

EVIL GENIUS: THE CASE OF THE TERRIBLE WEATHER: TEACHER GUIDE

Subject: Earth Science

Grade Level: Middle School

Last Updated: September 9, 2008

Case Summary

This case familiarizes students with weather phenomena and their effect on Earth's surface. Students will be expected to interpret weather maps, create and identify various weather equipment used by meteorologist. Students will also have the opportunity to study the different type of clouds, air pressure, relative humidity, and investigate convection currents.

Credits

This case was written by Dericka DeLoney (teacher Columbia Middle School, Decatur, GA) and Aron Barbey (PhD student, Psychology, Emory University, Atlanta, GA) fellows of the Emory University PRISM program (<http://www.prism.emory.edu>).

Learning Objectives

After completing the case, students will be able to:

1. Explain how the sun is the driving force in weather.
2. Explain the role of air pressure in weather.
3. Explain how tropical depressions and hurricanes form and describe the factors that lead to their development.
4. Describe and predict how tropical depressions and hurricanes affect the natural ecology of affected areas.
5. Explain how and why the weather of any particular area changes from day to day.
6. Demonstrate and explain how water can be changed from one state to another by heating or cooling.
7. Define the main types of clouds and explain how clouds affect weather and climate.
8. Explain the water cycle.
9. Demonstrate convection currents and explain how heat flows from warmer objects to cooler ones.
10. Demonstrate and explain how wind is created.
11. Define and explain relative humidity.
12. Create and record readings from weather instruments such as a barometer and psychrometer.

Georgia Performance Standards

- S6CS1.* Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. (NSES Content Standard A)
- a. Understand the importance of – and keep – honest, clear, and accurate records in science.

- b. Understand that hypotheses are valuable if they lead to fruitful investigations, even if the hypotheses turn out not to be completely accurate descriptions.
- S6CS2. Students will use standard safety practices for all classroom laboratory and field investigations.
- follow correct procedures for use of scientific apparatus.
 - Demonstrate appropriate techniques in all laboratory situations.
 - Follow correct protocol for identifying and reporting safety problems and violations.
- S6CS3. Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.
- Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers and decimals.
 - Use metric input units (such as seconds, meters, or grams per milliliter) of scientific calculations to determine the proper unit for expressing the answer.
 - Address the relationship between accuracy and precision and the importance of each.
 - Draw conclusions based on analyzed data.
- S6CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.
- Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files.
 - Estimate the effect of making a change in one part of a system on the system as a whole.
 - Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, and temperature, and choose appropriate units for reporting various quantities.
- S6CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
- Observe and explain how parts are related to other parts in systems such as weather systems, solar systems, and ocean systems including how the output from one part of a system (in the form of material, energy, or information) can become the input to other parts. (For example: El Nino's effect on weather)
 - Identify several different models (such as physical replicas, pictures, and analogies) that could be used to represent the same thing, and evaluate their usefulness, taking into account such things as the model's purpose and complexity.
- S6CS6. Students will communicate scientific ideas and activities clearly.
- Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.
 - Understand and describe how writing for scientific purposes is different than writing for literary purposes.
 - Organize scientific information using appropriate tables, charts, and graphs, and identify relationships they reveal.
- S6CS9. Students will investigate the features of the process of scientific inquiry.
Students will apply the following to inquiry learning practices:
- Scientific investigations are conducted for different reasons. They usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations.
 - Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions.
 - Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society.

- d. Scientists use technology and mathematics to enhance the process of scientific inquiry.
- e. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.

S6E4. Students will understand how the distribution of land and oceans affects climate and weather. (NSES Content Standard B)

- a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns.
- b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms.
- c. Relate how moisture evaporating from the oceans affects the weather patterns and weather events such as hurricanes.

Assessment

Students were given lab investigations to complete in order to get a better understanding of the concepts. We used the following lab activities:

National Aeronautic and Space Administration. (2001). The case of the phenomenal weather. Retrieved September 5, 2008 from <http://scifiles.larc.nasa.gov/educators/index.html>

Hot Air Currents

Round and Round We Go

The Coriolis Effect of Wind

Wind and Weather

Nice Angle (*found under In-Class Activities*)

(Note: to get to these activities, click on Episodes, and go to the 2000-2001 season. Choose The Case of the Phenomenal Weather. Click on At-Home Activities. Here you will find printable step-by-step instructions on the lab activities.)

