China's Water Resources and its Utilization

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Abstract: By recent estimation, the total annual runoff in China is about 2,638 km$^3$, corresponding to 2,670 m$^3$ per capita. The water problems of China are due to the uneven distribution of water resources and rapid increase of water demand, which have brought many difficulties in flood control and water supply. In this paper, characteristics of water resources and present situation of water resources development, conservation and utilization are discussed.

Introduction

China is situated in the eastern part of the Eurasian Continent, with a territory of 9.6 million km$^2$. The topography of the country is characterized by high plateaus and mountain ranges in the W and low and flat plains in the E. Plateaus and mountainous areas cover 59%, basins 19%, plains 12%, and hilly areas 10% of the total territory. The area of cultivated land is about 100 million ha, but they are mainly located in the NE Plains, the North China Plains, the Middle and Lower Chang Jiang Plains, Zhu Jiang (Pearl) River Delta as well as some inland plains. The climate of China is very complex, approximately 45% of the nation's territory in the N and W are arid and semi-arid, while the coastal areas in the E and S are humid which provides a consistent water surplus. The availability of water has been a major fact in the nature and direction of China's development.

China has more than 1500 rivers, each of which has a drainage area over 1,000 km$^2$. Among them, Chang Jiang (Yangtze River), Huang He (Yellow River), Zhu Jiang (Pearl River), Huai He, Hai He, Liao He, Songhua Jiang are the seven main rivers in China. More than 80% of population and cultivated land are concentrated in these river basins, which are the main developed districts of the economy and culture of the country. But the elevation of these districts are mostly below the high flood levels of the rivers. These lands are protected by dykes along river banks and are constantly menaced by floods. So the flood control of these main rivers is an important problem which affects our social development.

During the assessment of national water resources, the whole country has been divided into 10 major regions, as shown in Fig 1. These water resources regions are hydrologic areas, each of them is either the drainage area of a large river or the combined drainage area of a group of small rivers.

Main Characteristics of China's Water Resources

Precipitation

Precipitation is the source of nearly all water that occurs on and beneath the land surface. The total amount of annual precipitation of China is about 6,000 km$^3$, equivalent to an average depth of 628 mm which is 25% less than the world average.

The geographic distribution of precipitation, as shown in Fig 2, is extremely uneven, ranging from 6 mm annually in the deserts of Xinjiang, to 6,558 mm annually at a station in Taiwan. Such a great variation of precipitation from the SE to the NW is contributing as a main factor to the uneven distribution of water resources.

The seasonal distribution and annual variation of rainfall are also distinct in the most parts of our country, where some areas have excessive rain in certain periods and serious droughts in others. These are the main reasons for the frequent occurrence of floods and drought disasters, and for the unstable agricultural production in history.
Amount of Water Resources

According to recent estimation, the total annual runoff of all the streams in China is about 2,638 km³, of which the discharge from ground-water is about 621 km³, accounting for about 23%. Discharge from glaciers and melting snow is about 50 km³. The mean depth of annual runoff is 276 mm. In addition, China has a large amount of ground-water resources. The total amount of annual recharge to ground-water, including the direct infiltration of precipitation, the seepage from rivers, lakes, channel and irrigated areas, is about 770 km³. The total amount of water resources in China, including the part of ground-water which does not reappear as surface water, would be 2,720 km³, approximately.

In comparison with other countries, the total amount of annual runoff of China is ranking sixth in order, less than that of Brazil, USSR, Canada, USA and Indonesia. However, the per capita amount of annual runoff in China is 2,670 m³, which is only 1/4 of the world average, 1/5 of that of USA, 1/7 of that of USSR and Indonesia, or 1/50 of that of Canada. On the other hand, the amount of annual runoff per unit area of cultivated land is 1,750 m³, which is less than 3/4 of the world average.

The regional distribution of the runoff over China is also extremely uneven. The water is abundant in the S, but is scarce in the N. The amount of annual runoff per capita is very low in Hai He and Huai He, which is only 11–18% of the average of the whole country. Moreover, the seasonal and yearly variation of runoff is more obvious.