

CLIMATE CHANGE : A GLOBAL PHENOMENA

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Increasing world population and the increasing desire of human beings to raise their standard of living has led to technological innovations of all kinds. These innovations have made life more comfortable but at the cost of increased demands for food, air, water, minerals and energy. Rapid depletion of natural resources all around us has caused unprecedented changes in global climate resulting in serious implications on the survival of both human and animal species on earth. It is feared that one-fourth of earth's species could be headed for extinction by 2050. We should emphasise to use renewable sources of energy like wind, solar, biomass and ocean geothermal energy.

Key Words: IPCC-I, NSF, Climate change, Global warming

Introduction

Climate change means a long term change in earth's climate due to natural, mechanical and anthropological processes which result in the emission of greenhouse gases like CO₂, methane, etc.

Our planet earth has witnessed many changes in climate since the beginning. Geological records also show alternation of glacial and interglacial periods. The geomorphological features in high altitudes and high latitudes, exhibit traces of advances and retreats of glaciers. Deposition of sediment in glacial lakes also proves the occurrence of warm and cold periods. The sign of rings in the trees also provide clues about wet and dry periods. These proofs show that change in climate is a natural and continuous process. India also witnessed alternate wet and dry periods. Archaeological research shows that the Rajasthan desert experienced wet and cool climate around 8,000 B.C. The period 3,000-1,700 B.C. had higher rainfall. From about 2,000-1,700 B.C., this region was the centre of Harappa civilisation. Dry condition accentuated since then.

Variability in climate occurs all the time.

But the 9th decade of the twentieth century witnessed extreme weather events. The 1990s recorded the warmest temperature and worst floods around the world. The worst devastating drought in the Sahel region, south of Sahara desert, from 1967-1977 is one such variability. During the 1930s, a severe drought occurred in south-western Great Plains of the United States, described as the dust bowl.

Migration of people and crop yield or crop failures, of floods, also tell about the effects of changing climate. Europe faced many times warm, wet, cold and dry period, the significant episodes were the warm and dry conditions in the 10th and 11th centuries, when the Vikings settled in Greenland. Europe had 'Little Ice Age' from 1550 to about 1850. World temperature showed an upward trend during 1885-1940. The rate of increase in temperature slowed down after 1940.

Global Trends in Climate Change

Earth's climate continuously changed. In the last 650,000 years, there have been seven cycles of glacial advance and retreat. The

surface of the earth's temperature has risen about 1.62 degrees due to increased carbon dioxide and other human-made emissions into the atmosphere. The current warming trend is the result of human activity since the mid-20th century. United Nation's Intergovernmental Panel on Climate Change (IPCC-I) emphasises that increasing the use of coal and oil to fuel a worldwide consumer society will make the process of climate change rapidly worse. Burning of fossil fuels like coal, oil and clearing of land for human activities also increased concentrations of greenhouse gases.

Satellites and other technological advances reveal the signals of our climate changes. Tropical mountain glacier, Antarctica and Greenland show the earth's climate responding to changes in greenhouse gas levels. Ancient evidence shows that current warming is occurring roughly ten times faster than the average rate of ice age recovery warming. NASA's Gravity Recovery and Climate Experiment data show that Greenland lost an average of 286 billion tons of ice and Antarctica lost about 127 billion tons of ice per year between 1993 and 2016.

Satellite observation show glaciers of Himalayas, Andes, Rockies, Alps, Alaska and Africa are retreating and extent and thickness of Arctic sea ice have declined rapidly over the last several decades. A study reveals that 2 billion tons of carbon dioxide is absorbed by the upper layer of the oceans per year.

According to researchers of Ohio State University, USA glaciers and ice caps around the world are melting and retreating for over two decades. This will reduce hydroelectric power production, crop irrigation and drinking water supply in the region.

