

Name: _____

Causes of Climate

Climates around the country vary greatly. There are several reasons for such climatic variations, including differences in latitude, topography, closeness of lakes and oceans, availability of moisture, global wind patterns, and air masses.

Latitude:

Recall that different parts of Earth receive different amounts of solar radiation. The amount of solar radiation received by any one place varies because Earth is tilted on its axis, and this affects how the Sun's rays strike Earth's surface.

The area between 23.5 degrees S and 23.5 degrees N of the equator is known as the tropics. Tropical areas receive the most solar radiation and therefore are generally warm year-round.

The temperate zones lie between 23.5 degrees and 66.5 degrees north and south of the equator. As their name implies, temperatures in these regions are moderate.

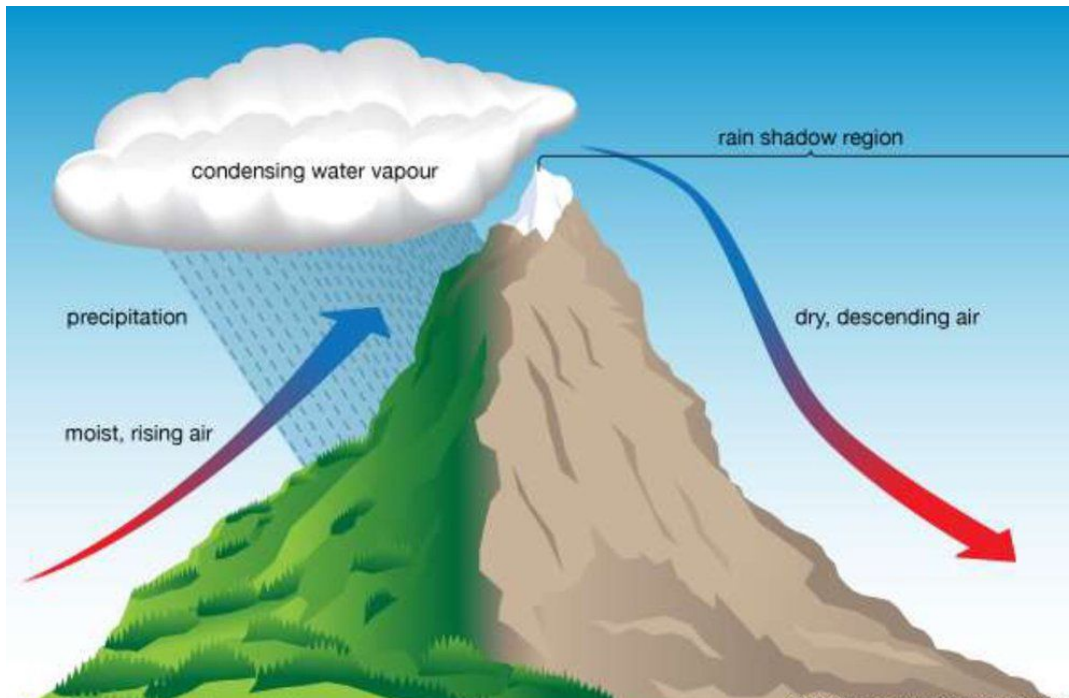
The polar zones are located from 66.5 degrees north and south of the equator to the poles. Solar radiation strikes the polar zones at a low angle and thus, polar temperatures tend to be very cold.

Topographic Effects:

Water heats up and cools down more slowly than land. Thus, large bodies of water affect the climates of coastal areas. Many coastal regions are warmer in winter and cooler in the summer than inland areas at similar latitudes.

Temperatures in the lower atmosphere generally decrease with altitude. Thus, mountain climates are usually cooler than those at sea level.

Orographic Lifting:



As airflow encounters a mountain or hill, it is forced to rise; this is referred to as orographic lift. If the flow is sufficiently humid, clouds form on the windward side of mountains and are called orographic clouds. The type of cloud that forms depends on the air stability and moisture content. These clouds often provide precipitation on the windward side as a result of rapid condensation due to rapidly decreasing temperatures with increasing altitude.

