

## Climate Change: An Analysis of Imprints of Changing Weather Pattern in the Anthropocene Epoch

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### ABSTRACT

*21<sup>st</sup> century witnessing the dynamic weather pattern where scorching heat in summers, chilling breeze in winters, and increasing pollutants in the air have become a part of daily weather news forecasts. India having the characteristics of tropical and sub-tropical climate is not far behind in being a victim of haphazard seasonal variations which leads to rising health issues. This changing pattern not only affects the health but also the daily hustling-bustling of life. Nevertheless, the economy faces huge disruptions which may at times lead to huge losses. Additional expenditure is incurred by the govt. to face the catastrophic situations caused by these changing weather patterns. In this paper, emphasis will be laid on the analysis of changing weather patterns in different countries and the severity of consequences faced by them. The objective of this paper is to highlight some of the real-time solutions that can be aptly chosen to mitigate the risks associated with such catastrophic situations. Special emphasis shall be laid upon illness & issues caused by unpredictable weather patterns impacting health and measures that can be opted for the betterment of mankind and society.*

**Keywords:** Dynamic Weather, Scorching Heat, Hustling-Bustling, Catastrophic, Mankind.

### Introduction

Presently, climate change has become the most important highlight, especially in the Anthropocene epoch. The Anthropocene epoch reflects the present time when human activities are impacting the earth's climate and environment. No doubt, we humans are the greatest contributors to the deterioration of our environment. Increasing Greenhouse gas emissions lead to rising temperatures on the earth's surface, affecting our landscapes a lot. Numerous examples of it can be seen like the melting of glaciers, algal bloom, ocean acidification, wildfires, drought, etc. All these have become a major concern for the survival of humanity. These long-term changing weather patterns and temperatures which are often described as climate change require utmost attention.

### Objectives of the Study

- To assess the changes in the weather pattern and its cascading effect on society.
- To propose the urgent need for interdisciplinary research and cooperation in addressing human-induced climate change
- To put forward mitigation and adaptation strategies to safeguard the planet's future.

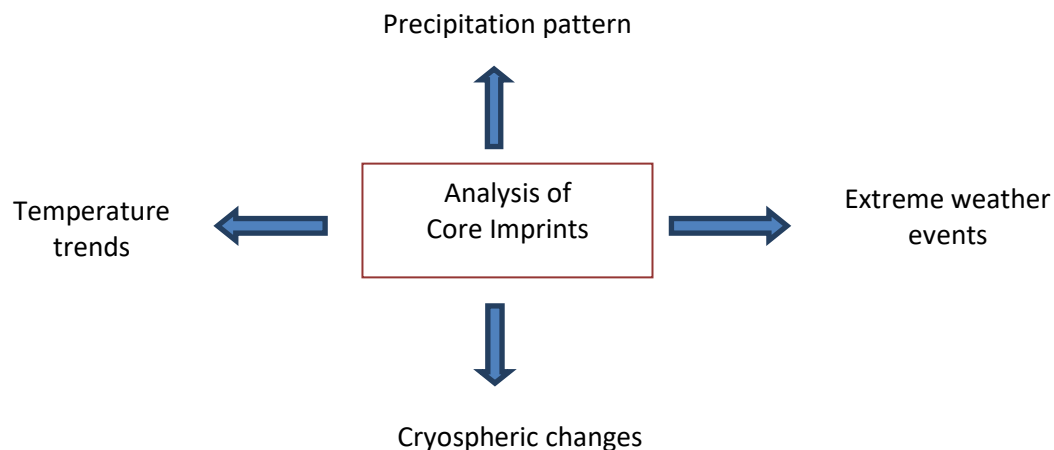
### Core Aspects

- The Anthropocene epoch has ushered in unprecedented changes in global weather patterns, with rising temperatures, altered precipitation regimes, and increased extreme events posing significant challenges to both natural ecosystems and human societies.
- The multifaceted impacts of climate change in the Anthropocene, including sea-level rise, ecosystem shifts, and atmospheric circulation changes, necessitate urgent and comprehensive mitigation and adaptation strategies to safeguard the planet's future.