At the end of the case, students passed in their box charts, which were graded based on completeness and clarity. Even though we go over these periodically in class, knowing that they will be passing the box charts in encourages students to listen and efficiently take notes.

For their final assessment, students create a cloud booklet that shows pictures of the various clouds within a family, the location in the atmosphere, and the type of weather expected.

Implementation Strategy

This case can be completed in five 120-minute class periods. A sample implementation plan is given below. Day 1 – 120 minutes

- Read scene 1 through role play; brainstorm and construct box chart
- Go over box charts; divide learning issues
- Each group will develop weather log of daily local weather reports using data from newspaper or weather channel for one week.
- Student will make barometers, anemometers, and psychrometers for collecting weather data.
- *HW – Research assigned learning issues, use more than one resource.*

Day 2 - 120 minutes

- Opening activity select 2 to 4 learning issues from day 1 - 10 minutes
- Record daily weather report – 15 min.
- Discuss learning issues with small group for 15 minutes
- Discuss learning issues with whole class for 30 minutes
- Role play scene 2 - 5minute
- Conduct convection current lab exercise and complete lab observations. – 30 min.

Day 3 - 120 minutes

- Opening activity – select 2 to 4 learning issues from day 2 – 10 min
- Record daily weather report – 15 min.
- Role play scene 3 – 5 minutes
- Conduct Barometer lab exercise and complete lab observations. – 30 min.
- Reconvene and discuss findings in groups (20 min.), then as a class (~40 min.)

Day 4 - 60 minutes

- Work on projects during class (~60 min.)

Day 5 - 120 minutes

- Case evaluation, wrap-up

Facilitator Guide:

The Case of the Terrible Weather Scene 1

Facts	Questions
1. A small cloud formation is spiraling above the Gulf of Mexico.	1. What is the digital globe?
2. The cloud formation is growing in size.	2. Who are what is the Evil Genius?
3. It will become the most devastating storm to reach North America.	3. Why did the Evil Genius use a toxic cloud seed method?
4. It could possibly destroy everything in its path.	4. Isn't a thunderstorm a natural disaster? Why did the Evil Genius say "they will think the thunderstorm is a natural disaster?"
5. A cloud seeding method was used.	5. How could hurricanes damage the National Weather's equipment? Is it not strong enough to stand against hurricanes?
6. The students were hoping that the recent tropical depression in the Gulf would lead to school cancellation.	6. Where is the weather equipment located?
7. The recent series of hurricanes across the Atlantic Ocean has damaged the weather equipment used by the National Weather Service (NWS).	7. Can the National Weather service predict a month of inclement weather, thunderstorms and other dangerous weather?
8. The community has to now rely on the local meteorologist to predict the weather in their area.	
9. The NWS is asking for local	

<p>communities to donate available weather equipment like barometers, psychrometers, anemometers, and thermometers.</p> <p>10. Previously the NWS predicted a month of inclement weather, such as heavy rain fall and thunderstorms.</p> <p>11. Thunder could be heard in the background, they believed it would rain soon.</p>	
<p style="text-align: center;">Hypothesis</p> <ol style="list-style-type: none"> 1. If a small cloud formation is spiraling above the Gulf of Mexico then the cloud is growing in size. 2. If the cloud continues to grow it will be very devastating to North America and could possibly destroy everything in its path. 3. The cloud seeding caused the clouds to grow quickly. 4. The tropical depression in the Gulf of Mexico will cause school in Atlanta to close. 5. If the local weather service has equipment that the National service can use, we don't need the National service. 	<p style="text-align: center;">Learning Issues</p> <ol style="list-style-type: none"> 1. What are small cloud formations? 2. Do clouds spiral? 3. How do clouds grow? 4. What is cloud seeding? 5. How do tropical depressions form? 6. Do tropical depressions in the gulf cause school closings in metro Atlanta? 7. What are the different types of weather equipment used by the National Weather Service? Local weather services? 8. What is the National Weather Service and where are they locate? 9. What are meteorologists? How do you become one? 10. Can you predict weather? If so how? 11. What are barometers, hydrometers, anemometers? 12. What are local convection currents? 13. What is inclement weather? 14. What is weather? 15. How is thunder formed and does it mean rain and how fast does it travel? 16. What type of clouds form before and during a thunderstorm? 17. What is relative humidity and how do you find it?

Resources

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