

Chapter Menu

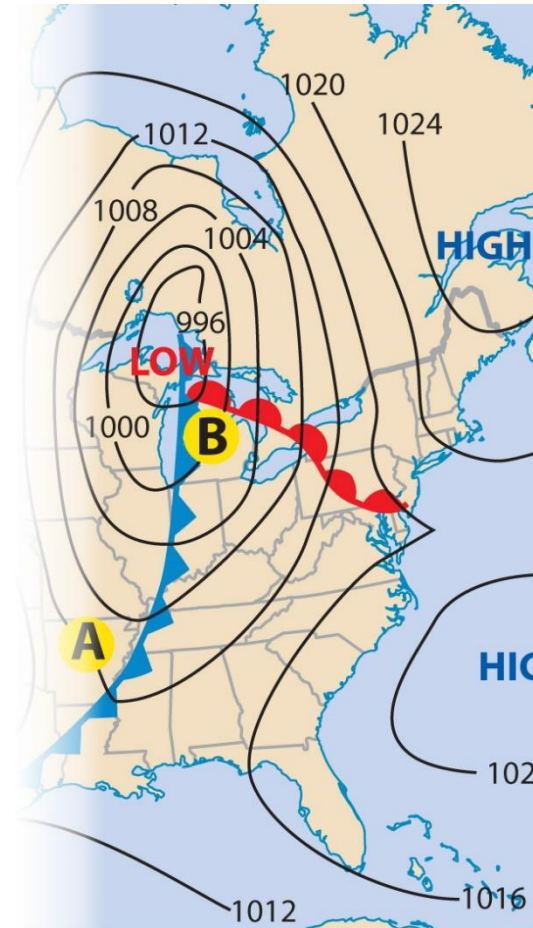
Chapter Introduction

Lesson 1 Describing
Weather

Lesson 2 Weather
Patterns

Lesson 3 Weather
Forecasts

Chapter Wrap-Up





How do scientists describe and predict weather?



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Get Ready**What do you think?**

Before you begin, decide if you agree or disagree with each of these statements. As you view this presentation, see if you change your mind about any of the statements.



Get Ready

Do you agree or disagree?

1. Weather is the long-term average of atmospheric patterns of an area.
2. All clouds are at the same altitude within the atmosphere.
3. Precipitation often occurs at the boundaries of large air masses.



Get Ready

Do you agree or disagree?

4. There are no safety precautions for severe weather such as tornadoes and hurricanes.
5. Weather variables are measured every day at locations around the world.
6. Modern weather forecasts are done using computers.



Lesson 1

Describing Weather

Key Concepts

- What is weather?
- What variables are used to describe weather?
- How is weather related to the water cycle?



Lesson 1

Describing Weather

Vocabulary

- weather
- air pressure
- humidity
- relative humidity
- dew point
- precipitation
- water cycle



What is weather?

- Weather is the atmospheric conditions, along with short-term changes, of a certain place at a certain time.
- Weather can change quickly or be the same for several days in a row.

Weather Variables

- Temperature and rainfall are just two of the variables used to describe weather.
- Meteorologists use a variety of variables to predict weather, including air temperature, air pressure, wind speed and direction, humidity, cloud coverage, and precipitation.



Weather Variables (cont.)



KEY CONCEPT CHECK

What is weather?



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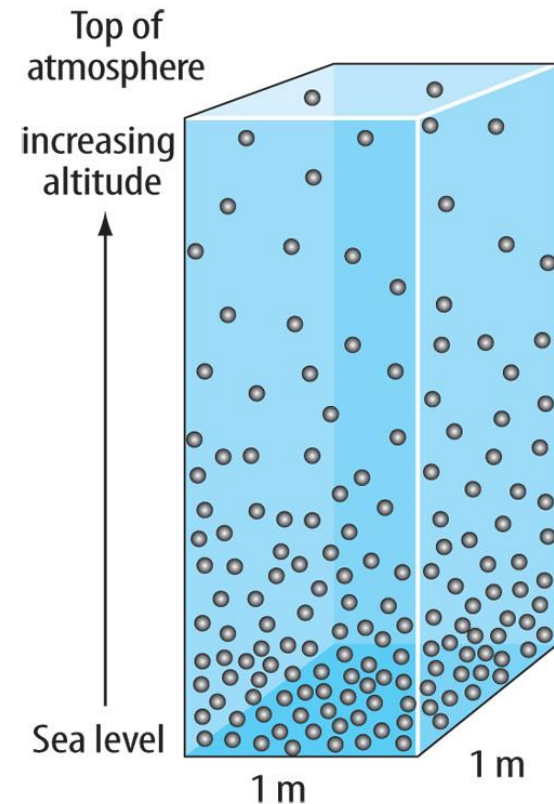
Weather Variables (cont.)

- Air temperature is the measure of the average kinetic energy of molecules in the air.
- Molecules in warm air move faster than molecules in cold air.



Weather Variables (cont.)

- Air pressure is the pressure that a column of air exerts on the air, or surface, below it.
- Air pressure is measured with an instrument called a barometer.



Weather Variables (cont.)

- As air moves from areas of high pressure to areas of low pressure, it creates wind.
- Meteorologists measure wind speed using an instrument called an anemometer.



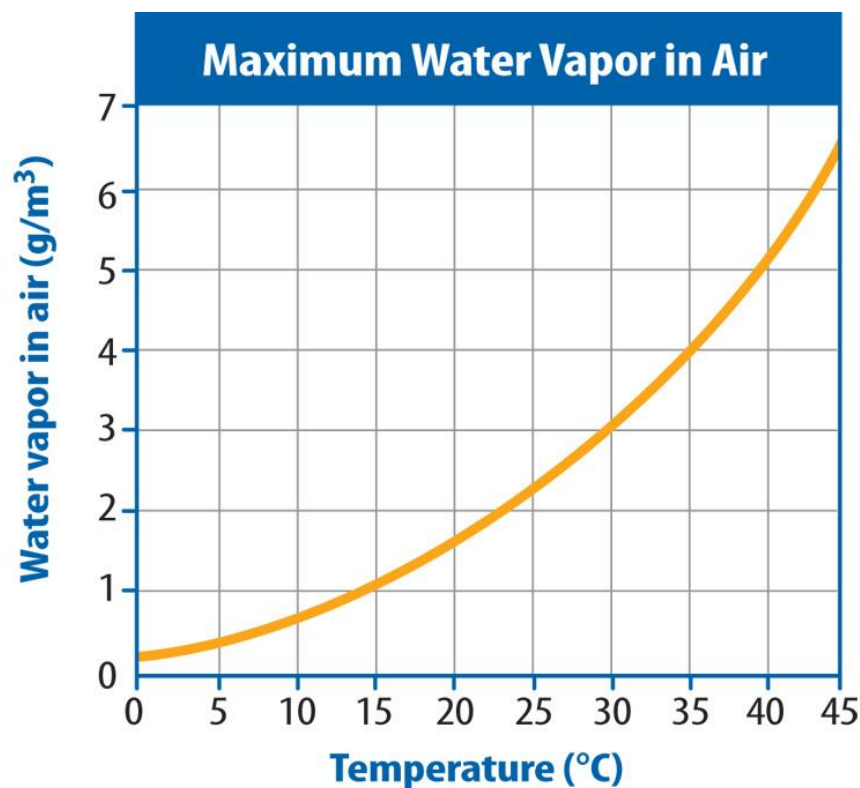
Weather Variables (cont.)

- The amount of water vapor in the air is called humidity.
- When the humidity is high, there is more water vapor in the air.
- The amount of water vapor present in the air compared to the maximum amount of water vapor the air could contain at the temperature is called relative humidity.



Weather Variables (cont.)

The dew point is the temperature at which air is fully saturated because of decreasing temperatures while holding the amount of moisture constant.



Weather Variables (cont.)

- Clouds are water droplets or ice crystals suspended in the atmosphere.
- A cloud that forms near Earth's surface is called fog.

Weather Variables (cont.)

Precipitation is water, in liquid or solid form, that falls from the atmosphere.