- The accelerating rate of climate change during the Anthropocene has led to complex interactions between various Earth systems, resulting in cascading effects that threaten biodiversity, food security, and human well-being on a global scale.
- The Anthropocene epoch's climate crisis demands a paradigm shift in our approach to environmental management, emphasizing the interconnectedness of atmospheric, oceanic, and terrestrial systems in developing effective solutions.
- The profound alterations in weather patterns during the Anthropocene highlight the urgent need for interdisciplinary research and international cooperation to address the complex challenges posed by human-induced climate change.

### Key Areas of Analysis

Climate change in the Anthropocene epoch has left significant imprints on global weather patterns, profoundly altering the Earth's climate system and affecting various aspects of our environment. This comprehensive analysis explores these changes, delving into their causes, manifestations, and potential consequences for both natural ecosystems and human societies.



Source: Diagram constructed by author

### Temperature Trends

Global average temperatures have risen by roughly 1 °C since pre-industrial times, with the rate of warming accelerating in recent decades. -further frequent and violent heatwaves seen across mainlands, leading to increased mortality rates, reduced labor productivity, and strain on energy systems. Accelerated warming in polar regions (Arctic modification), with the Arctic warming doubling fast then the global average. The urban heat island effect led to temperature increase in metropolises, posing fresh challenges for civic populations. The time 2024 saw a record- breaking rise in temperature reaching up to 45 degrees Celsius, especially in the Delhi- NCR region. Around 41,000 cases of heat stroke were reported across the nation causing around 116 deaths as per the data of the Ministry of Health and Family Welfare, government of India.

### Rainfall Patterns

The changing pattern of rainfall contrasts with the convectional pattern since ages. The areas or countries which were rainfall deficits are receiving huge quantities, whereas the ones receiving surplus are facing deficits.

For example – 2024 saw unanticipated events like the United Arab Emirates entering huge quantities of downfall creating flood like situations. Around 259.5 mm of downfall was recorded in a 24-hour span which caused huge destruction around the megacity. This part of the globe has always been a downfall deficiency area including the huge desert area, stacks, etc. But, in 2024 many of its stations entered huge quantities of downfall exceeding 100 mm like Dubai field with 144 mm which was around 1.5 times' worth of rain.

### **Extreme Weather Events**

Increasing events of Dust storm, cyclones, hurricanes, typhoons etc causes immense damage to areas and especially coastal communities. Some areas face droughts like situation back-to-back again in various regions, leading to water scarcity, agricultural losses, and increased wildfire. Continuous wildfire in wildfire prone areas result in extensive ecological damage, air quality issues, and threats to human settlements. Increased occurrence of extreme events, where multiple hazards occur simultaneously or in close succession, leaves a significant impact on that region

For example – Indian Heatwave, wildfires in South America, hurricanes & storms in Florida, record-breaking floods in Spain and UAE, California wildfires, etc. Presently 2025, China witnessing a Dust storm due to the formation of a vortex over the Mongolia region and its severity reached its peak as the warning is being issued by the government authorities that, "people weighing below 50 kgs should avoid going away outside as they can be blown away by the ferocious winds."

### **Cryosphere Changes**

Amidst the rising temperature, our cryosphere has seen substantial changes like melting of ice, rise in Arctic Sea position, deliquescing permafrost, etc. The cryosphere has always been one of the most pivotal areas and changes in it are relatively a disturbing index affecting the marine organisms and their niche, venturing the islet nations and their survival, etc. The cryosphere comprises that major knob that remains fixed around the time like snow covers, glaciers, ice wastes, icicles, and permafrost ground. All these can be well understood with polar caps, arctic icicles, Antarctic mass land, etc. According to data, the Greenland ice distance is losing ice at a rate of around 270 gigatons a time. This melting of glaciers also called permafrost thawing can lead to disastrous consequences like the release of greenhouse gases in the air like carbon dioxide and methane, the release of bacteria and contagions that have survived numerous geological periods, and their unforeseen release can lead to outbreak of pandemics and conditions. Also, this permafrost thawing can change the graphic geography into erratic muddy aesthetics destroying the glaciers, territories of marine organisms, etc.

