

# *Weather R.A.T.S.*

## **WE LIVE IN AIR: LET'S LOOK AT THE JET STREAM, PART 1**

**Grade Level: 4**

**Lesson # 3 in unit**

**Time Required for Lesson: 1 hour**

**Time Required for Unit: 15 wks.**

**Unit Summary:** This unit examines weather patterns in four different parts of the Weather RATS network: Puerto Rico, Arizona, Oklahoma, 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. 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.

**Lesson Summary:** This lesson introduces the jet stream: what it is, where it is, what role it plays in determining large-scale weather patterns in North America. Students will watch a Power Point that gives basic information about the jet stream, its cause, size, location, how it got its name, and a sequence of daily maps showing how the jet stream's ridges and troughs move back and forth, thus affecting local weather. This lesson assumes that students have been introduced to the terminology and concepts necessary for a basic understanding of weather observation earlier in the unit.

### **Lesson Standards:**

#### **MA Science/Technology/Engineering:**

*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.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)*

## **Lesson 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.

### **Level-specific:**

- **We Live in Air:** comparing weather and its impact on different economies, cultures, and diversity within CASA network. Look at Jet Stream and its effect on weather in the Weather RATS areas. Look for connections between RATS areas based on Jet Stream and water and wind currents.

## **CASA Connection:**

Students will increase their understanding of the global connection between local weather events in different geographic areas. CASA is concerned with accurate detection and observation of these local weather events, which are also influenced by these global currents.

## **Lesson Background and Concept for Teachers:**

The jet stream is a high-speed, high-altitude meandering wind current, generally moving in a westerly direction around the Northern hemisphere at speeds often exceeding 250 miles per hour. It is located about 6-9 miles above the Earth's surface. 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. Its motion is from West to East, the same direction as the planet's rotation, but its ridges and troughs can move air in northerly and southerly directions. Think of a garden hose turned on full-blast, and whipping around on the ground. Locations that are south of the jet stream will share similar warmer weather patterns because they are all under the same large-scale air masses originating in the sub-tropical parts of the planet. Locations to the north of the jet stream will be cooler, because they all share Arctic air. "Our" jet stream is actually 1 of 4 jet streams that exist on our planet at the boundaries between air masses of different temperatures: northern polar, northern sub-tropical, southern sub-tropical, and southern polar. While students do not need to be concerned with the other 3 jet streams at this juncture, it is worth knowing that "ours" is not the only one.

## **Key Vocabulary/Definitions:**

- *Jet stream:* a high-speed, high-altitude current of high-speed winds that blows in a west to east direction around the Northern hemisphere.
- *Ridge:* An area of high pressure that looks like a hill on a map. It brings warm, tropical air north into the United States and Canada.

- *Trough*: An area of low pressure that looks like a valley on a map. It brings cool, Canadian air south into the United States.
- *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.
- *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.

**Materials Needed:**

- Internet access.
- Clipboards and paper for note taking.
- Student-created data chart for one week.
- Access to a TV/computer hookup or Smart Board for projecting Power Point.

**Lesson Sequence:**

**Introduction/Motivation:**

Do students ever wonder why it's warm one day and cold and rainy the next? Where do those pesky heat waves come from? Severe cold spells in the winter? Why do we get big nor'easters in the winter that give us snow days? Remember what Mark Twain said about New England weather: if you don't like the weather here, just wait a minute. So, what happens in that minute to change things? We will be looking at the "big mover."

**Body of Lesson:**

Show students the Power Point entitled "What is the Jet Stream?" Depending on room arrangement where Power Point is being shown, students may be invited to move chairs close to TV or projector screen/Smart Board. Moving chairs close to screen allows all students to see slides clearly, and makes the lesson feel like "watching TV at home", thus increasing interest in the lesson – it doesn't "feel" like a regular lesson. Basic content is in first half of slide show – students should be encouraged to take notes. First half of slide show should be gone through slowly and carefully. Plan on spending *at least* 1 to 2 minutes per slide. Questions, comments should be encouraged. Tell students that the dates of the days shown in the slide show do not matter.

**Closure:**

Slide show ends with an informal pop quiz. Depending on length of class period, students can write formal responses with complete sentences or more informal responses with short words and phrases. The purpose of the quiz is to see if they got a sense of basic material contained in slide show. Explain to students that they should study notes taken today, because there will be another follow-up slide show next week, followed by a more formal assessment. The information they learned today will help them next week and the week after.

