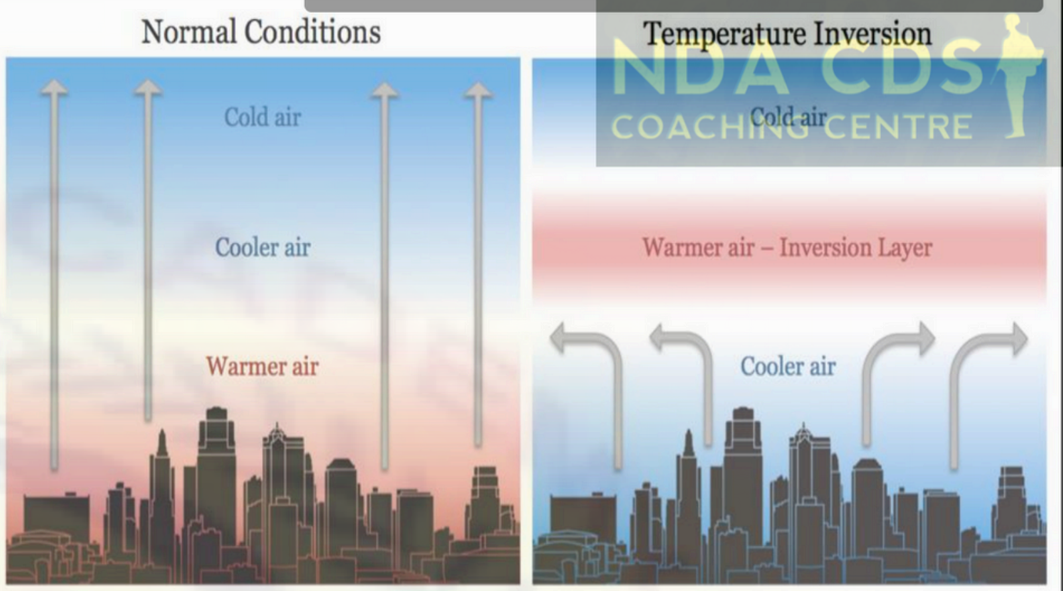
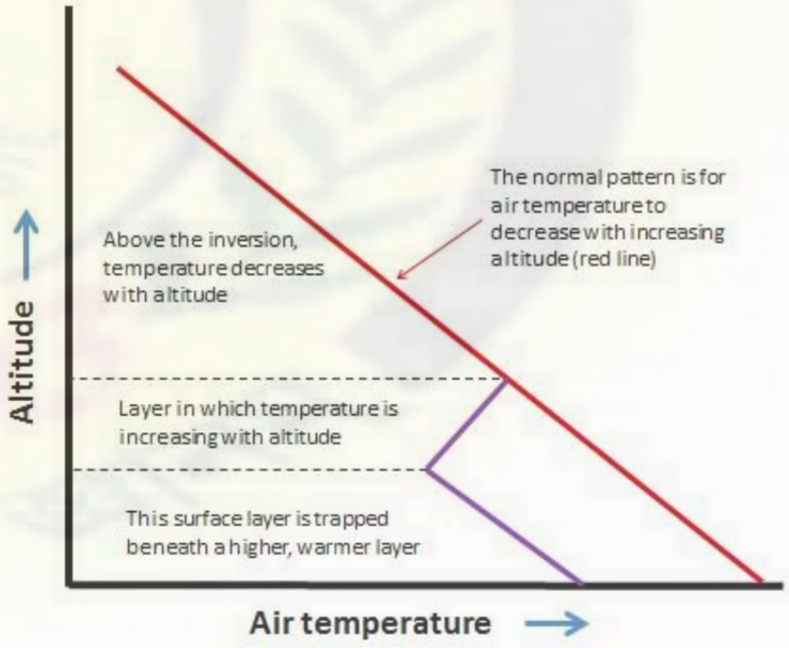
Inversion of Temperature

INVERSION OF TEMPERATURE

- **Temperature inversion**, also called **thermal inversion**, a reversal of the normal behaviour of temperature in the troposphere.
- Normally, temperature decreases with increasing altitude in troposphere at the rate of 6.5^0 C (normal lapse rate).
- At times, the situation is reversed, i.e. warm air lies over cold air and the normal lapse rate is inverted. It is called Inversion of temperature.
- Inversion may occur near the earth's surface or upper troposphere



