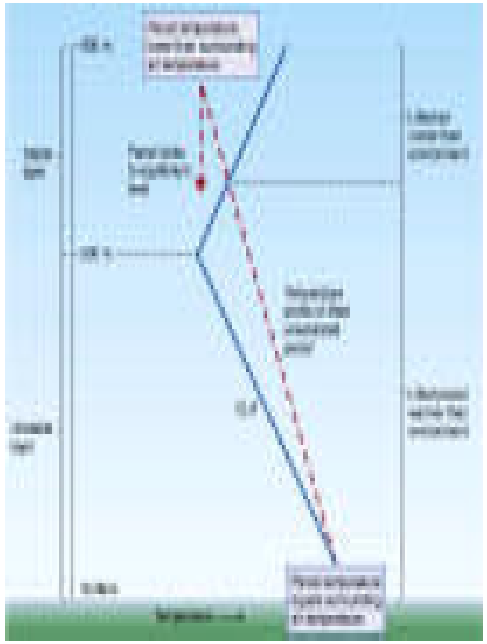
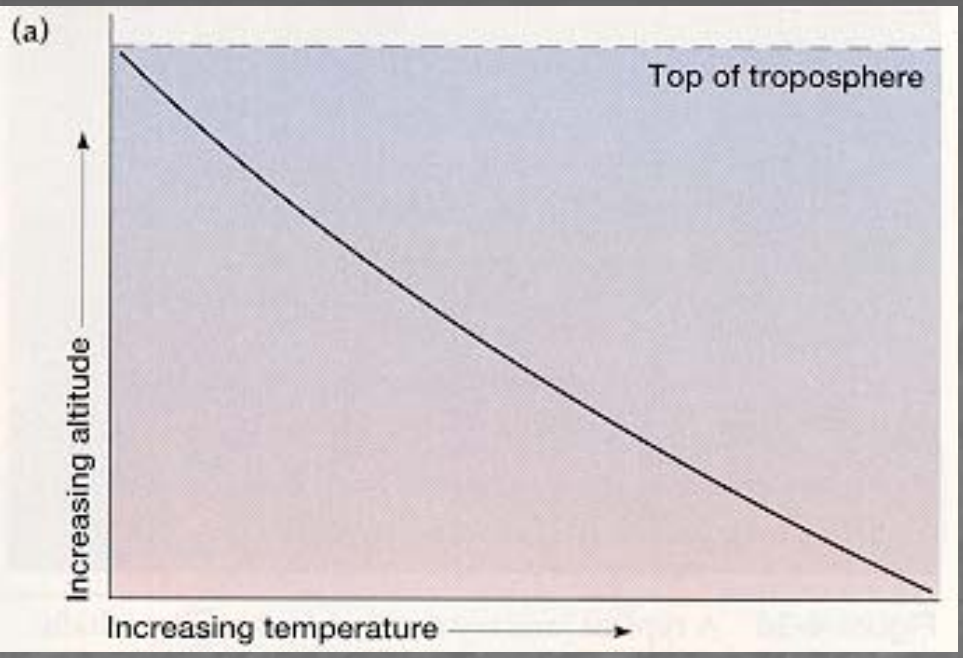
Terselme (inversion)

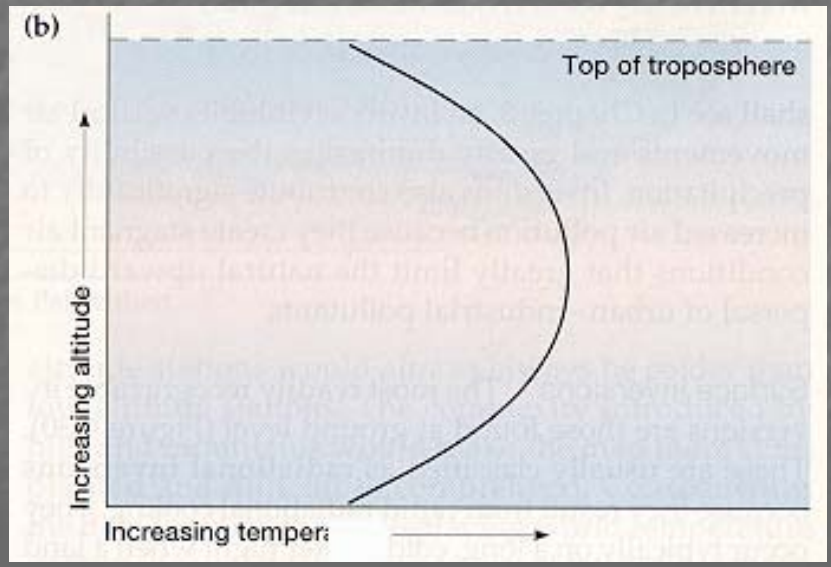
Inversions

- Layer of the atmosphere where temperature of the air increases with altitude
  - Makes the air extremely stable
- Types of Inversions
  - Radiation inversion
  - Frontal inversion
  - Subsidence inversion

Layer of Stable Air







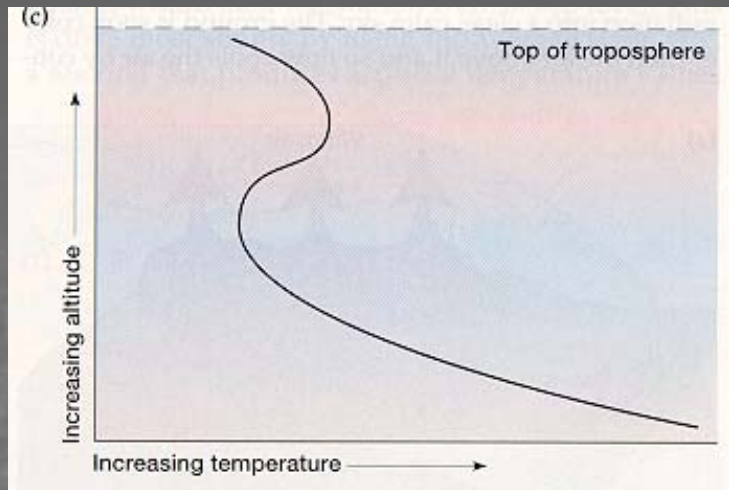
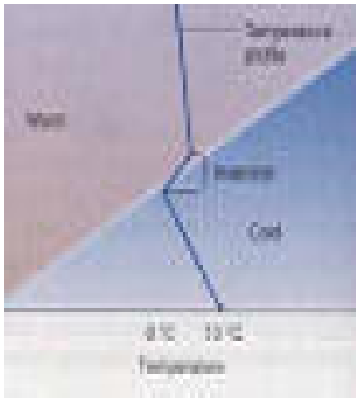


