Bei-jiang

Map of River

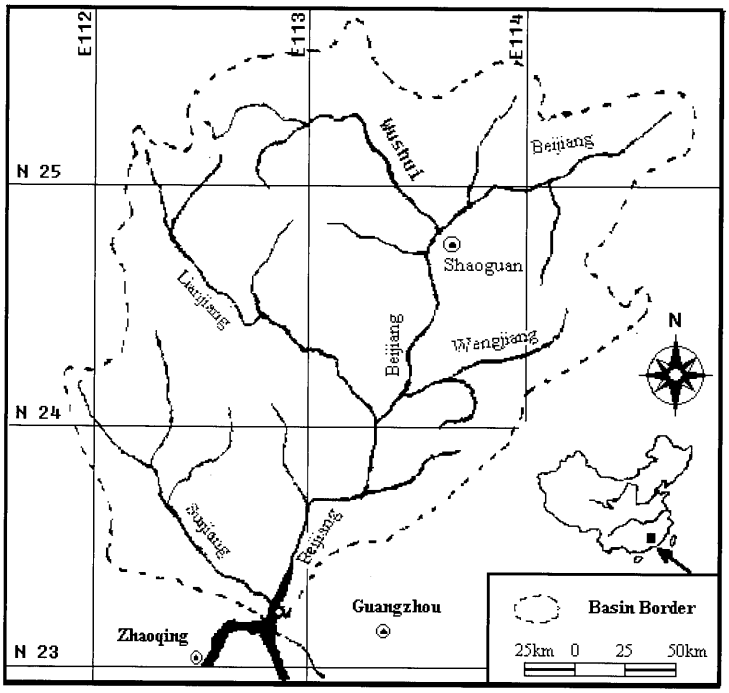


Table of Basic Data

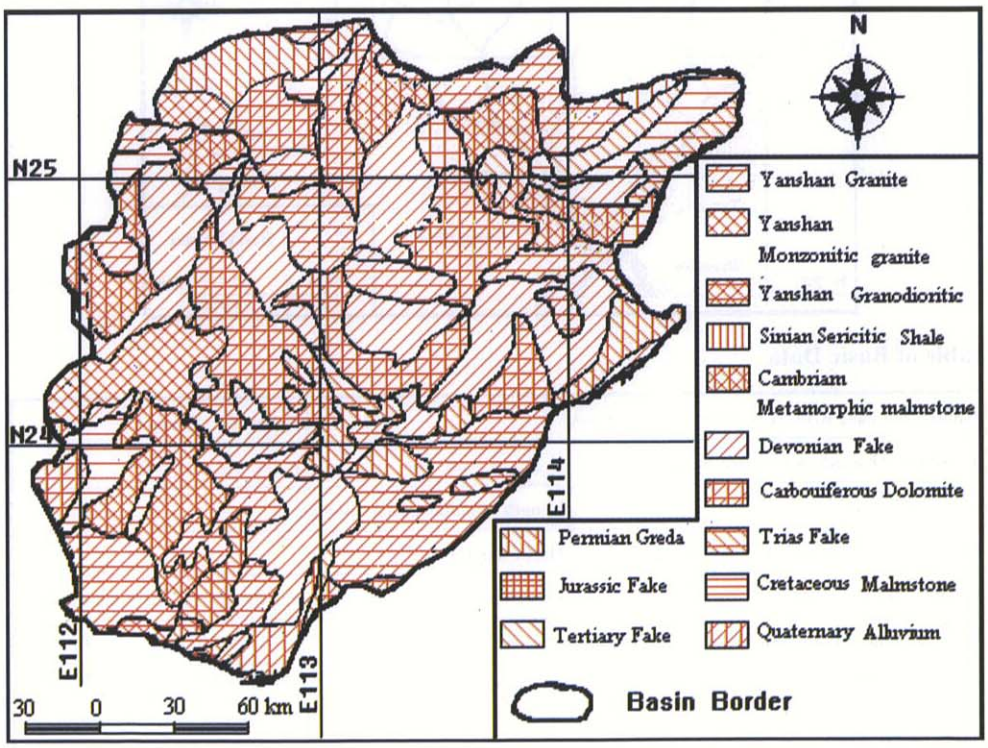
Name: Bei-jiang River (Left branch of Pearl River)		**Serial No.:** China-1
Location: Guangdong Province, Southern China	N 23° 10′ ~ 25° 40′	E 111° 50′ ~ 114° 57′
Area: 46 710 km^2	**Length of main stream:** 468 km	
Origin: Mt. Dayuling (1 073 m)	**Highest point:** 1 073 m	
Outlet: Sanshui county	**Lowest point:** 5 m (confluence with the Pearl River at Sanshui)	
Main geological features: Metamorphic rock, Igneous rock		
Main tributaries: Wushui River (7 097 km^2), Weng-jiang River (4 847 km^2), Lian-jiang River (10 060 km^2), Sui-jiang (7 184 km^2)		
Main lakes: None		
Main reservoirs: Nanshui (1 249 x 10^6 m^3), Changhu (149 x 10^6 m^3), Tanling (177 x 10^6 m^3)		
Mean annual precipitation: 1 707 mm (1947~1979) (basin average)		
Mean annual runoff: 1 324 m^3/s at Shijiao (38 363 km^2) (1952~1985)		
Population: 7 140 000 (1980)	**Main cities:** Shaoguan, Yingde, Qingyuan, Sanshui	
Land use: Forest (76.0%), Rice paddy (7.0%), Other agriculture (6.0%), Urban (6.0%) (1980)		

