Precipitation Characteristics and Main Influencing Factors in Pamir Plateau

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Abstract: Atmospheric precipitation is one of the most active elements in the atmosphere. It plays a very important role in the atmospheric process and energy cycle. The changes of precipitation strongly affect the hydrothermal conditions of a basin or region. Since the 19th century, the global climate has shown fluctuating warming, and many natural ecosystems have been affected by regional climate change. Pamir Plateau is a "pure natural mountain solid reservoir". Its melting will not only affect the rivers it can cover, but also reveal the characteristics of climate change. So, it is of great reference value to study the climate change in Pamir by detecting the variation of precipitation in the Pamir Plateau. This paper first introduces the geographical location of the Pamir Plateau. Then this paper analyses the precipitation of Pamir Plateau in recent decades. Finally, the main influencing factors are analyzed.

1. Introduction

The Pamir Plateau spans many countries, such as China, Afghanistan and Tajikistan. So, our research area is limited to the East Pamir Plateau, which is located in the central Asia and the southwestern edge of Xinjiang Province. The Pamir Plateau in China is located in the eastern part of the country, in the Autonomous Prefecture of Kirgiz and the Kashgar region. The Eastern Pamir Plateau has remarkable characteristics and wide valleys. The Pamir Plateau lies between 73°-76°longitude in the East and 38°-41°latitude in the north. Pamir is surrounded by the Tianshan Mountains in the north, the Salequole Mountains in the West and the Karakoram Mountains in the south. So, the average elevation in this area is more than 4000 meters above sea level. Through the Meteorological Research Report of this area, we can see that the annual average temperature in this area is 3.53℃, the summer average temperature can reach 15.14℃, and the winter average temperature is - 10.15℃.

2. Monitoring materials and data processing methods

The data we can use in the research are as follows. Remote sensing images taken in 1972; satellite remote sensing images taken in 2000; remote sensing images taken in 2011; and China meteorological administration's information on precipitation in Pamir plateau in recent years. Through mosaic and re-projection of remote sensing images, we can understand the changes of precipitation in the Pamir Plateau.

3. Precipitation characteristics of Pamir plateau

The average precipitation over the Pamir Plateau in summer is shown in Figure 1. The average precipitation over the Pamir Plateau in winter is shown in Figure 2. The average precipitation over the Pamir Plateau is shown in Figure 3.

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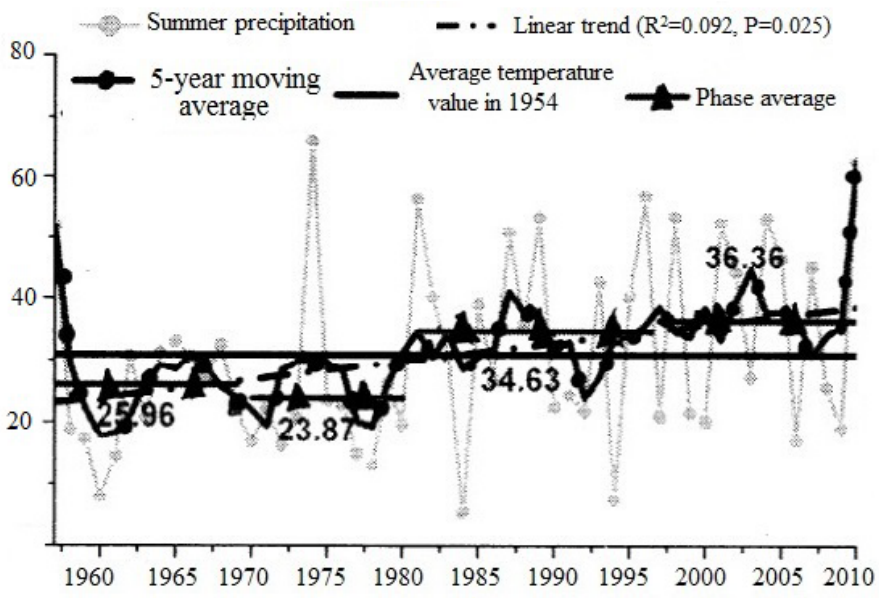

Figure 1 The average precipitation in summer (precipitation/mm)

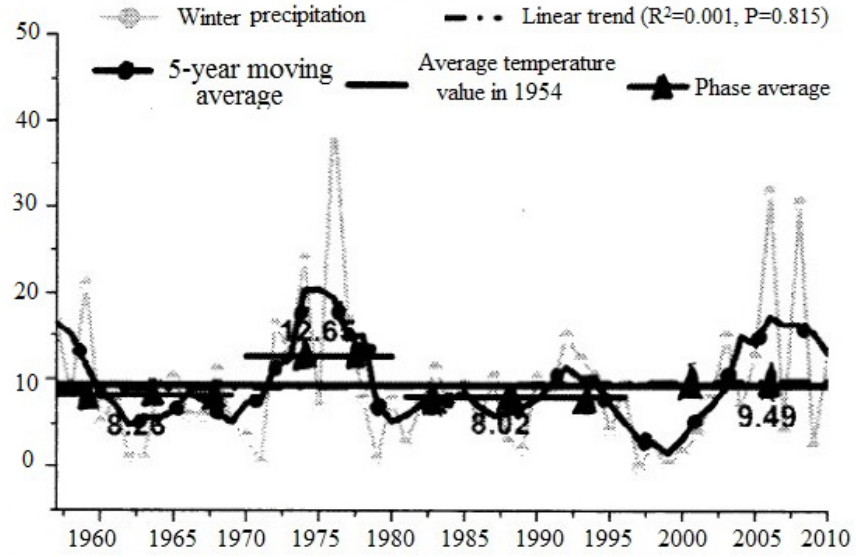

Figure 2 The average precipitation in winter (precipitation/mm)

