Atmospheric Composition & Structure

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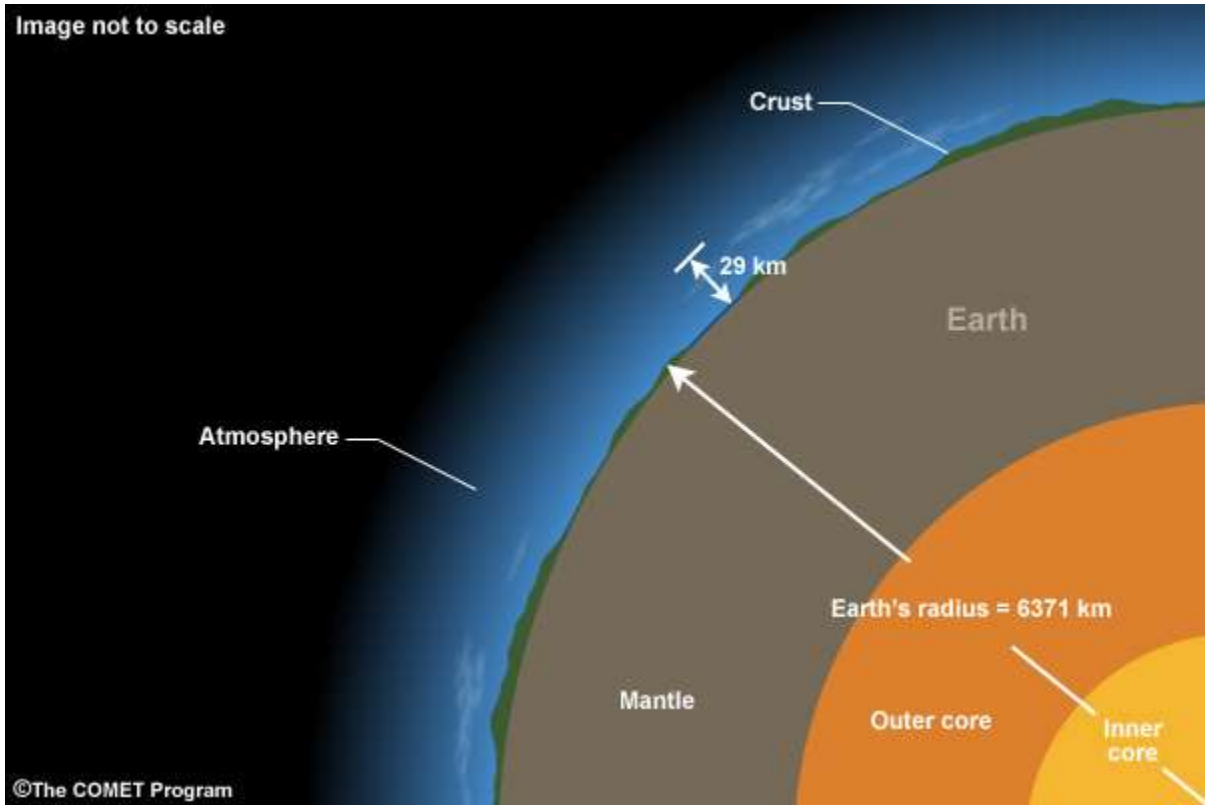
The atmosphere

- The atmosphere is a layer of gases—mainly nitrogen (N) and oxygen (O)—that surrounds Earth.
- Compared to the 12,753-km diameter of Earth, the atmosphere is very thin.
- Yet this thin layer provides us with the air we breathe, protects us from the Sun's harmful rays, and stores heat energy that makes the planet habitable for life.