1. General Description

The Bei-jiang River which flows through the Guangdong Province of China is 468 km long and drains an area of 46 710 km^2. It originates from Mt. Dayuling and joins the Pearl River delta in Sanshui county. The basin has an average annual rainfall of 1 707 mm, and the annual discharge at Shijiao (38 363 km^2) in 1954 was 1324 m^3/s. Three dams have been built across the river; the Tanling built in 1966 to store 142 x 10^6 m^3, the Nanshui built in 1971 to store 1 249 x 10^6 m^3, and the Changhu built in 1973 to store 149 x 10^6 m^3. The river above Shaoguan is considered the upper reach with large irrigated areas. The middle reach runs through mountainous and limestone areas between Shaoguan and Qingyuan. Guangzhou city is protected from floods by river dikes below Qingyuan. The basin population in 1980 was 7 400 000.

2. Geographical Information

2.1 Geological Map

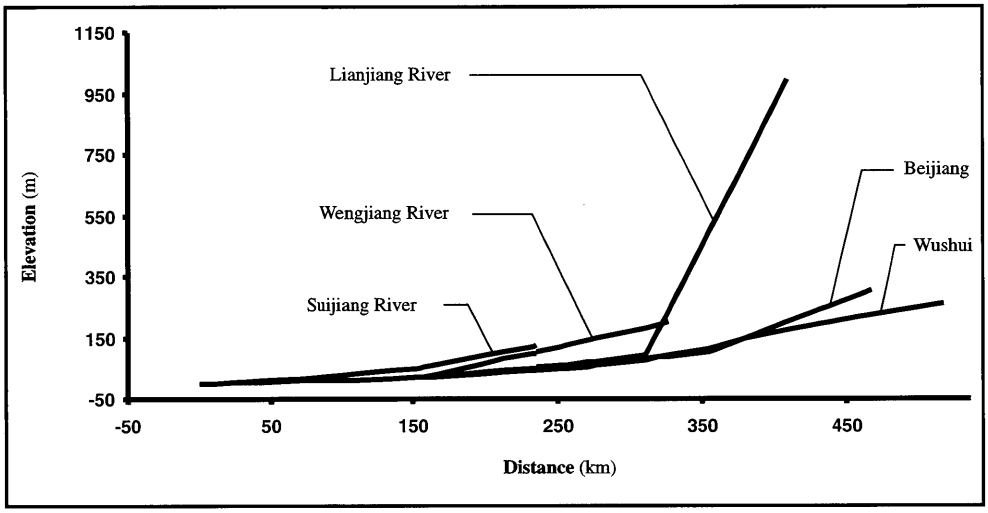


2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities Population (1980)	Land use [%] (1980)
1	**Bei-jiang** (Main River)	468 46 710	Mt. Dayuling, 1 703 Confluence at Sanshui 5	Shaoguan, Yingde, etc. 1 430 000	A (6) F (76)
2	**Wushui** (Tributary)	260 7 097	Mt. Xianhualing, 1 593 ----------	Lexian county, etc. 220 000	L (5) P (7)
3	**Weng-jiang** (Tributary)	173 4 847	Mt. Huangbanshi, 1 430 ----------	Wengyuan county, etc. 150 000	U (6)
4	**Lian-jiang** (Tributary)	275 10 060	Mt. Shikengkong, 1 902 ----------	Yangshan county, etc. 310 000	
5	**Sui-jiang** (Tributary)	226 7 184	Mt. Futang, 1 592 ----------	Huaiji county, etc. 220 000	