Introduce the short data collection project for next week. Since students are already collecting daily weather data for Arizona, Oklahoma, and Massachusetts, they should use their existing logs of temperatures for the 3 towns for next week. Students will plot temperatures for the 3 towns in Excel or on a paper chart. They will try to predict, based on temperatures alone, which towns were in a ridge and which were in a trough. The teacher will capture the jet stream maps from Accuweather.com for the same 5 days, and create a 5-slide Power Point. Students will then compare their predictions on which towns were in ridges and troughs to what actually occurred.

### **Assessments:**

#### **Pre-lesson:**

Whole-class discussion: are students aware of changes in local weather from warm to cool, rainy to dry, snowstorms roaring up the East Coast in the winter? Pre-test data normally confirms that students have no idea whatsoever about the Jet Stream prior to this sequence of lessons, so background knowledge will tend to be weak.

#### **In Process:**

Students should take careful notes during first half of Power Point. Do students ask questions? Answer questions asked by others? Offer comments? Make predictions or offer explanations?

#### **Summary:**

Pop quiz.

### **Suggested Modifications for Special Needs:**

Students who have difficulty writing notes fast enough to follow along with the class, or who need more time to review the Power Point, should be able to watch it again if it resides on the building server. It is also strongly suggested that the Power Point file can be e-mailed to parents for them to watch at home with their children.

### **Lesson Extension Activities:**

Students who know someone who flies planes could ask them about their experiences with the Jet Stream. Students could also investigate the other 3 jet streams that circle the planet and how they impact weather.

### **References:**

Jet Stream maps by Accuweather.com:

[http://www.accuweather.com/adcbn/jet\\_maps\\_large?nav=home](http://www.accuweather.com/adcbn/jet_maps_large?nav=home) These maps change daily and can be captured and inserted into a Power Point slide show. The cartoonish speech balloons with arrows clearly point to where the warm and cool weather are and are easily understood by elementary students.

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

Power Point presentation “What is the Jet Stream?” (Jet Stream 1.ppt) found on Weather RATS web site.

**Additional Resources and Information:**

National Weather Service. Jetstream: An Online Weather School. National Oceanic and Atmospheric Administration. 4 Sept. 2005 <http://www.srh.weather.gov/srh/jetstream/matrix.htm>

Jetstream images (less detailed than Accuweather.com):  
<http://www.weatherimages.org/data/imag192.html>

Wikipedia: [http://en.wikipedia.org/wiki/Jet\\_stream](http://en.wikipedia.org/wiki/Jet_stream)

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## *Weather R.A.T.S.*

### **WE LIVE IN AIR: LET'S LOOK AT THE JET STREAM, PART 2**

**Grade Level: 4**

**Lesson # 4 in unit**

**Time Required for Lesson: 3 hours**

**Time Required for Unit: 15 wks.**

**Summary:** This lesson is a continuation of the preceding lesson, which introduced the Jet Stream, its cause, size, location, how it got its name, and an illustration of how the jet stream's ridges and troughs move back and forth, thus affecting local weather. This lesson reviews and extends the basic information delivered last session in another Power Point. Students will then begin working with temperature data from Arizona, Oklahoma, and Massachusetts to compare to a sequence of Jet Stream maps captured by the teacher during the last week.

#### **Lesson Standards:**

##### **MA Science/Technology/Engineering:**

*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.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.*

1.7 *Collaborate with classmates to use teacher-selected web sites.*

### **Lesson 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.

#### **Level-specific:**

- *We Live in Air:* comparing weather and its impact on different economies, cultures, diversity within CASA network. Look at Jet Stream and its effect on weather in the Weather RATS areas. Look for connections between RATS areas based on Jet Stream and water and wind currents.

### **CASA Connection:**

Students will increase their understanding of the global connection between local weather events in different geographic areas. CASA is concerned with accurate detection and observation of these local weather events, which are also influenced by these global currents.

### **Lesson Background and Concept for Teachers:**

The lesson background and concepts are the same as for the previous lesson. In addition, this lesson asks students to analyze raw data and fit it into meaningful patterns that will match a weeklong series of visual representations of the Jet Stream's location. Being able to make sense of data and fit it into larger patterns is an important conceptual skill, which demands collaboration between the students and the teacher.

### **Key Vocabulary/Definitions:**

- *Jet stream:* a high-speed, high-altitude current of high-speed winds that blows in a west to east direction around the Northern hemisphere.
- *Ridge:* An area of high pressure that looks like a hill on a map. It brings warm, tropical air north into the United States and Canada.
- *Trough:* An area of low pressure that looks like a valley on a map. It brings cool, Canadian air south into the United States.
- *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.

- *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.

