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Research on the Impacts of Covid-19 on Climate Change

Junlin Chen[1, a], Wanli Chen[2, b], Rui Li[3, c]

[1]School of Science & Technology, Hong Kong Metropolitan University, Hong Kong, 999077, China
[2]School of Graduate Studies, Hong Kong Lingnan University, Hong Kong,999077, China
[3]School of Graduate Studies, Hong Kong Lingnan University, Hong Kong,999077, China
[a]1808994231@qq.com, [b]978916063@qq.com, [c]308330313@qq.com

Abstract: Since COVID-19, people's life has changed drastically. The measures being taken to prevent the spread of the virus took a significant toll on all of us. With less transportation and economic activities, many aspects of the world have shifted. Most importantly, the COVID-19 epidemic impacts the global climate in ways people didn't expect. This paper will illustrate the positive impacts and negative consequences of COVID-19 on climate change and the reasons behind it. After a series of lockdown and restriction policies, greenhouse gas emissions decreased, and air quality increased. However, coastal cities have higher precipitation during COVID-19, which could be a potential threat to floods. The conclusions are drawn based on the actual data of Wuhan on green gas emissions, air quality, and precipitation before and during COVID-19. It is evident statistically that COVID-19 has caused short-term changes in the climate, which should be addressed because both incidents are challenging people worldwide. And people should work together to improve the situation.

Keywords: COVID-19, Climate change, Greenhouse gas emission.

1. Introduction

The Covid-19 pandemic and climate change both have a pattern that ranges from causes to outcomes that might be characteristic of the Anthropocene [1]. As we all know, the SARS-CoV-2 outbreak is widespread worldwide, and individuals with the novel coronavirus infection can contribute to the virus's transmission whether they exhibit symptoms. This kind of asymptomatic infection is difficult to find, and only large-scale nucleic acid testing can be executed to screen out asymptomatic infections. When encountering a large-scale epidemic spread in the past, the government would also take relevant measures to cut off the spread of the virus in society. Some restrictions include keeping a safe distance from people, wearing masks on all occasions, and area lockdowns. Nevertheless, some control measures adopted by the government in response to the Covid-19 pandemic have reduced carbon emissions in some ways. For instance, the city must be closed, the number of vehicles in the city must be reduced; also, and the factory must be shut down. The relevant measures taken to prevent and control the epidemic will reduce the emission of greenhouse gases, thereby improving the city's air quality [2]. The impact of Covid-19 on the climate is short-lived and indirect, and some measures to prevent SARS-CoV-2 have also had short-term positive and negative effects on the climate.

Multi-causal event or process ascribed to humanity is climate change. Global warming is an important manifestation of climate change. The emission of greenhouse gases causes a gradual increase in temperature during industrial and social production. Rising temperatures are melting glaciers in the Arctic and Antarctic and raising sea levels globally [3]. Simultaneously, rising sea level is also an important change in the climate, including heat waves, droughts, floods, ocean acidification, and other severe weather. Their harsh climates result in the continuous deterioration of people's living environment. Many harmful gases are released during industrial manufacturing, damaging the earth's ecology, and polluting the water supply. Long-term exposure of people to polluted gases could lead to asthma, coronary heart disease, and other chronic diseases [4-6]. If a person were unfortunately infected with the coronavirus, they would have severe clinical symptoms. This article will discuss how closely climate change and Covid-19 are related and whether the SARS-CoV-2 epidemic has any real bearing on global warming.

2. Covid-19 Has A Positive Impact on Climate Change

In the short term, measures such as shutting down urban transport and suspending industrial activity to stop the spread of Covid-19 have reduced greenhouse gases. Through the years, humans have typically taken the following measures: (1) regulate the source of infection, (2) obstruct the path of transmission, and (3) safeguard those who are vulnerable [7]. To control the infection rate of SARS-CoV-2 and reduce the death rate when the 2019-nCoV pneumonia outbreak is widespread in mainland China, the government would choose to lock down the city, such as shutting down urban public transportation, closing factories, as well as prohibiting vehicles from driving on the streets. The steps above to stop the spread of Covid-19 have decreased the consumption of fossil fuels and greenhouse gas emissions, which has to some extent, reduced carbon emissions. The reduction in CO2 emission has also led to reductions in the demand for fuel oil. Covid-19 is among the major players in producing fuels for industrial processes, including the combustion of petroleum products and chemical substances in factories, transportation of goods by roadways or railroads, and manufacturing of metal alloys. As a result, the pandemic has halted industrial production, decreased airborne pollutants, and enhanced city air quality. The figure below demonstrates the data on major pollutant emissions and air quality in Wuhan before and since the outbreak.

