Humidity

- Water vapor content of the atmosphere
- Mass of water vapor / volume = absolute humidity.
- Ratio of mass of water vapor to mass of water vapor that can exist at a particular temperature (saturation volume) = relative humidity.
- Warm air can hold more water vapor than cold air.
- If temperature drops absolute humidity will approach the saturation point (dew point) - water vapor will condense into water drops or ice crystals.

Inverse correlation between temperature and relative humidity

Dew Point
Adiabatic Cooling

- The cooling of an air mass as it rises, due to expansion of the air as pressure decreases with altitude.

- As an air mass expands, it pushes on the air around it, doing work; since the air mass does work and gains no heat, it loses internal energy, and its temperature decreases at a rate of $9.8 \, ^\circ\text{C}/\text{km}$ (Dry Adiabatic Lapse Rate).

- The reverse occurs for a sinking parcel of air - Adiabatic Heating.

Wet Adiabatic Lapse Rate

- If a rising air mass reaches its dew point, water vapor will begin to condense.

- Condensation releases heat energy, which warms the air mass, slowing down its rate of cooling.

- Wet Adiabatic Lapse Rate is usually near $4.9 \, ^\circ\text{C}/\text{km}$.

- If rising air cools more than surrounding air, it will stop rising.

- If rising air cools less than surrounding air, it will continue to rise - forming tall clouds, often with rain.
Clouds

Composed of suspended water droplets or ice crystals that form when air reaches dew point.
Classified on the basis of height, shape, and precipitation.
High clouds (Cirrus), Middle clouds (Alto), Low clouds, and Vertical clouds.

High clouds (Cirrus) form above 20,000 ft (6000 meters) and are composed of ice crystals.
Mid-level clouds occur between 6,500 and 20,000 feet (2,000 to 6,000 meters). They are composed primarily of water droplets, but can also be formed of ice crystals when temperatures are cold enough.

Low clouds are mostly formed of water droplets since their bases lie below 6,500 feet (2,000 meters). However, these clouds may also contain ice particles and snow.
Vertical clouds form by thermal convection or frontal lifting and can grow to heights in excess of 39,000 feet (12,000 meters).
Continental U.S. weather is defined by interaction of cold and warm air masses along the Polar Front.

Cold, dense polar air flows equatorward across the Polar Front.

As cold air pushes under warm air, or as warm air rides over cold air, the air rises, creating a region of low pressure.

High pressure regions are caused by large air masses cooling at altitude, creating descending air.
Coriolis Effect on Pressure Systems
Descending air (high) flows clockwise (anticyclonic flow)
Ascending air (low) flows counterclockwise (cyclonic flow)

Weather Fronts
Cold Front
Warm Front
Precipitation
Warm Front

Occluded Front

Stationary Front - insufficient temperature contrast to mix the air masses - warm air and cold air flow past each other in waves, producing persistent rain.

A stationary front does not move or is almost motionless and winds blow parallel to the front but in opposite directions on either side.
Forms of Precipitation Developed along Fronts

Simplified Station Model

Temperature (°F)

Present Weather

Dew Point Temperature (°F)

Dew Point Pressure (mb)

Wind Direction and Speed

Simplified Frequently Used Present Weather Symbols

Rain

Drizzle

Showery

Thunderstorm

Fog

Sleet

Rain SHOWER

Light

Moderate

Heavy

Ice

Snow

Ice Pellets

Dew

Dust

Light Precipitation

Moderate Precipitation

Heavy Precipitation

Drizzle

Light Drizzle

Moderate Drizzle

Heavy Drizzle

Fog

Light Fog

Moderate Fog

Heavy Fog

Sleet

Light Sleet

Moderate Sleet

Heavy Sleet

Ice

Light Ice

Moderate Ice

Heavy Ice

Snow

Light Snow

Moderate Snow

Heavy Snow

Ice Pellets

Light Ice Pellets

Moderate Ice Pellets

Heavy Ice Pellets