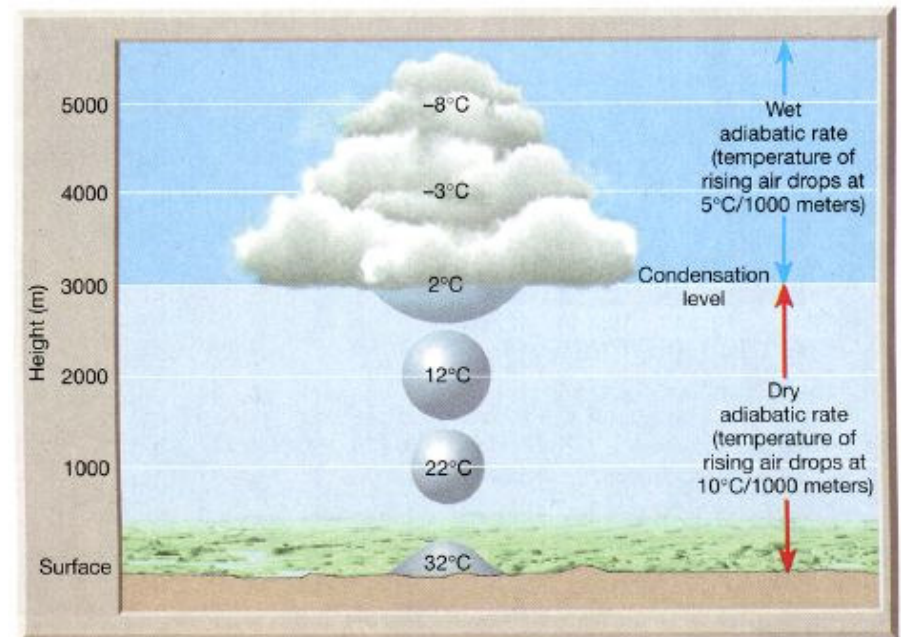


Ch 18.2 Cloud Formation

Air Compression and Expansion

- When air is compressed, the motion of gas molecules increases and the air temperature rises.
- The opposite happens when air is allowed to expand, it cools.
- This temperature changes that happen even though heat isn't added or subtracted are called **adiabatic temperature changes**.
- If a parcel of air rises high enough, it will eventually cool to its dew point. Condensation begins, latent heat of condensation stored in the water vapor will be released.
- It is at the condensation level in the atmosphere is where clouds are formed, this is done by **adiabatic cooling**.

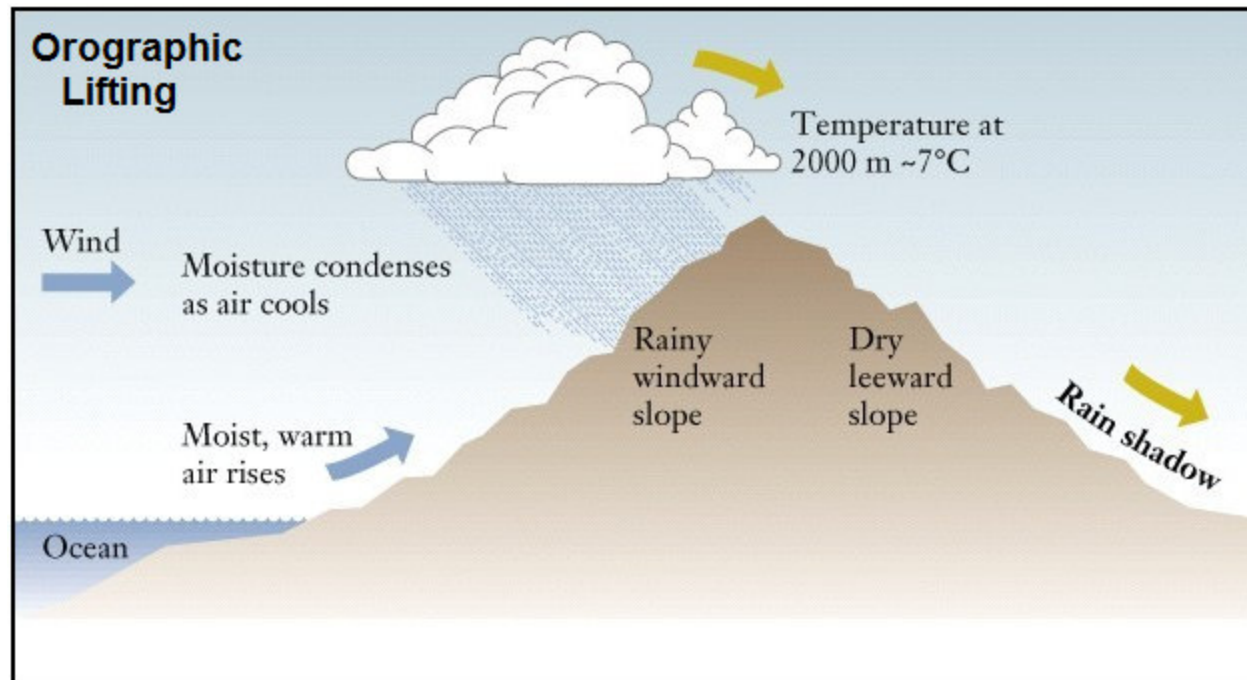


Processes That Lift Air

- For the most part, air resists vertical movement. Air located near the surface tends to stay near the surface.
- For some situations, clouds form because there is some mechanical process that forces air to rise.

