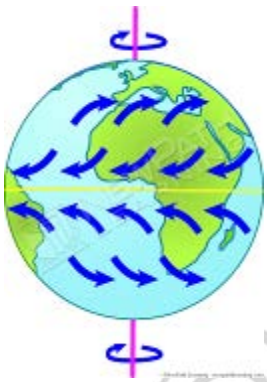
UNDERSTANDING WEATHER

The condition of the atmosphere at a specific time in a specific place is known as the **weather**. All weather starts with the sun because weather is driven by energy from the sun. The **weather** includes and is affected by water, wind, temperature, and air pressure. **Meteorologists** are scientists who study and predict weather and weather patterns.

The Sun's Energy, Heat Transfer and Wind

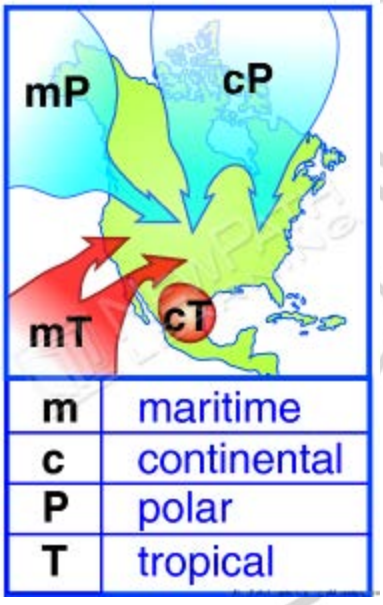
The sun's energy comes to the Earth as electromagnetic radiation. Molecules on the Earth and in the atmosphere absorb this radiation and it causes them to vibrate. This vibration energy becomes **heat**. **Wind** is created by differences in heating air masses. Simply put, wind is air in motion. Winds can be local meaning that they formed and moved over a relatively short distance. There are also **global winds** that move over large portions of the Earth.

The global winds in the Northern hemisphere curve to the right. The global winds in the Southern hemisphere curve to the left. One would expect them to travel in a straight line, but the Earth's rotation on its axis causes them to curve. This is due to the **Coriolis effect**.



Differences in temperature between the poles and the equator create **convection cells** of wind. Belts of cold air sinking and warm air rising in well-defined regions create this circular motion. As the graphic shows, these cells occur between the poles and 60 degrees N and S latitude, between 60 degrees and 30 degrees N and S latitude and between 30 degrees N and S latitude and the equator.

Air pressure and weather are closely related to the temperature of air masses that move into an area. Changes in the weather of any region are r mass is a large bo nt throughou e air pressure is s surface. By contras into a region bec e surface. Low-press em. High-press



m	maritime
c	continental
P	polar
T	tropical

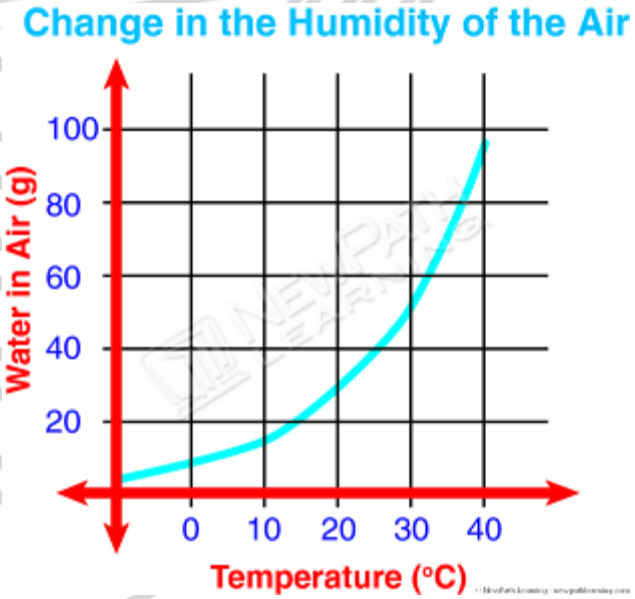
The Sun's Energy and the Water Cycle

The continuous movement of water from the Earth's surface to the atmosphere and back is called **the water cycle**. Energy from the sun heats water causing it to **evaporate.** Plants and animals also give off water: this is called **transpiration**. The largest source of atmospheric water vapor is the oceans. Evaporation from lakes, rivers, streams and surface water runoff also contributes to water vapor. This water vapor accumulates in the atmosphere and when the conditions are right, clouds form. A **cloud** is simply water. Water eventually **precipitates** out of the clouds and falls back to Earth either as rain, snow, or sleet. The form of precipitation (liquid or solid) depends on the temperature.

Lesson Checkpoint:
What is an air mass and how does it affect us?

Humidity

As water evaporates from oceans, lakes and rivers, it is held in the air. Th **dity**. Meteorolog ily weather re ynonyms. Relative hu of water vapor in th e air could hold n grams per cubic r perature. It decrease erature decreases.

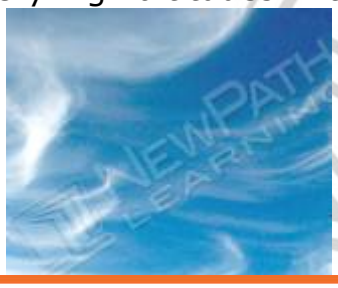


The **dew point** is the same as 100% relative humidity. It is the temperature at which the water in a saturated air mass comes out of the air mass as rain or dew or, if it is cold enough, snow or frost.

Cloud Types

Clouds form when minute droplets of water or ice crystals accumulate in the atmosphere. Different types of clouds form under different meteorological conditions. Clouds are categorized based on their form and composition.

1. **Cirrus clouds** are thin clouds that are composed of ice crystals and form at very high altitudes in the atmosphere.



2. **Stra** er large area s.


Stratus clouds

3. **Cumulus clouds** are large, white, puffy clouds with significant vertical development. They are typical of fair weather.

Cumulus clouds

4. **Cum**ouds that cont…nsible for thun… when the atmo…nstable air a…ass rapi… reach to over…
5. Types 1-3 occur at altitudes under 6,000 feet. When they occur at higher altitudes, between 6,000 and 20,000 feet, cloud types are identified by adding the prefix **alto-**. Therefore meteorologists refer to **altocumulus clouds** and **altostratus clouds.**
6. **Cirrocumulus clouds** are broken, cotton-ball like clouds that occur above 18,000 feet in the atmosphere. The look created by cirrocumulus clouds is often referred to as **mackerel sky.**

Fog is a cloud formation. Fog is simply layers of stratus clouds that have formed very close to the ground.

Lesson Checkpoint: Name the types of clouds.

Precipitation

Precipitation is water that has **condensed** in the atmosphere and falls to Earth. Sleet, snow, rain and hail are different forms of precipitation. The type that falls at a given time depends on temperature.

- **Snow** is crystallized water. Water crystallizes in the hexagonal crystal system. Minerals in the hexagonal system have six sides and snowflakes always have six-fold symmetry.
- **Sleet** generally refers to precipitation that is a mixture of water and ice. In some cases rain has only partially frozen. In others snow has partially melted as it falls to the ground.
- **Hail** is formed in cumulonimbus clouds associated with thunderstorms and severe weather. Water droplets are pushed upward by the energy in the storm clouds. The water droplets freeze and begin to fall but the currents within the cloud push the frozen drops back up into the cloud where another layer of water freezes onto the first frozen droplet. This process can continue until balls of cal hail is pea-siz und when the wei ud that holds it