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Causes and Consequences of Global Warming: A Case Study of the Tibetan Plateau

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Abstract. The development of human activities has led to the emergence of global warming, and then revisit influence which this phenomenon changes a part of world. In this way, understand area needing improvement and reduce the occurrence of harm is important. This paper starts with the causes of global warming and the damage it causes to the ecosystem. Large amounts of air pollution destroy the ozone layer and exacerbate global warming, causing sea level rise, floods that inundate low-altitude areas, biological extinction, enhanced ultraviolet radiation, oasis desertification, and the release of ancient pathogens by cryosphere meltwater. Mainly taking the Qinghai-Tibet Plateau as an example, the paper focuses on using detailed data to study changes in the cryosphere, soil and vegetation changes, and remote sensing monitoring of glaciers to further clarify the trend of global warming, and use this as direct evidence to make humans realize that global warming is imminent. This article aims to draw attention to the harm caused by global warming through the above research, and advocate the adoption of green environmental protection measures to effectively reduce the aggravation of air pollution.

Keywords: Global warming, cryosphere, Qinghai-Tibet Plateaut

1. Introduction

In today's era of advanced industrial technology, more and more disasters are caused by harmful gases and liquids produced and discharged by experiments in the development of science and technology. These toxic substances cause irreversible damage to the natural environment, and greenhouse gases are one of them, which eventually lead to a rising trend in the global climate year by year. Global warming causes the melting of polar glaciers, and the loss of habitats for organisms that depend on them for survival, which has a significant impact on the food chain. In addition, the meltwater from glaciers will cause sea levels to rise, flooding low-lying coastal areas and increasing the risk of floods. Monitoring glaciers can clearly show the shrinking trend of glaciers in a digital form, and it is this visualization experiment that makes humans truly pay attention to the harm that global warming brings to the world, minimize the increase of harmful substances, start environmental protection work, protect the earth's ecological environment, and build a comfortable and healthy home together.

In the context of global warming, several scholars have conducted long-term research on this. Two American biologists studied the impact of rising temperatures on animals and concluded that

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global warming causes animals and plants to shrink in size, posing a risk of extinction, thus causing irreversible damage to the food chain [1]. The United Nations Environment Program has also released a report stating that global warming will lead to an increase in water demand in many places, a decrease in rainfall, and gradual desertification of land [2]. Another scholar conducted a study on mangroves in the context of global warming and concluded that although global warming can increase the carbon burial area of mangroves, in the long run, continued global warming will cause the sea level to rise rapidly, increasing the beach surface of mangrove wetlands, causing mangroves to turn from carbon reservoirs to carbon sources, entering a vicious cycle of global warming [3].

The purpose of this study is to reduce the occurrence of global warming from the root. By studying the causes and impacts of global warming, further focusing on the remote sensing data monitoring of glaciers on the Qinghai-Tibet Plateau and the impact on lake hydrology, comprehensive suggestions are given from multiple aspects to reduce the intensification of global warming.

2. Global warming

Global warming refers to the gradual increase in the average annual temperature of the earth. The cumulative increase in the greenhouse effect eventually leads to unprecedented temperatures in various countries and regions. Since 1850, the overall average temperature has risen, and the global average surface temperature has increased by 0.74 degrees Celsius, marking the beginning of global warming. The upward trend has become more obvious since the beginning of the Industrial Revolution. In the next 40 years from 1900, the global temperature has risen by 0.5 degrees Celsius.

According to the analysis of global average temperature data from 1950 to 1995 released by NASA, it showed a sharp upward trend [4]. Throughout the 20th century, the surface temperature of the ground rose by an average of 0.6 degrees Celsius [5]. This trend continues to this day, and countries and regions have also set new high temperature records in their local areas. Experts have also successively put forward predictions on the rise in global warming temperatures, and the global average temperature may increase by 1 to 3.5 degrees Celsius in 2060 [4]. Based on the above multi-dimensional data analysis and comprehensive considerations, analyzing the causes and impacts of global warming is of great significance for slowing down the pace of global warming.