### **Sea-Level Rise**

The contemporary world is facing one of the major issues of rising sea level due to climate change. It depicts the rise in the average height of oceans of the world. Coastal submerging creating huge destruction of niche and lives is also one of the major consequences of rising ocean situations. Not only land but abysses play a huge part and are a treasure of resources. but presently, mortal conditioning leading to rising greenhouse gas emissions, pollution, imbalanced and disturbed ocean ecology and organisms' impact like ocean acidification, loss of oxygen, eutrophication (algal bloom), mass coral bleaching, etc.

For example – Maldives one of the most beautiful islets known for its pristine beauty has the smallest terrain in the world. According to the World Bank data, the entire islet will be submerged by 2100 if the ocean position continues to rise by 10 to 100 centimeters. Atmospheric rotation changes Climate change is affecting the general rotation pattern of the atmosphere, which leads to extreme climate events and indigenous rainfall patterns. Oscillation (ENSO) cycle, affecting global rainfall patterns and potentially enhancing its impacts. Changes in the polar vortex, affect downtime rainfall patterns in mid-latitude regions and potentially lead to further frequent cold air outbreaks. variations in the Hadley cell rotation, impacting tropical and tropical climate patterns. Not only Hadley but also Walker cell rotation is disturbed by rising ocean- face temperature which can lead to changes in El Nino/ La Nina Events and disrupt rush patterns. Ocean Rotation Changes studies have talked about the shifting major ocean currents and their movements which regulate the ocean-surface temperature, and rising air pattern and modifies the temperature and rainfall pattern of the area. Also, changes in the upwelling currents affect marine ecosystems, and fisheries potentially affecting the productivity in the region. differences in ocean temperature impact nutrient cycling and marine food webs. decelerating of the Atlantic Meridional Capsizing Rotation (AMOC), with implicit impacts on indigenous climate patterns and marine ecosystems.

### **Adversity and Consequences**

Increased frequency and intensity of hurricanes, cyclones, and typhoons, cause greater damage to coastal communities and infrastructure. More severe and prolonged droughts in various regions, lead to water scarcity, agricultural losses, and increased wildfire risks. Amplified wildfire seasons in fire-prone areas, result in extensive ecological damage, air quality issues, and threats to human settlements. Increased occurrence of compound extreme events, where multiple hazards occur simultaneously or in close succession, amplifying their impacts.

2025 witnessed a major wildfire incident in Los Angeles which devastated the region, taken up many lives, and displaced thousands from their homes. Around 1,50,000 residents have evacuated their homes, 12,000 buildings destroyed and around 150 billion dollars in damages have been estimated. The U.S. termed it as one of the costliest disasters ever. The blazing fires ravaging the homes were driven by Santa Ana Winds blowing at a speed of 100 mph in some areas and dry conditions intensifying its spread. Many iconic areas are ravaged by blazing fumes. Many human-caused incidents like debris burning and fireworks are said to be the cause behind the massive wildfire fueled by Santa Ana local winds blowing in this area.

Not only environmental but also these changing weather patterns affecting the health of the people. The onset of autumn & winter in the Delhi-NCR region has witnessed increasing pollution in this area due to stubble burning, rising emission of greenhouse gases, etc which has led to rising cases of respiratory problems, breathing problems, allergic conditions like rhinitis, sinus, asthma & bronchitis problems etc. Many a times, GRAP measures were implemented, and schools were shut down and switched to online mode still the problem of pollutants like P.M. 2.5 persists. Whooping cough & sneezing were being heard in almost every household increasing the demand for air purifiers & humidifiers in the market. All these are not only due to meteorological changes but also directly human-induced changing weather patterns leading to long-term impacts as witnessed in climate change.

