Weather versus Climate

Overview

One concept that is often confused by students is how weather differs from climate. Weather is a measure of the atmospheric conditions over a short period of time (i.e. a day, week, month). Each day, meteorologists report on and predict the weather conditions for the day or week. Meanwhile, the climate describes the conditions in an area over long periods of time. The climate of a location is the weather averaged over many years. Thus, when scientists talk about climate change, they are referring to alterations in the atmospheric conditions (i.e. temperature or precipitation) over years and decades and not seasonal or daily variations.

Motivating Question: What is the difference between weather and climate?

Engage:	Students discuss their current understanding of weather and how weather changes. Also, they are introduced to the motivating question.	10 minutes
Explore:	Students investigate the weather and discuss the differences between weather and climate	30 minutes
Make Sense:	Students use the "My Garden" game to understand the influence of climate on gardening and the effects of climate change.	20 minutes
	Total:	60 minutes

Materials

For the leader:

- ✓ Whiteboard or chart paper and a marker
- ✓ A graph or chart of weather data from the past two weeks

For each group:

- ✓ *1 Pasco Spark unit*
- ✓ 1 Pasco weather sensor
- ✓ 1 USDA Plant Hardiness Zone Map
- ✓ 1 Set of Plant Cards
- ✓ 1 Future Precipitation Map
- ✓ 1 Future Temperature Map
- ✓ 1 Blank Map of North America

Draft Pilot Version
Revised: June 9, 2010

Preparation (10 minutes)

1. Write the motivating question on the board or a large piece of paper:

   What is the difference between weather and climate?

2. Ensure that the PASCO Spark handheld devices are charged and ready to be used.

Obtaining Climate Data

There are a number of sources for obtaining past temperature data. One very useful site is:

http://wunderground.com/history

However, if you would prefer to use monthly averages or obtain more historical data on the weather, go to

http://climate.rutgers.edu/stateclim

click on *Climate Information* and then *Observations*.

3. Setup a table on the whiteboard or chart paper to record weather data from each group. Headings include: Temperature, Humidity, Dew Point, and Atmospheric Pressure.
4. Obtain information on the average, high, and low temperatures for the past two weeks (see note on *Obtaining Climate Data*).
5. Print off plant cards and maps for each participant. You may choose to laminate the cards, Hardiness Zone maps, and Future Climate Maps for multiple uses.

Engage (10 minutes)

1. **Think**: Start off by asking students to spend a few moments by themselves thinking about the weather in their town. What is it like? How does it impact the clothes you buy and wear? How does it impact the activities you choose to do? If you like, have students jot down their thoughts in a notebook.
2. **Pair**: Ask students to turn to the person next to them and discuss what weather patterns they have noticed in their town. For example, are the winters warm or cool, what season is the rainiest, is there a lot of snowfall?
3. **Share**: Have a few pairs share their thoughts with the group. Record all their responses on flip-chart paper, but be careful not to correct or comment on the students' answers.
4. As a group try to come to an agreement on what the weather was like over the last year versus previous years. Were the seasons this year colder or warmer than "normal"? Was it was drier or wetter than "normal"? How do you know?
5. Ask students if they can think of any factors that might influence their response. For example, would their perspective be different depending on how much time they spend outside or how much their lifestyle depends on the weather?
6. Point to the motivating question and ask:

   Q. What is the difference between weather and climate?

7. Again, have students share their ideas about the question with a partner and then with the table group. Finally, ask volunteers to share the ideas from their table group with the entire room. Tell them that we will now explore this question by collecting and analyzing data.

Think-Pair-Share

Dr. Susan Ledlow from Arizona State University describes the think-pair-share process as follows: "Think-Pair-Share is a low-risk strategy to get many students actively involved in classes of any size. The procedure is simple: after asking a question, tell students to think silently about their answers. As a variation, you might have them write their individual answers. (Depending on the complexity of the question and the amount of time I think is appropriate for the activity, I give them anywhere from 10 seconds to five minutes to work individually.) Then ask them to pair up with a partner to compare or discuss their responses. Finally, call randomly on a few students to summarize their discussion or give their answer. The random calls are important to ensure that students are individually accountable for participating. When you are satisfied that students understood the concept, or that most could solve a similar problem on their own, continue with your lesson."

