

# NOAA - LAYERS OF THE ATMOSPHERE

<http://www.srh.noaa.gov/srh/jetstream/atmos/layers.htm>  
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The envelope of gas surrounding the Earth changes from the ground up. Five distinct layers have been identified using: thermal characteristics (temperature changes), Chemical composition, Movement, and Density. Each of the layers are bounded by "pauses" where the greatest changes in thermal characteristics, chemical composition, movement, and density occur.

## TROPOSPHERE

The troposphere begins at the Earth's surface and extends from 4 to 12 miles (6 to 20 km) high. This is the layer of the atmosphere in which we live. The height of the troposphere varies from the equator to the poles. At the equator it is around 11-12 miles (18-20 km) high, at 50°N and 50°S, 5½ miles and at the poles just under four miles high. As the density of the gases in this layer decrease with height, the air becomes thinner. Therefore, the temperature in the troposphere also decreases with height in response. As one climbs higher, the temperature drops from an average around 62°F (17°C) to -60°F (-51°C) at the top of the troposphere. Almost all weather occurs in this region. The transition boundary between the troposphere and the layer above is called the tropopause. Together the tropopause and the troposphere are known as the lower atmosphere.

## STRATOSPHERE

The Stratosphere extends from the top of the troposphere up to around 31 miles (50 km) above the Earth's surface. This layer holds 19 percent of the atmosphere's gases but very little water vapor. In this region the temperature increases with height. Heat is produced in the process of the formation of Ozone and this heat is responsible for temperature increases from an average -60°F (-51°C) at tropopause to a maximum of about 5°F (-15°C) at the top of the stratosphere. This increase in temperature with height means warmer air is located above cooler air. This prevents "convection" since there is no upward vertical movement of the gases and is the reason for the 'anvil-shaped' tops of cumulonimbus clouds. These anvils occur at the tropopause. The transition boundary which separates the stratosphere from the mesosphere is called the stratopause.

## MESOSPHERE

The mesosphere extends from the top of the stratosphere to about 56 miles (90 km) above the earth. The gases, including the oxygen molecules, continue to become thinner and thinner with height. As such, the effect of the warming by ultraviolet radiation also becomes less and less leading to a decrease in temperature with height. On average, temperature decreases from about 5°F (-15°C) to as low as -184°F (-120°C) at the mesopause. However, the gases in the mesosphere are still thick enough to slow down meteors hurtling into the atmosphere, where they burn up, leaving fiery trails in the night sky. Both the stratosphere and the mesosphere are considered the middle atmosphere. Average temperature profile for the lower layers of the atmosphere - click to enlarge. The transition boundary which separates the mesosphere from the thermosphere is called the mesopause.

## THERMOSPHERE

Above the mesosphere the thermosphere extends up to near 375 miles (600 km) above the earth. This layer is known as the upper atmosphere. The gases of the thermosphere are increasingly thinner than in the mesosphere. As such, incoming high energy ultraviolet and x-ray radiation from the sun, absorbed by the molecules in this layer, causes a large temperature increase. Because of this absorption, the temperature increases with height and can reach as high as 3,600°F (2,000°C) near the top of this layer; however, despite the high temperature, this layer of the atmosphere would still feel very cold to our skin because of the extremely thin air. The total amount of energy from the very few molecules in this layer is not enough to heat our skin.

## EXOSPHERE

The Exosphere is the outermost layer of the atmosphere. It extends from the top of the thermosphere to 6,200 miles (10,000 km) above the earth. In this layer, atoms and molecules escape into space and satellites orbit the earth.