WORD ORIGIN

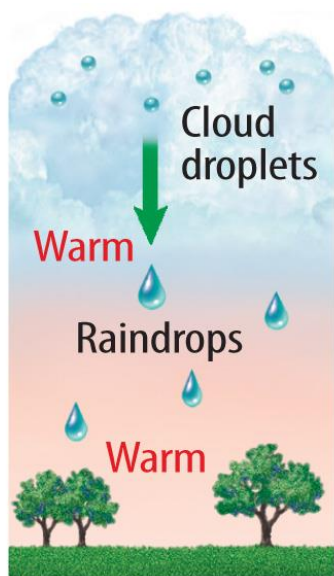
precipitation

from Latin *praecipitatus*, means
“to throw down” or “separate”

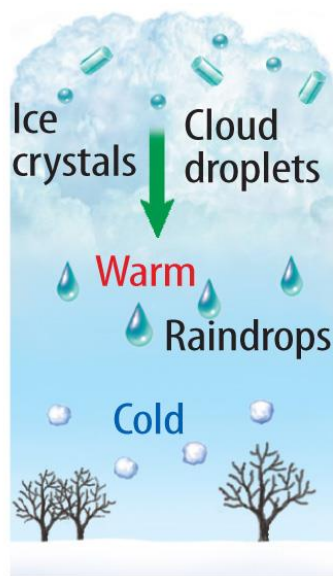


Weather Variables (cont.)

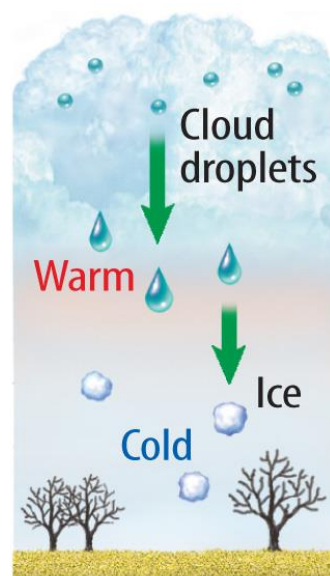
Rain, snow, sleet, and hail are forms of precipitation.



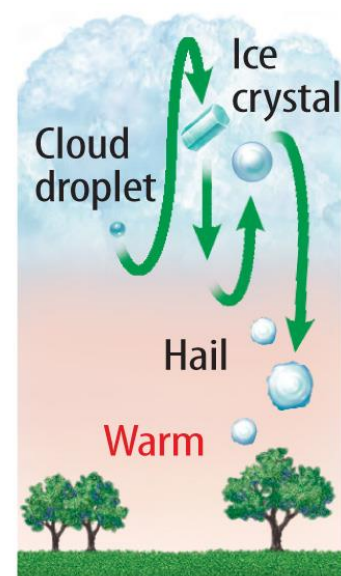
Rain



Snow



Sleet



Hail



Weather Variables (cont.)

- Rain is precipitation that reaches Earth's surface as droplets of water.
- Snow is precipitation that reaches Earth's surface as solid, frozen crystals of water.



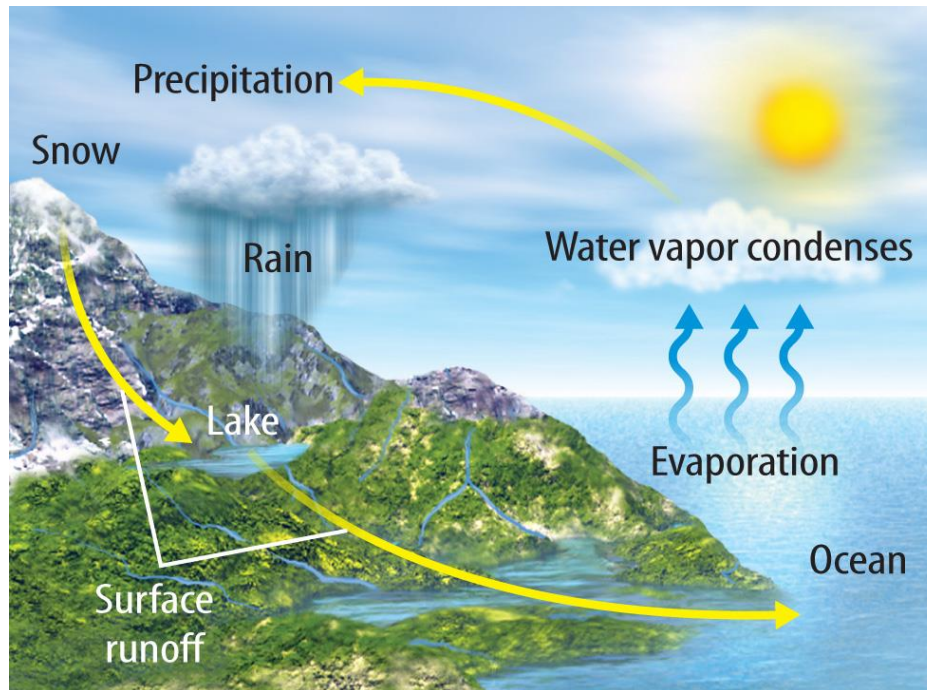
KEY CONCEPT CHECK

What variables are used to describe weather?



Weather Variables (cont.)

The water cycle is the natural process in which water continually moves among oceans, land, and the atmosphere.



 **Get Animated**

Weather Variables (cont.)



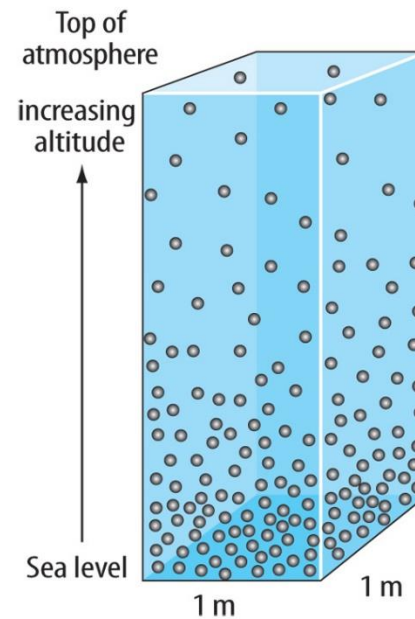
KEY CONCEPT CHECK

How is weather related to the water cycle?



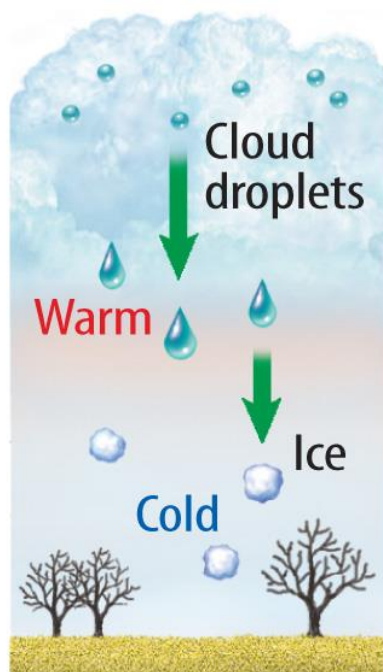
Summary

- Weather is the atmospheric conditions, along with short-term changes, of a certain place at a certain time.
- Weather variables include air temperature, air pressure, wind, humidity, and relative humidity.



Summary

- Forms of precipitation include rain, sleet, snow, and hail.



Lesson Review

What is the amount of water vapor in the air called?

- A. air pressure
- B. precipitation
- C. dew point
- D. humidity**



Lesson Review

Which of these is measured as a percent using an instrument called a psychrometer?

- A. precipitation
- B. relative humidity**
- C. dew point
- D. air pressure



Lesson Review

Which term refers to the natural process in which water continually moves through the oceans, land, and atmosphere?

- A. dew point
- B. relative humidity
- C. air pressure
- D. water cycle**



Lesson Review

What do you think **NOW?**

Do you agree or disagree?

1. Weather is the long-term average of atmospheric patterns of an area.
2. All clouds are at the same altitude within the atmosphere.