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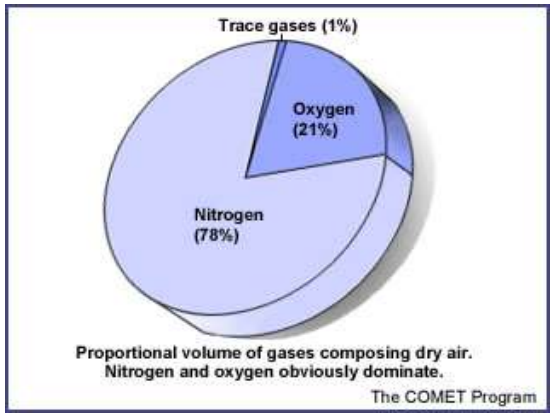
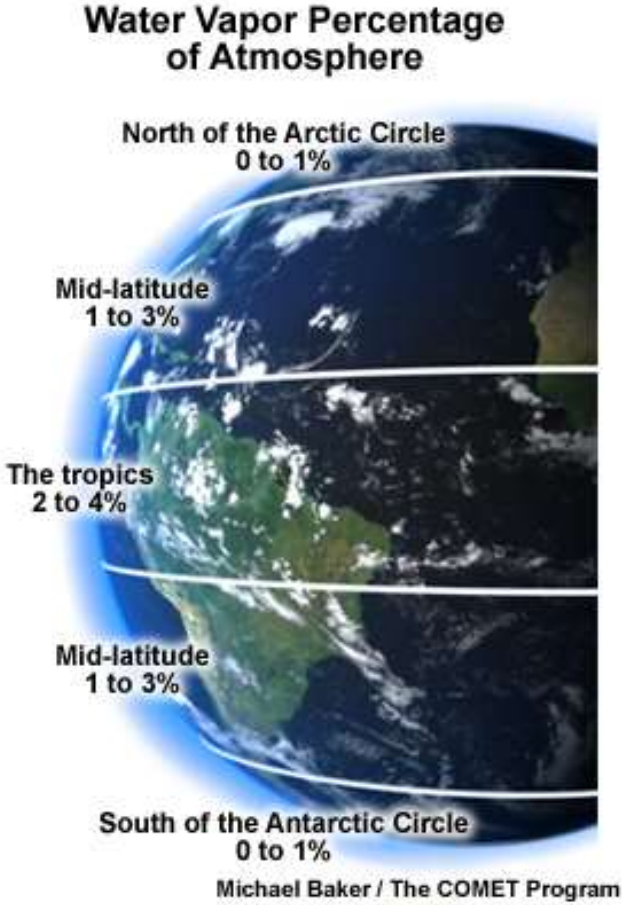
Composition

- Nitrogen composes 78%
- and oxygen accounts for 21%.
- The remaining 1% includes argon (Ar), neon (Ne), helium (He), hydrogen (H), xenon (Xe), and carbon dioxide (CO2).
- CO2 represents only a fraction of a percent of the gases in Earth's atmosphere, but has significant greenhouse properties that allow it to efficiently store and release heat.
- The atmosphere also contains water vapor, an important gas contributing to the formation of clouds and precipitation.
- Water vapor concentrations typically range from less than 1% to about 4%. Almost half of all water vapor is found within the lowest ~5 km of the atmosphere.





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Structure

layers that are defined based on the change in average air temperature with altitude within each layer.

Troposphere - Temperatures decrease with altitude in the 75-80% of the atmosphere's total mass.