Figure 4-29 A comparison of normal and inverted lapse rates. (a) Tropospheric temperature normally decreases with increasing altitude. (b) In a surface inversion, temperature increases with increasing altitude from ground level to some distance above the ground. (c) In an upper-air inversion, temperature first decreases with increasing altitude as in a normal lapse rate but then at some altitude well below the tropopause begins to increase with increasing altitude.

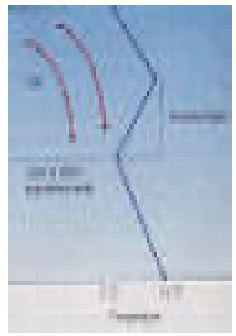
Inversions: Extremely Stable Air

1. Radiation Inversion
   - Cooling of Surface
   - Develops at Ground Level
   - Radiation Fog If Cools to Dew Point
   - Crop Damage If Cold enough - Frost



2. Frontal Inversion
   - 100s km long
   - Cold Enough - Sleet or Freezing Rain

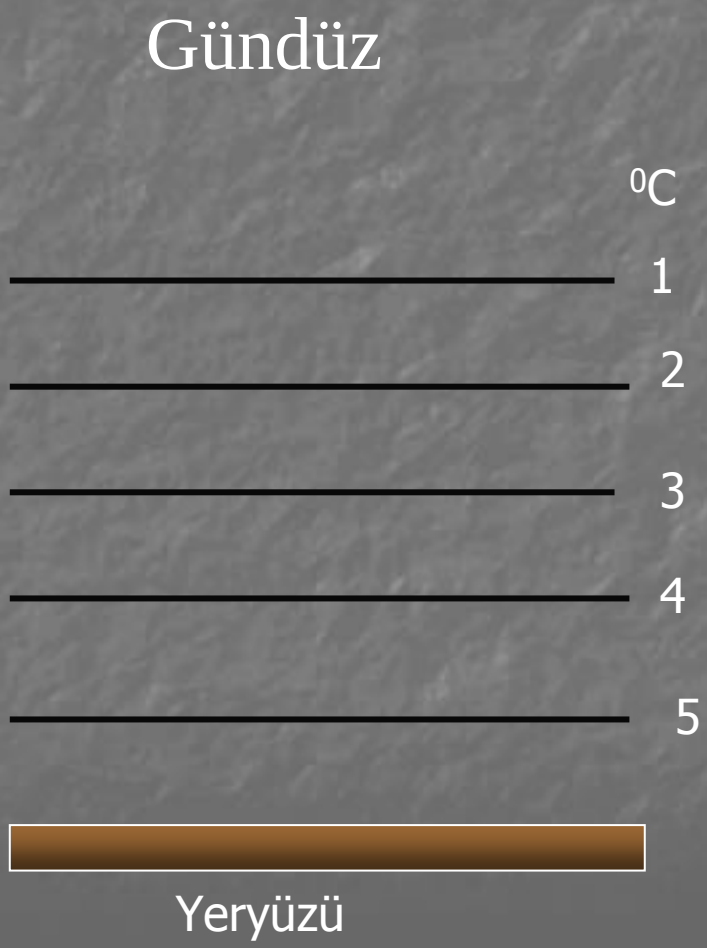
Inversions: Extremely Stable Air

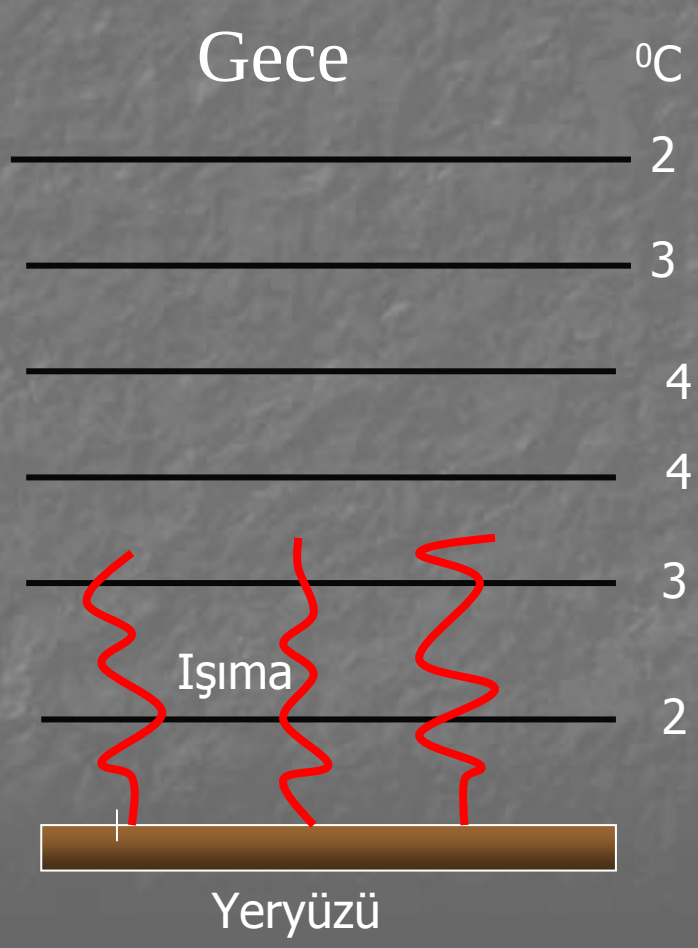


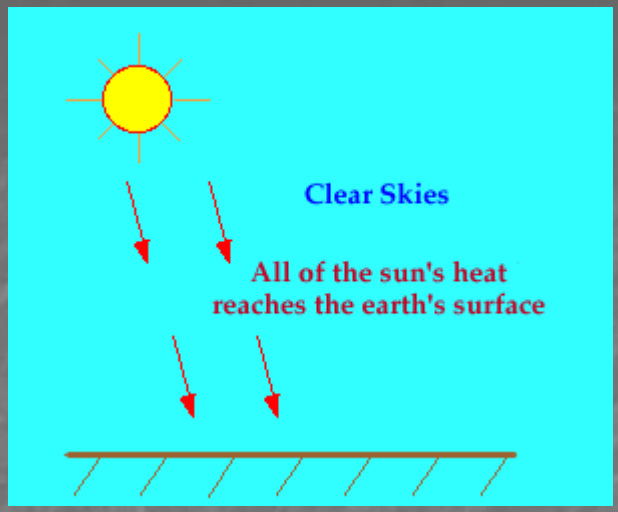
3. Subsidence (Sinking) Inversion
   - Compressed Gas
     - Warms
     - Top Sinks and Warms Most
     - Develops Well Above Surface

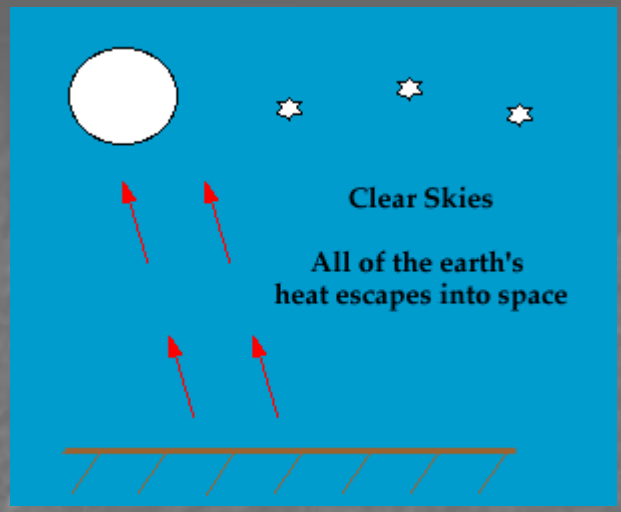
Hawaiian High
- Caps Air Above Los Angeles
  - Heavy Pollution

