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Climate Changing Process and Mechanism

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Abstract

This paper confirms that the impetus of sustainable development of marine ecosystem is nutrient silicon and water temperature through marine ecological changes, of which nutrient silicon is the main engine and water temperature is secondary engine. It expounds the climate changing process and mechanism utilizing the dynamic balance of earth ecosystem and displays the future climate changing mode of earth, such as the weather changing mode in 2020, based on many theories proposed by authors themselves, for example, three complementary mechanisms of earth ecosystem—complementary mechanism of nutrient silicon, water temperature and carbon in earth ecosystem, related concepts—the definition, structure, goals, functions, contents and significance of earth ecosystem, and climate models—the climate models in inshore region and drainage basin, inland, and ocean. Therefore, we should fully understand the climate changing process and mechanism and positively cope with the drought and flood disasters and high temperature it has brought to human, so as to give scientific support to disaster prevention and mitigation in China.

Keywords

Climate Changing, Process and Mechanism, Dynamic Balance, Earth System, Disaster Prevention and Mitigation

1. Introduction

In recent years, disasters such as global warming, sandstorms, floods, storm surges and red tides have occurred frequently, threatening the development of human society and the safety of life and property seriously. For the purpose of disaster prevention and mitigation, we should pay close attention to terrestrial ecosystem, marine ecosystem, and atmospheric ecosystem (Yang et al., 2000, 2002a, 2004a, 2004b, 2004c, 2005a, 2005b, 2006a, 2006b, 2007a, 2011a, 2011b, 2012). At present, there is a series of natural disasters that occur, such as drought, desertification, sandstorms, heavy rains, floods, mudslides, landslides, storm surges and red tides on the earth. The author has proposed the theoretical system of earth ecosystem, revealing the process and mechanism of a series of natural disasters (Yang et al., 2000, 2001, 2005a, 2005b, 2005c, 2005d, 2006a, 2006b, 2006c, 2007a, 2009a, 2012; Yang & Gao, 2007b; Yang, 2009b), and proposed three complementary mechanisms for the earth ecosystem in 2006: the nutrient silicon, water temperature and carbon complementary mechanisms of earth system (Yang et al., 2000, 2001, 2005a, 2005b, 2005c, 2006a, 2007a, 2009a, 2012; Yang & Gao, 2007b; Yang, 2009b). In the process of three complementary mechanisms, the author has revealed the future climate changing on the earth and made a study on the impact of marine ecological changes on climate and the relationship between crop planting in 2007 (Yang et al., 2009a). The future earth climate changing model proposed by the author has been gradually verified in the following years, especially in 2010 (Yang et al., 2012). As time goes on, the disasters of the earth climate changing have become more and more serious which stimulates the author to be aroused to reduce people's suffering and hardship, and to provide scientific support for dealing with major issues such as resource supply, ecological protection, environmental optimization, disaster prevention and mitigation, and national security relating to human survival and sustainable development.

2. The Contents of Earth Ecosystem

The earth ecosystem means that the earth itself has the characteristics of life, which can complete the sustainable development through its own adjustment and control, so that all substances on the earth can continue to exist in different forms, and its content covers all life on the earth and environment (Yang et al., 2005a, 2005b, 2014a, 2014b, 2014c, 2014d). On the earth, before the emergence of life, or if there is no life on the earth, the content of the earth ecosystem only contains environment. Therefore, the significance of the earth ecosystem is that the concept of the earth ecosystem regards global life and environment as a whole and carries out coordinated and harmonious sustainable development. The earth ecosystem maintains the dynamic temperature balance through the biogeochemical process of silicon and carbon, determines the dynamic changing of global climate, and ensures the sustainable development of earth ecosystem.

2.1. The Definition, Structure and Goals of Earth Ecosystem

The author put forward the definition, structure and goals of the earth ecosystem, which has laid the foundation for the research of dynamic balance of earth ecosystem (Yang et al., 2005a, 2005b, 2014a, 2014b, 2014c, 2014d).

The definition of earth ecosystem: Earth ecosystem refers that the earth has its own life characteristics, which can complete the sustainable development through its own adjustment and control, so that all substances on the earth can continue to exist in different forms.

The structure of earth ecosystem: The earth ecosystem is composed of three parts: terrestrial ecosystem, marine ecosystem and atmospheric ecosystem. The land, ocean and atmosphere have formed three interfaces with each other.

The goal of earth ecosystem is that all substances on the earth can continue to exist in different forms, so that the earth can develop sustainably, maintain the normal, stable and long-term dynamic operation, and have stable and dynamic ecological systems.

2.2. The Function, Content and Significance of Earth Ecosystem

The author puts forward the function, content and significance of the earth ecosystem, which provides a scientific platform for the climate changing of earth ecosystem (Yang et al., 2005a, 2005b, 2014a, 2014b, 2014c, 2014d).

The function of earth ecosystem: The earth ecosystem can maintain the long-term existence of the earth, keep the earth in a stable operation, and have sustainable development. The earth ecosystem is a dynamic and stable system for sustainable development of the earth.

The content of earth ecosystem: Now it includes all life and environment on the earth. Before the emergence of life, or if there is no life on the earth, then the content of the earth ecosystem only contains the environment.

Significance of earth ecosystem: The concept of earth ecosystem regards global life and environment as a whole, carrying out coordinated and harmonious sustainable development. It narrates the trajectory of earth movement from the structural aspect and analyzes the sustainable development of ecosystems in different areas of the earth from the functional aspect. Through the study of earth ecosystem, the author has demonstrated the changing process of earth ecosystem, clarified the law of evolution, determined the dynamic cause, revealed the operating mechanism and established the prediction theory of changing trends, providing a scientific basis for human survival and sustainable development.

3. The Dynamic Balance of Earth Ecosystem

Phytoplankton is the main primary producer and the foundation of marine food chain. In ocean waters, water temperature and nutrient silicon control the time and space changes of phytoplankton growth (Yang et al., 2005a, 2005b, 2014a, 2014b, 2014c, 2014d). Changes in water temperature and nutrient silicon cause changes in the growth and structure of phytoplankton, as well as changes in the marine ecosystem. Nutrient silicon and water temperature are the two engines of phytoplankton growth, of which nutrient silicon is primary, strong and rapid while water temperature is secondary, auxiliary, and slow (Yang et al., 2006b).