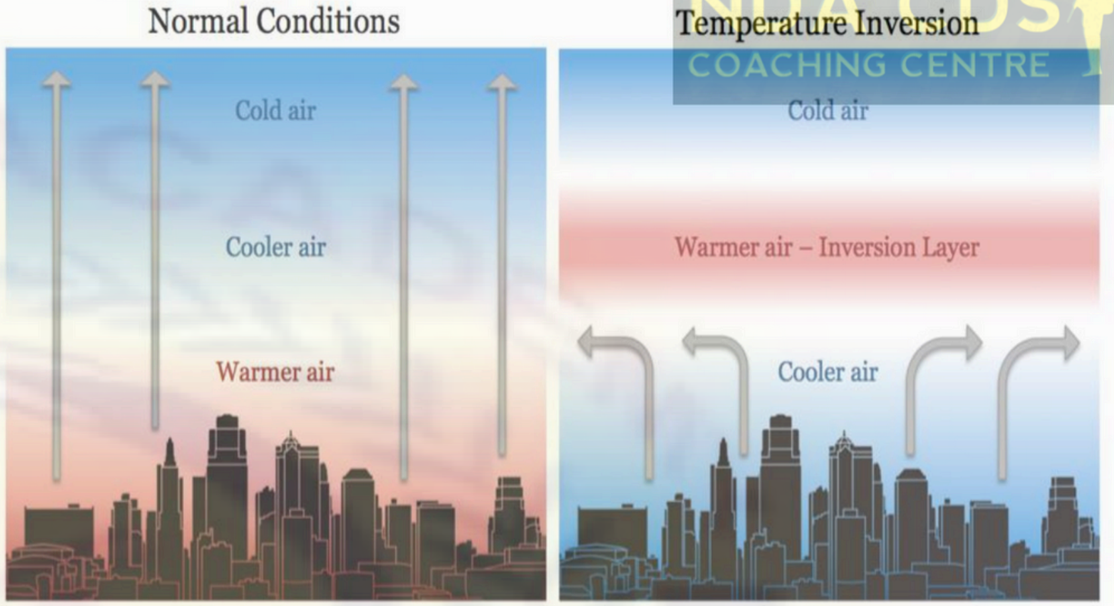


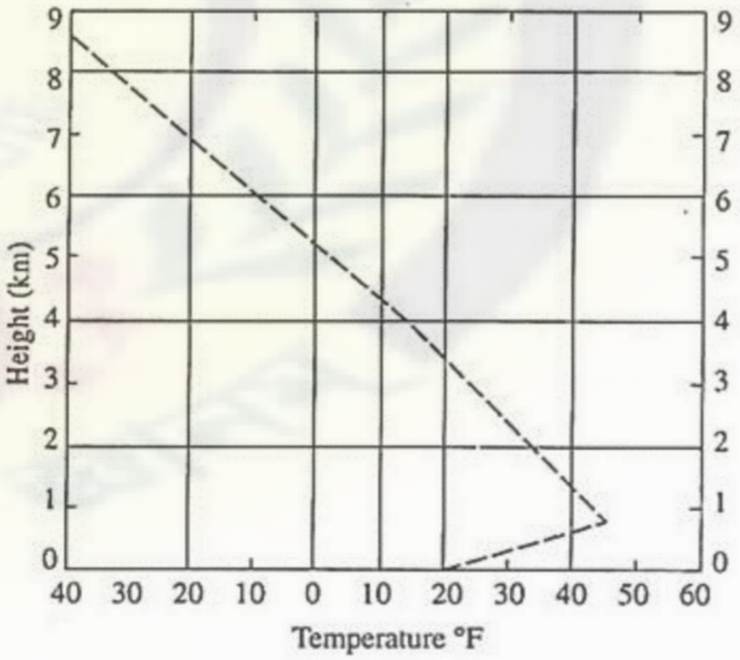
Types of Temperature Inversion

- **Non-Advectional (static) Temperature Inversion**
  - ➢ Ground/Surface/Radiation Inversion
- **Upper Air Inversion:**
  - **Thermal Temperature Inversion (Stratospheric Inversion)**
  - **Mechanical Temperature Inversion**
    - ➢ Subsidence Inversion
    - ➢ Turbulence & Convective Inversion
- **Advectional (dynamic) Temperature Inversion**
  - ➢ Frontal or Cyclonic inversion
  - ➢ Valley Inversion

Ground Inversion

- Occurs near Earth's surface due to radiation mechanism.
- Develops when air is cooled by contact with a colder surface until it becomes cooler than the overlying atmosphere;
- This occurs most often on clear nights, when the ground cools off rapidly by radiation (excessive nocturnal cooling).
- Common during winters in mid & higher latitudes, polar regions and tropical deserts.



