

# Atmospheric Composition

## Chapter 3: Earth's Atmosphere

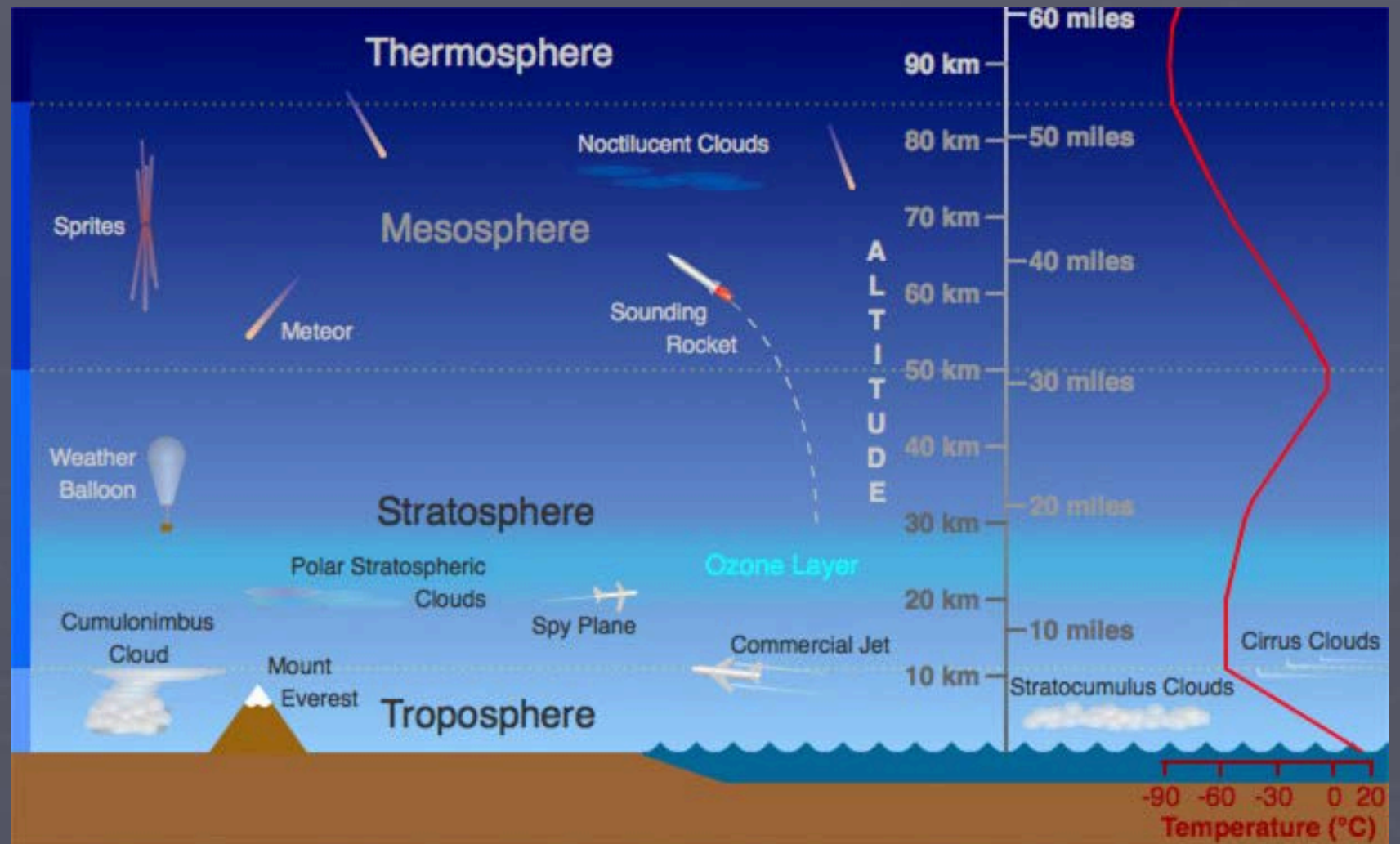
# Profile of the Atmosphere

- The Atmosphere extends 480 km (300 miles) above the Earth's Surface
  - 50% of Mass in first 6km (roughly 20,000 feet)
- The Exosphere extends from 480 km to 32,000 km (20,000 miles)
- Air pressure decreases as altitude increases



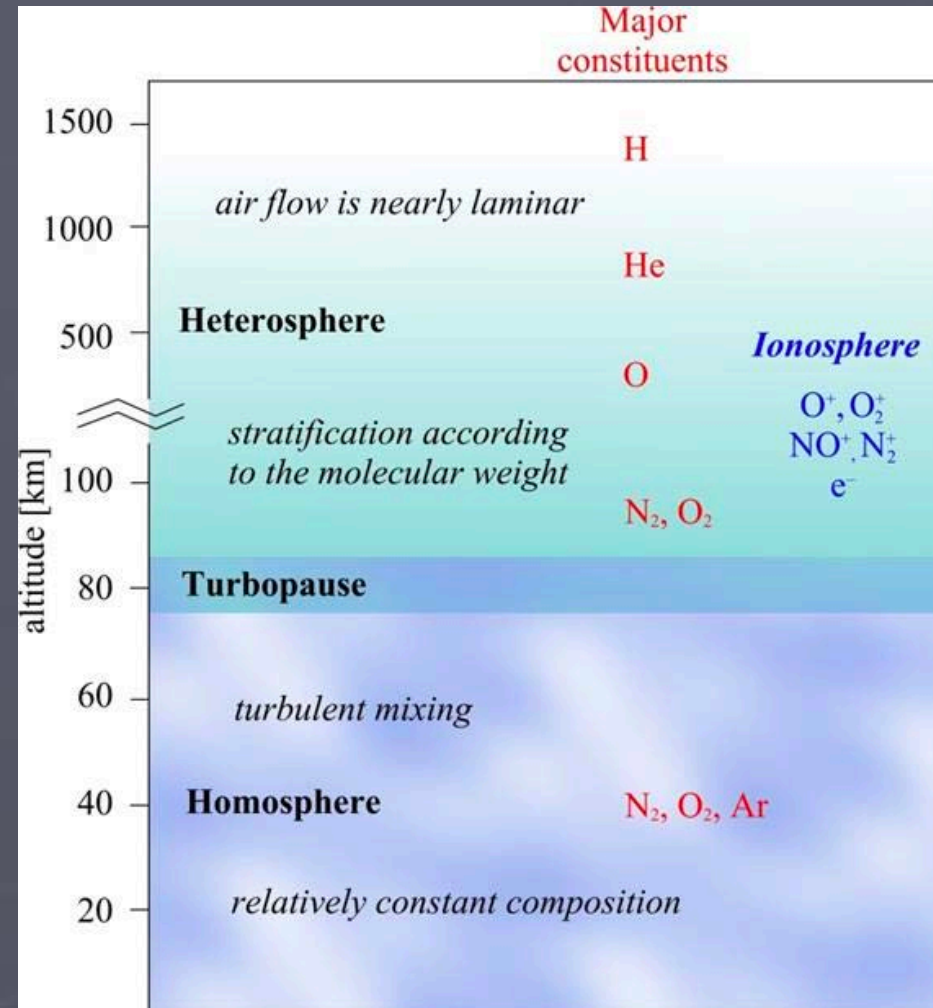
# Layers of the Atmosphere (Atmospheric Temperature)

