

TEMPERATURE INVERSIONS

Normal Conditions

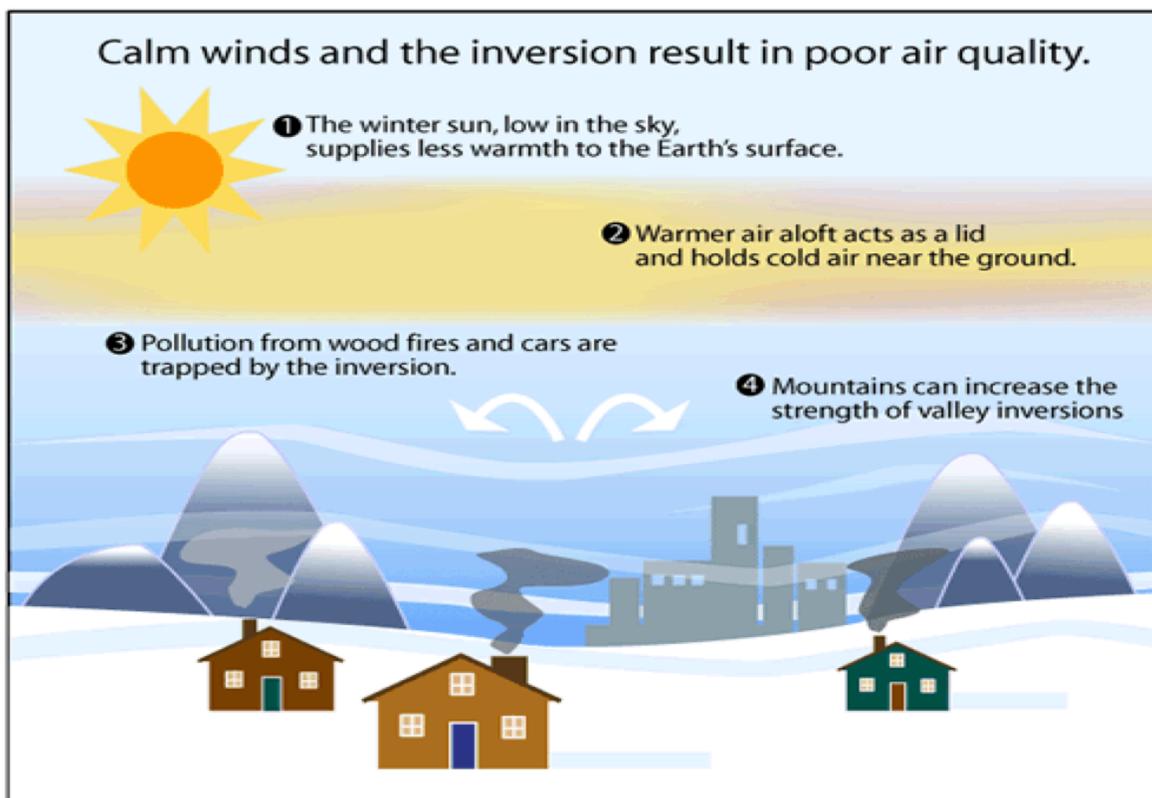
- * Atmosphere is cooler the higher up in altitude you go.
- * Most of the sun's energy is converted to heat at the ground level, warms air at the surface.
- * Warm air rises in the atmosphere, where it expands and cools.

Temperature Inversion Conditions

- * Air temperature actually increases with height.
- * Warm air ends up on top of cooler air (the temperature profile of the atmosphere is "inverted")

Types of Temperature Inversions

- * Surface inversions that occur near the Earth's surface (most important in the study of air quality)
- * Aloft inversions that occur above the ground



Formation of surface temperature inversions?

A strong inversion implies a substantial temperature difference exists between the cool surface air and the warmer air aloft.

*Cooling of the air near the ground at night.

*Sun goes down --->

ground loses heat very quickly --->

air in contact with the ground cools.

*Air just above the surface remains warm.

Conditions ---->

*Calm winds - prevent warmer air above the surface from mixing down to the ground

*Clear skies - increase the rate of cooling at the Earth's surface.

*Long nights - allow for the cooling of the ground to continue over a longer period of time, resulting in a greater temperature decrease at the surface

Additional Conditions---->

Wintertime - longer nights during the summertime, surface inversions are stronger and more common during the winter months

Daylight hours - surface inversions normally weaken and disappear as the sun warms the Earth's surface

Meteorological - strong high pressure over the area, these inversions can persist as long as several days

Topographical -can enhance the formation of inversions, especially in valley locations

How do inversions impact air quality?

- *Warm air above cooler air acts like a lid, suppressing vertical mixing and trapping the cooler air at the surface.
- *Pollutants from vehicles, fireplaces, and industry are emitted into the air, the inversion traps these pollutants near the ground, leading to poor air quality.

AQI

- *Strength and duration of the inversion will control AQI levels near the ground.
- *Strong inversion will confine pollutants to a shallow vertical layer, leading to very poor AQI levels.
- *Weak inversion will lead to some problems with AQI levels.

RESIDENTIAL WOOD BURNING

- *Large contributor to poor air quality during the winter
- *Wood smoke contains much higher amounts of particulate pollution than smoke from oil- or gas-fired furnaces.
- *Some areas of the country, local governments issue burn bans to curtail the use of woodstoves and fireplaces under certain weather and pollution conditions during the winter.