3.1. The Dynamic Balance of Silicon

The earth ecosystem must first maintain the healthy and sustainable development of marine ecosystem, for which it must import terrestrial silicon into the sea to satisfy the growth of marine phytoplankton. The earth ecosystem inputs a large amount of silicon to silicon-deficient water bodies through three approaches: land, atmosphere, and ocean (Yang et al., 2002a, 2002b, 2003a, 2003b, 2014a, 2004b, 2005a, 2005b, 2005c, 2005d, 2006a, 2006b, 2006c, 2014c, 2014d). On land, the weathering of silicon-bearing rocks and the loss of silicon-bearing soils dissolve silicon in water bodies that transport silicon to the ocean through coastal rivers and floods; in the atmosphere, the weathering of silicon-bearing rocks and the loss of silicon-bearing soils float silicon in the air through sandstorms that transport silicon to ocean waters; under the sea, the weathering of silicon-bearing rocks and the loss of silicon-bearing soils deposit silicon on the seafloor through storm surges that transport silicon to ocean waters.

When silicon is in the water bodies, it enters the organism through the absorption of diatoms. Dead diatoms and the excreta of zooplankton that ingest diatoms leave the euphotic layer and subside to the sea floor, while silicon leaves the surface of the sea and subsides to the sea floor. Therefore, silicon goes through such a depletion process: river input (origin) → phytoplankton absorption and death (biogeochemical process) → sedimentation to the seafloor (destination), showing the slow process that seas change into mulberry fields (Yang et al., 2003a, 2003b, 2014c, 2004a, 2004b, 2005a, 2005b, 2006a, 2006b, 2006c, 2014d). When inputting a large amount of nutrient silicon, the primary productivity of phytoplankton will exist a high peak, and sometimes there will be water blooms. On the one hand, as phytoplankton absorbs a large amount of silicon, the silicon content in seawater is greatly reduced; on the other hand, due to the lack of silicon, the growth of phytoplankton is severely restricted, resulting in a high sedimentation rate (Yang et al., 2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2005c, 2005d, 2006a, 2006b, 2006c, 2014c, 2014d). In this way, the dynamic balance of phytoplankton growth and silicon is maintained. Therefore, the earth ecosystem determines the growth of phytoplankton through silicon.

3.2. The Dynamic Balance of Carbon

The ocean is the largest adsorber of carbon dioxide in the atmosphere. Since carbon dioxide can be dissolved in seawater, a large amount of carbon in the atmosphere is able to enter the seawater. Phytoplankton absorbs the carbon dissolved in seawater, sinks to the sea floor, and stores it. In this way, there are a large number of phytoplanktons in the sea water, so that the carbon in the sea water can be continuously transferred to the sea floor. Hereby, the carbon dioxide in the sea water drops, and the carbon dioxide in the atmosphere is continuously dissolved in the sea to supplement, so that the carbon dioxide in the atmosphere also drops, which completes the carbon storage process from the atmosphere through the ocean to the sea floor (Yang et al., 2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2005c, 2006a, 2006b, 2006c, 2014c, 2014d). Silicon determines the vigorous growth of phytoplankton, so silicon determines the carbon content in the atmosphere.

Through the cyclical dynamic model of primary productivity of North Pacific atmospheric carbon—Jiaozhou Bay (Yang et al., 2002a, 2002b, 2010), the author discovers the conversion rate of phytoplankton and atmospheric carbon: the amount of atmospheric carbon absorbed per unit of primary productivity is 0.00321 - 0.00974 ppm/(mg·m^{-2}·d^{-1}), and the amount of primary productivity consumed per unit of atmospheric carbon is 102.66-311.52 (mg·m^{-2}·d^{-1}/ppm). If atmospheric carbon is not absorbed by primary productivity, the maximum value of atmospheric carbon is 345.61 - 347.13 (ppm). In winter, phytoplankton in Jiaozhou bay absorbs atmospheric carbon from 0.28963 to 0.87884 (ppm); in summer, phytoplankton in Jiaozhou bay absorbs atmospheric carbon from 6.88689 to 20.89668 (ppm). It can be seen that the amount of atmospheric carbon absorbed by phytoplankton varies greatly in winter and summer, and the weak and vigorous growth of phytoplankton determines the fluctuations of atmospheric carbon. The change of phytoplankton growth determines the change of atmospheric carbon, which shows periodic oscillation changes with the highest in May and the lowest in October. Therefore, phytoplankton determines the period and amplitude in the periodical variation of atmospheric carbon.

The change of atmospheric carbon is a curve change of periodic oscillation rising, which is a combination of trend increase and periodic oscillation (Yang et al., 2002a, 2002b, 2010). Combining human emission and phytoplankton absorption, the change of atmospheric carbon is a compound dynamic process of carbon increase and periodic changes, and these two changes are correspondingly determined by human emissions and phytoplankton growth. Therefore, the earth ecosystem determines the variation of atmospheric carbon through the growth of phytoplankton.

3.3. The Dynamic Balance of Earth

The earth ecosystem relies on the input of a large amount of silicon into silicon-deficient water bodies to enable phytoplankton to grow and reproduce rapidly, and to move a large amount of carbon from the atmosphere to the sea floor. **Figure 1** shows the biogeochemical process of silicon and carbon. Therefore, the earth ecosystem increases the carbon sedimentation rate, increases the carbon sedimentation amount to the sea floor, and maintains the dynamic balance of atmospheric carbon. At the same time, the elimination of large amounts of atmospheric carbon by the earth ecosystem will cause the atmosphere temperature and water temperature to drop, and restore them to a dynamic balance.

The earth ecosystem controls the input of a large amount of silicon into water bodies. Silicon controls the growth of phytoplankton. Phytoplankton controls the variation of carbon in the atmosphere. Atmospheric carbon controls the changes of atmospheric temperature and water temperature. Atmospheric temperature and water temperature control climate changes. Then the climate controls the changes of earth in turn. **Figure 2** shows the control chain of the earth ecosystem and the changing process of earth ecosystem control chain to control the earth. Therefore, the power of the earth ecosystem is silicon, the core of the earth ecosystem is the dynamic balance of temperature, and the goal of the earth ecosystem is the dynamic balance of the earth.

