

Reflect

You're going on vacation in a week and you have to start thinking about what clothes you're going to pack for your trip. You've read the weather reports for your vacation spot, but you know that the weather can change from day to day. You decide that the best way to pack is to choose clothes that work best for the climate you're going to. Is that a wise decision? What exactly is the difference between weather and climate?

What is weather? What are some characteristics of weather?

When we talk about *weather*, we mean the daily conditions in the atmosphere of a local area. Many conditions make up the weather. A few are cloud cover, wind, **humidity**, and *temperature*, which is how hot or cold the air is. One condition that is important for planning a vacation is rainfall. Rain is a type of precipitation. *Precipitation* is water that falls to Earth from clouds. There are many forms of precipitation, including rain, sleet, hail, and snow. They are all slightly different based on the temperature of the air as the water falls through it. Rain is

humidity: a measure of how much water vapor is in the air; the air feels moist and sticky when humidity is high

liquid water that falls in droplets. Snow and hail, on the other hand, are particles of ice that fall when it is colder outside. Sleet is a mixture of rain and snow. Weather is an important part of daily life. It describes the changing conditions of the environment around us. What is the weather like where you are today?



Hailstones are nuggets of falling ice, while rain is droplets of liquid water. Both are forms of precipitation.

What Do You Think?

This weather report provides information about the weather in the city over five days. How does the weather change in New York during this period of time? Is it the same or slightly different each day?



Look Out!

All weather is caused by the Sun heating Earth. When the Sun's energy heats the atmosphere unevenly, it causes different air pressures. *Pressure* is the weight of the air. Cold air weighs more than warm air because it is denser. Low-pressure air and high-pressure air cause different weather conditions. Low-pressure air often brings rain, thunderstorms, and hurricanes. High-pressure air usually means clear skies and sunshine. The uneven heating of the atmosphere is the reason there is different weather in most places on Earth during spring, summer, autumn, and winter.

What is climate? What are some characteristics of climate?

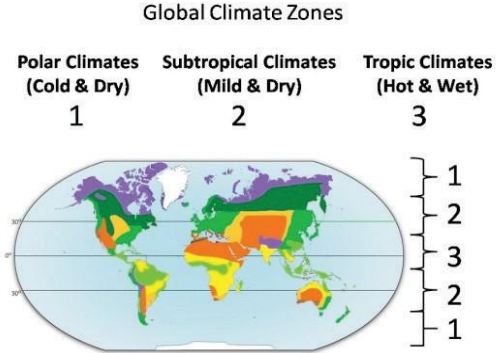
Weather is constantly changing. Scientists who predict, or *forecast*, the weather can't usually make forecasts beyond 10 days. Even weather reports cannot guarantee that the forecasts will be accurate. However, climate in a particular area is consistent. *Climate* is the type of weather in an area averaged over a long period of time, such as 30 years or more.

For example, when most people think of Hawaii they picture sunshine, high temperatures, and warm rainfall. Hawaii has a tropical climate. The weather there is usually warm and humid with cool breezes and it has been that way for many years. But, that doesn't mean that Hawaii doesn't have days with cold temperatures and storms. The climate of an area describes its average temperatures, precipitation, humidity, wind, cloud cover, and other weather conditions over long periods of time.



What climate zone is this place located in?

An area's climate is affected by several factors. These may include its distance from water (like oceans or lakes), its latitude on the globe, and its elevation above sea level. There are several different climate zones in the world. Tropical climate zones are found closest to the equator. The climate in a tropical zone is hot and humid with lots of rain. Rainforests are found mostly in tropical climates.



Look Out!

Temperate:
moderate, mild;
not extreme

Farther away from the equator is the temperate climate zone. Most of the United States has **temperate**, or subtropical, climate. The temperatures are neither very high nor very low, and there are moderate amounts of precipitation.

Temperate climates usually have different weather for each of the four seasons. Past the temperate climate zones are the polar zones. They are found close to the North and South Poles. These zones are well known for their extremely cold temperatures and snow. However, polar climate zones are also quite dry, with little precipitation during the year.

It's difficult to imagine a place with so much snow and ice as being a desert, but that is the case with Antarctica. Located at the South Pole, the continent of Antarctica is the largest desert in the world. It is called a polar desert, but it has many of the same characteristics as hot deserts. Deserts receive fewer than 250 millimeters (10 inches) of rainfall every year. Antarctica averages between 146 and 192 mm (5.7 to 7.6 in.) of precipitation per year. Any available water remains frozen year-round in glaciers and icebergs. Cold, dry air and high winds contribute to the desert climate. The lack of trees and plants also contributes to this desert climate.