Lesson 2

Weather Patterns

Key Concepts

- What are two types of pressure systems?
- What drives weather patterns?
- Why is it useful to understand weather patterns?
- What are some examples of severe weather?



Lesson 2

Weather Patterns

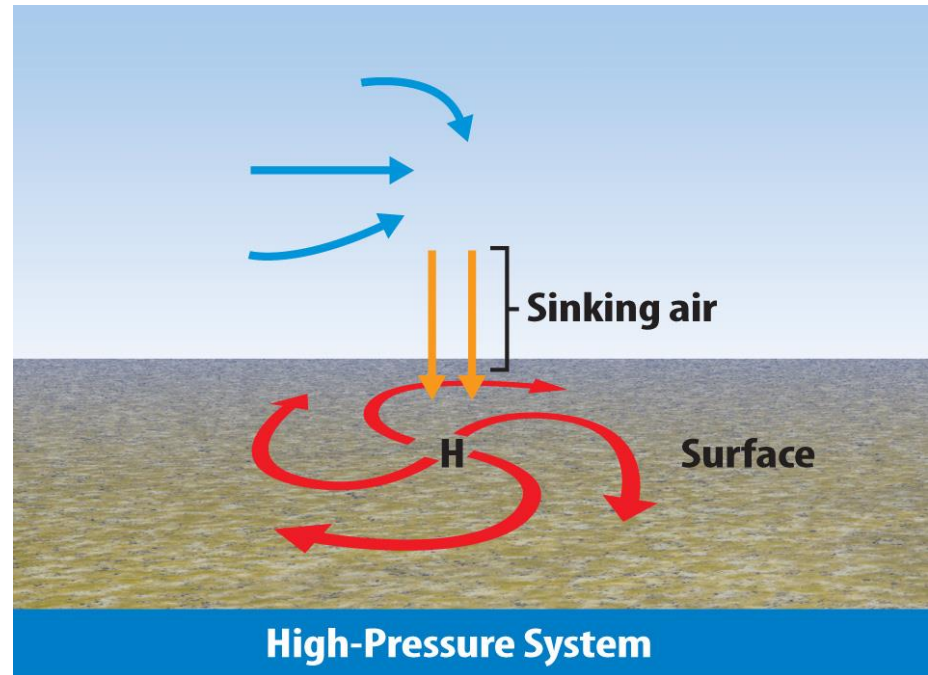
Vocabulary

- low-pressure system
- high-pressure system
- air mass
- front
- tornado
- hurricane
- blizzard



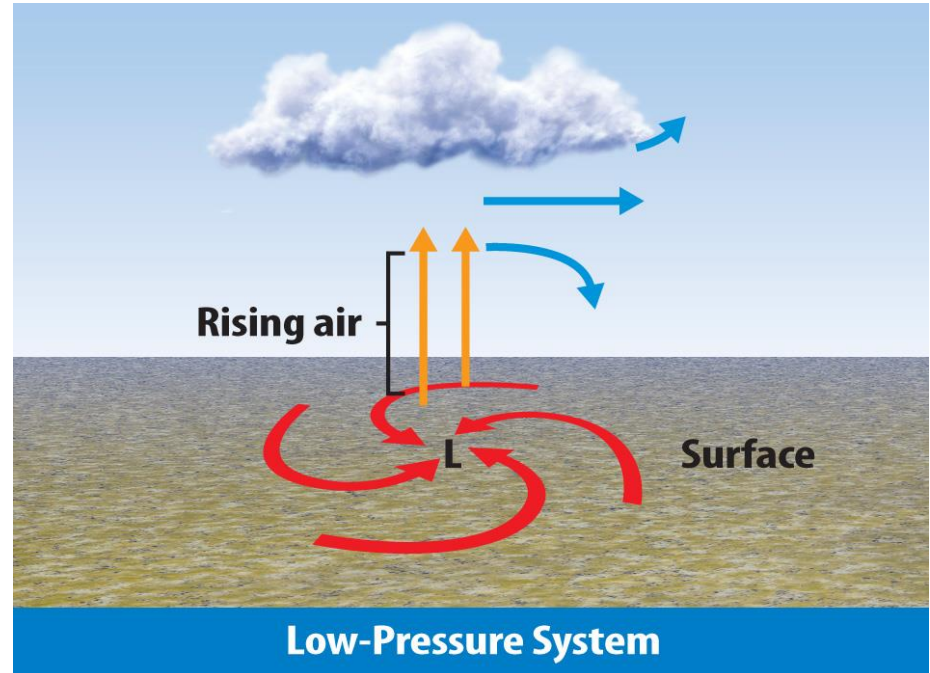
Pressure Systems

A **high-pressure system** is a large body of circulating air with high pressure at its center and lower pressure outside of the system.



Pressure Systems (cont.)

A low-pressure system is a large body of circulating air with low pressure at its center and higher pressure outside of the system.



Pressure Systems (cont.)



KEY CONCEPT CHECK

Compare and contrast two types of pressure systems.



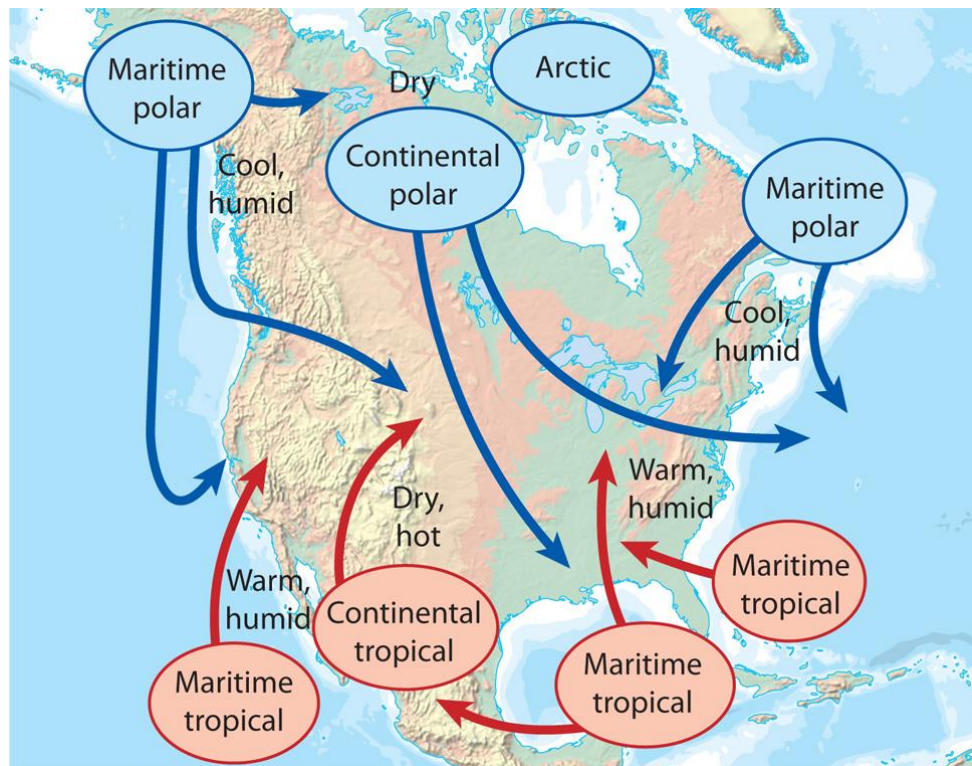
Air Masses

- Air masses are large bodies of air with distinct temperature and moisture characteristics.
- An air mass forms when a large high pressure system lingers over an area for several days.
- As a high pressure system comes in contact with Earth, the air in the system takes on the temperature and moisture characteristics of the surface below it.



