

Earth and Space Science:

Unit 3

Weather and Atmosphere:

Introduction

Purpose: The Why, What, and How of This Unit

Essential Question: What scientific understandings allow meteorologists to predict the weather?

Why This Unit? Weather is complex and can require a college-level understanding of Earth Science. But our scholars in fifth grade have studied the water cycle and weather before and can draw on that previous knowledge to discover foundational meteorological principles. They add to their understanding in this unit by studying climate, air mass formation, and the circulation of the Earth's air and water. They will also use meteorological data to predict weather patterns. This sets them up well for future units, where they will be studying climate change.

Unit Storyline Synopsis: Weather often seems unpredictable. As you look outside while it's hot and sunny, it seems impossible that it could be rainy and cold just a few hours later. The behavior of our atmosphere seems perplexing, and the ability to predict it even more so. How can meteorologists foretell something that hasn't happened yet? In this unit, scholars learn that predicting the weather is not magic but science! They uncover the rhythms of the Earth's wind, water, and air, each playing a part to shape the weather patterns we experience. In addition, they will learn how meteorologists analyze these patterns to create a forecast.

What Is the Bottom Line?

Big Idea: Weather changes stem from the motions and interactions of air masses.

- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.

Big Idea: The water cycle plays an important role in a region's weather.

- Water continually cycles among land, ocean, and atmosphere via several phases. Global movements of water and its changes in form are propelled by sunlight and gravity.

Big Idea: Earth's movement causes patterns of circulation that determine regional climates.

- Unequal heating and rotation of Earth cause patterns of atmospheric and oceanic circulation. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect the determination of regional climates.

How do Next Generation Science Standards practices and crosscutting concepts support mastery of the Big Ideas? Science and Engineering Practices highlighted in this unit:

- **Analyzing and Interpreting Data**
 - Collect data to describe ways the Earth's movement and four spheres (geosphere, biosphere, hydrosphere, and atmosphere) interact to create changes in weather and determine regional climates
 - Develop/use a model to describe the cycling of water through Earth's systems

Crosscutting Concepts highlighted in this unit:

- **Cause and Effect**
 - Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.
- **Systems and System Models**
 - A system can be described in terms of its components and their interactions.

Safety

Plan carefully for safety in all lessons. The top safety risks in this unit include:

- In Lesson 3, scholars use long-handled lighters. Ensure that scholars are aware of how to work with these materials safely to avoid accidentally burning themselves, as well as what to do

should they burn themselves. Ensure that scholars wear proper personal protective equipment (PPE) as indicated in this lesson.

- In Lesson 4, scholars use a hot plate. Set up hot plate stations around your room and ensure scholars are aware of how to work with hot materials safely to avoid accidentally burning themselves, as well as what to do should they burn themselves. All materials should be handled with oven mitts at the hot plate station as there is no way to see whether materials are too hot to touch. Ensure that hot plates are turned off at the end of each section. Ensure that scholars wear proper PPE as indicated in this lesson.
- In Lesson 6, teachers and scholars handle hot water. Ensure that scholars are aware of how to work with hot materials safely to avoid accidentally burning themselves, as well as what to do should they burn themselves. Ensure that scholars wear proper PPE as indicated in this lesson.

Important Note: These lesson plans highlight some of the safety risks you should be aware of while teaching these lessons. These safety suggestions are not meant to take the place of a formal science safety training. Please be sure to follow all safety rules from your district, as well as all local, state, and federal science safety guidelines.

Unit Storyline

Engage: Meteorologists seem to predict the weather every day—what scientific phenomena allows them to do this? Scholars try their hand at being a meteorologist and predicting the next day’s weather, which leads them on a unit-long quest to answer the Essential Question: What scientific understandings allow meteorologists to predict the weather?

- **Lesson 1: How Do Meteorologists Use Science to Predict the Weather?** How do meteorologists know what the weather will be like days in advance? Scholars try their hand at forecasting the weather and making predictions about how meteorologists do it.

Explore: Scholars discover and build new understandings about how to predict the future by analyzing different weather maps and models. They unveil the difference between weather and climate while making connections between air and water movement to weather predictions.

- **Lesson 2: Weather vs. Climate.** Weather and climate are commonly confused. What makes them different, and which do meteorologists consult when creating a forecast? Scholars investigate this challenging difference.
- **Lesson 3: How Does Air Move?** We know that wind, air pressure, and air temperature are important parts of a weather report. But what makes temperature or wind speed change? Scholars experiment to find out.
- **Lesson 4: What Goes Up Must Come Down.** Other key parts of a weather report include humidity and precipitation. By using a model to study water, scholars will gather clues as to why these fluctuate.

Explain: Scholars solidify understanding and will be able to explain their ideas using models and data about weather patterns.

- **Lesson 5: How Air Creates Our Climate.** To solidify their understanding of our atmosphere's role in creating global weather patterns, scholars study maps and visit a climate website!
- **Lesson 6: Fronts.** What are the “fronts” seen on a weather map, and how do they affect the weather in an area? Scholars read and observe models to find out.

- **Lesson 7: Our Swirling Atmosphere.** By creating a fun model that resembles spin art, scholars study the Coriolis effect and learn how it affects our weather.

Elaborate: Now that they've got the basics down, it's time to see how meteorologists report on some of nature's most awe-inspiring weather. In this investigation, scholars apply their knowledge of water and air movement to study thunderstorms, tornadoes, and hurricanes to predict their inevitability in certain locations on Earth.

- **Lesson 8: Storm Warning!** What causes extreme weather such as thunderstorms, hurricanes, and tornadoes? Scholars apply their knowledge from previous investigations to learn about these potentially catastrophic weather events.

Evaluate: Scholars respond to a letter from another scholar who has questions about climate and then try their hand at weather forecasting!

- **Lesson 9: You've Got Mail.** The class receives a letter from another scholar, who wonders why the climates in New York and Nevada differ. He wonders how two geographies can be so different! As scholars write back, they apply their new understanding.
- **Lesson 10: Lights, Camera, Action!** Armed with the new information gathered throughout the unit, scholars have another chance to step into the role of a meteorologist. They study a weather map and prepare a weather report for a given area and then, it's lights, camera, action!

Extra Resources

- [Printable Exit Tickets](#)
- [Printable Lab Notebook](#)