In this chain, the earth ecosystem transports silicon as much as possible to maintain the dynamic balance of silicon, the dynamic balance of phytoplankton, the dynamic balance of atmospheric carbon, the dynamic balance of atmospheric temperature and water temperature, the dynamic balance of climate, and the dynamic balance of the earth.

In this chain, human has attacked two links. One is silicon in water bodies; the other is atmospheric carbon. On the one hand, it greatly reduces the silicon input into the water body; on the other hand, it greatly increases the carbon emission to the atmosphere. As a result, the global climate is getting warmer and warmer.

4. The Complementary Mechanism of Earth Ecosystem

4.1. The Complementary Mechanism of Nutrient Silicon

In order to maintain the balance of phytoplankton growth in the ocean and the sustainable development of marine ecosystem, as well as the slowdown of carbon dioxide growth in the atmosphere, the earth ecosystem starts to initiate the complementary mechanism of silicate (Yang et al., 2003a, 2003b, 2005a, 2005b, 2005c, 2005d).

Large amounts of silicon are imported into silicon-deficient water bodies through coastal floods, atmospheric sand storms and seabed sediments. In this way, the terrestrial silicon is imported into the sea by three ways: land, atmosphere, and sea floor, to satisfy the growth of phytoplankton. Atmospheric carbon dioxide dissolves in the sea, and phytoplankton growth needs to absorb a large

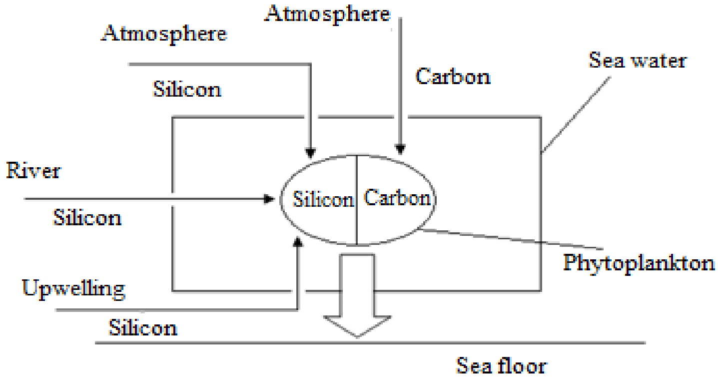

Figure 1. The biogeochemical process of silicon and carbon.

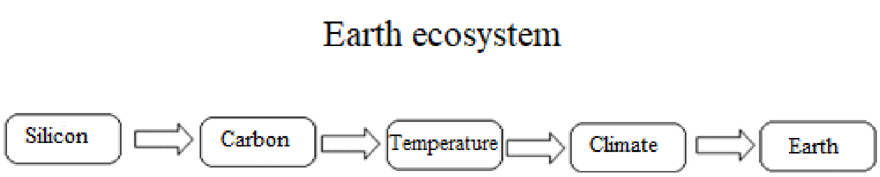

Figure 2. Silicon determines the variation of climate and earth.

amount of carbon dioxide in the sea water, and the carbon is carried to the sea floor with the sediment of phytoplankton (**Figure 3**).

4.2. The Complementary Mechanism of Water Temperature

In order to eliminate or slow down the increase of carbon dioxide brought to the atmosphere by human activities, and reduce the water temperature and restore to its original equilibrium position, the earth ecosystem has initiated the complementary mechanism of water temperature (Yang et al., 2006c, 2007a; Yang & Gao, 2007b).

The complementary of marine silicon by the earth ecosystem uses three methods to transport large amounts of silicon from inland, inshore and sea floor to ocean waters. A large amount of silicon makes phytoplankton grow vigorously. Because the growth of phytoplankton needs to absorb a large amount of carbon dioxide in seawater, and then the carbon is brought to the sea floor with the settlement of phytoplankton. In this way, the carbon dioxide in the sea water drops, and the carbon dioxide in the atmosphere is dissolved in the sea to supplement, so that the carbon dioxide in the atmosphere also drops as well. As a result, the temperature drops, which in turn leads to a drop in water temperature and restores a healthy balance of the earth ecology (**Figure 4**).

4.3. The Complementary Mechanism of Carbon Sediment

In the complementary mechanism of water temperature, the earth ecosystem starts to transport a large amount of silicon to the ocean, so that phytoplankton grows vigorously, and even produces diatom red tide, which deposits a lot of

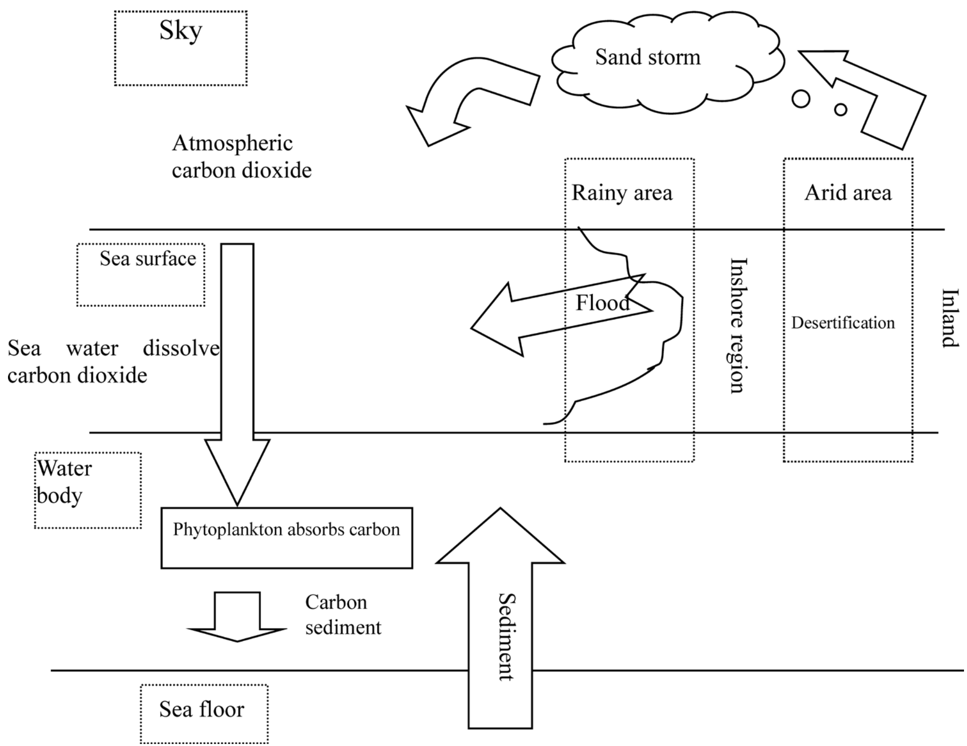

Figure 3. The complementary mechanism of nutrient silicon in earth ecosystem.