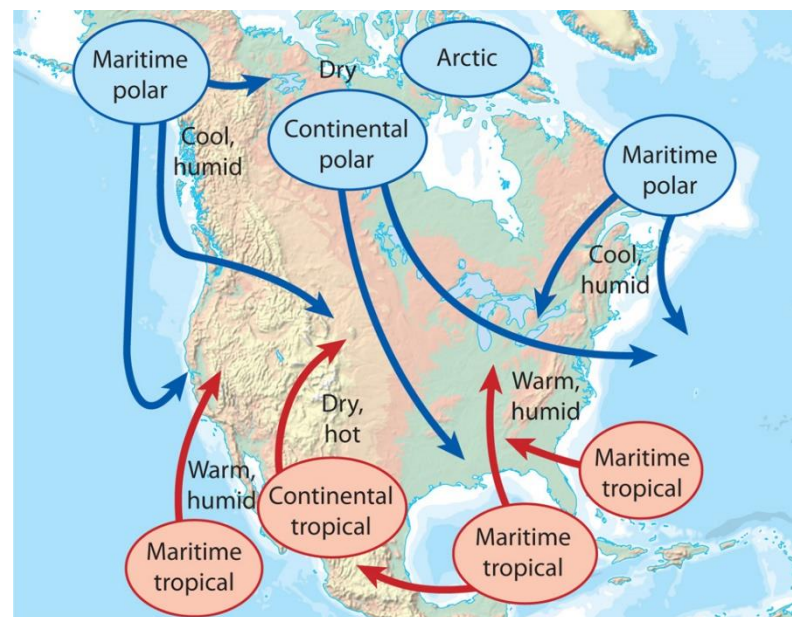
Air Masses (cont.)

Five main air masses impact climate across North America.



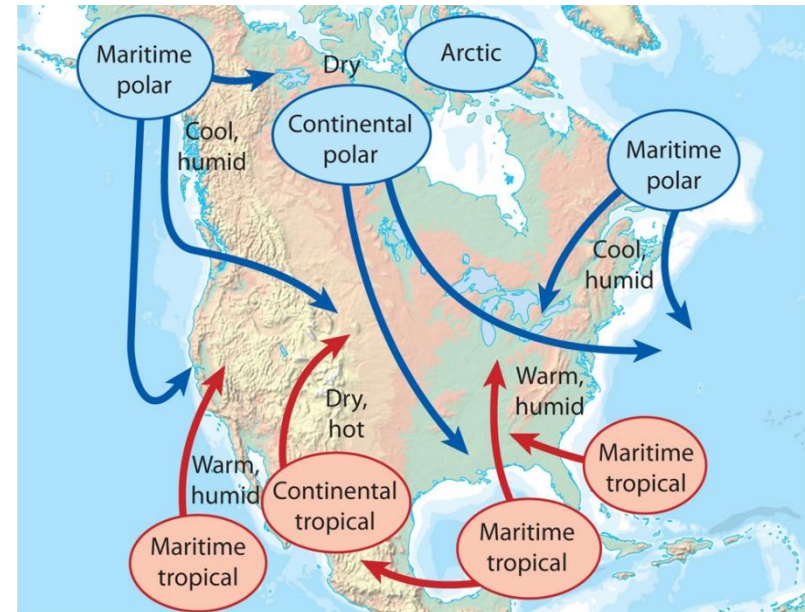
Air Masses (cont.)

- Air masses are classified by their temperature and moisture characteristics.
- Continental air masses form over land.
- Maritime masses form over water.



Air Masses (cont.)

- Tropical air masses form in the warm equatorial regions.
- Polar air masses form over cold regions.
- Arctic and antarctic air masses form near the poles, over the coldest regions of the globe.



Air Masses (cont.)



KEY CONCEPT CHECK

What drives weather patterns?



Fronts

- A weather front is a boundary between two air masses.
- Changes in temperature, humidity, clouds, wind, and precipitation are common at fronts.

Fronts (cont.)

SCIENCE USE V. COMMON USE

front

Science Use a boundary between two air masses

Common Use the foremost part or surface of something

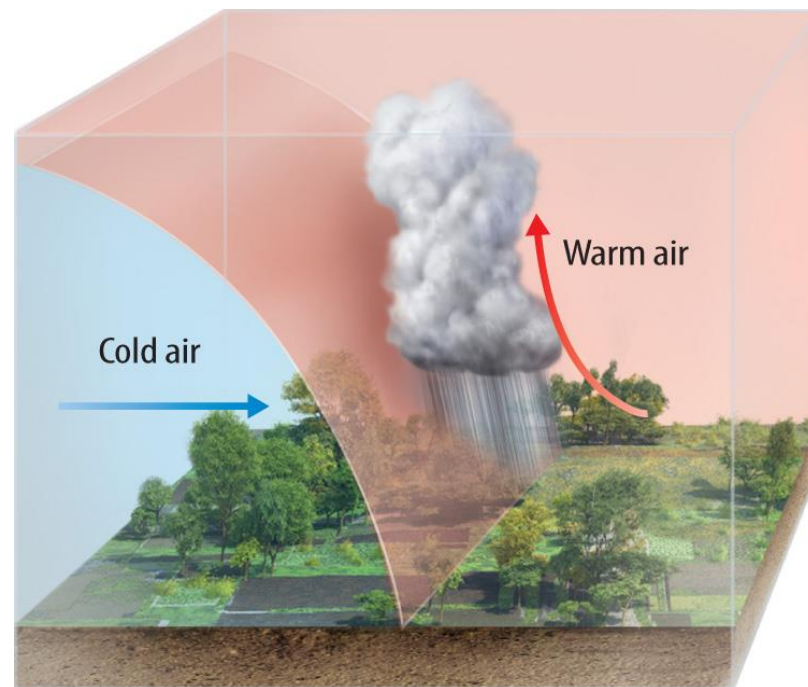


Fronts (cont.)

When a colder air mass moves toward a warmer air mass, a cold front forms.



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Cold

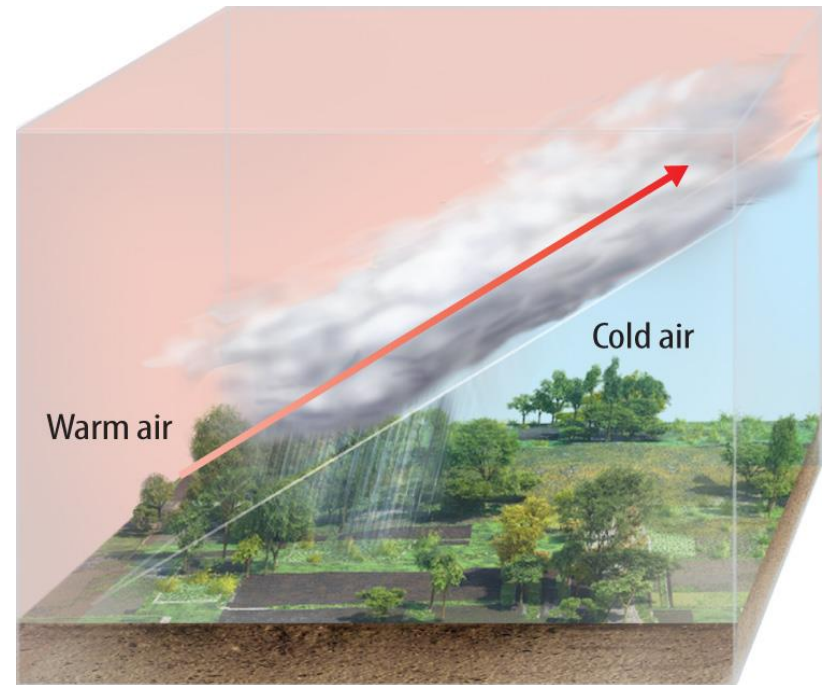


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Fronts (cont.)

A warm front forms when lighter, warmer air moves toward colder, heavier air.



