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The Origin of Coronavirus and Climate Change

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Abstract

The ongoing coronavirus pandemic has killed hundreds and thousands of people and led to the astonishing lockdowns which have relentlessly pushed the world economy into recession. We find that the origin of coronavirus is related to the increasing marine viruses with ecological evolution and natural selection. The marine viruses have already killed their hosts every day, reduced marine biodiversity and affected marine ecosystem and food webs. The "intermediate host" could be bats, pangolins, rats or other animals which passed the marine RNA viruses to humans. The climate change has already posed threat to the harmony and balance of natural ecosystem. Although the coronavirus pandemic has helped to reduce the carbon emissions temporally, we discover that the air pollution and climate change could still make significant contribution to the outbreak and high mortality rate of COVID-19 pandemic. It is urgent and necessary to improve the climate, ecological and epidemiological models with including viral processes for the better predictions of future emerging virus pandemic, air pollution and weather extremes.

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Viruses are most abundant biological entities (about 10^{31}) in the ocean, killing about 20% of its living biomass each day, thus playing a crucial role in ocean ecology and biogeochemical cycling [1-3]. Virus can also terminate the oceanic phytoplankton blooms and influence the oceanic carbon cycle and marine aerosol loading [4]. Despite the viruses had been identified decades ago, the sampling and genetic analysis of marine viruses are still limited. In 2016, about 125,000 DNA virus genomes were unveiled from samples taken around the world, including oceans, freshwater systems, soils, plants, animals and humans [5]. The number of published viral sequences has been rapidly growing since then. The global ocean DNA viruses had been identified up to 195,728 viral population [6], but many marine viruses have not yet been analyzed, particularly the marine RNA viruses, which have wide spread geographic distribution and that the dominate genotypes are under purifying selection [7]. This was confirmed in the recent quantitative study where the comparison of total mass of RNA and DNA in viral fraction suggests that the abundance of RNA viruses equaled or exceeded that of DNA viruses in coastal seawater [8]. The virus genome datasets are very important and useful for understanding the viral diversity and impacts on marine ecosystem. It is critical and imperative to improve marine ecosystem modeling with including the marine virus simulations.

The ongoing coronavirus pandemic had infected more than 12 million people and caused 558, 544 deaths (10 July, 2020). However, the origin of SARS-Cov-2 is still puzzling. From genetic analysis of coronavirus, the genome sequences of SARS-Cov-2 sampled in Wuhan have been identified to be 96% identical to a bat coronavirus [9]. Thus researchers suggest that wild bats or pangolins could be the "intermediate host" animals passed the coronaviruses to humans. However, the source of the virus from animal with this pathogen in its body was not found in the Wuhan wildlife and seafood market. Hence the spillover of virus link between animal and human is still missing. Recently, researchers have found that more than 8% of bats over the island of West Indian Ocean carrying on the coronaviruses. The evidence indicates that bats could be the first infected by marine RNA viruses, then transmit to other animals and humans. On 12 June 2020, the coronaviruses have been firstly detected from salmon in Beijing, which was imported from Denmark, Norway and Chile seawater regions. The American Seafood company in Seattle reported 86 members of the "American Dynasty "ship crew infected by coronavirus on 1 June 2020. French doctor Yves Cohen found the first patient infected by coronavirus between December 2019 and January 2020 in France was a fishmonger, and his wife was also working in the seafood market. In South Korea, there were 27 staff working in the Ministry of Marine and Fisheries infected by coronavirus from 10 to16 March 2020. These findings indicate that the dangerous marine RNA virus could pass to "intermediate host" through fishes and other seafood, and then transmit to humans. Therefore, it is important to detect the dangerous DNA and RNA viruses which have not only killed humans, but also already killed fishes, phytoplankton, zooplankton and other marine living beings.

The SARS-Cov-2 could be transmitted via human respiratory droplets and direct contact, but the knowledge about the aerosol transmission and polluted water transmission is still limited. The aerosol transmission was found in different areas of two Wuhan hospitals during COVID-19 outbreak, particularly the toilet areas [10]. The air pollutants (aerosol, NO2 etc.) could also contribute to the high mortality caused by COVID-19 viruses [11]. Viruses were found in patient's excrement and polluted water which could transmit to humans. Temperature and humidity have also influence on the virus transmission. Researchers have found that the COVID19 viruses are more effective transmission from human to human at the low temperature and low humidity conditions. Current numerical models could not account for the detailed disease transmission processes and meteorological factors, hence most epidemiological models failed to predict the COVID-19 virus spread. It is urgent and necessary to improve the model forecasts with more biological and meteorological measurement data for the better control of future pandemic outbreaks.

Despite the contribution of climate change to the coronavirus pandemic is still under investigation, the effect of global warming

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on the land and marine ecosystem had been already found decades ago. The climate change is not only influencing the energy, water or carbon cycle in the climate system leading to air pollution and weather extremes, but also degrading the land and marine ecosystem. The global warming has enhanced the occurrences of biomass burning, damaging the forests, grasslands and wetlands and releasing greenhouse gases and air pollutants. Wild fires from open vegetation burning, also releasing toxic gas and smoke, which pose serious human health risk and have been estimated to cause as much as 600, 000 pre-mature deaths per year globally [12,13]. According to the World Research Institute, only 15% of forests remain intact now. With the forests, grasslands and wetlands destroyed by wildfires due to disorderly human activities, the biodiversity has sharply decreased. The living species on the planet have already dropped by 20% and more than a million animal and plant species are reported facing extinction now.

