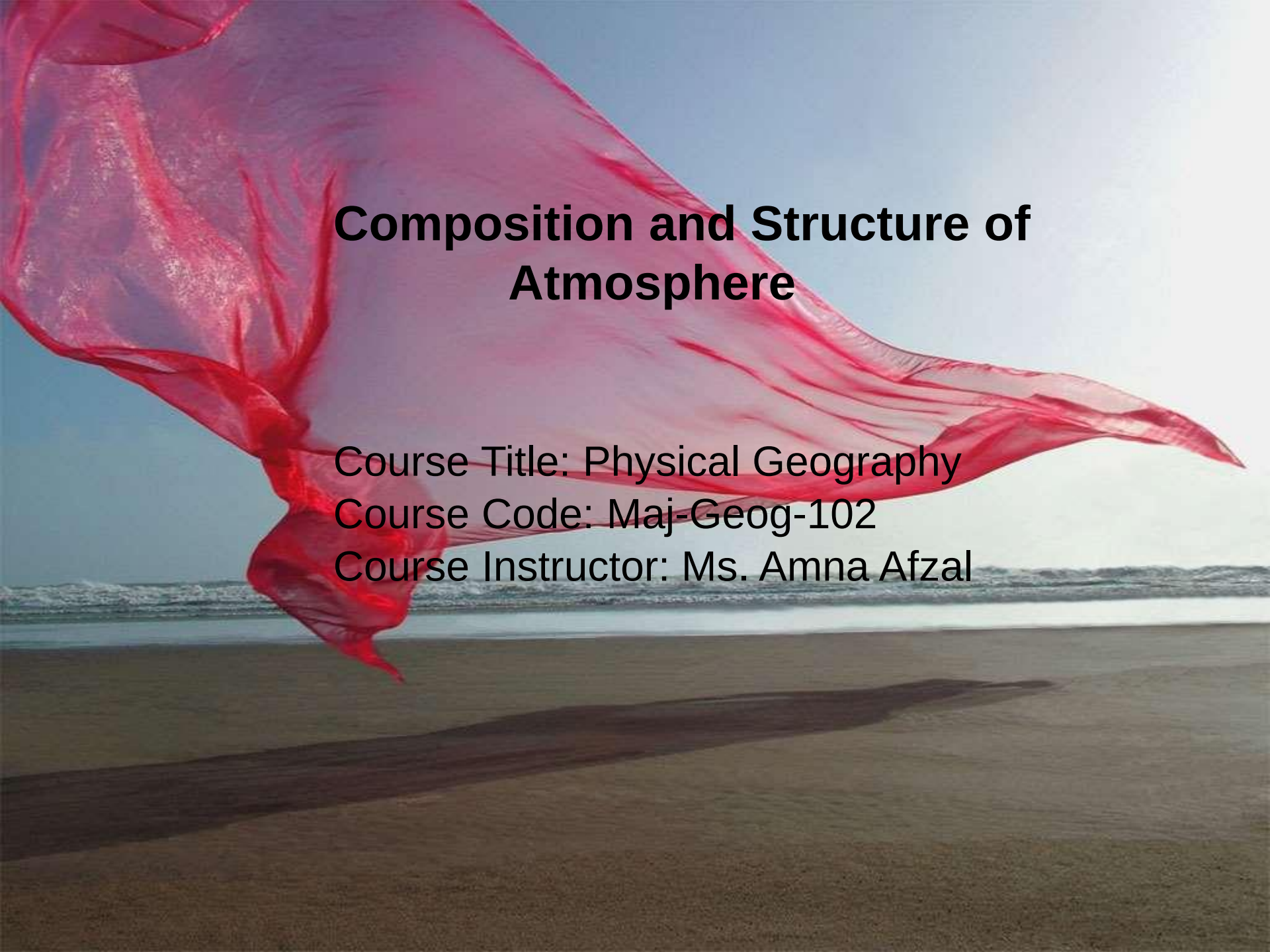


Composition and Structure of Atmosphere

Course Title: Physical Geography
Course Code: Maj-Geog-102
Course Instructor: Ms. Amna Afzal

Composition of Atmosphere

- The atmosphere is composed of gases, water vapour and dust particles. Table 8.1 shows details of various gases in the air, particularly in the lower atmosphere. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

Composition of Atmosphere

Permanent Gases of the Atmosphere

Constituent	% by Volume
• Nitrogen (N_2)	78.08
• Oxygen (O_2)	20.95
• Argon (Ar)	0.93
• Carbon dioxide (CO_2)	0.0325
• Neon (Ne)	0.002

Composition of Atmosphere (Cont.)