- By Atmospheric Temperature characteristics
  - From Troposphere to Thermosphere



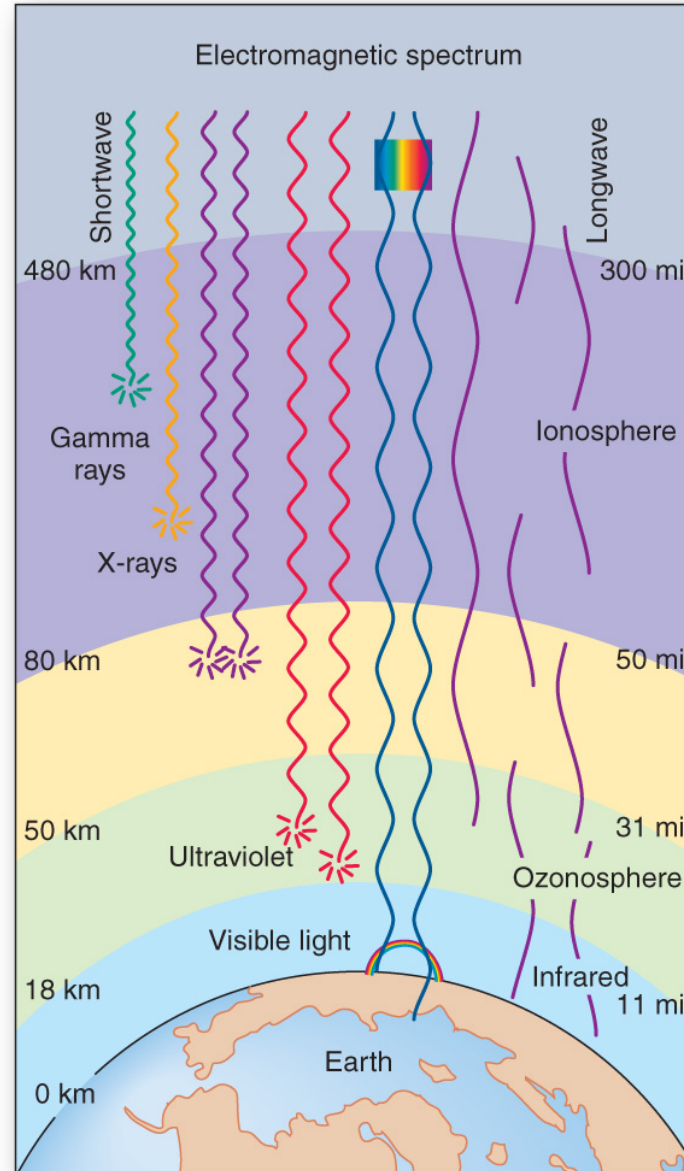
# Layers of the Atmosphere (Atmospheric Composition)

- **Heterosphere**  
(gases not mixed, layered) and  
**Homosphere**  
(gases intermixed)



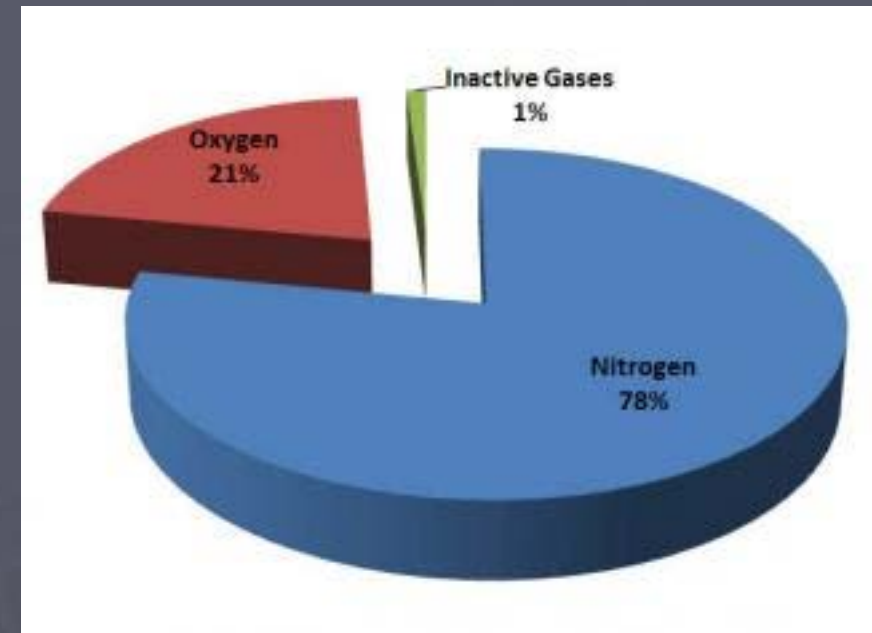
# Layers of the Atmosphere (Atmospheric Function)

- **Ionosphere** (changes incoming molecules to positively charged ions) and **Ozonosphere** (Absorbs UV radiation)
  - Aurora takes place in ionosphere



# Composition of the Earth's Atmosphere

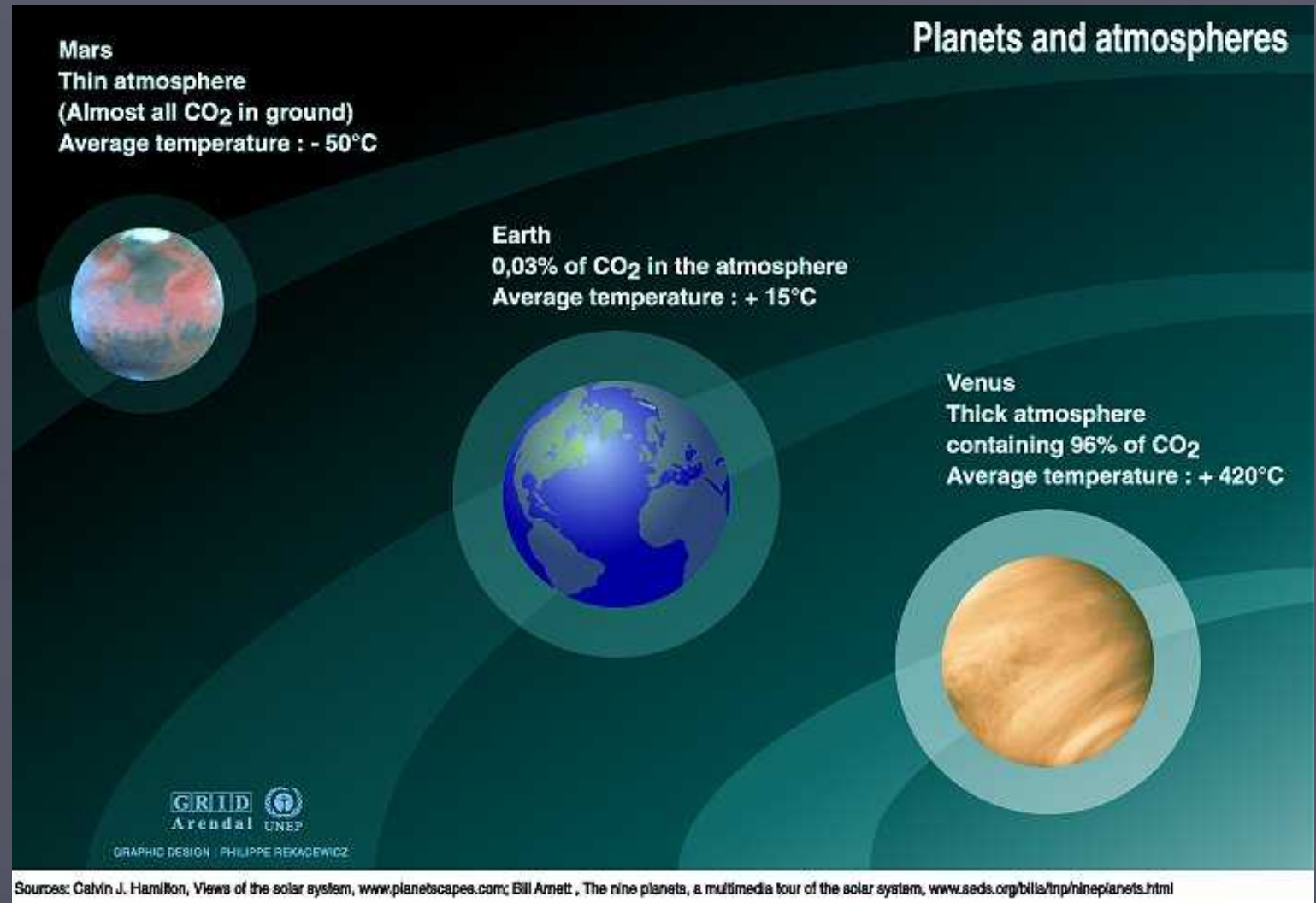
- Mostly comprised of Nitrogen (78%) and Oxygen (21%)
- Other 1% includes mixture of other gasses like argon, neon, helium, hydrogen, and xenon
  - And mixture of water vapor, carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons
  - Important in the absorption of energy





