UNIT STORYLINE

Unit Question: Why does a lot of hail, rain, or snow fall at some times and not others?

How students will engage with each of the phenomena

HANDS-ON/ LAB ACTIVITIES | VIDEOS OR IMAGES | DATA SETS | READINGS | COMPUTER INTERACTIVES

Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it

LESSON 1

3 days

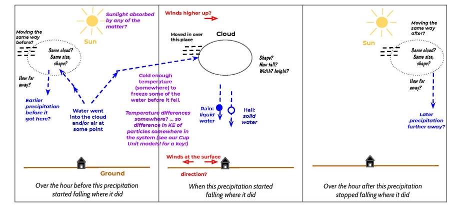
What causes this kind of precipitation event to occur?

Anchoring Phenomenon

Large, frozen pieces of water fall from the sky during storms at different locations on what appear to be relatively warm days.

We observe three video clips of hail falling in different areas of the United States on different days. We develop a model to try to explain what causes this to occur. We develop questions for our Driving Question Board (DQB) about the mechanisms that cause different kinds of precipitation events. We brainstorm investigations we could do and sources of data that could help us figure out answers to our questions. We figure out these things:

- Rain and wind accompany some hail events.
- Some of the water that reaches the ground reached a low enough temperature to freeze, at some point, before it fell.
- Clouds can be seen moving into and out of the area where it hailed.
- Cloud movement in the sky, moving air (wind) at Earth's surface, and temperature may be related to why, where, and when different forms of precipitation fall.



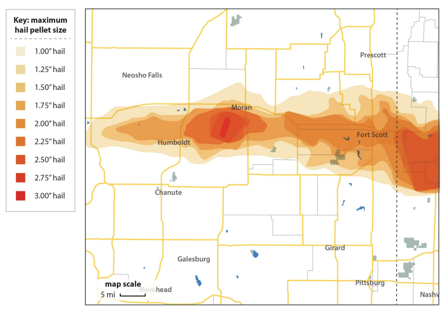
⇓ **Navigation to Next Lesson:** Many of our questions were about hail. Explaining how it forms could also help explain other precipitation events. It looked like the hail fell in places where green stuff was growing, and we weren't sure how the water got cold enough to freeze and form hail. We wanted to know more about what the air was like on these days (and others) when it hailed. We also thought it would be useful to look at hail more closely, as it may provide some clues about how it formed.

LESSON 2

1.5 days

What are the conditions like on days when it hails?

Investigation

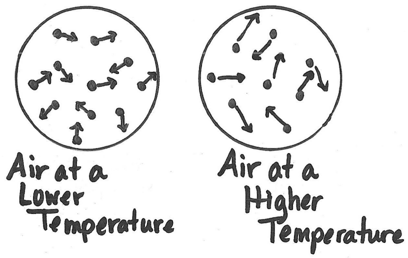
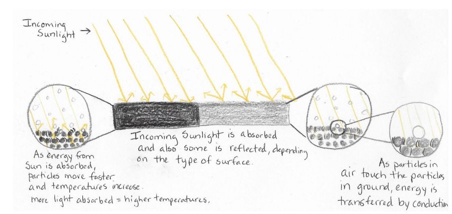


Images of hailstones show that they come in different shapes and sizes. Maps and weather condition data show that hailstorms occur in many places and on relatively warm days.

We examine photos of hailstones and analyze and interpret data from cases of hail events at different locations and times of year to notice patterns and identify relevant factors that might explain the formation of hail. We figure out these things:

- Hailstones are made of ice, often in layers.
- Hailstorms are more common in the central United States, with fewer events in the west.
- The days that have hail also have relatively warm air temperatures (mostly in the 50–90°F range, which is above the melting/freezing point of water) and relative humidity in the range of 37–96 percent.
- Hailstorms happens later in the day in the spring, summer, and fall. They impact a small area (20-60 square miles).

⇓ **Navigation to Next Lesson:** We saw that the temperature near the ground was well above freezing all day on days when it hailed. This makes us wonder how it is possible for frozen water (hail) to fall from the sky in those conditions.