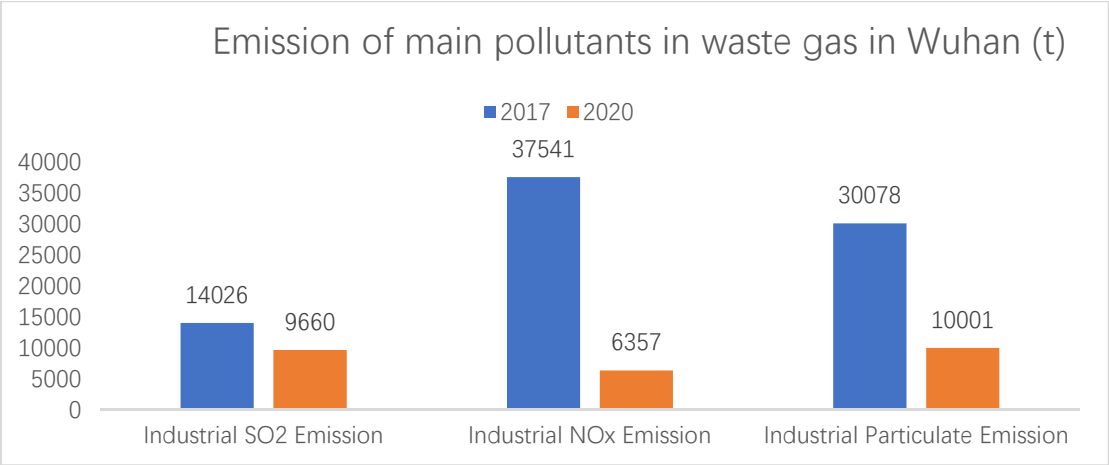

Figure 1. Emission of main pollutants in waste gas in Wuhan

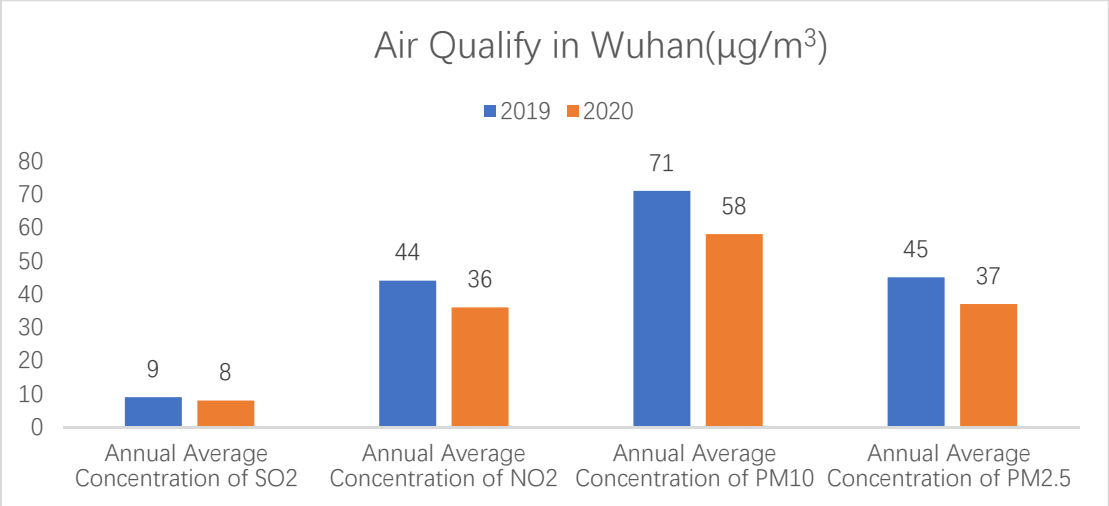

Figure 2. Air quality in Wuhan

During the COVID-19 pandemic, global greenhouse gas emissions were temporarily reduced. Global greenhouse gas emissions have fallen by about 5.5% since the COVID-19 pandemic. This is a temporary reduction mainly because of decreased economic activity and travel. However, emissions have been expected to rebound as the pandemic subsides and economies recover. The COVID-19 pandemic has resulted in a temporary decrease in global greenhouse gas emissions. For instance, Wuhan was closed for nearly half a year due to the Covid-19 epidemic in 2020. The average temperature in Wuhan in 2020 is 17.1°C, according to China's 2021 Statistical Yearbook, and 17.3°C in 2020, according to China's 2020 Statistical Yearbook [8]. As shown in Figure 1, the shutdown of factories due to the epidemic prevention and control has led to a significant decrease in industrial pollutant emissions in Wuhan, compared to 2019, especially for nitrogen oxides, which are 1/6 of 2019 emissions in 2020, and 1/3 of 2019 emissions of particulate matter in 2020. Moreover, as shown in Figure 2, where the yearly average SO2, NO2, PM10, and PM2.5 concentrations in 2020 are all lower than in 2019, the reduction of industrial pollution particles and gas emissions brought about by factory shutdowns has resulted in steadily improving air quality in Wuhan. To sum up, the positive impact of epidemic prevention and control on reducing greenhouse gases is short-lived. Piers Foster's study confirmed that measures to prevent and control Covid-19 had a negligible impact on global climate change in the long run.