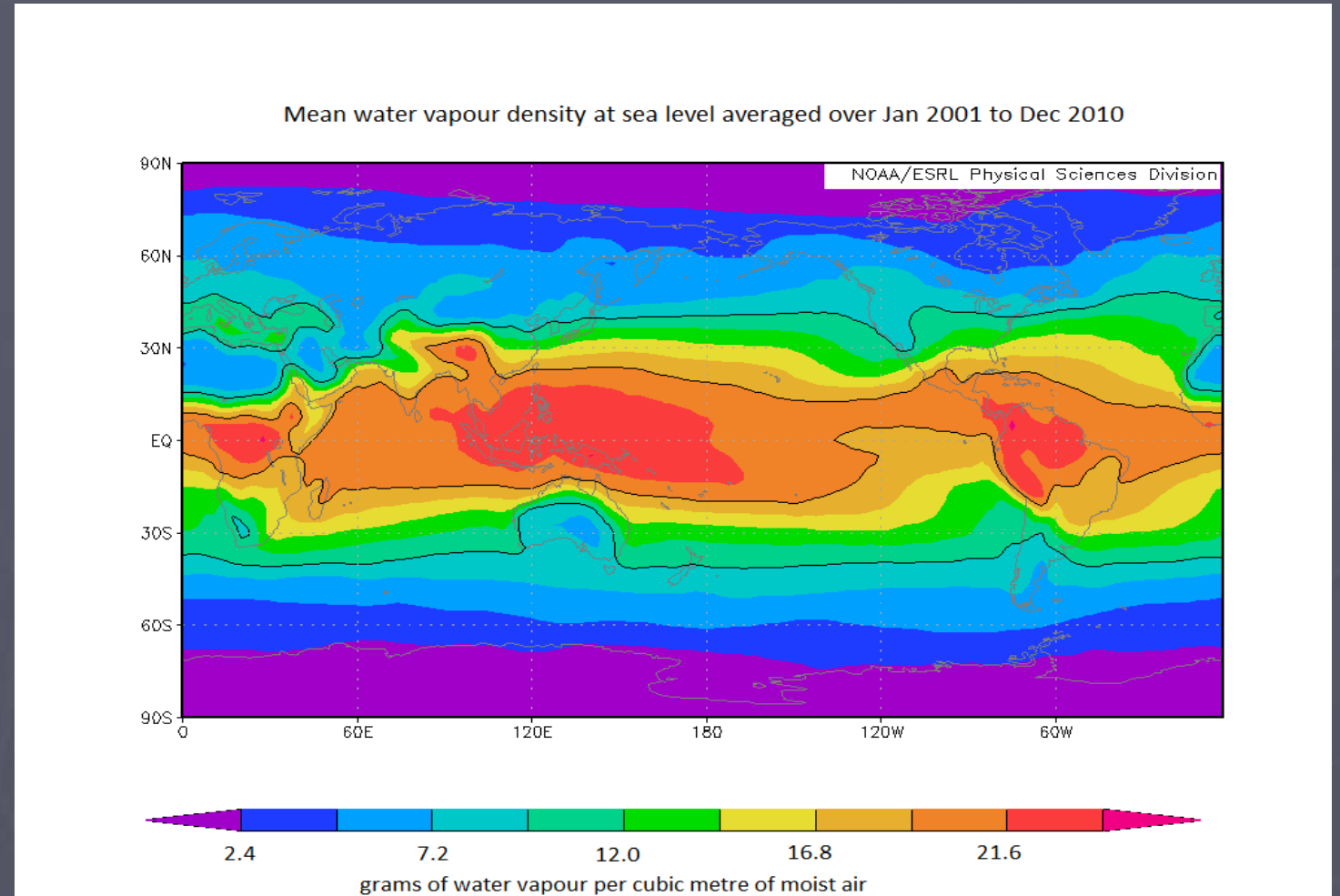
# Relationship between Co2 and Temperature

- Co2 makes up about .03-.04% of Earth's atmosphere
  - Major greenhouse gas that traps sun's energy
  - Created by cellular respiration and fossil fuel combustion



