CHINA WATER RESOURCES BULLETIN 2004

Ministry of Water Resources
People's Republic of China

China WaterPower Press

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The class I water resources regions in China

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Note: 1. The data of the whole country involved in the Bulletin do not include those of Hong Kong and Macao special administrative regions and Taiwan Province.

2. Hydrological normal mentioned in the Bulletin is referred to the average over synchronous hydrological data series from 1956 to 2000 adopted for the country.

1. General

In 2004, the average precipitation in China was 600.6 mm, equivalent to a quantity of 5,687.64 billion m^3, or 6.5% less than normal. The quantity of surface water resources was 2,312.64 billion m^3, 13.4% less than normal; the quantity of groundwater resources was 743.63 billion m^3, 7.8% less than normal; and the quantity of groundwater resources non-overlapping with surface water was 100.32 billion m^3, and the total quantity of water resources was 2,412.96 billion m^3, 12.9% less than normal.

In 2004, 17.9 billion m^3 of water flowed from abroad into China; 609.4 billion m^3 of water flowed from China into abroad and 97.0 billion m^3 of water flowed from China into international border rivers; and the total quantity of water flowing from China into the sea was 1,292.1 billion m^3, or 333.0 billion m^3 less than that in 2003.

In 2004, the total water storage of 462 large-sized reservoirs and 2,771 medium-sized reservoirs increased by 2.52 billion m^3; and the storage of shallow groundwater in the extraction areas of the northern plains decreased by 6.8 billion m^3.

In 2004, the total water supply and total water use in China were both 554.78 billion m^3. Of the total water supply, surface water occupied 81.2%, groundwater 18.5%, and other water resources 0.3%. Of the total water use, domestic use occupied 11.7%, industrial use 22.2%, agricultural use 64.6%, and ecological use (only containing artificial supply for urban environment and part of supplement to wetlands and lakes) 1.5%. The national water consumption in 2004 was 300.07 billion m^3 with a consumption rate (proportion of consumption to use) of 54%. The annual wastewater discharge in the whole country was 69.3 billion tons, of which industrial wastewater occupied two-thirds and domestic sewage one-third.

In 2004, the per capita water use in China was 427 m^3, the water use per 10,000 yuan of GDP (at current price) 399 m^3, the water use per *mu* of irrigated farmland 450 m^3, the water use per 10,000 yuan of added industrial output value 196 m^3, the per capita domestic water use in urban areas 212 L/d (including public water use) and that in rural areas 68 L/d.

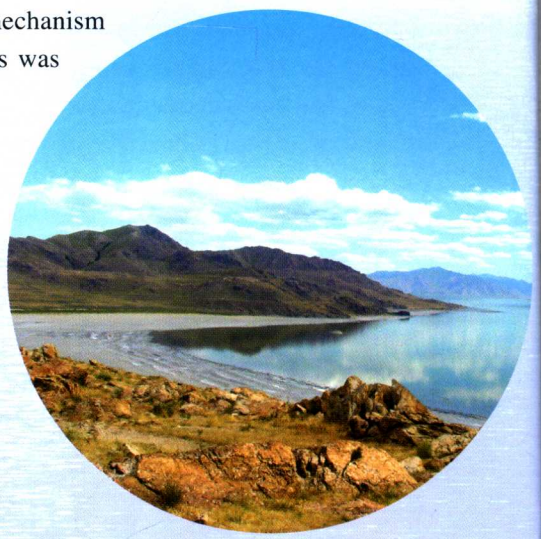
In 2004, evaluation of water quality was made for 133,600 km of river reaches. Of the total evaluated river reaches, 59.4% was of the third class and better, or 3 percentage points less than that of the last year. Water quality at 229 monitoring sites on provincial-border water bodies was evaluated, of which 39.3% was of the third class and better, and 34.5% had severe water pollution with a quality poorer than the fifth class. Evaluation of water quality was also made for 50 lakes and 322 reservoirs, of which 18 lakes and 265 reservoirs had a water quality of the third class and better. Trophic state of 49 lakes and 238 reservoirs was evaluated, of which about two-thirds of lakes and one-third of reservoirs were in a eutrophic state.

In 2004, large rivers in China experienced a relatively stable flow regime except local reaches of the Yangtze and Huaihe rivers and the Xijiang River in the Pearl River Basin, which experienced floods exceeding the warning stage, and big floods occurred to some medium and small rivers. In 2004, droughts were not serious in the country and the area of farmland affected by drought was 110 million *mu* less than that in 2003, but serious droughts occurred to some areas in South China. The Central Communist Party Committee and the State Council both paid great attention to flood control and drought fighting and the governments and flood control and drought relief headquarters at all levels cooperated closely. Flood management was strengthened and the scope of drought fighting was expanded, thus the disasters were put under control with losses reduced and a bumper grain harvest guaranteed.

In 2004, water resources administrations at all levels eagerly followed the scientific concept of development and promoted sustainable water resources management according to the policies of the central government, achieving new progress in all the aspects of water resources planning, hydraulic works construction, allocation and protection of water resources, water conservation, and reform of water sector, hence contributing greatly to the undertakings of water resources management in the new era and the comprehensive construction of a "well-to-do" society. Significant achievements were made in rural water resources management, rural water saving,

soil and water conservation and rural hydropower, and the tasks of rural drinking water supply set out in the Tenth Five-year Plan were fulfilled one year ahead of schedule, helping more than 57 million people get rid of drinking water difficulties. Construction of key water resources projects was accelerated, and the focus of investment in construction was shifted to key projects such as Huaihe River Harnessing and South-to-North Water Transfer and to rural areas, western areas and the northeastern old industrial bases. The pilot projects of water saving society were expanded, and the pilot projects for initial allocation of water rights and water right transfer progressed smoothly. Rational operation of water resources was further strengthened in order to improve the ecology and environment, maintain rivers' health and guarantee the safety of water supply. The reform of water sector was continued, encouraging achievements were made in the institutional reform of water affairs management, and new measures were adopted in the reform of water pricing system. Further efforts were made to promote the management of water function zones and the management of groundwater overdraft areas,

and protection of water resources was further strengthened. Plentiful achievements were made in water resources planning and important interim results were achieved in the national comprehensive water resources planning. The reform of investment mechanism and investment management systems was intensified, and new progress was made in promoting water resources management by law.