Try Now

Use everyday materials to model different climates. To complete this activity, you will need:

- Two small bowls
- Plastic wrap
- Two rubber bands
- Water

1. Start by adding water to the bowls. Fill each bowl about three-quarters full.
2. Next, cover each bowl with plastic wrap spread tightly across the top. Place a rubber band around the top of each bowl to keep the plastic wrap in place.
3. Put one of the bowls in a warm area, such as near a heater or in a window that gets a lot of sunlight. Put the other bowl in a cool area with shade.
4. After several hours (or the next day), check the bowls. What do you observe?
5. What type of climate have you modeled with each of the bowls? Which "bowl climate" do you think a rainforest would grow in? Why?

Look Out!

Career Corner: Climatologist

If you're interested in more than just the weather, consider the job of a climatologist. These scientists study climate over long periods of time and analyze the history of weather patterns. Some climatologists even study the climate from thousands of years ago. They use those data to make inferences about what ancient climates might have looked like.



Like most scientists, climatologists use tools and technology to help them do their jobs. From satellite images, they gather data about weather conditions in the atmosphere. They also use computer simulations to analyze and make predictions about past and future climate trends. Some of the most important data that climatologists collect are from core samples. A hole is drilled into a tree, a rock, or a glacier in order to take a sample from its core, or center. Many trees, rocks, and glaciers have been on Earth for thousands of years or longer. Their core samples provide information about climates in the past that can't be found anywhere else on Earth. Being a climatologist might even take you beyond Earth: Some climatologists study the climates of other planets!

Looking to the Future: The Effects of Human Activity on Climate Change

Recent evidence collected by climatologists shows that the climate on Earth is changing. It is becoming warmer and warmer. Even small climate changes can cause big problems for humans and other living things. Increasing temperatures can lead to melting glaciers, rising sea levels, and longer-lasting heat waves. All of these events can disturb ecosystems and damage habitats.

Natural climate changes are common in Earth's history. We know that ice ages have come and gone naturally. But human activities are also contributing to the rising temperatures. When we burn fossil fuels—such as gasoline or oil—to power our cars and heat our homes, we release greenhouse gases. These gases—including carbon dioxide, methane, and nitrous oxide—trap heat within the atmosphere and keep it near Earth's surface. The more greenhouse gases in the atmosphere, the more heat is trapped on Earth. Using clean energy from other sources—for example, sunlight or winds—may help to reverse the effects of the changing climate.

What Do You Think?

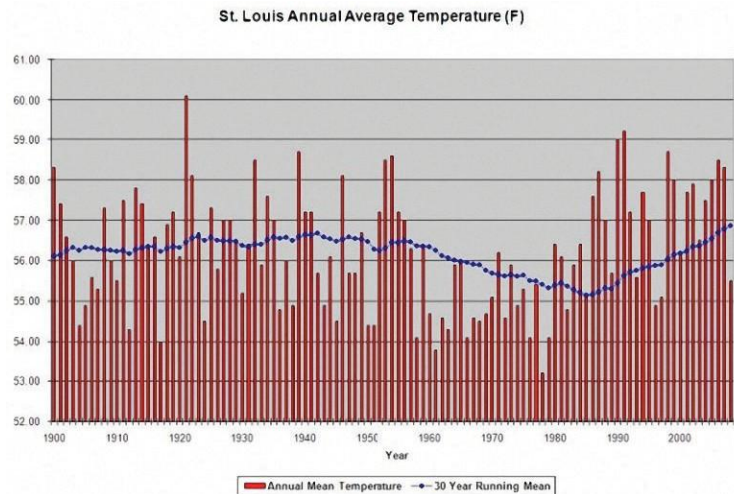
On your way out the door for school, your mother yells after you to put a jacket on. She says that the day is supposed to be cold and windy with a chance of rain. Is your mom telling you about the weather or the climate?

What is the difference between weather and climate?

You can use time to tell the difference between weather and climate. Weather is immediate. It describes the conditions in the atmosphere for a short period of time—today or the next few days. Climate is the overall weather conditions for a long period of time. Because weather can change from day to day, climates are averages and trends.

For example, over the past 30 years, the temperature in Houston in October

has ranged from as high as 88°F (31°C) to as low as 29°F (−2°C). Houston's climate is an average of those temperatures over time and falls somewhere in between. For many places on Earth, the weather may be cold and rainy one day and hot and sunny the next. The climate, though, is an average of those weather patterns from many years of data. It describes an area's overall atmospheric conditions.



