The 3rd International Conference on Materials Chemistry and Environmental Engineering
DOI: 10.54254/2755-2721/3/20230554

# Analysis on the Influence of Doubled Carbon Dioxide on the Extreme Weather

**Meijia Shan**

Dulwich International Suzhou High School, Suzhou, Jiangsu, China, 215000

Shanmeijia0301@163.com

**Abstract.** In recent years, there has been a rise in the amount of attention paid to the problem of climate change. Temperature and precipitation patterns on a global scale are influenced by climate change, which is brought on by the release of greenhouse gases (such as $CO_2$, $CH_4$, and $N_2O$) from human activities. The research that was done on the harsh weather that was induced by the increase in the amount of carbon dioxide content in recent years is the basis for this paper. This study uses a method known as a literature review to investigate the extreme weather that would occur and be improved when the level of carbon dioxide is doubled, as well as to uncover solutions to reduce the occurrence of such weather. According to the findings of the paper, there is currently no workable solution to the problem, which will result in an increase in the likelihood as well as the frequency of extreme weather events.

**Keywords:** Global warming, Extreme weather, Carbon dioxide, Drought, Increased temperature.

## 1. Introduction

In recent years, there has been a rise in the amount of attention paid to the problem of climate change. Both the temperature and the amount of precipitation on a global scale are affected by climate change [1], which is caused by human activities that result in the release of greenhouse gases such as $CO_2$, $CH_4$, and $N_2O$. As can be seen in Figure 1, the rise in the average temperature of the earth over the past thousand years has coincided with an increase in the amount of carbon dioxide in the atmosphere. In addition, the study from the IPCC states that the most recent decade, which spans from 2010 to 2019, has been the warmest decade in the instrumental record thus far (since 1850) [2].

In the meantime, severe weather events (such as blizzards, droughts, heat waves, and floods) have been happening more regularly over the planet in recent years, which has resulted in enormous losses for humanity. For instance, the European Environment Agency recently made public statistics suggesting that the heat wave that hit Europe in 2003 was probably the warmest in the region since 1500 A.D. and that it was responsible for the deaths of 70,000 people [3].

© 2023 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2755-2721/3/20230554

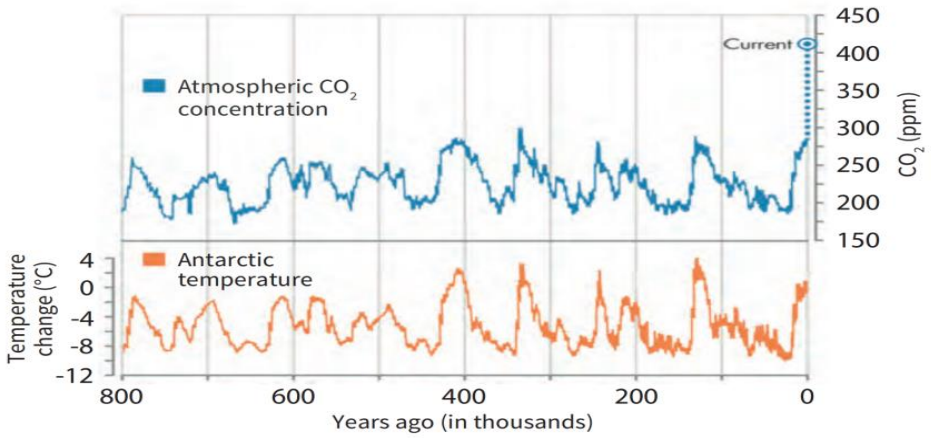



**Figure 1.** Temperatures and Atmospheric $CO_2$ concentrations over the past 800,000 years (Source: Based on figure by Jeremy Shakun, data from Lüthi et al., 2008 and Jouzel et al., 2007).

Regarding this topic, the author was also responsible for checking the papers of other people. The author of "Global Warming Causes and Effects" outlines potential catastrophes, such as a rise in global temperature [4], an increase in sea level, and an increase in the frequency of sand storms, as well as potential consequences, such as hunger and the extinction of species.