With the support of multiple data and research materials from all parties, it can be clearly analyzed that the global average temperature is rising at an alarming rate over time.

2.1. Factor

The main cause of global warming is the greenhouse effect, which can be caused by both natural and human factors. The greenhouse effect is atmospheric. The sun's short-wave radiation reaches the ground through the atmosphere. After the surface is heated, it releases a large amount of long-wave thermal radiation to the outside world, which is then absorbed by the atmosphere, eventually increasing the temperature of the surface and the underlying atmosphere. The greenhouse effect is caused by greenhouse gases, which are gases re-emitted by the atmosphere. Global warming is caused by the imbalance between the absorption and emission of energy by the earth-atmosphere system. The earth-atmosphere system continues to accumulate energy, which eventually leads to temperature rise.

The greenhouse effect caused by natural factors usually includes solar activity, volcanic activity, natural variability, etc. Volcanic eruptions release a large amount of greenhouse gases such as carbon

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dioxide, which may cause the temperature to continue to rise in the short term. However, after a large amount of volcanic ash and aerosols enter the stratosphere, it may reduce solar radiation and cause short-term global cooling. In the long run, there is still great uncertainty about the impact of volcanic activity on the global climate. In addition, scientists believe that most natural factors are the result of self-regulation of the atmosphere. The emission of carbon dioxide and methane by earth organisms or objects in the atmosphere will cause the surface temperature to rise. The greenhouse effect caused by this temperature fluctuation makes the earth's temperature rise to a temperature suitable for the survival of human beings and other organisms [5]. The global warming changes caused by natural factors are reversible to a certain extent, while the opposite is true for human causes.

The extreme causes of global warming are mostly caused by human factors. Since the beginning of the Industrial Revolution in the 19th century, carbon dioxide emissions have risen rapidly, making global warming more serious and even endangering human survival. In December 1995, the IPCC published a report that mentioned for the first time that global warming is not entirely caused by nature. This is because the high average temperature in 1995 occurred without the influence of natural conditions. This supports the argument that the accumulation of greenhouse gases caused by human activities affects the earth's climate change [4]. There are many types of human influences, including land use, deforestation, factory pollution gas emissions (carbon dioxide, methane and most other chemical pollution gases), and fossil fuel combustion (natural gas, coal and oil).

This large amount of anthropogenic carbon emissions and indiscriminate deforestation have damaged the ecosystem, causing the forests that could absorb carbon dioxide to continue to decrease and be unable to fully bear most of the Carbon dioxide(CO2), intensifying the damage to the ozone layer and aggravating global warming.

2.2. Impact

The impact of global warming involves many aspects, including the melting of the cryosphere, rising sea levels, ozone layer depletion and changes in ecosystems. The melting of the cryosphere has intensified flood disasters, rising sea levels have caused low-altitude areas to be submerged, oases have become desertified, and organisms have been destroyed and extinct.

The cryosphere is mainly composed of glaciers, frozen soil, snow and sea ice. The cryosphere meltwater has the function of solid reservoirs, which has the function of replenishing water resources and regulating river peaks and filling gaps. With the impact of global warming, the amount of water entering major river areas after glacier meltwater has increased significantly. A research report shows that the runoff water volume in the Urumqi River source area has increased by 70%, the runoff water volume in Xinjiang has increased by 40% in the past decade, and the water volume of the Aksu River in southern Xinjiang has increased by one-third [6]. At the same time, in the survey of the Chinese Academy of Sciences, it was proposed that in the past 40 years, the overall area of glaciers surveyed, covering nearly 20,000 square kilometers, has been shrinking, with a shrinkage rate of 2.7%. In the past 30-40 years, the thickness of some glaciers has shrunk by nearly 70 meters [6]. Glacier retreat will directly affect the release of inorganic and organic matter contained in them.