Geographical Areas of East China, Central China and West China

East China: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan

Central China: Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan

West China: Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang

2. Quantity of Water Resources

2.1 Precipitation

In 2004, precipitation in most areas of China was less than normal. The isohyetal map of precipitation in 2004 (Figure 1) shows that the Yangtze River Basin and areas south of the river basin, southeastern Northeast China, part of areas between the lower Yellow River and the Huaihe River and southern Tibet had an annual precipitation of above 800 mm, of which some areas had an annual precipitation of over 1,600 mm; most of Northeast China, North China, most of Shaanxi and southern Gansu had an annual precipitation of 400~800 mm; central-eastern Inner Mongolia, northern Ningxia, central Qinghai and central Tibet had an annual precipitation of 200~400 mm; and western Inner Mongolia, northwestern Gansu, northwestern Qinghai, northern Tibet and most of Xinjiang had an annual precipitation of below 200 mm. Compared with normal (Figure 2), eastern North China, lower reaches of the Yellow River and nearby areas, central Inner Mongolia, eastern and central-western Southwest China and most of Xinjiang had more than normal precipitation, in which the lower reaches of the Yellow River, western Yunnan and northwestern Xinjiang had an annual precipitation 30% over normal; precipitation was less than normal in most of the rest areas, in which eastern Inner Mongolia, the lower reaches of the Huaihe River, coastal areas of Guangdong, eastern Hainan, western Gansu and northwestern Qinghai had an annual precipitation over 30% less than normal.

In 2004, the average annual precipitation in China was 600.6 mm, equivalent to 5,687.64 billion m^3 in volume, which was 6.0% less than that of the last year and 6.5% less than normal. The six Class I water resources regions (Class I WRRs), Songhua, Liaohe, Haihe, Yellow, Huaihe and Northwest Rivers (i.e., the Northern Six Regions), had an areal annual precipitation 6.3% less than normal; and the four Class I WRRs, Yangtze including the Taihu Lake, Southeast Rivers, Pearl and Southwest Rivers (the Southern Four Regions), had an areal annual precipitation 6.6% less than normal. Among the ten Class I WRRs, only the Haihe, Southwest Rivers and Northwest Rivers regions had an annual precipitation more than normal, but all within 2.5% above normal, and all the rest seven regions had an annual precipitation less than normal to a varying degree, in which the Songhua, Pearl and Southeast Rivers regions had the least ones, 18.3%, 17.8% and 14.9% less than normal, respectively. See Table 1 and Figure 3 for precipitation in the Class I WRRs and comparison with the last year and the normal annual precipitation.

Of the 31 provincial administrative regions (PARs), eight had an annual precipitation more than normal, containing Shandong, Xinjiang, Tianjin, Tibet, Henan, Hunan, Chongqing and Qinghai, in which Shandong had an annual precipitation 13.3% above normal. Of the 23 PARs with an annual precipitation less than normal, Guangdong, Hainan, Jiangsu and Inner Mongolia had an annual precipitation above 20% less than normal, Fujian, Ningxia, Anhui, Gansu, Heilongjiang, Zhejiang, Jiangxi and Guangxi had an annual precipitation 10%-20% less than normal. See Table 2 and Figure 4 for precipitation in the PARs and comparison with the last year and the normal annual precipitation.