<table>
<tr><th>Lesson Question</th><th>Phenomena or Design Problem</th><th>What we do and figure out</th><th>How we represent it</th></tr>
<tr>
<td>LESSON 3
1.5 days
How does the air higher up compare to the air near the ground?
Investigation</td>
<td>
Weather balloon data from four sites at four different times during the year show that the temperature of the air closer to the ground is warmer than the temperature of the air higher up in the atmosphere.</td>
<td>We analyze and interpret temperature profiles of the atmosphere collected from weather balloons at various altitudes at different locations during different times of the year. We develop a consensus model for representing the motion of the molecules that make up air at different temperatures. We figure out these things:
• Regardless of the season, the temperature of the air always decreases as you move away from Earth's surface and higher into the atmosphere.
• The air temperature at very high altitudes (approx. 40,000 ft) is coldest in winter.
• When the temperature of the air increases, the speed of the molecules that make up air increases, and when the temperature of the air decreases, the speed of the molecules that make up air decreases.</td>
<td>
</td>
</tr>
<tr><td colspan="4">⇓ Navigation to Next Lesson: In this lesson, we figured out that the air higher up in the atmosphere is colder than the air near the ground. This causes the molecules that make up air to move much more slowly and move closer together high up in the atmosphere, where it is cold, than they do near the ground, where it is warmer. Next we will investigate how the air right above the ground compares to the air a few feet above the ground, and determine the mechanisms that play a role in heating and cooling air.</td></tr>
<tr>
<td>LESSON 4
2.5 days
Why is the air near the ground warmer than the air higher up?
Investigation</td>
<td>
Surfaces on Earth absorb and reflect light differently.</td>
<td>We plan and carry out an investigation to figure out what causes the air above different ground surfaces to be warmer than the air higher in the atmosphere. We measure the temperature of the air at different ground surfaces, the air temperature above those surfaces, and the amount of sunlight reaching and reflecting off those surfaces. We figure out these things:
• Energy from the Sun is absorbed by the ground, which then increases the kinetic energy (and therefore temperature) of the particles in the ground.
• Different surfaces heat up differently depending on how much energy from the Sun is absorbed.
• As particles in the air come into contact with the ground, energy is transferred to those particles through conduction.
• On a sunny day, air temperatures above the ground are cooler than the ground itself.</td>
<td>
</td>
</tr>
<tr><td colspan="4">⇓ Navigation to Next Lesson: We know that the ground absorbs energy from sunlight and transfers that energy to the air through conduction. We are wondering what happens to that air after it warms up.</td></tr>
</table>

Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it

LESSON 5

2.5 days

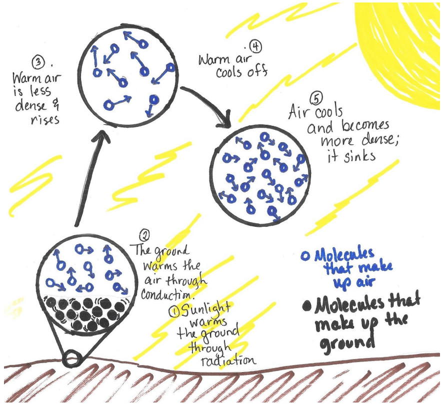
What happens to the air near the ground when it is warmed up?

Investigation

Warming and cooling air in a bottle with a soap bubble film over the opening causes the bubble to inflate and deflate. Warming a helium-filled Mylar balloon causes it to increase in volume and rise upward; it decreases in volume and sinks as it cools.

We conduct an investigation to figure out how transferring thermal energy into and out of a parcel of air in a closed system (a bottle of air with a soap bubble film over the top) affects that air's volume and behavior. We conduct a second investigation to observe how density changes in a parcel of air (in a balloon) cause it to float or sink in the surrounding air. For each investigation, we develop a model to represent how the speed, spacing, and density of the molecules that make up air are affected by temperature changes. We figure out these things:

- Changing the temperature of a parcel of air causes changes in the air's density due to changes in the kinetic energy (speed) and spacing of the molecules that make up the air.
- Parcels of air that are less dense than the surrounding air rise. Parcels of air that are more dense than the surrounding air sink.
- As they rise, parcels of warm, less dense air eventually cool off, transferring thermal energy to the surrounding air.



⇓ **Navigation to Next Lesson:** We figured out that air near the ground becomes less dense and rises after it is warmed up by the ground through conduction. We will continue to examine the mechanisms that contribute to the formation of hailstorms by investigating the movement of air in a hailstorm cloud.

LESSON 6

2 days

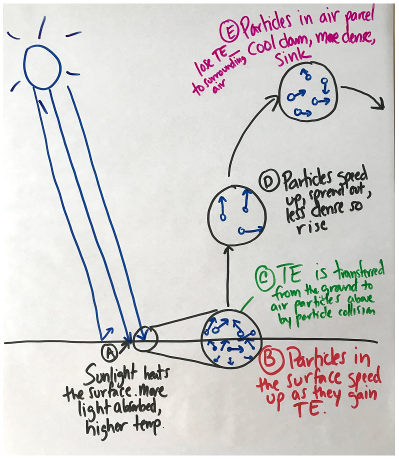
How can we explain the movement of air in a hail cloud?

Putting Pieces Together

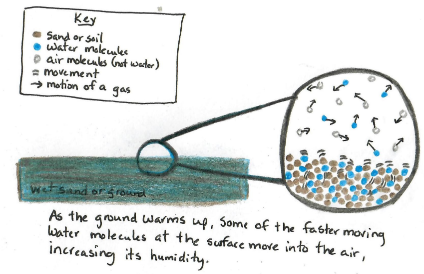
A time-lapse video shows vertical cloud growth on a sunny day in the type of cloud that tends to form hail.

