

Layers of Earth's Atmosphere

Earth's atmosphere has a series of layers, each with its own specific traits. Moving upward from ground level, these layers are named the troposphere, stratosphere, mesosphere, thermosphere and exosphere. The exosphere gradually fades away into the realm of interplanetary space.

Troposphere

The **troposphere** is the lowest layer of our atmosphere. Starting at ground level, it extends upward to about 10 km (6.2 miles or about 33,000 feet) above sea level. We humans live in the troposphere, and nearly all weather occurs in this lowest layer. Most clouds appear here, mainly because 99% of the water vapor in the atmosphere is found in the troposphere. Air pressure drops, and temperatures get colder, as you climb higher in the troposphere.

Stratosphere

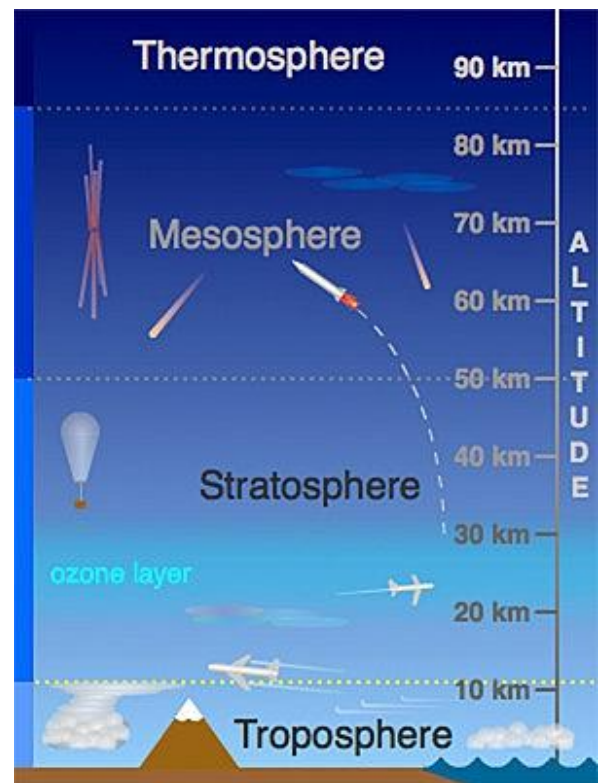
The next layer up is called the **stratosphere**. The stratosphere extends from the top of the troposphere to about 50 km (31 miles) above the ground. The infamous ozone layer is found within the stratosphere. Ozone molecules in this layer absorb high-energy ultraviolet (UV) light from the Sun, converting the UV energy into heat. Unlike the troposphere, the stratosphere actually gets warmer the higher you go! That trend of rising temperatures with altitude means that air in the stratosphere lacks the turbulence and updrafts of the troposphere beneath. Commercial passenger jets fly in the lower stratosphere, partly because this less-turbulent layer provides a smoother ride. The jet stream flows near the border between the troposphere and the stratosphere.

Mesosphere

Above the stratosphere is the **mesosphere**. It extends upward to a height of about 85 km (53 miles) above our planet. Most meteors burn up in the mesosphere. Unlike the stratosphere, temperatures once again grow colder as you rise up through the mesosphere. The coldest temperatures in Earth's atmosphere, about -90°C (-130°F), are found near the top of this layer. The air in the mesosphere is far too thin to breathe; air pressure at the bottom of the layer is well below 1% of the pressure at sea level, and continues dropping as you go higher.

Thermosphere

The layer of very rare air above the mesosphere is called the **thermosphere**. High-energy X-rays and UV radiation from the Sun are absorbed in the thermosphere, raising its temperature to hundreds or at times thousands of degrees. However, the air in this layer is so thin that it would feel freezing cold to us! In many ways, the thermosphere is more like outer space than a part of the atmosphere. Many satellites actually orbit Earth **within** the thermosphere! Variations in the amount of energy coming from the Sun exert a powerful influence



Layers of the atmosphere: troposphere, stratosphere, mesosphere and thermosphere.

Credit: Randy Russell, UCAR

on both the height of the top of this layer and the temperature within it. Because of this, the top of the thermosphere can be found anywhere between 500 and 1,000 km (311 to 621 miles) above the ground. Temperatures in the upper thermosphere can range from about 500° C (932° F) to 2,000° C (3,632° F) or higher. The aurora, the Northern Lights and Southern Lights, occur in the thermosphere.

Exosphere

Although some experts consider the thermosphere to be the uppermost layer of our atmosphere, others consider the **exosphere** to be the actual "final frontier" of Earth's gaseous envelope. As you might imagine, the "air" in the exosphere is very, very, very thin, making this layer even more space-like than the thermosphere. In fact, air in the exosphere is constantly - though very gradually - "leaking" out of Earth's atmosphere into outer space. There is no clear-cut upper boundary where the exosphere finally fades away into space. Different definitions place the top of the exosphere somewhere between 100,000 km (62,000 miles) and 190,000 km (120,000 miles) above the surface of Earth. The latter value is about halfway to the Moon!

Ionosphere

The **ionosphere** is not a distinct layer like the others mentioned above. Instead, the ionosphere is a series of regions in parts of the mesosphere and thermosphere where high-energy radiation from the Sun has knocked electrons loose from their parent atoms and molecules. The electrically charged atoms and molecules that are formed in this way are called ions, giving the ionosphere its name and endowing this region with some special properties.

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