A **weather pattern** is an identifiable and regularly observed occurrence of consistent weather conditions. It could be short term (like a storm front moving through) or long term (such as a hot and humid summer, or the conditions leading to long-term drought).

Explore (30 minutes)

1. Ask the students what they think that the weather is like outside right now. Ask about the temperature, humidity (define this term if necessary), winds and clouds. Also inquire as to what they based their estimate of the weather on.
2. Distribute the Pasco Spark units, weather sensors and datasheets. If necessary, instruct students on how to turn on and load up the appropriate electronic workbook.
3. Tell students to spread out around the schoolyard when taking measurements and to work together to follow the lesson in the workbook.
4. Tell the students that they will have 15 minutes to follow the instructions on their Spark unit.
5. When groups finish the lab, have students enter their results onto a master table on the whiteboard or chart paper.
6. Based on the collected data, calculate the high, low, and average temperature as measured by the group.
7. Post the high, low, and average temperatures for the past two weeks on the blackboard or chart paper.
8. Ask students how the measurements they collected compare with the values observed during the last 2 weeks. How does your data compare with yesterday? With the average of the last week? The last two weeks? (The goal is for students to begin to understand that daily variations in weather are normal.)
9. Have the students Think – Pair - Share the following question and report to the group:

   Q: If your friend was coming to visit from far away and they asked you what to pack, would you go out with your weather sensor and tell them what to pack based upon the current conditions or would you make recommendations based on [what you already know] the average weather [will be like] during that time?

10. Point to the motivating question and ask:

    Q. What is the difference between weather and climate?

For more information on using the Pasco Science Learning System, see the introduction in the Leader's Guide.

Instructor's Note

If students ask why the weather measurements differ between groups, the following are potential reasons: measurements were made at different locations (i.e. sunny vs. shady spots) or there were difference due to the sensors (i.e. they were calibrated differently or not calibrated properly, the sensors have different sensitivities, and some measurements may have been made more quickly than it takes for the sensors to equilibrate)

Make Sense (20 minutes)

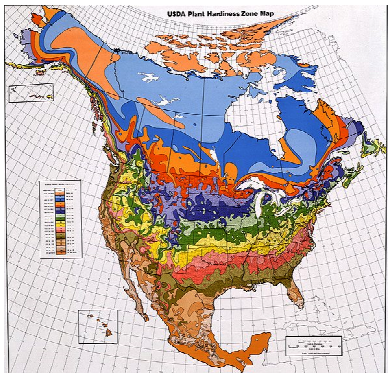
1. Ask the students if the climate is the same everywhere. If not, how does it vary?
2. Explain that when planning a garden, it is important to consider your local climate when choosing which plants to plant. Some plants cannot handle severe winters; others wither in heat; still others, such as many spring-flowering bulbs, need a cold period to stimulate growth cycles.
3. Inform the students that today they are the official gardening representative of NATO (the North America Trade Organization). Their job is to determine which flowers should be planted in gardens in different areas across North America.
4. Distribute to each group the *USDA Plant Hardiness Zone Map*, one set of Plant Cards, a blank map of North America and markers.
5. Have the students work in groups and outline on the map what they would try to grow in each area of North America.
6. Post the students maps at the front of the room and ask the students the following questions:

   Q: How did you decide where to plant each type of plant?

