Lecture - 1 SC209

Atmospheric molecular interaction

→ Molecular bonds stretch & bend after absorbing IR electro. rad^n. Why?

Greenhouse gases concentration → highest in Troposphere.
⇒ IR from earth & Sun absorbed by CO_2 & CH_4 in tropos.

On hot day → it feels so because N_2 & O_2 → High K.E.
But N_2 & O_2 → X absorb IR because charges are evenly distributed. ⇒ How do they gain energy?

∴ They gain energy by collision & de excitation.

Wave no. $\propto \frac{1}{\text{wavelength}}$

⇒ At a particular wavelength, unique for different gases absorb energy at that particular λ because of the vibr^n of molecules.

∴ N_2 & O_2 gain energy by ~~convection~~ cond^n (→ conduction.) when they collide with CO_2 & CH_4.

Tropospheric Lapse rate :-

Lapse rate = $\frac{\text{Temp.}}{\text{Alt.}}$

Trop. lapse rate - Rate at which temp. ↓ with ↑ alt.

←

* Why does Lapse rate exist?

→ Atmosphere is made of naturally compressible gases like N_2 & O_2. N_2 & O_2 get compressed by the grav^t. pull of earth. & compression releases heat. ⇒ As we approach ground, temp ↑ & gets warm.

* Effective rad^n Altitude.

↳ The height beyond which the energy gets dissipated into the upper atmosphere.
This energy which escapes does so at a lower temp & therefore less energy escapes ⇒ More energy retained in the troposphere and therefore causes more warming.
∴ If effective rad^n altitude ↑ ⇒ Warming ↑.

Are all GHGs the same?

→ Do all GHGs have same effect?
Depends on 1) Conc^n of the gas in atmos.
2) Lifetime of the gas molecules in the atmosphere.
3) The region of IR that gas absorbs & how much it absorbs.

GHGs: A Closer Look.

Key Idea 1: Water Vapour (WV)

WV ⇒ Most abundant GHG in our atmosphere.
→ Responsible for over half of earth's greenhouse forcing, helps in keeps the surface of Earth warm.

~~##~~ WV Pressure:- WV content in atmosphere at any given moment.

↑ Vapor pressure ↑, ∴ gaseous water molecules ↑. ⇒ ~~↑ Temp.~~

↳ ⇒ Retention of energy will be high.

Carbon Dioxide

Keeling curve, → we know about this

p^H → ↓ over the years in the ocean ⇒ Surface ocean water is acidic.

Methane (Swamp gas, Marsh Gas)

↳ Natural Source & Biologic Source

Methane conc. ↑ from 0.7 ppm to 1.7 ppm.

Global warming potential ⇒ Change in radiative forcing by 1kg of greenhouse gas to that of 1kg CO_2.

↳ CO_2's GWP is 1.

~~Rad~~ Radiative forcing - Change in balance b/w incoming & outgoing rad^n of climate.

* Methane ~~clarate~~ clatharate :- As temp ↑, they have the potential to release stores of methane currently locked away in methane clatharate.

∴ Stored in methane clatharates overall is 1 & 00 000 Gigaton-

* N_2O (Nitrous Oxide)

- Trap - 300 times as large as CO_2.
  → potent GHG.