ARM

CLIMATE RESEARCH FACILITY

Education and Outreach Lesson Plan

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Grade levels K–2

What is an Aerosol?

What is an Aerosol?

Approximate Time

1 1/2, or two 45-minute segments

Objective

The student will investigate and demonstrate understanding of aerosols as evidenced by completion of the aerosol activity.

Key Points to Understand

- Aerosols are small particles suspended in the air, like dust, soot, or sea salt. They are so small that you need a microscope to see them.
- Aerosols come from many places in nature, such as fires, volcanoes, and sea salt.
- Humans also create aerosols when they drive cars, burn coal and gas to create electricity, or manufacture goods. These actions release small particles of soot, sulfur, and other materials into the atmosphere.

Background Information

On a hazy day, there are lots of aerosols in the atmosphere and you can't see very far into the distance. This "haze" comes from light that is bounced around by the aerosols in the air. Energy gained from incoming sunlight and lost from the warm Earth into cold space determines the average temperature and climate of the Earth. This is called Earth's energy balance. Just like the view on a hazy day, aerosols in the atmosphere scatter sunlight back into space, cooling the Earth. To understand the climate of the Earth and what causes it to change, scientists keep track of all the elements of the atmosphere that scatter and absorb light and heat, including clouds, gases, and aerosols. Each of these elements shifts the balance of energy by absorbing heat and light or reflecting sunlight back into space.

For example, records show that more carbon dioxide in the atmosphere absorbs heat, warming the Earth. It is relatively easy to measure this because the amount of carbon dioxide in the atmosphere changes slowly and mixes well throughout the atmosphere. Therefore, measurements of carbon dioxide made anywhere are a good indication of the change in carbon dioxide throughout the Earth's atmosphere.

It is much more difficult, however, to measure how changes in aerosols will impact the climate. Aerosols in the atmosphere both reflect and absorb sunlight, either cooling or heating the Earth, depending on what they are made of—soot, dust, salt, and sulfur. Aerosols can also change cloud reflectivity by providing more particles for cloud water droplets to form on, reflecting more sunlight back into space and cooling the Earth. This effect also depends on what type and how many aerosols are in the atmosphere, as well as the altitude of the clouds. Because the number and type of aerosols changes quickly and regionally, it is difficult to know how many aerosols of each type exist around the Earth at any given time.

For more information, refer to the July 2012 Education Newsletter, "Aerosols in the Atmosphere," at http://education.arm.gov/outreach/publications/12Julnewsletter.pdf.

Key Vocabulary

- **Aerosols**: Particles in the atmosphere. There is an abundance of naturally occurring aerosols in the Earth's atmosphere, such as dust and salt from sea spray. Pollution also contributes aerosols for cloud formation.
- **Atmosphere**: The air surrounding the Earth and bound to the Earth by gravity.
- **Climate**: The weather conditions of a region, throughout the year, averaged over a series of years.
- **Cloud droplets**: The small drops of water that make up a liquid cloud. These cloud droplets are quite small—often a few thousandths of a millimeter!
- **Earth's energy balance**: The heat that the Earth absorbs from the sun minus the heat emitted from the Earth back into space.
- **Haze**: Aerosols in the atmosphere that reduce visibility.

Materials

- Dark surface that does not absorb water (a dark-colored paper plate, a sheet of foil, etc.) for each student
- Spray bottle with a fine sprayer for each group of students
- Table salt
- Small cups
- Crayons or colored pencils
- Student Record Sheet

Preparation

Before the lesson, gather materials. Each student should have a dark surface, such as a dark paper plate, on their desk. Provide one spray bottle full of tap water per group of students and a small cup filled with salt. Students will need to share.

Management Tip

Students may need to fill in Student Record Sheets as directed by the teacher, depending upon student needs. The Student Record Sheet can be modeled under a document camera or can be enlarged to poster size to be completed as a whole-class activity.

Procedure

1. Before beginning the lesson, ask students the following questions and have a class discussion:
    - What is an aerosol?
    - What does it mean when we see haze outside?
    - How do you and your family release aerosols into the atmosphere?
    - What do you think happens when salt water evaporates into the atmosphere or when a salt spray hits a rock?
2. Instruct students to pour the salt into the spray bottle (full of tap water) and give it several good shakes to mix it up.
3. Each student should now have a dark surface, such as a dark paper plate, on their desk. Depending on the level of the students, guide them or allow them to independently spray the water. Students will record their observations on the Student Record Sheet under "Day 1." Students will then let their paper plate sit overnight to air-dry.
4. On Day 2, have the students observe their paper plate. What do they see today?

Closure and Evaluation Questions

Ask students:

1. How would you know if there were lots of aerosols in the atmosphere by looking up at the clouds in the sky?
2. How do aerosols affect the atmosphere?
3. What are some examples of aerosols?
4. What are some things your family could do to reduce the amount of aerosols you release into the atmosphere?

Suggested Follow-Up Activities

- Take the students outside to look at the sky. Is it a hazy day? Are there lots of aerosols in the atmosphere? Have students write a few sentences about what they see.
- Find the "Air Quality Index" (often found in the weather section of the local newspaper or online) for your city and graph the results after checking the index over a week.
- Choose books that discuss aerosols, pollution, and the atmosphere for students to read.
- Research poems about the atmosphere on the Internet. Discuss and or write a paragraph analyzing the poem.
- Interview adults about different kinds of pollution they have seen in their lifetime.
- Write a report about pollution, weather, global warming, or the atmosphere.

Name:_____

Date:_____

Title:_____

What is an Aerosol?

Research Question: What happens when salt water evaporates in the atmosphere?

Hypothesis

_____

_____

Materials

- Dark paper plate
- Salt
- Water spray bottle
- Crayons or colored pencils

Data

Paper Plate Observations

	Day 1	**Day 2**
Sketch what you see		
Write a description of what you see		

Conclusion

Based on what I observed on the paper plate on Day 2, I can conclude...

_____

_____

_____