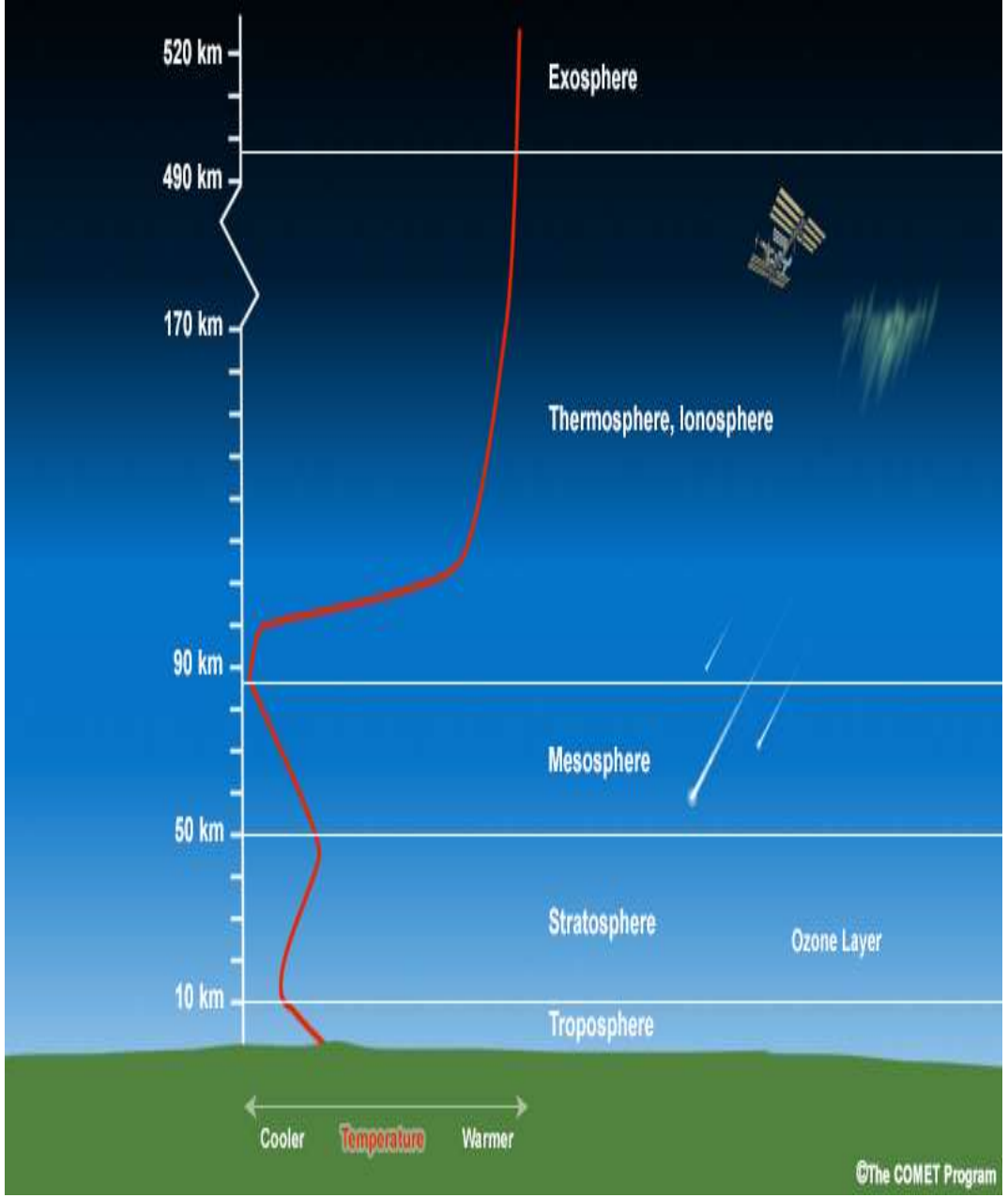
Stratosphere - Temperatures increase with altitude, the ozone layer resides.

mesosphere- temperatures decrease with altitude. Most meteors from space burn up in this layer.

Thermosphere -temperatures begin to increase with altitude -air molecules are so few that although temperatures are high, the air itself transfers very limited amounts of heat. The thermosphere is often considered the "edge of space", Ionized gases form a layer within the thermosphere called the ionosphere,

Exosphere Above the thermosphere, air molecules are even fewer in number in the. This layer marks the transition to interplanetary space.

A "pause" separates each of these layers, marked by changes in temperature and density