# Composition of the Atmosphere: Water Vapor

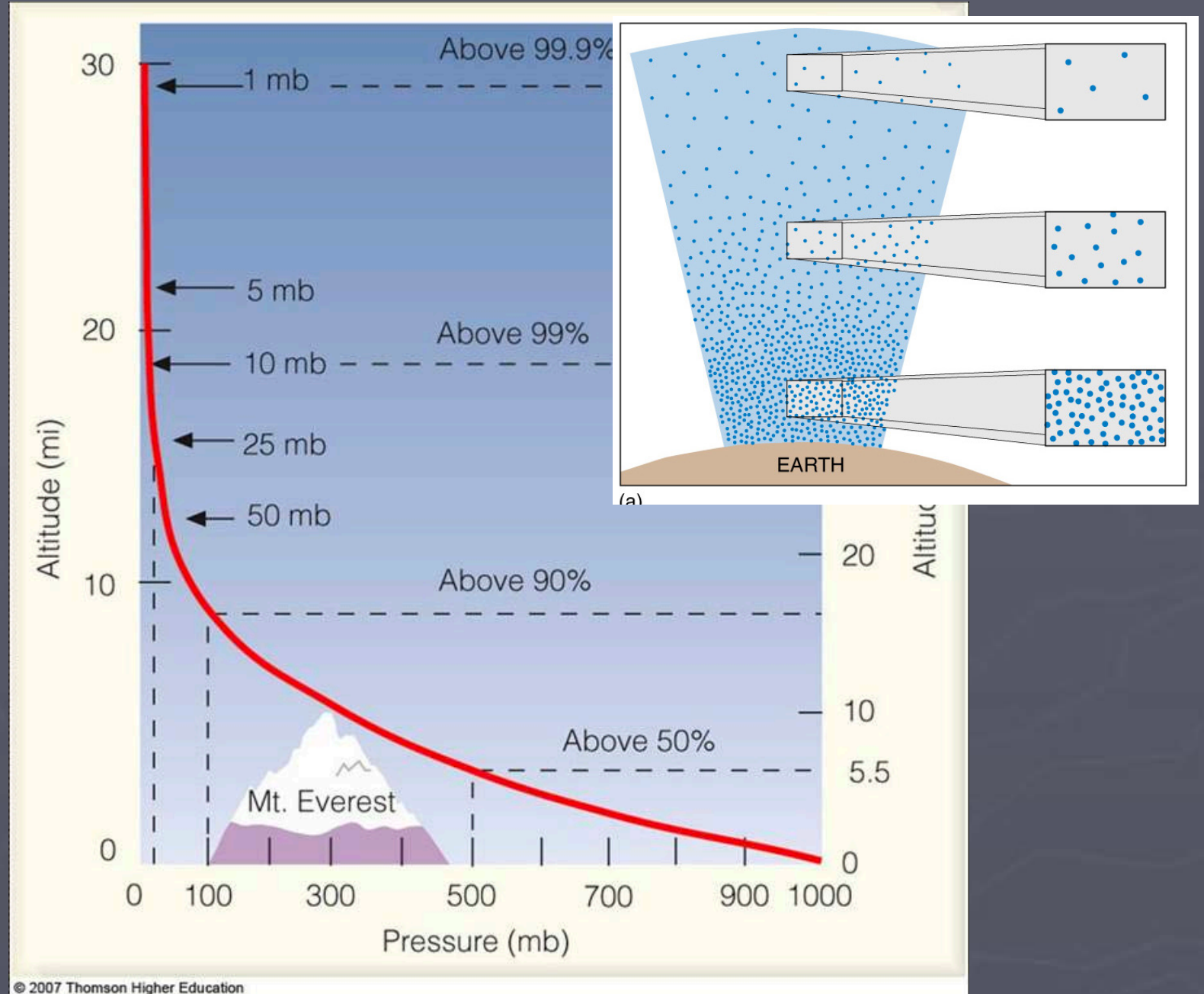
- Makes up 0-4% of air particles
  - Concentrated near equator
- Comes from evaporation, photosynthesis, and geological processes
- Absorbs heat





# Air Pressure

- Air pressure caused by the ongoing collision of gas molecules
  - Less molecules = less pressure
  - More pressure closer to the Earth's surface due to gravity

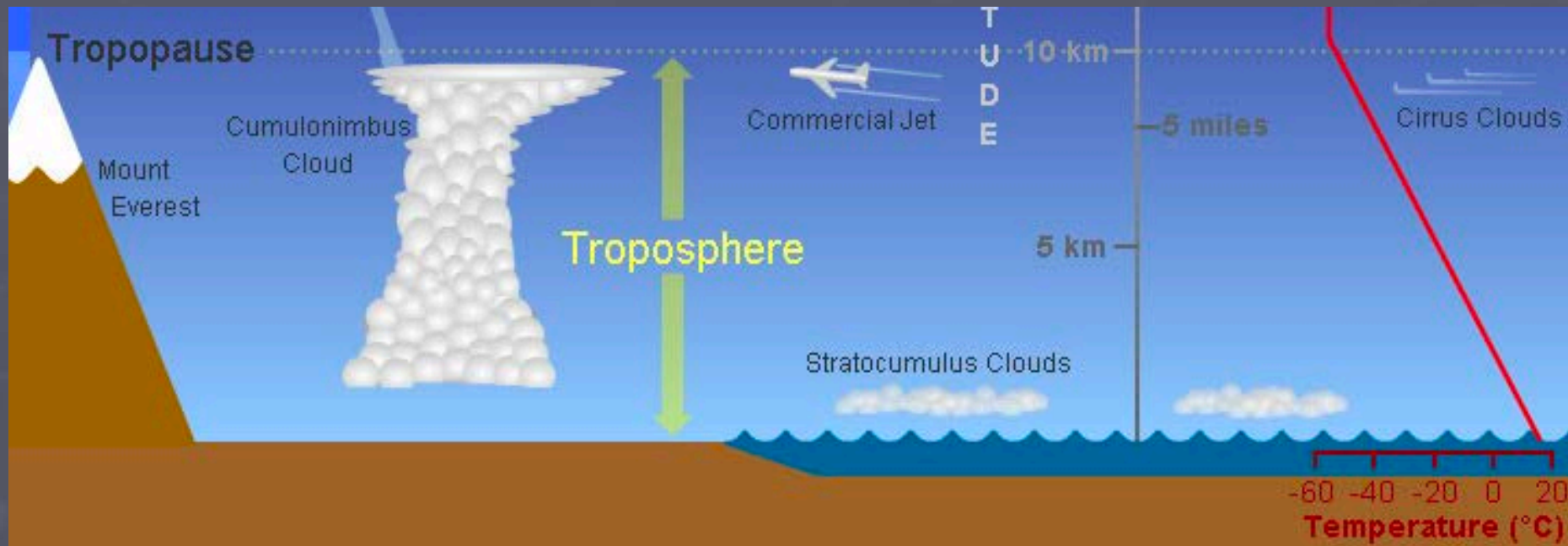


**TABLE 3-2 Atmospheric Pressure at Various Altitudes  
Expressed as a Percentage of Sea-Level Pressure**

Altitude		<i>Percentage of Sea-Level Pressure</i>
<i>Kilometers</i>	<i>Miles</i>	
0	0	100
5.5	3.5	50
16	10	10
32	20	1
48	30	0.1
80	50	0.001
96	60	0.00001

