

Weather R.A.T.S.

WE LIVE IN AIR: TRACK THE WEATHER LIKE A METEOROLOGIST

Grade Level: 4

Lesson # 2 in unit

Time Required for Lesson: 3 hours

Time Required for Unit: 15 wks.

Unit Summary: This unit examines weather patterns in four different parts of the Weather RATS network: Puerto Rico, Oklahoma, Arizona, and Massachusetts. Students will learn how to measure and track daily weather readings and discover the global connections between weather events in the four places. They will investigate global weather connections via the Jet Stream and other factors. As part of this unit, students will also study global contrasts in the water cycle, as it exists in each area. They will uncover the issues and social problems surrounding severe weather events in each area. Students will investigate how weather impacts people living in these areas by communicating with peers via the discussion forum. They will notice that even though people's daily lives are impacted in different ways by local weather, there are fundamental connections between weather events in different geographic locations: that we all "live in air," and are joined together by the atmosphere that sustains us all.

Lesson Summary: This lesson (or more correctly, a tightly integrated sequence of lessons) involves setting up procedures for data collection and analysis from the Weather RATS network for Tuba City, Enid, Mayagüez, and Wilbraham. Other towns in the RATS network can be used in any of the four states. Data collection will proceed for 20 school days. Students will input their data into Excel and create line plots that compare and contrast the weather patterns in the four locations. Students will analyze patterns in the data and draw conclusions about how the weather in each location is similar or different. They will increase their understanding of these patterns in the data by writing to peers from these locations in the Weather RATS discussion forum. As a culminating activity, students will communicate their understanding of the weather patterns and weather problems by creating a Power Point (from a teacher-made outline and accompanying template) that documents their data, their charts, and an understanding of how the weather in each location is globally connected. As a social studies extension, students can define and research the major weather-related issues that exist in every area.

The data collected by student teams will be used for other purposes in this unit, so it is very important that each student and each team collect and maintain a complete data set.

This lesson assumes that students are being introduced to the terminology and concepts used for data tracking as the unit proceeds. It also assumes students will have an introduction to the jet stream as part of this unit, and are aware of its role in determining global winds and weather movement. It further assumes that other lessons in the unit will be taking place while data collection and analysis are going on.

Unit Standards:**MA Science/Technology/Engineering:**

- E6 Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.*
- E7 Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.*
- E8 Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.*

MA Math:

- 4.D.1. Collect and organize data using observations, measurements, surveys, or experiments, and identify appropriate ways to display the data. (See also 3.D.1 for same standard)*
- 4.D.2. Match representations of a data set such as lists, tables, or graphs (including circle graphs) with the actual set of data. (See also 3.D.2 for similar standard)*
- 4.D.3. Construct, draw conclusions, and make predictions from various representations of data sets, including tables, bar graphs, pictographs, line graphs, line plots, and tallies. (See also 3.D.3. for similar standard)*

MA Instructional Technology:

Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.

PreK-4 Exploratory Concepts and Skills

- 1.1 Develop basic skills for using hardware and applications (e.g., open/close a file, navigate using scroll bars, arrow keys, special keys, and mouse).*
- 1.2 Use correct terminology for basic components of a computer system (e.g., monitor, keyboard, disk, printer, mouse), and develop understanding of their basic functions.*
- 1.6 Explore and understand the basic function and purpose of a spreadsheet.*
- 1.7 Collaborate with classmates to use teacher-selected web sites.*
- 1.8 Collaborate with classmates and teacher to send a class e-mail message (online discussion forum hosted by UMass will meet this standard).*

- 1.9 *Collaborate with classmates and teacher to create a slide presentation with existing template.*

Standard 3. Demonstrate ability to use technology for research, problem solving, and communication. Students locate, evaluate, collect, and process information from a variety of electronic sources. Students use telecommunications and other media to interact or collaborate with peers, experts, and other audiences.

PreK-4 Exploratory Concepts and Skills

- 3.2 *Explore the use of application programs (e.g., word processing, database, spreadsheet) for organizing information into charts, tables, and diagrams.*
- 3.3 *Explore the use of content-specific tools to enhance understanding of curriculum content (e.g., environmental probes, sensors, robotics, simulation software, and measuring devices).*
- 3.5 *Collaborate with classmates and teacher to exchange e-mail with another classroom (online discussion forum hosted by UMass will meet this standard).*

Unit Learning Objectives:

K-12 General:

- Be able to track local weather and compare it to weather in diverse geographic locations.
- Use emerging weather measurement and instructional technologies as tools to examine and address real-world problem situations, such as data collection, tracking and analyzing patterns in weather events.
- Develop an appreciation for the global nature of the atmosphere.
- Collect, analyze, and graph daily weather data for an extended period of time.
- Use mathematics as a tool for making sense of weather data.
- Increase students' understanding of how local weather and climate patterns affect the course of everyday life for people living in those places.
- Increase students' understanding of peers living in different cultures and geographic regions by communicating with them.