My research has further explained the causes of these environmental changes; however, there are fewer solutions than there were mentioned in the article "Innovative Solutions to Climate Change"[5]. The author of that paper mentioned the solutions that are required for various changes in the environment.

As a result, this study will investigate whether or not there is a connection between the increased concentration of $CO_2$ and extreme weather. The importance of this research is in establishing a link between $CO_2$ and extreme weather, locating viable solutions, and offering recommendations pertaining to this field. In addition to that, the paper presented a few potential solutions.

## 2. Analysis

### *2.1. The direct impact of the doubling of $CO_2$*

It is common knowledge that carbon dioxide is a type of greenhouse gas, and it is also common knowledge that an increase in the concentration of greenhouse gases causes a rise in the average temperature of the earth. Therefore, the rise in temperature that will result from the direct effect of doubling the concentration of carbon dioxide will result in an increase in the Earth's overall temperature. Figure 2 illustrates the basic idea that greenhouse gases are to blame for the warming of the planet. The sun is the primary contributor of heat to the globe, and the sun's rays supply the world with energy in the form of visible light, most of which is in the form of short-wave radiation [6]. In spite of the fact that greenhouse gases like carbon dioxide are unable to make direct use of the energy provided by short-wave radiation, short-wave radiation is converted into long-wave radiation as a result of energy loss that occurs when sunlight travels through the earth's surface and is subsequently reflected back into space. At this time, carbon dioxide would be capable of absorbing the energy carried by long-wave radiation, which would cause the temperature of the Earth to rise.

DOI: 10.54254/2755-2721/3/20230554

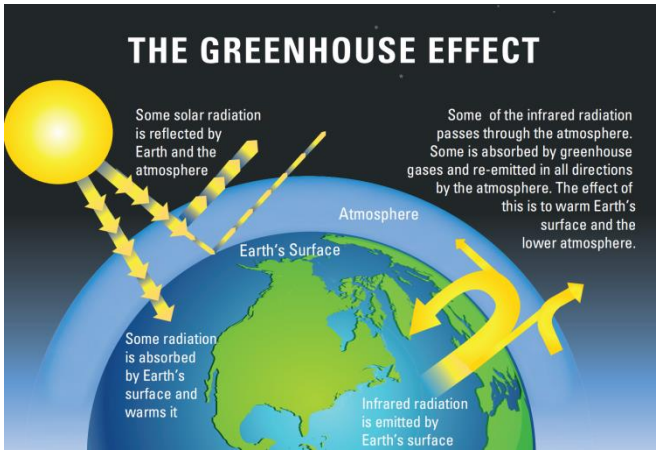



**Figure 2.** Principle of Greenhouse effect (Source: US Environmental Protection Agency).

## *2.2. More Extreme Weather from Carbon Dioxide Doubling*

*2.2.1. More intense heat waves and more frequent droughts.* To begin, the increase in carbon dioxide levels would cause an increase in the average global temperature as well as an increase in the number of heat waves that occur throughout the summer. When $CO_2$ concentrations are doubled, there will be more hot days and fewer cold days, which will lead to an increase in the severity of heat waves. This is because a warmer environment will have more days with warm temperatures. Extreme heat can have very serious repercussions. According to the World Health Organization, throughout the course of the past half-century, individuals in Europe have been killed by temperatures that were too high. After the year 2080, practically the entire United States will, on average, be afflicted by severe droughts, as predicted by models developed by the NOAA that take into account the concentrations of greenhouse gases, as shown in figure 3.

