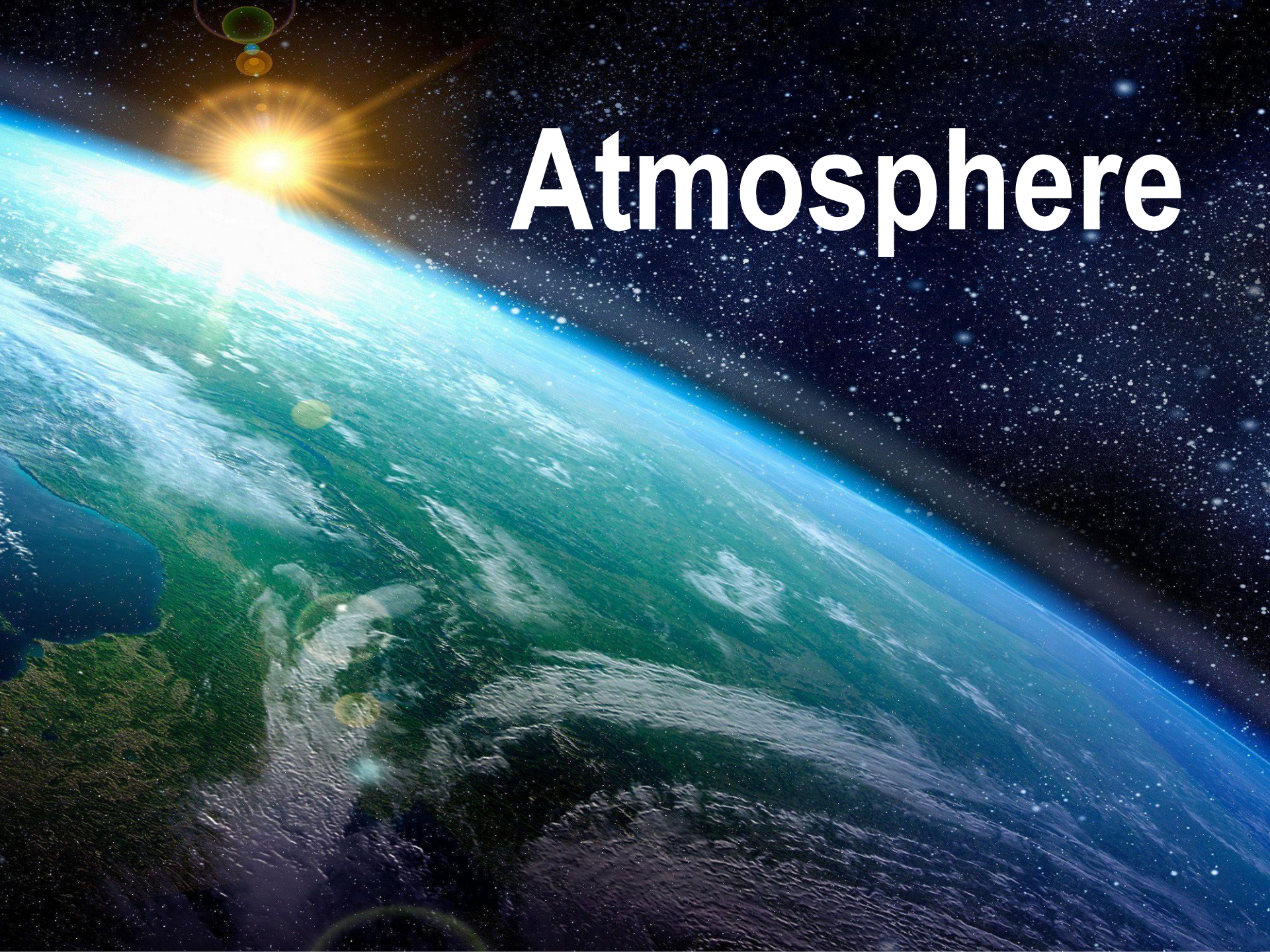


॥ नमस्ते ॥

# Atmosphere



# **ATMOSPHERE**

- **An atmosphere is a layer or a set of layers of gases surrounding a planet or other material body that is held in place by the gravity of that body.**
- **An atmosphere is more likely to be retained if the gravity it is subject to is high and the temperature of the atmosphere is low.**

