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A SURVEY OF CHINA'S CLIMATE AND HYDROLOGY

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1. Introduction

America and China are very similar in natural and meteorological conditions. Both have vast territories, famous rivers, and mountains. For example, in America there is the famous Mississippi River; in China there are the Yangtze and Yellow Rivers. Every year both countries sustain heavy losses from floods, despite the construction of many reservoirs. In America there is a threat of flash floods from medium and small sized rivers, while in China there are often serious calamities due to mountain floods. America is often affected by hurricanes while China is threatened by typhoons. Both countries have also been hit by storm-surge along their long coastlines, and they often suffer from severe droughts.

2. China's Climate

China's climate is greatly affected by the monsoons. In the winter, the monsoons carry cold dry air from central Asia across China towards the sea. In the summer, monsoons carry warm wet air inland from the sea. Summer temperatures average 80°F over much of China. The inland temperatures average 20°F in January over much of northern and central China.

During summer, depressions coming from the south and the west cause unsettled weather, but because of lack of water vapor they do not form clouds, even in regions of generally rising air. In winter, sinking air in the Central Asian anticyclone mostly determines the weather. Occasionally, there are invasions of cold air far to the south, especially on the eastern coast.

Average annual precipitation is about 648 mm (25.5 in). Annual precipitation varies among regions with progressive decreases from the southeastern coast to the northwestern inland areas. Annual averages range from 1800 mm (71 in) to less than

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200 mm (8 in). Annual precipitation totals can range from more than 2000 mm (79 in) to less than 30 mm (1.2 in). While precipitation varies from year to year, it is distinctly concentrated to four consecutive months (May through August), amounting to 50-70 percent of the year's total in southeastern China and 70-80 percent of year's total in other areas. The maximum annual precipitation is two or three times more than the minimum in the southern part of China and three to six times more in the northern part. There are successive abundant water years and successive dry years. The maximum 24-hour rainfall is 1060 mm (42 in); the maximum 6-hour rainfall is 830 mm (33 in).

China often suffers damage from typhoons of great intensity. Disasterous floods occur frequently. In contrast, drought is one of the major natural disasters in northern China, especially in northwestern China in this century.

3. China's Hydrology

Over 1500 rivers have watershed areas larger than 1000 km² (Figure 1). China is densely populated in its eastern plains. The areas in the middle and lower reaches of the seven major rivers (Yangtze, Yellow, Huai, Hai, Liao, Pearl, and Songhua) cover approximately 1 million km². With many important cities, such as Beijing, Shanghai, Tianjin, Guangzhou and Wuhan, and more than half of the country's population, these areas have developed into political, economic and cultural centers. China is greatly dependent on agriculture, its leading industry.

The threat of flooding is a serious problem in China. In many places land surface elevations of major populated areas are below the flood levels of the rivers. Consequently, they have to be safeguarded by dikes. The dikes are in poor condition. Serious soil erosion and subsequent deposition on the middle and lower reaches of the rivers have increased the risk of flooding. Also, ice jam floods and clogging of dams by ice often occur in the rivers of the northern part of China. Some cities in that region are seriously deficient in water resources. Proper control and protection of water resources (including 87,000 reservoirs) through hydrologic information and forecasting of flooding, drought, ice regimes, sediment, water quality, and groundwater are very important.

3a. The Yangtze River

The Yangtze River is the largest river in China and also one of the largest rivers in the world. It originates from the northern slopes of the Tanggula mountain range on the Qinghai-Tibet Plateau and flows through ten provinces

(autonomous regions and municipalities) into the East China Sea. Its total length is 6,300 km. The tributaries of the Yangtze extend to ten provinces. Its drainage area is 1.8 million km², equal to about one-fifth of the total area of the country.

The Yangtze basin is rich in water, hydropower, minerals, forestry, and aquatic resources. The value of industrial and agricultural output amounts to about 40 percent of the nation's. The population is about one-third of the total of the country. Many industrial and commercial cities stand along the river banks. Therefore, the Yangtze occupies a very important position in the development of the economy.

According to historical records, more than 210 disastrous floods occurred in the 2,000 years from the beginning of the Han dynasty (185 B.C.) to the end of the Qing dynasty (1911 A.D.), or once in every ten years on average. Since 1921, 11 unusual floods have occurred, with an average of one about every six years.

3b. The Yellow River

As the world famous "hanging river"², the downstream region of the Yellow River, flows through the Plain of North China. There are banks on the two sides of the river's reach between the cities of Huayuankou and Hekou. The maximum distance between the two banks is 20 km. The river course is wide, shallow and meandering. Most reaches on the downstream portion of the Yellow River are controlled by the banks on both sides and there is no inflow from tributaries. On the average, this section of the Yellow River deposits 0.05-0.1 m (5-10 cm) of mud and sand every year. Changes in erosion and deposition are very radical.

Usually a flood drains through the main river channel. The area of the flood plain is considerably large, having a resident population of more than 1.3 million. When a great flood overflows the bank, it drains through both the river channel and the flood plain. After 1958, a great number of dikes were built. These dikes measure about two meters high and at bank crest are 4-6 meters wide. Like second banks, their flood control capacity can reach more than 10,000 m³/s. Therefore, the natural baneful flood is restrained.

² "Hanging river" refers to the river channel being higher than the surrounding land.

However, the great deal of mud and sand deposited in the river channel raises the height of the river above the flood plain year by year. Analysis of available data indicates that great differences exist in the height of the river channel from place to place. This will cause a baneful flood to produce differing damages on different river reaches.



Figure 1. Map of China