We examine photos and a video of clouds that produce hail to look for patterns in the motion of air. We construct an explanation using evidence for the path of air movement below, within, and at the top of a cloud that tends to form hail. We figure out:

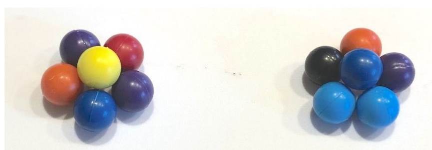
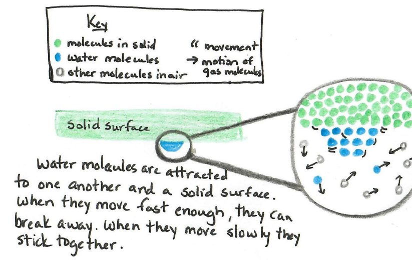
- Air near the surface of the ground is warmed from thermal energy transfer from the ground through conduction.
- The warm air near the ground becomes less dense than the surrounding air and rises.
- Eventually, the warm air transfers its energy to the surrounding air, becoming just as cold and dense as the air around it, and it stops rising.
- If that air becomes even cooler than the surrounding air, it sinks.
- This type of air movement happens more on sunny days because the air right above the ground gets warmed up more by light from the Sun on those days.
- Air is a mixture of different types of substances) in the gas state including water vapor which is measured as humidity.



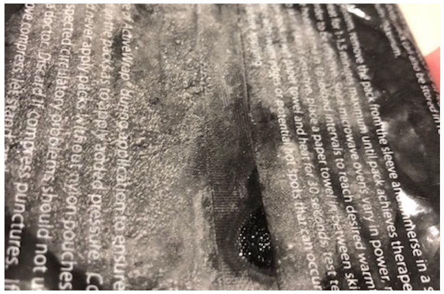
⇓ **Navigation to Next Lesson:** We know how air below and through a hail cloud is moving and we know that air has water in it, but we still have questions about how all that water got into the air.

Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it
LESSON 7 2 days **Where did all that water in the air come from, and how did it get into the air?** Investigation	 *Models of different Earth environments show an increase in relative humidity when thermal energy (heat) is added to the system.*	We plan and carry out an investigation to determine where the water in the air comes from by measuring the humidity in the air over samples of different Earth surfaces. We figure out these things: • Water can go into the air (increasing its humidity) from many different types of surfaces with water in or on them. • When individual water molecules on the surface of a liquid gain enough motion energy (kinetic energy), they leave the liquid to become a gas; this process is called evaporation.	

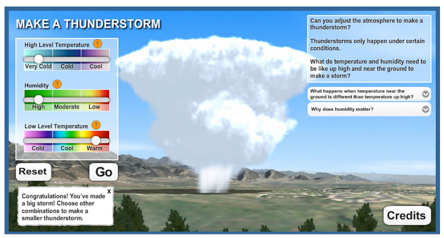
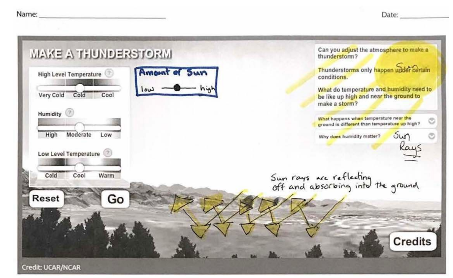
⇓ **Navigation to Next Lesson:** We know how water gets into the air, but what happens to that water vapor as it rises and cools?

Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it
LESSON 8 2 days **What happens to water vapor in the air if we cool the air down, and why?** Investigation	 *Water droplets appear and grow on cool surfaces when humid air comes in contact with them. When two water droplets touch, they move toward each other to become one. The motion and interactions between magnetic marbles in a collision change depending on how fast they are moving.*	We carry out investigations to explore what happens when air containing water vapor is cooled and what happens when water droplets make contact with each other. We use magnetic marbles to develop a model for how mutual attraction between water molecules and changes in their speed cause water to change from gas to liquid when it cools below a certain temperature. • Water molecules are attracted to each other. When they are moving fast enough, they can break away from each other and bounce off each other. When they are moving slow enough, they clump and stick together. • Water droplets can grow over time as they run into other water droplets or as more molecules of water vapor condense and stick to them. • When water is below a certain temperature (its condensation/boiling point), the molecules are moving slow enough to remain in liquid form; when water is above that temperature, the molecules are moving fast enough to remain in gas form; they change state when cooled below or heated above that temperature.	