# ATMOSPHERIC PRESSURE

- Atmospheric pressure at a particular location is the force per unit area perpendicular to a surface determined by the weight of the vertical column of atmosphere above that location.
- On Earth, units of air pressure are based on the internationally recognized standard atmosphere (atm), which is defined as 101.325 kPa (760 Torr or 14.696 psi). It is measured with a barometer

# Standard Atmosphere Conditions

At the sea level condition,

$$T = 288.15 \text{ k},$$

$$P = 1.01325 \times 10^5 \text{ N/m}^2,$$

$$\rho = 1.225 \text{ Kg/m}^3,$$

$$\mu = 1.79 \times 10^{-5} \text{ Kg/ms},$$

At the 11 km altitude,

$$\text{Temperature, } T = 216.66 \text{ k},$$

$$\text{Pressure, } P = 2.2346 \times 10^4 \text{ N/m}^2,$$

$$\text{Density, } \rho = 0.359332 \text{ Kg/m}^3,$$

$$\text{Dynamic viscosity, } \mu = 1.42 \times 10^{-5} \text{ Kg/ms.}$$

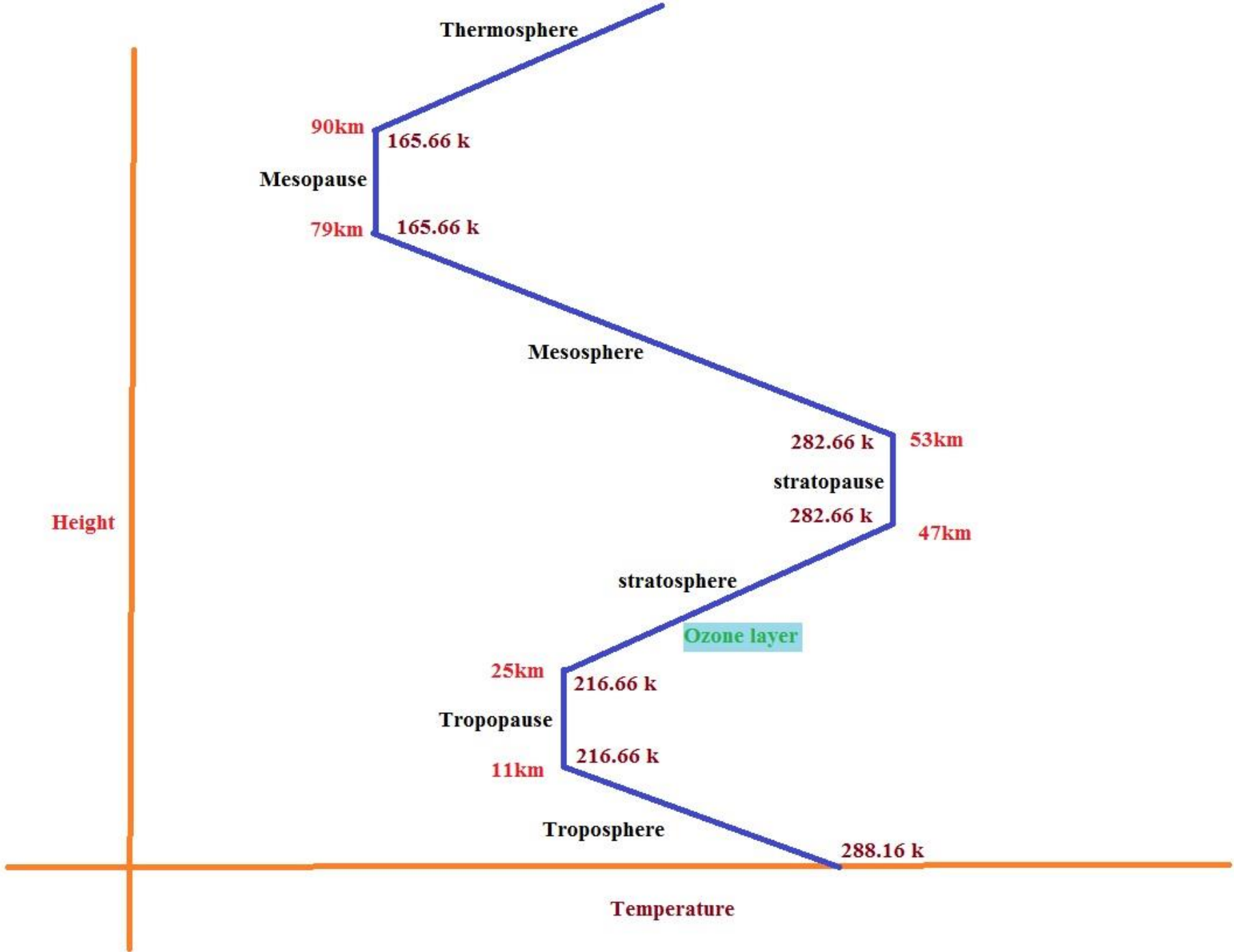
# LAPSE RATE

- Change temperature with Altitude is called lapse Rate.
- Denoted by  $a$
- $$a = \frac{\Delta T}{\Delta h} = \frac{T_2 - T_1}{h_2 - h_1} = \text{kelvin/km}$$
- $T$  is temperature in kelvin
- $h$  is altitude in km

# Layers of Atmosphere

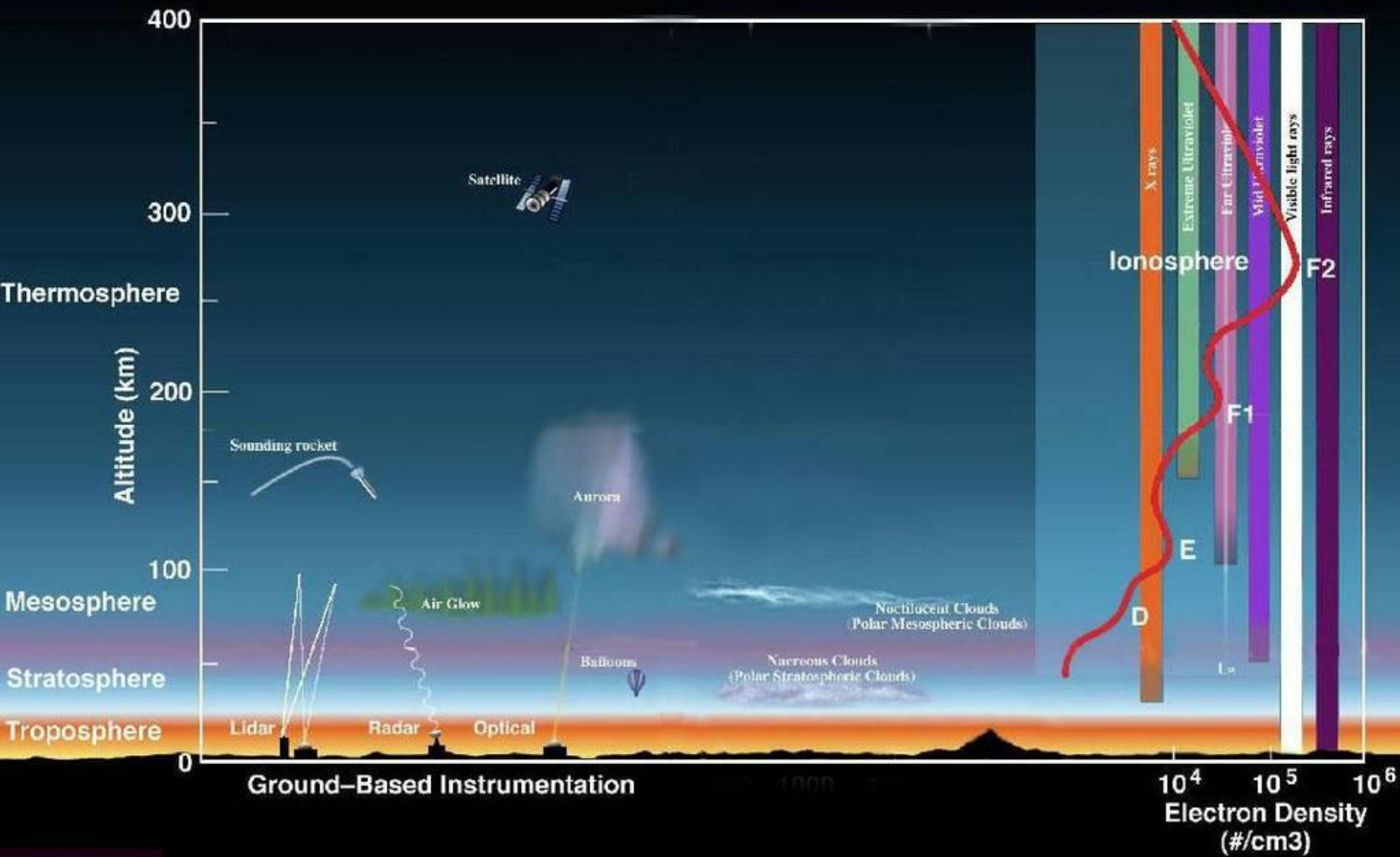
- **Troposphere( 0-11km)**
- **Tropopause (11-25km)**
- **Stratosphere(25-47km)**
- **Stratopause (47km-53km)**
- **Mesosphere (52-79km)**
- **Menopause (79-90km)**
- **Thermosphere (30-600km)**
- **Thermo Pause (600-1000km)**
- **Ionosphere (48km-965km)**
- **Exosphere (1000-190000km)**
- **Space (Above 190000km)**

