

Examining Extreme Weather

Companion Lesson Plan to X-STEM All Access Episode "[Making an Impact with Meteorology](#)"

Grade/ Grade Band: 6-8	Topic: Weather	
Brief Lesson Description: Students explore weather patterns and then examine extreme weather events		
Performance Expectation(s): MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions		
Specific Learning Outcomes: Students are able to state the role of air masses and ocean currents in weather patterns Students are able to discuss the importance of accurate weather forecasting for various industries and safety precautions needed during extreme weather events		
Narrative / Background Information		
Prior Student Knowledge: Students should understand the water cycle Students should be able to define temperature, humidity, and wind as components of weather		
Science & Engineering Practices: Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. <ul style="list-style-type: none"> Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5) 	Disciplinary Core Ideas: ESS2.C: The Roles of Water in Earth's Surface Processes 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. (MS-ESS2-5) ESS2.D: Weather and Climate Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)	Crosscutting Concepts: Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)
Possible Preconceptions/Misconceptions: Students might believe weather is random and unpredictable. Explain that weather follows patterns and can be predicted using scientific methods. Students might also believe cold air is heavier than warm air. To clarify this misconception be sure to define air masses by their temperature and humidity and not their weight.		
LESSON PLAN – 5-E Model		
ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions: Begin the lesson by asking students “Why do we predict the weather? How do we predict the weather? What causes different types of weather?” Capture students’ ideas for everyone to see. Show the video featuring Capt. Matthew Steiner, Making an Impact with Meteorology . After viewing the video ask students if there is anything to add to the list of responses about why we predict the weather and how we predict the weather?		
EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions: Collect the following materials prior to lessons (per pair): <ul style="list-style-type: none"> laptops Students will use the Smithsonian Science Education Center’s Weather Lab to explore weather, air masses, and ocean currents. Begin with the question, “What happens when ocean currents and air masses interact?” Students should work in pairs, to record the names and locations of the ocean currents and the air masses and a description of how they interact.		

EXPLAIN: Concepts Explained and Vocabulary Defined:

Explain to students that weather refers to the conditions of the atmosphere at a given time and place. It depends on air temperature, air pressure, humidity, precipitation, and wind speed and direction. Weather occurs because of the Sun's unequal heating of the atmosphere. Warm air is less dense, so it rises, and more dense air flows in to take the place of the warm air creating wind. The rising air cools as it moves higher in the atmosphere.

Highlight for students that air masses, large bodies of air with similar temperature and humidity, that are close to the equator are warm/hot and air masses at higher latitudes are cold. Also, air masses that form over the ocean tend to absorb moisture from the water making the air humid while air masses that form over continents tend to be dry.

Ask students, what are the four air masses that form over North America (as seen during the explore phase: mTropical/maritime tropical, cTropical/continental tropical, mPolar/maritime polar, cPolar/continental polar). Have students discuss these air masses in terms of temperature, humidity, and location based on their observations during the explore activity (mPolar- cold, moist, and from north Atlantic and north Pacific, cPolar-cold, dry and from Canada, mTropical- warm, moist. from the Gulf and Pacific, and cTropical- warm, dry, from Mexico/Texas).

Ask students to describe the water cycle.

Explain that high and low pressures form due to water and air interactions of the atmosphere and water in oceans and lakes. In a low-pressure system air rises in the atmosphere, the water vapor within condenses, forming clouds and often precipitation. Whereas in a high-pressure system air moves in the opposite of a low-pressure system and is normally associated with light winds, clear skies, and rising temperatures during the day.

Vocabulary:

Weather- conditions of the atmosphere at a given time and place

Air masses- large bodies of air with similar temperature and humidity throughout

Pressure systems- is a region of the Earth's atmosphere where air pressure is unusually high or low;

ELABORATE: Applications and Extensions:

Students will need laptops and access to the internet.

Begin by asking students to name some weird or extreme weather events (possible ans.: hurricanes, heatwaves, tornadoes, extreme rainfall/flooding, hailstorms, thunderstorms, dust storms, ice storms, and blizzards). Discuss with students how these weather events might impact the community if they occurred locally; steer them to talk about new businesses that might develop because of the weather (rock salt business if there are ice storms or a cotton weaving textile business if there are sandstorms) or businesses that might be impacted (tourist industry or farmers if there are hurricanes, tornadoes, or blizzards).