Level-specific:

- We Live in Air: comparing weather and its impact on different economies, cultures, and diversity within CASA network.
- Connect the dots: tornadoes, hurricanes, and floods in the CASA states: where does the weather go, and what does it do in different places?

CASA Connection:

CASA is concerned with understanding and monitoring atmospheric phenomena in different parts of the country. Like CASA, the students will detect and analyze weather data in

the lowest part of the atmosphere and draw connections between local data and global patterns. They will use mathematics and graphing to make sense of the data. Like CASA, students will investigate the cultural impacts of weather.

Lesson Background and Concept for Teachers:

Weather is defined as the conditions of the atmosphere in a particular time and place. The jet stream is the high-speed upper-atmosphere winds that blow west to east, dividing arctic air masses to the north and tropical air masses to the south. While local weather conditions will vary, there will be broader connections between the locations based on where the jet stream is at any point in time. Locations on the southern side of the jet will be warmer and more similar than locations on the northern side.

Students may encounter severe weather during this series of lessons, including hurricanes, wildfires, and drought. The causes of these are ultimately tied to the water cycle, which will receive attention in this unit. Students should refer to their data sets when investigating the water cycle and its forms as part of classroom or lab science. For further detailed background on the water cycle, visit the Hydrologic Cycle page from Jetstream, the Online Weather School: <http://www.srh.weather.gov/srh/jetstream/atmos/hydro.htm> . Further background on other weather concepts can be found at Jetstream's Topic Matrix: <http://www.srh.weather.gov/srh/jetstream/matrix.htm> .

Key Vocabulary/Definitions:

- *Air Temperature:* Measure of the average kinetic energy of air particles, expressed in terms of units or degrees. The degree of hotness or coldness of the air.
- *Wind:* Wind is moving air. Its movement is caused by differences in air pressure between adjacent air masses. Air under high-pressure moves toward areas of low pressure. The greater the difference in pressure between adjacent air masses, the faster the air moves. It is described with wind direction (based on compass directions) from which the wind is blowing, and speed.
- *Absolute humidity:* Ratio of the mass of water vapor contained in a certain volume of air.
- *Relative humidity:* The amount of water vapor in the air, given a certain temperature. What is usually meant when people say "humidity." Its value varies with temperature. Useful for determining conditions of human comfort. 100% relative humidity is complete saturation of the air at a given temperature: all the water it can hold at that temperature.
- *Dew point:* The temperature to which air must be cooled at a constant pressure to become saturated (the point at which no more water vapor can be added to a volume of air).
- *Air pressure:* Caused by the weight of air molecules above the Earth. The blanket of air piled on top of the Earth is pulled down by gravity. It pushes in all directions. Pressure is force exerted over a unit of area.

- *Precipitation*: Water falling from the sky in one of 4 basic forms: rain, snow, hail, or sleet.
- *Jet stream*: High altitude, high-speed wind current that circles the globe in the northern hemisphere. It divides cool arctic air to the north from warmer, tropical air to its south. It moves and whips around from day to day, thus redistributing the locations of cooler and warmer air across the North American continent.
- *Air*: a collection of molecules that form a blanket around the Earth that is about 80 miles thick. It is comprised of 78% Nitrogen, 21% Oxygen, and 1% of argon, carbon dioxide, and other rare gases.

Materials Needed:

- Internet access
- Data sheets for Track the Weather Like a Meteorologist
- Access to Excel, Power Point

Lesson Sequence:

Introduction/Motivation:

Using the interactive maps on the Weather RATS home page, look at maps of the United States and Puerto Rico. Identify the locations of the four towns. Do students think that weather is the same today in each of these four places? Why or why not? Where would they rather be today? Has anyone ever visited Oklahoma, Arizona, or Puerto Rico? Have students record their initial ideas and predictions on the Preview Paper, which functions as a pre-test. Collect the Preview Paper and save it until the end of the lesson sequence.

