

Mechanisms that Lift Air

- **Orographic Uplift**
 - When air moves toward a mountain, it cannot go through the mountain. It must move upward toward the peak.
 - As it does so, it adiabatically cools. As a result, it condenses and clouds form.
 - This is known as ‘orographic uplift’.
- **Frontal lifting**
 - When there are large temperature differences over short distances, a zone called a ‘front’ exists.
 - A ‘cold front’ is one in which cold air approaches warm air.
 - Cold, dense air displaces the warm, relatively lighter air ahead of it.
 - A ‘warm front’ is one in which warm air approaches cold air.
 - Warm air is displaced upwards over the cold, denser air.
- **Convergence**
 - With regard to a surface low, winds converge on the center of the low from all directions.
 - As a result, the air at the center of the low must rise upward (it cannot go into the ground).
 - The rising air must cool adiabatically.
- **Localized Convection**
 - During spring and summer, incoming solar radiation at the Earth’s surface can lead to convection over a small area.
 - ‘Convection’ in this instance refers to thunderstorms.

Cloud Types

- Clouds are composed of liquid droplets, ice crystals, or both.
- Clouds are defined by height:
 - **High Clouds**
 - *Cirrus, cirrostratus, and cirrocumulus*
 - Usually do not cover the entire sky. In other words, blue skies are interspersed with the high clouds.
 - **Middle Clouds**
 - *Altostratus, and altocumulus*
 - **Low clouds**
 - *Stratus, stratocumulus, and nimbostratus*
 - Usually cover the entire sky. It sometimes leads to lower visibilities.
 - **Clouds with extensive vertical development**
 - *Cumulus, and cumulonimbus*

- **High clouds**
 - Located generally above 19,000 ft.
 - Almost always composed of ice crystals.
 - Cirrus
 - Simplest of the high clouds.
 - Resemble ‘mares’ tails’.
 - Cirrostratus
 - When in the sky, the Moon or Sun has a whitish, milky appearance.
 - Creates the ‘halo’ appearance around the Sun or Moon.
 - Cirrocumulus
 - Precursor to precipitation.
 - Associated with a ‘mackerel sky’.
- **Middle clouds**
 - Occur between 6,500 and 19,000 ft.
 - Usually made up of liquid droplets.
 - Are prefixed by ‘alto’ which means middle.
 - Altostratus
 - When in the sky, the Sun or Moon are observed as bright spots instead of a halo.
 - Altcumulus
 - Layered clouds that resemble long bands or puffy clouds arranged in rows.
 - Gray in color.
- **Low clouds**
 - Have bases below 6,500 ft.
 - Stratus
 - Layered clouds.
 - Nimbostratus
 - Low, layered clouds that produce light precipitation.
 - Resemble stratus, except they produce precipitation.
 - Stratocumulus
 - Low, layered clouds with some vertical development.
- **Clouds with Vertical Development**
 - Cumuliform clouds have vertical development and occur when the atmosphere is unstable.
 - They are divided into subgroups according to their vertical development.
 - Cumulus humilis
 - Formed by very localized heating.
 - They do not have precipitation.
 - Known as ‘fair-weather cumulus’.

- **Cumulus congestus**
 - **Contain multiple towers of great depth.**
 - **Form in unstable air.**
- **Cumulonimbus**
 - **Identifiable by the presence of an ‘anvil’.**
 - **Often produces severe thunderstorms.**
- **Unusual Clouds**
 - **Lenticular**
 - **Form downwind of mountain barriers.**
 - **Have curved shapes.**
 - **Resemble eyeglass lenses.**
 - **Mistaken as ‘unidentified flying objects’.**
 - **Mammatus**
 - **Form from portions of cumulonimbus clouds.**
 - **Hang downward in sac-like shapes.**
 - **Often a precursor to violent thunderstorms with hail.**

Helpful Links:

<http://www.free-online-private-pilot-ground-school.com/images/cloud-types.gif>

<https://scied.ucar.edu/clouds>