Ref-John D Anderson & Nasa Website Above Values  
are approx.

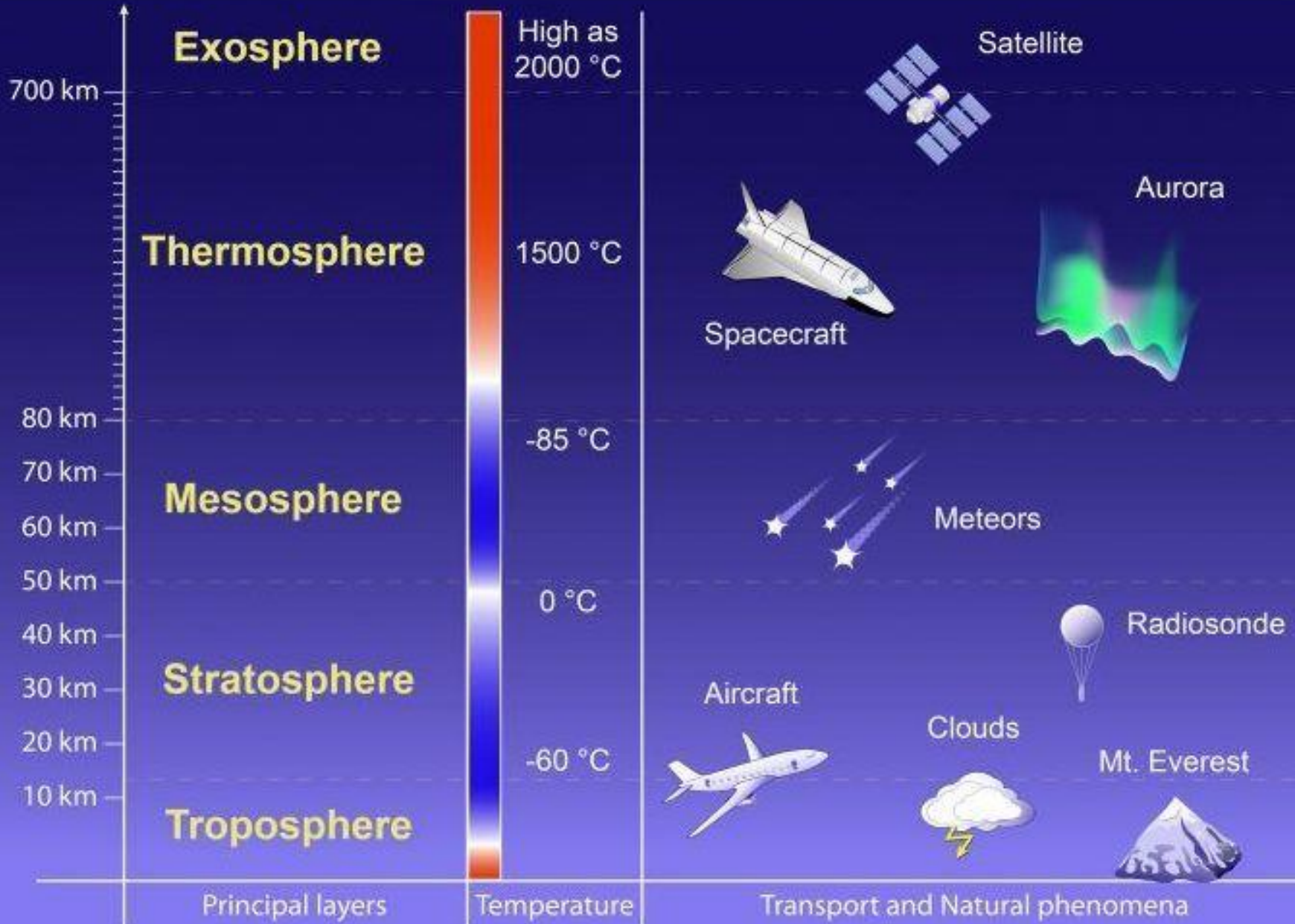




# Exosphere



# LAYERS OF THE ATMOSPHERE



# Troposphere( 0-11km)

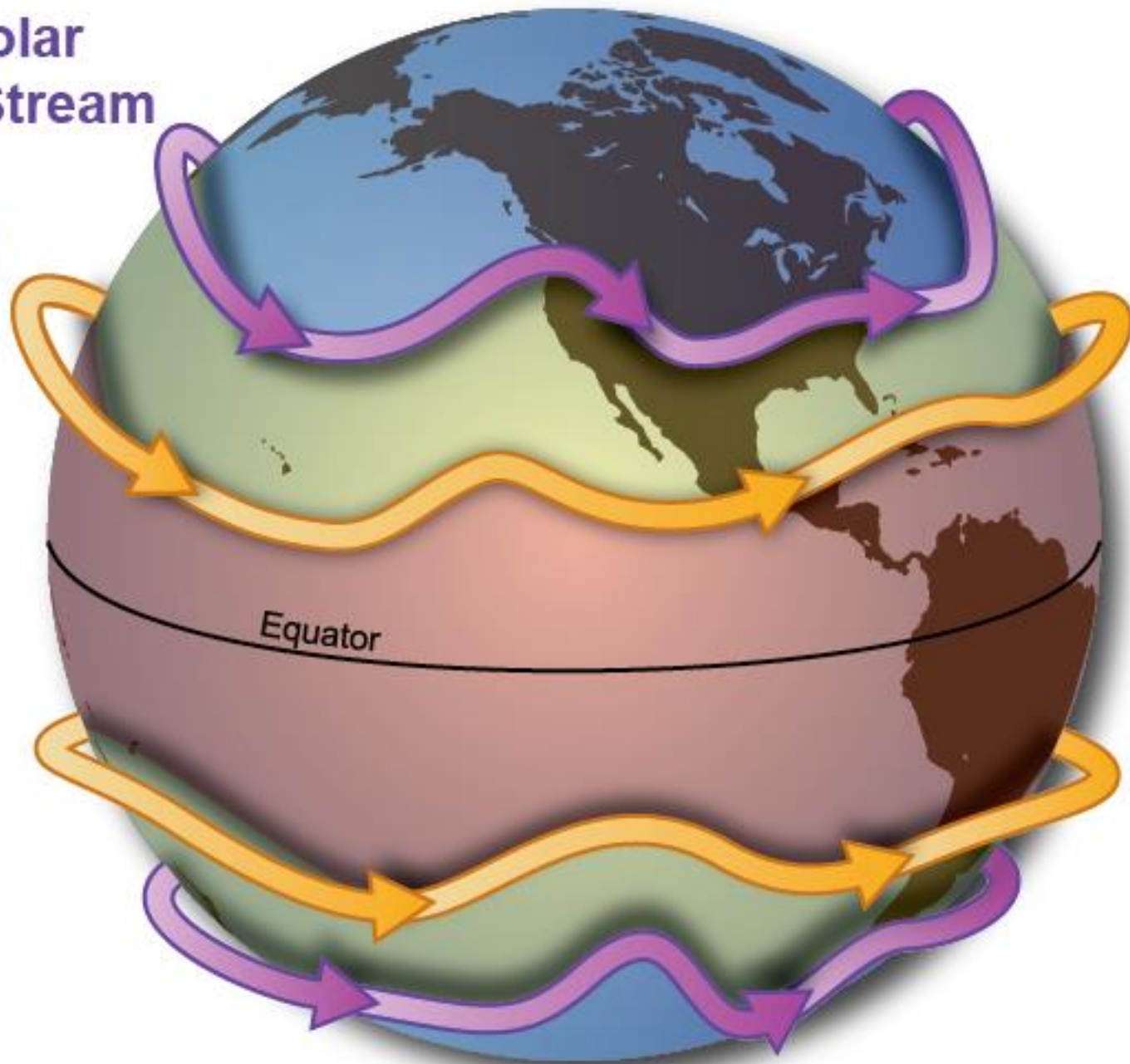
- The Troposphere contains 75% of the mass of the Atmosphere and almost all of the water Vapour.
- There is considerable movement and mixing of air within the Troposphere and it is within this layer of the Atmosphere that most of the Weather occurs.
- Within the Troposphere, temperature and pressure decrease uniformly with height until the Tropopause.
- The lowest level of the Troposphere, where the airflow is affected by friction with the ground, is sometimes referred to as the Planetary Boundary Layer
- clouds and weather occurs in this layer.
- Most of the aircrafts flies in this layer