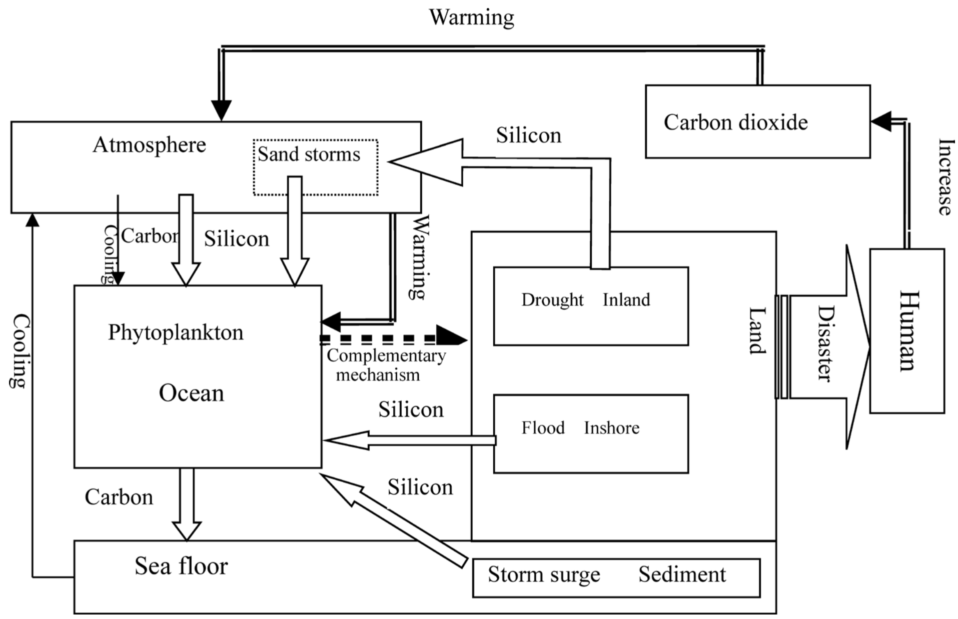

Figure 4. The complementary mechanism of atmospheric temperature and water temperature in the earth ecosystem.

carbon on the sea floor, causing the temperature to drop. However, if the earth ecosystem cannot activate the complementary mechanism of silicate and cannot to send a large amount of silicon to the ocean, the complementary mechanism of carbon sediment will be activated to drop the temperature (Yang et al., 2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2005c, 2005d, 2006a, 2006b, 2006c, 2014c, 2014d). Most of the waters in the ocean are rich in nitrogen and phosphorus, and in the inshore waters, the water bodies are eutrophic. The absorption ratio of nitrogen and phosphorus by phytoplankton is magnitude higher than the absorption ratio of silicon by phytoplankton, far exceeding the threshold for algae.

In this way, the complementary mechanism of carbon sediment makes the non-diatoms of phytoplankton algae in the marine ecosystem produce red tides, forcing the carbon in the ocean to sink to the sea floor. This makes the atmospheric temperature drop and the water temperature drop (**Figure 5**).

It can be seen that in order to maintain the balance of the atmosphere, the earth ecosystem has adopted silicate complementary mechanism, water temperature complementary mechanism, and carbon sediment complementary mechanism, striving to maintain a healthy development of earth ecosystem.

The importance on the earth ecosystems are arranged in descending order: atmospheric ecosystem, marine ecosystem and terrestrial ecosystem. Then, in order to survive in the earth ecosystem, humans must pay strong attention to the atmospheric ecosystem, especially carbon dioxide emissions and rising temperatures.

5. Support for Patterns in 2020 Weather Changes

According to the weather data in 2020 released by China Weather Network

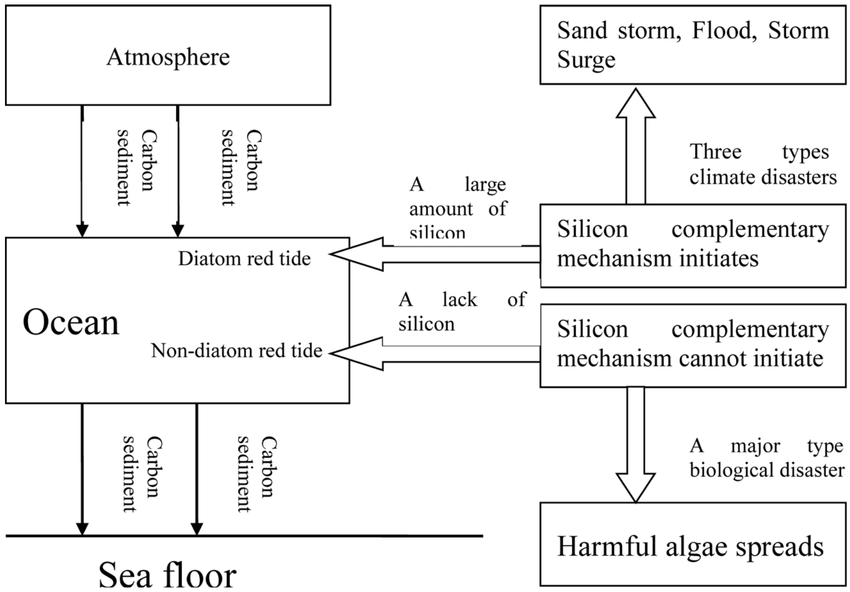

Figure 5. The complementary mechanism of carbon in earth ecosystem.

(Yang et al., 2011a; China Typhoon Net, 2020; Weather China, 2020; National Climate Centre, 2020), the overall climate situation of China this year is terrible. Heavy rains, floods, high temperature and strong convection and other meteorological disasters frequently occur, which have a heavy impact. Through analysis, the following research results can be obtained:

5.1. Inshore Region

Monitoring by the National Climate Center shows that since the beginning of this year (as of October 13), the overall climate conditions of China is somewhat terrible, of which floods are more serious than droughts. Heavy rainfall with strong extremity, severe floods, heavy rains, high temperatures, droughts, strong convection and other meteorological disasters, abnormal typhoon activities, cold waves and strong cold air have a significant impact on the climate. Except for the central and western regions of northwest district, southern regions of South China and other places where the precipitation is less, most of the central and eastern regions have more precipitation.