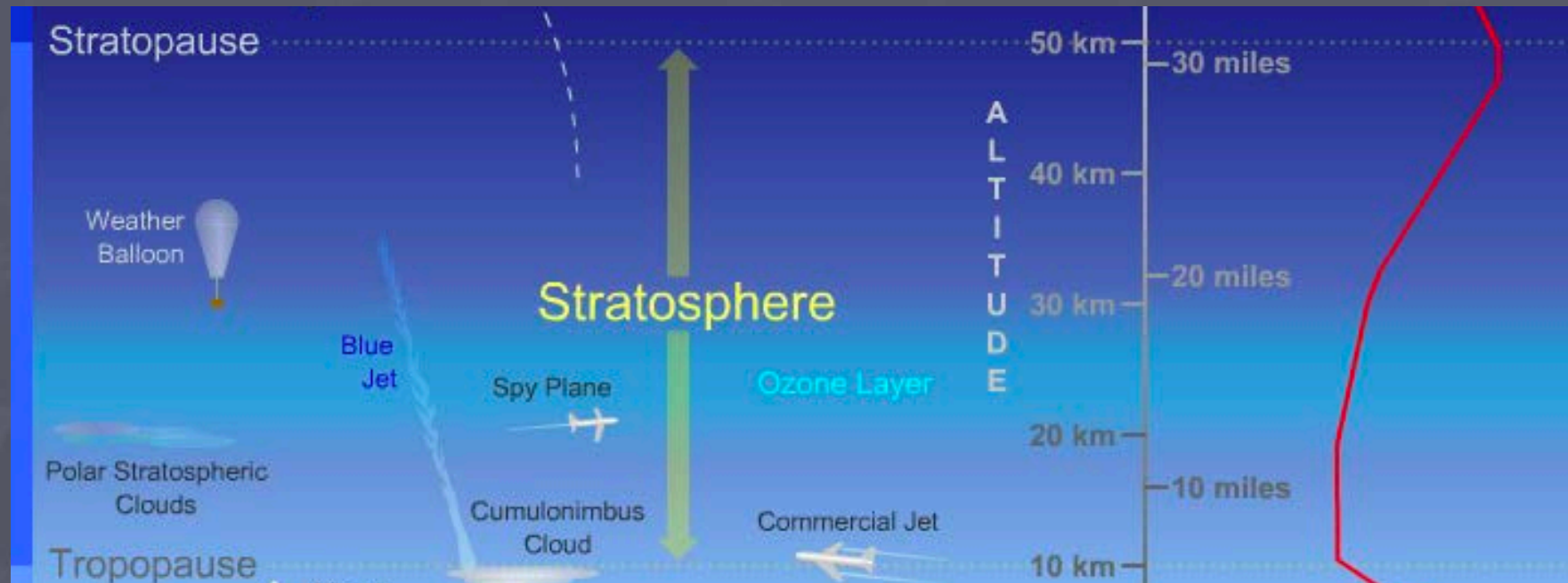
# Layers of the Atmosphere: Troposphere

- Extends from the Earth's surface to about 11km
- Contains about 90% of atmosphere's mass
- Responsible for all weather and jet stream



# Stratosphere

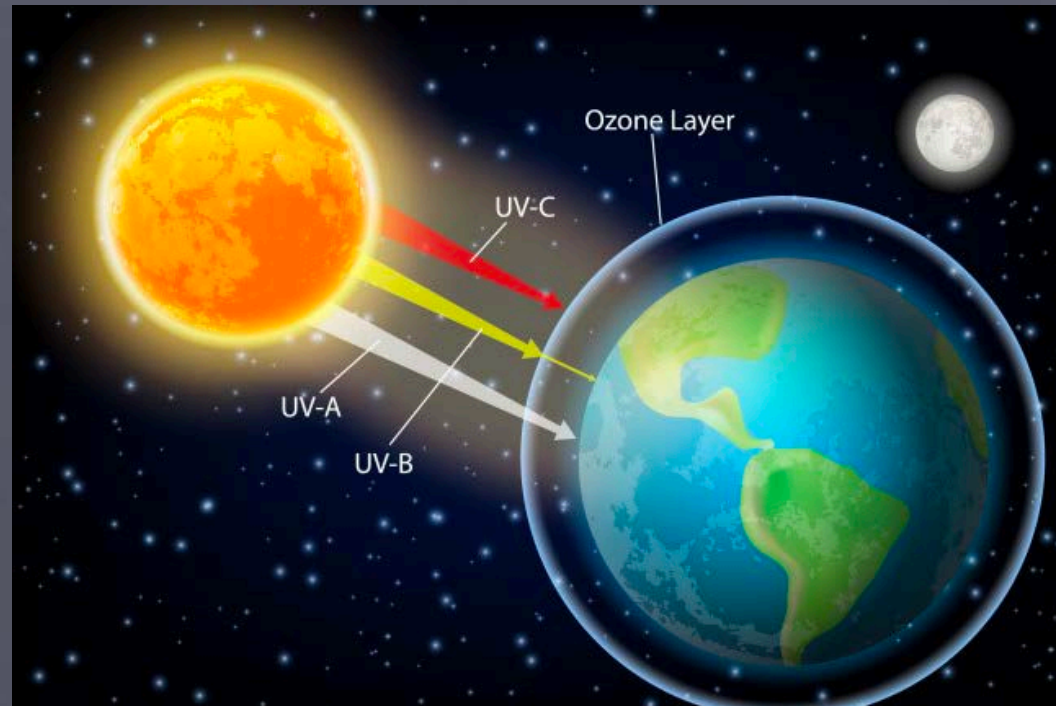
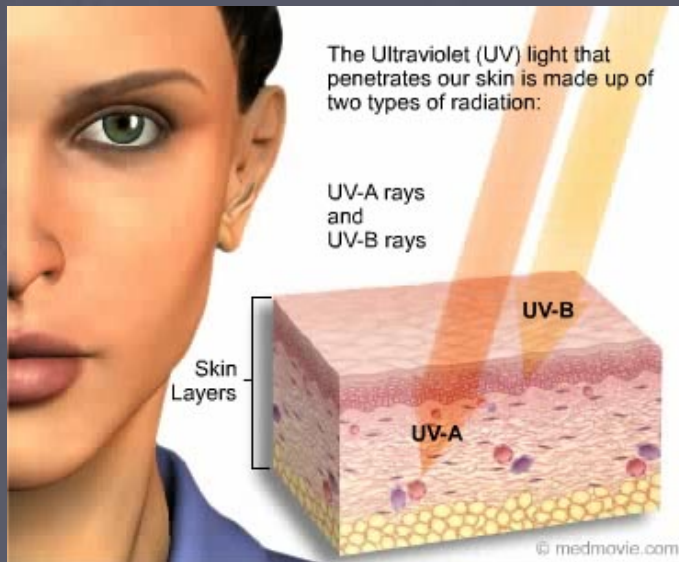
- Extends from troposphere to about 50km above Earth's surface
- Location of most ozone particles
  - Which absorb sun's energy causing increase in temperature



