

River TangHe

Map of River TangHe

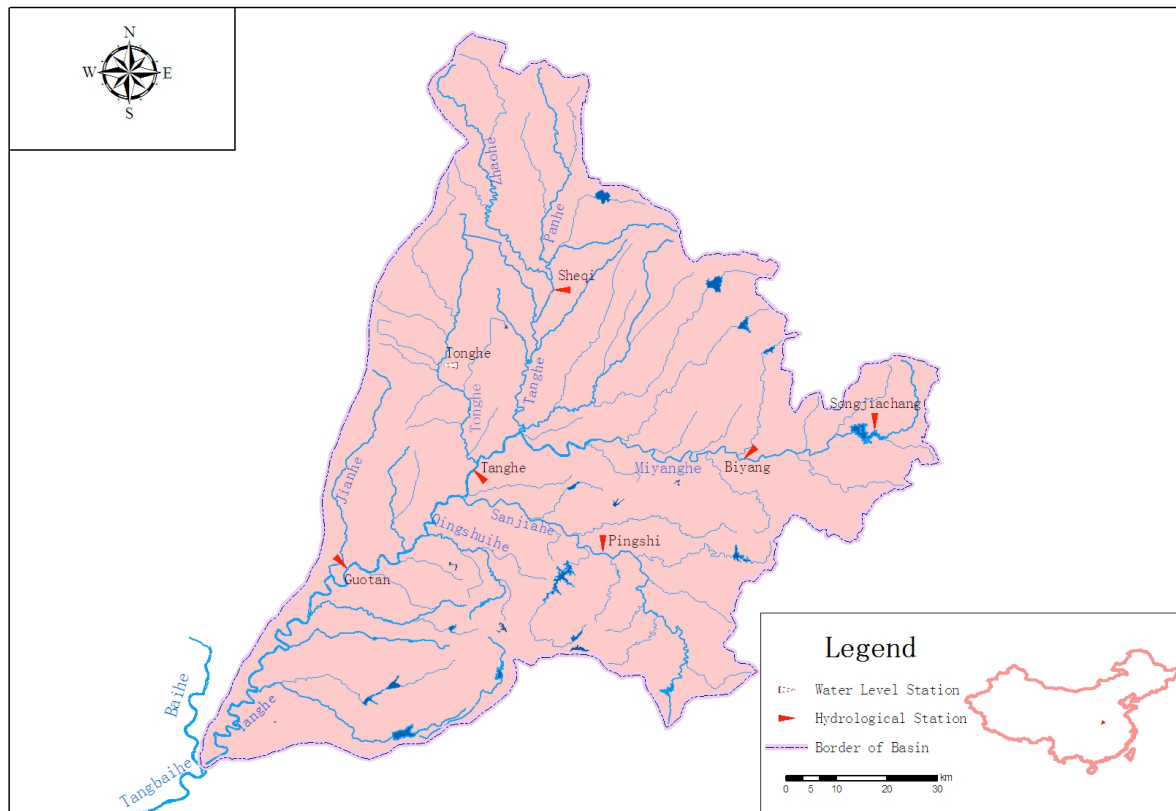


Table of Basic Data

Name: Tanghe		Serial No.: China-15
Location: Henan Province	N 32° 10' ~ 23° 55'	E 112° 18' ~ 33° 29'
Area: 8010km ²	Length of main stream: 286km	
Origin: Qifeng Mountain	Highest point: 720m	
Outlet: TangBai river	Lowest point: 70m	
Main geological features: Various hard, Massive intrusive rocks; Cohesive soil		
Main tributaries: Biyanghe, Tonghe, Sanjiahe		
Main lakes:		
Main reservoirs: Huashan (63.5*10 ⁶ m ³ , 1958), Sanshan (12.96*10 ⁶ m ³ , 1959), Songjiachang (132*10 ⁶ m ³ , 1959), Songjiachang (132*10 ⁶ m ³ , 1959)		
Mean annual precipitation: 820mm (309 ~1097) at Guotan		
Mean annual runoff: 52m ³ /s (13.3 ~ 124) at Guotan		
Population: 2,800,000 in 2001	Main cities: Tanghe, Biyang, Sheqi	
Land use: Forest (25%), Urban land (12%), Agriculture (55%), Others (8%)		

1. General Description

The Tanghe River is a branch of Tangbai River which flows into the Han River. It is mainly located in the southwest part of Henan Province with a small part located in Hubei province. The catchment area is 8010 km² with a main river length of 286 km. The river flows in a southwest direction from