With the onset of the South China Sea summer monsoon, heavy rainfall occurred in Guangdong from May 20 to 22, with large intensity and wide ranges, causing rainstorm and floods in many places in Guangdong (**Figure 6**).

From June 2 to 10, there was a large-scale rainstorm in southern region of China, resulted that the main streams of Liujiang River, the main streams of the Luoqing Jiang River, Hejiang River, and Guijiang River experienced super-alarm floods and the Xijiang and Beijiang Rivers successively experienced floods No.1.

5.2. Drainage Basin

During the major flood period (June-August), except for the Liao River and Pearl River basins, the precipitation in the remaining regions of seven major river basins is relatively high. The precipitation in the Yangtze and Yellow River basins was 38% and 39% higher than normal in the same period respectively, both of which were the highest in the same period in history since 1961; the Huaihe River and the Lake Taihu were 45% and 64% higher than in the same period in history, both of which were the secondary highest in the same period in history; Songhua River and Haihe River were 15% and 10% higher than it in history, respectively; the Liaohe River and Pearl River basins were 7% and 15% smaller than normal in the same period (**Figure 7**).

5.3. Heavy Rainstorm

Main weather and climate characteristics this year: early flood season, long rainy

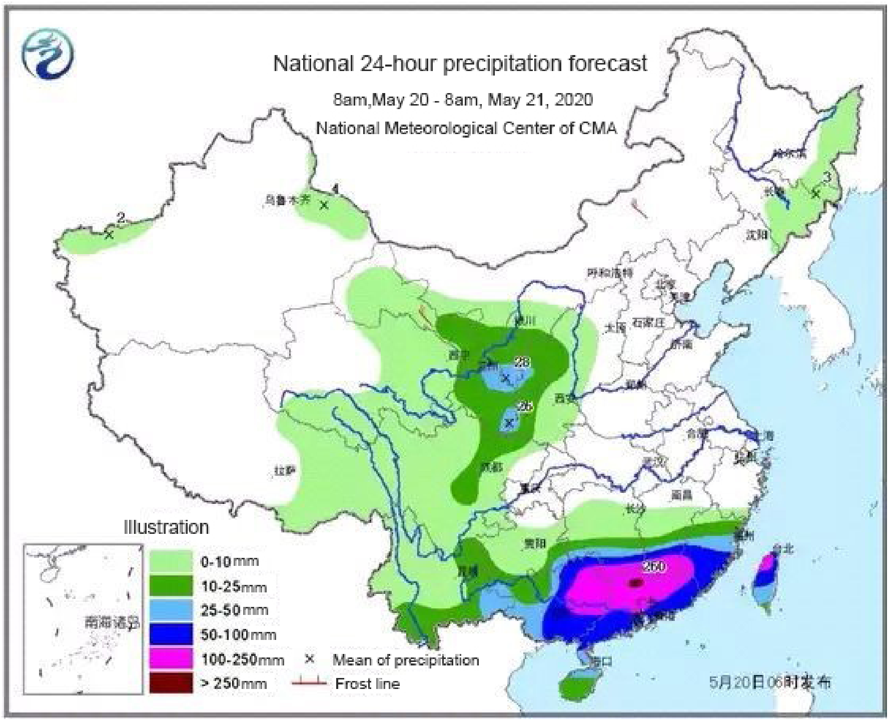

Figure 6. National 24-hour precipitation forecast on May 20.

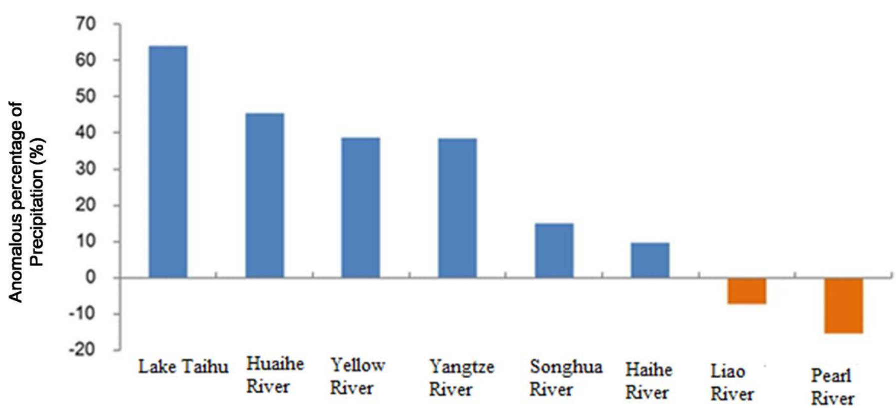

Figure 7. Anomalous percentage of precipitation of seven major river basins and Lake Taihu in major flood period (June-August) in 2020.

season, and heavy rainfall.

1) The pre-rainy season in South China started on March 25, 12 days earlier than normal. The average precipitation in South China was 359.2 mm, which was 14.5% less than normal.

2) The plum rains in the Yangtze-Huaihe river basin began on June 1, 7 days earlier than normal and ended on August 2 (15 days later than normal). The rainy season lasted for 62 days. The rainfall of the rainy season reached 759.2 mm, 1.2 times more than that of normal, which is the highest since 1961.

3) The rainy season in North China began on July 28, 10 days later than normal and ended on August 25 (7 days later than normal). The precipitation was 182 mm, which was 34% more than normal.

4) West China entered the rainy season on September 9. The start time of the autumn rain in West China is the same as that of normal years. So far, the accumulated precipitation is 160.8 mm, which is 51.7% more than the same period of normal years.

There are many heavy rain days, high overlap of rainy areas, and strong precipitation extremes. 76% of counties (cities) across the country experienced rainstorm, and the average number of rainstorm days was 27% more than that of the same period in normal years, which is the secondary most in the same period since 1961 (**Figure 8**).