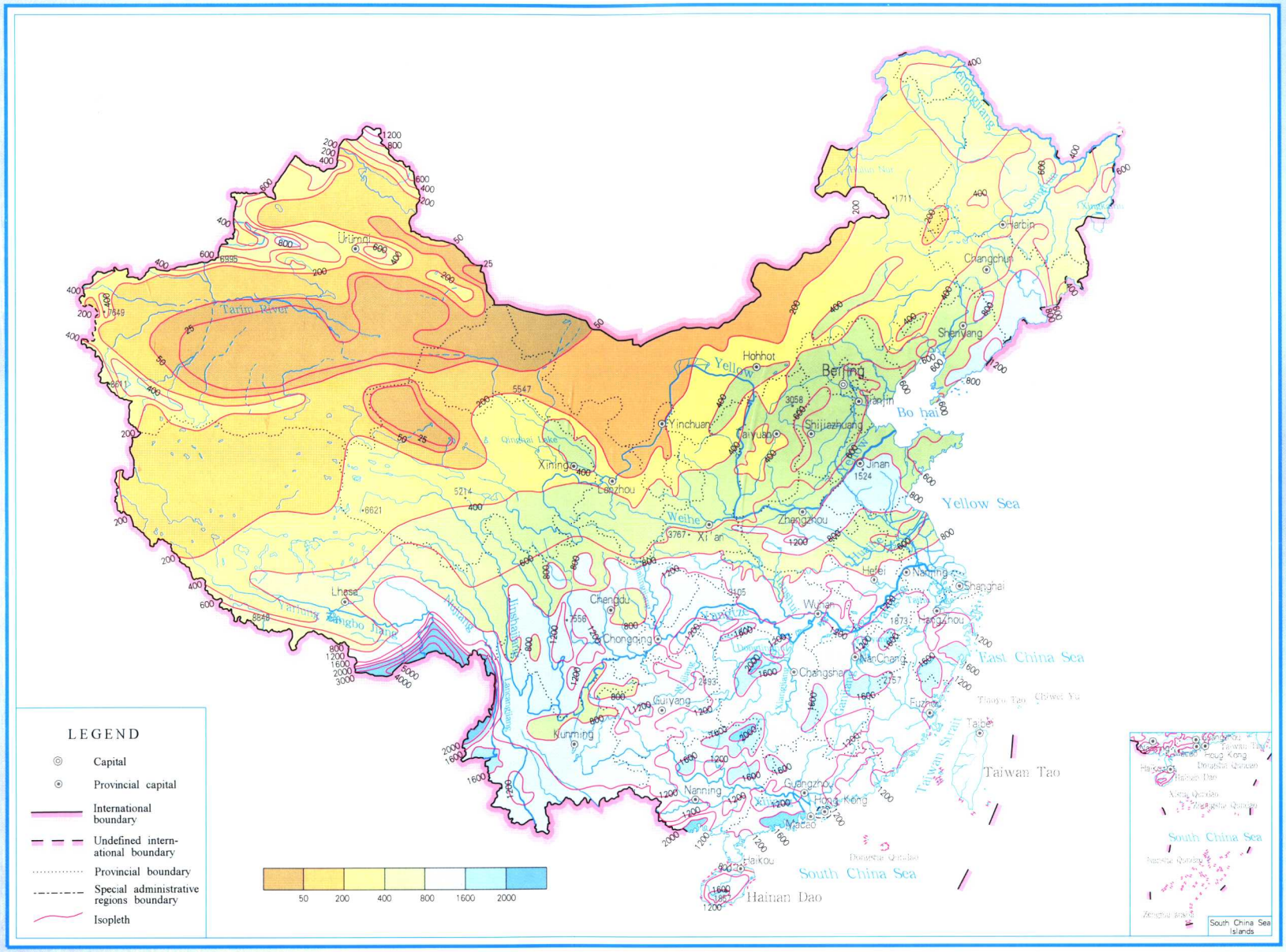


Figure 1 Isohyetal map of annual precipitation in China, 2004 (Unit: mm)

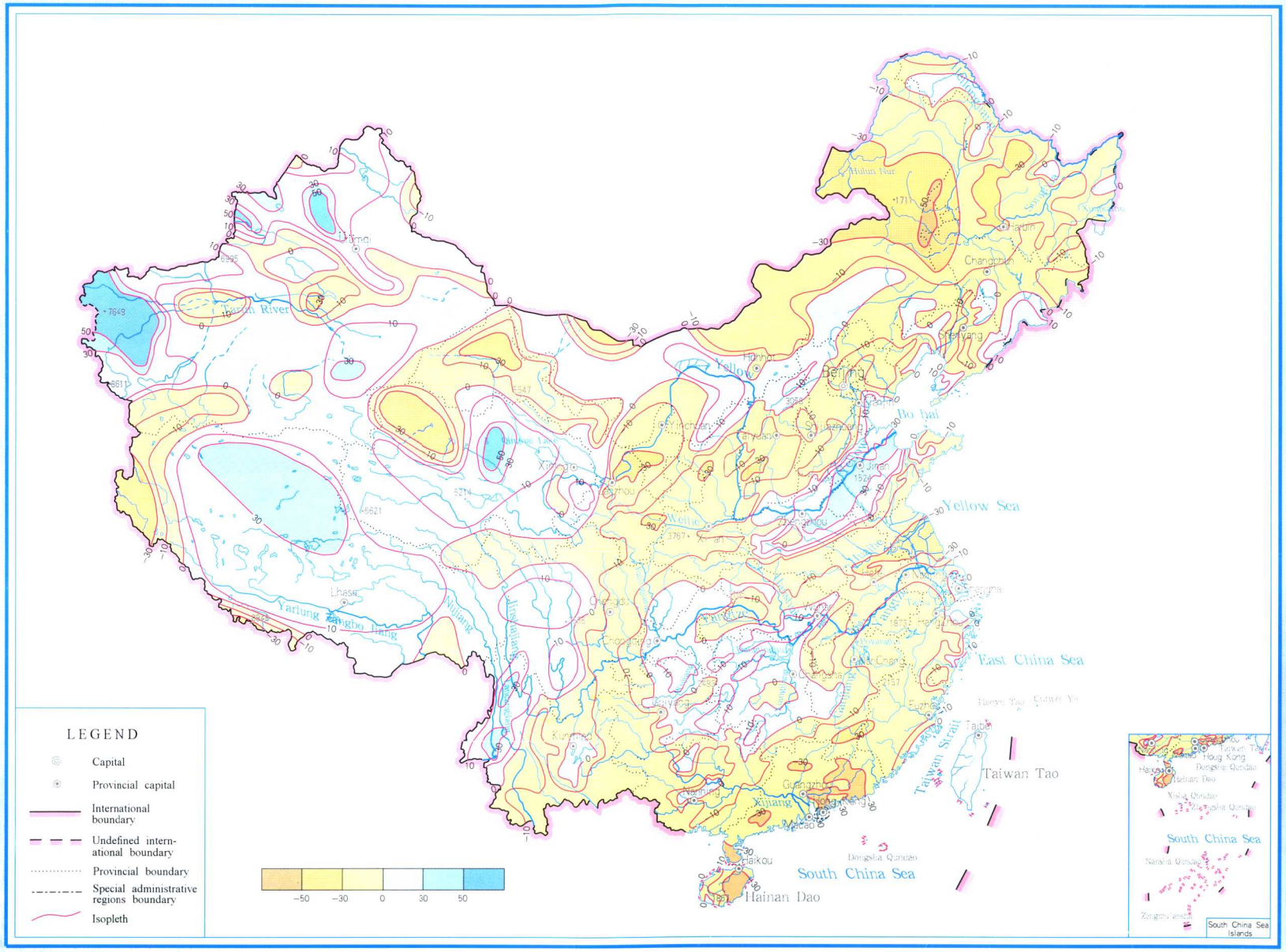
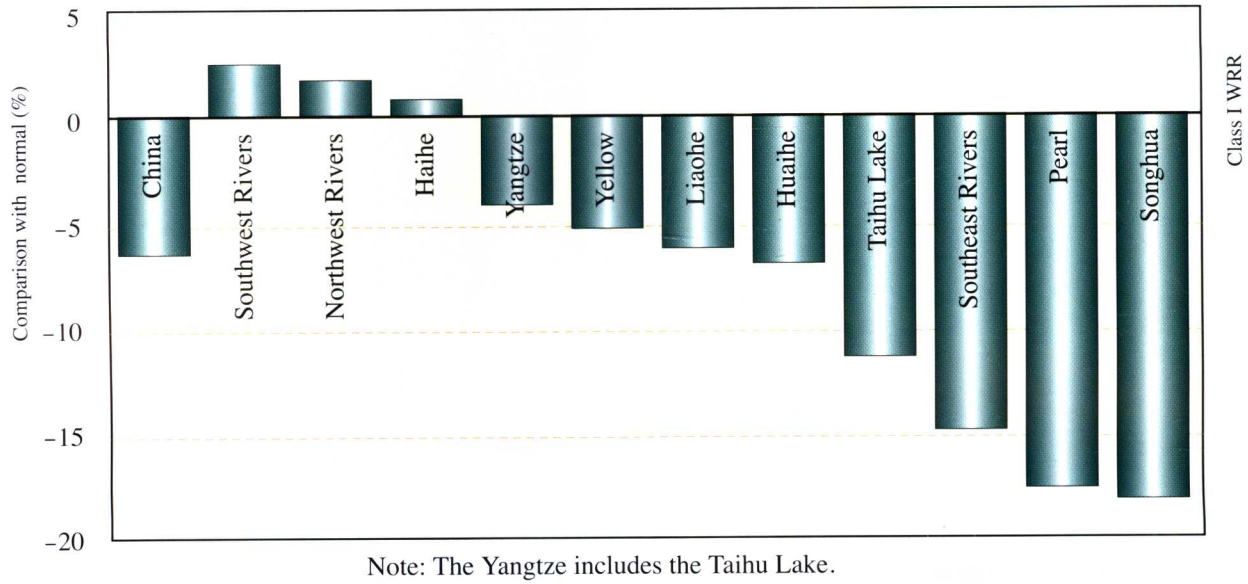