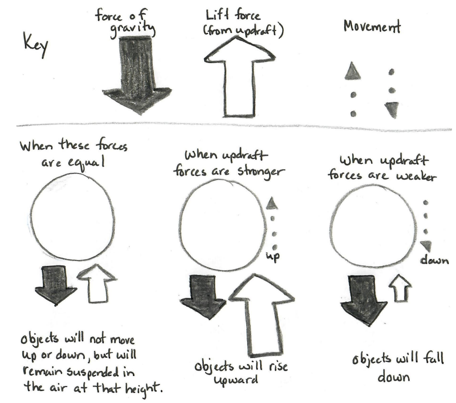
⇓ **Navigation to Next Lesson:** We know water droplets can form in air that is cooled that has water vapor in it. So why aren't water droplets always forming in the air above us outside? What is going on with water in the clouds above us on any given day?

Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it
LESSON 9 1 day **Why don't we see clouds everywhere in the air, and what is a cloud made of?** Investigation	 *Informational text describes what clouds are made of, why we can see them, the role of cloud condensation nuclei, and methods of cloud seeding. Ice crystals appear and then grow larger on the surface of a cold gel pack over a container with humid air in it.*	We read about what clouds are made of, why we can see them, the role of cloud condensation nuclei, and methods of cloud seeding. We argue that what happens in clouds is similar to what we see happen on the surface of a cold gel pack over humid air in our 2-L bottles. We figure out these things: • Clouds are made of water droplets and/or ice crystals and molecules of gas (including water vapor). • We see clouds because the water droplets or crystals in them reflect and scatter or absorb a noticeable amount of light. • For molecules of water vapor in the air to start the condensation or deposition process, the air has to reach 100% humidity and then be cooled. The water vapor also needs a solid surface to stick to. In the air, these surfaces are cloud condensation nuclei (small, solid particles).	

⇓ **Navigation to Next Lesson:** We figured out a lot about what happens to water in the air in clouds as they form. We want to see if we can apply these ideas to explain why clouds might not form all the time in the air above us.

Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it
LESSON 10 2 days **Why do clouds or storms form at some times but not others?** Investigation	 *Changing temperature and humidity inputs changes the size of the thunderstorm developed in a computer simulation.*	We use our *Gotta-Have-It Checklist* to test and revise a thunderstorm simulation to produce larger and smaller storms. We focus on temperature and humidity conditions that are likely to produce storms. We think about what additional features we would like to include in the simulation and we design interfaces for those features. We figure out these things: • A greater difference between near-ground and atmospheric temperatures is correlated with larger storm development. • Higher humidity is correlated with stronger storms. • Simulations are models that can represent only parts of a system, which limits their use.	

⇓ **Navigation to Next Lesson:** We noticed stronger storms have taller clouds form and we know hail comes from stronger storms. We are wondering if the tall clouds have something to do with hail formation.

<table>
<tr><th>Lesson Question</th><th>Phenomena or Design Problem</th><th>What we do and figure out</th><th>How we represent it</th></tr>
<tr>
<td>LESSON 11
2 days
Why don't water droplets or ice crystals fall from the clouds all the time?
Investigation</td>
<td>
Tissue paper and a Ping-Pong ball can be suspended in the air by blowing air on them from below. Air blown downward onto a scale or away from it affects the amount of force registered on the scale. A pointer taped to a balloon stretched over the mouth of a jar moves upward when additional force is applied downward on the balloon.</td>
<td>We try to lift or suspend different objects with air blown upward, and we record the weight of different objects and the amount of force registered when air is blown toward or away from a digital scale. We develop a model to show how objects might be lifted, fall, or remain suspended in the air depending on the relative strength of two different forces acting on them. We record the air pressure using a homemade barometer and record the cloud cover and precipitation outside. We figure out these things:
The more mass something has, the greater the force of gravity pulling down on it (which can be measured as its weight on a scale).
Moving air (wind) pushes (exerts a force on) matter in its path.
Air moving upward (updrafts) can keep an object suspended or floating in the air when the force from the molecules in that air colliding with that object counterbalances the downward force from gravity. When those forces are no longer balanced, the object that was suspended will start moving upward or downward.
A barometer can detect changes in the density of the air outside of it.</td>
<td>
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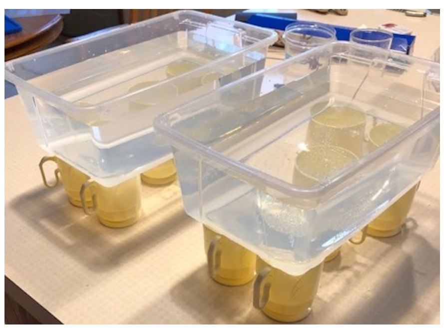
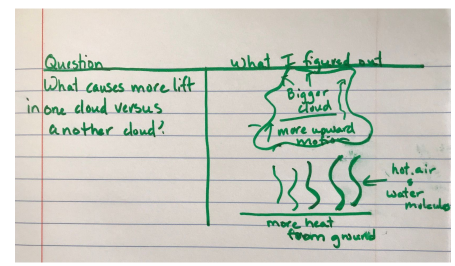
<tr><td colspan="4">⇓ Navigation to Next Lesson: We have ideas for what might cause an updraft to be stronger in one cloud versus another and we want to investigate those further. We also started taking measurements with a barometer to see if our predictions about whether changes in the pressure of the air outside correspond to changes in cloudiness and/or precipitation, and we want to keep collecting that data over future lessons.</td></tr>
<tr>
<td>LESSON 12
2 days
What causes more lift in one cloud versus another?
Investigation</td>
<td>
Dye added to water in a tub rises and moves differently when different amounts of thermal energy are added to the system.</td>
<td>We plan and carry out an investigation to determine what variables affect the amount of lift produced in a fluid. We explain how the results of our investigation help us understand how differences between air and ground temperatures can cause different amounts of lift and movement of air. We figure out these things:
When one spot in a fluid heats up, it becomes less dense, which causes it to rise. When it cools down, it becomes more dense and sinks. This leads to circular motion in fluids, called convection.
The greater the thermal energy input into the fluid, the stronger the lift or convection currents. The more of Earth's surface that is in contact with the air above it, the more thermal energy it can transfer to that air.
Some winds are the result of this convection. Air at the surface moves toward an area where warmed air rose, filling in the space left behind.</td>
<td>
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<tr><td colspan="4">⇓ Navigation to Next Lesson: We have figured out what causes air to lift, move around, and sink. We are ready to see if this can help us explain how a hailstorm forms.</td></tr>
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Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it

