

**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH
TECHNOLOGY****GLOBAL WARMING AND ITS IMPACT ON WATER RESOURCES****Debu Mukherjee**Department of Civil Engineering, Batanagar Institute of Engineering, Management and Science
(A unit of Techno India Group), Kolkata- 700141, West Bengal, INDIA

DOI: 10.5281/zenodo.51043

ABSTRACT

Global warming is the gradual heating of earth's surface, oceans and atmosphere. Global warming is primarily a problem of too much carbon dioxide in the atmosphere which acts as a blanket, trapping heat and warming the planet. The relationship between water, energy, agriculture and climate is a significant one. As the earth's temperature continues to rise, we can expect a significant impact on our fresh water supplies with the potential for devastating effects on these resources. As temperatures increase, evaporation increases, sometimes resulting in droughts. In addition, rising temperatures are melting glacial ice at an unprecedented rate. Glaciers are an important source of freshwater worldwide, and some, like those at Glacier National Park, are in danger of disappearing within the 21st century. Once these glaciers have melted away, they can't be restored. Areas that previously depended on glaciers for freshwater will then have to seek other sources. Climate change will affect water resources through its impact on the quantity, variability, timing, form, and intensity of precipitation. This paper provides an overview of the projected physical and economic effects of climate change on water resources and a brief discussion of potential means to mitigate adverse consequences.

KEYWORDS: Climate, Atmosphere, Energy, Warm, Water, Glaciers etc.**INTRODUCTION**

The effects of global climate change that have important implications for water resources include increased evaporation rates, a higher proportion of precipitation received as rain, rather than snow, earlier and shorter runoff seasons, increased water temperatures, and decreased water quality in both inland and coastal areas. The physical and economic consequences of each of these effects are discussed below. Increased evaporation rates are expected to reduce water supplies in many regions. The greatest deficits are expected to occur in the summer, leading to decreased soil moisture levels and more frequent and severe agricultural drought. More frequent and severe droughts arising from climate change will have serious management implications for water resource users. Agricultural producers and urban areas are particularly vulnerable, as evidenced by recent prolonged droughts in the western and southern United States, which are estimated to have caused over \$6 billion in damages to the agricultural and municipal sectors. Such droughts also impose costs in terms of wildfires, both in terms of control costs and lost timber and related resources. Water users will eventually adapt to more frequent and severe droughts, in part by shifting limited water supplies towards higher-value uses. Such shifts could be from low to high-value crops or from agricultural and industrial to environmental and municipal uses. A period of delay is likely, however, because gradual changes in the frequency and severity of drought will be difficult to distinguish from normal inter-annual variations in precipitation. Economic losses will be larger during this period of delay, as compared to a world with instantaneous adjustment, but preemptive adaptation could also be costly given the uncertainty surrounding future climate. Rising surface temperatures are expected to increase the proportion of winter precipitation received as rain, with a declining proportion arriving in the form of snow. Snow pack levels are also expected to form later in the winter, accumulates in smaller quantities, and melt earlier in the season, leading to reduced summer flows. Such

shifts in the form and timing of precipitation and runoff, specifically in snow-fed basins, are likely to cause more frequent summer droughts. Timing of runoff will affect the value of hydropower potential in some basins if peak water run-off occurs during nonpeak electricity demand. Energy shortages and resulting energy price increases will provide incentives to expand reservoir capacities or develop alternative energy sources.

