GREEN HOUSE EFFECT AND GLOBAL CLIMATE CHANGE

According to NASA; Weather consists of the short-term changes (minutes to months) in temperature, clouds, precipitation, humidity and wind in the atmosphere of a region or a city.

Climate is the long-term behavior of the weather in a particular area. Its description includes the following parameters

1. Averages of temperature and rainfall

2. The extremes of temperature and rainfall and the frequency of their occurrence

3. Meteorological measurements such as wind velocity, air-pressure, solar radiation, humidity, precipitation, atmospheric particle count, and cloud cover etc. over a long period of time in a given region

The Factors Determining the Climate

Two major determinants of climate are as follows.

1. The solar radiation is the most important factor. The angle at which Sun strikes the Earth's surface determines the areas which will be hot or which areas shall be cold.

2. The other important factor is the general circulation. The determinants of global circulation are ocean currents and global wind system. It is responsible for redistribution of heat. Wind system is broken into different cells by Earth's topography and rotation to produce characteristic patterns of prevailing winds.

The drivers of drastic changes in climate are the following natural and anthropogenic factors.

Natural Factors

1. Small natural change in Earth's orbit around the Sun alters the amount of solar energy, which the Earth receives, and its seasonal redistribution.

2. The Sun does not emit radiation at a constant flux. A slight variation in the output of the sun has strong effect on temperature.

3. Volcanic eruptions send dust clouds high in the atmosphere and these scatter the solar radiation back in space.

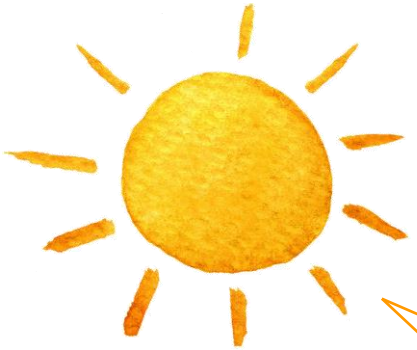
4. Atmosphere – ocean interactions

Anthropogenic Factor

Now, a new dimension to the above natural climate changes has been added by the increasing concentrations of greenhouse gases such as CO_2, CH_4, N_2O, CFCs etc.

Greenhouse and Greenhouse Effect

- A greenhouse is made up of glass walls and ceiling. Trees and plants are grown in it under controlled climatic conditions. Glass walls and ceiling are transparent to solar radiation, which are largely visible, so these are allowed to go into the greenhouse. Greenhouse does not allow most infrared radiation to go out, resulting its warming. The atmospheric gases which behave like glass walls and do not allow the infrared radiation released by Earth to go out to space are called greenhouse gases.
- Likewise, atmosphere is transparent to solar radiation, so these radiation reach Earth surface and heat it. The infrared radiation emitted by Earth are not allowed by greenhouse gases, CO_2, water vapors, methane, etc., to go out, resulting in the warming of the atmosphere. This is greenhouse effect.



Most of the IR escapes to outer space.

IR is given off by the Earth.

But some IR is trapped by gases in the air.

Sunlight passes throug the atmosphere.

<u>Greenhause Effect</u>

Increasing levels of CO_2 increase the amount of heat retained.

Greenhouse Gases and Their Sources

1. Carbon Dioxide, CO_2

CO_2 has largest amount in atmosphere among all greenhouse gases. The major obvious manmade contribution is the combustion of fossil fuels. Deforestation is another. The trees and plants work as carbon bank by storing carbon. The biological processes release CO_2 and fortunately, this amount is balanced by photosynthesis. It is in equilibrium with oceans, which absorb and release it. Human activities have led to net increase in CO_2 level. Beginning with industrial revolution, there is a rising trend in its concentration since 19^{th} century.

2. Methane, CH_4

Methane is continuously rising since the later part of 20th century, primarily due to increase in number of cattle and paddy fields. Methane is released by ruminants as stomach gas. In water-filled paddy fields, anaerobic biodegradations release methane. Municipal waste disposal landfills and coal-mines are other important sources.

3. Nitrous Oxide, N_2O

The microbiological processes in soil and ocean are the main sources. Increased use of nitrogen–based fertilizers is believed to be another cause. Other sources are change in agricultural practices and industrial manufacture of nylon.

4. Chlorofluorocarbons, CFCs

These are manmade compounds and there is no known natural source. These are inert and non-toxic and have a long lifetime of about 100 years. Since their synthesis in 1930s, these are widely used as coolant, insulator in refrigeration, blowing agents in foams, in cleaning of electronic equipment, and propellants for aerosols. There is no removal mechanism for these in troposphere, so their concentration has continued to increase and some of it passed into stratosphere leading to ozone depletion.

5. Tropospheric ozone and the greenhouse effect

Tropospheric ozone contributes to the greenhouse effect.

Global Warming Impacts	
1. Rising seas and increased coastal flooding	9. Increased pressure on groundwater supplies
2. Longer and more damaging wildfire seasons	10. Growing risks to our electricity supply
3. More destructive hurricanes	11. Changing seasons
4. More frequent and intense heat waves	12. Melting ice
5. Costly and growing health impacts	13. Disruptions to food supplies
6. An increase in extreme weather events	14. Destruction of coral reefs
7. Heavier precipitation and flooding	15. Plant and animal range shifts
8. More severe droughts in some areas	16. The potential for abrupt climate change

Kyoto Protocol

It is an international treaty, which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gases emissions, based on the premise that (a) global warming exists and (b) man-made CO_2 emissions have caused it.