LESSON 13

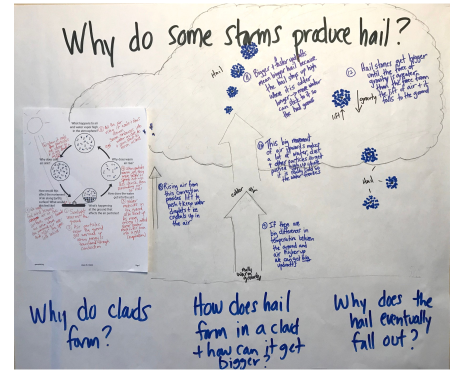
3 days

Why do some storms produce (really big) hail and others don't?

Putting Pieces Together

Different storms produce different types of precipitation (snow, rain, hail). Storms that produce larger hail also produce stronger updrafts.

We add to our Gotta-Have-It checklist and develop a final model to explain why some storms produce hail. We revisit the DQB and discuss the questions that we have now answered. We apply our understanding to a new phenomenon (hurricanes) and individually take an assessment.



⇓ **Navigation to Next Lesson:** We can now answer many of the questions from our DQB but there are still some long-term weather events from our related phenomena list that we have questions about.

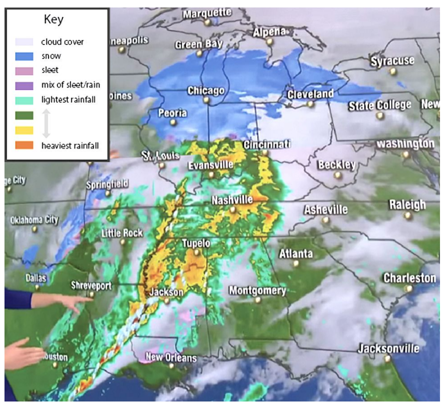
Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it

LESSON 14

2 days

What causes a large-scale precipitation event like this to occur?

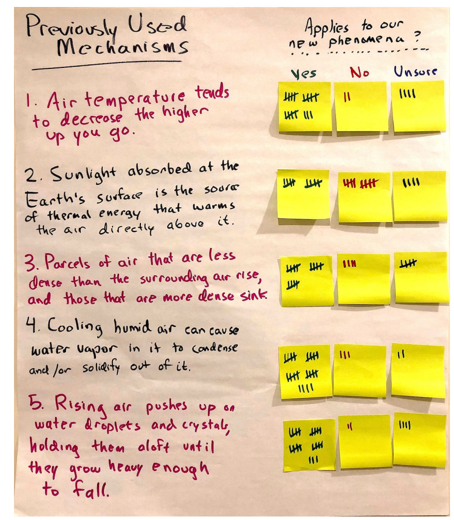
Anchoring Phenomenon



Different forms of precipitation were falling over the midwestern United States on the morning of Saturday, Jan. 19, 2019. A forecast predicts that this storm will produce heavy snowfall and ice accumulation in the northeastern United States by the end of the weekend.