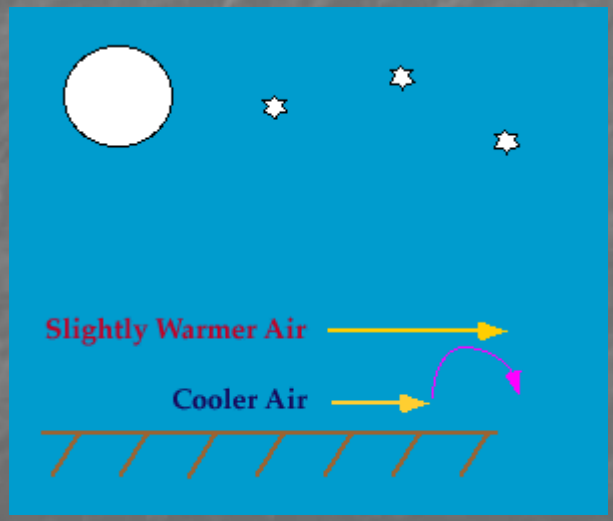
Termik Terselme

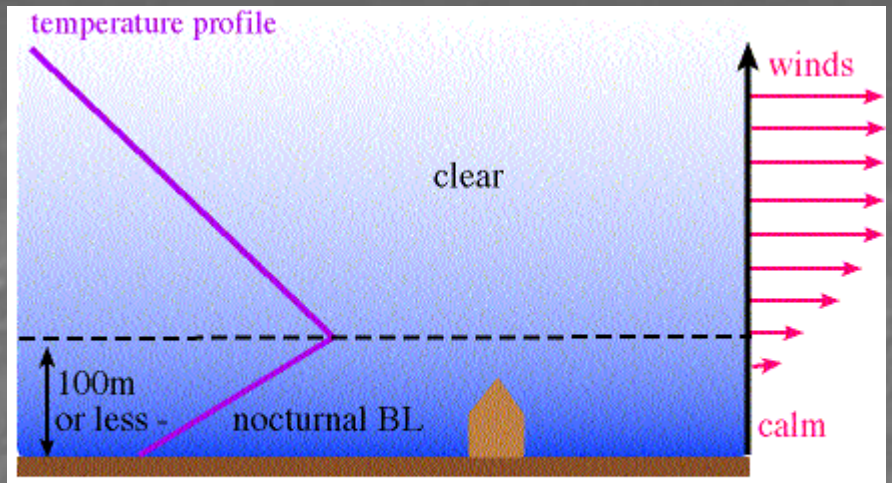




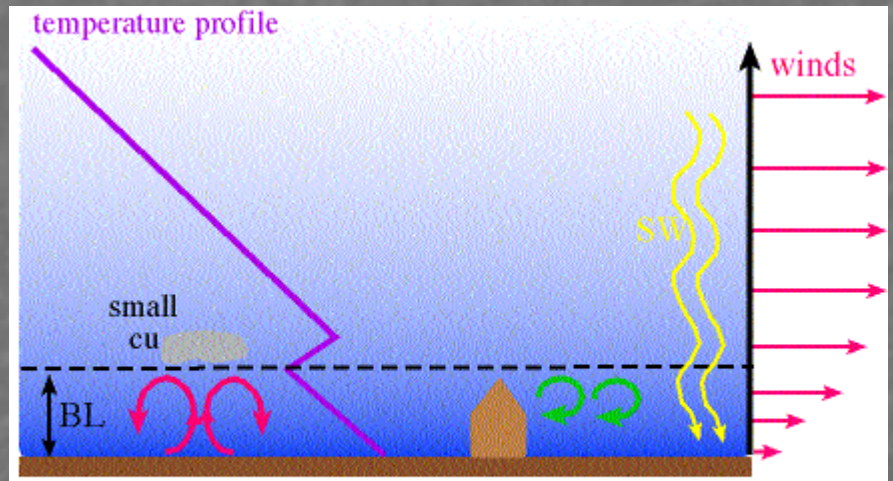

Clear Skies
All of the sun's heat
reaches the earth's surface


Clear Skies
All of the earth's
heat escapes into space

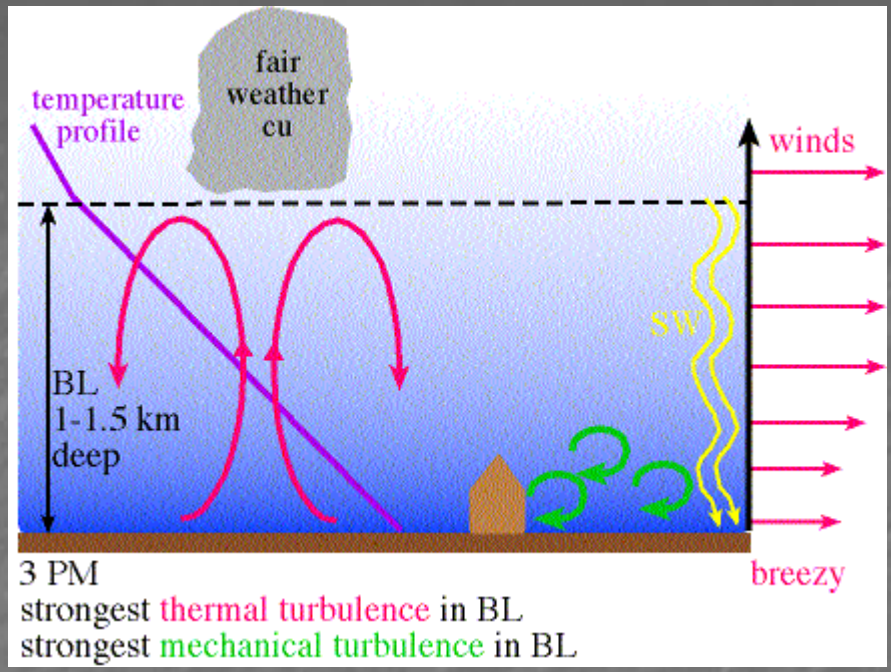

Slightly Warmer Air
Cooler Air



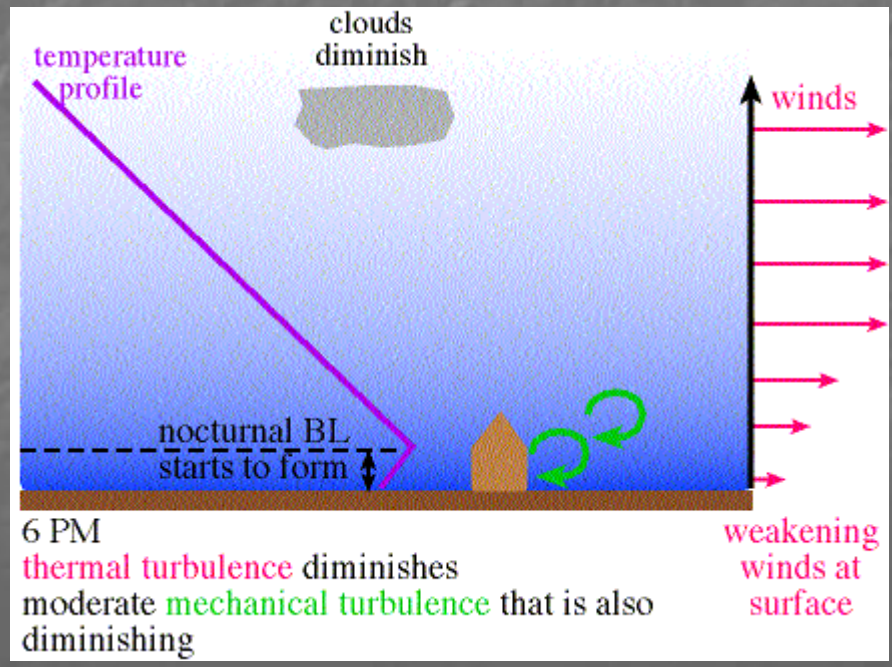
6 AM
No thermal turbulence
Little/no mechanical turbulence



11 AM
weak-moderate thermal turbulence near surface
weak-moderate mechanical turbulence near surface



3 PM
strongest thermal turbulence in BL
strongest mechanical turbulence in BL



6 PM
thermal turbulence diminishes
moderate mechanical turbulence that is also diminishing

Stable Air – contd.

- Atmosphere is stable when lapse rate is small
- The cooling of surface air could be due to:
  - Nighttime radiational cooling of the surface
  - Influx of cold air from other region brought by wind
  - Air moving over a colder surface
- The air is generally most stable in the early morning around sunrise
- Subsidence Inversion: Inversion produced by compressional warming – the adiabatic warming of a layer of sinking air
- Presence of inversion near the ground fog, haze, & associated pollutants are kept close to the surface