Constituent	% by Volume
• Helium (He)	0.0005
• Krypto (Kr)	0.001
• Xenon (Xe)	0.00009
• Hydrogen (H_2)	0.00005

Gases

- Carbon dioxide is meteorologically a very important gas as it is transparent to the incoming solar radiation but opaque to the outgoing terrestrial radiation. It absorbs a part of terrestrial radiation and reflects back some part of it towards the earth's surface. It is largely responsible for the green house effect. The volume of other gases is constant but the volume of carbon dioxide has been rising in the past few decades mainly because of the burning of fossil fuels. This has also increased the temperature of the air. Ozone is another important component of the atmosphere found between 10 and 50 km above the earth's surface and acts as a filter and absorbs the ultra-violet rays radiating from the sun and prevents them from reaching the surface of the earth.

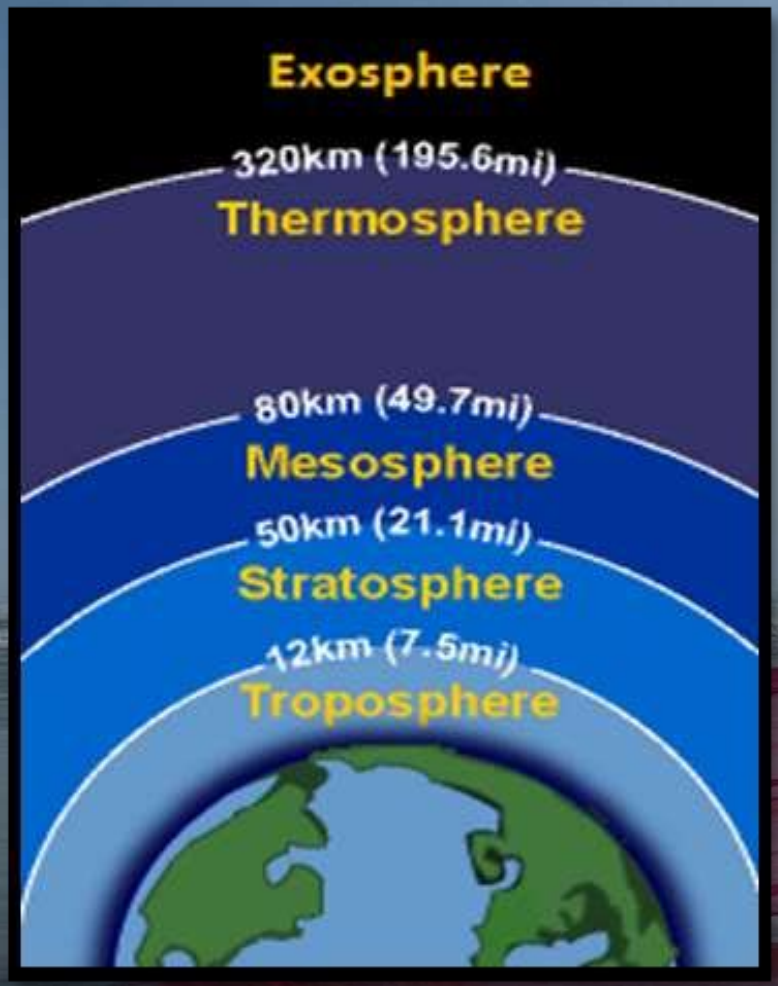
Water Vapour

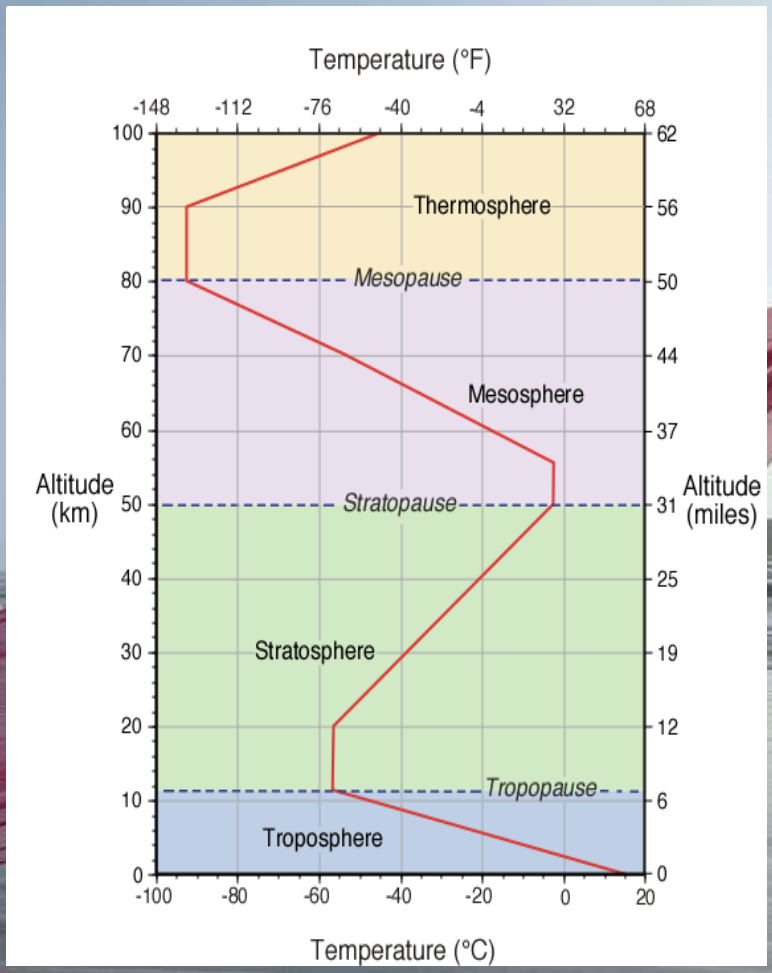
- Water vapour is also a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold areas of desert and polar regions, it may be less than one per cent of the air. Water vapour also decreases from the equator towards the poles. It also absorbs parts of the insolation from the sun and preserves the earth's radiated heat. It thus, acts like a blanket allowing the earth neither to become too cold nor too hot. Water vapour also contributes to the stability and instability in the air.

Dust Particles

- Atmosphere has a sufficient capacity to keep small solid particles, which may originate from different sources and include sea salts, fine soil, smoke-soot, ash, pollen, dust and disintegrated particles of meteors. Dust particles are generally concentrated in the lower layers of the atmosphere; yet, convectional air currents may transport them to great heights. The higher concentration of dust particles is found in subtropical and temperate regions due to dry winds in comparison to equatorial and polar regions. Dust and salt particles act as hygroscopic nuclei around which water vapour condenses to produce clouds.

Structure of the Atmosphere





ere


STRATOSPHERE
Air temperature
increases with height due to sunlight absorption by ozone
5 – 8 miles high
TROPOSPHERE
Air temperature
decreases with height

- TROPOSPHERE

This is the layer of the atmosphere closest to the Earth's surface, extending up to about 10-15 km above the Earth's surface. It contains 75% of the atmosphere's mass. The troposphere is wider at the equator than at the poles. Temperature and pressure drops as you go higher up the troposphere.

The Tropopause: At the very top of the troposphere is the tropopause where the temperature reaches a (stable) minimum. Some scientists call the tropopause a "cold trap" because this is a point where rising water vapor cannot go higher because it changes into ice and is trapped. If there is no cold trap, Earth would loose all its water!