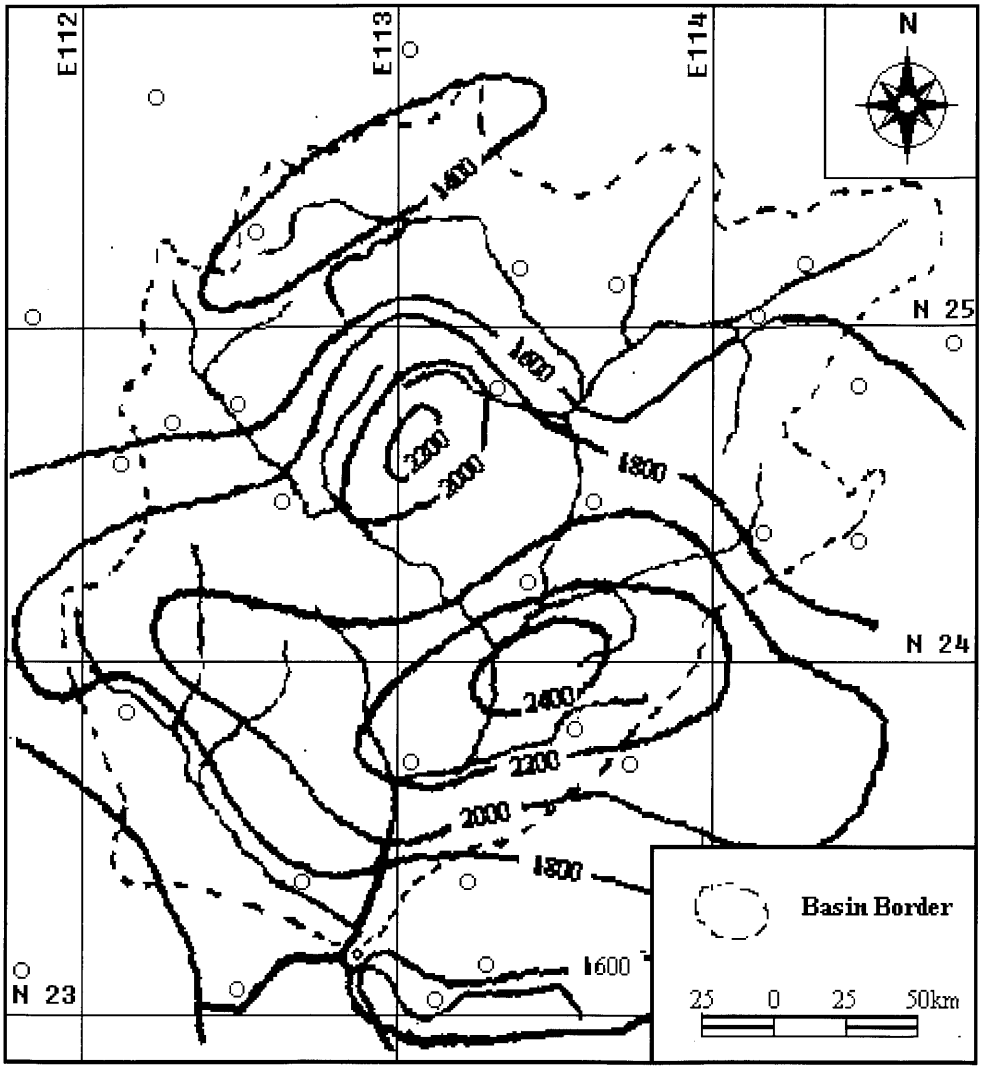
A: Other agricultural field F: Forest L: Lake, River, Marsh P: Paddy field U: Urban