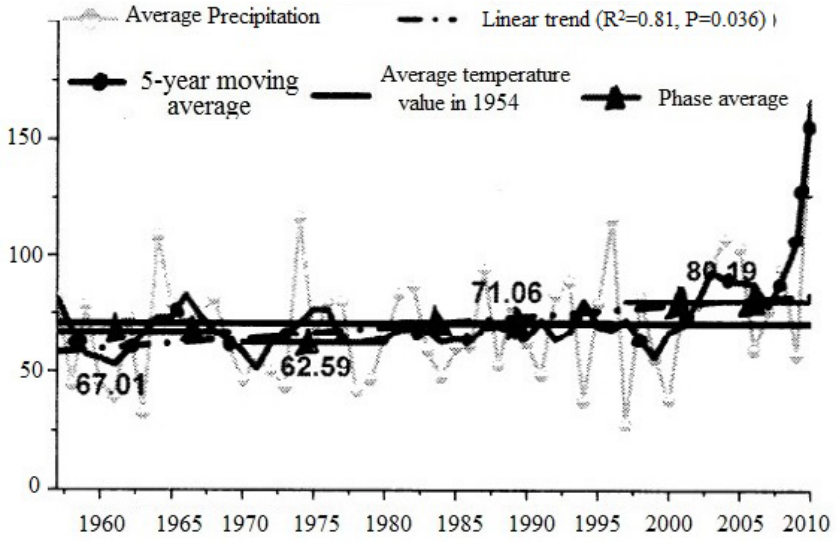

Figure 3 The average precipitation over the Pamir Plateau (precipitation/mm)

In Figures 1, 2 and 3, we can see the following conclusions. The annual average precipitation

from 1970 to 1980 is 8.14 mm lower than that from 1957 to 2010. It shows that the Pamir Plateau was in a relatively dry period at that time. The average annual precipitation from 1981 to 1996 was basically the same as that from 1957 to 2010, which was 8.47 mm higher than that from 1970 to 1980. It shows that the precipitation increased slightly during this period. 2000-2010 is a relatively warm and humid stage, with the highest average temperature and precipitation. The linear growth of summer precipitation in the Pamir Plateau is the most significant, showing a linear upward trend. The winter precipitation in the Pamir Plateau showed a less significant linear downward trend.

4. The main influencing factors of precipitation in Pamir plateau

4.1 Influencing factors of glaciers

Through the data analysis of Pamir in recent years, we can see that the Pamir Plateau glaciers have been showing a trend of shrinking. In the first 30 years, 583 glaciers retreated, 4 glaciers disappeared and only 3 glaciers increased their coverage. From the total area and reserves of glacier coverage, the glacier coverage has shrunk in varying degrees. At the same time, the storage of glacier area shows a declining trend. Among them, the area of the Koksayi Glacier has decreased the most seriously. In the past 40 years, its glacier coverage has decreased by nearly 5.74 square kilometers. In recent years since 2000, at least 3089 glaciers have retreated and only 16 glaciers have advanced. Compared with the reduction rate in the first 30 years, the reduction rate is relatively moderate. In recent years since 2000, at least 3089 glaciers have retreated and only 16 glaciers have advanced. Compared with the reduction rate in the first 30 years, the reduction rate is relatively moderate. In recent years since 2000, at least 3089 glaciers have retreated and only 16 glaciers have advanced. Compared with the reduction rate in the first 30 years, the reduction rate is relatively moderate. With the increasing melting rate of glaciers, the precipitation in the Pamir Plateau shows an increasing trend year by year. Therefore, the melting of glaciers provides better conditions for precipitation. With the increase of summer temperature, the accumulation of glacial substances decreases and the precipitation increases. Through glacier changes, we can conclude that the relationship between precipitation and glacier retreat is closely related. Especially in summer, the change of glacier has a great influence on precipitation. High temperature in summer will lead to accelerated glacier dissolution, and the total accumulation of glaciers will directly affect precipitation.

4.2 Influencing factors of geographical position

The Pamir Plateau lies between 73°-76°longitude in the East and 38°-41°latitude in the north. The Pamir Plateau has a severe continental alpine climate, especially in the eastern Pamirs, where winter is long.The Pamir Plateau is perennially affected by the westerly and southwestern monsoon climate. The monsoon cold and humid air flow will continuously enter the marginal mountain areas in the northwest of the Qinghai-Tibet Plateau, which leads to the formation of large-scale glaciers. The Pamir Plateau is located in the hinterland of Eurasia, so it is difficult to be affected by the marine climate. So the Pamir Plateau is cold and dry all year round. East Pamir has mountains that block the westward flow of wet air, so its annual precipitation is only 75-100 mm, less than 30 mm in the Kara Lake Basin. West Pamir is a parallel mountain range with high mountains and deep valleys. Therefore, the climate in this region varies greatly vertically. Wet air from the Atlantic Ocean is blocked by mountains, so wet air rises and cools down the slope. When the humid air is over 2000-3000 meters, it condenses into a dense fog, and there is a lot of precipitation. The annual precipitation on windward slopes of alpine areas can reach 1000 mm, while that in valleys is only 100-200 mm.

5. Conclusions

At present, the glaciers in the East Pamir Plateau are still retreating, so the climate in this region

will gradually change to warm and wet climate. The change of annual precipitation in summer can reflect the change of glacier and climate. According to the current trends and the lagging characteristics of glacier changes, we can conclude that the precipitation in East Pamir will increase in the next 20 years.

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