We explore video and maps from three parts of a weather report and forecast from Jan. 19, 2019. We develop a model to explain how what was happening in one part of the country at one point in time can be connected to what is predicted to happen in another part of the country over a day later. We develop questions for our Driving Question Board (DQB). We brainstorm ways we could investigate these questions. We will figure out these ideas:

- Some storms are very large (hundreds of miles across) and can last for many days.
- These large-scale storms can produce different types and amounts of precipitation over different areas.
- Many of the mechanisms we used to explain small-scale precipitation events seem like they could be relevant to explaining large-scale storms too.
- Large-scale storms also may have something to do with large areas of cold air and warm air moving over great distances.



Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it

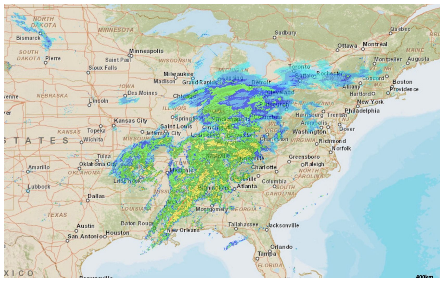
⇓ **Navigation to Next Lesson:** We have ideas for what might be causing this large-scale rain, ice, and snowstorm. One set of ideas was that it was related to how a large amount of relatively cold and warm air was moving over the country. We want to see if the data support that idea.

LESSON 15

2 days

What happens with temperature and humidity of air in large storms?

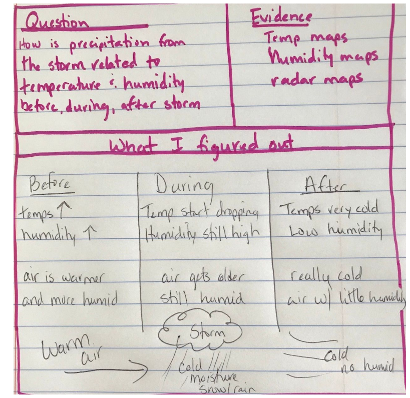
Investigation



Students analyze temperature, humidity, and radar data to track the progression of the storm and precipitation along the front line.

In this lesson we use temperature, humidity, and radar data across eight-hour increments during the timeline of the storm to track the movement of air and precipitation. We consider how air moves horizontally in large parcels, called air masses, and we also notice that precipitation and storms develop where air masses of different characteristics meet. As a class, we develop different ways of representing what is happening with warm air and cold air across the land. We figure out these ideas:

- Air masses are large parcels of air (hundreds of miles wide) with similar characteristics (e.g., temperature, humidity).
- Air masses move horizontally, such as from west to east across the United States.
- Storms and precipitation can develop where two air masses with different characteristics meet; this boundary is called a *front*.



⇓ **Navigation to Next Lesson:** We wonder what happens when two very different air masses interact and if this is why storms develop along these boundaries.

LESSON 16

2 days

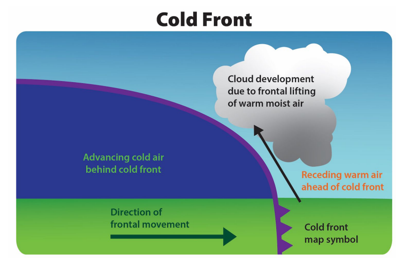
How do warm air masses and cold air masses interact along the boundaries between them?

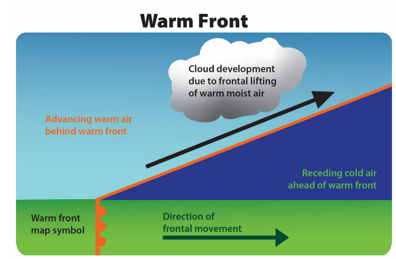
Investigation

When warm water and cold water interact, cold water sinks, pushing warm water upward. This serves as a model for the interactions that occur between warm and cold air masses in the atmosphere.

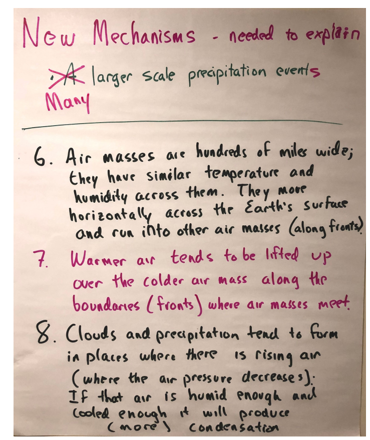
We carry out an investigation to explore what happens along a frontal boundary where warm air and cold air meet. We develop models to describe interactions between warm and cold air masses and use patterns in data to explain changes in precipitation that can occur when air masses collide. We figure out:

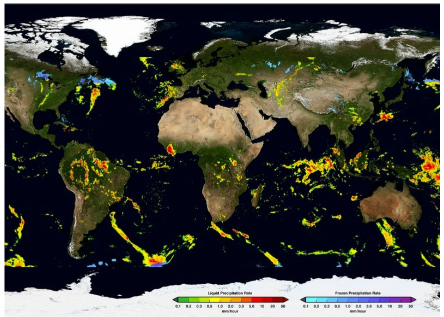
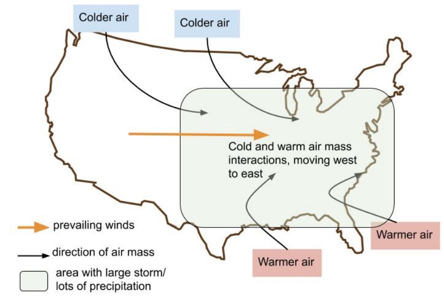
- When a warm air mass moves toward a cold air mass, the warm air slides over the cold air. When a cold air mass moves toward a warm air mass, the cold air pushes into and below the warm air, pushing it up and over. Both interactions cause predictable changes in weather.
- The maximum amount of water vapor that air at a given temperature can hold is referred to as 100% relative humidity.
- The maximum amount of water vapor that can be in the air changes based on the temperature of the air; warmer air can hold more water vapor than colder air.
- Cooling air at 100% relative humidity will cause water vapor to condense out of the air; the greater the decrease in air temperature, the greater the amount of water vapor that will condense out of it.





<table>
<tr><th>Lesson Question</th><th>Phenomena or Design Problem</th><th>What we do and figure out</th><th>How we represent it</th></tr>
<tr><td colspan="4">⇓ Navigation to Next Lesson: In this lesson, we figured out what happens when warm air masses and cold air masses interact and why it happens. What we don't yet know is how scientists know when this is going to happen. In the next lesson we will explore how scientists use tools to predict the movement of warm and cold fronts and the accompanying changes in weather.</td></tr>
<tr><td>LESSON 17
1 day
Is there a relationship between where the air is rising and where precipitation falls?
Investigation</td><td>
Pressure maps for the United States show different amounts of air pressure in different places at different times. A homemade barometer detects changes in the density of the air outside of it.</td><td>We analyze national pressure maps from around the time of the original forecast. We construct an explanation of the patterns we notice among (1) the area of lowest air pressure, (2) the locations of the fronts, and (3) where precipitation would fall. We apply scientific ideas to explain what is causing these three things to be connected to one another. We will figure out these ideas:
• When the air pressure outside decreases, it tends to correspond with the appearance of cloudier skies and in some cases precipitation.
• Large-scale, low-pressure air masses can move and their movement can be predicted.
• The movement and location of warm and cold fronts appear to be connected to this low-pressure center.
• Precipitation tends to fall along the line of the cold front and warm front and behind the low-pressure center.</td><td></td></tr>
<tr><td colspan="4">⇓ Navigation to Next Lesson: We've developed individual explanations for what caused the patterns we saw in the weather associated with the Jan. 19, 2019 storm. We argued we will have to work together next time to come to agreement on the mechanisms that are the causes that led to this.</td></tr>
<tr><td>LESSON 18
2 days
How can we explain what is happening across this storm (and other large-scale storms)?
Putting Pieces Together, Problematizing</td><td>

A weather forecast shows that three different storm systems were predicted to affect different parts of the United States from the morning of Nov. 22, 2019 into Nov. 27, 2019.</td><td>We explore video and maps from three parts of a weather report and forecast from Jan. 19, 2019. We develop a model to explain how what was happening in one part of the country at one point in time can be connected to what is predicted to happen in another part of the country over a day later. We develop new questions for our Driving Question Board (DQB) and brainstorm ways we could investigate these questions. We will figure out these things:
• Many storms are due to the path that air masses follow as they are moving, other air masses they interact with along their boundaries (fronts), and how much lift occurs in the air mass or along those fronts.
• We have new questions about whether certain weather patterns are typical for different places in our country and what causes any differences in those from one place to another over longer periods of time.</td><td>
</td></tr>
<tr><td colspan="4">⇓ Navigation to Next Lesson: The new questions that emerged from considering whether the patterns we see in storm tracks, precipitation amounts, and types of precipitation are typical for different areas of our country are ones we want to investigate further in future lessons.</td></tr>
</table>