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

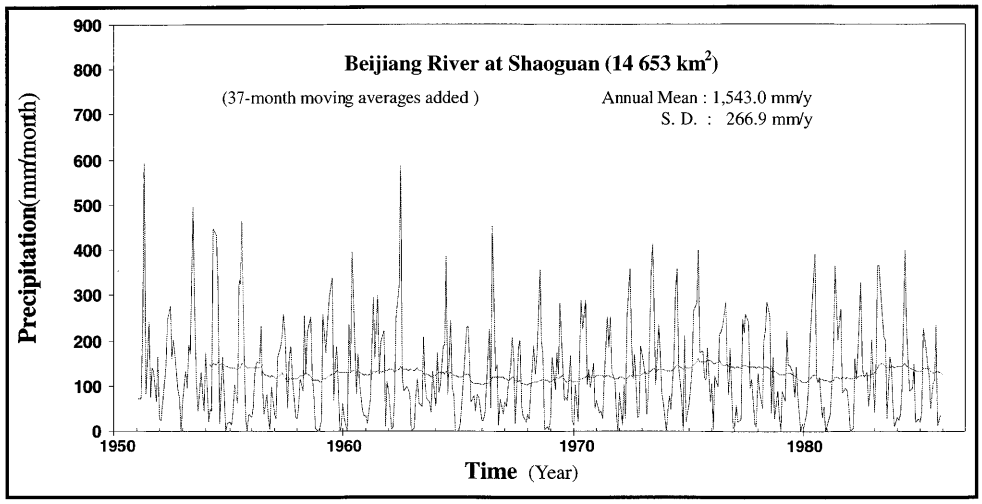
No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [1] [mm]	Mean annual evaporation [1] [mm]	Observation items [2]
	Zhenwan	70	N 24° 53′ E 113° 42′	1953~present	1 470	1 377.8	P(TB),E
	Lishi	64	N 24° 53′ E 113° 32′	1955~present	1 486	-----	P(TB)
	Shaoguan	62	N 24° 48′ E 113° 35′	1950~present	1 533	-----	P(TB)
	Gaodao	35	N 24° 09′ E 113° 10′	1954~present	1 882	1 187.7	P(TB),E
	Hengshi	27	N 23° 51′ E 113° 16′	1953~present	2 401	-----	P(TB)
	Qingyuan	18	N 23° 42′ E 113° 01′	1946~present	2 311	1 643.6*	P(TB),E
	Shijiao	16	N 23° 34′ E 112° 57′	1952~present	1 888	-----	P(TB)
	Shigou	18	N 23° 23′ E 112° 35′	1954~present	1 762	1 392.9**	P(TB),E

*: Evaporation with 20 cm Evaporation pan
**: Evaporation with E601 (diameter 601 mm); other Evaporation with 80 cm Evaporation pan
1) Period for the mean is from the beginning of the observation period to 1972
2) P: Precipitation, E: Evaporation TB: Tipping bucket with recording chart

3.3 Monthly Climate Data

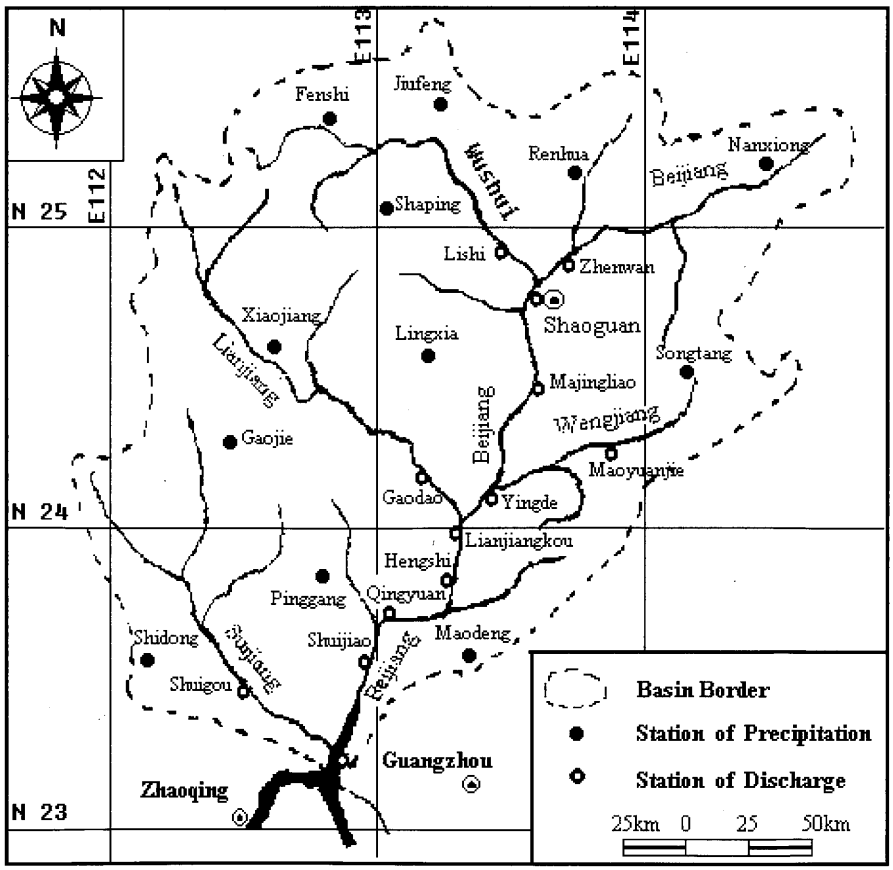
Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	**Shaoguan**	10.0	11.5	15.5	20.1	24.7	27.0	29.1	28.5	26.6	22.1	16.8	12.0	20.3	1951~1980
Precipitation [mm]	**Shaoguan**	55.0	80.8	140.6	226.7	259.9	249.2	136.8	139.6	85.8	67.9	46.4	48.5	1 537.4	1951~1980
Evaporation [mm]	**Shaoguan**	77.7	70.3	85.6	106.3	141.7	162.8	225.9	201.3	179.4	154.0	110.2	83.4	1 598.6	1952~1980
Solar radiation [MJ/m²/d]	**Shaoguan**	6.95	4.33	4.55	6.72	11.9	15.7	20.4	17.3	14.3	13.3	11.6	8.54	11.3	1983~1985
Duration of sunshine [hr]	**Shaoguan**	119.4	84.9	81.2	91.1	133.3	158.0	256.4	236.1	201.6	187.9	164.7	143.4	1 858.0	1953~1980