From June to July, the main rain band was mainly concentrated in Guizhou, Sichuan, Chongqing and the middle and lower reaches of the Yangtze River. The precipitation in Anhui, Hubei, and Chongqing were 113%, 101%, and 67% higher than normal in the same period, all of which are the highest in historical period since 1961. The precipitation in Jiangsu, Zhejiang, Shanghai and Henan were 78%, 39%, 74% and 40% higher than normal in the same period respectively, all of which are the secondary largest in history. Since August, parts of the northeast and southwest have noticeably more precipitation. Sichuan, Jilin,

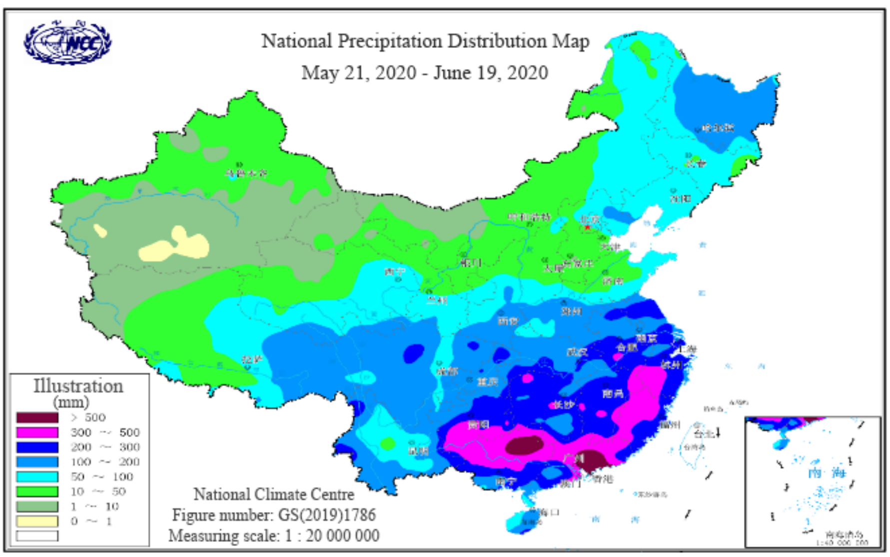

Figure 8. National 24-hour precipitation forecast on May 21.

Heilongjiang and other provinces have the highest precipitation since 1961, followed by Inner Mongolia, and Guizhou and Hunan.

Heavy rains and floods in the Yangtze River basin and other places are serious. A total of 634 rivers across the country have experienced floods exceeding the alarm level, of which 194 exceeded guaranteed level and 53 exceeded historical level.

From June to July, the Yangtze River occurred heavy river floods in basin, and the middle and lower reaches of Sha city and the areas of Dongting Lake and Poyang Lake exceeded alarming level. The maximum over-alarm time was 42 days.

From 8 am on July 7 to 8 am on July 8, 2020, there were heavy rains in some areas in western Jianghuai, southern Jianghan, northern Jiangnan, southeastern Chongqing, northern Guizhou, southern Sichuan, northwestern Yunnan, and eastern Heilongjiang (**Figure 9**), among which there were heavy rainstorms in parts of southern Anhui, northwestern Zhejiang, eastern and southern Hubei, northern Hunan, northern Guizhou, and local heavy rains (250 - 280 mm) in eastern Hubei and northern Hunan. Some of the above areas were accompanied by short-term heavy precipitation (the maximum hourly rainfall was 30 - 50 mm, and some local area can exceed 70 mm), and there was strong convective weather such as thunderstorms and winds. Large basin floods occurred in the Huai River, the sections from Wangjiaba to Zhengyangguan on the main stream exceeded guaranteed level, and sections from Runheji to Wangji were over-historical level. A basin-wide flood occurred in Lake Taihu, with the highest water level reaching 4.79 meters, wich is the third highest water level in history.

5.4. Inland Area

Regional periodic meteorological droughts are frequently happened, and meteorological droughts have periodic and regional nature, with an overall mild degree. Since the beginning of this year, some parts of Northeast China, North

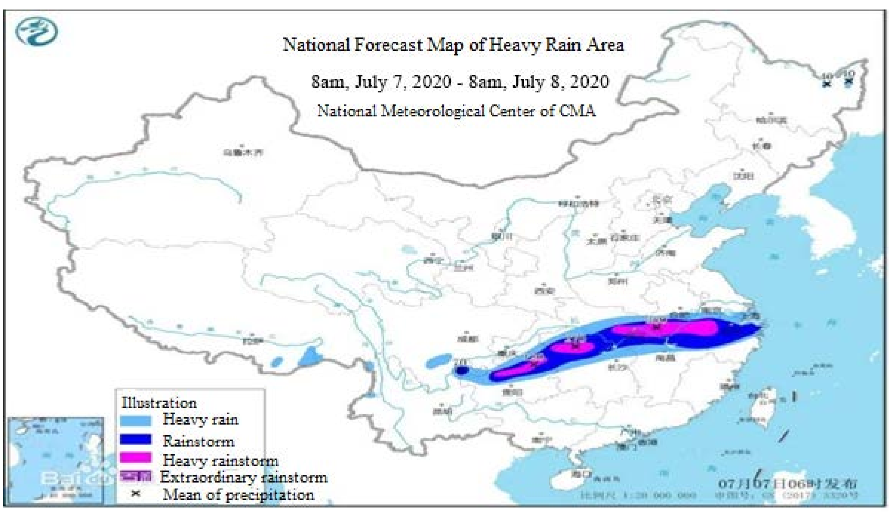

Figure 9. National 24-hour precipitation forecast on July 7.

China, South China, Northwest China, and Southwest China have experienced periodic meteorological droughts.

In mid-July, the meteorological drought in the central and southern parts of Northeast China, southern China, Xinjiang, Inner Mongolia, Fujian and other places gradually increased. Since August, effective precipitation in arid areas has gradually increased, and meteorological drought has been gradually relieved.

The high temperature and low rainfall in the spring of Yunnan led to the development of meteorological drought in the southern and western regions. By April 11, the area of moderate drought and above reached 195,000 square kilometers, which was 2.7 times more than that on April 1, with a rapid development. Water storage in reservoirs and ponds in Yunnan is obviously low, and drought has adversely affected crop yields, spring planting and urban water supply.