Warm

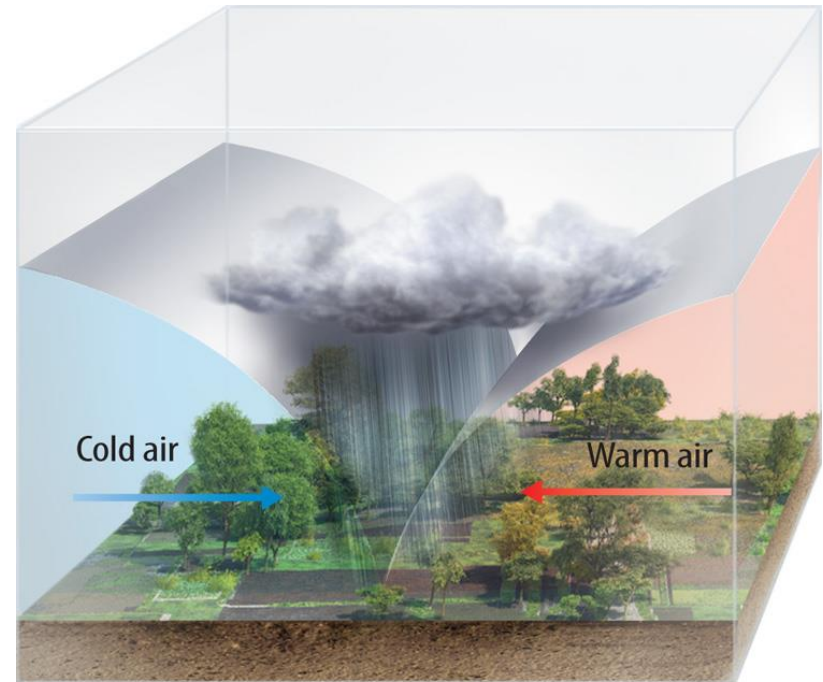


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Fronts (cont.)

When the boundary between two air masses stalls, the front is called a stationary front.

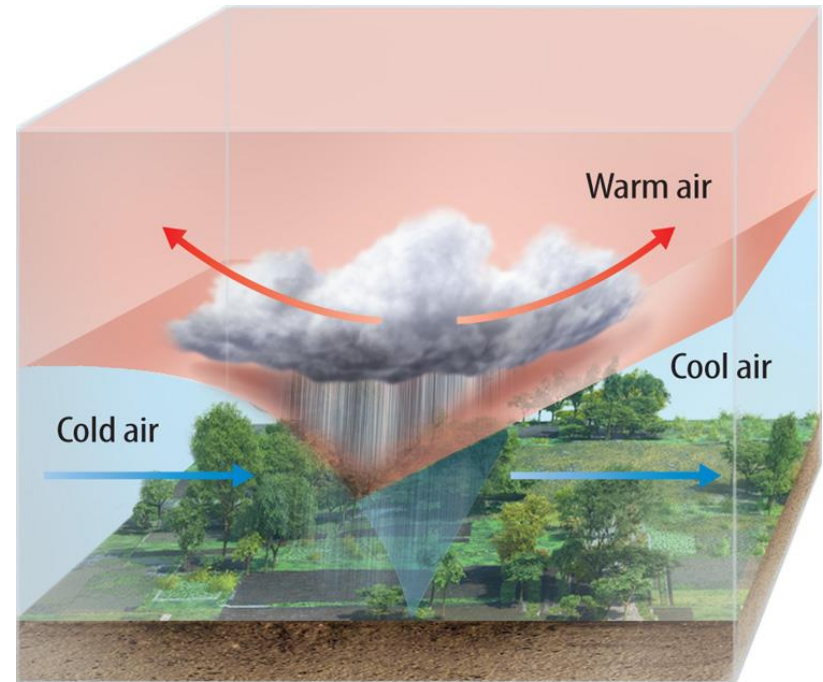


Stationary



Fronts (cont.)

When a fast-moving cold front catches up with a slow-moving warm front, an occluded or blocked front forms.



Occluded



Fronts (cont.)



KEY CONCEPT CHECK

Why is it useful to understand weather patterns associated with fronts?



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Severe Weather

- Thunderstorms have warm temperatures, moisture, and rising air, which may be supplied by a low-pressure system.
- Thunderstorms have a three-stage life cycle: the cumulus stage, the mature stage, and the dissipation stage.



Severe Weather (cont.)

- The cumulus stage is dominated by cloud formation and updrafts.
- After the cumulus stage, downdrafts, which are air currents moving vertically toward the ground, begin to form.



Severe Weather (cont.)

- In the mature stage, heavy winds, rain, and lightning dominate the area.
- In the dissipation stage, updrafts stop, winds die down, lightning ceases, and precipitation weakens.



Severe Weather (cont.)

- A tornado is a violent, whirling column of air in contact with the ground.
- Tornadoes form when thunderstorm updrafts begin to rotate.
- Tornado Alley is the name given to the area of the central United States that experiences the most tornadoes.



Severe Weather (cont.)

An intense tropical storm with winds exceeding 119 km/h is a hurricane.

WORD ORIGIN

hurricane

from Spanish *huracan*, means
“tempest”



Hurricane Formation



1 As warm, moist air rises into the atmosphere, it cools, water vapor condenses, and clouds form. As more air rises, it creates an area of low pressure over the ocean.



2 As air continues to rise, a tropical depression forms. Tropical depressions bring thunderstorms with winds between 37–62 km/h.

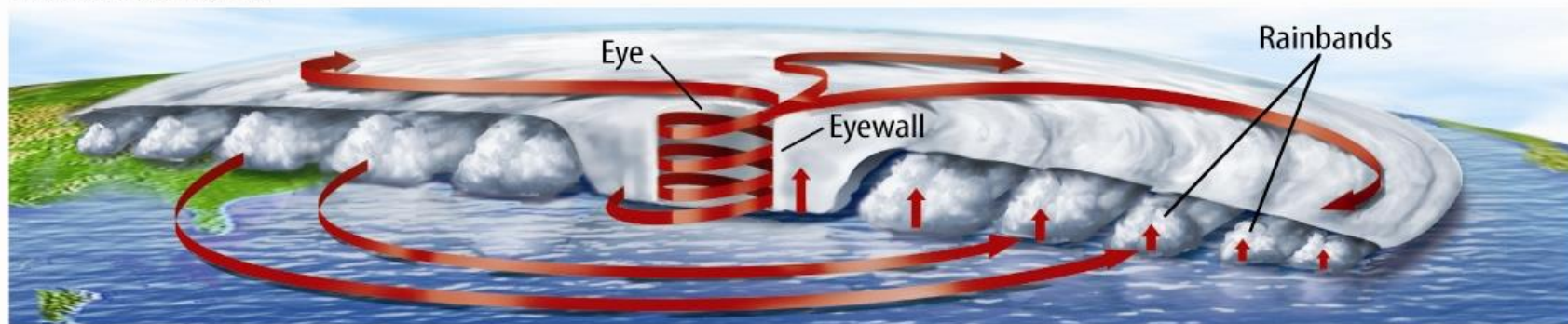


3 Air continues to rise, rotating counterclockwise. The storm builds to a tropical storm with winds in excess of 63 km/h. It produces strong thunderstorms.



4 When winds exceed 119 km/h, the storm becomes a hurricane. Only one percent of tropical storms become hurricanes.

Inside a Hurricane



Severe Weather (cont.)

A blizzard is a violent winter storm characterized by freezing temperatures, strong winds, and blowing snow.



KEY CONCEPT CHECK

What are examples of severe weather?



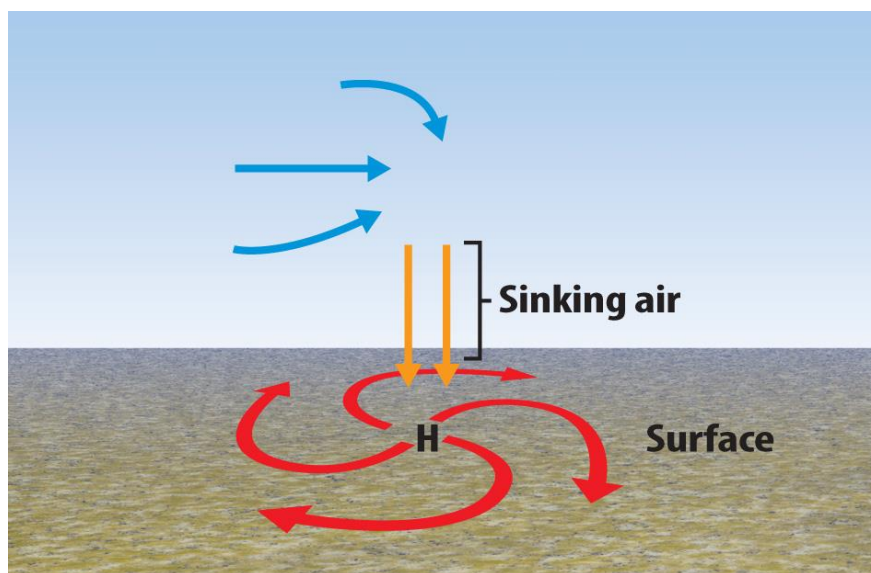
Severe Weather (cont.)