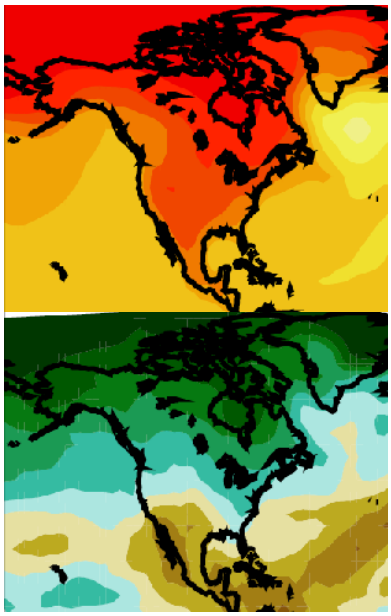
   Q: How were your maps similar or different to each other?
7. Distribute the projected temperature and precipitation change maps for 2080-2099. Explain that these maps show how scientists believe the average climate of the later 21st century will change due to greenhouse gas emissions.
8. Return each group's original map to them and ask them to use another color to indicate on their maps what plants they would chose to plant at each location in 2080-2099.
9. Have the students Think – Pair - Share the following questions and report to the group:

   Q: Did you choose to plant different flowers at each location in 2010 than you did in 2080-2099? Why?

   Q: How did your maps change from the 2010 version to the 2080-2099 version?



USDA Plant Hardiness Zones



Predicted changes in temperature and precipitation from the 1980-1999 average to the 2080-2099 average

10. Explain the climate change will influence everything in our lives from what we wear to where we live to what crops/plants we grow.

How's the Weather?

Date: _____ Time: _____

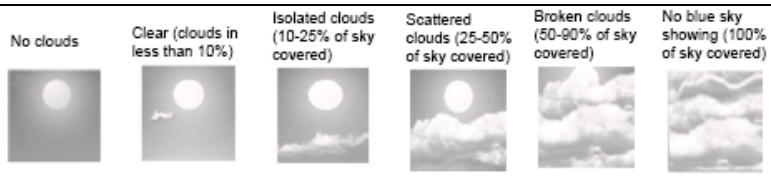
First, describe the location where you took your weather measurements:

_____

_____

_____

Then, fill in the measurements you made (don't forget the units):

Temperature	
Relative Humidity	
Dew Point	
Atmospheric Pressure	
Cloudiness	
Precipitation	___ Heavy Rain ___ Light Rain ___ Heavy Snow ___ Light Snow ___ Hail ___ Other:
Wind	___ Completely Calm ___ Light Breeze (wind felt on face, leaves rustle) ___ Moderate Breeze (flags flap a little, small branches and leaves move) ___ Strong Breeze (wind whistles, umbrellas turn inside out, bushes sway) ___ Gale (it's difficult to walk in the wind, tree twigs break)

Worksheet adapted from: http://eo.ucar.edu/educators/ClimateDiscovery/LIA_lesson1_9.28.05.pdf

DATASHEETS FOR THE SPARK UNITS

Temperature

Page 10: Describe below how the current temperature compare with the record high and low temperature in NJ.

Page 11: If you were to take the same measurement 12 hours, 3 months or 6 months from now, what do you think the temperature would be?

Page 12: How does the current temperature compare with the climate in Camden, NJ?

Relative Humidity

Page 15: Answer the following questions on relative humidity.

a) How does the relative humidity right now "feel" to you?

b) Do you think the current humidity level is "normal" for this time of year?

c) If you were to take the same measurement 12 hours, 3 months or 6 months from now, what do you think the relative humidity would be?

Page 16: How does the current relative humidity compare with the climate in Camden, NJ?

Dew Point

Page 18: Answer the following questions on dew point

a) Did you see dew this morning?

b) How does the dew point compare with the current temperature and relative humidity?

Air Pressure

Page 20: What conditions do your air pressure measurements relate to (i.e. dry, stormy)? Is this what it is like outside?

Precipitation

Page 21: Answer the following questions on precipitation

a) Did it rain or snow today? About how much?

b) Is there typically a lot of rain or snow during this month compared to other months in Camden, NJ?

Wind Speed

Page 22: Answer the following questions on wind speed

a) How windy is it right now (i.e. very, slightly, very calm)?

b) What is the typical wind speed for this month in Camden, NJ?

Sky Cover

Page 23: Answer the following questions on precipitation

a) About how cloudy is it right now?

b) How does today compare with the climate in Camden, NJ?