In mid-to-late July, meteorological droughts in the central and southern parts of Northeast China, southern China, Xinjiang, Inner Mongolia, and Fujian gradually increased. On July 17, the area of national moderate drought and above was the largest this year (1.913 million square kilometers). Spring maize in areas with poor irrigation conditions in the northeast China has short plants, thin stalks, and yellow leaves. The severely drought-stricken maize has empty stalks due to the inability to head. In some areas of South China, the filling period of immature early rice is shortened or the filling is not full, so the growth of crops is affected to different degrees.

5.5. High Temperature

The national average temperature is 12.5˚C, 0.8˚C higher than the same period in normal years, which is the fourth highest in history since 1961. The temperature in most parts of China is 0.5˚C - 2˚C higher than previous (**Figure 10**).

North China and Jiangnan are heavily affected by the continuous high temperature. From June 2 to 8, a high temperature occurred in North China, Huanghuai and other places. The daily maximum temperature of 21 observation stations including Ci County in Hebei (41.8˚C) and Jiaozuo in Henan (41.9˚C) reached the extreme event standard.

From July 11 to September 3, the number of high temperature days in southeastern Hunan, central and southern Jiangxi, southern Zhejiang, most of Fujian, and central and eastern Guangdong reached 30 - 40 days, and more than 40 days locally. Sustained high temperature has reduced the seed setting rate and thousand-grain weight of some early rice, and affected the growth and development of late rice, vegetables, fruits and dryland crops.

The high temperature appears early, and the high temperature in southern part lasts for a long time.

The national average number of high temperature days is 9.4 days, 1.7 days longer than normal. Among them, Hainan (46.5 days) and Guangdong (31.8 days) have the highest number of high temperature days since 1961, and Fujian

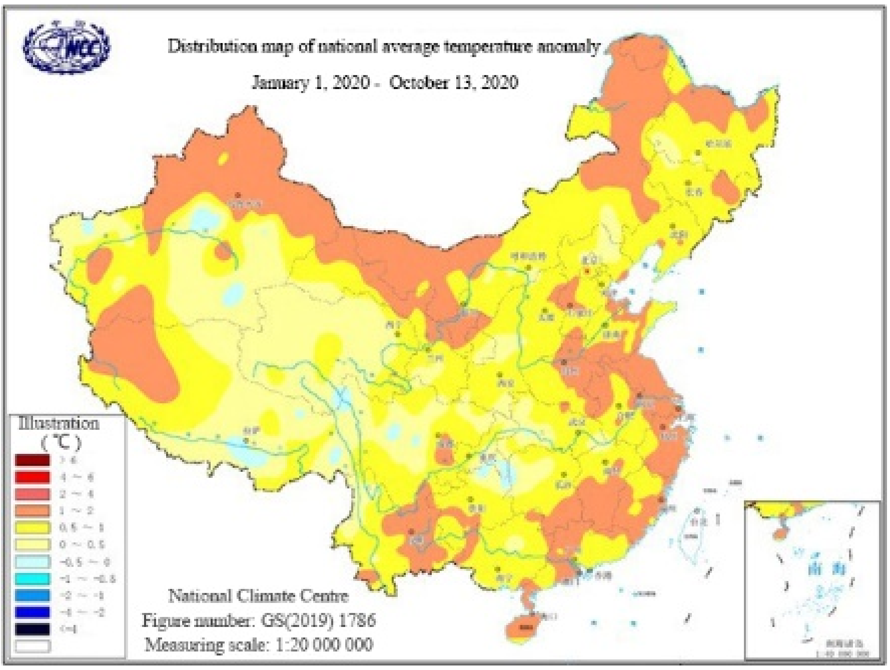

Figure 10. Distribution map of national average temperature anomaly this year.

(40.7 days) has the secondary highest number in history.

From May 1 to 9, the earliest high temperature process since 1961 occurred in the central and eastern part of China, 49 days earlier than normal (June 19).

From July 11 to September 3, a regional high temperature occurred in southeastern Jiangnan and eastern South China, which lasted for the second longest time since 1961.

5.6. Typhoons

According to the analysis of typhoon forecast published by China Typhoon Network [29-31], the following research results can be obtained.

Landing typhoons have the characteristics of "short life, strengthening inshore, and concentrated influence of wind and rain". There are 4 typhoons from June 14 to August 27, 2020, which shows that the typhoons were concentrated in these 3 months.

1) Typhoon path growth

Typhoon "Parrot" is the first typhoon to land in China in 2020, which is the No. 2 in 2020. The future path would be mainly northwest, landing on the coast of Guangdong, with strong impact of wind and rain. The path of typhoon No. 4 in 2020, Hagupit, moved to the northwest, maintained or slightly increased in intensity, and made landing along the coast from Wenling to Cangnan in Zhejiang (**Figure 11**). After landing, it would move to the north, and its intensity will gradually weaken. It would pass through Zhejiang and Jiangsu successively, and move from northern Jiangsu to the west of the Yellow Sea during the day on August 5, and then turn to the northeast. The No. 7 typhoon "Higaos" of 2020 made landing on the coast of Jinwan District, Zhuhai City, Guangdong Province