### **Materials Needed:**

- Internet access.
- Student-created data charts from last week.
- Access to a TV/computer hookup or Smart Board for projecting Power Point.
- Pre-assembled map packets for each group – 5 maps pages per packet.
- Teacher-made Power Point slide show of Accuweather.com jet stream maps from past week.

### **Lesson Sequence:**

#### **Introduction/Motivation:**

Ask students what they remember about the Power Point they saw last week. Many students will, at this point, pull out their notes from last week and refer to them as they volunteer facts and insights they gained. The teacher should ask students where the students think they are at the moment, based on temperature: in a ridge or trough? Explain that students will watch another Power Point, but that they will not need to take additional notes as the content is a review of last week. They will also see how local temperatures in the 4 towns are correlated with the Jet's location. They will then watch an animated sequence of jet stream maps, which demonstrate how the ridges and troughs swing around as they travel from West to East.

#### **Body of Lesson:**

As with last week, it is a good idea to invite students to pull their chairs up close to the display screen or TV to watch the Power Point. Show the second Power Point, spending 1-2 minutes on each slide. Expect and encourage questions and comments. At the end, students love the animated sequence of maps and will probably ask to see them again and again. Again, tell students that the dates of the days shown in the slide show do not matter.

Ask students to plot the week's temperatures for the 4 towns on graph paper. They will need to set up their x-axis (day of the week) and the y-axis (degrees Fahrenheit). They can use a different colored pencil or marker to plot each of the 3 towns. Based on this graph, can they predict now where the ridges and troughs are for the week? Ask students to discuss or write a quick paragraph stating their own prediction for where they think the ridges and troughs are during the week, and why. Depending on class scheduling, this may take more than 1 week. It is best to model the plotting process by doing several days together with the class on an overhead transparency. Draw the X and Y-axes, and then label them. Students at this age need direct instruction on how to set up a graph. Plot data point by point with the class, and then connect the dots to form 4 lines, one for each town.

Then ask students to take out their weather data for OK, AZ, PR, and MA, which they have recorded over the past week. Distribute the Weather RATS map packets, 1 per group. Ask students to label the 5 maps for each day of the week. Students will then plot their data on the maps for each day, writing the temperature next to the red dot signifying the town. Based on the temperatures alone, can students predict where the ridges and troughs are on each day? Students will draw a line on each day's map showing where they think the ridges and troughs are.

After map packets are set aside, show the teacher-made sequence of slides. Power Point is an excellent way to do this. Each slide can be advanced by a mouse click, or slide transition can be set to advance automatically at 1-second intervals. To find the map images to insert into Power Point, go to Accuweather.com>Maps>Wind>Jet Stream: <http://www.accuweather.com/maps-surface.asp?partner=accuweather&type=jet> . Save each Jet Stream image as a jpeg file. On a PC, click Save Image As>My Pictures. Label each slide with the date to keep them straight, because they all start to look alike after a while. From My Pictures, you can insert them one at a time into separate slides in a Power Point file.

After you show the Power Point, discuss with the class where the ridges and troughs were, and how this connects with the students' data. Were students fairly close in predicting the locations of ridges and troughs? Expect students to focus intently on the meaning in each map, and compare it page by page to their own predictions. Let students share with classmates how close they were, or weren't, in predicting the jet stream's location.

**Closure:**

Ask students to revisit their original predictions about the location of the Jet Stream, whether these predictions were oral or written. Have them write a short paragraph reflecting on how accurate their predictions were, and why. Did students correctly pinpoint the locations of the ridges and troughs? Did they connect local weather to the global pattern of the jet stream's motion? If they were incorrect in their predictions, can they say why?

Remind students that the next class will be a formal assessment of their knowledge of the jet stream. They should study their notes.

**Assessments:**

**Pre-lesson:**

Whole-class discussion of Power Point. Do students remember information from previous lesson? Can they add other comments and insights?

**In Process:**

- Week's temperature data on 4 towns.
- Successfully completed graph of temperature in 4 towns for each day.
- Map packet of 5 days' temperatures for each student group.

**Summary:**

Submission of predictive and explanatory paragraphs reflecting on temperature data and correlation to national map.

**Suggested Modifications for Special Needs:**

Students who have difficulty with the content, or who need more time to review the Power Point, should be able to watch it again if it resides on the building server. It is also strongly suggested that the Power Point file can be e-mailed to parents for them to watch at home with their children.

**References:**

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Wikipedia: [http://en.wikipedia.org/wiki/Jet\\_stream](http://en.wikipedia.org/wiki/Jet_stream)

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