- The U.S. National Weather Service issues watches and warning for different types of severe weather.
- A watch means that severe weather is possible.
- A warning means that severe weather is already occurring.



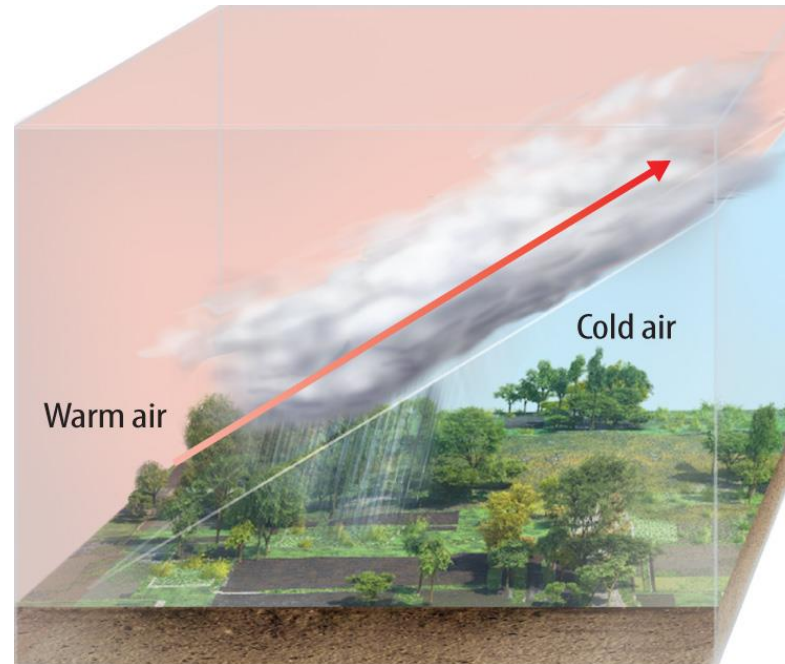
Summary

- Low-pressure systems, high-pressure systems, and air masses all influence weather.



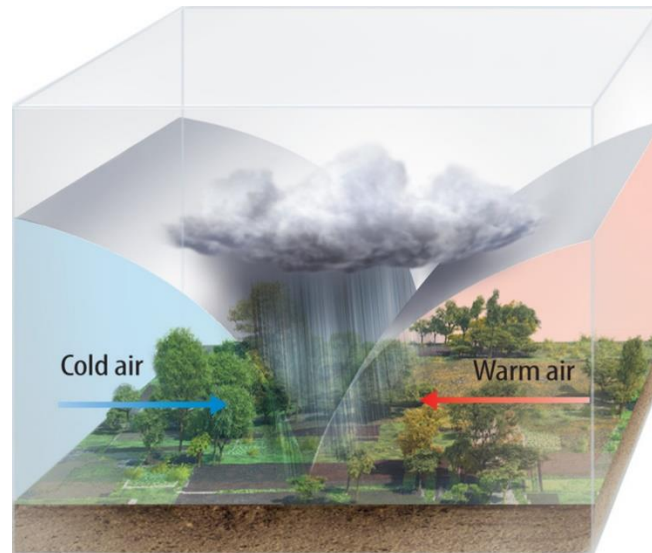
Summary

- Weather often changes as a front passes through an area.



Summary

- The National Weather Service issues warnings about severe weather such as thunderstorms, tornadoes, hurricanes, and blizzards.



Lesson Review

What are large bodies of air with distinct temperatures and moisture characteristics?

- A. high-pressure systems
- B. low-pressure systems
- C. weather fronts
- D. air masses**



Lesson Review

Which of these form over land near the North Pole and contain cold, dry air?

- A. continental air masses
- B. arctic air masses**
- C. polar air masses
- D. maritime air masses



Lesson Review

A large body of circulating air with low pressure at its center and higher pressure outside of the system is called what?

- A. an air mass
- B. a low-pressure system**
- C. a high-pressure system
- D. a continental polar ice mass



Lesson Review

What do you think **NOW?**
Do you agree or disagree?

3. Precipitation often occurs at the boundaries of large air masses.
4. There are no safety precautions for severe weather such as tornadoes and hurricanes.



Lesson 3

Weather Forecasts

Key Concepts

- What instruments are used to measure weather variables?
- How are computer models used to predict the weather?



Lesson 3

Weather Forecasts

Vocabulary

- surface report
- upper-air report
- Doppler radar
- isobar
- computer model



Measuring the Weather

- A surface report describes a set of weather measurements made on Earth's surface.
- An upper-air report describes wind, temperature, and humidity conditions above Earth's surface.
- Radar measures precipitation using radio waves that bounce off raindrops and snowflakes.

Measuring the Weather (cont.)

Doppler radar is a specialized type of radar that can detect precipitation as well as the movement of small particles, which can be used to approximate wind speed.

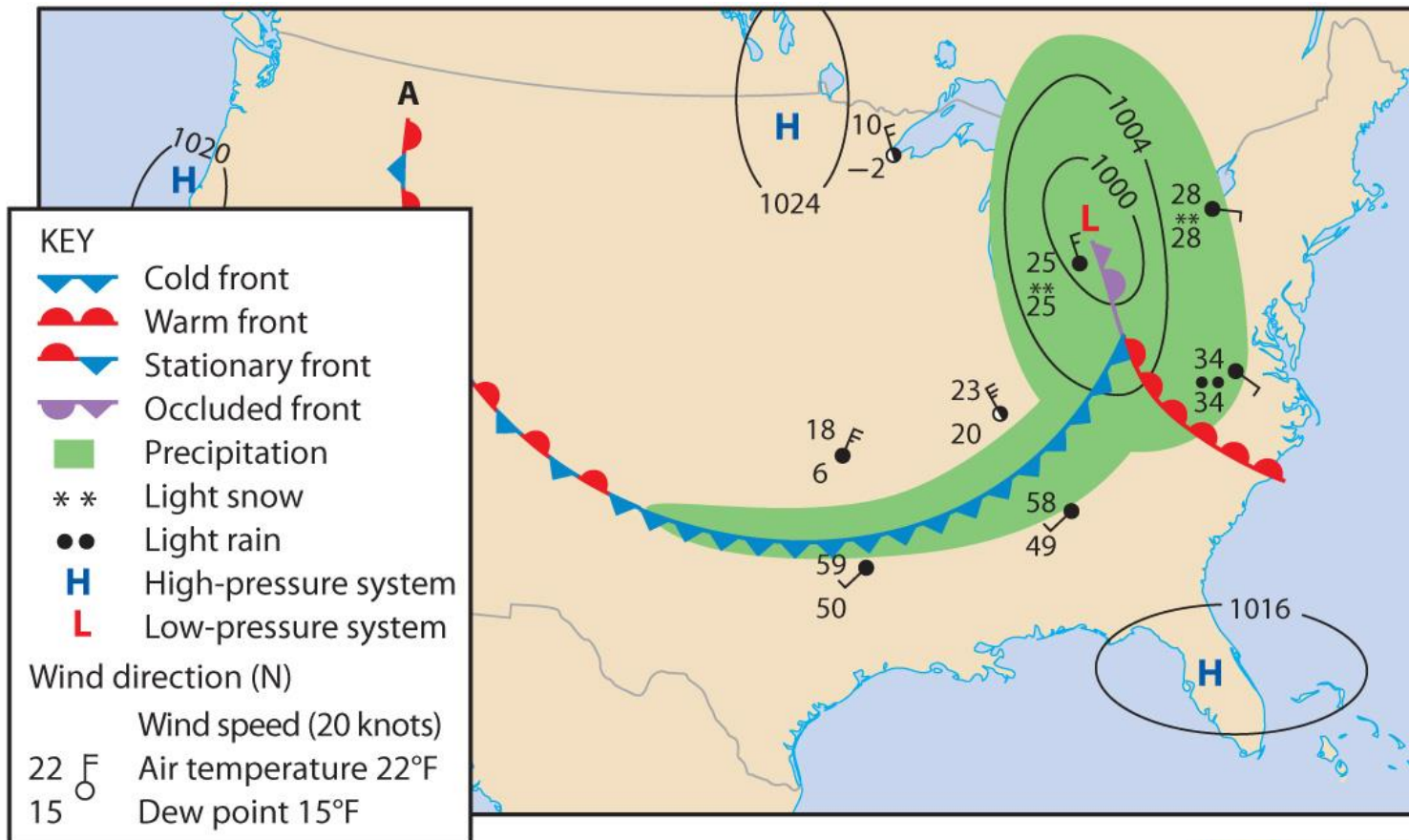


KEY CONCEPT CHECK

Identify the weather variables that radiosondes, infrared satellites, and Doppler radar measure.

