

ATMOSPHERIC STABILITY

*** **STABILITY**: refers to the tendency of an air parcel, with its water vapor, either to remain in place or to change vertical position by ascending (rising) or descending

* a **stable** parcel of air resists displacement upward or, when disturbed, tends to return to its starting place

* an **unstable** parcel of air continues to rise until it reaches an altitude where the surrounding air has a density & T° similar to its own

Rules of Stability

1) When an air parcel is warmer & less dense than the surrounding air, the parcel will rise:

UNSTABLE air or condition

2) When an air parcel is colder & denser than the surrounding air, it will tend to stay

at the same level or sink: **STABLE** air

3) the **Environmental Lapse Rate (ELR)** is the T° profile of the atmosphere (air surrounding a parcel of air). The actual (T°) lapse rate in the lower atmosphere at any particular time under local weather conditions.

Whether a particular parcel of air will rise (unstable) or not rise (stable) is a function of the T° inside the parcel of air as compared to the T° outside the parcel of air, thus the ELR determines air stability.

Types of Stability

Stable: the condition of the air when ELR < DAR;

Absolutely Stable Conditions or Absolute Stability

- * usually result in NO UPLIFT of air, but subsidence r sinking of air
- * clear skies, maybe a few stratus clouds

- * often associated with **High pressure cells**
- * most severe example is a **T° inversion**: when the air T° is increasing with increasing altitude in the atmosphere

Unstable: the condition of the air when ELR > DAR

Absolutely Unstable Conditions or Absolute Instability

- * usually result in UPLIFT of the air parcel
- * often leads to cloudy skies, *cumulus clouds and precipitation*
- * associated with **Low pressure cells**
- * often occurs during the warmest months & on clear days

Conditionally Unstable: the condition of the air when the ELR is between the DAR & the SAR SAR < ELR < DAR

- * atmosphere will vary between Stable & Unstable
- * usually if air is saturated then upper portion of the atmosphere is Unstable
- * usually if air is unsaturated then the lower portion is Stable

- ** Stability is important in daily weather patterns.
 - * controls whether clouds form or not & the type
 - * partially controls precipitation type & amounts

***** LIFTING MECHANISMS**

- * For air masses or parcels of air to cool adiabatically (by expansion) and to reach the dew-point T° and saturate, condense, and form clouds and perhaps precipitation, they must lift and rise in altitude.

- * There are 4 principal lifting mechanisms which operate in the atmosphere.

Convective Lifting: the process of warming a parcel of air at the surface by conduction, then the whole parcel rising into the atmosphere since it is warmer than the surrounding air

- * the heating helps produce **UNSTABLE conditions**
- * if there is enough moisture in the air parcel, then may get cloud develop & precipitation
- * *common in summertime, producing afternoon thunderstorms especially here in the SE US*
- * part of the process that occurs in **Low pressure cells** in conjunction with convergence

Convergent Lifting: the process by which winds come together from opposite directions and are forced to rise due to compression or squeezing

- * part of the process that occurs in **Low pressure cells** in conjunction with convection
- * both convection & convergence are at work to form the **(ITZC) InterTropical Convergence Zone**

Orographic Lifting:

- * precipitation occurs on the **windward** side of the mountain
- * little to no precipitation occurs on the **leeward** side
- * may create a **Rain Shadow Desert** on the leeward side

Frontal Wedging: the process by which cold, dense air acts similarly to a mountain barrier forcing warmer, less dense air to rise over it

- * The leading edge of a mass of cold air is known as a **cold front** & similarly the leading edge of a mass of warm air is known as a **warm front**. So this lifting