The uneven heating of the regions of the troposphere by the Sun causes convection currents and winds. Warm air from Earth's surface rises and cold air above it rushes in to replace it

Tropopause

- The zone separating the tropsophere from stratosphere is known as the tropopause. The air temperature at the tropopause is about minus 800C over the equator and about minus 45o C over the poles. The temperature here is nearly constant, and hence, it is called the tropopause.

ere


ozone layer
Stratosphere
20 km
15 km
Tropopause
10 km
Troposphere
5 km
ALTITUDE

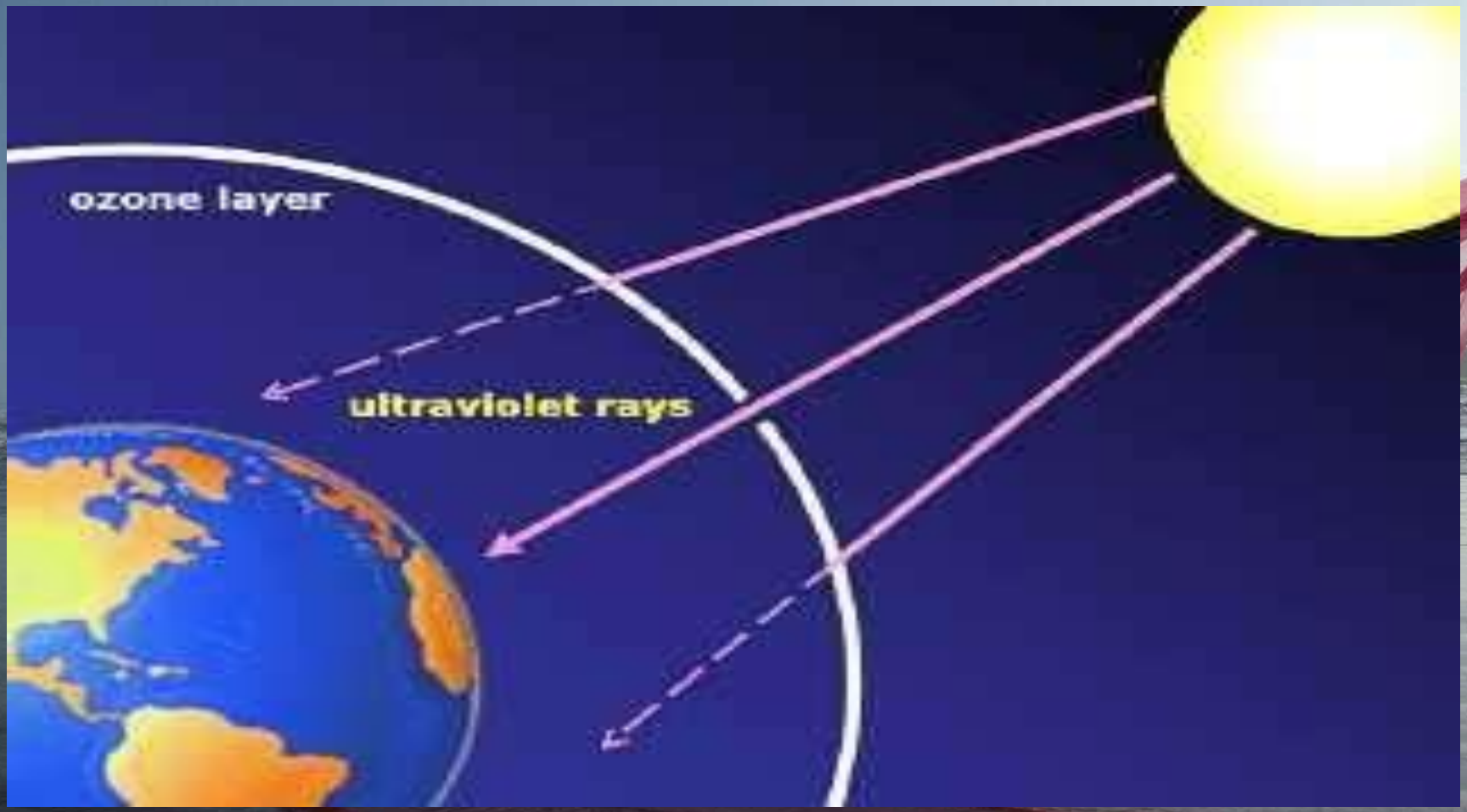
- **STRATOSPHERE**

  This layer lies directly above the troposphere and is about 35 km deep. It extends from about 15 to 50 km above the Earth's surface. The lower portion of the stratosphere has a nearly constant temperature with height but in the upper portion the temperature increases with altitude because of absorption of sunlight by ozone. This temperature increase with altitude is the opposite of the situation in the troposphere.

- **The Ozone Layer**

  The stratosphere contains a thin layer of ozone which absorbs most of the harmful ultraviolet radiation from the Sun. The ozone layer is being depleted, and is getting thinner over Europe, Asia, North American and Antarctica --- "holes" are appearing in the ozone layer.