<table>
<tr><th>Lesson Question</th><th>Phenomena or Design Problem</th><th>What we do and figure out</th><th>How we represent it</th></tr>
<tr>
<td>LESSON 19
1 day
Are there patterns to how air masses move that can help predict where large storms will form?
Investigation</td>
<td>
Visualized precipitation data reveal predictable patterns in the movement and direction of air masses.</td>
<td>In this lesson, we observe a visualization showing precipitation movement across the United States in a predictable pattern from west to east in most locations. These predictable air movements seem to bring colder air from the north and warmer air from the south. We zoom out to a global view and notice the U.S. pattern is the same as other places in the northern hemisphere and a mirror image of the southern hemisphere. We figure out these things:
• There are patterns in the direction that air and precipitation move over a region.
• Patterns in air movement are caused by prevailing winds and the prevailing winds in the northern hemisphere mirror the southern hemisphere.
• These patterns help us predict where air and precipitation come from (colder from the north and warmer from the south).
• Climate is the long-term average of weather in an area, typically averaged over 30 years.</td>
<td>
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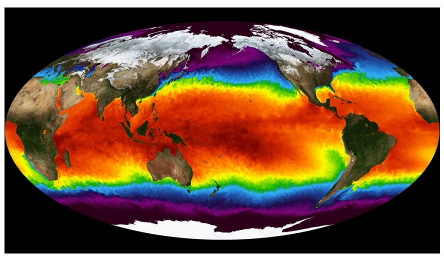
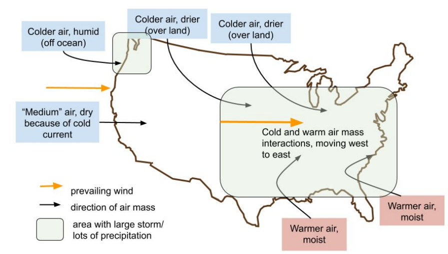
⇓ **Navigation to Next Lesson:** We figure out that air mostly moves in the same pattern across most of the United States, from west to east, bringing colder air from the north and warmer air from the south. We notice precipitation is more common over or near the ocean and wonder how the ocean changes air masses and precipitation patterns.

<table>
<tr>
<td>LESSON 20
2 days
How do oceans affect whether a place gets a lot or a little precipitation?
Investigation</td>
<td>
Ocean temperatures and currents affect evaporation rates and therefore the temperature and humidity of different air masses.</td>
<td>In this lesson, we come to agreement about the temperature of air masses and the direction of their movement. We gather additional information about the role of the ocean by observing a visualization of ocean temperatures, reading about ocean currents, and interpreting precipitation data for coastal cities. We revise a model for air mass interactions that explain (1) the places where certain kinds of air masses form, and (2) their predictable movements over time. We figure out:
• The ocean is warmer near the equator and cooler near the poles.
• Ocean currents can bring warmers waters toward the poles and cooler waters toward the equator.
• More evaporation occurs over warmer ocean waters.
• The temperature of the ocean affects the humidity of the air moving over it.</td>
<td>
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</table>

⇓ **Navigation to Next Lesson:** We figure out that the ocean affects the humidity of air masses. We are curious as to why the moisture from the Atlantic Ocean and Gulf of Mexico can travel so far inland compared to the moisture from the Pacific Ocean.

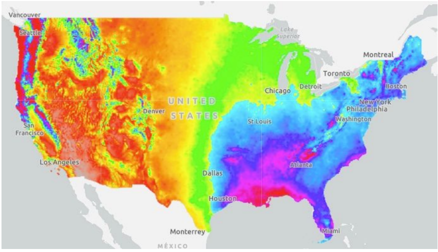
Lesson Question	Phenomena or Design Problem	What we do and figure out	How we represent it

LESSON 21

2 days

Why is there less precipitation further inland in the Pacific Northwest than further inland from the Gulf Coast?

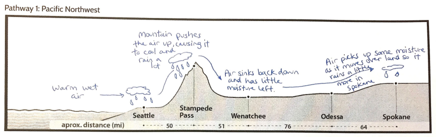
Investigation



Data from five locations along prevailing wind pathways in the Pacific Northwest and Gulf Coast show that changes in elevation are associated with changes in air temperature and precipitation.

We analyze precipitation, temperature, and elevation data at five locations along two different prevailing wind pathways to explore why there is less precipitation further inland in the Pacific Northwest than there is further inland from the Gulf Coast. We model what happens as an air mass moves from above the ocean to locations over mountains and relatively flat landforms. We develop a list of key ideas and data we need to explain climate patterns in places outside of the United States. We figure out:

- Changes in elevation affect the flow of air over the land.
- As elevation increases, the air flowing over the land is forced upward; as elevation decreases the air flowing over the land can fall back downward.
- Air that is forced upward cools as it rises and tends to lose much of the water vapor in it through condensation and precipitation.



⇓ **Navigation to Next Lesson:** We have a list of key ideas and data needed that we're ready to use to explain climate patterns outside of the United States.

LESSON 22

1 day

How can we explain differences in climate in different parts of the world?

Putting Pieces Together

South America has both temperate and tropical rainforests, which have high precipitation rates but different average temperatures.

We use our key ideas list from Lesson 21 to explain why the rainforests are located where they are and why they have different climates. We revisit the Driving Question Board and discuss all of our questions that we have now answered.

LESSONS 1-22

42 days total