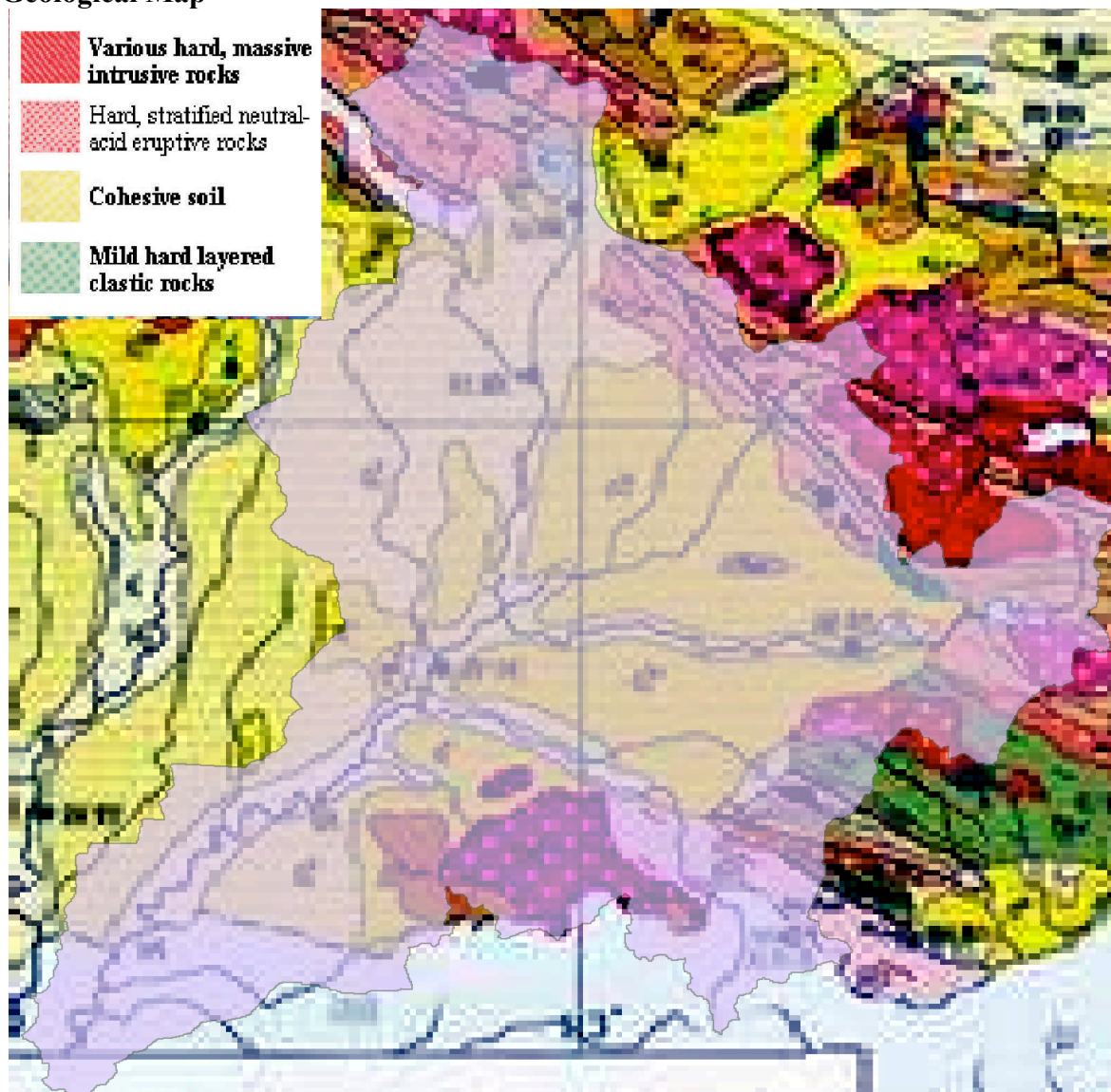
its origin near Qifeng Mountain in the northeast of the catchment. There are several tributaries, namely Biyanghe, Tonghe and Sanjiahe. The river is influenced by Subtropical High climate. There are quite a few large reservoirs have been constructed in this basin, such as Huashan, Sanshan, Songjiachang, Hushan and Heqinghe Dam/reservoirs. The Songjiachang Reservoir is classified as large-scale reservoir according to the China State Reservoir Identification Standard. Total reservoir storage capacity is 320 million m³. In the basin, there are three important economically counties including Tanghe, Biyang and Sheqi. Water quality in the river is identified as grade II and III at the upper river reaches and down stream areas, respectively.

The average annual precipitation for the basin is 950 mm and annual discharge is 52m³/s (based on time series of 1956-2009). 25% of the basin area is covered by forests. The geographical features include mountain, hill, basin and plain.