Figure 2 Anomaly map of annual precipitation in China, 2004 (Unit: %)

Table 1 Precipitation in 2004 and comparison with the last year and the normal annual precipitation by Class I WRR

Class I WRR	Precipitation in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)	Class I WRR	Precipitation in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)
China	600.6	-6.0	-6.5	Yangtze	1,040.3	-0.2	-4.3
Songhua	412.3	-19.4	-18.3	in which Taihu Lake	1,044.9	8.1	-11.4
Liaohe	510.1	1.0	-6.4	Southeast Rivers	1,414.4	18.5	-14.9
Haihe	538.2	-7.5	0.6	Pearl	1,273.6	-3.0	-17.8
Yellow	421.8	-24.1	-5.4	Southwest Rivers	1,114.2	5.3	2.4
Huaihe	780.0	-35.6	-7.0	Northwest Rivers	164.0	-11.9	1.7



Note: The Yangtze includes the Taihu Lake.

Figure 3 Comparison between precipitation in 2004 and the normal annual precipitation by Class I WRR

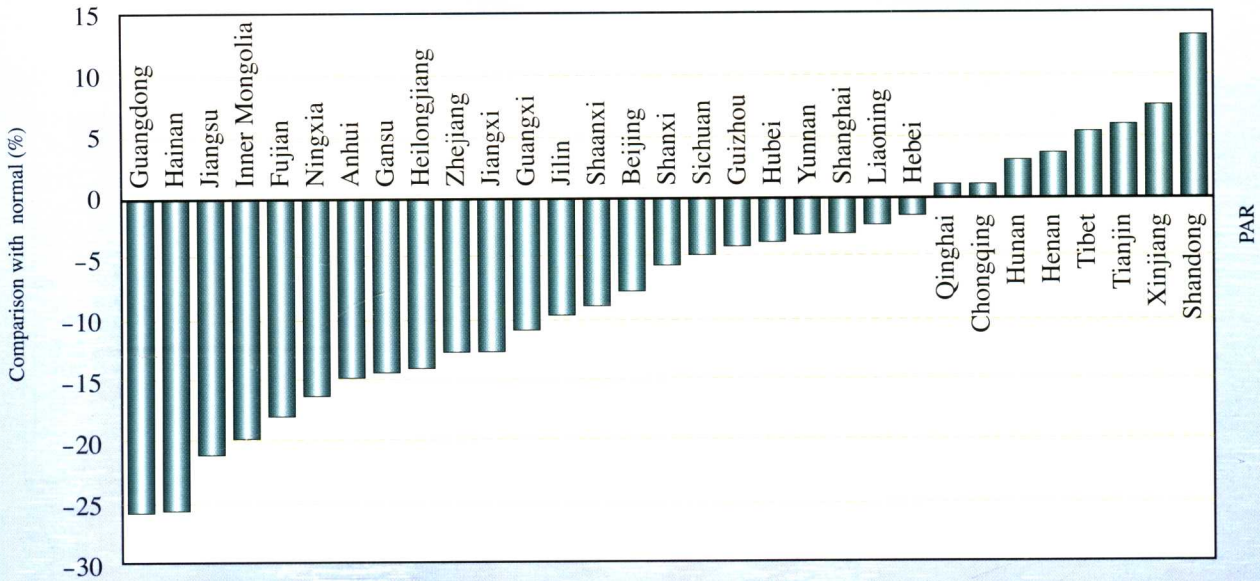


Figure 4 Comparison between precipitation in 2004 and the normal annual precipitation by PAR

Table 2 Precipitation in 2004 and comparison with the last year and the normal annual precipitation by PAR