After students complete the initial Preview Paper, invite them to think further about what these four areas are like by touching on the questions in the paper. On the Weather RATS web site, examine pictures from Oklahoma, Arizona, and Puerto Rico and introduce the RATS schools from those places. Students can look at maps of Oklahoma, Arizona, and PR by accessing National Geographic's MapMachine and Google maps stored on the school server. What would winter and summer be like in these places, and why? What forces would influence the weather in each place? Who has snowstorms, wildfires, tornadoes, hurricanes, or drought, and why? Tell students we are going to study weather factors in these places.

Introduce data collection charts to students and review how to use them with the weather station data on the Weather RATS web site. Students should have seen the weather station and the web site prior to today's lesson. Each student should pick ONE town to focus on for data collection. Out of a group of 4, each student should take a different town. In a group of 3, one town will not be studied. No student should work with more than one town. Students should be given time to make their own choices about which town to study. Take the first day's readings and develop a plan for taking daily weather readings in the classroom.

Body of Lesson:

Students will collect daily weather data on four towns for 20 days (school days only). This is easily done in the classroom first thing in the morning or at another break point during the

day. Data collection is easily accomplished in a one-computer classroom. The teacher should pre-teach how to enter data on the table by doing one day's worth of data collection as a whole-class demonstration. Once students understand how to collect and enter data on the table, it is easy to establish a daily classroom routine that extends for 20 days. The best way to handle extended data collection is to have one person for each town collect the day's data and post it in a central location in the classroom. Other students can copy it from there. After 20 days (or at several junctures during this time, depending on scheduling), students will enter the data into Excel, with each town on a different page of the Excel file. Students can then generate line plots for each town showing the four towns' data for each variable (for example, one chart will show temperature for the four towns, another chart will show precipitation for the four towns, etc.).

Students will spend several sessions on the computer lab learning how to use Excel's Chart Wizard to create this series of graphs, which display data for all 4 towns for temperature, rainfall, and humidity. Students will learn how to copy and past particular data columns from different pages of the spreadsheet in order to create a composite graph. These graphs, which will be done by table group (not individually), will be stored on the server and used as part of the Power Point summary assessment.

As students are collecting daily weather data, they will research the major weather impactors in each area (drought in Arizona, tornadoes and wildfires in Oklahoma, hurricanes in Puerto Rico, heavy rain and nor'easters in New England). This information will serve as background information for research later in the unit. The additional research on weather impactors and cultural connections can also be done as part of social studies.

In the computer lab, students will use the discussion forum to talk to peers from the other three towns. They can ask them about how they experience their weather, how it impacts their daily life, and how the patterns are similar or different. Students can ask their peers any questions they have about concepts they are learning or data they have collected.

Closure:

Student teams will create Power Points summarizing what they learned about the weather pattern differences and similarities in the four towns. They can include photos from the Weather RATS web site or other photos (Google images is a good source). The photos will draw the connection between weather patterns, landscape, vegetations, and cultural patterns. Students will also include Excel charts comparing weather patterns in each location. The Power Points will be made from a teacher-created template.

Assessments:

Pre-lesson:

Track the Weather Like a Meteorologist Preview Paper

Whole-class discussion of predictions about weather in four towns, and how that weather might impact daily life. Student sharing of trips to AZ, OK, and PR, background knowledge, or questions should be encouraged.

In Process:

Accurate and timely completion of weather data charts for 4 towns.

Excel charts for weather variables in 4 towns.

Documented participation in online discussion forum (each student will make a predetermined number of posts on the forum).

Summary:

Power Points summarizing data collected and conclusions about weather pattern similarities or differences.

Lesson Extension Activities (Computer lab):

Web Weather for Kids <http://eo.ucar.edu/webweather> Read: *Thunderstorms/Tornadoes, Clouds, Hurricanes, Blizzards/Winter Weather*.

Kids' Crossing <http://eo.ucar.edu/kids/index.html>

Weather and Climate Basics <http://eo.ucar.edu/basics/index.html> Read: *Weather Wonders: The Big Picture, Building Blocks of Weather, Wild Weather, Weather Forecasting, NCAR Studies Weather*.

Dan's Wild Wild Weather Page <http://www.wildweather.com/> Read: *Tornadoes, Hurricanes, Radar, Weather Quizzes*.

Edheads Weather Activities <http://www.edheads.org/> Click on the Weather link on the left side of the home page.

Lesson Extension Activities (Social Studies):

Students can research the rich culturally significant issues and history of each area. For example, the Navajo Indian heritage in Arizona, the Oklahoma Dust Bowl in the 1930's, or the history and culture of Puerto Rico and its current relationship to the United States.