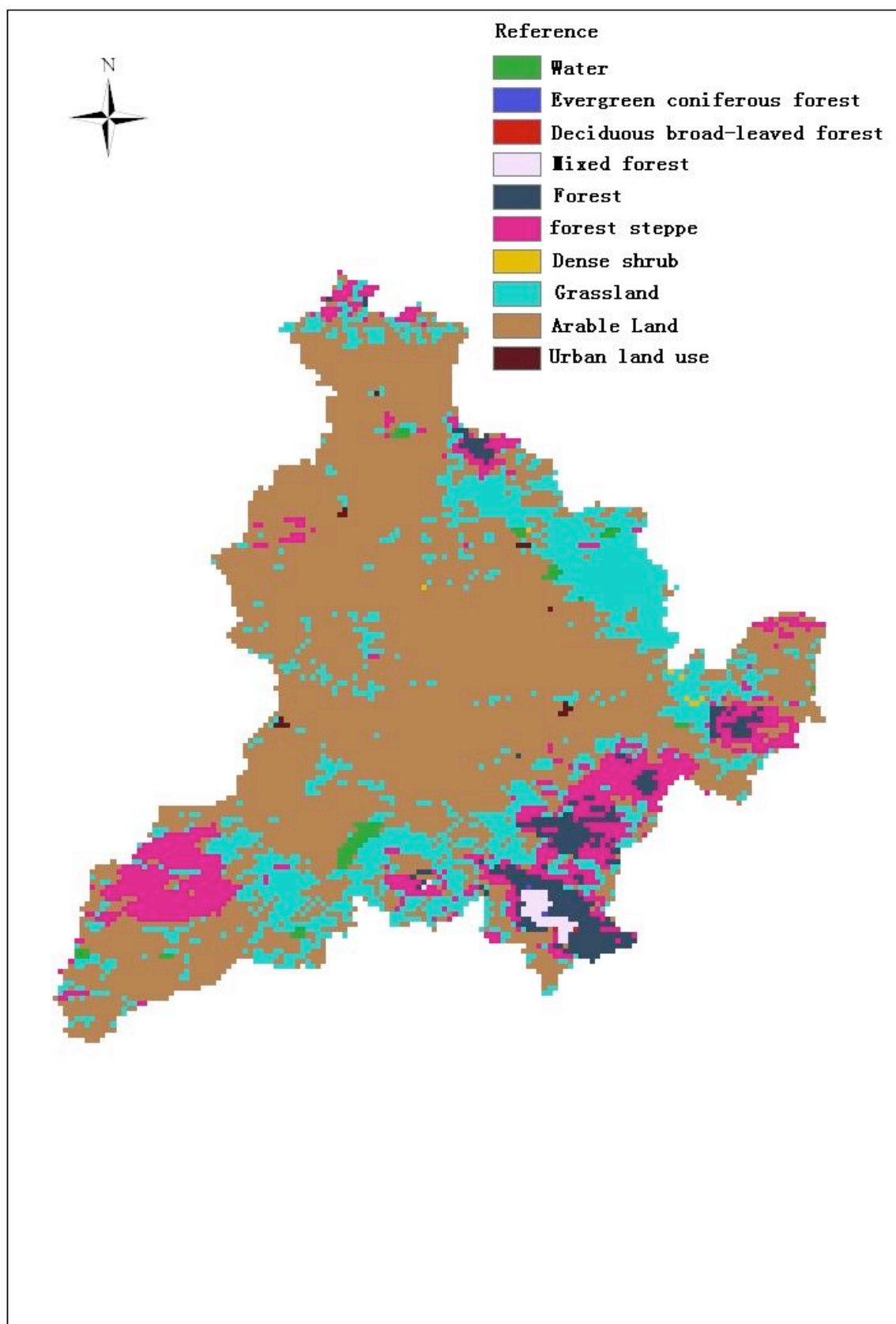
2. Geographical Information

There are several kinds of rocks and soils, which can be identified from the geological map as presented below.