# Tropopause (11-25km)

- The tropopause is the upper limit of the troposphere and therefore constitutes the boundary between it and the Stratosphere.
- Temperature is constant
- Jet Stream Occurs in this layer.
- The location of the tropopause is of interest to flight crew because it indicates the altitude at which temperature becomes constant with increasing altitude, which is an important factor in performance and fuel calculations.
- Most of the efficient aircraft flies in this layer

**Polar  
Jet Stream**

**Subtropical  
Jet Stream**



# **Stratosphere (25-47km)**

## **Stratopause (47km-53km)**

- **The Stratosphere is characterized by a temperature which is steady or increases with height.**
- **Towards the top of the layer, the average temperature is only a little below 0°C.**
- **The relatively high temperatures in this region of the atmosphere is due to the presence of small quantities of Ozone.**
- **Ozone layer occurs at 27km which is in stratosphere.**
- **No Weather Exits**

# MesoSphere (52-79km)

## Mesopause (79-90km)

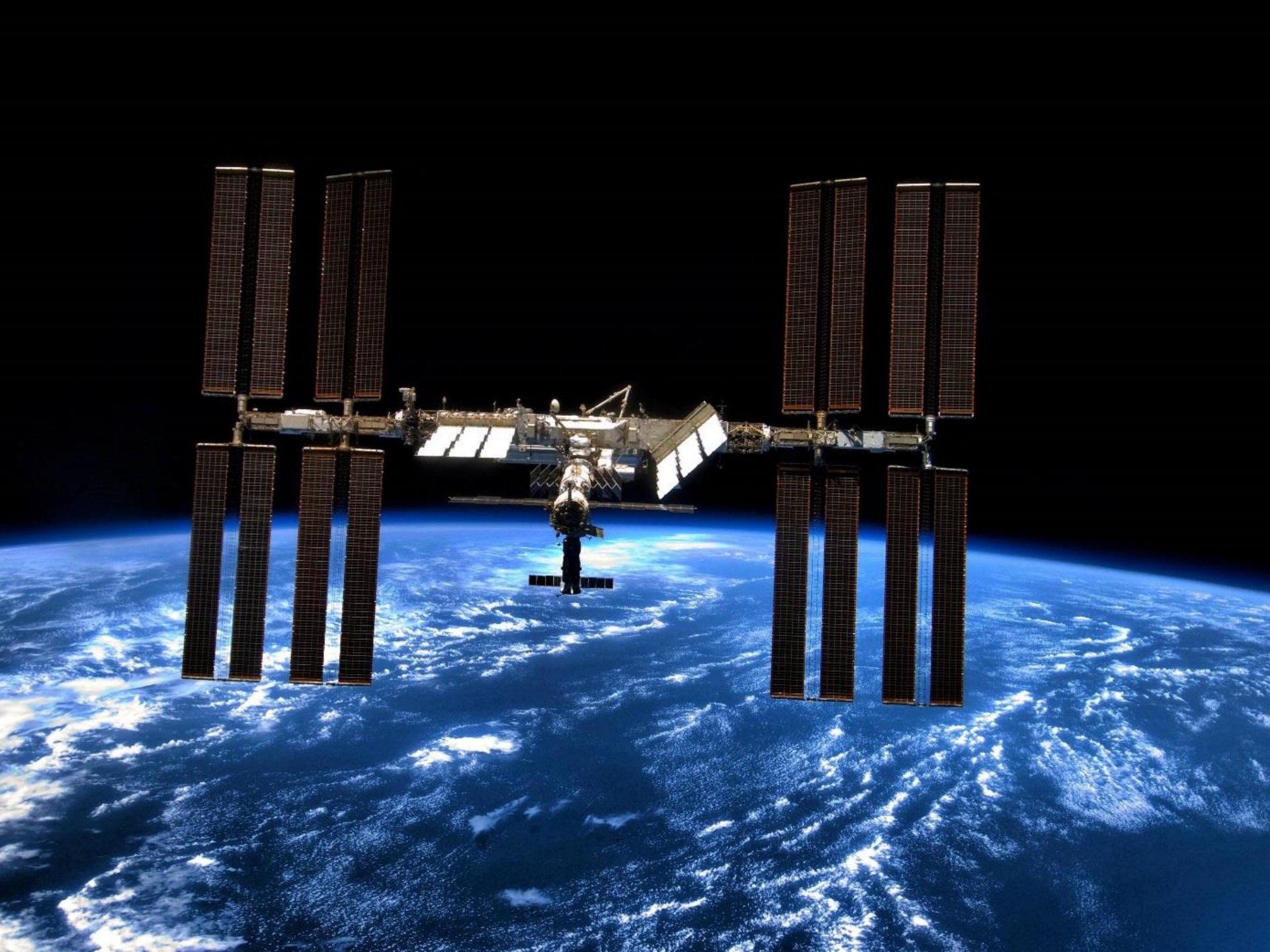
- The Mesosphere is characterized by falling temperature with height - temperatures fall to -100°C.
- Thin clouds comprised of ice crystals, Noctilucent Clouds, sometimes occur at higher latitudes in the higher part of the Mesosphere at approximately 80km in altitude.
- Meteoroids burn in Mesosphere (Shooting stars)