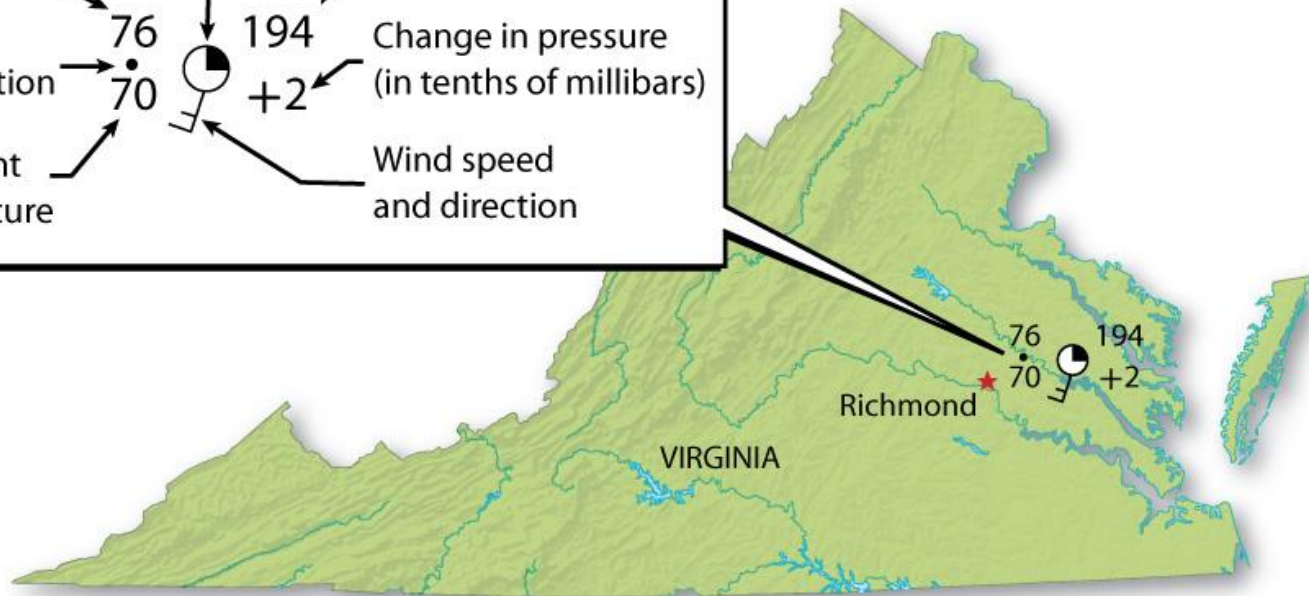
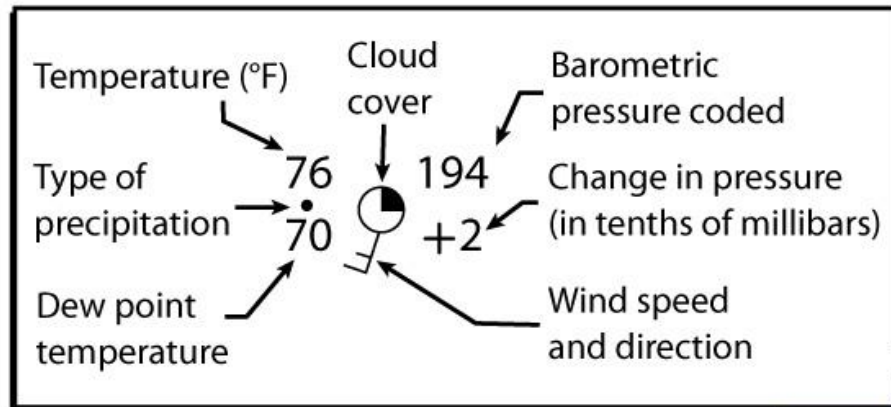


Weather maps contain symbols that provide information about the weather.



Get Animated

The station model displays data from many different weather measurements for a particular location.



Weather Maps

- A station model uses observations from surface reports and upper-air reports.
- **Isobars** are lines that connect all places on a map where pressure has the same value.
- Isobars show the location of high- and low-pressure systems and provide information about wind speed.

Weather Maps (cont.)

WORD ORIGIN

isobar

from Greek *isos*, means “equal”;
and *baros*, means “heavy”



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Weather Maps (cont.)

- Isotherms are lines that connect places with the same temperature.
- They show which areas are warm and which are cold.

Predicting the Weather

- Computer models are detailed computer programs that solve a set of complex mathematical formulas.
- Computer models are used in modern weather forecasts to predict what temperatures and winds might occur, when and where it will rain and snow, and what types of clouds will form.



Predicting the Weather (cont.)

Government meteorological officers also use computers and the Internet to exchange weather measurements continuously throughout the day.



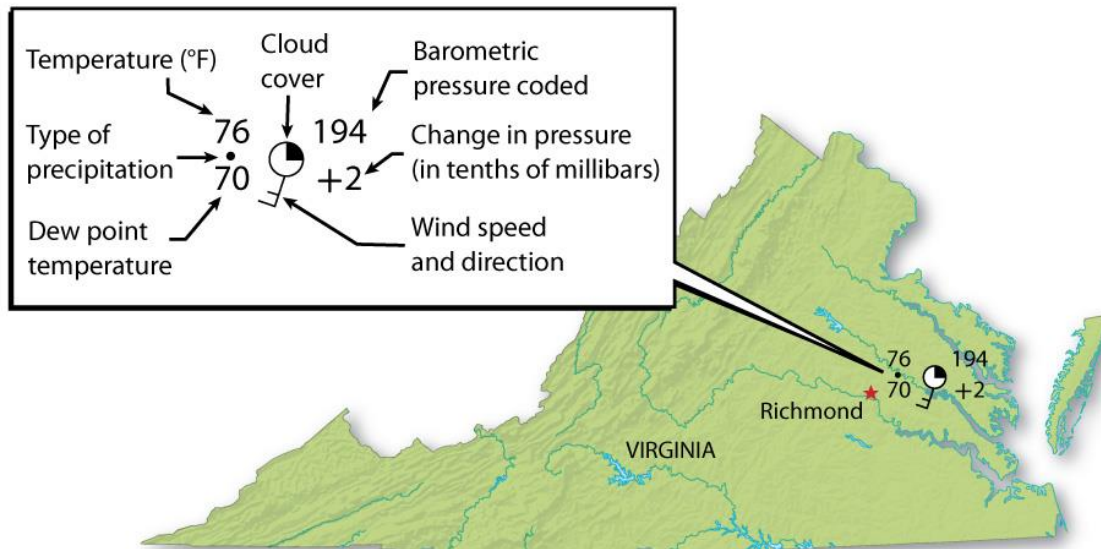
KEY CONCEPT CHECK

How are computers used to predict the weather?