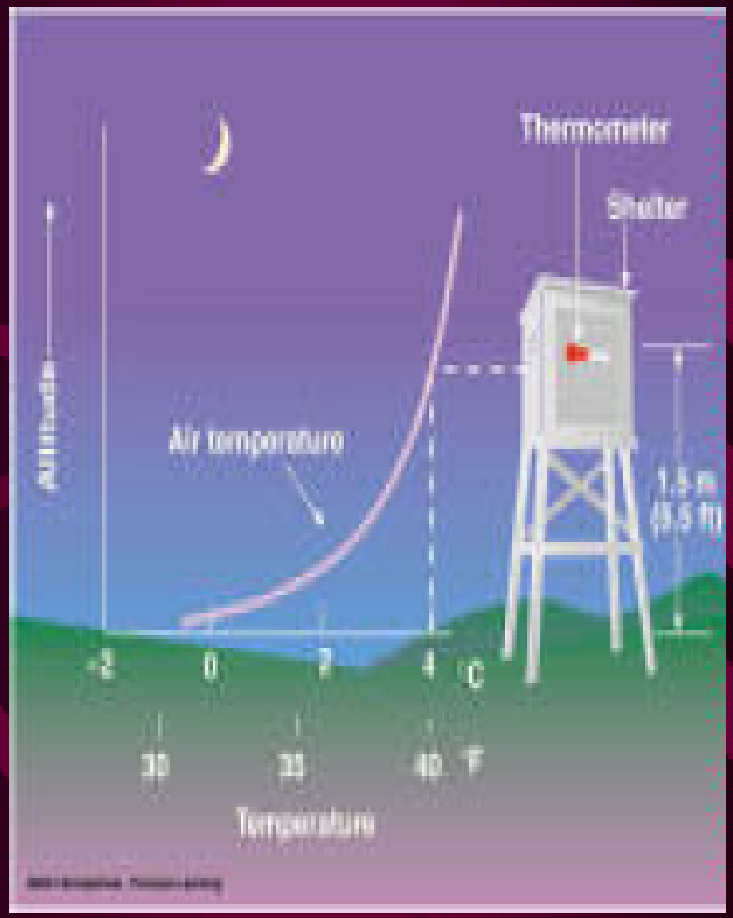
Cold surface air produces a stable atmosphere that inhibits vertical motions – fog & haze are kept close to the ground

Radiation fog nestled in a valley

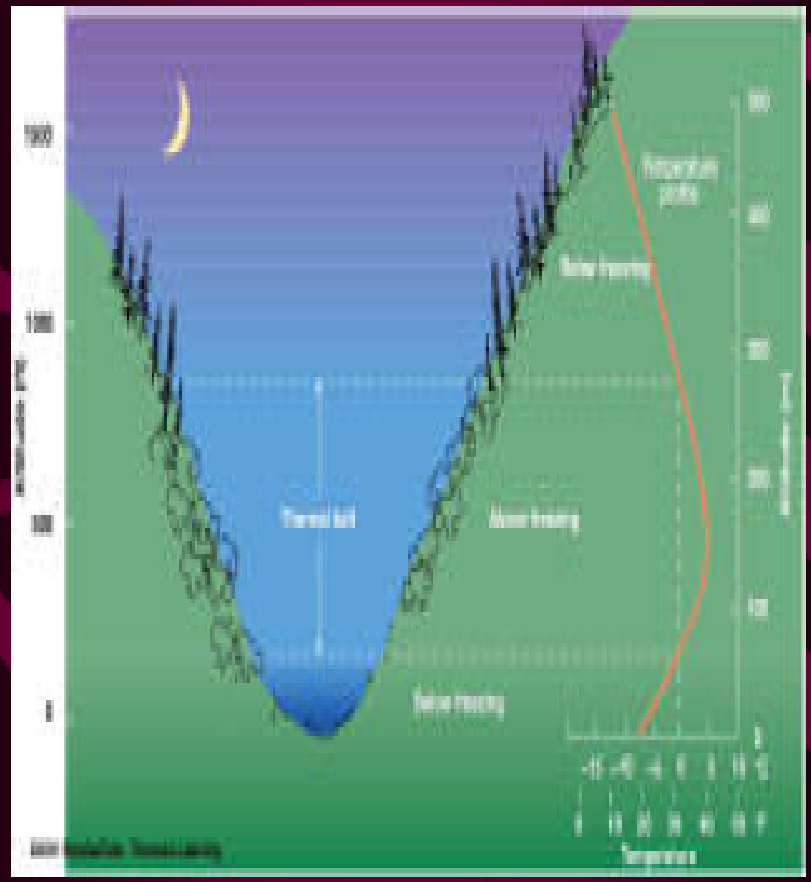
Orchard Heaters circulate air by convection

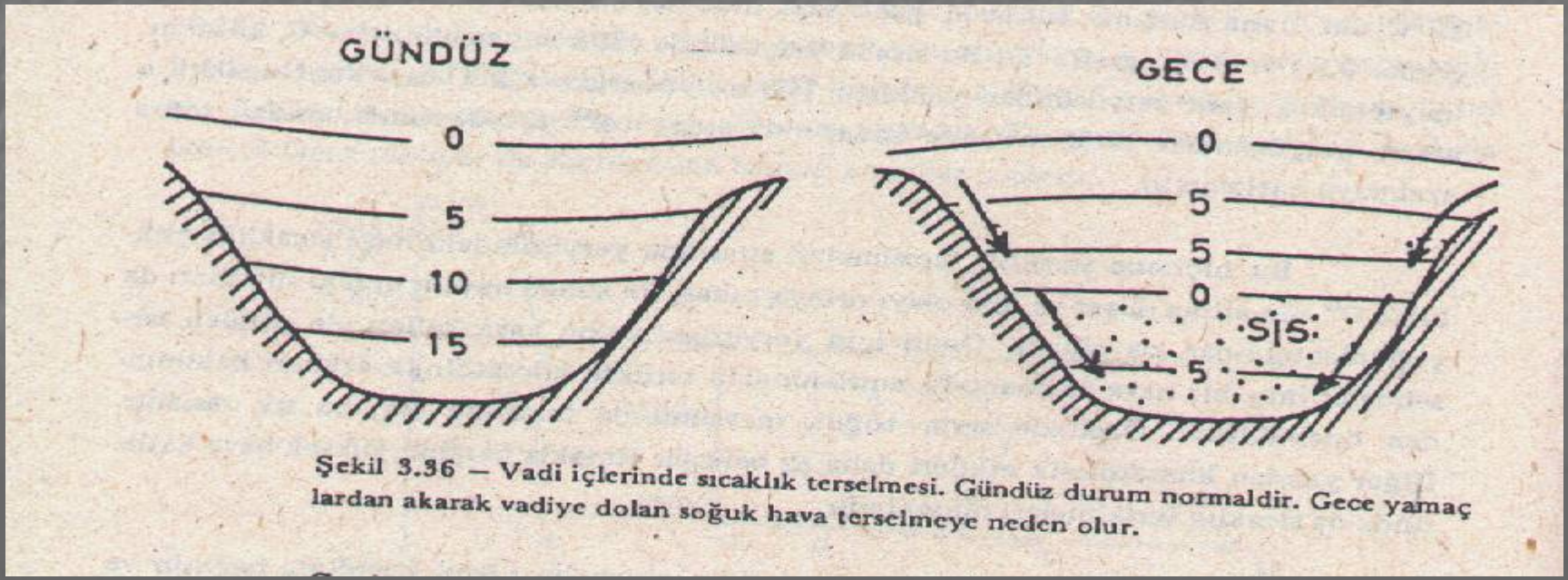
Wind machines mix cooler surface air with warmer air above