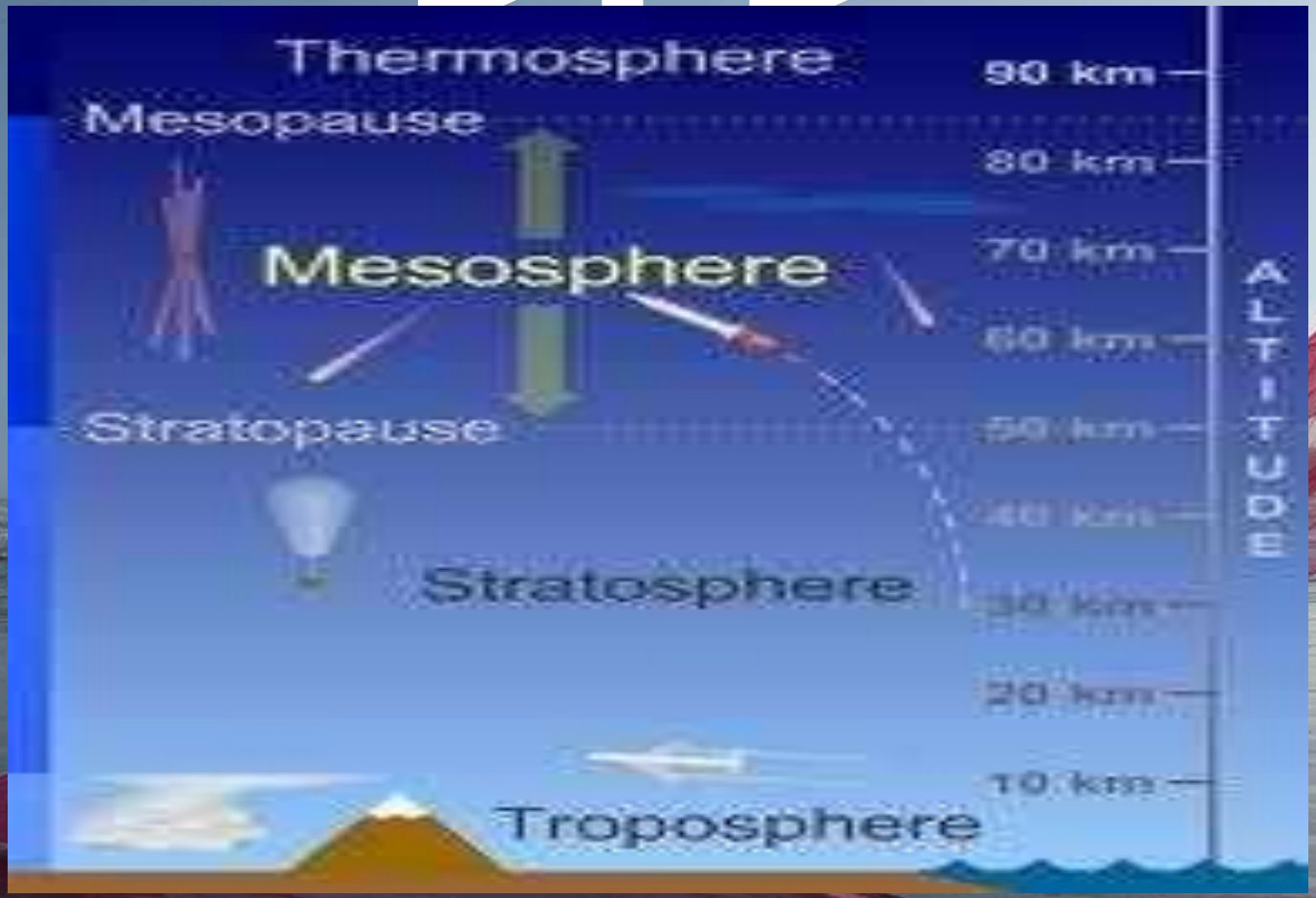
Sunlight crossing the Ozone Layer



Statopause

- The **stratopause** (formerly Mesopeak) is the level of the atmosphere which is the boundary between two layers: the stratosphere and the mesosphere. In the stratosphere the temperature increases with altitude, and the **stratopause** is the region where a maximum in the temperature occurs.

ere


Thermosphere
90 km
Mesopause
80 km
70 km
Mesosphere
60 km
ALTITUDE
Stratopause
50 km
40 km
Stratosphere
30 km
20 km
10 km
Troposphere

- **Mesosphere**

The mesosphere lies above the stratosphere, which extends up to a height of 80 km. In this layer, once again, temperature starts decreasing with the increase in altitude and reaches up to minus 100° C at the height of 80 km.

