Weather R.A.T.S.

WE LIVE IN AIR:
CLIMATE

Grade Level: 4	**Lesson # 7 in unit**
Time Required for Lesson: 5 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 defines the term "climate", explains how it relates to weather, gives students opportunities to collect and analyze climatic data, and asks them to apply their learning about U.S. climate zones. Students will use a web site entitled "Weather Eye", which includes online interactive quizzes and an excellent overview of regional climates in the United States. Most of this lesson will be taught in a computer lab or location where there is one computer for every 1-2 students. Part of the lesson can be conducted in the classroom. The lesson sequence from Weather Eye will not be repeated in detail here. The web site contains detailed teacher notes.

Lesson Standards:

MA Science/Technology/Engineering:

E9 *Differentiate between weather and climate.*

E11 *Give examples of how the cycling of water, both in and out of the atmosphere, has an effect on climate.*

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)

4.P.4. Use pictures, models, tables, charts, graphs, words, number sentences, and mathematical notations to interpret mathematical relationships.

4.N.10. Select and use appropriate operations (addition, subtraction, multiplication, and division) to solve problems…

4.N.11. Know multiplication facts through 12 x 12 and related division facts. Use these facts to solve related multiplication problems and compute related problems…

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).

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).

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.
• Collect, analyze, and graph daily weather data for an extended period of time.
• Use mathematics as a tool for making sense of weather data.

Level-specific:

• What is climate? Local climate study: students design climate measurement data collection strategies (school day, 24 hr., weekly, etc.) and compare data.

CASA Connection:

CASA meteorologists, like all meteorologists, have a grasp of climate and how it is expressed in long-term weather data. The ability to analyze long-term data and relate it to weather-caused hazards to life and property is essential to the CASA mission. The long-term wind and storm patterns for a particular area, say the west coast of Puerto Rico, are factors in radar placement. How many radars are needed and where they should be placed relative to one another and to the topography are factors that are determined in part by long-term climate trends. What the local weather is likely to do, based on climate data, is a key piece of information needed to develop a DCAS radar network.

Lesson Background and Concept for Teachers:

Climate is a very difficult concept for students. Typically, climate data are calculated over 30-year time spans. For students who are only 10 years old, and for whom a 10-month school year is an eternity, the concept of 30 years simply holds no meaning. Developmentally, only about half the students in any class will grasp this concept after detailed instruction. Students easily grasp the concept of weather and can describe it in clear, articulate terms. They

believe climate is just more weather, however. They tend to describe climate in the very same terms as weather, because in their mind, there is no difference.

The origin of the 30-year time span for measuring climate comes from the Oklahoma Dust Bowl in the 1930's. When the drought and agricultural practices in use in Oklahoma during the Depression destroyed the topsoil and caused horrific dust storms, scientists wanted to know why this was happening. They looked at weather data going as far back as possible, which in Oklahoma's case was only 30 years – hence, the tradition of using a 30-year time span. There is no mathematical or scientific rule that requires the use of 30-year intervals. It is possible to analyze climate with shorter time intervals.

This lesson takes the approach that students can define their own climate intervals in slices of time that are meaningful for them and easy to handle, such as "climate of the day" or "climate of the week". They can get at the meaning behind averaging discrete weather measurements if they use intervals that are sensible within their frame of reference.

Key Vocabulary/Definitions:

- *Climate:* The historical record and description of average daily weather and seasonal weather events that help describe a region. Statistics are generally drawn over several decades.
- *Weather:* The state of the atmosphere at a specific time and with respect to its effect on life and human activities. It is the short-term variations of the atmosphere, as opposed to the long term, or climatic, changes.

Materials Needed:

- Access to Smart Board or computer lab
- Access to Internet in classroom (1 or 2 computers is OK)
- Photocopied packets on 7 regional climate zones in United States – 1 packet per student. These are especially helpful if student access to computer lab is limited.