Radiation temp inversion- increase in air temp with increasing height



Temperature profile in a hill-valley region





Şekil 3.36 — Vadi içlerinde sıcaklık terselmesi. Gündüz durum normaldir. Gece yamaçlardan akarak vadiye dolan soğuk hava terselmeye neden olur.

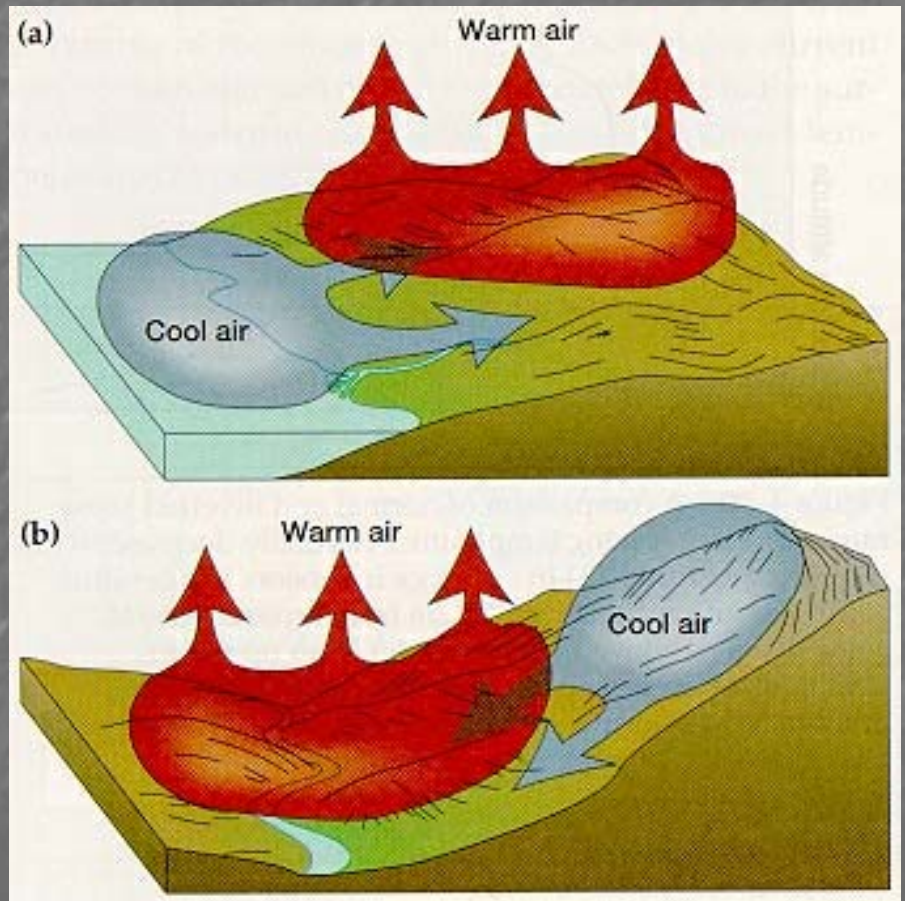
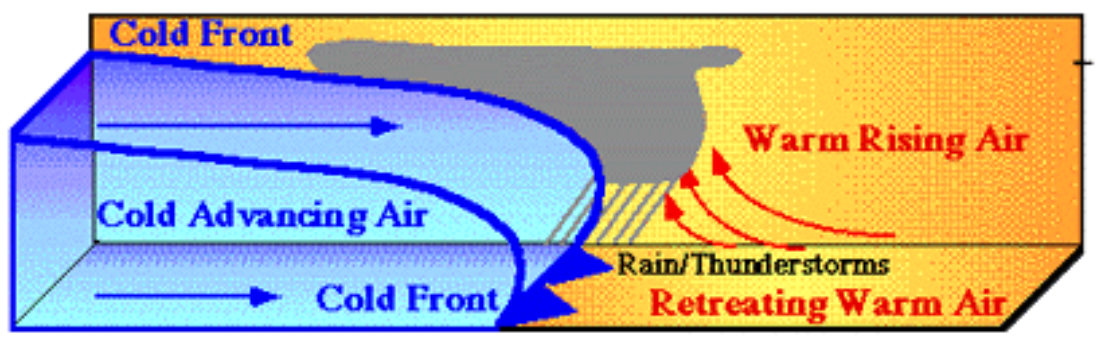
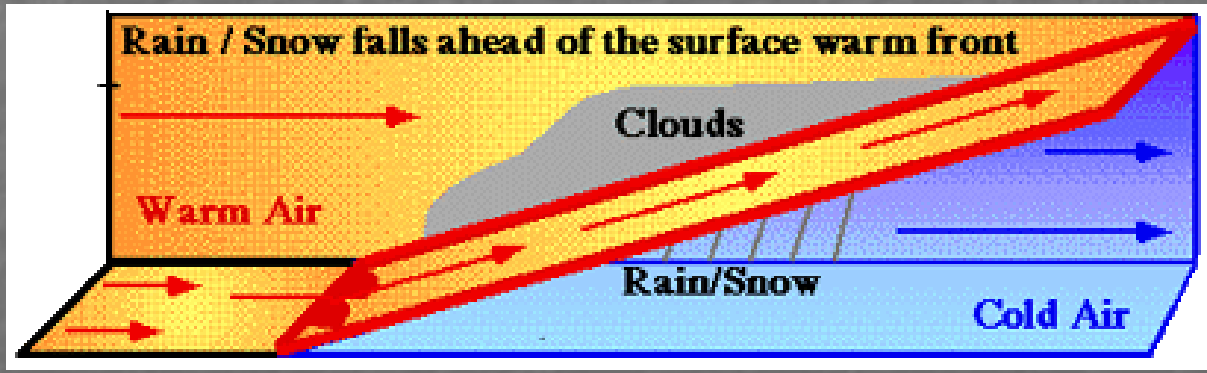