The climate change is also one of the driving sources to force living species to change habitats, pushing animals and humans into new regions or threaten their food and water supply chains. The biodiversity can ensure the natural variety of plants, animals and humans living harmoniously with nature and with great resiliency against threats and offers a delicately balanced and harmonious safety net for the natural ecosystem. With the biodiversity decline due to climate change, the natural harmonious balance has been broken, old pathogens in the polar or remote regions could be released and new pathogens could be produced. The living species on this planet are more vulnerable to the transmission of infected diseases due to the emerging viruses [14]. According to recent studies, primates (rates) and bates have been found to have more zoonotic viruses than any other animal species, and the virus transmission risk has been increased with increasing rats and bats abundance and expanding to human-dominated landscapes [15].

The climate change has also affected the land use. The ongoing deforestation and desertification due to wildfires and dust storms have decreased our farm land use more than 30%. However, our global population surges to 7.8 billion and will continue to increase to 10 billion by the 2050. To feed the planet's humans, the increasing land demand for farm food and clean water will get more intense and lead to more pressure and stress. Searching for food and water, hunting for timber, cropland and other natural resources have never relentlessly pushed human being so near to the wild regions with wildlife. As the increasing contacts with wildlife, the infected viruses and diseases will be more likely to transmit to human being. Nevertheless, the current coronavirus pandemic is a kind of warning and punishment by the powerful nature. We are thus in the presence of an effective host-pathogen arms race for survival and coexistence, where host resistance, mitigation or adaption to the catastrophic events is crucial for offspring and maintenance [16]. Although the cumulative global carbon emissions for 2020 could drop by anything from 4-7% due to the COVID-19 pandemic, the emissions could recover quickly with the reopening economy [17]. Certainly, more coronavirus pandemic, air pollution and weather extremes will be expected to occur if we do not take sufficient action to tackle the emerging global problems from environmental deterioration. Current climate, ecological or epidemiological models have not included the viral processes of origin, transmission and impact. It is urgently needed to improve climate models with coupling atmosphere-ocean-cryosphere-biosphere (Figure 1), and including viral simulation using genetic data for the better predictions of future emerging virus pandemic, air pollution and weather extremes.

Competing Interests

The author declare that there is no competing interests regarding the publication of this article.

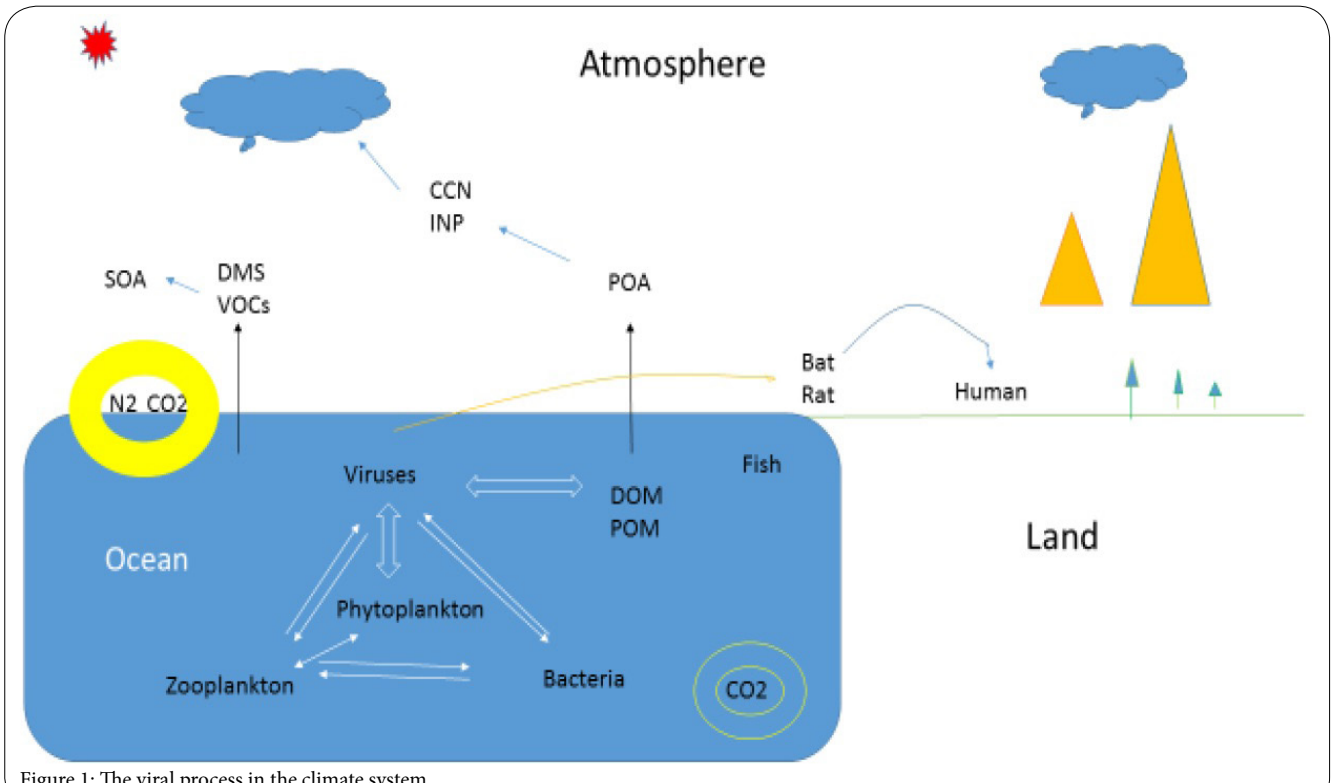

Figure 1: The viral process in the climate system.

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