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Research Paper

Global Warming: Overview and Strategies

Shree Meenakshi.K
[1] *(Department of Chemistry, Anna University India)*
Corresponding Author: Shree Meenakshi.K

ABSTRACT : *Climate change is a long time change in the average weather patterns that have come to define Earth's local, regional and global climates. These changes have a broad range of observed effects that are synonymous with the term. Changes observed in Earth's climate since the early 20th century are primarily driven by human activities, particularly fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere, raising Earth's average surface temperature. These human-produced temperature increases are commonly referred to as global warming. This research paper deals with the causes, effects and preventive measures to minimise global warming.*
KEYWORDS: *Development activities, Natural Resources, Environmental degradation, Crop productivity.*

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I. INTRODUCTION

Global warming is the long-term heating of Earth's climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere. The term is frequently used interchangeably with the term climate change, though the latter refers to both human- and naturally produced warming and the effects it has on our planet. It is most commonly measured as the average increase in Earth's global surface temperature. Since the pre-industrial period, human activities are estimated to have increased Earth's global average temperature by about 1 degree Celsius (1.8 degrees Fahrenheit), a number that is currently increasing by 0.2 degrees Celsius (0.36 degrees Fahrenheit) per decade. Most of the current warming trend is extremely likely (greater than 95 percent probability) the result of human activity since the 1950s and is proceeding at an unprecedented rate over decades to millennia.

II. GREEN HOUSE EFFECT

The continuous rise in temperature of the planet is really a cause of concern. The root cause for this is global warming. Global warming begins when sunlight reaches the Earth. The clouds, atmospheric particles, reflective ground surfaces and surface of oceans then sends back about 30 % of sunlight back into the space, whilst the remaining is absorbed by oceans, air and land. This consequently heats up the surface of the planet and atmosphere, making life feasible. As the Earth warms up, this solar energy is radiated by thermal radiation and infrared rays, propagating directly out to space thereby cooling the Earth. However, some of the outgoing radiation is re-absorbed by carbon dioxide, water vapors, ozone, methane and other gases in the atmosphere and is radiated back to the surface of Earth. These gases are commonly known as greenhouse gases due to their heat-trapping capacity. It must be noted that this re-absorption process is actually good as the Earth's average surface temperature would be very cold if there was no existence of greenhouse gases. The dilemma began when the concentration of greenhouse gases in the atmosphere was artificially increased by humankind at an alarming rate since the past two centuries.

Greenhouse gases from human activities are the most significant driver of observed climate change since the mid-20th century. The indicators in this chapter characterize emissions of the major greenhouse gases resulting from human activities, the concentrations of these gases in the atmosphere, and how emissions and concentrations have changed over time. When comparing emissions of different gases, these indicators use a concept called "global warming potential" to convert amounts of other gases into carbon dioxide equivalents. As greenhouse gas emissions from human activities increase, they build up in the atmosphere and warm the climate, leading to many other changes around the world—in the atmosphere, on land, and in the oceans. The indicators in other chapters of this report illustrate many of these changes, which have both positive and negative effects on people, society, and the environment—including plants and animals. Because many of the major greenhouse gases stay in the atmosphere for tens to hundreds of years after being released, their warming effects on the climate persist over a long time and can therefore affect both present and future generations.

Enhanced greenhouse effect

Since the mid 1800's the average concentration of CO_2 in the earth's atmosphere has risen from about 280 parts per million (ppm) to just over 383 ppm in 2007, and methane from about 800 parts per billion (ppb) to around 1790 ppb in 2008. While these changes represent only a very small change to the overall composition of the earth's atmosphere, it is a significant change to its capacity to absorb and emit heat. The main contributors are changes to the carbon cycle that have led to increased levels of carbon dioxide in the earth's atmosphere in the last 200 years. These include reduced CO_2 removal and storage through deforestation; direct CO_2 production from the burning of fossil fuels and CO_2 released from cement production. The increased release of nitrogen oxides (NOx) from burning fossil fuels and soil denitrification (particularly with the introduction of high nitrogen fertilizers) and intensive production of livestock such as cows and pigs which produce methane have also contributed to the enhanced greenhouse effect.

The differing chemical structures of these gases produce a different absorption spectra or wavelengths of radiation which they will absorb or let through (Figure.1). An important aspect of this is that even if the atmosphere is saturated with water vapor there are wavelengths of infrared radiation that it will not be absorbed. However, CO_2 and other greenhouse gases can absorb the infrared radiation at the wavelengths missed by water vapor.

The capacity for a gas to absorb long wavelength (Infrared) radiation and the length of time it spends in the atmosphere both impact on its potential to act as a greenhouse gas. This potential is often expressed as its CO_2 equivalent, or the number of equivalent molecules of CO_2 it would take to absorb as much heat as one molecule of the gas in question over a given time period (usually 100 years). The CO_2 equivalents of some greenhouse gases are shown in table 1 below.