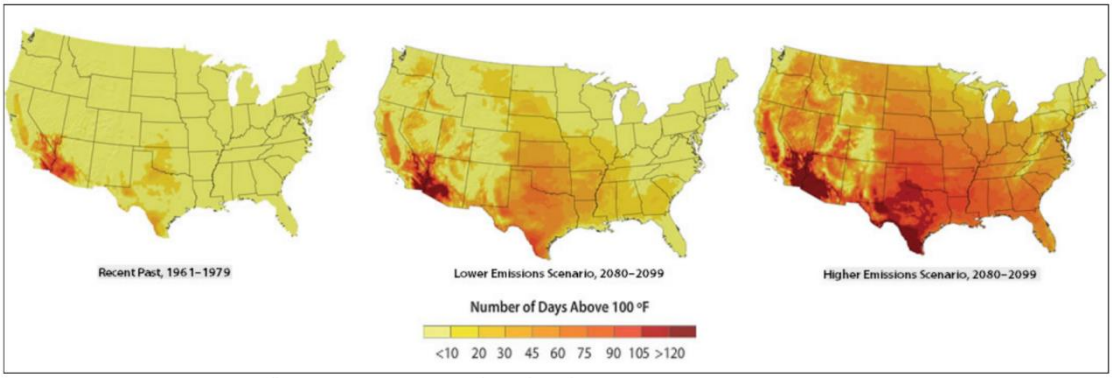



**Figure 3.** Prediction of drought frequency in the United States (Courtesy of NOAA http://www.climatewatch.noaa.gov/image/2011/projected-increases-in-100%C2%B0-days-by-end-of-century).

In addition, as was said before, an increase in the temperature of the Earth's surface will throw off the planet's delicately maintained equilibrium. For instance, the water found in rivers and soils will evaporate at a faster rate, which will lead to an increase in the number of regions suffering from drought all over the world.

DOI: 10.54254/2755-2721/3/20230554

*2.2.2. More Hurricanes, heavy rain and floods.* There is a good chance that storms will become more powerful as a result of climate change, which warms the ocean's surface. Hurricanes are able to harness the heat energy that is present in the waters and transform it into storm energy. Hurricanes receive a greater supply of heat energy from warmer oceans, which enables them to grow into more powerful storms with greater wind speeds. Furthermore, as the climate warms, hurricanes are able to transport more moisture, which can cause intense precipitation and devastating floods and damage, such as those that occurred with Typhoon Firework in Zhengzhou, China in 2021, which killed 380 people and caused 40.9 billion RMB in property damage [7].

At the same time, as the temperature continues to rise, an increasing number of water molecules get energy, which causes them to transform into water vapor. This indicates that there are an increased number of molecules of water vapor in the atmosphere. The water vapor in the high altitude will condense into raindrops if the temperature decreases or if there is a typhoon blowing, which will cause there to be a rainfall. For instance, a catastrophic flood struck the state of Kentucky in the United States in the month of July 2022, causing at least 37 deaths and leaving hundreds of people missing [8].

In addition, as a result of the increasing warmth of the ocean water, the rate at which the polar ice sheets melted increased, which led to the progressive elevation of the global sea level. The increased likelihood of flooding will be exacerbated by both the gradual elevation of sea levels and the more regular occurrence of storms. For instance, in 2006, the island of Lohachara, which is home to over 10,000 people, submerged as a direct result of climate change [9].

*2.3. The consequences of frequent extreme weather events*

According to the information presented in table 1, in 2022, the agricultural sector in Ethiopia was hit by the most severe drought in forty years. More than 3 million animals have perished as a direct result of the drought, and around 18 million people are now in danger of starvation. The country of Pakistan was hit hard by flooding during the same year. It is estimated that more than 794000 cattle and 2 million acres of cropland were lost.

**Table 1.** The effects of frequent weather extremes.

| | Heat waves/ Drought | Heavy rain/ Floods |
|---|---|---|
| Impact on agriculture | Reduced crop yields; increased the probability of wildfires | Soil loss; soil too wet to grow food; reduced food production |
| Impact on human health | More heat stroke; risk of food or water shortage | Increased risk of death and injury; more water-based disease |
| Impact on water resource | More widespread water stress | Increased water availability; water pollution |

Because of the drought, food yields are down, which means that those living in arid areas will be more likely to go hungry and will have their physical functions deteriorate. The flood brings vast numbers of flies and mosquitoes closer to humans, which in turn causes malaria and influenza to spread throughout the area.

A location that is experiencing drought will either have no water or very little water. In order to find a solution to this issue, humans have begun moving water resources from wetter locations to drier ones. In the long run, there will be a greater demand placed on the utilization of available water resources. If the flood is strong enough, it will contaminate the sources of pure water and spread pollutants throughout the area.