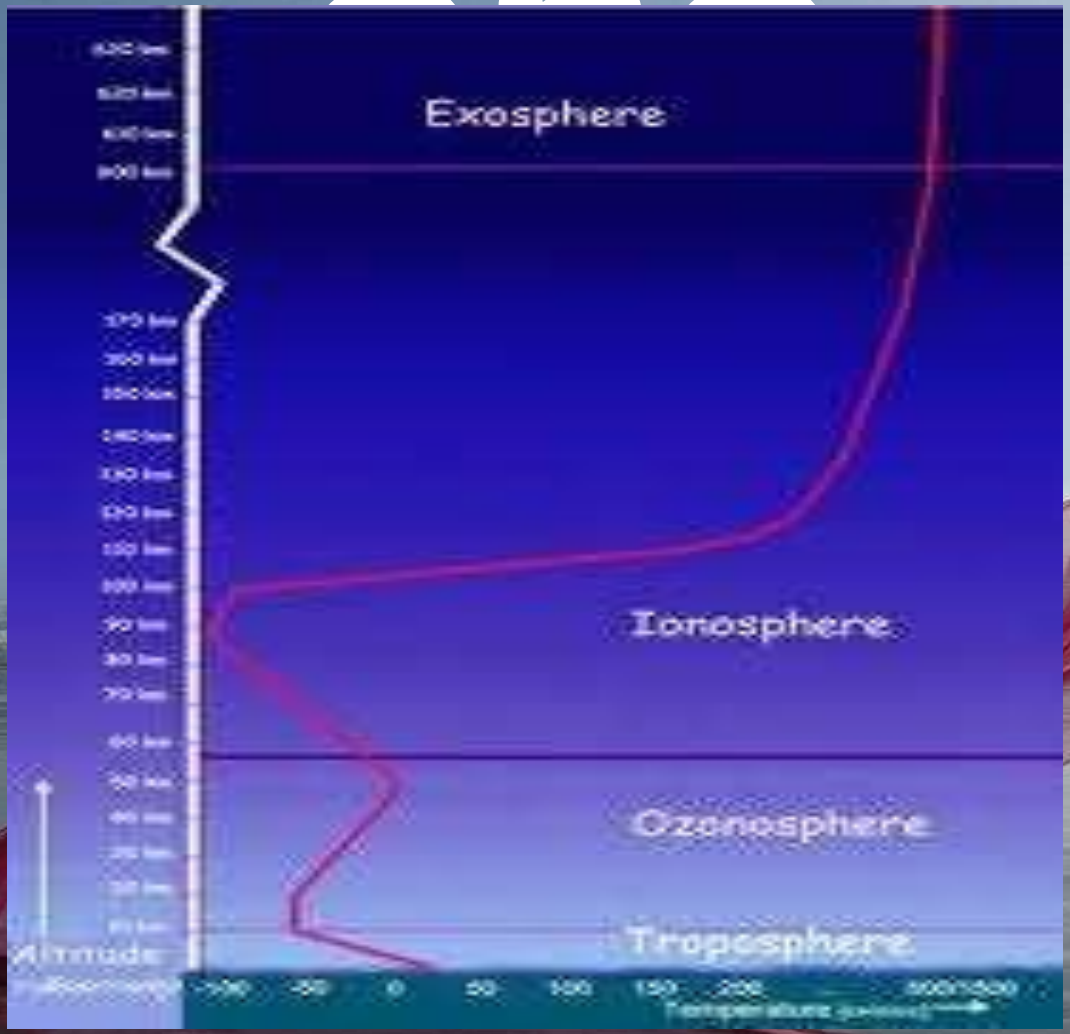

THERMOSPHERE

- **THERMOSPHERE**

  The thermosphere extends from 80 km above the Earth's surface. The thermosphere is the fourth layer of the Earth's atmosphere. It is found above the mesosphere. The air is really thin that high up. The temperature changes with the solar activity. If the sun is active, temperatures in the thermosphere can get up to 1,500°C or higher!

Inosphere

- The ionosphere is located between 80 and 400 km above the mesopause. It contains electrically charged particles known as ions, and hence, it is known as ionosphere. Radio waves transmitted from the earth are reflected back to the earth by this layer. Temperature here starts increasing with height.