Lesson Sequence:

Introduction/Motivation:

Ask students to remember the pre-test they took at the beginning of this unit. Do they remember the question "What is weather?" How did students answer that? Do they remember the next question "What is climate?" How did they answer that? How is climate different from weather, or is it just another word for weather? What is our climate like here, and how do you know? Can you tell whether or not to wear a raincoat tomorrow based on a description of local climate? Tell students they will be working with the idea of climate using a web site, and by collecting some local weather data and finding the averages.

Body of Lesson:

On the web site Weather Eye, have students read the first passage called "Weather vs. Climate." Check for understanding: ask students if their idea about climate has changed from reading this short passage.

Students will then go to the following web page on "Regional Climates." There are 7 different climate regions in the United States. Students need to read and digest the data for each climate zone. This can be done in many ways. Students can underline important data in their packets, or take notes on each climate page. They can quiz their neighbors on climate information. As a whole class, they can read the climate summaries aloud. They can complete a graphic organizer for each zone, which includes space for climate in January, climate in July, temperatures and precipitation for each. They can make card sets for each climate zone, with different data on each card. They can create a flipbook for the climate zones, with each zone being one flap of the book. There are dozens of ways for students to engage with the content.

After sufficient time has passed for students to feel comfortable with the data for the 7 climate zones, direct students to take the online quiz. They should complete all the identifying information, including their name, school, teachers' name and e-mail address, etc. The quizzes are graded and scores will be e-mailed to the teacher. Students always want to know if an assessment "counts", so it is suggested that this quiz "count" so that they will take it seriously.

In the classroom, students will begin a small research project on creating their own definitions for climate and collecting data to study local climate. Students may define "climate of the day", or "climate of the week," or some other short-term measurement. It is highly advisable to let students choose their own definition of climate. If there are multiple definitions in one class, this opens up interesting comparisons when the time comes to look at patterns in the data. Students will need to decide when to take temperature readings. For example, for "climate of the day" they might take a temperature reading every hour throughout one day. For "climate of the week" they might take temperature readings once a day for 5 days. They will need to set up data charts with dates and times that match their time interval. It will take up to one week to complete this short project.

Closure:

Students will complete the embedded assessment on evaluating the climate data from the 7 regions of the United States. They will decide which regions are best suited as a destination for a winter and summer vacation. They will use climate data to justify their conclusions, and they explain why they did not choose the other regions as destinations. They will then describe the clothes and gear they would need to pack in their suitcases for the summer and winter vacations.

Students will analyze and summarize the data they collected in their short-term climate study. Students will determine the temperature average for their chosen interval (day, week, etc.). Students will stage an informal class debate focused on the question "Which time interval is best for studying short-term climate?" They will team up with others who used their time interval, and develop a definition for what "best" means. They will then argue why their time interval most accurately reflects the range of individual data points.

After participating in a class debate, students will write a one-page reflection explaining what time interval they used, and how accurately it reflects hour-by-hour changes in temperature. They will also demonstrate their developing awareness of the issue "What is climate?"

Assessments:

Pre-lesson:

Whole-class discussion of questions on pre-test ("What is weather?" and "What is climate?"). Discussion of student ideas about climate, what it measures, and how it is different from weather.

In Process:

Online quiz on Weather Eye to recognize normal and abnormal weather conditions.

Summary:

Open response prompt on ideal destinations for winter and summer vacations.
Class debate on "best" time interval for local climate study.
Written reflection and accompanying data chart for local climate study.

Lesson Extension Activities:

Students can research how climate affects daily life in each of the RAT communities. Students can exchange insights and ask questions of peers in the online discussion forum. They can focus on small, seemingly trivial things that people in each climatic zone take for granted, but which are different and interesting to others. For example, raking leaves and shoveling snow in New England (each chore is now the source of small business ventures and contributes to the local economy), or building tornado shelters in Oklahoma. How do students practice tornado drills in Oklahoma schools? Where do Arizona communities get their fresh produce if they live in a desert? How do the Native Americans in Arizona view their dry climate and the four sacred mountains? How do students in Puerto Rico prepare for hurricanes? How have hurricanes influenced their local architecture and school schedule? The cross-curricular possibilities are rich. Map skills, natural resources, locations of cities and towns, schools, architecture, business and economy, family life, clothes and fashion, sports and leisure activities, all are influenced by climate.

