

Weather Study Guide

Climate is the condition of the atmosphere in an area over a long period of time. Climate is predictable. Weather is the day-to-day changes in the condition of the atmosphere in a particular place. Weather is caused by the interaction of air, water, and the sun.

Energy from the sun

Electromagnetic radiation from the sun includes **infrared radiation** (longer), **visible light**, and **ultraviolet radiation** (shorter). This energy can be absorbed, reflected, or scattered by the atmosphere. Much of the energy gets through and is absorbed by Earth's surface. Absorbed radiation changes into thermal energy (the earth heats up).

As the surface of the Earth warms up, it warms up the atmosphere. This happens mostly by convection.

Conduction – energy transfer by two things in contact

Convection – energy transfer by the movement of a fluid (a liquid OR a gas that flows)

Radiation – energy transfer across space

The **greenhouse effect** keeps Earth warm by trapping in heat. This is a GOOD thing, but when we put additional stuff in the air that traps **too much** heat, we call it **global warming**, a BAD thing.

Convection currents (warm air rising, cooler air moving in to fill the empty space) in the atmosphere cause global winds and local winds such as land and sea breezes. Unequal heating of the earth's surface, creating high pressure and low pressure areas, causes all winds. Air tends to move from areas of high pressure towards areas of low pressure. The sun provides the energy that makes winds blow.

Trade winds blow east to west towards the equator

Polar Easterlies blow east to west away from the poles

These winds move east to west because slower moving air is outrun by the earth spinning beneath it.

Prevailing Westerlies blow west to east near the middle latitudes.

These winds move west to east because fast moving air outruns the earth

Doldrums and **Horse Latitudes** are areas with very little wind. Most air here is moving vertically (up or down).

Sea breezes blow from water to land as the land warms up.

Land breezes blow from land to water as the land cools down faster.

The sun also fuels the water cycle – evaporation, condensation, transpiration, precipitation, and collection. *Transpiration is the evaporation of water through the open stomata of plants.*

Clouds form when warm, moist air rises and cools. The water vapor condenses to form clouds. Clouds are bunches of little water droplets that have condensed as air cooled down and relative humidity increased. When these small water droplets become too large to be suspended in the clouds, they fall as some type of precipitation.

The three main types of clouds are:

- Cumulus - Fluffy
- Stratus - Flat
- Cirrus - Feathery

Remember that air is like a sponge. It can only hold a certain amount of water. The colder the air is, the less water vapor it can hold. The warmer it is, the more water vapor it can hold. The amount of water in the air RELATED to the amount of water the air CAN hold at a certain temperature is **RELATIVE HUMIDITY** (*written as a percent*). As temperature drops, air can hold LESS water vapor, so water vapor condenses, or changes to liquid water. When this happens, we get precipitation, dew, and a wet iced tea glass. The dew point is the temperature at which air cannot hold any more water vapor.

Types of Precipitation

Rain – may start as ice or snow, but changes to liquid water before it reaches the ground

Sleet – drops of liquid water that freeze as they fall through the troposphere (winter)

Hail – Ice pellets that get continually pushed back up into colder layers by convection currents.

Each time they rise, another layer freezes. This happens mainly in summer when very warm air causes strong convection currents.

Snow – Formed when water vapor changes directly into ice crystals. Gas to solid: skipping the liquid phase of matter. Much precipitation begins as snow in the upper troposphere, but melts on the way down.

Freezing rain – cold rain that does not freeze until it actually hits the ground. Produces very dangerous, slick ice. Freezing rain can cause heavy layers of ice that can damage trees and power lines.

Tools for collecting Weather Data

Thermometer – Temperature

Anemometer – Wind Speed

Barometer – Pressure

Wind Vane – Wind Direction

Psychrometer – Relative humidity

Rain Gauge – Amount of precipitation