References:

Weather RATS web site: <http://weatherrats.cs.umass.edu/wxrats/index.php>

NOAA Weather page (alternative data source): <http://www.noaa.gov/wx.html>

National Center for Atmospheric Research and the UCAR Office of Programs. NCAR (National Center for Atmospheric Research) and UCAR (University Center for Atmospheric Research). <http://www.ucar.edu/>

National Weather Service. Jetstream: An Online Weather School. <http://www.srh.weather.gov/srh/jetstream/matrix.htm>

Additional Resources and Information:

National Geographic MapMachine: <http://plasma.nationalgeographic.com/mapmachine/>

Contributors:

Mary M. Taft, Science Specialist, Soule Road School, Hampden-Wilbraham Regional School District, Wilbraham, MA

Christine Goonan, Science Specialist, Stony Hill School, Hampden-Wilbraham Regional School District, Wilbraham, MA

4. Will the weather in Wilbraham, Massachusetts be similar in any way to any of the other three towns? Why or why not?

5. What kind of severe weather do you think might occur sometimes in each of the four towns? How often do you think this severe weather might happen?

Tuba City, AZ –

Enid, OK –

Wilbraham, MA –

Mayagüez, PR –

Name _____

Table no. _____

Homeroom _____

DATA FROM WILBRAHAM, MASSACHUSETTS

Day #	Date	High Temp. (°F)	Wind Speed (m/h)	Relative Humidity	Air Pressure	Daily Precip. (in.)	Dew Point
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							

Name _____

Table no. _____

Homeroom _____

DATA FROM TUBA CITY, ARIZONA

Day #	Date	High Temp. (°F)	Wind Speed (m/h)	Relative Humidity	Air Pressure	Daily Precip. (in.)	Dew Point
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							

Name _____

Table no. _____

Homeroom _____

DATA FROM MAYAGÜEZ, PUERTO RICO

Day #	Date	High Temp. (°F)	Wind Speed (m/h)	Relative Humidity	Air Pressure	Daily Precip. (in.)	Dew Point
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							

Name _____

Table no. _____

Homeroom _____

DATA FROM ENID, OKLAHOMA

Day #	Date	High Temp. (°F)	Wind Speed (m/h)	Relative Humidity	Air Pressure	Daily Precip. (in.)	Dew Point
1.							
2.							
3.							
4.							
5.							
6.							
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19.							
20.							

TRACK THE WEATHER LIKE A METEOROLOGIST POWER POINT GUIDELINES

Your team will put together a Power Point slide show summarizing what you have learned about the weather in the four towns and how it affects people living in these places. You will share some of the work you have done in Excel, as well as some research you conduct on the 4 locations. This outline will help you know what to put into your Power Point. You will use the Power Point template for this project, which is stored on the server under SHAREDSTUDENTSS\$, Science Lab, Weather RATS, called *4towndata.ppt*. The template has a blank white background. You can change the slide designs or add a color scheme *AFTER YOUR SLIDES ARE FINISHED!* Do not change the font.

Slide 1: Introductory slide.

- Title
- Names
- Table number
- Homeroom teacher's name

Slide 2: Map of the four towns' locations

This will be cut and pasted from the Internet and saved to the server. You can use the Weather RATS map if you like, which is already saved to the server, or use another one. It's your choice.

Slide 3: Tuba City, Arizona

- Picture of Tuba City
- Landscape, vegetation, and towns: what is it like there?
- Where does local weather come from?

Slide 4: Enid, Oklahoma

- Picture of Enid
- Landscape, vegetation, and towns: what is it like there?
- Where does local weather come from?

Slide 5: Wilbraham, Massachusetts

- Picture of Wilbraham
- Landscape, vegetation, and towns: what is it like there?
- Where does local weather come from?

Slide 6: Mayagüez, Puerto Rico

- Picture of Mayagüez
- Landscape, vegetation, and towns: what is it like there?
- Where does local weather come from?

Slide 7: Excel chart of daily temperatures for 4 towns

Slide 8: Excel chart of daily humidity readings for 4 towns

Slide 9: Excel chart of daily rainfall for 4 towns

Slide 10: Patterns in the data

What do the charts tell you about weather in the 4 towns?

How are the patterns alike or different?

How does the Jet Stream connect the 4 towns, if at all?

Slide 11: What we learned.

What did EACH group member learn about weather and the 4 towns during this data collection project?

Slide 12: What do you want to learn about next?

There is no “right” answer here. EACH person should share what he or she are most curious about and want to study next.