The greenhouse effect not only destroys the world's freshwater reservoirs but also projected to cause floods and droughts, reduce the area of arable land, adversely

impact fish and food stocks, erode coastlines as sea levels rise and trigger the large movement of population to safer areas. This will lead to large scale migration and competition for resources.

National Climate Data Centre (NCDC) and the National Science Foundation (NSF) reveal that global warming has contributed to the emergence of stronger hurricanes in the Atlantic ocean.

The report of the International Panel on Climate Change (IPCC) has made it clear that climate change is happening largely because of human activity.

Causes of Climate Change

There are many causes responsible for climate change. But we can divide them into astronomical and terrestrial causes. In the astronomical causes, we saw changes in solar output associated with sunspot activities. Sunspots are also playing a major role in climate change. Some meteorologists agree that when there is increase in the number of sunspots, we feel cooler and wetter weather and but greater storminess occur.

Volcanism is also a major cause of climate change. Volcanoes discharge a lot of aerosols into the atmosphere. These aerosols remain in the atmosphere for a considerable period of time reducing the sun's radiation reaching the earth's surface. The most important anthropogenic effect on the climate is the increasing trend in the concentration of greenhouse gases in the atmosphere which is the cause of global warming.

Outcomes of Climate Change

The main outcomes of climate change are:

1. Global Warming (Green House Effect)
2. Acid Rain
3. Ozone layer depletion

Global Warming (Greenhouse Effect)

Global warming is a gradual increase in the overall temperature of the earth's atmosphere. It is generally attributed to the greenhouse effect caused by increased levels of CO₂, methane (CH₄) and other harmful gases in the atmosphere.

Some sunlight that hits the earth is reflected back into space while the rest warms the earth. But increased level of greenhouse gases (CO₂, CH₄, N₂O) prevent heat from escaping into space, warming the earth more.

Carbon dioxide is responsible for climate change; it is released through volcano eruptions and human activities such as deforestation, land-use changes and burning fuels. Methane (CH₄) is an active greenhouse gas and produced through natural sources and human activities including the decomposition of wastes and agriculture.

Nitrous oxide (N₂O) is an important greenhouse gas released by soil cultivation practices, especially the use of commercial and organic fertilisers, fossil fuel combustion and biomass burning.

Chlorofluorocarbons (CFCs) are also greenhouse gases. They are products of human activity. Ozone occurs in the stratosphere where ultraviolet rays convert oxygen into ozone thus ultraviolet rays do not reach the earth's surface. Chlorofluorocarbons drift into the stratosphere and destroy the ozone. Large depletion of ozone occurs over Antarctica.

The presence of greenhouse gases in the atmosphere is behaving like a greenhouse. The atmosphere transmits the incoming solar radiation but also absorbs the vast majority of long wave radiation emitted upwards by the earth's surface. The gases which absorb long

wave radiation are called Greenhouse gases. The processes that warm the atmosphere are called the greenhouse effect.

Acid Rain

Normal rain drop is slightly acidic, with a pH of 5.6, while acid rain generally has a pH between 4.2 and 4.4. The main common cause of acid rain is air pollution. Mainly oxides of nitrogen and sulphur are responsible for acid rain. Oxides of sulphur and nitrogen react with water vapour present in the atmosphere and form sulphuric acid (H₂SO₄) and nitric acid (HNO₃). Then, these come to the earth surface by rain. Acid rain creates a negative effect on human being, aquatic animals, plants, stones and other materials.

Ozone Layer Depletion

Ozone (O₃) is the triatomic molecule of oxygen and it is a natural gas. O₃ is present in both Troposphere and the Stratosphere.

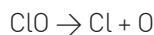
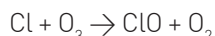
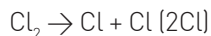
Positive O ₃	Stratosphere	90% O ₃
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Negative O ₃	Troposphere	10% O ₃
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Tropospheric Ozone is negative for the living organisms because it creates pollution in the Troposphere, i.e. photochemical smog. While stratospheric Ozone is positive for us because it protects our earth surface from the ultraviolet radiation. Ultraviolet radiation has a wavelength from 100 nm - 400 nm, that is very harmful to the living organism.