DOI: 10.54254/2755-2721/3/20230554

## 3. Measures of Carbon dioxide emission reduction

Since it is difficult to entirely get rid of carbon dioxide, the most that we can do is work toward reducing the amount of carbon dioxide that we emit. The following are the actions that we can take:

First, cut back on your consumption of fossil fuels: The combustion of fossil fuels will result in the production of a significant amount of carbon dioxide, and we can cut back on the usage of transportation powered by fossil fuels.

Second, make fewer purchases: Purchasing an excessive quantity of products will inevitably result in waste, and the procedures necessary to deal with the garbage will involve burning. Buying fewer items or the appropriate quantity will help alleviate this issue.

Third, increase the usage of clean energy sources by constructing additional wind and hydroelectric power plants: Clean energy and renewable energy are two forms of energy that do not contribute to the production of carbon dioxide, making them attractive alternatives to the usage of fossil fuels.

Reduce the availability of food and other items sourced from other locations: The method of carrying food that has been imported typically involves the utilization of huge ships or aircraft, both of which consume significantly more fuel than regular automobiles do.

Plant trees: Trees can absorb carbon dioxide. Increasing the number of trees in an area can cause them to take in more carbon dioxide.

In China, for instance, there is a program for the general public's welfare that is known as "Ant Forest." Users are able to collect "energy" and utilize "energy" to exchange for a tree, after which "ant forest" will plant the tree in certain regions. This is accomplished by encouraging people to live low-carbon lifestyles. This not only inspires individuals to live lives with lower carbon footprints but also leads to an increase in the area covered by forests. The "Ant Forest" project and its partners will have planted 326 million trees across China by the year 2021.

## 4. Conclusion

Extreme weather will increase much more than twofold in frequency and severity if the quantity of carbon dioxide in the atmosphere continues to rise. The majority of the increase in the concentration of carbon dioxide can be attributed to humans. People should make changes immediately if they do not want to have to deal with more severe weather in the future.

The lack of sufficient data gathering is the flaw in this study, and the inability to appropriately show the data in certain areas is also a shortcoming of the study. The amount that is described in this report is not the full extent of the rise in extreme weather that will occur as a result of a doubling of $CO_2$ levels. It is important that the author seeks for further material that contains precise facts. In the future research and development direction of this topic, the author believes it is necessary to find out some less noticeable extreme weather development and ways to encourage people to travel with low carbon. In addition, the author believes it is necessary to find out some ways to encourage people to travel with low carbon.

## References

[1] Schwartz, S. E. (2018). Resource Letter GECC-1: The Greenhouse Effect and Climate Change: Earth's Natural Greenhouse Effect [J]. American Journal of Physics, 86(8), 565-576.

[2] Robinson, S. A. (2020). Climate change adaptation in SIDS: A systematic review of the literature pre and post the IPCC Fifth Assessment Report [J]. Wiley Interdisciplinary Reviews: Climate Change, 11(4), e653.

[3] Long-term effects of the 2003 European heat wave, 2014. http://www.uua.cn/show-44-2420-1.html(in Chinese)

[4] Global Warming Causes And Effects, 2019. Retrieved from https://paperap.com/paper-on-global-warming-causes-effects-and-remedies/

[5] Innovative Solutions to Climate Change, 2022. Retrieved from https://paperap.com/innovative-solutions-to-climate-change/

[6] Latake, P. T., Pawar, P., & Ranveer, A. C. (2015). The greenhouse effect and its impacts on

DOI: 10.54254/2755-2721/3/20230554

environment [J]. Int. J. Innov. Res. Creat. Technol, 1(3), 333-337.
[7] Science and Health in Henan, 2022. Http://henan.china.com.cn/m/2022-01/21/content_41860388.html(in Chinese)
[8] Collins, Lois M. “Kentucky Flooding 2022: Who Are the Victims? How Many People Were Killed? - Deseret News.” Deseret News, Deseret News, 3 Aug. 2022. https://www.deseret.com/u-s-world/2022/8/3/23290414/dead-eastern-kentucky-2022-flooding-swept-away-died-who-were-victims-massive-rainstorm-appalachia.
[9] Global warming claims its first inhabited island, 2016. https://foreignpolicy.com/2006/12/28/global-warming-claims-its-first-inhabited-island/