PAR	Precipitation in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)	PAR	Precipitation in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)
China	600.6	-6.0	-6.5	Henan	797.8	-26.2	3.4
Beijing	539.0	19.0	-7.8	Hubei	1,134.8	-7.9	-3.8
Tianjin	608.7	3.9	5.9	Hunan	1,493.6	14.9	3.0
Hebei	523.2	-6.4	-1.6	Guangdong	1,314.7	-7.6	-25.7
Shanxi	479.6	-27.5	-5.7	Guangxi	1,366.9	1.5	-11.1
Inner Mongolia	225.8	-22.4	-20.0	Hainan	1,301.3	-23.8	-25.6
Liaoning	662.1	5.2	-2.4	Chongqing	1,196.6	-2.7	1.0
Jilin	548.5	-3.1	-9.9	Sichuan	933.0	-6.1	-4.7
Heilongjiang	458.3	-17.7	-14.1	Guizhou	1,129.7	9.0	-4.2
Shanghai	1,057.6	36.3	-2.9	Yunnan	1,239.0	20.8	-3.1
Jiangsu	784.3	-37.5	-21.1	Tibet	601.8	-3.4	5.2
Zhejiang	1,397.9	16.4	-12.8	Shaanxi	596.3	-28.9	-9.1
Anhui	998.0	-31.7	-14.9	Gansu	257.1	-26.7	-14.6
Fujian	1,374.7	19.3	-18.0	Qinghai	293.2	-2.4	0.9
Jiangxi	1,430.3	9.3	-12.7	Ningxia	241.3	-28.1	-16.4
Shandong	769.7	-17.8	13.3	Xinjiang	166.4	-10.7	7.5

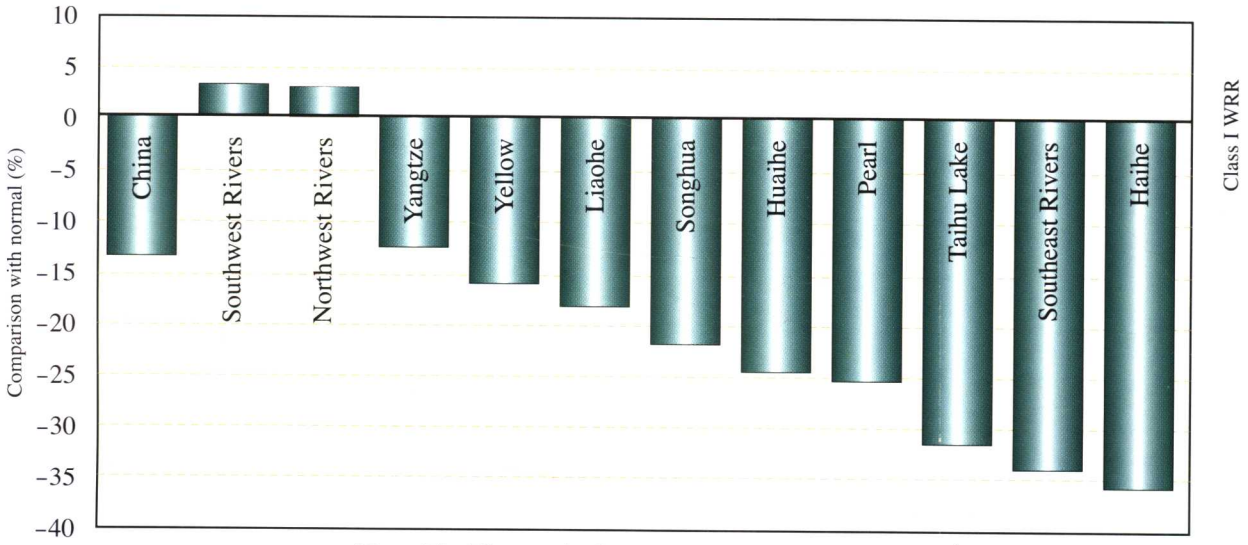
2.2 Surface Water Resources

Quantity of surface water resources refers to the dynamic quantity of surface water bodies, such as rivers, lakes and glaciers, that is, quantity of natural runoff. The quantity of surface water resources in China in 2004 was 2,312.64 billion m^3, equivalent to 244.2 mm in depth, which was 11.8% less than that of the last year and 13.4% less than normal. The quantity of surface water resources in the Northern Six Regions in 2004 was 15.2% less than normal, and that in the Southern Four Regions 13.0% less than normal. Among the ten Class I WRRs, the Southwest Rivers and Northwest Rivers regions had an annual quantity of surface water resources less than 4% over normal, the rest had an annual quantity less than normal to a varying degree, in which the Haihe and Southeast Rivers regions had an annual quantity over 30% less than normal, and the Pearl, Huaihe and Songhua regions had an annual quantity over 20% less than normal. See Table 3 and Figure 5 for annual natural runoff depth in 2004 and comparison with the last year and the normal annual depth by Class I WRR.

Of the 31 PARs, only the four regions of Shandong, Tibet, Xinjiang and Shanghai had a more than normal annual runoff, in which Shandong had an annual runoff 18.3% over normal and the rest three all had an annual runoff less than 7% over normal. Among the 27 PARs with an annual runoff less than normal, Beijing, Jiangsu, Hebei and Hainan had an annual runoff over 40% less than normal, and Fujian, Gansu, Guangdong, Jiangxi and Shanxi had an annual runoff 30%-40% less than normal. See Table 4 and Figure 6 for natural runoff depth in 2004 and comparison with the last year and the normal annual runoff by PAR.