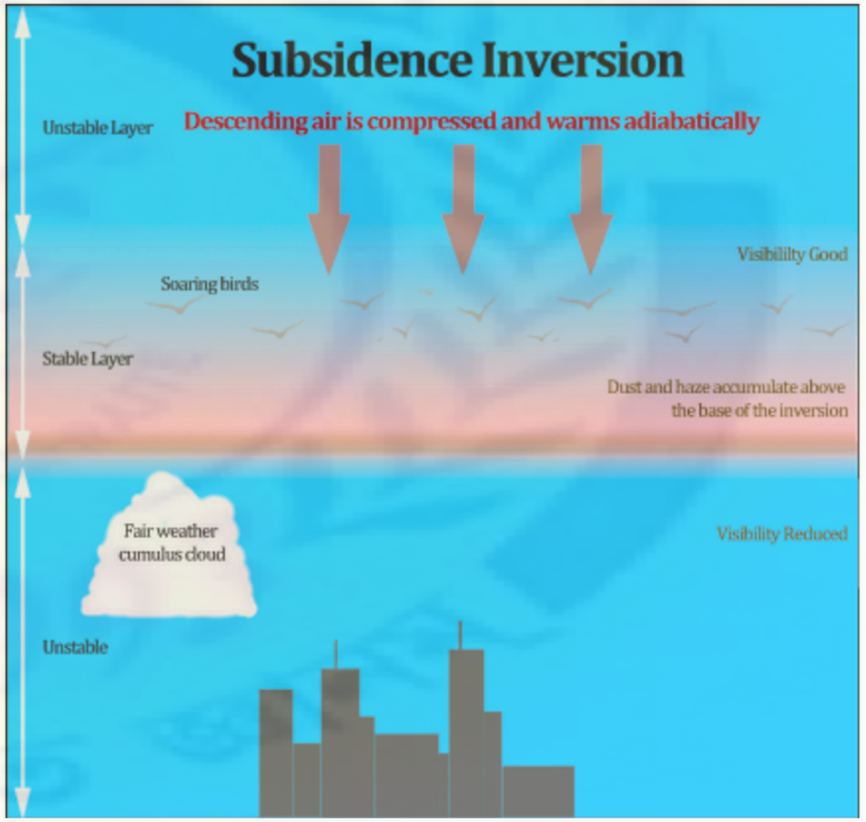


Conditions for Ground Temperature Inversion

- **Long winter night :** enables earth's surface to cool down more (loss of heat by terrestrial radiation during night exceeds heat from insolation)
- **Clear sky:** Clouded sky doesn't let the temperature escape from the ground by acting like a shield.
- **Calm and stable air:** If there is turbulence going on in the air, mixing of heat happens, preventing inversion. Calm and stable air enables the warm air to rise smoothly.
- **Dry air near the ground:** so that it may not absorb much terrestrial radiation

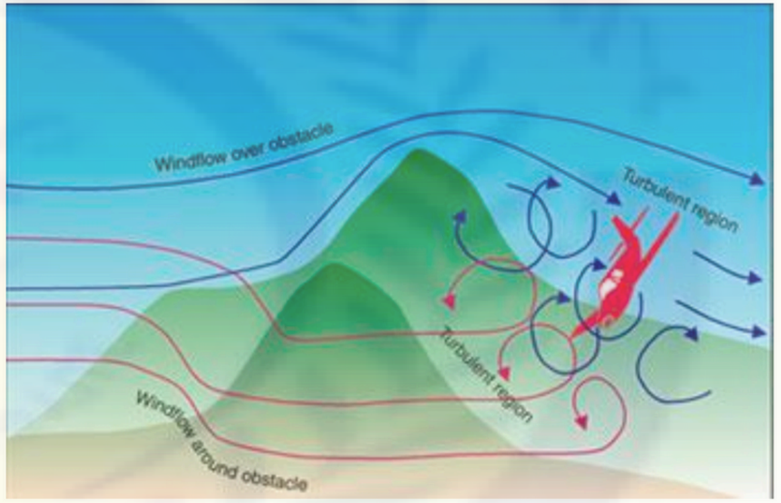
Subsidence Inversion

- When in upper troposphere a widespread layer of air descends.
- The descending layer is compressed and adiabatically heated by the increase in atmospheric pressure (dry adiabatic rate of 9.8^0 C/ km.)
- Thus, causing lying of warm air above cold air, producing a temperature inversion.
- Such inversions are common over middle latitudes, northern continents in winter and over subtropical oceans (high pressure areas) & associated with anticyclone conditions



