

ATMOSPHERIC RESOURCES

COMPOSITION OF THE ATMOSPHERE

* Some components are fairly stable while others vary spatially and temporally

** **constant Gases** (found in same proportions within lower atmosphere)

** **variable Gases** (present in differing amounts spatially and/or temporally)

Constant Gases: 3 gases make-up just under 100% of the atmosphere

Variable Gases: 3 which influence weather and life systems

** **Carbon dioxide & Methane:**

** **water vapor:**

4% by volume in tropics to < 1% in deserts

* source of clouds and precipitation

* absorbs radiant energy & important in energy transfer

* Water is only substance found in all 3 states (solid, liquid, gas)

** **Ozone:**

* concentrated in the **stratosphere** (10-50 km above the surface)

* formation is by splitting an O₂ molecule with shortwave radiation and the single O atoms combining with an O₂

** ***OZONE "HOLE"*** (Thinning)

* CFC's are a family of chemicals used as coolants (Freon), propellants in aerosol cans, cleaners for computer chips, sterilants, fumigants, bubbles in foam insulation & packaging

* ozone layer thinning is primarily around the Antarctic & Arctic areas

* ozone layer may be reduced by as much as 50% around the Antarctic and 11-38% around the Arctic area

** ***Consequences (of less ozone):***

* increased cases of skin cancer & cataracts

* increased damage to plants and animals

** ***Solutions:***

- * Montreal Protocol agreement of 1987 (with several revisions, the last in 1999) was a step in this direction. As with the banning of CFCs by most industrialized nations in North America, Europe and others.
- * The Kyoto Protocol of 2006 was also a good step in reducing **greenhouse gases**.

VERTICAL STRUCTURE OF THE ATMOSPHERE

- ** **Air Pressure**: force exerted by the weight of a column of air above a given point
 - * at sea level the average pressure is 1013 mb or 1 kg above every cm², 29.92 inches of mercury
 - * there is an **inverse relationship between air pressure and height**; pressure decreases with increasing height
 - * 50%, by volume, of atmosphere is below 5.6km (~3.5mi)
 - * 90%, by volume, of atmosphere is below 16km (~9.5mi)
- ** **Temperature (T°)**: measure of the degree of hotness or coldness of a substance; **the average molecular motion of an object**
 - * T° may decrease or increase with increasing altitude
 - * in the Troposphere it normally decreases 6.5°C/km
 - * if the T° increases with altitude it's called an **inversion**
 - * a change in T° with a change in altitude is called the **lapse rate** or the **Temperature lapse rate**

Layers of the Atmosphere:

2 general regions : based on chemical composition

Homosphere: uniform chemical composition; from surface to a height of 80 - 100 km (50 - 63 mi)

Heterosphere: changing chemical composition; from top of homosphere upwards 4 main layers: based on temperature

Troposphere: T° usually decreases with increasing altitude; from surface to average height of 12 km (7.5 mi or 40,000'). clouds, affects temps.

Stratosphere: T° stays constant or increases with altitude;

** **contains the ozone layer (ozonosphere)**; very little H₂O

Mesosphere: T° decreases with increasing altitude; between ~ 50 & 80 km (31 & 50 mi)

Thermosphere: T° increases dramatically with altitude; T°'s may reach upwards of 900°C (1650°F); area above 80 km (50 mi)

CLIMATE CHANGE: EVIDENCE & TIMING

** Variations in climate on many different time scales from decades to millions of years, & the possible causes of such variations

* climate system; the interaction of the atmosphere, lithosphere, biosphere, & hydrosphere

* when change occurs in one sphere, it affects the other spheres

Evidence of Climate Change

Seafloor sediments, Oxygen isotope analysis, Tree rings (wet of dry?),

Palynology(pollen cores), Geology, Historical Records

CLIMATE CHANGE: CAUSES

Non-human Induced Causes:

Plate Tectonics, Volcanic output, Solar variation,

Astronomical Theory: **eccentricity**-change the shape of orbit, making bigger or smaller, further from sun colder vice versa, 100,000 year cycle **obliquity**-change the tilt, polar regions larger or smaller 41,000year cycle, **precession**- wobbleing 26,000 year cycle **know these parts and the years**

Human Induced Causes:

Changes in **atmospheric CO₂ levels**: a "greenhouse gas" which traps outgoing LW & thus helps keep the earth warm

* if levels increase, can lead to global warming

* since 1800 have seen a 25% increase on CO₂ levels from burning of fossil fuels

* a .5°C T° increase has been detected since 1880, but not sure the only cause is increased CO₂ levels

Changes in **atmospheric levels of other greenhouse gases**

* may also contribute to increased T°'s

What is Global Warming?

* the atmosphere is heated by a process known as the greenhouse effect

* LW radiation is "bounced" back & forth between the atmosphere, esp. Clouds, dust, and any CO₂, & the ground. This helps to keep the earth's