

lecture 4

lesson 4

context volcano on Iceland erupts emitting 250 million cubic m of ash.

Effect of atmospheric ash on T?

& Radiation Balance

when amount of radiation entering = radiation exiting

- Earth is a blackbody radiator.  
Absorbs photons of electromagnetic radiation and re-emits at diff frequency

Ashes - obstructs the incoming radiation. eat

↳ in troposphere and stays for 5-7 years.

→

~~Earth's albedo is affected~~  
Total

\* factors affecting Radiation Balance in a planet: -

- Albedo (Reflectivity)

↑ energy in ↓

Distance from Sun

D ↑ Energy in ↓

- Greenhouse effect

↑ Energy out ↓

Surface Temp.

T ↑ Energy out ↑

↓ screenshot

Next is a(ss) and comparison of planets.

Incoming Radiation (99%) UV visible IR

30% of received energy reflected away on the top of Earth's atmosphere due to albedo.

light is reflected back by clouds, ice, snow, sand, vegetation and water bodies.

Much of life require visible light for survival, light used for photosynthesis (PAR lies in visible range)

Two graphs

(pictures are separately uploaded)



Hot summer day ~ the heat is not all sun. warm T are a result of Earth's conversion of sun's visible light  $\rightarrow$  infrared radiation.

Effect of aerosols: -

Volcanic ash  $\rightarrow$  particles suspended in atmosphere in form of aerosols.

reflect incoming photons individually

coalesce into raindrops and become clouds (reflecting)

cools T

Also releases  $\text{SO}_2$ ,  $\text{CO}_2$  which may have other climatic effects.

Earth black body reflector. (radiation emitted depends on T)  
earth cooler than sun, emits at lower frequency in IR region.

~~IR radiation more in region of vegetation~~  
~~(as said by sir but compared to black soil)~~

Paleocene - Eocene Thermal Maximum (PETM)  
1000 km from Arctic circle 55 million years ago

A period of maximum global T  
high  $\text{CO}_2$   $\text{CH}_4$  concentration.

due to destabilization of methane clathrate hydrate ice like substance. In which gas molecules are trapped in cage of host molecules, found in arctic hundreds ago formed under high P low T

during PETM, it is believed that movement of earth's tectonic plates disrupted ocean patterns, dumping warming Arctic waters.



Scientists using PETM to study changes right now.  
In next 50 years a ~~greenhouse~~  $T$  will  $\uparrow$  and  
this  $\uparrow$  will be more in the arctic region.

↓  
Positive feedback loop.

as  $T \uparrow$  arctic water melts snow cover  $\downarrow$  which  
 $\downarrow$  the albedo which in turn  $\uparrow T$ . and due to this  
Arctic warms more quickly than other areas.

## Coral Reefs

↓  
stay in  
stable  
 $T$   
shallow  
coastal  
waters  
 $18-30^\circ\text{C}$

↳ symbiotic relation between  
coral polyps and colourful zooxanthellae  
algae.

↓  
provides nutrients  
and protection.

↓  
provides sugar via  
photosynthesis.

coral bleaching  $\rightarrow$  coral to white color and after  
prolonged time dies.  
ejection of colorful algae.

↳ majority due to Temp. changes  
so algae produces less sugar due to damage  
of photosynthetic machinery, and coral expels the algae.

•  $T \uparrow$  ocean level  $\uparrow$  which affects the habitat  
water as coral live in shallow waters.

• Increase in ocean mineral content  
Increase in  $\text{CO}_2$   $\text{pH} \downarrow$  ocean acidification  
 $\text{CaCO}_3$  & in shells dissolves.

vector borne disease = mosquito ~~bred~~ in regions  
of Africa

## Extreme Weather

El-Nino & Southern Oscillation (ENSO) in  
Pacific ocean  $\rightarrow$  has an extensive influence on the  
probability of hurricanes in the Atlantic.

El Niño - SST anomaly that exerts influence of Atmospheric pressure and wind patterns.

Biodiversity  
 frog population declining, sensitive to environmental change  
 ↓  
 thermoconformers - change in body T with change in environment