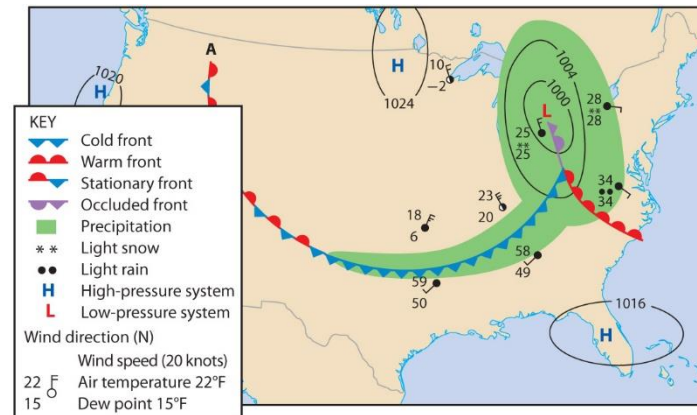
Summary

- Weather variables are measured by weather stations, radiosondes, satellites, and Doppler radar.



Summary

- Weather maps contain information in the form of a station model, isobars and isotherms, and symbols for fronts and pressure systems.
- Meteorologists use computer models to help forecast the weather.



Lesson Review

Which of these is a specialized type of radar that can detect precipitation as well as the movement of small particles?

- A. upper air report
- B. satellite
- C. Doppler radar**
- D. isobar



Lesson Review

Lines that connect all places on a map where pressure has the same value are called what?

A. computer models

B. radar

C. satellite images

D. isobars



Lesson Review

Which of these refers to a package of weather instruments that measure atmospheric conditions?

- A.** a radiosonde
- B.** satellites
- C.** Doppler radar
- D.** isobars



Lesson Review

What do you think **NOW?**

Do you agree or disagree?

5. Weather variables are measured every day at locations around the world.
6. Modern weather forecasts are done using computers.



Menu

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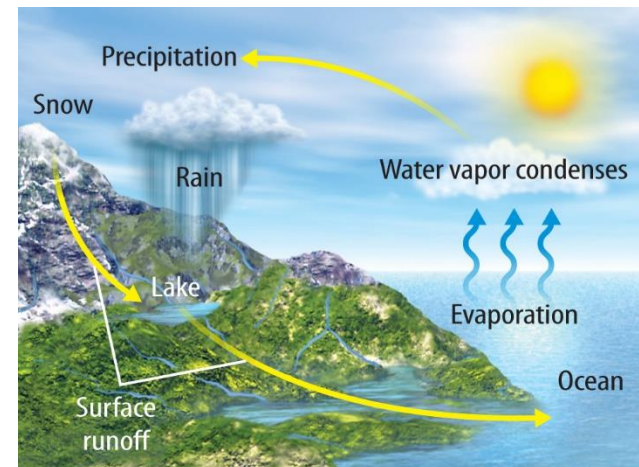


Scientists use weather variables such as temperature, air pressure, and wind direction and speed to describe weather and study weather systems. Scientists use computers to predict the weather and model interactions between Earth's systems.



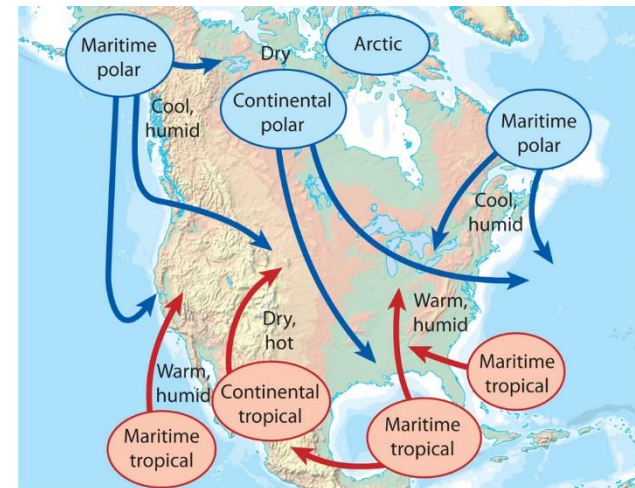
Lesson 1: Describing Weather

- Weather is the atmospheric conditions, along with short-term changes, of a certain place at a certain time.
- Variables used to describe weather are air temperature, air pressure, wind, humidity, and relative humidity.
- The processes in the water cycle—evaporation, condensation, and precipitation—are all involved in the formation of different types of weather.



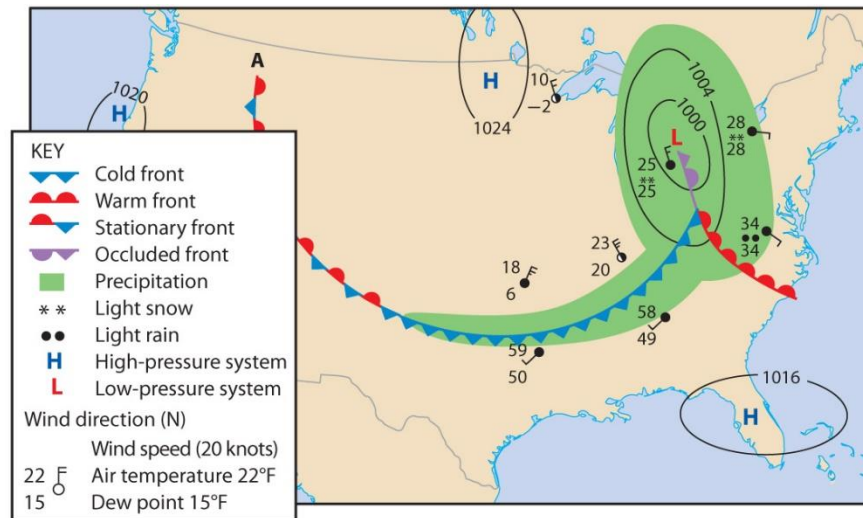
Lesson 2: Weather Patterns

- Low-pressure systems and high-pressure systems are two systems that influence weather.
- Weather patterns are driven by the movement of air masses.
- Understanding weather patterns helps make weather forecasts more accurate.
- Severe weather includes thunderstorms, tornadoes, hurricanes, and blizzards.



Lesson 3: Weather Forecasts

- Thermometers, barometers, anemometers, radiosondes, satellites, and Doppler radar are used to measure variables.
- Computer models use complex mathematical formulas to predict temperature, wind, cloud formation, and precipitation.



Chapter Review

The amount of water vapor present in the air compared to the maximum amount of water vapor the air could contain at that temperature is referred to as which of these?

- A. humidity
- B. precipitation
- C. relative humidity
- D. air pressure



Chapter Review

Which weather variable is dependent on how many air molecules are overhead?

- A. humidity
- B. barometric pressure**
- C. water cycle
- D. precipitation



Chapter Review

A large body of circulating air with high pressure at its center and lower pressure outside of the system is called what?

- A.** high-pressure system
- B.** blizzard
- C.** low-pressure system
- D.** tornado



Chapter Review

Which of these refers to a boundary between two air masses?

- A.** a weather front
- B.** an arctic air mass
- C.** a low-pressure system
- D.** a high-pressure system



Chapter Review

A set of weather measurements made on Earth's surface are referred to as which of these?

- A. upper-air reports
- B. surface reports**
- C. Doppler radar
- D. radiosonde reports



Standardized Test Practice

Which weather variable can change with the air temperature?

- A. air pressure
- B. humidity
- C. relative humidity**
- D. wind



Standardized Test Practice

Which of these refer to water droplets or ice crystals suspended in the atmosphere?

- A.** rain
- B.** precipitation
- C.** clouds
- D.** air pressure



Standardized Test Practice

What is a violent, whirling column of air that comes in contact with the ground?

- A.** hurricane
- B.** ice storm
- C.** tornado
- D.** blizzard



Standardized Test Practice

Which of these refer to air currents moving vertically toward the ground?

- A. updrafts
- B. downdrafts**
- C. hurricanes
- D. thunderstorms



Standardized Test Practice

Which of these is able to solve a set of complex mathematical formulas to predict the weather?

- A. isobars
- B. Doppler radar reports
- C. surface reports
- D. computer models**