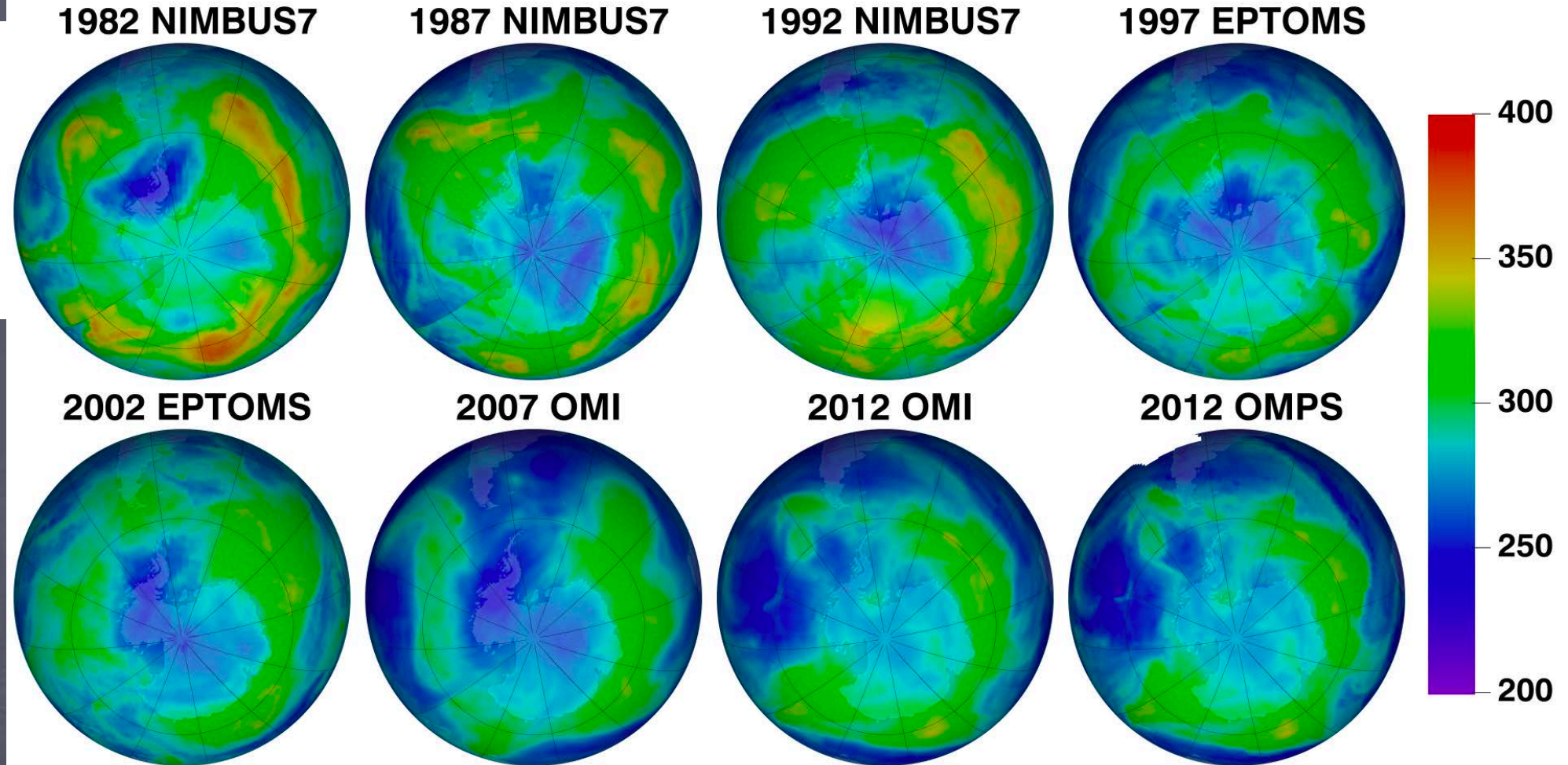
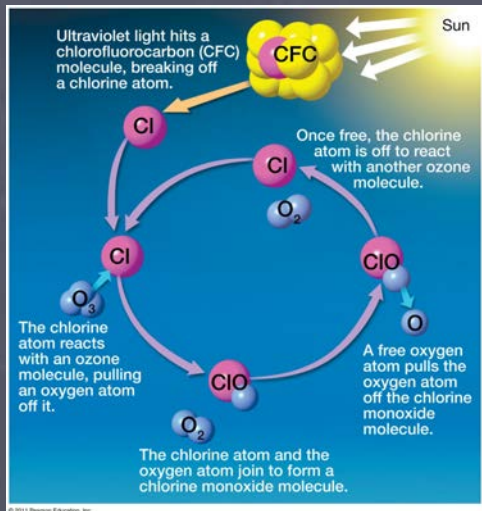
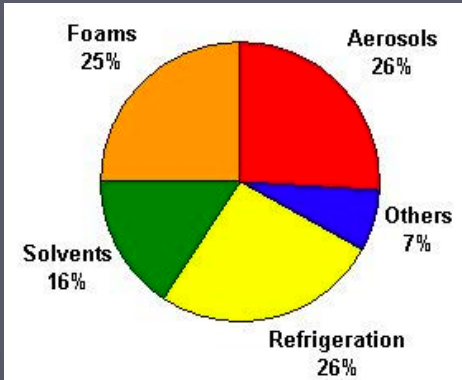


# The Ozone Layer

- Positioned in stratosphere
- Comprised of highly concentrated oxygen molecules as  $O_3$
- Absorbs much of sun's ultraviolet radiation
  - Heats up stratosphere



# Ozone Layer Depletion



Thickness of the Ozone Layer in Dobson Units



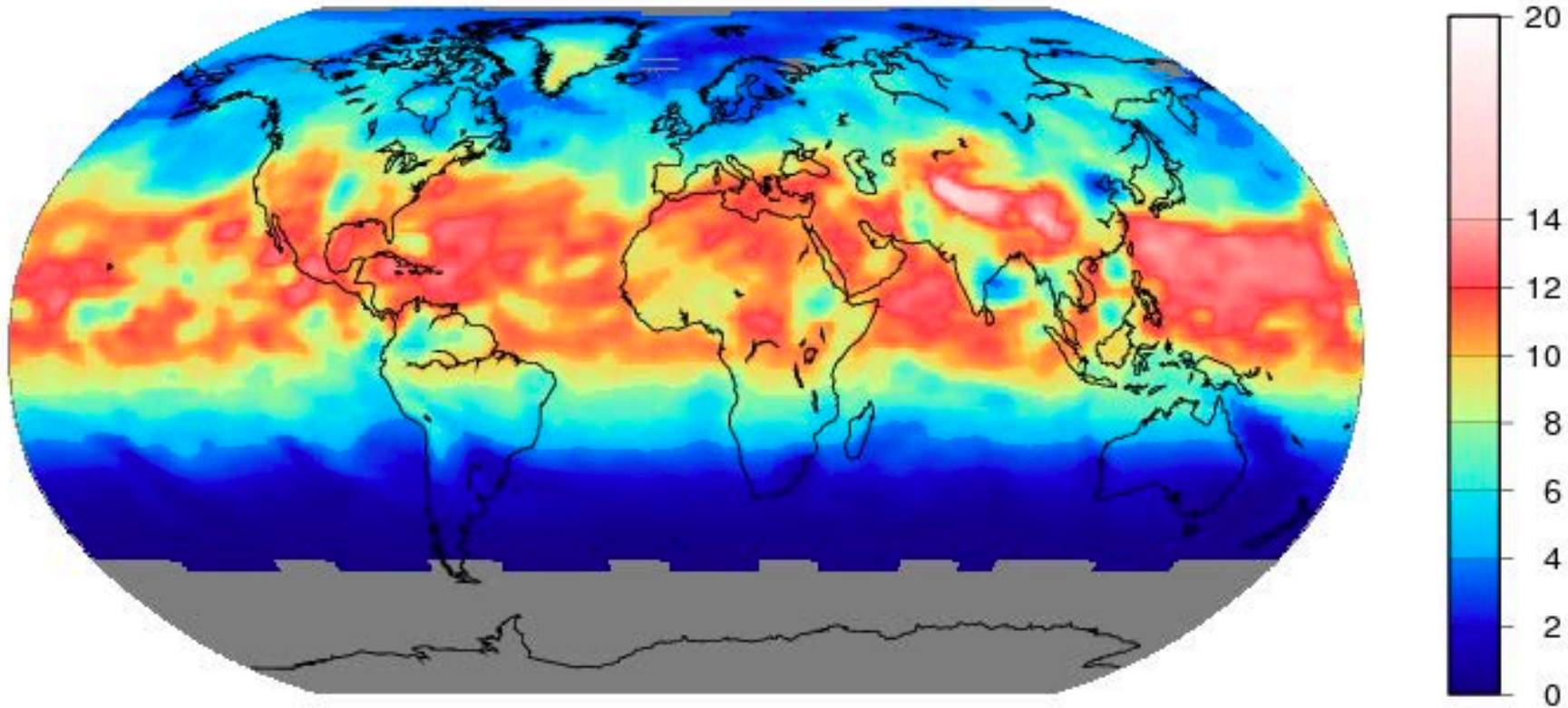
# The UV Index

- Ozone helps deflect much of the sun's harmful Ultraviolet rays
  - UVB causes sunburn
  - UVA can cause cancer
- Amount of UV affected by season, ozone, and other factors (ie. latitude, altitude)