On Weather Eye, under the Cadet section, http://weathereye.kgan.com/cadet/lessons.html, there are several worthwhile investigations that connect with CASA research. Flash Floods, Disaster Spot, and Adopt-a-City in the USA (can be used for any RAT community) are all particularly relevant. The Adopt-a-City project has students create a brochure or newspaper article about a particular city, which includes information on factors that influence the local weather, cultural and historical factors, weather data, and observations from real-time weather cams. This is a close parallel to weather data students are collecting for this unit on the Weather RAT schools. It is a small step to offer these activities as extensions for motivated students.

References:

Jetstream Online Weather School. Climate:
http://www.srh.weather.gov/srh/jetstream/global/climate.htm

Weather Eye – Weather vs. Climate: http://weathereye.kgan.com/cadet/climate/index.html

Additional Resources and Information:

The Weather Channel Weather Glossary: http://www.weather.com/glossary/a.html

Blueplanetbiomes. World Climates (Koeppen Classification System):
http://www.blueplanetbiomes.org/climate.htm

Exploring Earth. What Factors Control Your Local Climate?
http://www.classzone.com/books/earth_science/terc/content/investigations/es2101/es2101page01.cfm?chapter_no=investigation

NCAR (National Center for Atmospheric Research) and UCAR Office of Programs. Weather and Climate Basics: http://eo.ucar.edu/basics/index.html

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Weather R.A.T.S. Travel Agency

Perfect weather every day…guaranteed!

Congratulations! You have won a secret drawing, and are eligible for the grand prize: the Weather RATS are sending you on vacation – *twice!!* You get a week's vacation in the summer, and another week's vacation in the winter. As with every "free prize," there is a little catch.

a.) You must use data from the 7 climate zones on Weather Eye to choose a region for your summer vacation *AND* your winter vacation.

b.) Use the climate data to justify why you chose the regions you did, *AND* why you did *NOT* choose the other regions for your destinations.

c.) List 5 things will you need to pack in your suitcase for *EACH* vacation, and *WHY* they are necessary for that season.

You may refer to your climate zone data pack while writing your response.

ASSESSMENT ON WINTER/SUMMER VACATIONS
SCORING GUIDE

Score	Description of Typical Response
4	Response demonstrates **thorough** knowledge of the climate in all 7 U.S. zones. For **each** vacation, response gives **rich, detailed** discussion of the climate conditions for the zones the student chose **and** for the zones the student did not choose. Response lists **5** items to pack for **each** vacation, and gives a **detailed explanation that refers directly to climate data**.
3	Response demonstrates a **general** understanding of the climate in all 7 U.S. zones. For **each** vacation, response gives a **reasonable** discussion of the climate conditions for the zones the student chose **and** for the zones the student did not chose. Response lists **5** items to pack for **each** vacation, and gives a **general explanation for each season**.
2	Response demonstrates a **basic** or **limited** grasp of the climate in all 7 U.S. zones. For **each** vacation, response gives a **partial** discussion. Response either gives a **limited** discussion of zones that were and were not chosen for **each** vacation, **or** gives a **general** discussion of the zones that were or were not chosen for **one** vacation. Response lists **5** items to pack for **each** vacation, but **gives no explanation** as to why.
1	Response demonstrates a **minimal** understanding of the climate in all 7 U.S. zones. Response states which zones are chosen for each vacation, but **does not discuss** zones that were not chosen. Response **does not justify choices by referring to climate data**. Response gives **fewer than 5 items** to pack, and **gives no explanation** as to why.
0	Response is **incorrect**, or **contains correct work that is irrelevant to the question**, or is left **blank**.