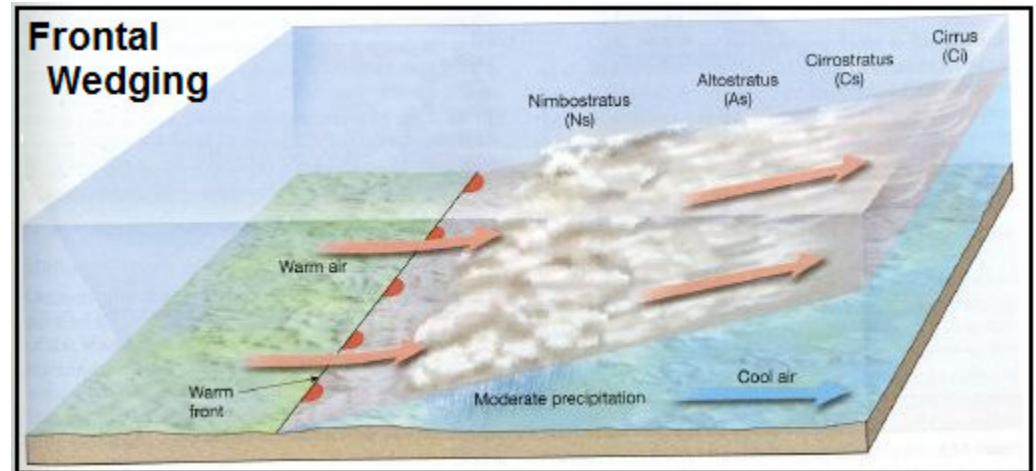
Orographic Lifting

- Mountains (mountain range), act as barriers to air flow. As air goes up a mountain slope, adiabatic cooling can occur generating clouds and precipitation on the windward side of the mountain.
- As the air reaches the leeward side of the mountain, much of its moisture has been lost, if air descends, it warms adiabatically. This creates a **rain shadow** – little to no rain.
- In a rain shadow, a desert can be created – Arizona.



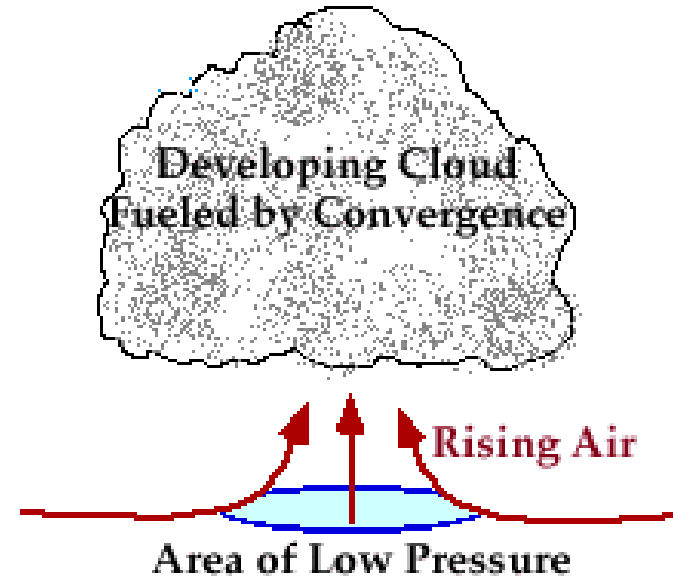
Frontal Wedging

- In central North America, masses of warm air and cold air collide producing a **front**.
- The cooler air is denser and acts like a barrier and causes the warmer air, which is less dense, to rise. This process is called **frontal wedging**.



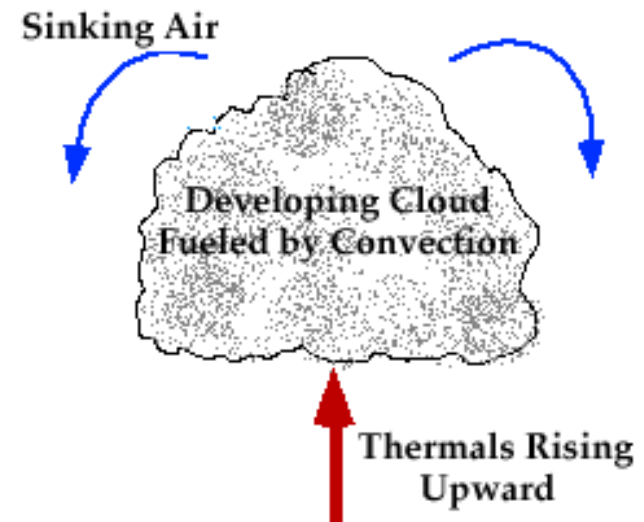
Convergence

- When contrasting air masses collide, the lower atmosphere flows together and lifting results.
- This uplifting of air causes cloud development and precipitation.
- The uplifting is also helped with solar heating of the land, aiding in the uplifting of air.



Localized Convective Lifting

- As the earth is heated by the sun, bubbles of hot air (called thermals) rise upward from the warm surface. A thermal cools as it rises and becomes diluted as it mixes with the surrounding air, losing some of its buoyancy (its ability to rise).
- An air parcel will rise naturally if the air within the parcel is warmer than the surrounding air (like a hot air balloon). Therefore, if cool air is present aloft with warm air at lower levels, thermals can rise to great heights before losing their buoyancy.



Stability

- Stable air resists vertical movement. Stable air tends to remain in its original position, while unstable air tends to rise.
- Air stability is determined by measuring the temperature of the atmosphere at various heights.
- Air is stable when the temperature decreases gradually with increasing altitude.
- A **temperature inversion** is a stable condition when air temperature actually increases with height.