The melting of the cryosphere also means that bacteria and fungi that were frozen in the cryosphere in ancient times will gradually appear in human vision. Although the thawed ancient microorganisms are of great value to paleoclimate research, some microorganisms may still be infectious and spread again in the ecosystem, even affecting human health. According to computer analysis[7], there are about 800 types of ice poisoning in North American lakes and about 10,000

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types in Antarctic ice lakes. It has been reported that giant viruses that are still infectious 30,000 years old have been isolated from the frozen soil in Siberia[7]. In the anthrax epidemic that occurred in Russia in 2016[8], some researchers proposed that the source of the pathogen was most likely the carcasses of reindeer infected with anthrax buried in the frozen soil for more than 70 years, which were then spread to humans through various media.

Global warming not only affects the living environment of humans, but also has a huge devastating impact on organisms. A research report published in the journal Nature Climate Change shows that the size of animals and plants is gradually shrinking due to global warming. A researcher named Bickford said that the shrinkage of animal and plant size is proportional to the rise in global temperature [1]. At the same time, a group of researchers from Australia, the United Kingdom and the Seychelles surveyed corals in the Seychelles Islands and found that 90% of the corals died due to the overheating of the Indian Ocean caused by global warming. As the corals disappeared, marine life lost their living environment and food, and some fish species have become extinct [2]. If this continues, some animals will have to obtain more food than in the past to ensure the energy supply they need. The amount of food they consume will increase, and excessive intake will break the balance of the food chain. Over time, the number of certain species will inevitably decrease and become extinct, and the animals at the top of the food chain will also seek other prey due to the loss of food. This vicious cycle will eventually lead to an increase in the number of extinct species.

According to a report published by researchers from various countries on the website of Nature magazine, an ozone hole has appeared in the Arctic for the first time. The ozone layer at an altitude of 18-20 kilometers has decreased by more than 80%. This ozone layer, which is only 20 kilometers from the surface, can effectively absorb ultraviolet rays and protect humans from being harmed by them. [9] The appearance of the ozone hole allows more and more ultraviolet radiation to reach the ground, which puts greater pressure on surface heating and atmospheric radiation emission, aggravating global warming. According to the analysis of researchers, the ozone hole appeared because the cold weather in the Arctic region lasted longer than in previous years from winter to spring, which was also caused by the large-scale release of chlorofluorocarbons and other ozone-destroying substances by humans. Combining the various theoretical models, empirical cases and expert research results discussed in the previous article, it is not difficult to draw the following core conclusion: global warming caused by human factors is more deadly than natural factors.

3. Impacts of global warning on the Tibetan Plateau

The Qinghai-Tibet Plateau is the highest plateau in the world (average altitude is above 4,000 meters), accounting for a quarter of China's land area. It is known as the "Roof of the World" and the "Water Tower of Asia". It is also an important source of freshwater resources and major rivers in Asia. Some experts point out that due to global warming and climate change within the Qinghai-Tibet Plateau, rainfall has decreased, which has eventually led to the gradual deterioration of the ecological environment within the Qinghai-Tibet Plateau[9].

Global warming has caused the Qinghai-Tibet Plateau to gradually become warmer and wetter, which has a critical impact on the changes in vegetation on the Qinghai-Tibet Plateau. Plant growth is affected by multiple factors, including temperature, precipitation, soil moisture content, and solar radiation. In extremely cold temperature environments, global warming allows vegetation to grow in combination with photosynthesis, while in extremely arid areas, increased rainfall and melting of the cryosphere make the land moist and promote plant growth. In the past decade or so, studies using satellite remote sensing NDVI data have found that the amount of vegetation on the Qinghai-Tibet Plateau is on the rise. A large number of experiments and simulation tests have shown that the

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melting of the cryosphere caused by global warming significantly increases the moisture content in the soil [9], further proving that the unique geographical environment of the Qinghai-Tibet Plateau is extremely sensitive to climate change.