Air also rises up a slope due to daytime heating so both orographic and thermal lifting often work together to produce tall, vertically developed Cumulus clouds. Therefore, hilly areas are often cloudier than nearby lower land.

Air Masses:

Two of the main causes of weather are the movement and interaction of air masses. Air masses also affect climate. Recall that air masses have distinct regions of origin, caused primarily by differences in the amount of solar radiation. The properties of air masses also depend on whether they formed over land or water. Thus, air masses can be warm or cold, AND humid or dry.

Airmass Name	Abbreviation	Where it Forms	Characteristic Weather
Maritime Polar	mP	Cold Ocean	Cool and Humid
Maritime Tropical	mT	Warm Ocean	Warm and Humid
Continental Polar	cP	Cold Land	Cool and Dry
Continental Tropical	cT	Warm Land	Warm and Dry
Continental Arctic	cA	Extreme North	Very Cold Very Dry

Long-Term Climatic Changes:

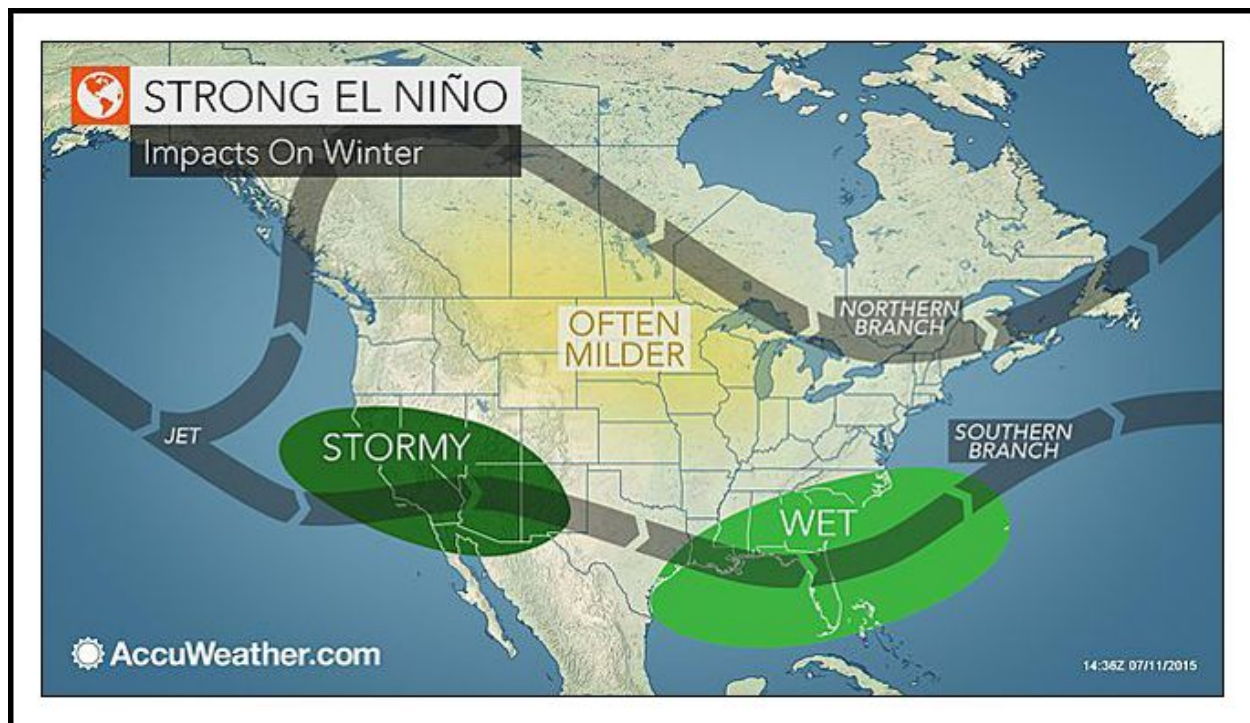
A study of Earth's history over hundreds of thousands of years shows that climates have always been, and currently are, in a constant state of change. These changes usually take place over long time periods.

