**Introduction to the Atmosphere**

**The atmosphere** is a mixture of different gases, particles and aerosols collectively known as air which envelops the Earth, 99% of the mass of the atmosphere lies below about 25 to 30km altitude, whilst 50% is concentrated in the lowest 5km.

Air is uniform in composition, and that the result of efficient recycling processes and turbulent mixing in the atmosphere. Such recycling and mixing of the air helps to minimize the amount of time which man-made pollution spends in the atmosphere at any location, thereby reducing the environmental impacts. Dry air from [Earth's atmosphere](https://en.wikipedia.org/wiki/Atmosphere_of_Earth) contains 78% nitrogen, 21% oxygen, 0.9% argon, 0.03% carbon dioxide, and traces of hydrogen, helium, and other "noble gases" (neon, helium, krypton, xenon and ozone), but generally a variable amount of water vapor is also present, on average about 1% at sea level. While the atmospheres of the planets [Venus](https://en.wikipedia.org/wiki/Venus) and [Mars](https://en.wikipedia.org/wiki/Mars) are primarily composed of [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide), with small quantities of [nitrogen](https://en.wikipedia.org/wiki/Nitrogen), [argon](https://en.wikipedia.org/wiki/Argon), [oxygen](https://en.wikipedia.org/wiki/Oxygen) and traces of other gases.

The two most abundant gases are nitrogen and oxygen and together they make up over 99% of the lower atmosphere. There is no evidence that the relative levels of these two gases are changing significantly over time.

**Layers of the atmosphere**

The atmosphere is comprised of layers based on temperature. These layers are the troposphere, stratosphere, mesosphere and thermosphere. A further region at about 700 km above the Earth's surface is called the exosphere.

**1- The Troposphere (0-12 km)**

This is the lowest part of the atmosphere - the part we live in. . It extends from Earth's surface to an average height of about 12 km, although this altitude actually varies from about 9 km at the poles to 17 km at the equator. It contains most of our weather - clouds, rain, snow.

In the troposphere, the temperature decreasing higher we go on the earth's surface until it reaches -50°C or -80°C, by about 6.5°C per kilometer because the troposphere is mostly heated through energy transfer from the surface. Thus, the lowest part of the troposphere (i.e. Earth's surface) is typically the warmest region of the troposphere. The actual change of temperature with height varies from day to day, depending on the weather. The troposphere contains about 75% of all of the air in the atmosphere, and almost all of the water vapor (which forms clouds and rain). The decrease in temperature with height is a result of the decreasing pressure. The top of the troposphere is called the tropopause.

**2- The Stratosphere (12-50 km)**

This extends upwards from the tropopause to about 50 km. It contains much of the ozone in the atmosphere. The increase in temperature with height occurs because of absorption of ultraviolet (UV) radiation from the sun by this ozone. Temperatures in the stratosphere are highest over the summer pole, and lowest over the winter pole.

By absorbing dangerous UV radiation, the ozone in the stratosphere protects us from skin cancer and other health damage. However chemicals (called CFCs or freons, and halons) which were once used in refrigerators, spray cans and fire extinguishers  have reduced the amount of ozone in the stratosphere, particularly at polar latitudes, leading to the so-called "Antarctic ozone hole".

Now humans have stopped making most of the harmful CFCs we expect the ozone hole will eventually recover over the 21st century, but this is a slow process. The top of the stratosphere is called the stratopause.

**3- The Mesosphere (50-80 km)**

Directly above the stratosphere, extending from 50 to 80 km above the Earth's surface, the mesosphere is a cold layer where the temperature generally decreases with increasing altitude. Here the temperature again decreases with height, reaching a minimum of about -90°C at the "mesopause". Here in the mesosphere, the atmosphere is very rarefied nevertheless thick enough to slow down meteors hurtling into the atmosphere, where they burn up, leaving fiery trails in the night sky.

**4- The Thermosphere and Ionosphere (80-700 km)**

The thermosphere lies above the mesopause, the thermosphere extends from 80 km above the Earth's surface to outer space. and is a region in which temperatures again increase with height. This temperature increase is caused by the absorption of energetic ultraviolet and X-Ray radiation from the sun.

The region of the atmosphere above about 80 km is also called the "Ionosphere", since the energetic solar radiation knocks electrons off molecules and atoms, turning them into "ions" with a positive charge. The temperature of the thermosphere varies between night and day and between the seasons, as do the numbers of ions and electrons which are present. The ionosphere reflects and absorbs radio waves, allowing us to receive shortwave radio broadcasts in New Zealand from other parts of the world.

**Other layers**

**1- The Exosphere (700-10000 km)**

The exosphere is the outermost layer of Earth's atmosphere.which is located at the top of the thermosphere at an altitude of about 700 km above sea level, to about 10,000 km. This layer is mainly composed of extremely low densities of hydrogen, helium and several heavier molecules including nitrogen, oxygen and carbon dioxide closer to the exobase.

**2- The Magnetosphere**

The earth behaves like a huge magnet. It traps electrons (negative charge) and protons (positive), concentrating them in two bands about 3,000 and 16,000 km above the globe - the Van Allen "radiation" belts. This outer region surrounding the earth, where charged particles spiral along the magnetic field lines, is called the magnetosphere.

