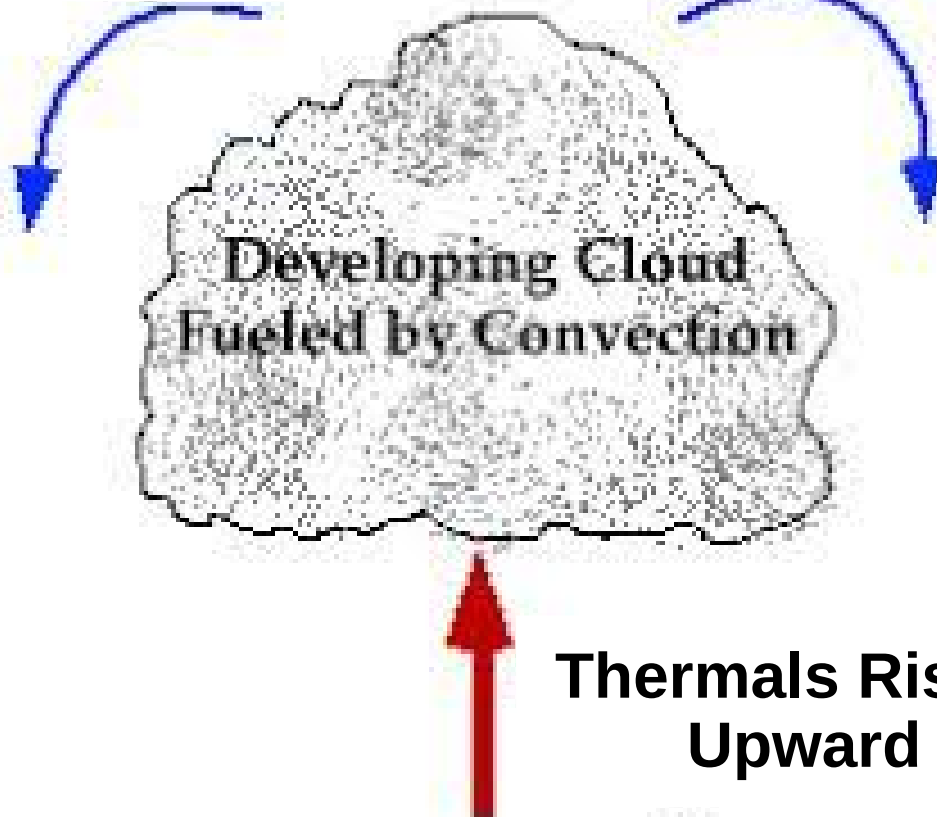


Cloud Dynamics

Sinking Air

Sinking Air

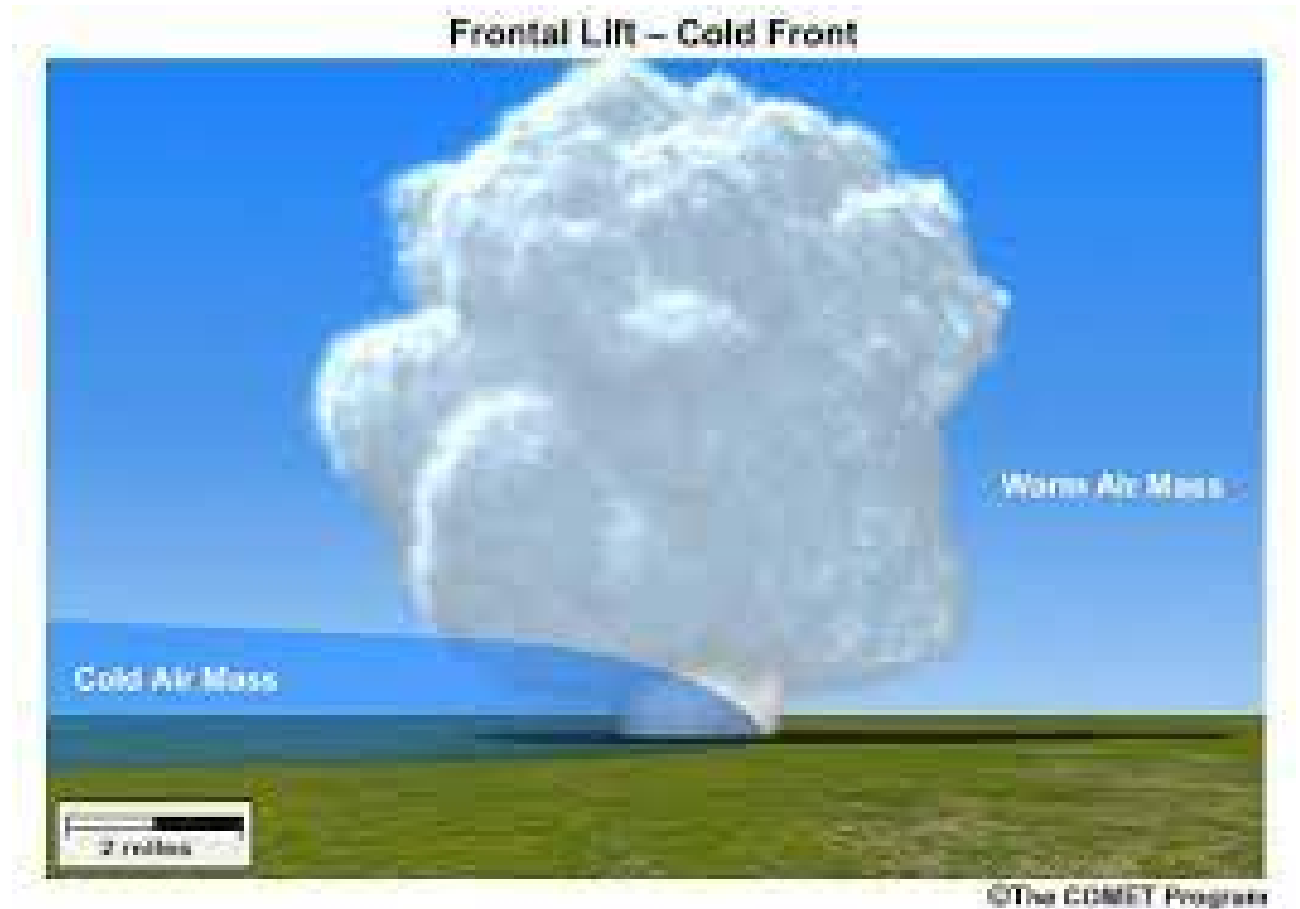


**Developing Cloud
Fueled by Convection**

**Thermals Rising
Upward**

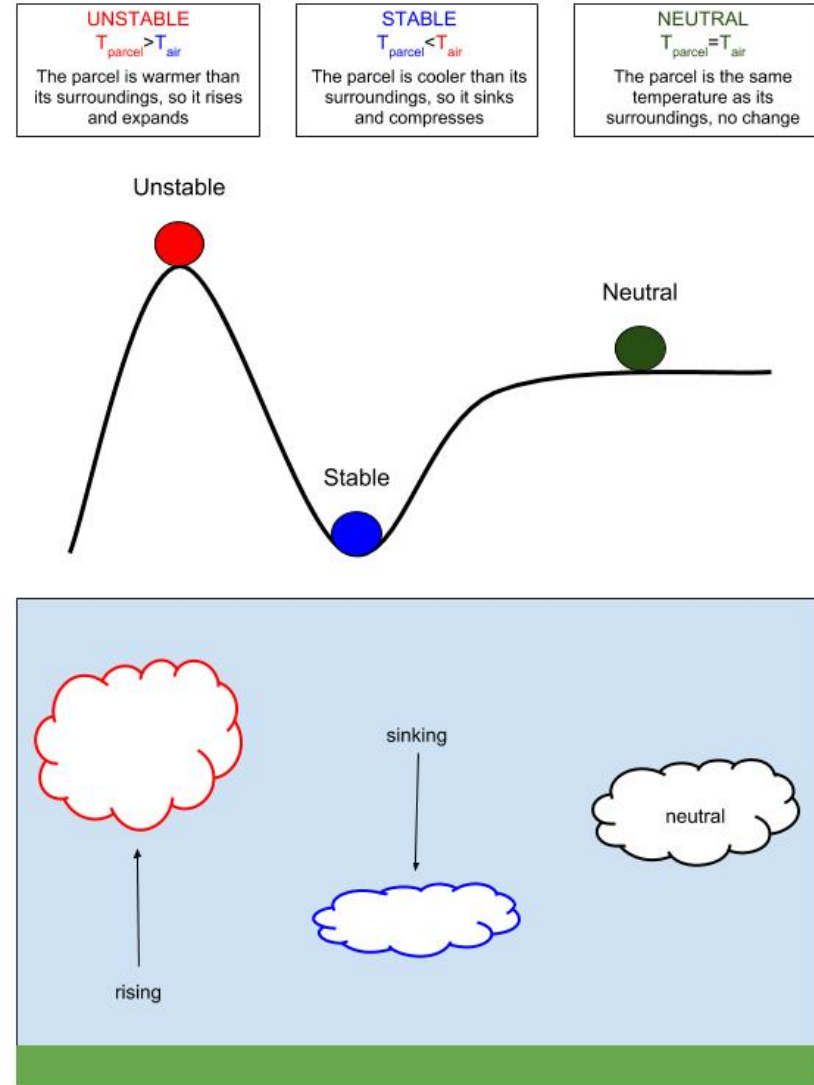
Cloud Formation

- Rising Air Due to:
 - Synoptic Lifting
 - (Low Pressure)
 - Mesoscale Lifting
 - (Jet Streaks)
 - Thermals
 - Fronts
 - Terrain



Atmospheric Stability

- Air motions are governed by atmospheric stability.
- Stable -> Limited Vertical Motion
- Unstable -> Rapid Vertical Motion
- Stability: Resistance of the atmosphere to vertical motion.



Effects of Latent Heating

- Condensation and Freezing Release Latent Heat
- Cloud Air Warms Slightly
- Warming Produces Buoyancy
- Buoyancy Causes the Air to Rise



Entrainment and Detrainment

- Air within the cloud mixes with air around the cloud because of turbulent air motions (cloud air is going up through the environment)
 - Entrainment is outside air entering the cloud
 - Detrainment is cloudy air leaving the cloud
- Cloud air is saturated, surrounding air is unsaturated
- Mixed air is unsaturated, so cloud particles evaporate

Effects of Entrainment

- Mixing at the cloud boundary results in evaporation, which is a cooling process.
- Cooling increases air density, causing it to sink.
- This offsets some of the cloud rising motion.
- Drier air works its way toward the interior of the cloud and will eventually stop the updraft.

Precipitation Loading

- Precipitation loading refers to the effect of condensed water in the updraft.
- Cloud particles are pulled downward by gravity.
- Particles have increasing drag as they grow.
- Combined drag of all particles slows the upward moving air in the cloud (“updraft”) and reverses the flow from upward to downward (“downdraft”).

Downdraft Effects

- As downdraft air moves through subsaturated air more evaporation cooling occurs.
- Cooling causes the air to accelerate downward.
- Downdraft spreads out horizontally as it nears the ground.
- Leading edge of spreading air (“gust front”) lifts air ahead of it, which may cause new clouds to form.

MedEd

- **Principles of Convection I: Buoyancy and CAPE**