CO_2	1
CH_4	21
N_20	310
HFC's	140 ~ 11,700
PFC's	6,500 ~ 9,200
SF6	23,900

Table 1: The CO_2 equivalents of some greenhouse gases

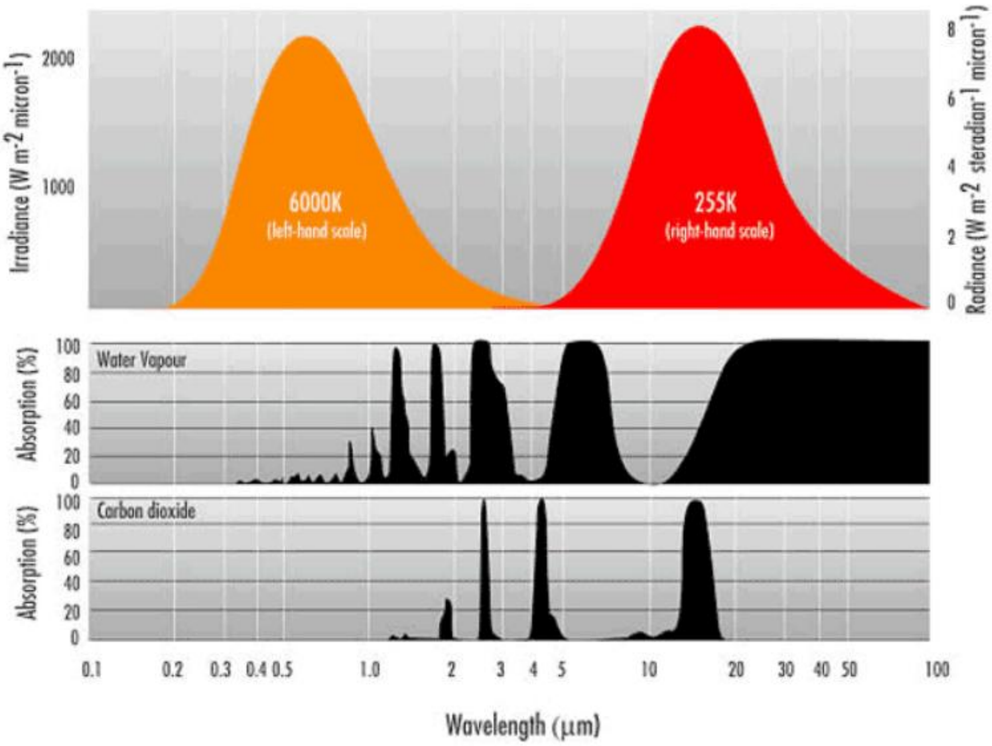

Figure 1. The radiation absorption characteristics of water vapour and carbon dioxide

While methane (CH_4) and N_2O both absorb more heat per molecule than CO_2, CO_2 concentrations are much higher (100 -100 times higher respectively) and therefore have more overall effect on the enhanced greenhouse effect. Residence time plays an important role as well as concentration. While water vapour is by far the greatest contributor to the natural greenhouse effect, it spends so little time in the atmosphere (days rather than centuries) that it is not well mixed and thus its effects on temperature are short lived and very localized.

III. CONSIDERATIONS FOR MEASUREMENT AND INTERPRETATION

Air pollution occur when large number of undesirable gases and particulate matter are found in air. This results in deterioration of air quality, requires control and monitoring. If it is not controlled, it results in diseases, allergies or premature death in humans. In general, it is the contamination of air by smoke, gases (chiefly carbon dioxide, sulphur dioxide, and nitrogen dioxide), suspended particles, particulate matter and other air pollutant. It is directly related to greenhouse effect and global warming which is primarily caused due to carbon di oxide & other greenhouse gases.

While we can directly measure the levels of CO_2 and other greenhouse gases in the atmosphere and we know how they have changed in the past, the extent to which their concentrations will change in the future is uncertain (Fig. 2). How much greenhouse gas will be emitted in the future is dependent on a number of complex factors, such population change, economic development, changes to technology along with social and political ideology. Projections of future emissions of greenhouse gases are made based on scenarios, or plausible descriptions of the future. A scenario provides a set of assumptions that describe what might happen in the future. As the interactions between each of the factors within a scenario and how each of the factors will affect greenhouse emission are not completely understood, uncertainty is introduced at every step of the projection process. The possible error in projected emissions is carried into the projected levels of greenhouse gases and further compounded when a projection of temperature change is made from the greenhouse gas concentrations.