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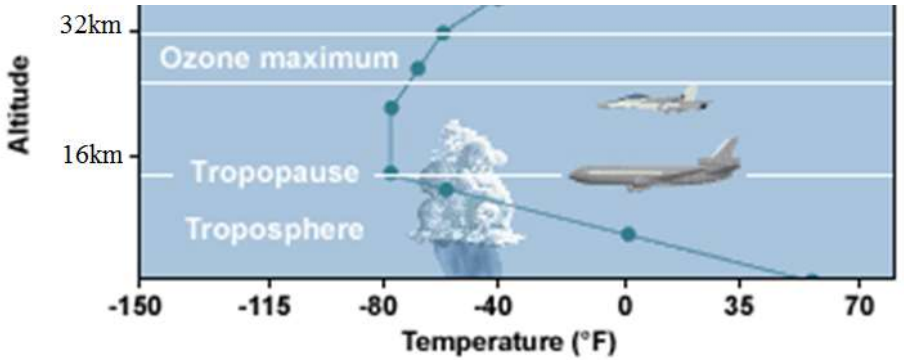
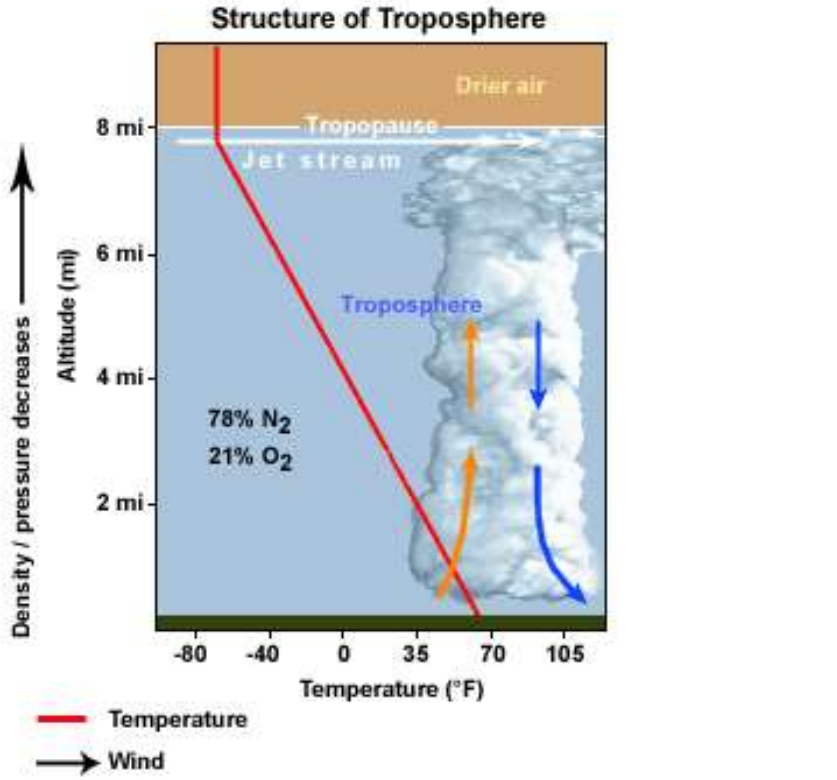
The troposphere





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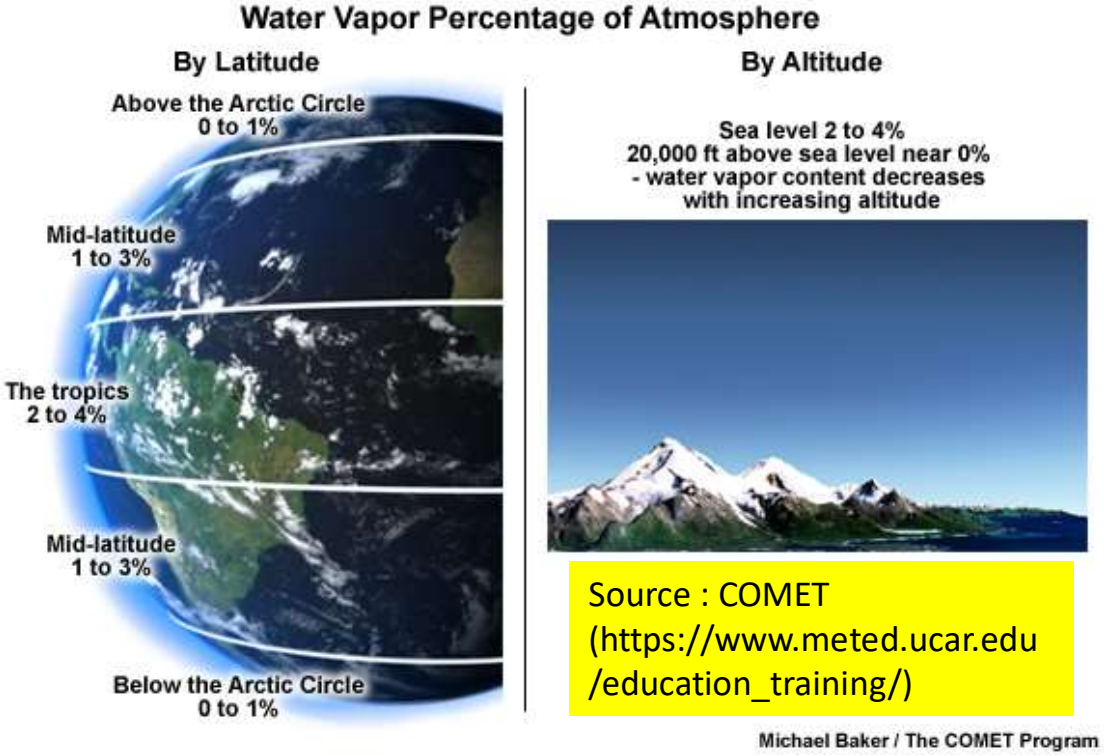
•Temperature tends to decrease with altitude through the troposphere, which is the layer where weather processes occur. The troposphere extends from the surface to between 6 and 12 miles above sea level. On average, within the troposphere, the air temperature drops 6.5 Celsius degrees for every 1000 m increase in altitude