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

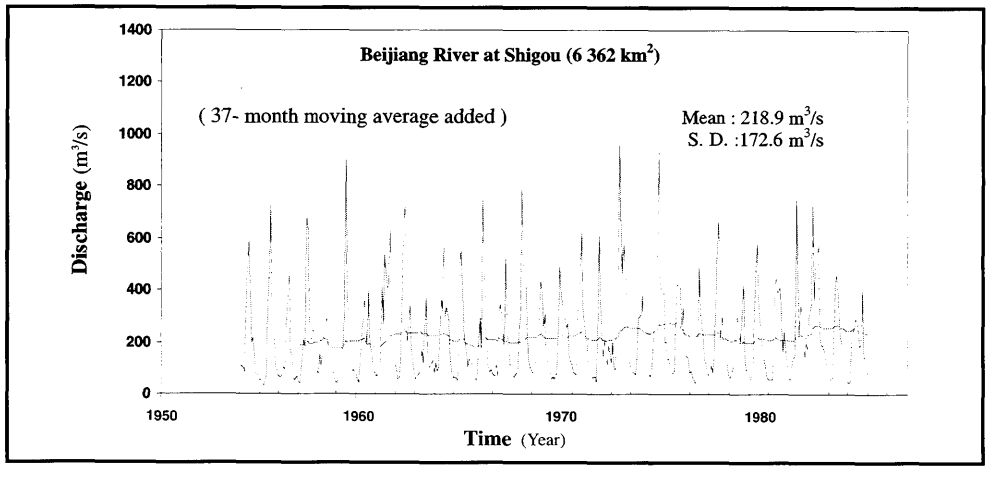
Station	Location	Catchment area (A) [km^2]	Observation period	Observation items [1] (frequency)
Zhenwan	N 24° 53′ E 113° 42′	6 764	1953~present	H2, Q
Gaodao	N 24° 09′ E 113° 10′	9 007	1954~present	H2, Q
Hengshi	N 23° 51′ E 113° 16′	34 013	1953~present	H2, Q
Shijiao	N 23° 34′ E 112° 57′	38 363	1924~present	H2, Q
Shigou	N 23° 23′ E 112° 35′	6 362	1953~present	H2, Q