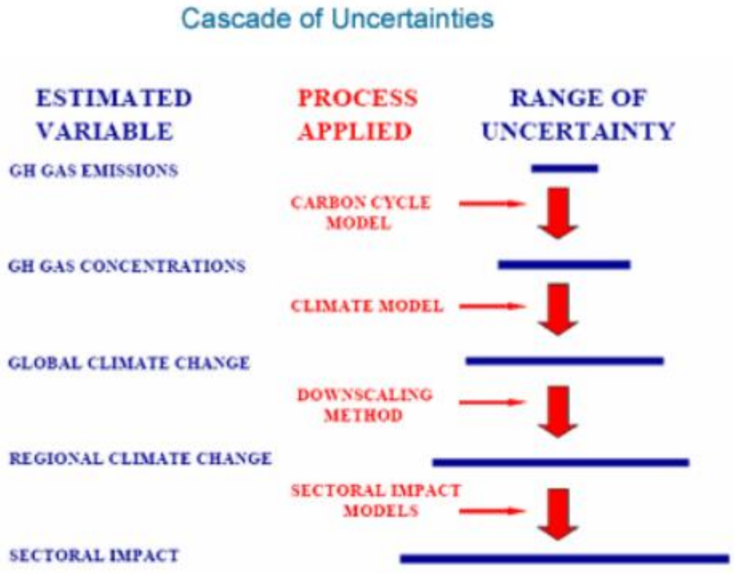

Figure 2. Flow chart illustrating that uncertainty is introduced into predictions of impacts at every step, and these uncertainties accumulate

The uncertainty of the temperature projections is further increased due to our limited understanding of the exact sensitivity of climate to various concentrations of greenhouse gases, i.e., how much will temperature rise from a given increase in CO_2 levels (Fig. 3). This is even further complicated by the issue of feedbacks in which higher temperatures will lead to increased release of greenhouse gases leading to even higher temperatures and thus releasing more greenhouse gas and so on. An example would be the release of methane from permafrost (ground currently frozen all year round) as it thaws in the Northern Hemisphere.

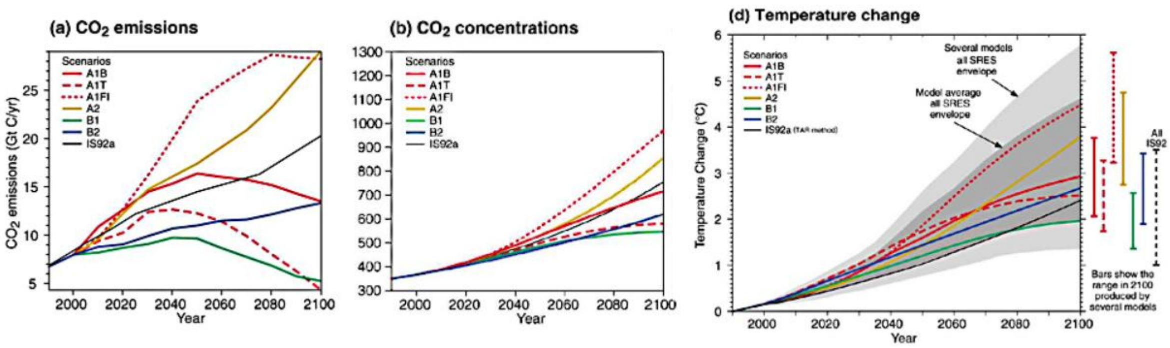

Figure 3. Projections of a) CO_2 emissions, b) atmospheric CO_2 concentrations, and d) temperature change, associated with the IPCC emission scenarios. Note the levels of uncertainty associated with the projections of temperature change. From the IPCC special report on emission scenarios 2000).

IV. CAUSES, EFFECTS AND PREVENTION OF GLOBAL WARMING

The major cause of global warming is the greenhouse gases. They include carbon dioxide, methane, nitrous oxides and in some cases chlorine and bromine containing compounds. The build-up of these gases in the atmosphere changes the radiative equilibrium in the atmosphere. Their overall effect is to warm the Earth's surface and the lower atmosphere because greenhouse gases absorb some of the outgoing radiation of Earth and re-radiate it back towards the surface. The net warming from 1850 to the end of the 20th century was equivalent to nearly 2.5 W/m2 with carbon dioxide contribution about 60 % to this figure, methane about 25 per cent, with nitrous oxides and halocarbons providing the remainder. In 1985, Joe Farman, of the British Antarctic Survey, published an article showing the decrease in ozone levels over Antarctica during the early 1980s.

The response was striking: large scale international scientific programmes were mounted to prove that CFCs (used as aerosol propellants in industrial cleaning fluids and in refrigeration tools) were the cause of the problem. Even more important was abrupt international action to curb the emissions of CFCs. The second major cause of global warming is the depletion of ozone layer. This happens mainly due to the presence of chlorine containing source gases. When ultraviolet light is present, these gases dissociate releasing chlorine atoms which then catalyzes ozone destruction.