- The top of the troposphere is marked by the tropopause, which separates the troposphere from the stratosphere.
- The height of the tropopause tends to be highest over the tropics and lowest over the polar regions.
- It marks the position of high winds called the jet stream, which meanders in narrow channels from west to east across both the northern and southern hemispheres.
- The upper boundary of the troposphere, called the **tropopause**, is a transition zone between the troposphere and the next higher layer, the stratosphere.
- The tropopause also represents the upper limit of nearly all weather in the atmosphere.

Source : COMET (https://www.meted.ucar.edu/education_training/)

Water vapor concentration

- The atmosphere contains water vapor, an extremely important constituent contributing to water and ice clouds that produce various types of precipitation.
- Water vapor also stores and releases great quantities of heat energy, called latent heat, that is used to power thunderstorms and hurricanes.
- The highest water vapor amounts are typically found in tropical locations, where water vapor can account for up to 4% of atmospheric gases.
- In colder, polar regions, its concentration might be a mere fraction of a percent.
- Water vapor amount decreases with altitude so mountains and higher elevations have lower water vapor amounts than coastal areas.



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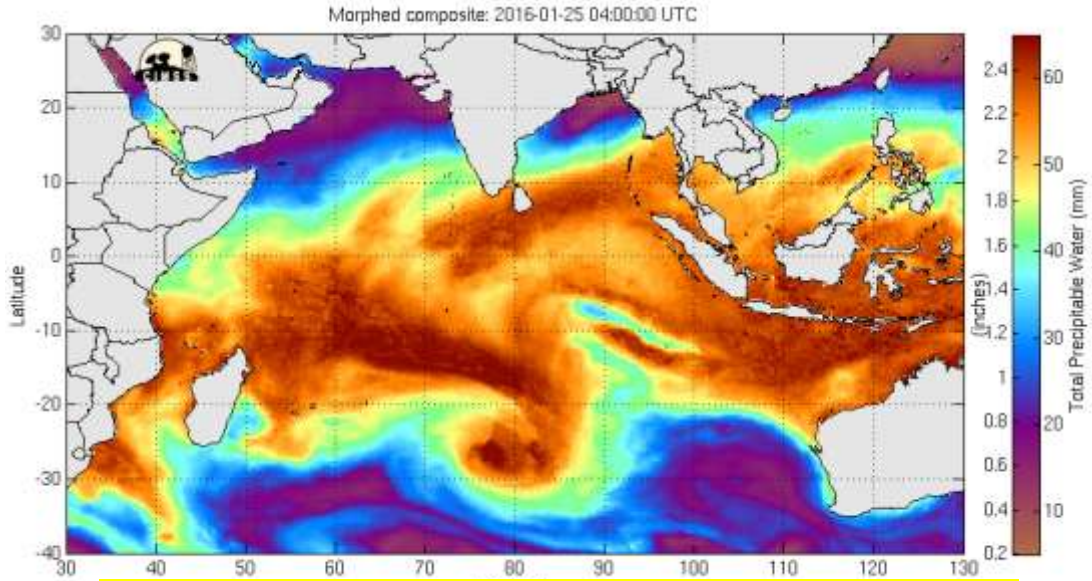
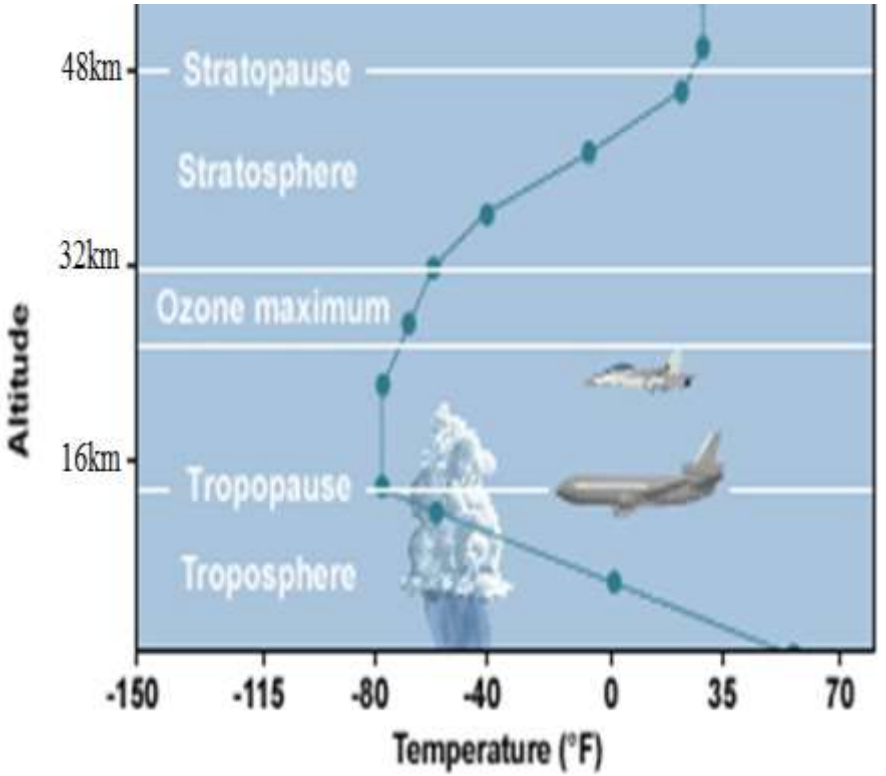