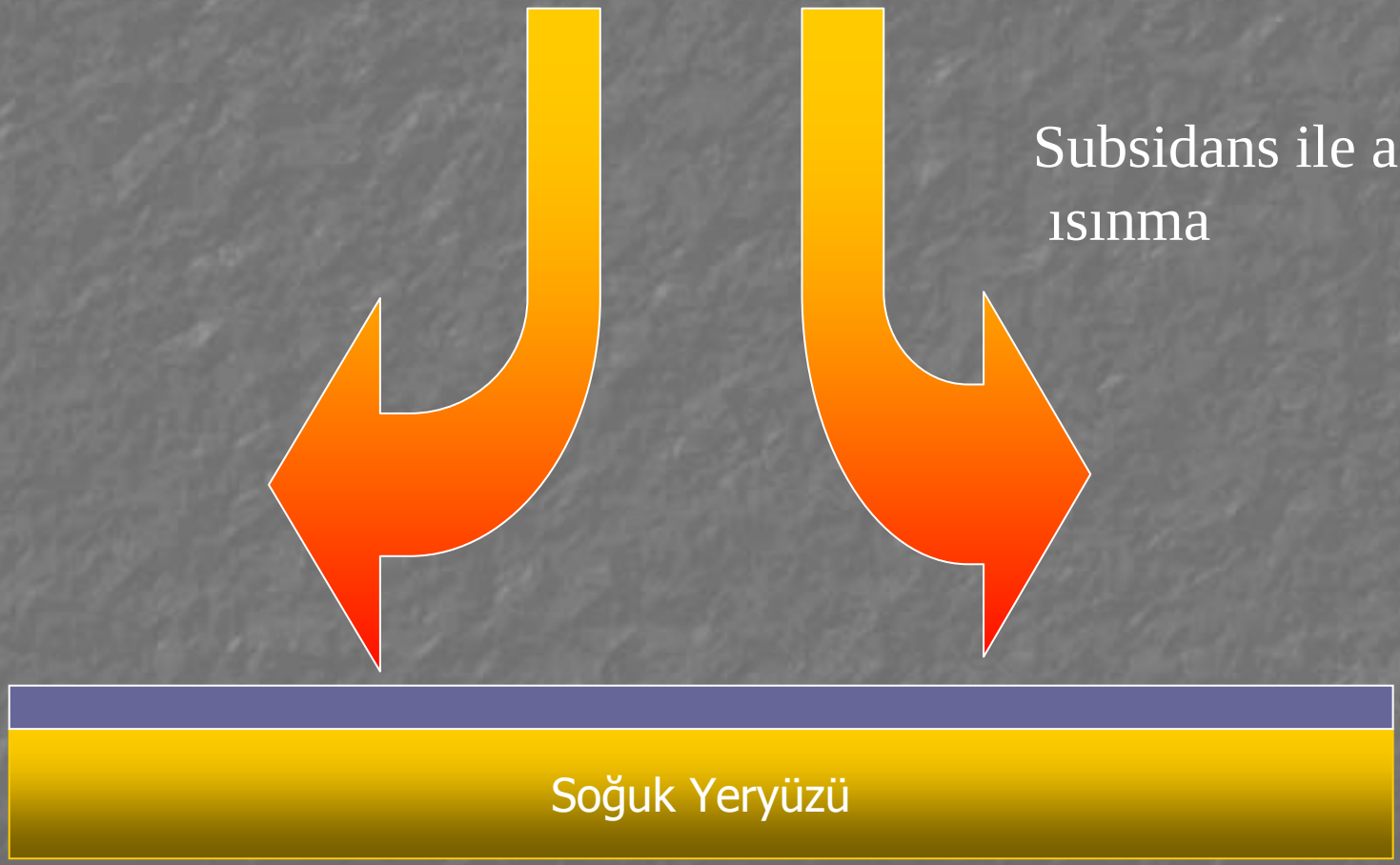
Figure 4-31 (a) Formation of an advectional inversion. (b) Formation of a cold-air-drainage inversion.