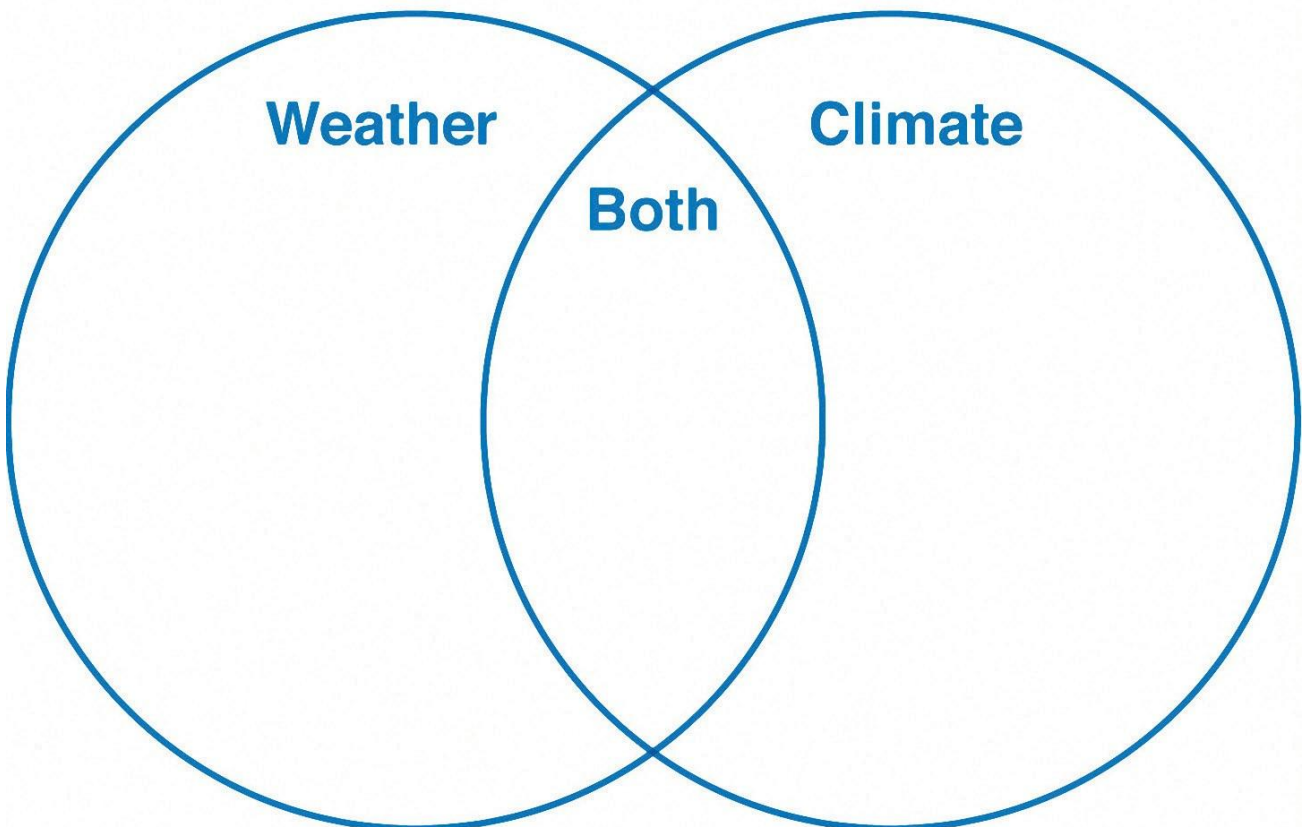
A climate graph shows the average (or *mean*) temperature of an area over many years.

What Do You Think?

What do you know?

Weather and climate are related to each other. Both are descriptions of conditions in the atmosphere and the surrounding environment for specific places on Earth. However, there are ways to tell them apart. Read each characteristic below and decide whether it applies to weather or to climate. Then place the characteristic in the circle with the correct heading. If a description applies to both weather and climate, place it in the space where the two circles overlap, labeled “Both.”

- Observed and measured over a short time period
- Includes factors such as precipitation, temperature, humidity, and wind
- Measures day-to-day changes
- Divided into several zones around the world
- Observed and measured over a long time period
- Measurements are averaged over 30 years or more
- Can be predicted for about 10 days



Family Vacation to the Climate Zones

To help students learn more about weather and climate, take them on a virtual tour to other climate zones around the world. Have students choose three locations on the planet that they may want to visit some day. You may use a globe or a map to help students choose, or perhaps they may want to focus on somewhere they have already been. Encourage students to choose locations from each of the climate zones (tropical, temperate, and polar). Together, create a mini-tour guidebook for each location.

Here is one possible format for a guidebook. Divide a sheet of paper into five sections. Label the sections with “Today’s Weather,” “Location on Earth,” “Climate Zone,” “Climate,” and “Pictures.” Using the library or Internet, research each of the categories with your child. Begin by having your child find the current weather at each destination. Then, use a map or the globe to find the city’s location on the planet. For example, if your child chose Paris, France, the city is located in Europe at a latitude of about 50°N. That latitude indicates that Paris is in a temperate climate zone. Have your child research and describe the conditions in a temperate climate zone, and then find pictures in magazines or online that demonstrate the Parisian climate. The temperate climate zone in particular has variations between the seasons. Encourage your child to cover how the climate changes from season to season in both the description and pictures.

Here are some questions to discuss with your child:

- Why is it important to know the weather and the climate of a destination? What do you learn about a place from its weather and climate?
- What geological features (oceans, lakes, mountains, etc.) are near each of your destination cities? How do you think these features affect each city’s climate?
- What climate zone do you think we live in? How do you know?