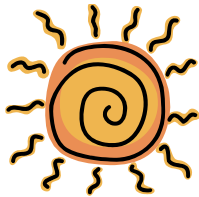


The Science Spot: Focus on Weather Factors

Energy in the Atmosphere

Earth receives energy from the sun by radiation. *Radiation* is the transfer of energy as electromagnetic waves. The waves travel through the air from the sun to reach us. However, most of the sun's energy doesn't even get to us here on Earth! We only receive about two-billionths of the sun's energy, yet it still is the reason for life here! Of the tiny fraction of energy from the sun that makes it to us, about 50% is absorbed by Earth's surface. Twenty percent is absorbed by the ozone, clouds, and atmospheric gases, and 25% is scattered and reflected by clouds and air. About 5% is reflected by Earth's surface.



In addition to radiation, heat is transferred two other ways: by *thermal conduction*, which is heat transfer through a material, and *convection*, which is the circular movement of matter due to differences in density. We have convection in the mantle, in water, and in the air. It's all around us!



Water in the Atmosphere

We know there is water in the atmosphere in all forms. As a solid, it's snow and hail. As a liquid, it's rain. As a gas we call it water vapor. We can measure solids and liquids pretty easily, but how do we go about measuring it? We call the water in the air humidity, and we express it with a mathematical formula that gives us something called the *relative humidity*. Relative humidity is the amount of water vapor in the air compared to the maximum amount of water vapor the air can hold at the current temperature. This is measured in grams per cubic meter. Relative humidity can be measured using a *psychrometer*, which consists of two different types of thermometers and compares the difference between the two.

Water in the atmosphere also exists as clouds. Clouds are formed when water

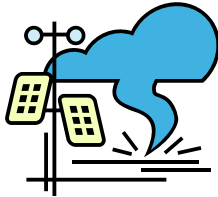
vapor cools, condenses, and collects in the sky as tiny droplets or even ice crystals. Clouds are classified by their form and their altitude. *Cumulus* clouds are puffy, white, and a sign of fair weather. However, as they get larger they can produce thunderstorms. At that point, they are cumulonimbus clouds. Clouds with the word part nimbo- or -nimbus are likely to produce rain. Cumulus clouds are typically found between altitudes of 2000 and 4000 meters.

Stratus clouds are large and flat, and they also form in layers. They are usually lower hanging clouds and because of their layers, they can block out the sun. Stratus clouds are formed by the gentle lifting of a large air mass. Fog is a special type of stratus cloud that forms near the ground. *Cirrus* clouds are thin and featherlike, and form at high altitudes. They form when winds are high and indicate a change in the weather is coming.

In addition to the three basic types of clouds, other prefixes and suffixes can be added to the cloud names to be more descriptive. Cirro- clouds form at high altitudes. Alto-clouds form at middle latitudes. Nimbo- or -nimbus clouds usually bring precipitation.

Did you Know...

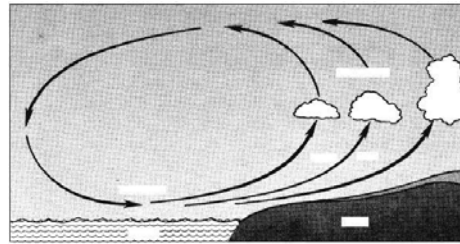
An area of high pressure (which moves down in a clockwise manner and typically is cooler in temperature) is called an *anticyclone*. Anticyclones bring dry, clear weather.



A cyclone is an area of low pressure, which moves upward in a counterclockwise manner, starts out as warm air. However, as that air rises it cools, forms clouds, and often brings rain.

Global Winds

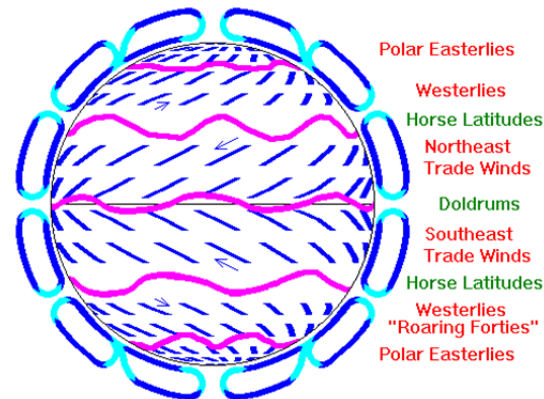
Winds can move locally (like sea breezes and valley breezes during the day, and land breezes and mountain breezes at night). They can also move over greater areas - globally! Air travels across the globe in convection cells, which are large circular patterns. The convection cells are separated by pressure belts - band of high and low pressure - and are found about every 30° of latitude. Part of the motion of these global winds is due to the Coriolis effect.



Is this a sea breeze or a land breeze?

The Coriolis Effect makes winds traveling to the north curve east, and winds traveling south to curve west in the northern hemisphere.

Polar easterlies form as cold, sinking air moves from the poles toward 60° north and south latitude. They bring cold, arctic air to the US, producing snow and freezing weather.



Westerlies are wind belts between 30° and 60° latitude in both hemispheres. They go toward the poles from west to east.

Trade winds blow from 30° latitude almost to the equator. The Coriolis effect causes them to curve west in the northern

hemisphere; east in the southern hemisphere.

Doldrums are where the trade winds meet, near the equator. Very little wind here because of warm, rising air creating an area of low pressure. Doldrums means "sluggish" or "dull."

Horse latitudes are found at 30° north and south. Sinking air creates high pressure which causes the area to have weak winds.

Why are they called horse latitudes? Sailors work off debt

When the sailors had worked long enough to again earn enough to be paid they would parade around the deck with a straw-stuffed effigy of a horse. After the parade the sailors would throw the straw horse overboard.

Second explanation about horses

The second explanation is not well documented. The Horse Latitudes got their name from the time when Spaniards carried horses aboard their ships when they were sailing to the colonies in the West Indies. The sailing ships sometimes became becalmed and the ships ran out of water before reaching land. The dead and dying horses were thrown overboard.

Jet streams are narrow belts of high speed winds that blow in the upper troposphere and lower stratosphere. They are not always in the same place, but go in the same direction. They move weather around the earth.