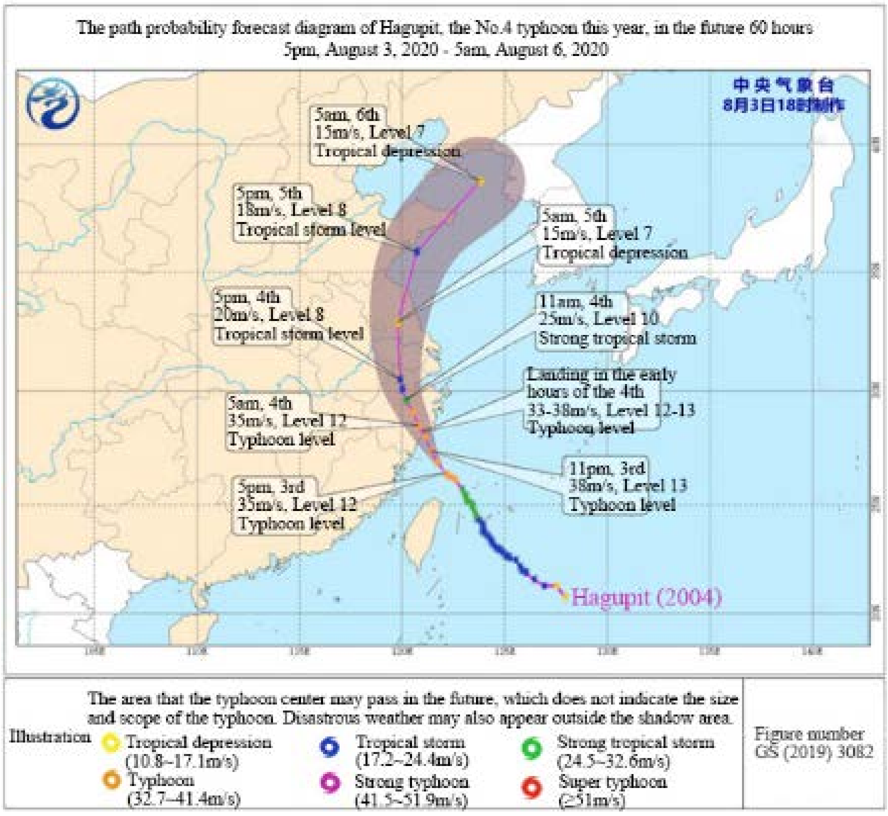

Figure 11. No. 4 typhoon "Hagupit" this year.

at around 6 am on August 19. The maximum wind force near the center was 12 grade (35 m/s) at the time of landfall, and the lowest pressure in the center was 97,000 Pa. Typhoon No. 8 "Bavi" in 2020 moved north to west at a speed of about 10 kilometers per hour, and its intensity gradually increased, reaching the strongest typhoon level. The center of typhoon "Bavi" landed on the coast of Pingan North Road in North Korea on the morning of August 27 around 8:30, near the border between China and North Korea. The maximum wind force near the center was 12 grade (35 m/s) when it landed.

2) Typhoon has brought great impact on inshore land and waters.

Typhoon No. 2 in 2020, "Parrot", from 2 pm on the 13^{th} to 2 pm on the 14^{th}, caused heavy rains in parts of southern Guangxi, southeastern Guangxi, and northeastern Hainan Island, and rainstorms or heavy rainstorms (80 - 120 mm) in some areas. The path of Typhoon No. 4 in 2020, Hagupit, moved northwest, maintained or slightly increased in intensity, and landed along the coast from Wenling to Cangnan in Zhejiang Province. From 8 pm on August 3 to 8 pm on August 4, there were heavy rains to heavy rainstorms in the central and eastern part of Zhejiang, including heavy rainstorms or extraordinary rainstorms (250 - 300 mm) in southeastern Zhejiang. Affected by Typhoon No. 7 of 2020, "Higos", cities and counties in the Pearl River Delta, Maoming, Yangjiang, and Yunfu have rainstorms to heavy rainstorms, extraordinary rainstorms in some parts area, and other cities and counties have moderate to heavy rains and rainstorms in some areas. This year's No. 8 typhoon "Bavi" will land on the coast from Pingan North Road in North Korea to Donggang City, Liaoning Province, China on August 27. From 8 am on the 27^{th} to 8 am on the 28^{th}, central and eastern Heilongjiang, most of Jilin, eastern Liaoning, and Inner Mongolia have heavy rains to rainstorms in parts of areas. Among them, there are heavy rainstorms (100 - 150 mm) in parts of southeast Heilongjiang and eastern Liaoning. Some of the above areas are accompanied by short-term heavy precipitation (the maximum hourly precipitation is 30 - 50 mm, and the local area can exceed 60 mm), and there are strong convective weather such as thunderstorms and winds. From the end of August to the beginning of September, the Northeast China is hit by a rare triple-hit typhoon within two weeks, with "Bavi", "Mesaac" and "Poseidon" successively. The heavy rainfall areas are overlapped, and the overlap effect is obvious, causing some rivers and reservoirs to exceed the warning water level, affected people's production and life.

6. Conclusion

Through the study of many natural phenomena of earth, the author proposes the earth ecosystem for the first time, expounds its definition, structure, goals, function, content and significance, explains the characteristics of earth ecosystem, creates the theory of earth ecosystem, and demonstrates the changing process and operating mechanism of the earth ecosystem. Through the nutrient silicon complementary mechanism of the earth ecosystem, the author comes up with a model of future climate changing in the earth. The analysis and research on this model show the types, content, characteristics, distribution and functions of the variation patterns of future earth climate. And applying the weather changes in 2010 to confirm the future earth climate change pattern. Nowadays, extreme weather often occurs, but there will be no extreme weather as it occurs for a long time and frequently. This is a future development trend of climate change.

According to the patterns of future earth climate change, different regions have different future climates. Then, we should establish different disaster prevention and mitigation systems and infrastructures. In inshore areas and basins, construct drainage systems, drain flooded fields and farmlands, pay attention to continuous rainstorms, and prevent possible flood disasters: collapse, rockfalls, mountain torrents, mudslides, landslides and other disasters. In inland areas, build water-saving irrigation systems, do a good job of drought prevention in cities and farmland, pay attention to high temperature, strong winds and continuous drought, and prevent possible drought disasters: desertification, sandstorms and other disasters. In the ocean area, build forecasting and forecast facilities and equipment, improve forecasting and prediction facilities and equipment, perfect the prediction mechanism, pay attention to the area, intensity, and speed of storm surges, and prevent marine disasters that may be caused by storm surges such as typhoons, hurricanes, tropical storms, and cold waves.

Floods, sandstorms and storm surge transport silicon to the sea in three ways, which are three kinds of disasters for human survival, but these disasters are insignificant compared with the disasters caused by the rise of global temperature and water temperature (Yang et al., 2007a; Yang & Gao, 2007b). This is because floods, sandstorms and storm surges are local disasters, but the disasters caused by the rise in global temperature and water temperature are global disasters. Therefore, through the future earth climate changing model, we should constantly monitor the flood disasters, drought disasters, storm surge disasters and other disasters to improve forecast precision and accuracy. To cope with the changes brought by climate change to the ecological environment and the drought and flood disasters brought to humans, humans need to actively take emergency measures and plans, and use modern technology to strengthen the construction of disaster prevention and reduction systems in order to reduce the impact of future natural disasters on humans.

Therefore, it is necessary to understand the changing process and mechanism of future earth climate so as to provide scientific basis and early warning preparation for disaster prevention and mitigation.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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