Source : https://tropic.ssec.wisc.edu/real-time/mtpw2/

Stratosphere - Temperatures increase with altitude, the ozone layer resides.

- *As we know, ozone (O_3) is concentrated in this part of the atmosphere. This ozone (O_3) absorbs shortwave ultraviolet (UV) radiation from the sun and converts them into heat.*
- *More radiation is absorbed at higher altitudes compared to the lower stratosphere, so the temperature increases with height.*



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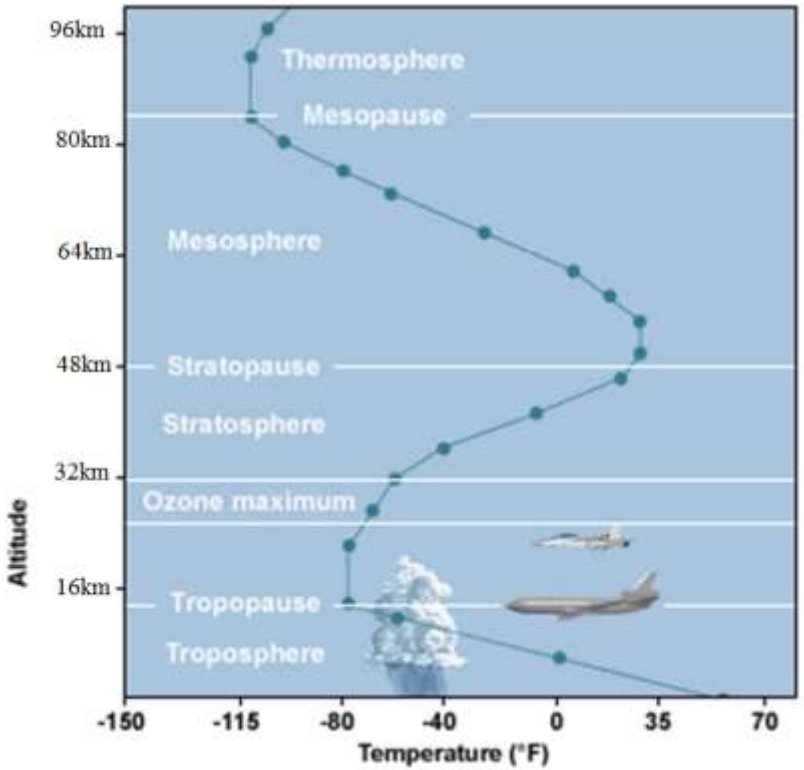
Mesosphere- temperatures decrease with altitude. Most meteors from space burn up in this layer

