Endeavor
STEM Teaching Certificate Project

Investigating the Atmosphere and Weather Patterns

Grade(s): 8th
Lesson Duration: Class 5 classes (50 minutes each)
Course Name(s): Earth Science
Lesson Author: Nashville, TN

***Directions for using this template:** The red text provides guidance on what to include in the sections with the blue or gray headers. Remove this set of directions as well as the red text and replace the red text with your own text.*

BIG IDEAS

- Understanding the role of air masses and their interactions in shaping weather conditions.
- Recognizing the influence of atmospheric layers on climate and weather.
- Exploring how satellite data can predict and track weather phenomena.

EDUCATION STANDARDS

These will be copied into your lesson plan below. NGSS, Common Core, or related State standards. Write out (or copy and paste) standards completely. In the 5E section, please identify the point when each standard is addressed in the 5E template below.

Science Performance Expectations (or state Science standard): *(List the PEs here, and then list the associated NGSS elements in the table below.)*

Science and Engineering Practices: *(SEP elements connected to the PEs or standards)*	Disciplinary Core Ideas: *(DCI elements connected to the PEs or standards)*	Crosscutting Concepts: *(CC elements connected to the PEs or standards)*
Analyzing and interpreting data: Students will analyze NASA satellite data to understand air mass movements and weather patterns. **Developing and using models:** Creating models to	**ESS2.D:** Weather and climate—students learn how interactions between the atmosphere, hydrosphere, and geosphere create weather patterns. **PS3.B:** Conservation of energy and energy transfer	**Cause and effect:** How changes in atmospheric conditions cause different weather events. **Systems and system models:** Understanding the atmosphere as a system where air masses interact and

simulate air mass interactions. **Engaging in argument from evidence:** Discussing how air mass interactions lead to different weather phenomena.	—students will explore how energy moves within the atmosphere to drive weather changes.	affect weather patterns. **Patterns:** Identifying patterns in weather systems through satellite data.
Common Core State Standards: *You are required to connect your lesson to either the CCSS for Math or for ELA. Use your state Math or ELA standards if Common Core is not applicable in your state. However, you are encouraged to list both the CCSS and your state standards.* **Math:** CCSS.MATH.CONTENT.7.SP.B.3 **and/or** **ELA:** CCSS.ELA-LITERACY.RI.8.7 **State Math or ELA Standards:** *If applicable*		
ITEEA Standards: *If applicable*		
Other Standards: *(as needed)*		

MEASURABLE STUDENT LEARNING OBJECTIVES

- Students will analyze and interpret satellite data to understand air mass movements and predict weather patterns.
- Students will create a model simulating air mass interactions and their impact on weather.
- Students will explain how weather phenomena are influenced by the atmosphere's layers.
- Students will present their findings on a specific weather event, demonstrating their understanding of the atmosphere’s role.

MATERIALS NEEDED

- NASA satellite data (GPM, EOSDIS)
- Clear containers, hot/cold water, food coloring (for air mass simulation)
- Computers or tablets for research
- PowerPoint or poster board for presentations
- NASA Gold missing data and atmosphere-related resources from Space Place

ENGAGING CONTEXT/PHENOMENON

The lesson begins by engaging students with real-world images and data from a recent extreme weather event, such as a hurricane or tornado. The phenomenon of rapidly changing weather conditions is introduced, drawing attention to how air masses interact to cause these events..

DATA INTEGRATION

NASA Global Precipitation Measurement (GPM) data will be used to visualize air mass movements.

NASA GOLD Mission data and A-Train Satellites will be used to show atmospheric layer interactions.

Real-time satellite data will be analyzed in the Explain and Elaborate phases, providing students with authentic data to support their learning..

TEACHER BACKGROUND KNOWLEDGE

Teachers should be familiar with:

- Basic concepts of meteorology, including air masses, pressure systems, and weather fronts.
- How to access and interpret NASA satellite data from resources such as GPM and the A-Train Satellites.
- The layers of the atmosphere and their role in weather and climate patterns.

DIFFERENTIATION OF INSTRUCTION

Advanced learners can analyze more complex weather phenomena, such as hurricanes, and predict their development using satellite data.

Students needing support will work with simplified data and simulations, focusing on core concepts like basic air mass interaction.

ELL students will be provided with visual aids and simplified language to ensure understanding.

REAL-WORLD CONNECTIONS FOR STUDENTS

Students will see the connection between the content and their everyday lives by tracking real-time weather systems and making predictions about upcoming local weather. They will understand how meteorologists use satellite data to predict weather and keep people safe.

POSSIBLE PRIOR or MISCONCEPTIONS

Weather changes randomly: Students may think weather changes are random, not caused by the interaction of air masses.

Air masses are just air: Students may not realize that air masses differ in temperature, humidity, and pressure, influencing weather patterns.

Weather only happens at ground level: Students may not understand how atmospheric layers impact weather phenomena.