1-2	3-5	6-7	8-10	11+
<b>Low</b> ----- Sunscreen SPF 30+ Sunglasses	<b>Moderate</b> ----- Sunscreen SPF 30+ Sunglasses Cover up & Hat  Seek Shade (midday)	<b>High</b> ----- Sunscreen SPF 30+ Sunglasses Cover up & Hat  Seek Shade  Limit Sun from 11 am - 5 pm	<b>Very High</b> ----- Sunscreen SPF 30+ Sunglasses Cover up & Hat  Seek Shade  Avoid Sun from 11 am - 5 pm	<b>Extreme</b> ----- Sunscreen SPF 30+ Sunglasses Cover up & Hat  Seek Shade  Avoid Sun from 11 am - 5 pm

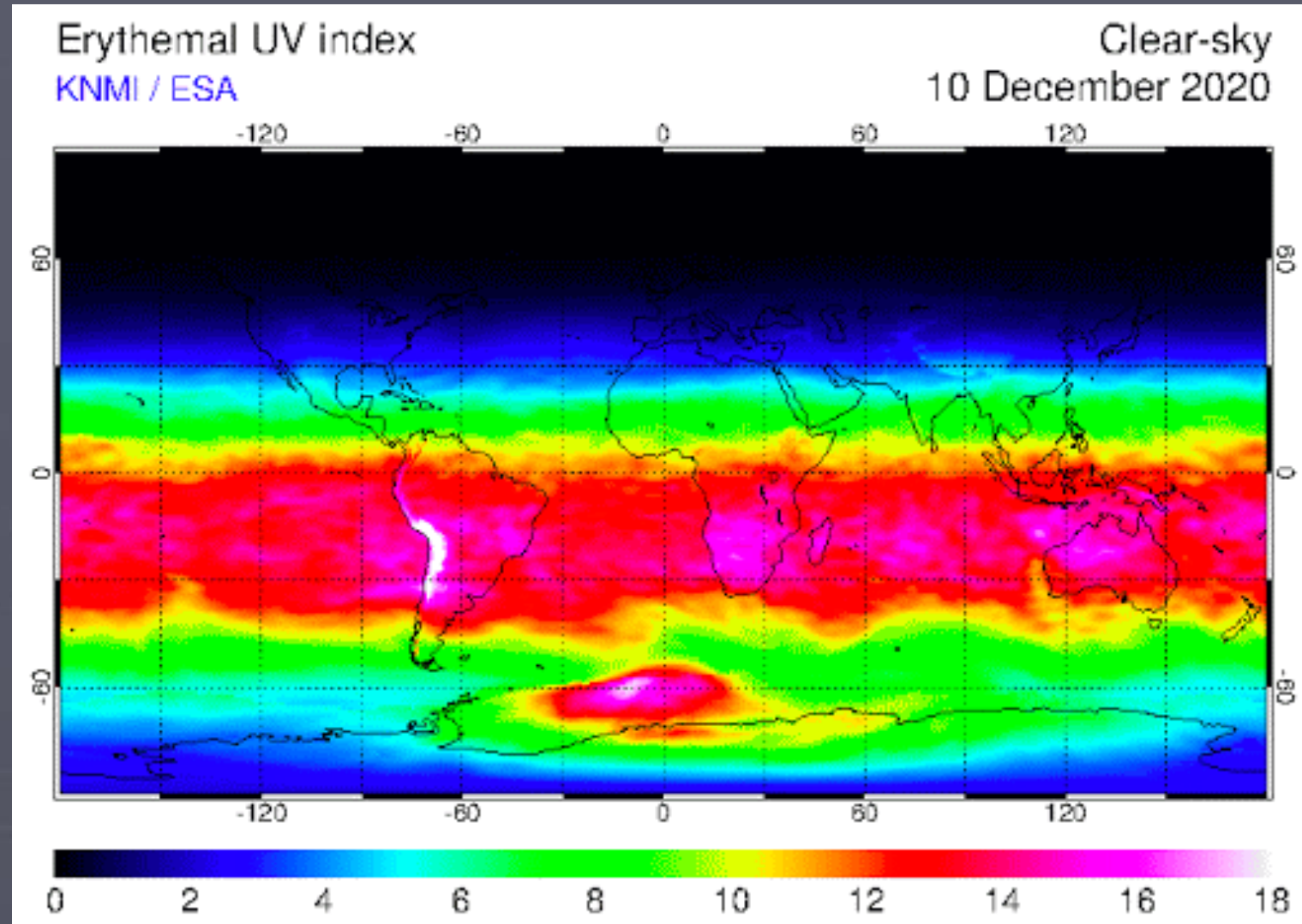
# UV Index at a Glance

UV Record – Vitamin-D Daily Dose on 2007-06-27 (kJ/m<sup>2</sup>)