- *The mesosphere has the coldest temperatures in the atmosphere.*

- *The air density in the mesosphere is low than in the stratosphere below. Due to less air particles, not enough heat is absorbed which eventually leads to a colder temperature.*



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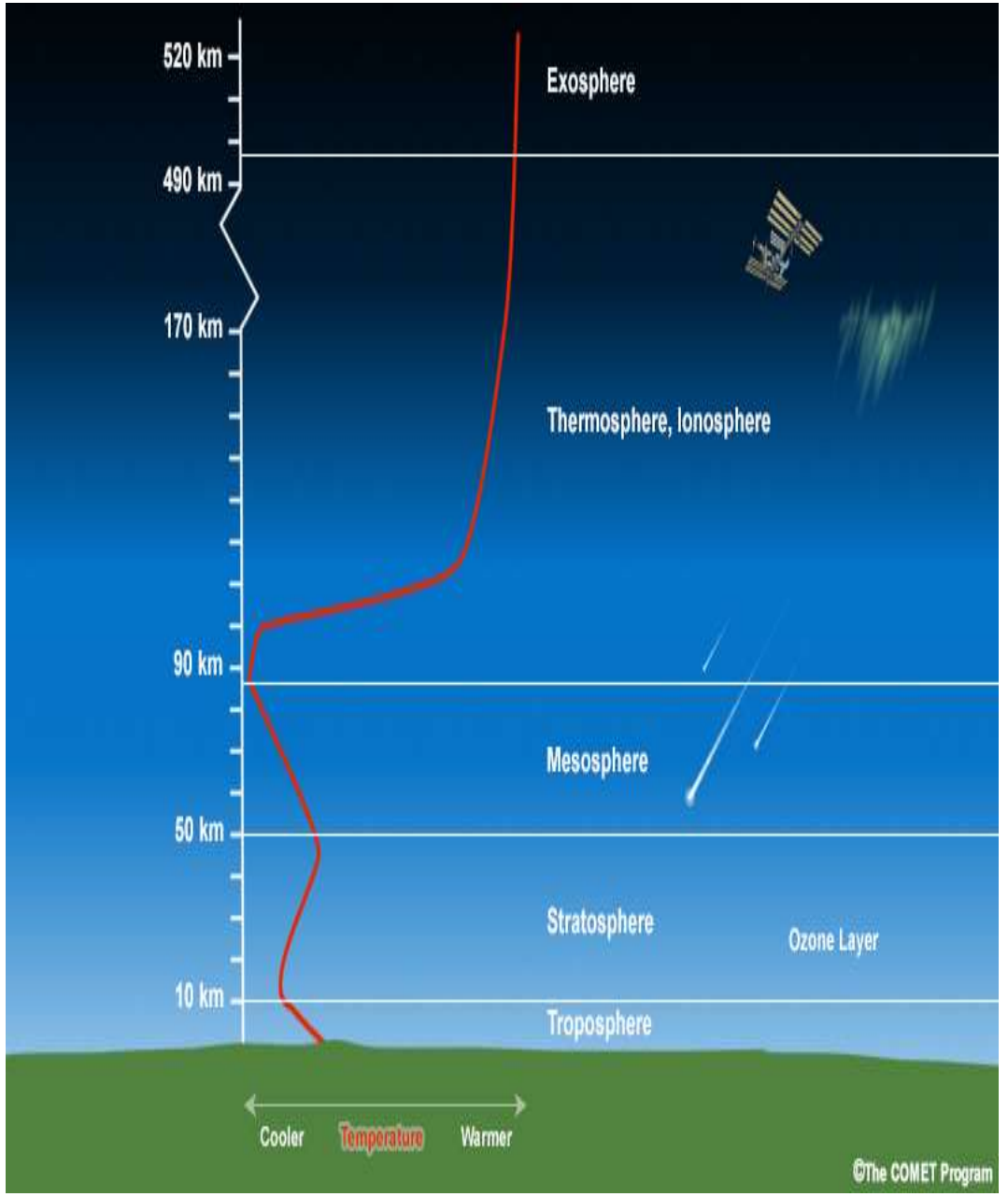
Thermosphere

- Temperatures begin to increase with altitude
- Air molecules are so few
- Temperatures thermosphere are high, the air itself transfers very limited amounts of heat.
- The thermosphere is often considered the “edge of space”, Ionized gases form a layer within the thermosphere called the ionosphere,



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Thank you