LESSON PROCEDURE

This is where you include each phase of the 5E. They should be extremely clear, well organized, and ready to be used by another educator. Be sure that each learning experience meets the guidelines for each “E”. The template below will help you.

5E	Details of 5E Lesson Implementation *(Visit BSCS to learn more about the 5E instructional model)*
Engage Introduce weather phenomena through NASA satellite images. Discuss how weather changes and ask for student predictions.	**Lesson Objective** Introduce students to the phenomenon of changing weather patterns using satellite images and real-world weather events. **Standards Addressed MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. **Materials & Resources** NASA satellite images (GPM, EOSDIS) NASA Space Place: Link to Atmosphere **Procedure:** Show students NASA satellite images of extreme weather events. Initiate a class discussion: "What causes these sudden weather changes?" Ask students to make predictions about how weather events unfold. **Formative/Summative Assessments** Class discussion on the causes of weather changes. Student responses to questions about weather predictions. **Modifications** Provide visual aids and simplified language for ELL students. Use closed captions or transcript for video-based satellite imagery.
Explore Conduct hands-on simulations to explore air mass interactions. Students record observations and compare findings..	**Lesson Objective** Students explore the interaction of air masses through hands-on simulations to observe the creation of weather conditions. **Standards Addressed** **MS-ESS2-5:** Focus on data collection and observation of interactions between different air masses. **Materials & Resources** Clear containers, warm/cold water, food coloring, thermometers NASA GOLD Mission: Link **Procedure:** In groups, students simulate air mass interactions using hot/cold water and food coloring. Record observations of how air masses interact and form weather conditions. **Formative/Summative Assessments**

	Observation logs where students record what they see in their simulations. **Modifications** For students who struggle with fine motor tasks, assign roles that accommodate their abilities (e.g., recorder). Advanced students can be given more complex materials, such as different temperature gradients.
Explain Use NASA satellite data (GPM) to explain the scientific basis of air mass behavior. Discuss real-world applications, such as weather prediction.	**Lesson Objective** Students will learn about the science behind air mass movements and atmospheric layers using NASA satellite data. **Standards Addressed** **MS-ESS2-5:** Understanding how air masses affect weather systems. **Materials & Resources** NASA Global Precipitation Measurement (GPM) satellite data NASA GOLD Mission Data **Procedure:** Present real-time satellite data of air mass movements. Explain how warm, cold, moist, and dry air masses interact and how they influence weather patterns. **Formative/Summative Assessments** Complete a worksheet summarizing the key concepts of air mass interactions and weather formation. **Modifications** Provide extra time for students who may need additional support understanding the satellite data. Allow students to work in pairs to discuss the worksheet.
Elaborate • Group projects where students research and model specific weather phenomena using NASA data. • Presentations on the	**Lesson Objective** Students apply their understanding by researching a specific weather phenomenon, using NASA satellite data to model how air masses contributed to its formation. **Standards Addressed** **MS-ESS2-5:** Application of knowledge to real-world weather systems. **Materials & Resources** NASA satellite data: GPM and A-Train Satellites (Link) Poster boards or PowerPoint for presentations **Procedure:** In groups, students select a weather event to research. Using satellite data, create a model or presentation showing how air

interaction of air masses and the resulting weather event.	masses created that event. **Formative/Summative Assessments** Group presentations on their weather event models, explaining the role of air masses. **Modifications** Provide templates for organizing presentations for students who need guidance. Pair students with different skill levels to collaborate on projects.
Evaluate Students present their findings, and assessment is based on accuracy, depth of understanding, and clarity of explanation. Exit tickets will evaluate their ability to predict weather based on air mass movements.	**Lesson Objective** Assess students' understanding of how air masses affect weather and their ability to use satellite data for prediction. **Standards Addressed** **MS-ESS2-5:** Evaluation of understanding through data and predictions. **Materials & Resources** Exit tickets (written response) NASA satellite images **Procedure:** Provide satellite images showing air masses and ask students to predict the resulting weather conditions. Exit tickets with questions requiring students to explain how air masses interact and affect weather. **Formative/Summative Assessments** Exit tickets graded for accuracy in predicting weather patterns based on air mass interactions. Assessment of group presentations and weather event models. **Modifications** Offer sentence starters or structured templates for exit ticket responses for students who need additional support. Use visual prompts for students who struggle with written assessments.

REFERENCES

NASA Global Precipitation Measurement (GPM) Mission. (n.d.). Retrieved from https://gpm.nasa.gov/

Earth Observing System Data and Information System (EOSDIS). (n.d.). Retrieved from https://earthdata.nasa.gov/

NASA GOLD Mission. (n.d.). Retrieved from https://science.nasa.gov/mission/gold

NASA Space Place - Atmosphere. (n.d.). Retrieved from https://spaceplace.nasa.gov/menu/atmosphere/