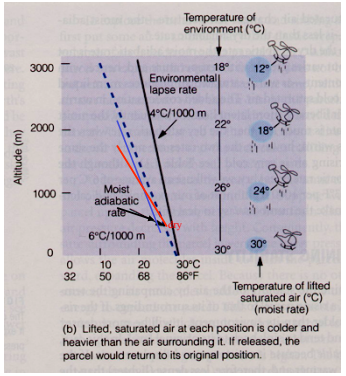
Saturated Rising Air Cools Less Than Dry Air!

- If a rising air parcel becomes saturated condensation occurs
- Condensation warms the air parcel due to the release of latent heat
- So, a rising parcel cools less if it is saturated
- Define a moist lapse rate
  - ~ 6 C/1000 m
  - Not constant (varies from ~ 3-9 C)
  - depends on T and P

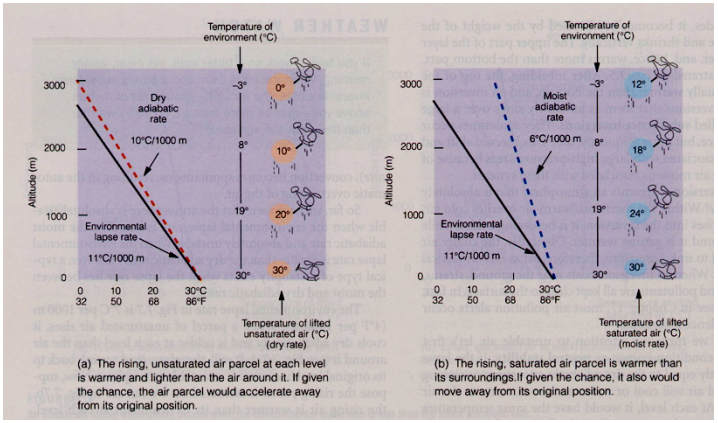
Stability and the moist lapse rate

Atmospheric stability depends on the environmental lapse rate

- A rising saturated air parcel cools according to the moist lapse rate
- When the environmental lapse rate is smaller than the moist lapse rate, the atmosphere is termed *absolutely stable*
- What types of clouds do you expect to form if saturated air is forced to rise in an absolutely stable atmosphere?

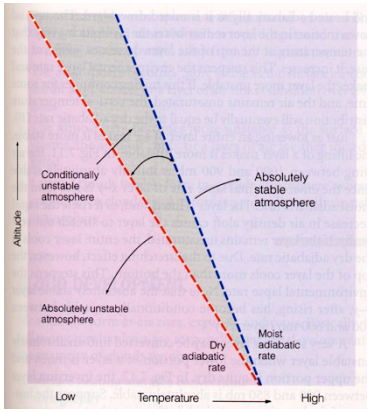


Absolute instability (examples)



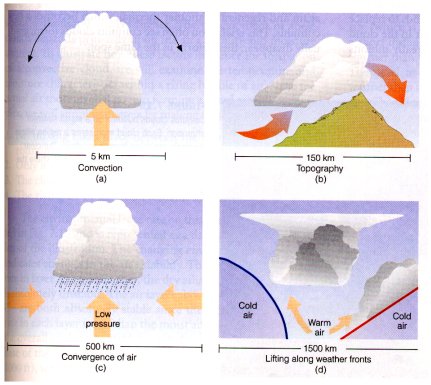
Conditionally unstable air

- What if the environmental lapse rate falls between the moist and dry lapse rates?
  - The atmosphere is unstable for saturated air parcels but stable for unsaturated air parcels
  - This situation is termed *conditionally unstable*
- This is the typical situation in the atmosphere



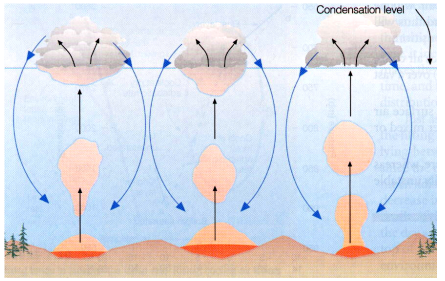
Cloud development

- Clouds form as air rises, expands and cools
- Most clouds form by
  - Surface heating and free convection
  - Lifting of air over topography
  - Widespread air lifting due to surface convergence
  - Lifting along weather fronts



Fair-Weather Cumulus Clouds

- Air rises due to surface heating
- RH rises as rising parcel cools
- Clouds form at RH ~ 100%



- Rising is strongly suppressed at base of subsidence inversion produced from sinking motion associated with high pressure system
- Sinking air is found between cloud elements