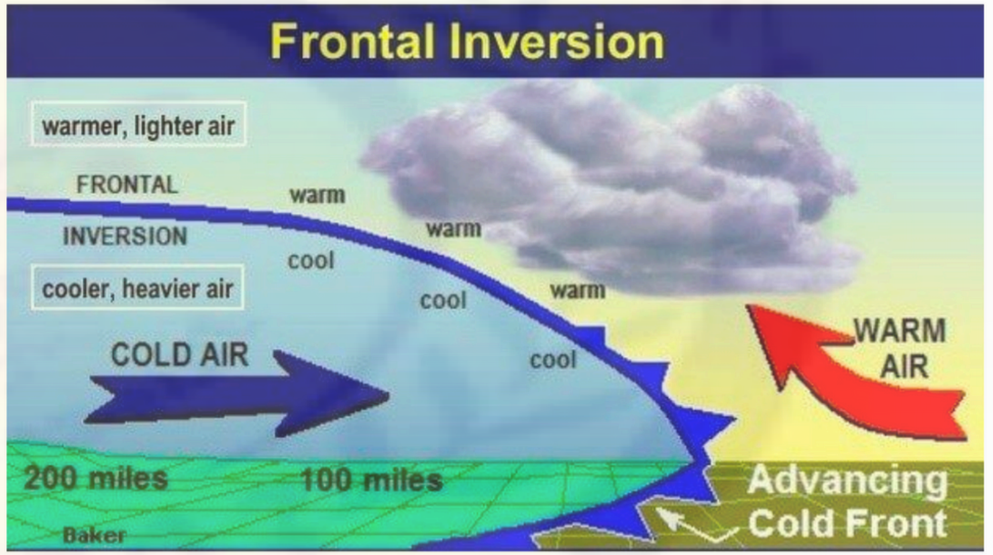
Turbulence Inversion

- Sometimes due to eddies (whirls of winds) formed by frictional forces, warm air is suddenly transported upwards to the zone of cold air
- Warm air being less dense, settle over cold air, causing inversion



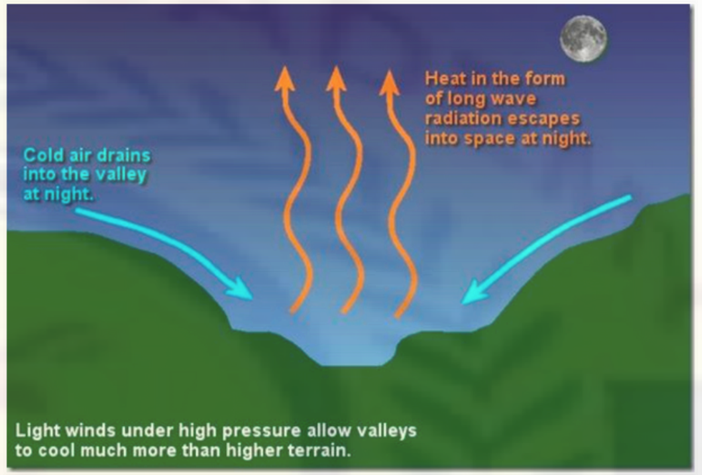
Frontal temperature inversion

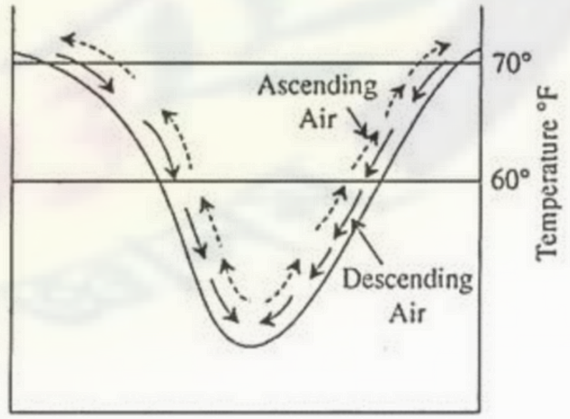
- In this type of inversion there is a convergence of warm and cold air mass.
- The warm air being lighter goes upward and the cool air being heavier sinks down.
- This kind of inversion has a considerable slope, whereas other inversions are nearly horizontal.
- It often happens in temperate zones (convergence of warm westerlies and cold polar winds) and creates temperate cyclones.



Valley Inversion

- Generally occur in mountainous valleys due to radiation.
- During winter nights, the upper surface radiates heat and get cooled.
- The air become denser and descends downhill into the valley under the influence of gravity to pile up in pockets and valley bottoms with warm air above.
- This is also called air drainage.





Effects of Temperature Inversion

- **Fog formation –** Foggy condition is created near the ground because the water vapour is trapped.
- **Less Visibility** – due to accumulation of smoke, dust particles & fog (air is cooler) beneath the inversion layer
- **Health Hazards** – trapping of smog (smoke + fog)
- **Frost -** Inversion of temperature causes frost when the condensation of warm air due to its cooling by cold air below occurs at temperature below freezing point.
- **Dry Conditions** - Inversion of temperature causes atmospheric stability (no movements of air). This discourages rainfall and favours dry condition.