Cephesel terselme

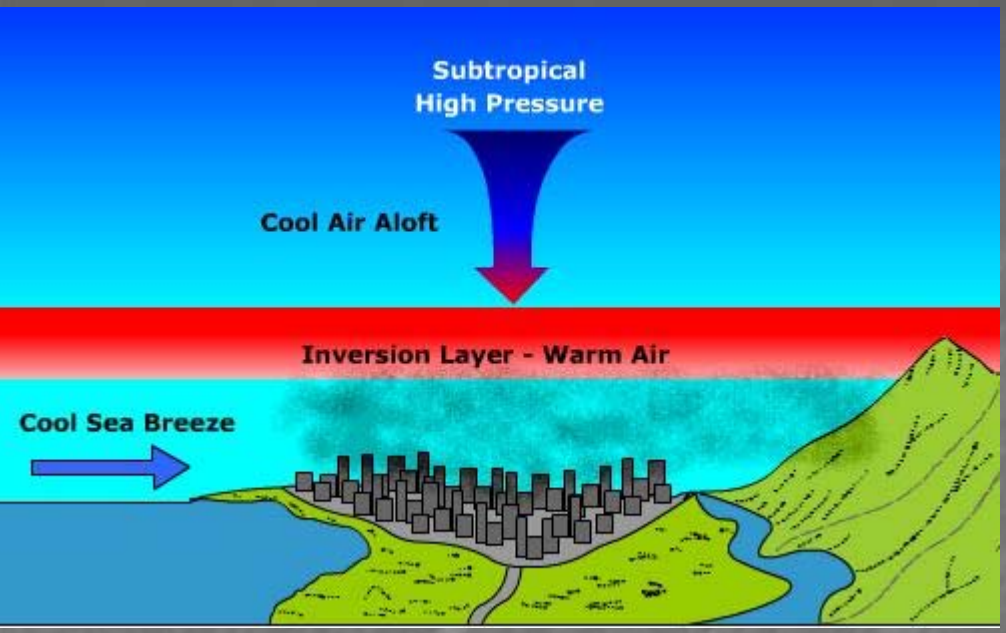




Subsidans terselme



Subsidans ile adyabatik
ısınma



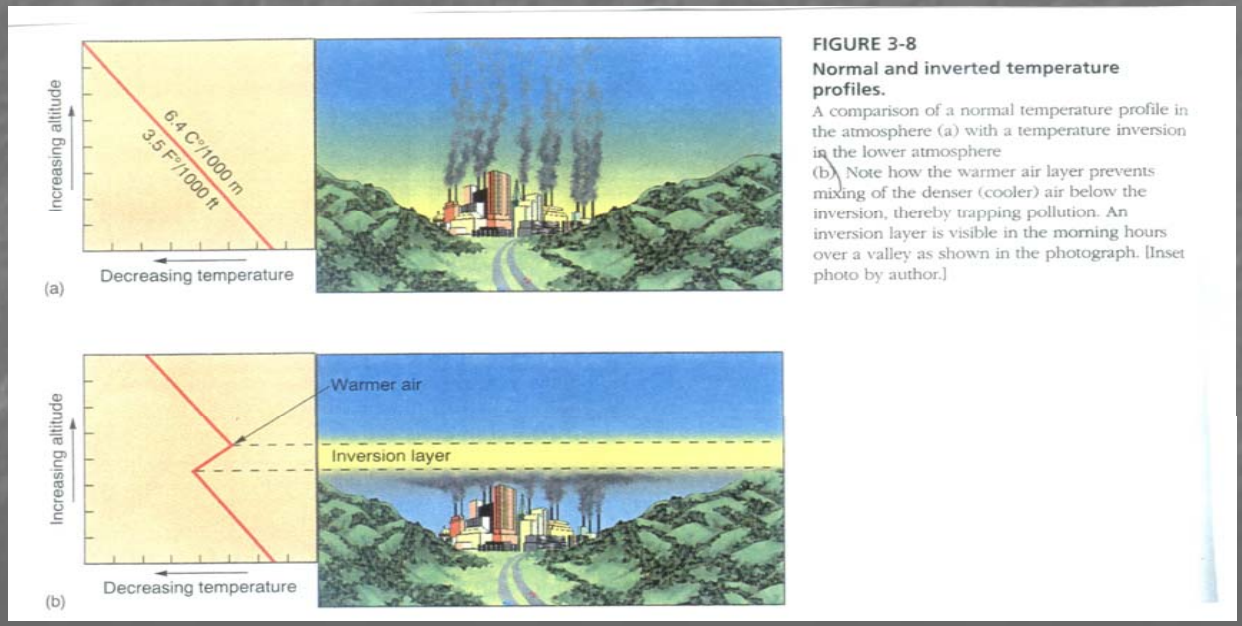
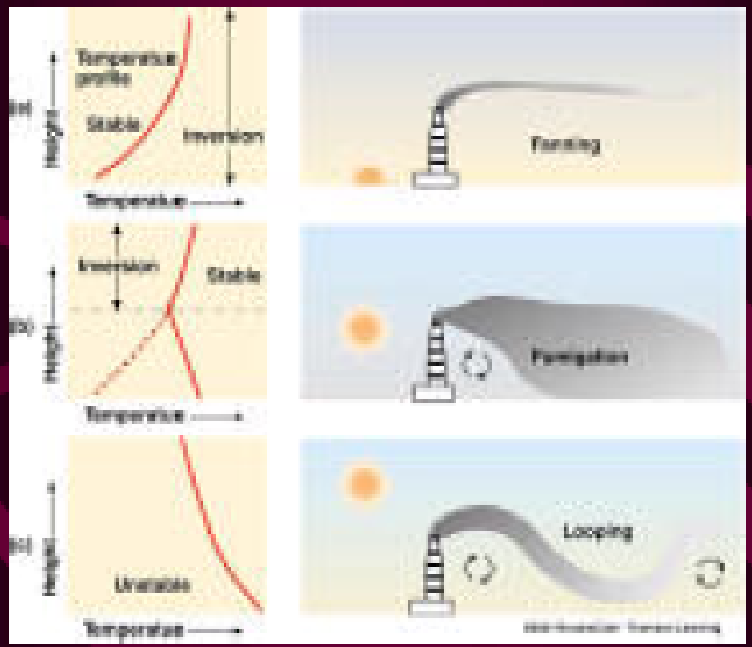


FIGURE 3-8
Normal and inverted temperature profiles.
A comparison of a normal temperature profile in the atmosphere (a) with a temperature inversion in the lower atmosphere (b). Note how the warmer air layer prevents mixing of the denser (cooler) air below the inversion, thereby trapping pollution. An inversion layer is visible in the morning hours over a valley as shown in the photograph. [Inset photo by author.]

As vertical temp profile changes, the pattern of emitted smoke also changes



Inversion layer preventing the escape of pollutants