Global warming has a huge impact on the glaciers in the Qinghai-Tibet Plateau. The rising temperature has caused the glaciers to melt, and some glaciers are retreating every year. Due to the increase in meltwater, the area of lakes on the Qinghai-Tibet Plateau has continued to increase and even overflowed from the lakes, causing floods. According to the survey report of the "Remote Sensing Survey and Monitoring of the Ecological Resistance Environment of the Qinghai-Tibet Plateau" project team, the glaciers on the Qinghai-Tibet Plateau have lost an average of 147.36 square kilometers per year in 30 years. In the 10 years from 1970 to 1980, the glacier area was 48,859.18 square kilometers. By the beginning of the 21st century, the glacier area on the Qinghai-Tibet Plateau had decreased by nearly 4,420.78 square kilometers, with an average annual loss of 147.36 square kilometers of glaciers, and a total reduction rate of about 9.05%. Through repeated verification and cross-comparison of a large amount of experimental data, it can be clearly observed that most glaciers on the Qinghai-Tibet Plateau are in a retreat trend, and the snow line is gradually rising to several hundred meters [3].

Since 1970, the lakes on the Qinghai-Tibet Plateau have shown an expansion trend, and the total area of lakes has increased by about 18% in 40 years. At the same time, the number of lakes with an area of more than 1 square kilometer increased by 16%, with an increase of about 42 lakes.[10] As the global climate warms, most of the water from melting glaciers flows into lakes and rivers, flooding some land and causing a relative reduction in other resources (vegetated land) on the Qinghai-Tibet Plateau.

Part of the glacial meltwater is temporarily retained by the glacial lake and does not flow out of the cryosphere through the surface to the runoff area. This is because the glacial water resources enter the glacial lake, causing its area to increase. This shows that the glacial lake has delayed the loss of glacial meltwater, adjusted the entire water cycle system of the Qinghai-Tibet Plateau [11], and reduced the pressure of sea level rise. But at the same time, because the glacial lake can store water, it also proves to a large extent that the glacial lake may cause the risk of flood disasters. The albedo of the water is small, and the solar shortwave radiation is absorbed more by the lake due to the growth of lake water. Heat accumulates in the center of the glacial lake. This heat will accelerate the melting of the frozen soil of the glacial lake dam, causing the water resources contained in the glacial lake to break through the glacial lake dam itself, thereby causing the risk of periodic sudden floods [12].

4. Conclusions

This article studies the causes of global warming and its impacts and disasters on various aspects from the perspectives of natural and human factors, focusing on the analysis of the cryosphere and vegetation soil of the Qinghai-Tibet Plateau.

The article uses the precise data of researchers from all sides to analyze that the average world temperature is increasing at a rate of 0.5 degrees Celsius per year, and it is speculated that there will be a more obvious temperature increase in 2060. The cause of global warming is mostly due to the increase in CO2 emissions caused by human activities, which damages the ozone layer and forms an ozone hole, exacerbating the greenhouse effect and falling into a vicious cycle. With the occurrence of global warming, the meltwater in the cryosphere has increased the amount of water and the retreat of glaciers, and then fungi and bacteria that were frozen in the glaciers in ancient times have appeared. Some pathogens are even contagious and may cause disasters in the ecological

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environment. The focus was subsequently on the Qinghai-Tibet Plateau. Under the influence of global warming, the Qinghai-Tibet Plateau gradually became humid and warmer, increasing vegetation growth, and studying the increase in the number of lakes due to glacial meltwater. Glacial lakes can temporarily delay the loss of glacial meltwater, but there is also a high probability that the rise in global temperature will cause the melting of glacial lake dams and floods.

In the future, if humans continue to carry out various activities that generate pollution and do not stop the loss in time, the global temperature will continue to rise and even increase faster and faster. In the next 20-40 years, the global average temperature will reach 50 degrees Celsius or even 60 degrees Celsius, which is beyond the heat that humans and other organisms can survive. The earth will no longer be suitable for biological survival, and humans and other organisms will eventually go extinct. Therefore, humans should strengthen environmental protection measures, promote green travel and reduce the use of disposable items, and research new energy to reduce carbon emissions.

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