding weather symbol on the window prior to students' placing it on the calendar.
- Use white boards to depict pictorial or written predictions comparing the temperature in the classroom with the outside temperature.

Weather Logs

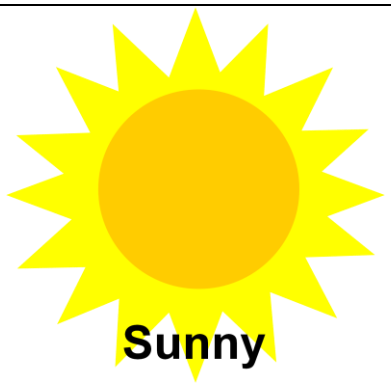
Date:	
Time:	
Temperature	
Clouds	
Wind speed	
Wind direction	
Precipitation type	
Precipitation amount	

Date:	
Time:	
Temperature	
Clouds	
Wind speed	
Wind direction	
Precipitation type	
Precipitation amount	

Weather Symbols

for the

Daily Weather Calendar

Student Graph – Dates for Types of Weather