Aerosols present in the atmosphere are also causing global warming by changing the climate in two different ways. Firstly, they scatter and absorb solar and infrared radiation and secondly, they may alter the microphysical and chemical properties of clouds and perhaps affect their lifetime and extent. The scattering of solar radiation acts to cool the planet, while absorption of solar radiation by aerosols warms the air directly instead of permitting sunlight to be absorbed by the surface of the Earth.

The human contribution to the amount of aerosols in the atmosphere is of various forms. For instance, dust is a by-product of agriculture. Biomass burning generates a mixture of organic droplets and soot particles. Many industrial processes produce a wide diversity of aerosols depending on what is being burned or generated in the manufacturing process. Moreover, exhaust emissions from various sorts of transport produce a rich mixture of pollutants that are either aerosols from the outset or are transformed by chemical reactions in the atmosphere to form aerosols.

Predicting the consequences of global warming is one of the most difficult tasks faced by the climate researchers. This is due to the fact that natural processes that cause rain, snowfall, hailstorms, rise in sea levels is reliant on many diverse factors. Moreover, it is very hard to predict the size of emissions of greenhouse gases in the future years as this is determined majorly through technological advancements and political decisions. Global warming produces many negative effects some of which are described here.

Firstly, extra water vapour which is present in the atmosphere falls again as rain which leads to floods in various regions of the world. When the weather turns warmer, evaporation process from both land and sea rises. This leads to drought in the regions where increased evaporation process is not compensated by increased precipitation. In some areas of the world, this will result in crop failure and famine particularly in areas where the temperatures are already high. The extra water vapour content in the atmosphere will fall again as extra rain hence causing flood. Towns and villages which are dependent on the melting water from snowy mountains may suffer drought and scarcity of water supply. It is because the glaciers all over the world are shrinking at a very rapid rate and melting of ice appears to be faster than previously projected. According to Intergovernmental Panel on Climate Change (IPCC), about one-sixth of the total population of the world lives in the regions which shall be affected by a decrease in melting water. The warmer climate will likely cause more heat waves, more violent rainfall and also amplification in the severity of hailstorms and thunderstorms.

Rising of sea levels is the deadliest effect of global warming, the rise in temperature is causing the ice and glaciers to melt rapidly. This will lead to rise of water levels in oceans, rivers and lakes that can pilot devastation in the form of floods. Before, the 20th century, the situation was well under control but the beginning of the current century, the situation started to worsen. This was all due to increase in global warming majorly due to the fact that new industries and power houses started operation and emitted harmful gases which cause the planet to heat up. This data is based on the research carried out by different climate and environmental research agencies.

There is no one-size-fits-all approach to stopping or slowing global warming, and each individual, business, municipal, state, tribal, and federal entity must weigh their options in light of their own unique set of circumstances. Experts say it is likely many strategies working together will be needed. Generally speaking, here are some examples of mitigation strategies we can use to slow or stop the human-caused global warming: We can switch to renewable sources of energy (such as solar and wind energy) to power our homes and buildings, thus emitting far less heat-trapping gases into the atmosphere. We can drive electric vehicles instead of those that burn fossil fuels; or we can use mass transit instead of driving our own cars. Energy can be conserved by better insulating our homes and buildings, and by replacing old, failing appliances with more energy-efficient models. We can counterbalance our annual carbon dioxide emissions by investing in commercial services that draw down an equal amount of carbon out of the atmosphere, such as through planting trees or carbon capture and storage techniques. Local businesses that use and promote sustainable, climate-smart practices such as those listed above should be supported. We can consider placing an upper limit on the amount of carbon dioxide we will allow ourselves to emit into the atmosphere within a given timeframe.

*Corresponding Author: Shree Meenakshi.K

V. CONCLUSION

As long as mankind produces greenhouse gases, global warming will continue to accelerate. The consequences which are felt at a much smaller scale which will increase to become drastic in the near future. The power to save the day lies in the hands of humans, the need is to seize the day. Energy consumption should be reduced on an individual basis. Fuel efficient cars and other electronics should be encouraged to reduce the wastage of energy sources. This will also improve air quality and reduce the concentration of greenhouse gases in the atmosphere. Global warming is an evil which can only be defeated when fought together. It is better late than never. If we all take steps today, we will have a much brighter future tomorrow. Global warming is the bane of our existence and various policies have come up worldwide to fight it but that is not enough. The actual difference is made when we work at an individual level to fight it. Understanding its importance now is crucial before it becomes an irrevocable mistake. Exterminating global warming is of utmost importance and each one of us is as responsible for it as we need to save the environment for the future generations to come.

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