3. The Negative Consequences of Covid-19 on Climate Change

Despite the Covid-19 pandemic, the government's actions to block its spread have reduced the release of industrial pollutants and improved air quality. However, the Covid-19 epidemic will affect climate change and have adverse effects. The oceans' temperature has been increasing quickly in recent decades and is expected to continue for several more decades. In addition, global sea ice extent and cover are declining due to the melting of Arctic glaciers. This could result in increased vulnerability of marine ecosystems. The warming of ocean temperatures could enhance the risk that coastal communities might be impacted by flooding due to higher tides or even inundation.

The Yangtze River Basin saw precipitation levels that broke records in the summer of 2020. In eastern China, air convection was bolstered by the decrease in carbon emissions caused by the pandemic. The Yangtze River Basin experiences increased rainfall due to melting polar glaciers,

rising sea levels, and water vapor from the ocean interacting with the atmosphere there [9]. The consequent changes in precipitation patterns may impact river flows that are affected by climate change. Moreover, these fluctuations might cause floods or other hazards to rivers downstream of the basin, causing flooding issues for communities and infrastructure throughout the region. Water is also used to irrigate the area's crops, livestock, and industrial sectors, which could influence land use patterns and agricultural productivity. As global temperatures increase, more rainwater would flow into the basin because of the higher atmospheric pressure (which causes faster evaporation). Therefore, greater amounts of water will be stored and released at lower rates than during periods when temperature increases are not expected.

The increase in summer rainfall is more obvious in Wuhan, located in the middle reaches of the Yangtze River, owing to the impact of SARS-CoV-2 [10]. Figure 3 below is the precipitation data table of Wuhan in June and July 2019 and in June and July 2020.

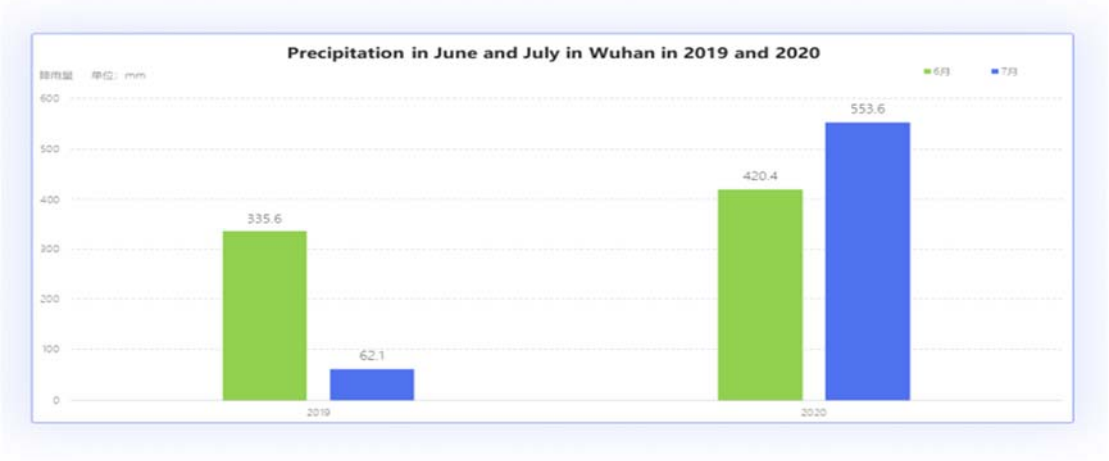

Figure 3. Precipitation in June and July in Wuhan in 2019 and 2020

As per the comparison of the precipitation in June and July of Wuhan in 2019 and 2020 in the above picture, the amount of precipitation in 2020 has dramatically increased, especially the precipitation in July 2020 was nearly nine times more than that in July 2019. It shows that owing to the impact of the epidemic, reducing carbon emissions will make the atmosphere circulate; the precipitation will increase, thus increasing the probability of floods.

4. Summary

The steps are done to manage Covid-19 have some short-term indirect consequences on climate change. The long-term effect of Covid-19 on climate change is essentially nonexistent. People have focused on the Covid-19 outbreak and global climate change in the past three years. People are also grappling with the negative effects of climate change as well as the coronavirus pandemic [11]. The pandemic has significantly increased greenhouse gas emissions [12], while the economic slowdown has decreased funding for climate change mitigation and adaptation measures. This has developed a perfect storm of sorts, with the most vulnerable people and communities withstanding the worst impacts. The epidemic and climate change are both global concerns that necessitate a coordinated response; thus, they both need to be addressed immediately. The pandemic has demonstrated that we must be prepared for future shocks, and climate change is our biggest shock. The government must take action to decrease greenhouse gas emissions and build resilience to climate change impacts. The epidemic has shown how crucial it is to be ready for unexpected events in the future. Climate change is the most significant shock we face, and its impacts are already being felt worldwide. The whole society must take urgent action to reduce emissions and build resilience to climate change [13].

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