Table 3 Natural runoff in 2004 and comparison with the last year and the normal annual natural runoff by Class I WRR

Class I WRR	Runoff in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)	Class I WRR	Runoff in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)
China	244.2	-11.8	-13.4	Yangtze	484.2	-13.9	-12.4
Songhua	107.8	-17.1	-22.2	in which Taihu Lake	295.0	14.7	-31.7
Liaohe	106.9	32.9	-17.7	Southeast Rivers	630.7	0.7	-33.9
Haihe	43.1	5.4	-36.1	Pearl	605.9	-13.9	-25.6
Yellow	65.2	-24.4	-16.0	Southwest Rivers	707.2	3.4	3.4
Huaihe	155.0	-66.4	-24.4	Northwest Rivers	35.6	-4.6	3.1



Note: The Yangtze includes the Taihu Lake.

Figure 5 Comparison between the natural runoff in 2004 and the normal annual natural runoff by Class I WRR

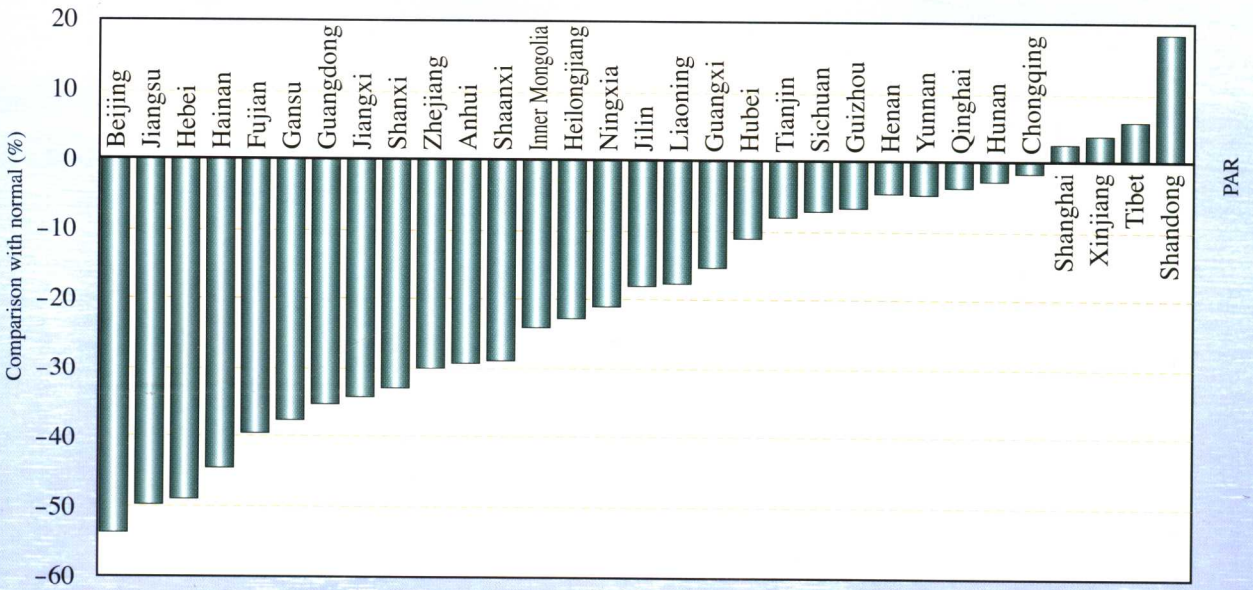


Figure 6 Comparison between the natural runoff in 2004 and the normal annual natural runoff by PAR

In 2004, the total quantity of water flowing from abroad into China was 17.9 billion m^3, of which 200 million m^3 flowed into the Songhua; 5.2 billion m^3 into the Pearl; 2.6 billion m^3 into the Southwest Rivers; and 9.9 billion m^3 into the Northwest Rivers. The total quantity of water flowing from China into abroad and international border rivers was 706.4 billion m^3, including 97.0 billion m^3 of water flowing into the international border rivers, of which 79.4 billion m^3 was from the Songhua; 17.3 billion m^3 from the Liaohe; 1.0 billion m^3 from the Pearl; 585.5 billion m^3 from the Southwest Rivers; and 23.2 billion m^3 the from Northwest Rivers. The national quantity of water flowing into the sea was 1,292.1 billion m^3, or 21% less than that of the last year, of which 8.9 billion m^3 was from the Liaohe; 3.7 billion m^3 from the Haihe; 19.9 billion m^3 from the Yellow; 32.5 billion m^3 from the Huaihe; 797.4 billion m^3 from the Yangtze; 116.4 billion m^3 from the Southeast Rivers; and 313.3 billion m^3 from the Pearl.

Table 4 Natural runoff in 2004 and comparison with the last year and the normal annual natural runoff by PAR

PAR	Runoff in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)	PAR	Runoff in 2004 (mm)	Comparison with the last year (%)	Comparison with normal (%)
China	244.2	-11.8	-13.4	Henan	175.0	-46.4	-4.7
Beijing	48.6	34.7	-54.0	Hubei	481.2	-25.8	-11.1
Tianjin	82.1	59.2	-8.1	Hunan	771.5	-8.7	-2.9
Hebei	32.7	31.8	-49.0	Guangdong	663.2	-18.7	-35.3
Shanxi	37.2	-34.8	-33.0	Guangxi	678.0	-15.2	-15.2
Inner Mongolia	26.8	-12.8	-23.7	Hainan	495.1	-41.4	-44.4
Liaoning	170.9	38.6	-17.8	Chongqing	678.1	-5.4	-1.6
Jilin	148.6	4.0	-19.1	Sichuan	502.3	-8.2	-7.0
Heilongjiang	116.7	-23.6	-22.7	Guizhou	562.5	8.2	-6.7
Shanghai	394.0	65.2	2.6	Yunnan	549.6	23.9	-4.7
Jiangsu	129.9	-73.5	-50.0	Tibet	388.0	-1.9	6.2
Zhejiang	638.0	17.4	-29.8	Shaanxi	139.2	-46.8	-28.9
Anhui	331.2	-55.5	-29.1	Gansu	40.8	-31.6	-37.6
Fujian	574.1	-11.7	-39.7	Qinghai	82.4	-4.5	-3.7
Jiangxi	608.9	-24.5	-34.2	Ningxia	14.5	-25.1	-21.0
Shandong	149.7	-32.9	18.3	Xinjiang	49.2	-6.6	3.9