If the runoff season occurs primarily in winter and early spring, rather than late spring and summer, water availability for summer-irrigated crops will decline, and water shortages will occur earlier in the growing season, particularly in watersheds that lack large reservoirs. Agricultural producers, in response to reduced water supplies and crop yields, will adjust their crop mix. Producers in irrigated regions might reduce total planted acreage, or deficit-irrigate more acres, to concentrate limited water supplies on their most valuable crops (e.g. onions and potatoes, rather than wheat and alfalfa). Producers in rain-fed regions might shift to crop species and varieties with shorter growing season requirements or greater drought tolerance, such as winter grains. These adjustments will mitigate a portion of private economic losses. They will also affect environmental quality, although the expected direction is more difficult to predict. Climate change is expected to affect water quality in both inland and coastal areas. Specifically, precipitation is expected to occur more frequently via high-intensity rainfall events, causing increased runoff and erosion. More sediments and chemical runoff will therefore be transported into streams and groundwater systems, impairing water quality. Water quality may be further impaired if decreases in water supply cause nutrients and contaminants to become more concentrated. Rising air and water temperatures will also impact water quality by increasing primary production, organic matter decomposition, and nutrient cycling rates in lakes and streams, resulting in lower dissolved oxygen levels. Lakes and wetlands associated with return flows from irrigated agriculture are of particular concern. This suite of water quality effects will increase the number of water bodies in violation of today's water quality standards worsen the quality of water bodies that are currently in violation, and ultimately increase the cost of meeting current water quality goals for both consumptive and environmental purposes. Rising sea levels could also reduce water quality and availability in coastal areas. Recent projections of sea-level rise by the end of the 21st century range from 19 to 58 cm. A more dramatic increase in sea-level, on the order of meters rather than centimeters, is possible, but most scientists consider it a low probability risk. For example, complete melting of the Greenland Ice Sheet or West Antarctic Ice sheet would trigger such a large rise. Rising sea levels could affect groundwater quality directly via saltwater intrusion. Radical changes to the freshwater hydrology of coastal areas, caused by saltwater intrusion, would threaten many coastal regions' freshwater supplies. Rising sea levels could also affect water availability in coastal areas indirectly by causing water tables in groundwater aquifers to rise, which could increase surface runoff at the expense of aquifer recharge. Water shortages will cause the price of water to rise, through monthly water bills or one-time connection fees for new homes and businesses. A sufficiently large price increase could affect the extent and pattern of urban growth throughout the United States. Costly water supply projects, such as desalination plants, pipelines, and dams will also become more economically attractive.

CAUSES OF GLOBAL WARMING

Global warming is a serious issue and is not a single issue but a numerous of environmental issues. Global warming is rising the surface temperature of the earth that has changes various life forms on the earth. The issues that causes the global warming is divided into two categories include natural and human influence of global warming:

Natural Causes:

- The climate has continuously changing for centuries. The global warming happens because the natural rotation of the sun that changes the intensity of sunlight and moving closer to the earth.
- Another cause of global warming is greenhouse gases. Greenhouse gases are carbon monoxide and sulphur dioxide it trap the solar heats rays and prevent it from escaping from the surface of the earth. This has cause the temperature of the earth increase.
- Volcanic eruptions are another issue that causes global warming. For instance, a single volcanic eruption will release amount of carbon dioxide and ash to the atmosphere. Once carbon dioxide increase, the temperature of earth increase and greenhouse trap the solar radiations in the earth.
- Methane is another issue that causes global warming. Methane is also a greenhouse gas. Methane is more effective in trapping heat in the atmosphere that carbon dioxide by 20 times. Usually methane gas can release from many areas. For instance, it can be from cattle, landfill, natural gas, petroleum systems, coal mining, mobile explosion, or industrial waste process.

Man-made causes

Human influence has been a very serious issue now because human do not take care the earth. Human that cause global warming are more than natural causes global warming. The earth has been changing for many years until now it is still changing because of modern lifestyle of human. Human activities include industrial production, burning fossil fuel, mining, cattle rearing or deforestation.

- First issue is industrial revolution. Industrial have been using fossil fuels for power machines. Everything that we use is involved in fossil fuel. For example, when we buy a mobile phone, the process of making mobile phone have involve
- machines and machines uses fossil fuels, during the process carbon dioxide is releasing to the atmosphere. Besides industrial, transportation such as cars is also releasing carbon dioxide from exhaust.
- Another issue is mining. During the process of mining, the methane will trap below the earth. Besides, rearing cattle will also cause methane because cattle released the form of manure. However, cattle is important because it make the latter equally responsible for the occurrence of global warming.
- Next is the most common issue that is deforestation. Deforestation is human influence because human have been cutting down trees to produce papers, wood, build houses or more houses or more. If human continuing deforestation, carbon dioxide will concentrate in the atmosphere because trees can absorb carbon dioxide from atmosphere. Besides, human also release carbon dioxide when breathe. Therefore the amounts of millions of people breathe have release carbon dioxide to the atmosphere. If human continue deforestation, human breathing that release carbon dioxide will stay at the atmosphere.