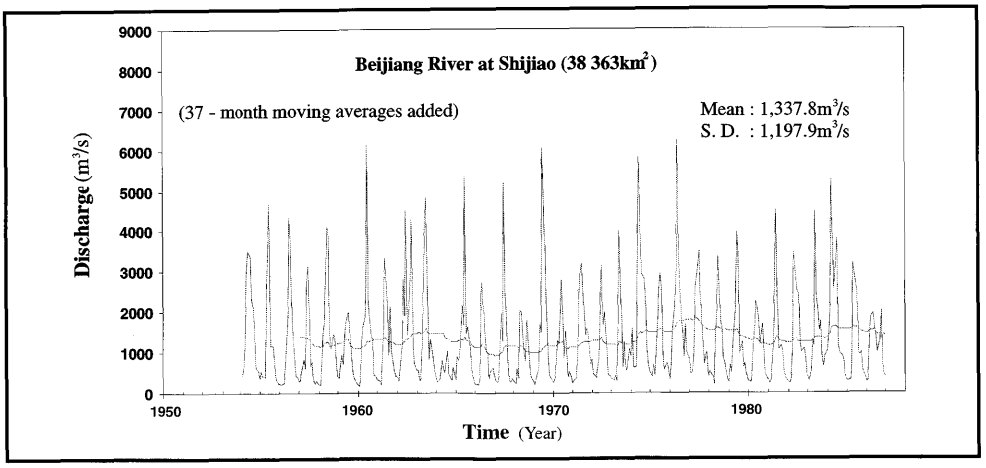
$\overline{Q}$ [2] [m^3/s]	Q max [3] [m^3/s]	$\overline{Q}_{max}$ [4] [m^3/s]	$\overline{Q}_{min}$ [5] [m^3/s]	$\overline{Q}$ / A [m^3/s/100km^2]	Q max / A [m^3/s/100km^2]	Period of statistics
185	4 730	2 729	31.0	2.735	69.9	1953~1980
326	5 720	3 634	34.0	3.619	63.6	1943~1980
1.077	15 000	9 367	190	6.166	44.1	1953~1980
1.324	14 900	9 485	217	3.451	38.8	1924~1980
216	4 480	2 049	45.0	3.360	70.4	1953~1980

1) H2: Water level by manual reading
Q: Discharge

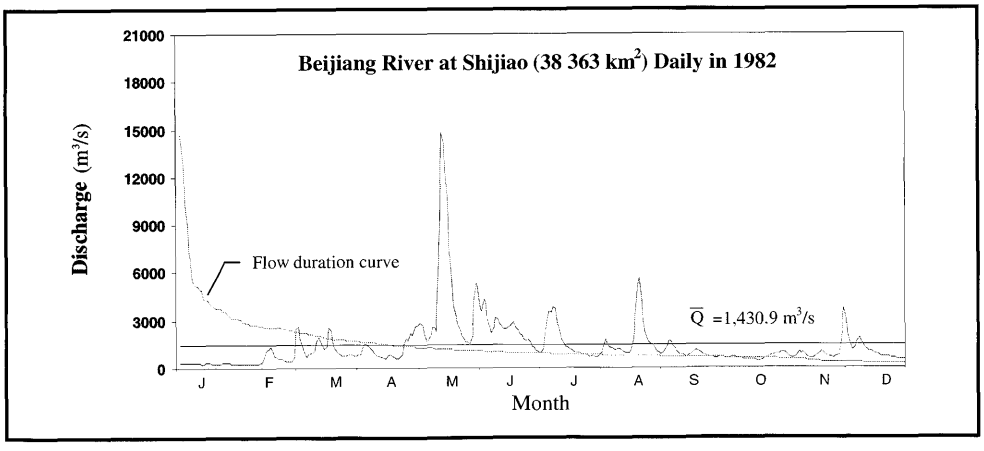
2) Mean annual discharge
3) Maximum discharge
4) Mean annual maximum discharge
5) Mean annual minimum discharge

4.3 Long-term Variation of Monthly Discharge





4.4 Annual Pattern of Discharge



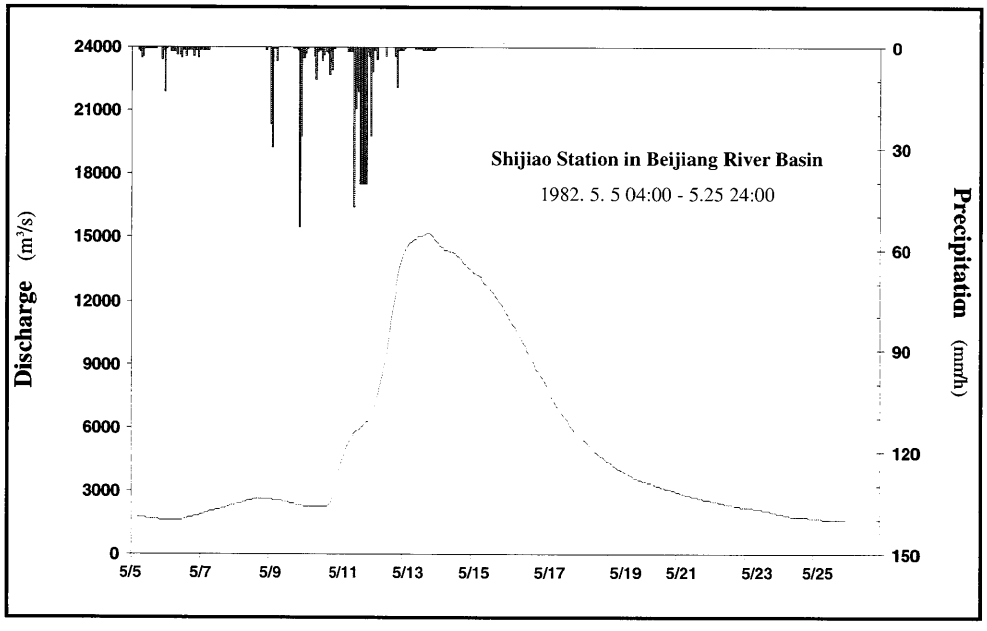
4.5 Annual Maximum and Minimum Discharges