Assign students to work in groups to research and create an interactive presentation about a weird weather event. The presentation of the weather event should include the following:

- meteorological characteristics- temperature, precipitation, wind speeds, atmospheric pressure
- how do meteorologists predict the event (what characteristics are they looking for?)
- historical example(s)
- how likely it is to occur locally with an explanation why it is likely or unlikely to occur?
- impact on the local community and businesses

Suggested websites for research:

1. National Oceanic and Atmospheric Administration (NOAA): NOAA's website offers a wealth of information on all types of extreme weather events, from hurricanes to tornadoes. It includes educational resources, real-time weather data, and historical data.

Website: [NOAA](https://www.noaa.gov/)

2. The Weather Channel: The Weather Channel's website provides articles, videos, and interactive features that explain various

extreme weather phenomena. It's a great resource for students looking to understand weather events visually.

Website: [The Weather Channel](#)

3. National Weather Service (NWS): The NWS website provides detailed information on weather forecasts, alerts, and warnings. It's a valuable resource for students interested in tracking current weather events.

Website: [National Weather Service](#)

4. NASA Climate Kids: NASA's Climate Kids website offers educational materials about climate and weather, including interactive games and videos. It's designed to engage younger audiences and is suitable for middle school students.

Website: [NASA Climate Kids](#)

5. Weather Wiz Kids: Weather Wiz Kids is an educational website that explains various weather phenomena in a kid-friendly way. It includes information on extreme weather events like hurricanes, tornadoes, and blizzards.

Website: [Weather Wiz Kids](#)

6. UCAR Center for Science Education: The University Corporation for Atmospheric Research (UCAR) offers educational resources on atmospheric science, including materials on weather and extreme weather events. Their website includes articles, simulations, and videos.

Website: [UCAR Center for Science Education](#)

7. Scholastic Weather Watch: Scholastic's Weather Watch website provides weather-related articles, videos, and interactive features designed for students. It covers various weather topics, including extreme events. *You'll need a subscription.*

Website: [Scholastic Weather Watch](#)

8. National Geographic Kids: National Geographic Kids provides educational resources about the natural world, including weather and climate. It offers articles, videos, and quizzes that can help middle school students learn about extreme weather. *You may need a subscription.*

Website: [National Geographic Kids](#)

EVALUATE:

Formative Monitoring (Questioning / Discussion): Assess students' understanding of weather patterns and the role of air masses using the [Weather Lab App](#)

Summative Assessment (Quiz / Project / Report): use the presentation of the extreme weather event to assess students' understanding of data analysis of weather forecasting and the importance of accurate weather forecasting for various industries and the safety measure

Elaborate Further / Reflect: Enrichment: Students research and present the potential connections between climate change and their extreme weather event. Students look for patterns in temperature, humidity, and frequency of occurrence of the particular weather event over time to determine if there is climatic change to the area. Then they revise their presentations to include updated data and evidence of climate change.

SOCIAL EMOTIONAL LEARNING ACTIVITY

CASEL Competency: SELF-MANAGEMENT

Capt. Matthew Steiner shares two lessons he learned from his wife: don't fear rejection and reach beyond the unattainable. To take on these lessons requires self-management. Self-management is the ability to manage one's emotions, thoughts, and behaviors effectively to achieve goals and aspirations.

Begin the lesson with this video clip from the movie [Pursuit of Happyness](#). Ask students if they have ever set a goal they thought was unattainable? or shared a goal that someone said was unattainable? Lead a brief discussion about how they responded when faced with a perceived unattainable goal.

Introduce the idea of "stretch goals" as a goal that might seem unattainable at first glance, but are achievable with effort and perseverance. To achieve a stretch goal, students need a growth mindset, the belief that abilities and intelligence can be developed over time and with effort and work. Emphasize that setbacks and challenges are part of the learning process and not an indication of failure.

On an index card, students write down one goal they consider challenging.

Collect the index cards, shuffle and then randomly redistribute them to students. Each student will receive a classmate’s goal and become a “goal champion”. As the goal champion, they will write down at least three ways the person can work toward achieving the goal. Then students share their ideas with the group by reading the goal and their suggestions aloud.

Finally conduct a class discussion on the goal swapping activity. Ask students to share insights and strategies they came up with for other people’s goals. Have students reflect on how their perspectives on their own initially unattainable goal have shifted.

INTERDISCIPLINARY CONNECTIONS/IDEAS

RET.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.
WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Materials Required for This Lesson/Activity

Quantity	Description
per pair	laptops
per student	index cards (for SEL Activity)



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