A good example of climatic change involves glaciers, which have alternately advanced and retreated over the past 2 million years. At times, much of Earth's surface was covered by vast sheets of ice. During these periods of extensive glacial coverage, called ice ages, average global temperatures decreased by an estimated 5 degrees Celsius. Global climates became generally colder and snowfall increased, which sparked the advance of existing ice sheets. Ice ages alternate with warm periods -called interglacial intervals -and Earth is currently experiencing such an interval.

Short-Term Climatic Changes:

Seasons are short-term periods of climate change with specific weather conditions caused by regular variations in daylight, temperature, and weather patterns. The tilt of Earth on its axis as it revolves around the Sun causes different areas of Earth to receive different amounts of solar radiation. Throughout the year, the seasons are reversed in the northern and southern hemispheres. During the spring and fall, neither pole points towards the sun.

Other short-term climatic changes include those caused by **El Niño**, a band of anomalously warm ocean temperatures that occasionally develops off the western coast of South America. During El Niño events, the sudden presence of warm water heats the air near the surface of the water. Convection currents strengthen, and the normal cool and dry northwestern coast of South America becomes much warmer and wetter. The increased convection pumps large amounts of heat and moisture into the upper atmosphere, where upper-level winds transport hot, moist air eastward across the tropics. This short-term climatic change is responsible for violent storms in California and the Gulf Coast, and stormy weather to areas farther east that are normally dry, and drought conditions to areas that are normally wet.



Human Impact

Global Warming:

Recall that the greenhouse effect is a natural phenomenon in which Earth's atmosphere traps thermal energy in the troposphere to warm Earth. This leads to an increase in Earth's average surface temperature known as Global Warming. Over time, Earth has experienced periods of global warming and cooling. However, human activities, such as the burning of fossil fuels, continue to contribute to increased levels of carbon dioxide. The unnatural increase in the rate of global warming affects organism populations around the world. Organisms sensitive to temperature variations will not have adequate time to adapt, and thus, may face extinction.

Air Quality:

Photochemical smog, a yellow-brown haze near densely populated areas, forms mainly from automobile exhaust in the presence of sunlight. Air pollutants from vehicle exhaust cause ground-level ozone, which is harmful to breathe, and can have harmful effects on plants. Additionally, particulate matter -solid particles of materials such as ash, dust, and pollen ranging in size from microscopic bits to large grains, can cause breathing difficulties and lung disease.

Chlorofluorocarbons (CFCs) destroy ozone in the upper atmosphere. The ozone layer in the stratosphere serves as a protective shield as it absorbs and filters out harmful UV radiation which has been linked to eye damage, skin cancer, and reduced crop yields. While most countries have banned CFCs and the ozone hole has diminished, there is still an extremely thin area over Antarctica.

Acid precipitation is another major air pollution problem which forms when sulfur dioxide and nitrogen oxides combine with atmospheric moisture to create sulfuric acid and nitric acid. Acid precipitation includes acidic rain, snow, fog, mist, and gas. Acid precipitation forms as the result of burning coal at coal-burning power plants, and naturally, from volcanic eruptions. When acid rain enters surface waters, it damages aquatic ecosystems and vegetation and can negatively affect plants and soil.

Water Quality:

Water-pollution sources are grouped into two main types. Point sources originate from a single point of origin, or a direct source of origin. Such as wastes that enter streams from illegal dumping, accidental spills, and industries that use water in manufacturing processes and discharge waste into streams and rivers. While nonpoint sources generate over widespread areas, or from indirect sources of origin. Nonpoint source pollution occurs when precipitation absorbs air pollutants and deposits them far from their source, or as surface runoff washes pesticides into streams as it flows over farmland.

List 10 terms or concepts you learned this year in Earth Science that was used somewhere within the text

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____