Cause of Ozone Layer Depletion

Some gases like CFC – Chlorofluorocarbon, HCFC – Hydrochlorofluorocarbons and CCl₄ – Carbon tetrachloride are mainly responsible for ozone layer depletion. From the gas chlorine molecule reacts with ozone and depletes it.



In this way, one chlorine atom depletes many O_3 molecules.

Impact of Climate Change in India

A large population of India depends upon agriculture, forest and fishery for livelihood. The impact of climate change in the form of increasing temperature and decreasing rainfall would create many problems in the country. The 15th Edition of Global Climate Risk Index 2020 found that about 2,081 deaths in 2018 in India were due to extreme weather events caused by climate change—cyclone, heavy rainfall, floods and landslides. These impacts can be discussed under the following headings:

- Drying Rivers

Climate change is threatening the very existence of Himalayan glaciers. The Gangotri glacier, whose melted water feed the river Ganga has, for instance, been receding since 1780 but its rate of retreat has tripled in the last three decades. If this trend continues over the next 30 to 40 years, the Ganga could initially swell in volume because of increasing melting which could produce widespread flooding, rock avalanches from destabilised slopes and affected water resources within two or three decades, and when the river flow starts declining, Ganga and its tributaries could become a seasonal river.

- Agriculture and Food Security

India's food security will be affected by climate change shortly. Indian

agriculture depends on monsoon but the change in the precipitation pattern will reduce rice cultivation in Indo-Gangetic plains.

Crop productivity will fall especially in non-irrigated lands as temperature rises by 1.2-degree centigrade on average by 2040 and greater crop loss of over 25 per cent as temperature rises to 5.4-degree centigrade by the end of this century. It means lower caloric intake for India's rural population. This grim situation indicates that the Indian government should give priority to better water management, new agricultural technology in a region-specific manner and evolve new cropping patterns which can tolerate higher temperature and water scarcity.

- Coastal Areas

Climate change will raise sea level, which could inundate and erode coastal area, increase flooding and saltwater intrusion. Sea level will rise 40 cm higher by 2100 and 50 million people in coastal India will be displaced by flooding. It will affect coastal agriculture, fisheries and aquaculture, freshwater resources, human settlement and tourism. The state like Tamil Nadu can face increased frequency of coastal storm, higher mean temperature, more frequent drought and sudden flash flood.

- Human Health

There is growing evidence that change in the global environment will have a profound effect on human health in India. Excessive monsoon rainfall and high humidity will enhance mosquito breeding. Scientists are concerned that

climate change can lead to an increase in temperature-related infections or diseases like malaria and kala-azar. Human health is also affected by cyclone, drought and heavy rainfall. Climate change will reduce food production which will lead to hunger and malnutrition.

- Forestry

With erratic rainfall and decrease in precipitation levels, India's forest would deplete rapidly. The extreme temperature would extinct flora and fauna by 2030. According to R. Sukumar, an environmental scientist of Indian Institute of Science "Changes in temperature and rainfall associated with global warming could result in about 80 percent of existing forests in the country changing the type of vegetation". Climate change is rapidly becoming the most serious threat to the planet's biodiversity.

Conclusion

Climate change is a variable factor, it changes time to time from Human and Natural Activity to climate and culture, hence establishing close relationship. According to climate change culture automatically changes. Some harmful impacts of climate change are global warming, acid rain and ozone layer depletion. To sum up, it can be said that there is a need to change lifestyle and consumption pattern in all developed and developing countries. The world community should generate political consensus to mitigate greenhouse gases. Climate change is no longer an environmental issue but it is related to global security and survival. India must adopt new, energy-efficient technologies to reduce the CO₂ level. We should emphasise to use renewable sources of energy like wind, solar, biomass and ocean geothermal energy. In India collaborative action by government, the community and individuals could combat climate change.

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