EFFECTS OF GLOBAL WARMING

The greenhouse gases will stay in the atmosphere for many years since hundreds years ago. However, the effect that global warming will cause on earth are extremely serious. There are many effects that will happen in the future if global warming continues. That includes polar ice caps melting, economic consequences, warmer waters and more hurricanes, spread of diseases and earthquake etc. Some of them are:

- **Rise in Sea levels worldwide:** First effect is polar ice caps melting. As the temperature increase, the ice at North Pole will melt. Once the ice melt the first effect will be raise on sea levels because the melting glaciers become oceans. According to the National Snow and Ice Data Center "if the ice melted today the seas would rise about 230 feet". It affects many low lying areas such as Netherland. In future, Netherland will be cover by water once the North pole is melted. Scientists predict an increase in sea levels worldwide due to the melting of two massive ice sheets in Antarctica and Greenland, especially on the East coast of the U.S. However, many nations around the world will experience the effects of rising sea levels, which could displace millions of people. One nation, levels. However, it is not going to happen so fast but the sea level will continue rise
- **Widespread extinction of species:** Rising temperatures could lead to the extinction of more than a million species. Andbecause we can't exist without a diverse population of species on Earth, this is scary news for humans. Another effect is the species loss it habitat. Species that include polar bears and tropical frogs will be extinct due to climate change. Besides, various birds will migrate to other places because animals are not like humans. They cannot adapt the habitat that changes their living or temperature.
- **More storms/hurricanes:**The severity of storms such as hurricanes and cyclones is increasing. More hurricanes will occur and economic consequences still affect as well. Hurricane causes damage to houses and government need to spend billions of dollars in damage and people need places to stay or have been killed. Once a disaster happens many people have died and diseases happen. Diseases are more serious because it can spread to other people very fast and more people will get the disease and the disease maybe come more serious because of different weather.
- **Massive crop failures:**"Climate change is expected to have the most severe impact on water supplies. "Shortages in future are likely to threaten food production, reduce sanitation, hinder economic development and damage ecosystems. It causes more violent swings between floods and droughts. According to recent research, there is a 90% chance that 3 billion people worldwide will have to choose between moving their families to milder climes and going hungry due to climate change within 100 years.
- **Disappearance of coral reefs:**The 'bleaching' of corals from small but prolonged rises in sea temperature is a severe danger for ocean ecosystems, and many other species in the oceans rely on coral reefs for their

survival. For reefs, warming waters and acidification are closing in like a pair of jaws that threaten to make them the first global ecosystem to disappear.

REMEDIES & SOLUTIONS TO STOP GLOBAL WARMING

Now there are solutions that we can stop global warming. However we human and governments need to move forward to implement the global warming solutions. To reduce global warming we can do to reduce the contribution of greenhouse gases to the atmosphere. Therefore, the solutions that we can reduce global warming are reducing gasoline, electricity and our activities that cause global warming.

- To reduce gasoline mean we have a choice to choose a hybrid car that reduce using gasoline. Besides, petrol price are increasing. If a person everyday drives to work they need to pump petrol after 3 days and causes carbon dioxide. Another wa
- y to reduce gasoline is take public transport or carpool to work. It can help reduce carbon dioxide and save cost.
- Recycle can reduce garbage by reusing plastic bags, bottles, papers or glass. For instance, when we buy foods, we can use our own containers instead of plastic bags. Another example is after finish drinking the water from the bottle; we can reuse it or use our own bottle. If all this is being reuse, human can reduce deforestation and help save environment. Besides, turn off electricity if unused. It can save thousands of carbon dioxide and buy product that have energy saving because it saves cost and save environment.
- Human should stop open burning such as burning dry leafs or burning garbage. It will release carbon dioxide and toxic if burning garbage with plastic. Besides, government should reduce deforestation because the earth temperatures are increasing. Trees will help to improve the temperature on earth.

Also, there is no single solution to global warming, which is primarily a problem of too much heat-trapping carbon dioxide (CO₂), methane and nitrous oxide in the atmosphere. The technologies and approaches outlined below are all needed to bring down the emissions of these gases by at least 80 percent by mid-century:

- **Boosting energy efficiency:** The energy used to power, heat, and cool our homes, businesses, and industries is the single largest contributor to global warming. Energy efficiency technologies allow us to use less energy to get the same—or higher—level of production, service, and comfort. This approach has vast potential to save both energy and money, and can be deployed quickly.
- **Greening transportation:** The transportation sector's emissions have increased at a faster rate than any other energy-using sector over the past decade. A variety of solutions are at hand, including improving efficiency (miles per gallon) in all modes of transport, switching to low-carbon fuels, and reducing vehicle miles traveled through smart growth and more efficient mass transportation systems.
- **Reviving up renewables:** Renewable energy sources such as solar, wind, geothermal and bioenergy are available around the world. Multiple studies have shown that renewable energy has the technical potential to meet the vast majority of our energy needs. Renewable technologies can be deployed quickly, are increasingly cost-effective, and create jobs while reducing pollution.
- **Phasing out fossil fuel electricity:** Dramatically reducing our use of fossil fuels—especially carbon-intensive coal—is essential to tackle climate change. There are many ways to begin this process. Key action steps include: not building any new coal-burning power plants, initiating a phased shutdown of coal plants starting with the oldest and dirtiest, and capturing and storing carbon emissions from power plants. While it may sound like science fiction, the technology exists to store carbon emissions underground. The technology has not been deployed on a large scale or proven to be safe and permanent, but it has been demonstrated in other contexts such as oil and natural gas recovery. Demonstration projects to test the viability and costs of this technology for power plant emissions are worth pursuing.
- **Managing forests and agriculture:** Taken together, tropical deforestation and emissions from agriculture represent nearly 30 percent of the world's heat-trapping emissions. We can fight global warming by reducing emissions from deforestation and forest degradation and by making our food production practices more sustainable.

- **Exploring nuclear:** Because nuclear power results in few global warming emissions, an increased share of nuclear power in the energy mix could help reduce global warming—but nuclear technology poses serious threats to our security and, as the accident at the Fukushima Daiichi plant in Japan illustrates to our health and the environment as well. The question remains: can the safety, proliferation, waste disposal, and cost barriers of nuclear power be overcome?
- **Developing and deploying new low-carbon and zero-carbon technologies:** Research into and development of the next generation of low-carbon technologies will be critical to deep mid-century reductions in global emissions. Current research on battery technology, new materials for solar cells, harnessing energy from novel sources like bacteria and algae, and other innovative areas could provide important breakthroughs.
- **Ensuring sustainable development:** The countries of the world—from the most to the least developed—vary dramatically in their contributions to the problem of climate change and in their responsibilities and capacities to confront it. A successful global compact on climate change must include financial assistance from richer countries to poorer countries to help make the transition to low-carbon development pathways and to help adapt to the impacts of climate change.

CONCLUSION

- Global Warming have causes many problem for human but we human who make global warming happens. Many people have died because of disease or disaster. It also affects the economics of the country. However, we need to be reduce the global warming by using less gasoline, recycle and human should help to reduce global warming instead of making the earth temperature increased. Our generation should start taking care of the earth because in the next generation they will suffer if we do not do reduce global warming. Therefore, global warming is a serious issue now.
- There is very little doubt that global warming will change our climate in the next century. There must be an international political solution. Second, funding for developing cheap and clean energy production must be increased, as all economic development is based on increasing energy usage. We must not pin all our hopes on global politics and clean energy technology, so we must prepare for the worst and adapt. If implemented now, a lot of the costs and damage that could be caused by changing climate can be mitigated.
- The needed focus for the study of climate change and variability is on the regional and local scales. Global and zonally-averaged climate metrics would only be important to the extent that they provide useful information on these space scales.
- Global and zonally-averaged surface temperature trend assessments, besides having major difficulties in terms of how this metric is diagnosed and analyzed, do not provide significant information on climate change and variability on the regional and local scales.
- Global warming is not equivalent to climate change. Significant, societally important climate change, due to both natural- and human- climate forcing, can occur without any global warming or cooling.
- The spatial pattern of ocean heat content change is the appropriate metric to assess climate system heat changes including global warming.
- In terms of climate change and variability on the regional and local scale, the IPCC Reports, the CCSP Report on surface and tropospheric temperature trends, and the U.S. National Assessment have overstated the role of the radiative effect of the anthropogenic increase of CO₂ relative to the role of the diversity of other human climate forcing on global warming, and more generally, on climate variability and change.
- Global and regional climate models have not demonstrated skill at predicting regional and local climate change and variability on multi-decadal time scales.
- Attempts to significantly influence regional and local-scale climate based on controlling CO₂ emissions alone is an inadequate policy for this purpose.
- A vulnerability paradigm, focused on regional and local societal and environmental resources of importance, is a more inclusive, useful, and scientifically robust framework to interact with policymakers, than is the focus on global multi-decadal climate predictions which are downscaled to the regional and local scales. The vulnerability paradigm permits the evaluation of the entire spectrum of risks associated with different social and environmental threats, including climate variability and change.

Humans are significantly altering the global climate, but in a variety of diverse ways beyond the radiative effect of carbon dioxide. The IPCC assessments have been too conservative in recognizing the importance of these human climates forcing as they alter regional and global climate. These assessments have also not communicated the inability of the models to accurately forecast the spread of possibilities of future climate.

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