At Shijiao [38 363 km^2]

Year	Maximum[1]		Minimum[2]		Year	Maximum[1]		Minimum[2]	
	Date	[m^3/s]	Month	[m^3/s]		Date	[m^3/s]	Month	[m^3/s]
1952	6.03	6 900	12	333	**1967**	4.05	7 040	3	200
1954	6.03	8 500	12	214	**1968**	6.27	14 900	3	170
1955	7.23	12 100	3	139	**1969**	5.19	7 640	10	189
1956	6.19	7 500	12	177	**1970**	6.04	8 620	1	191
1957	6.07	10 100	2	186	**1971**	7.29	7 620	12	235
1958	6.25	7 290	12	181	**1972**	5.09	12 300	3	218
1959	6.15	10 700	2	164	**1973**	6.30	11 200	3	360
1960	6.17	6 920	3	57	**1974**	6.27	10 000	12	300
1961	6.14	12 000	2	237	**1975**	5.22	11 800	1	406
1962	5.19	11 600	2	234	**1976**	6.11	12 000	2	346
1963	4.24	2 740	3	163	**1977**	6.02	6 560	3	157
1964	6.16	13 700	12	237	**1978**	5.20	10 300	12	198
1965	5.27	5 780	2	150	**1979**	6.12	5 140	1	212
1966	6.24	12 800	10	155	**1980**	4.26	11 800	1	200