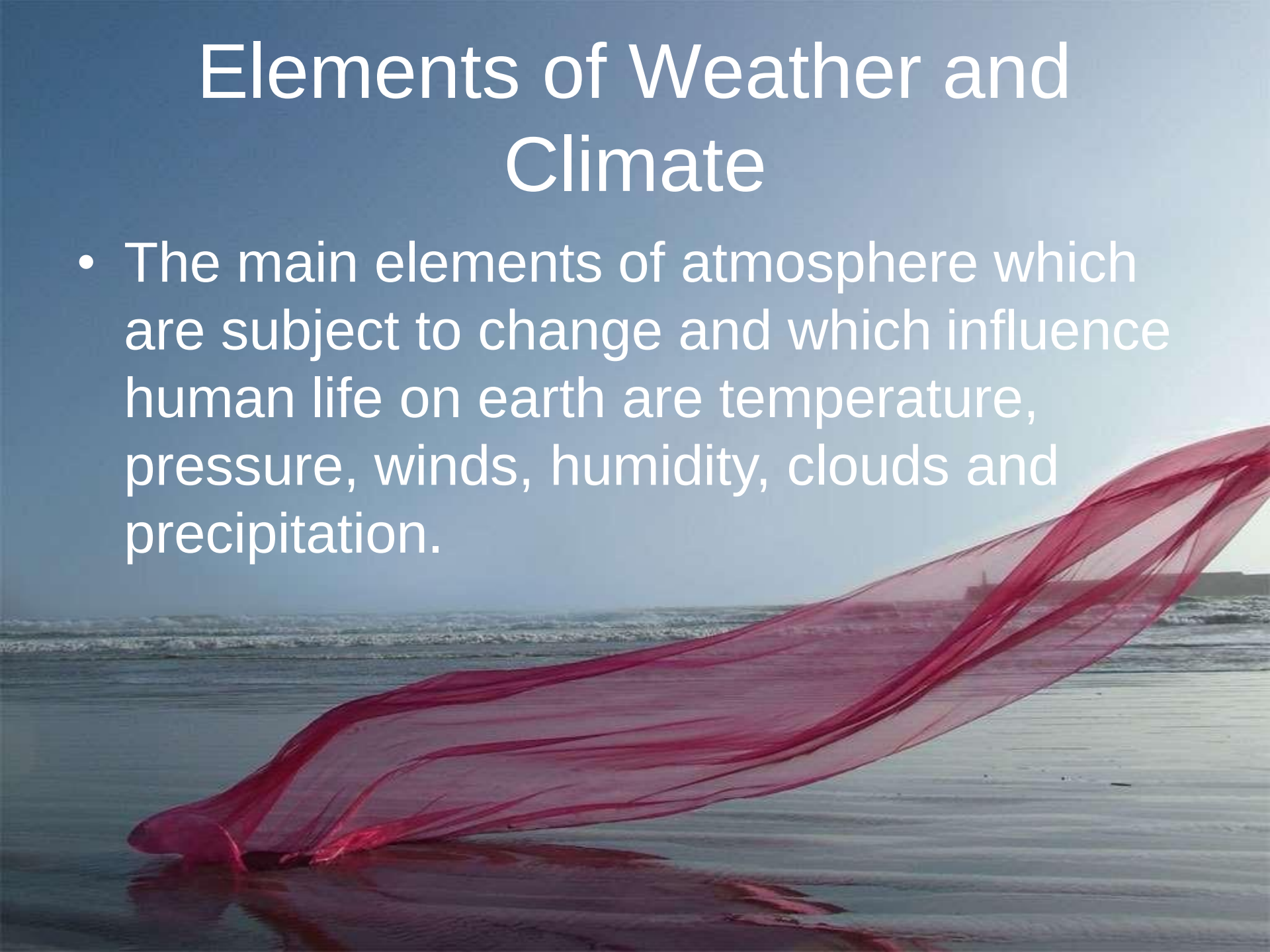

Exosphere
Ionosphere
Ozonosphere
Troposphere

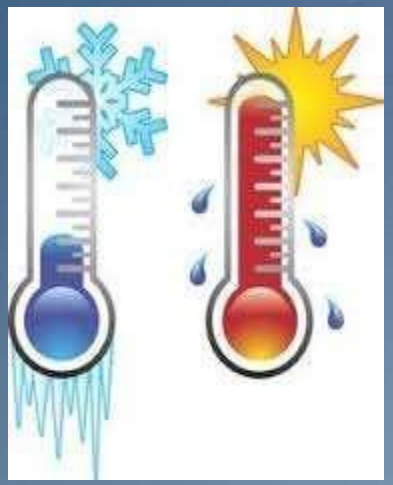
- ***The Exosphere***

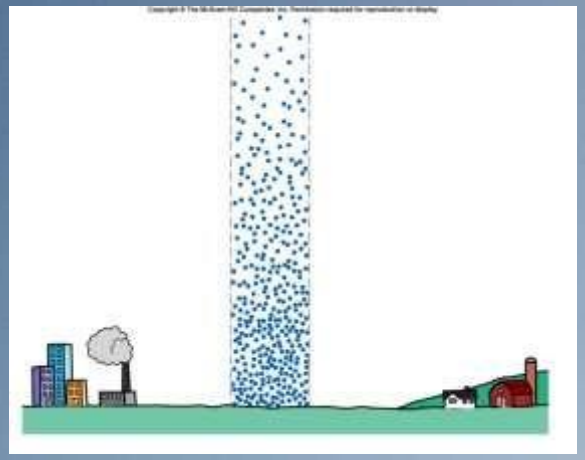
  The **exosphere** is the uppermost layer of Earth's atmosphere. In the exosphere, an upward travelling molecule moving fast enough to attain escape velocity can escape to space with a low chance of collisions; if it is moving below escape velocity it will be prevented from escaping from the celestial body by gravity. In either case, such a molecule is unlikely to collide with another molecule due to the exosphere's low density.

Elements of Weather and Climate

- The main elements of atmosphere which are subject to change and which influence human life on earth are temperature, pressure, winds, humidity, clouds and precipitation.








Forms of precipitation


Thank
You