2.3 Groundwater Resources

Quantity of groundwater resources refers to the dynamic quantity of water percolating into aquifers from precipitation and surface water bodies in rivers, lakes, reservoirs and canals and canal-irrigation water on farm field. The quantity of groundwater resources in mountainous and hilly areas is calculated in terms of groundwater discharges, containing river base flow, piedmont lateral seepage discharge, evaporation from water table and net consumption via groundwater extraction, and the quantity of groundwater resources in plain areas is calculated in terms of groundwater recharges, containing recharge by direct precipitation infiltration, recharge by surface water infiltration, and recharge by piedmont lateral seepage. The overlap between calculated quantities of groundwater resources in mountainous and hilly areas and in plain areas is deducted in determining

the quantity of groundwater resources in a water resources region or an administrative division.

In 2004, the national calculation area of groundwater resources with a mineralization degree ⩽2g/L was 8.55 million km² and the annual quantity of groundwater resources was 743.63 billion m³, or 7.8% less than normal. In the total quantity of groundwater resources, plain areas occupied 164.16 billion m³, and had a total groundwater recharge of 170.40 billion m³ with recharge by well irrigation added. The total groundwater recharge in the plain areas of the Northern Six Regions accounted for 81% of the national total. See Table 5 for the quantities of groundwater resources in the Class I WRRs in 2004 and Table 6 for the quantities of groundwater resources in the PARs.

In the plain areas of northern China, groundwater resources are an important source of water supply and the degree of groundwater exploitation is generally high. In 2004, the total groundwater recharge in the plain areas of the Northern Six Regions was 137.87 billion m³, of which recharge by direct precipitation infiltration accounted for 51.2%, recharge by surface water infiltration 36.3%, recharge by piedmont lateral seepage 8.0%, and recharge by well irrigation 4.5%. Recharge by direct precipitation infiltration was the major source of

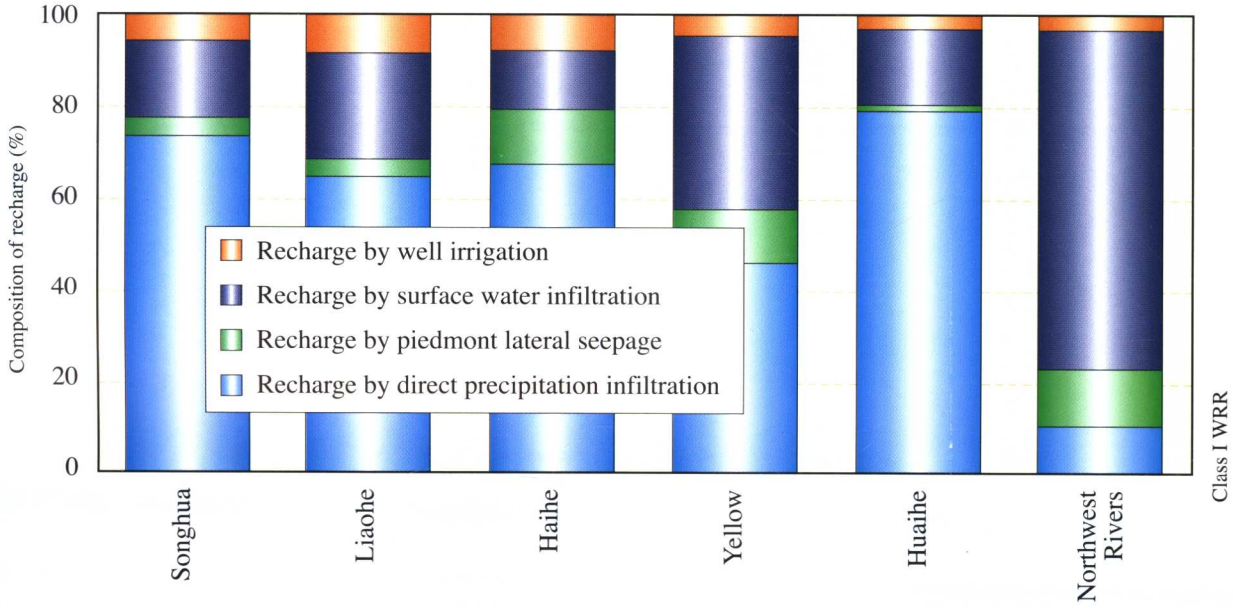


Figure 7 Composition of plain groundwater recharge in the northern Class I WRRs

groundwater resources in the Yellow-Huaihe-Haihe plain and the Songhua-Liaohe plain, accounting for 70% of total recharge, and recharge by surface water infiltration was the major source of groundwater in the plain of the Northwest Rivers, accounting for 73% of total recharge, see Figure 7 for details. The total groundwater recharges in the plain areas of the Northern Six Regions in 2004 were as follows: the Songhua, 22.37 billion m³; the Liaohe, 11.37 billion m³; the Haihe, 16.95 billion m³; the Yellow, 16.19 billion m³; the Huaihe, 28.50 billion m³; and the Northwest Rivers, 42.49 billion m³.