1), 2) Instantaneous observation by recording chart

4.6 Hyetographs and Hydrographs of Major Floods



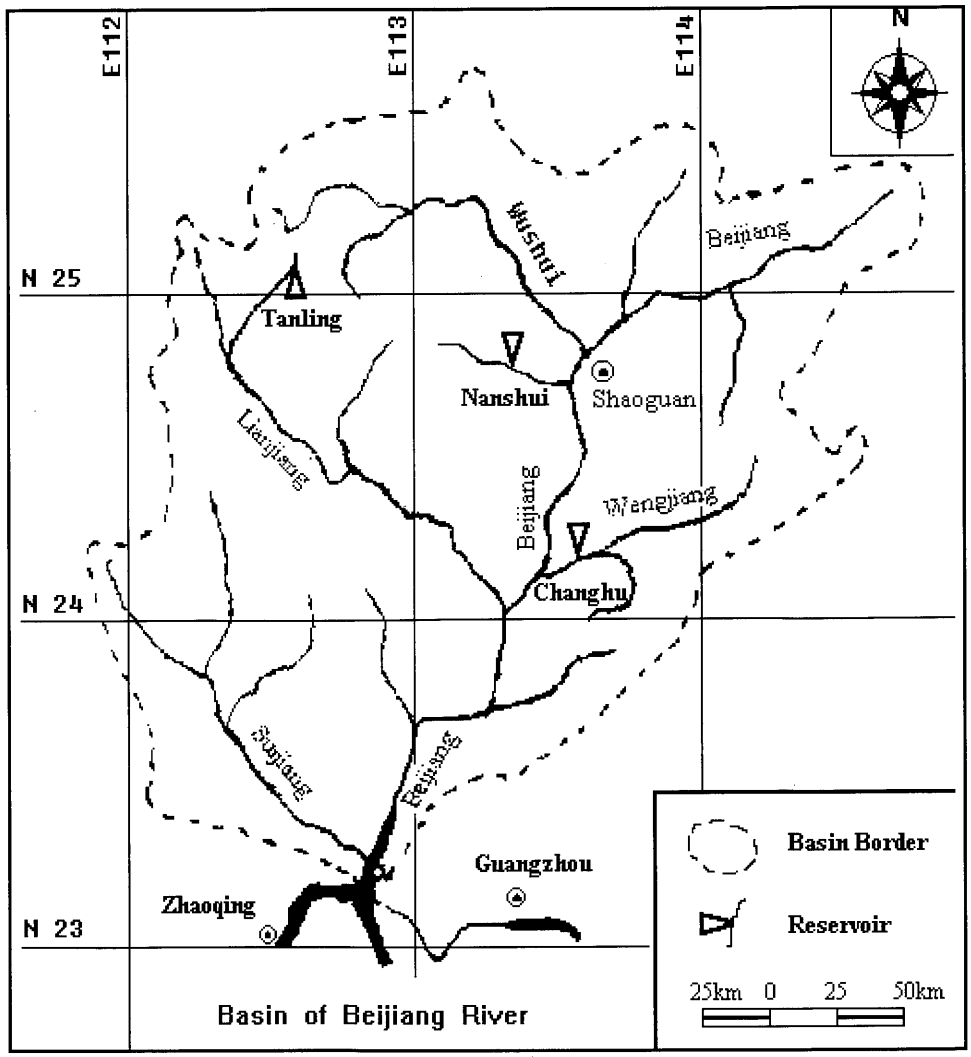
5. Water Resources

5.1 General Description

The Bei-jiang is the largest river in the Guangdong Province. The river basin takes up about 20% of the provincial area. In the past, there were many frequent floods in this basin. During the 34 year period from 1952-1985, there have been 130 occurrences of floods with annual maximum discharges greater than 5000 m^3/s at Shijiao. Typhoon related floods occur mostly from late July to early September. Three large reservoirs have been built in the basin, one for hydropower only, and the other two for hydropower, flood control and agricultural purposes. The largest one, the Nanshui, completed in 1971, has a storage capacity of 1 249 x 10^6 m^3.

The Bei-jiang plain with the river and lowland network is situated in the middle and downstream parts of the catchment. The flood prevention works are designed for return periods of 5 to 10 years. Municipal water supply in the limestone area is a problem in the basin that needs urgent attention.

5.2 Map of Water Resources Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of river	Name of dam (reservoir)	Catchment area [km^2]	Gross capacity [$10^6 m^3$]	Effective capacity [$10^6 m^3$]	Purpose[1)]	Year of completion
Nanshui	Nanshui	608	1 249	909	A,F,P	1971.5
Weng-jiang	Changhu	4 800	149	77	P	1973.3
Lian-jiang	Tanling	142	177	165	A,F,P	1966.9

1) A: Agricultural use F: Flood control P: Hydro-power

5.4 Major Floods and Droughts

Major Floods at Shijiao [38 363 km^2]

Date	Peak discharge [m^3/s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1964. 6.16	13 700	417.7 6.08~6.23	Frontal Rain	-----	Qingyuan,Sihui city,etc.
1966. 6.24	12 800	443.5 6.05~6.23	Frontal Rain	-----	Qingyuan,Sihui city,etc.
1968. 6.27	14 900	539.0 6.11~6.25	Frontal Rain	-----	Qingyuan,Sihui city,etc.
1972. 5.09	12 300	278.1 5.02~5.11	Frontal Rain	-----	Qingyuan,Sihui city,etc.
1976. 6.11	12 000	238.7 5.31~6.09	Frontal Rain	-----	Qingyuan,Sihui city,etc.
1980. 5.10	11 800	229.0 5.01~5.07	Frontal Rain	-----	Qingyuan,Sihui city,etc.
1982. 5.13	15 200	649.5 5.04~5.13	Frontal Rain	-----	Qingyuan,Sihui city,etc.

6. Socio-cultural Characteristics

Bei-jiang means "north river". In total, there are three rivers flowing to the Pearl River Delta. Bei-jiang basin has the best natural scenic area in the province attracting many sightseers every year. The climate is warm and wet.

7. References, Databooks and Bibliography (In Chinese)

Geology Press (1973): *The atlas of geology in China*.
Guangdong Hydrological General-station (1986): *The water resources of Guangdong Province.*
Guangdong Hydrological General-station (1952~1985): *The year-book of hydrological data in China*, No. 4, Vol. 8.
Meteorological Press (1985~1987): *The solar radiation data (1983~1985).*
Pearl-River Water Resources Commission (1984): *The flood-control guideline for Pearl-River basin.*
Pearl-River Water Resources Commission (1987): *The groundwater resources of Pearl-River basin.*
Water Resources Department of Guangdong Province (1985): *The development of water resources in Guangdong Province.*