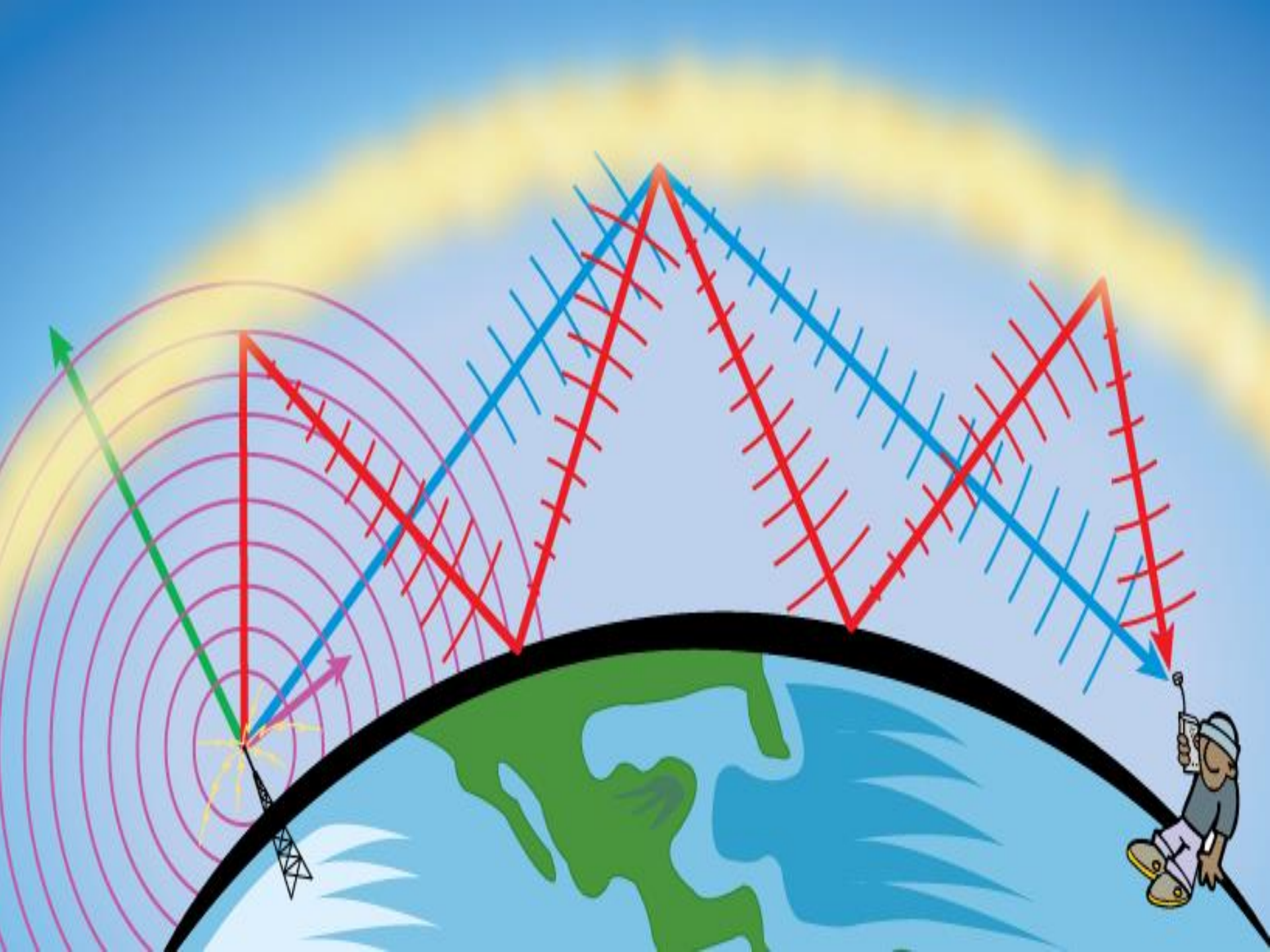
# Thermo-Sphere (90-600km)

- The Thermosphere is characterized by rising temperature with height - temperatures rising to 1500°C.
- When the Sun is active around the peak of the sunspot cycle, X-rays and ultraviolet radiation from the Sun heat and "puff up" the thermosphere.
- International Space Station is in this layer (At330km)
- The height of the thermopause varies considerably due to changes in solar activity.



# Inosphere (48km-965km)

- The ionosphere contains a high proportion of free electrons which influence radio propagation.
- High Frequency (HF) radio waves hitting the free electrons in the ionosphere cause them to vibrate and re-radiate the energy back down at the same frequency, effectively bouncing the radio wave back towards the Earth.
- This characteristic of the ionosphere has long been exploited to enable long range radio communications.
- Movement of ions across the earth's magnetic field generates electrical currents within the ionosphere. Aurora, also known as the Northern Lights or Southern Lights occur in the Ionosphere, close to the Mesopause during geomagnetic storms.
- The ionosphere increases in thickness and moves closer to the Earth during daylight and rises at night allowing certain frequencies of radio communication a greater range.





# **Exosphere (1000-190000km)**

- **The exosphere is the uppermost region of Earth's atmosphere as it gradually fades into the vacuum of space.**
- **Air in the exosphere is extremely thin - in many ways it is almost the same as the airless void of outer space.**
- **In the exosphere, molecules and atoms of atmospheric gases constantly collide with each other. However, air in the exosphere is so thin that such collisions are very rare.**

# Today's Amazing Fact???????

The Lowest ever recorded temperature was at vastok station in Antarctica on 21<sup>st</sup> July 1983 bitter -89.6 degree C





ANY  
QUESTIONS?

#200204417



# धन्यवाद

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