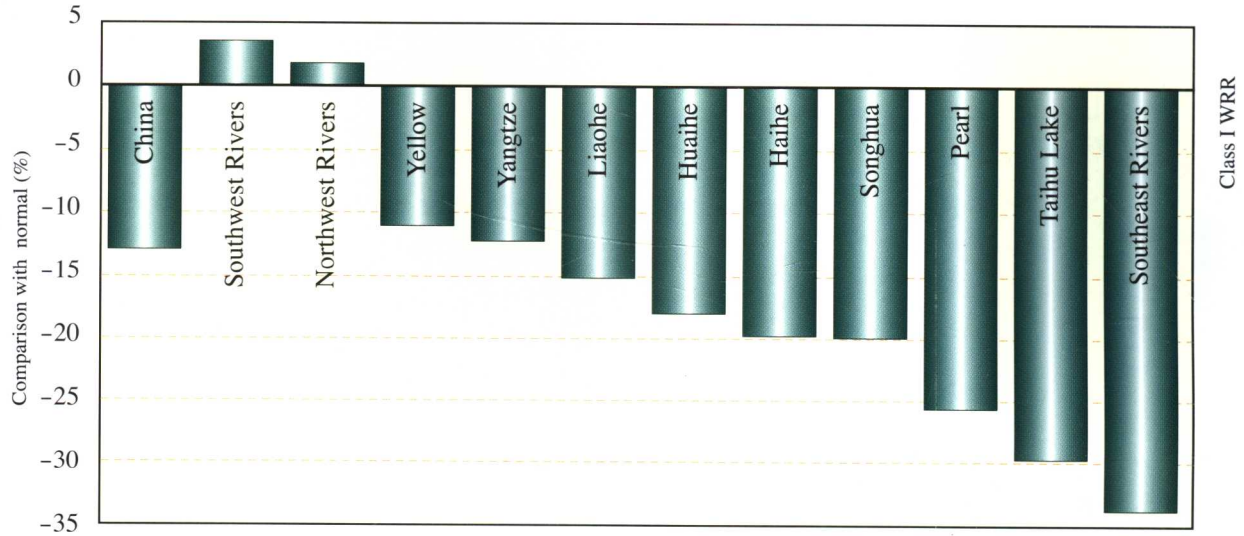
2.4 Total Quantity of Water Resources

Total quantity of water resources refers to the total quantity of surface water and groundwater yields formed by local precipitation in an evaluation region, excluding water from outside the regions, and is calculated by summing up the quantities of groundwater and surface water resources minus the overlap between them.

The total quantity of water resources in China in 2004 was 2,412.96 billion m³, 12.9% less than normal. The quantity of groundwater resources non-overlapping with surface water was 100.32 billion m³, accounting for 13.5% of groundwater resources, which means that 86.5% of groundwater resources overlaps with surface water. The total water yield was 42.4% of the total precipitation, and the water yield per square kilometer was 255,000 m³.

See Table 5 for total quantities of water resources in the Class I WRRs and Figure 8 for comparison with normal. The total quantity of water resources in the Northern Six Regions in 2004 was 458.90 billion m^3, which was 12.7% less than normal and 19.0% of the 2004 national total; and the total quantity of water resources in the Southern Four Regions was 1,954.06 billion m^3, which was 13.0% less than normal and 81.0% of the 2004 national total. See Table 6 for total quantities of water resources in the PARs and Figure 9 for comparison with normal.

The variational process of quantity of water resources for the China, northern China and southern China during 1997-2004 (Figure 10) reveals that, in China, except 1998 when the quantity of water resources was significantly more than normal and 2004 when the quantity of water resources was significantly less than normal, all the other years experienced a quantity of water resources close to normal. In the Southern Four Regions, the quantity of water resources was more than normal in 2003 and 2004 and less than normal in all the other years. In the Northern Six Regions, except that 1998 and 2003 saw a quantity of water resources more than normal, all the other years experienced a quantity of water resources less than normal. The quantities of precipitation and water resources in 2004 were the least in the past eight years, which, together with the occurrence of consecutive dry years in northern China, has resulted in a grim situation of water resources.



Note: The Yangtze includes the Taihu Lake.

Figure 8 Comparison between the total quantity of water resources in 2004 and the normal annual total quantity by Class I WRR

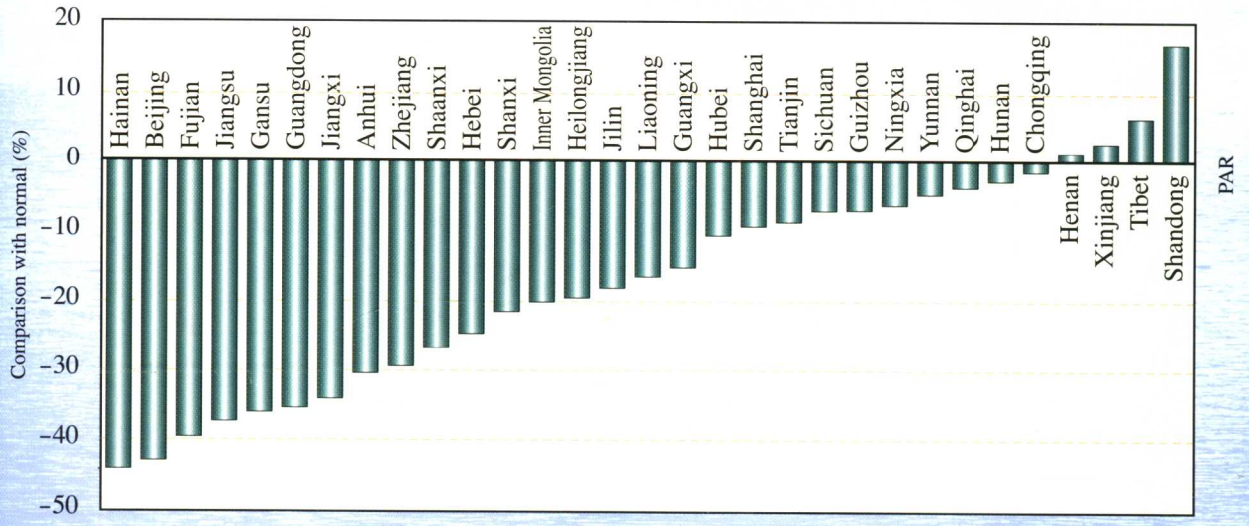


Figure 9 Comparison between the total quantity of water resources in 2004 and the normal annual total quantity by PAR