Prolonged heatwave conditions do trap the northern part of the country primarily focusing on the national capital region in 2024 leading to thousands of deaths and around 40,000 cases of heatstroke, and rapid expansion of urbanization leading to the development of skyscrapers and business centers not only traps more heat but also leads to urban heat island effects. Adding to it, changing climatic conditions like drought-like conditions cause the land to heat up more rapidly reducing available moisture.

#### **Need of the Hour: Adaptation & Strategies**

The need of the hour, currently analyzing the present scenario calls for some environment friendly approach, more environment centric rather than purely human centric to reduce its negative consequences on the mankind and environment. Technological driven solution is much into the usage for planning mitigation strategies and developing sustainable solutions to cope up with the impacts of climate change. Artificial intelligence, Geospatial data referencing, remote sensing techniques have revolutionized the world, where technological tools can predict and issue early warning to mitigate the possible risks, destruction and casualties.

Individual & community actions play an important role in everyday life, to mitigate the effects of climate change like:

- Adopting plant-based diets rather than going for meat & animal products to reduce carbon footprint.
- Switching to more energy-efficient appliances like solar cookers, 5-star rating energy saving electronics and opting for renewable energy sources like solar panels in houses, offices etc.
- Walking, using public transportation, using electric vehicles and hybrid electric vehicles plays an important role in reducing greenhouse gas emissions, lowering down the earth's temperature.
- Planting more trees in houses, surroundings and forest areas, preparing compost pits at home using kitchen wastes, preparing green roofs mitigate urban heat island effects etc. Can help in more carbon sequestration, cooling down the earth's temperature and purifying air making environment more soothing and fresher.

#### **Ex- Miyawaki Garden Concept of Japan**

- Stabilizing coastal ecosystems by building hardened structures, planting more trees like mangroves species or the trees native to the area helps in binding the soil, reducing coastal erosion and improving stormwater management etc.
- Investing in more low-carbon technologies like electric-arc furnaces, cement blends to reduce emissions from industrial processes.
- Opting for carbon pricing, electricity metering, carbon credits etc. such tools help in channelizing people towards a sustainable future.
- Going for sustainable & innovative agriculture like aquaponics, hydroponics, vertical farming, regenerative agriculture etc. helps in reducing carbon emissions and deforestation.

- Wind power, hydroelectric power helps in providing a clean and sustainable energy options.
- Carbon recycling- converting captured carbon dioxide into useful products like stronger concrete.
- DAC (Direct Air Capture): Removing DAC directly from the atmosphere potentially leading to capturing carbon from the atmosphere and storing it into the oceans.
- AI (Artificial intelligence) & technology-driven companies are actively participating in harnessing technology to combat climate change. Few companies like:
  - **Clime works:** Actively involved in direct carbon capture technology to remove CO<sub>2</sub> from the atmosphere, partnering with carbfix to store CO<sub>2</sub> underground.
  - **Chakr Innovation:** Actively involved in capturing particulate matter using technological tools, from diesel generators and convert them into usable products.
  - **OLA electric:** Rolling out electric car service reducing greenhouse gas emissions.
  - **Digital Paani:** Using digital technology to treat wastewaters, reducing water pollution.
  - **Agro2o:** Develops biodegradable plastics from agricultural byproducts.
  - **Ekmatra:** Creating sustainable packaging from banana and mango leaves.
  - **Phool:** Using floral waste to make patented organic fertilizer and charcoal-free luxury incense products, reducing waste and pollution.
  - **Uravuu Labs:** Develops technology to extract drinking water from air using renewable energy, addressing water scarcity.

### Conclusion

After analysing all the aspects, their consequences it could be very well understood that climate change have been an important phenomenon and human activities have a major proportion in contributing to the rising earth's temperature. However, the smart approaches, environment centric and sustainable living plays a pivotal role in reducing carbon emission and greenhouse gas emissions. Technological advancement is playing an important role in predicting its impact and suggesting mitigation and adaptation strategies for the benefit of environment and mankind.

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