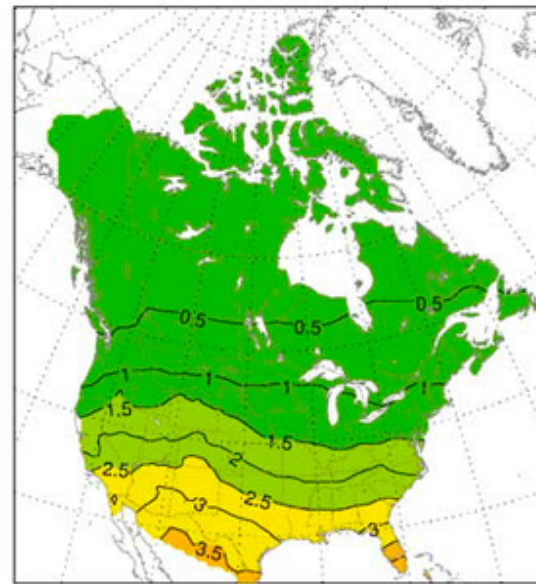
# UV Index Seasonality

UV Index has shifted reflecting seasonal changes in direct sunlight

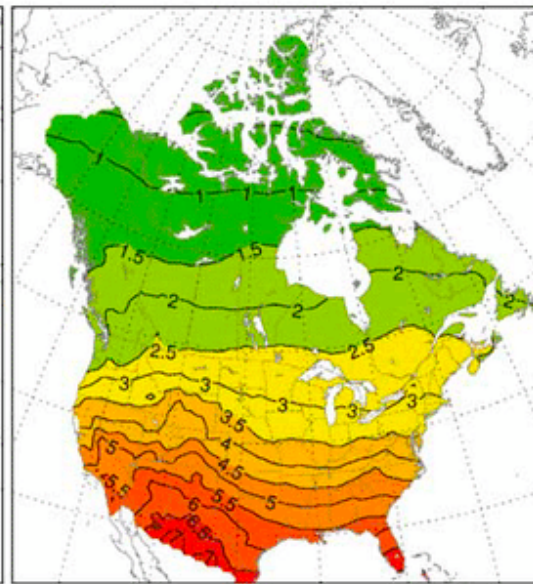




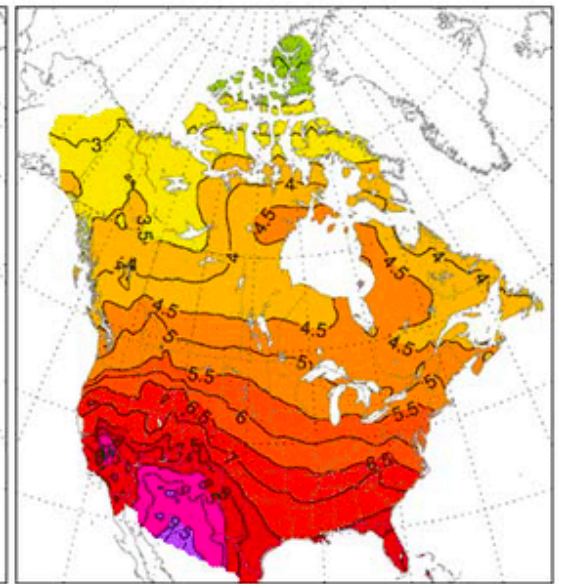
# UV Index in the United States over time



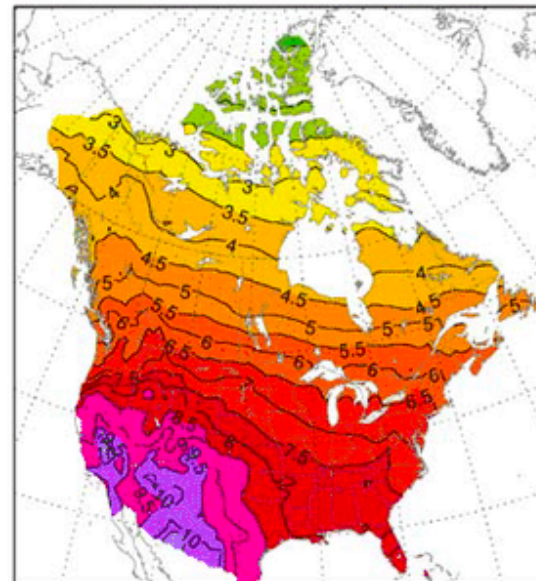
January



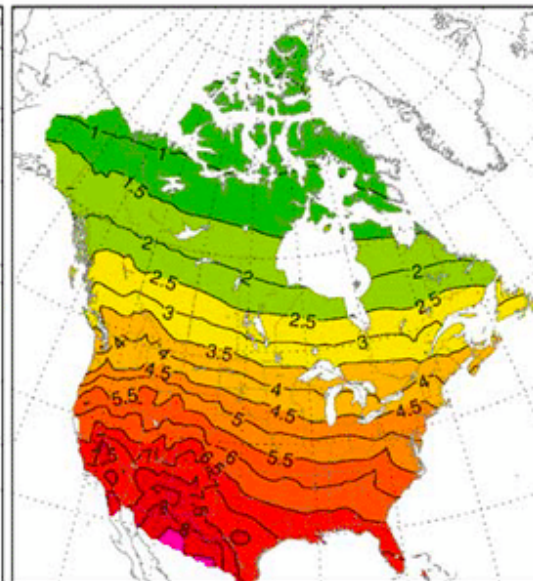
March



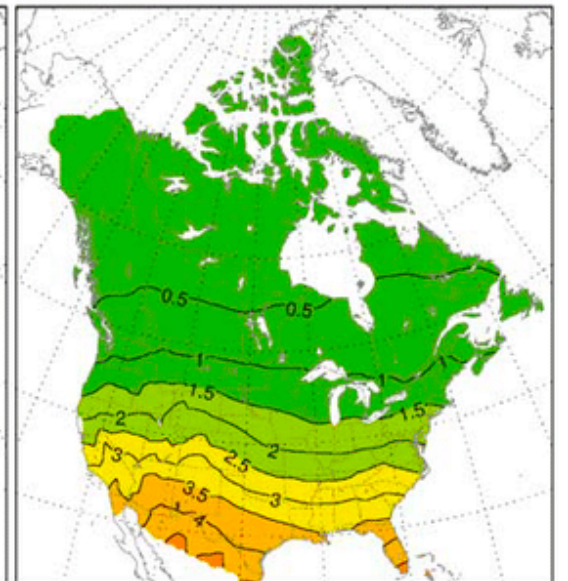
May



July



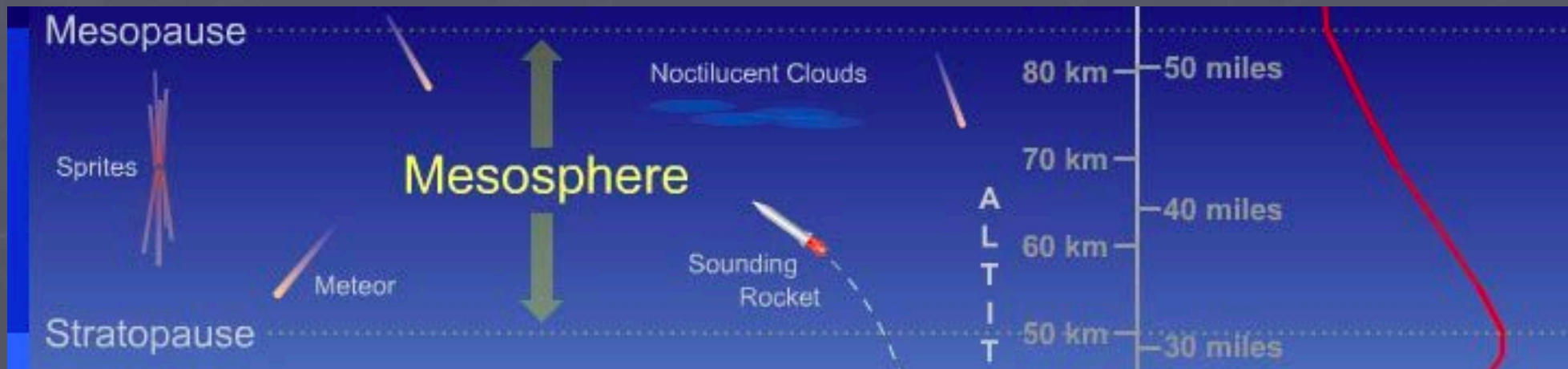
September



November

# Mesosphere

- Extends from edge of stratosphere to about 80km above Earth's surface
- Coldest portion of the atmosphere
  - Temperatures down to -90 degrees C (-130 degrees F)
- Noctilucent clouds
  - Created by crystallization around cosmic and meteoric dust



# Thermosphere

- Extends from edge of Mesosphere to about 600km
  - Beyond is exosphere (outer space) which extends to 32,000 km
    - Molecules escape into vacuum of space
- Characterized by an increase in temperature again
  - Absorption of UV and X-Ray radiation
  - Continuous stream of protons and electrons from Solar Winds