2.1 Geological Map



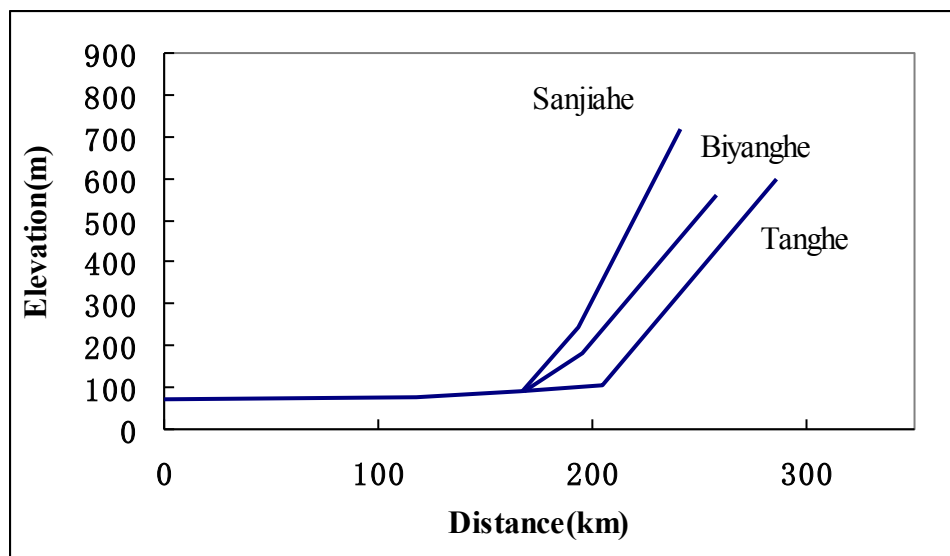
2.2 Land Use Map



2.3 Characteristics of River and Main Tributaries

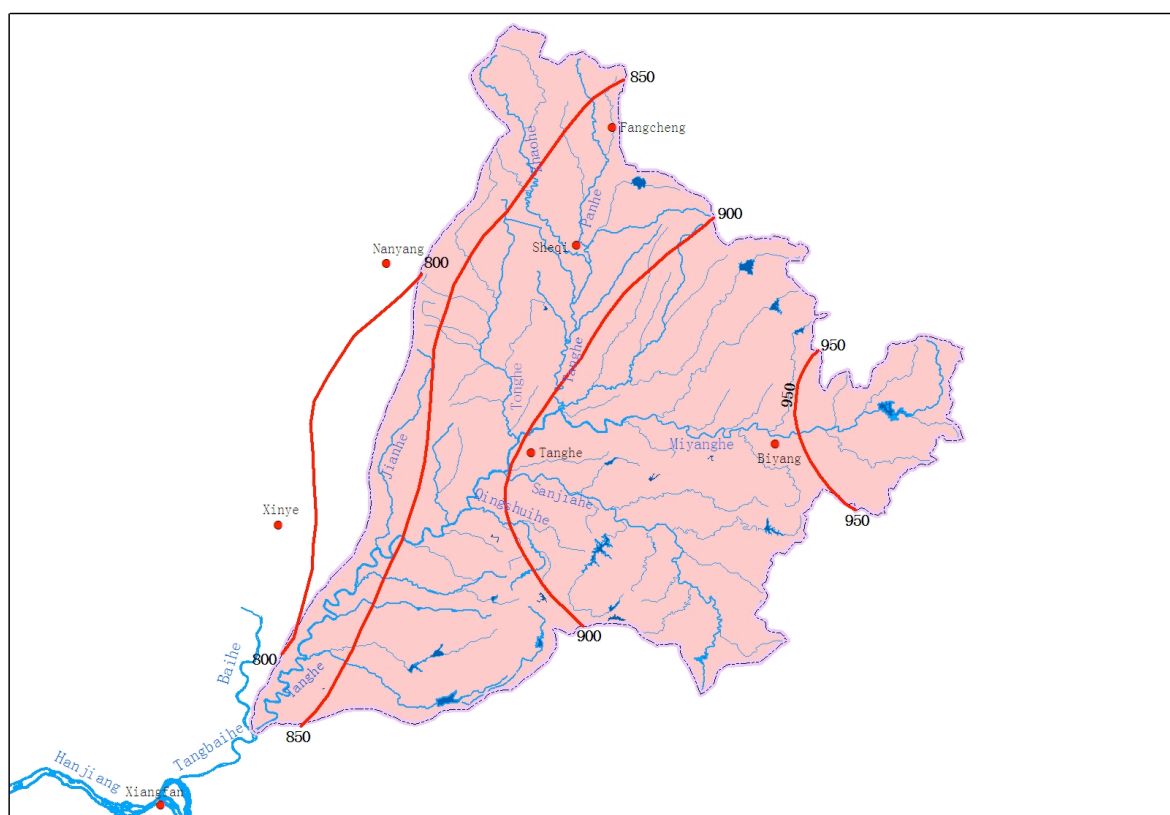
No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m] Lowest point [m]	Cities population	Land use [%]
1	Tanghe River (Main River)	286 8010	600 70	1,277,000	Forest (25%) Urban land (12%) Agriculture (55%) Others (8%)
2	Biyanghe (Tributary)	110 1734	560 90	813,273	
3	Sanjahe (Tributary)	85 1325	720 89	2,670,553	

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

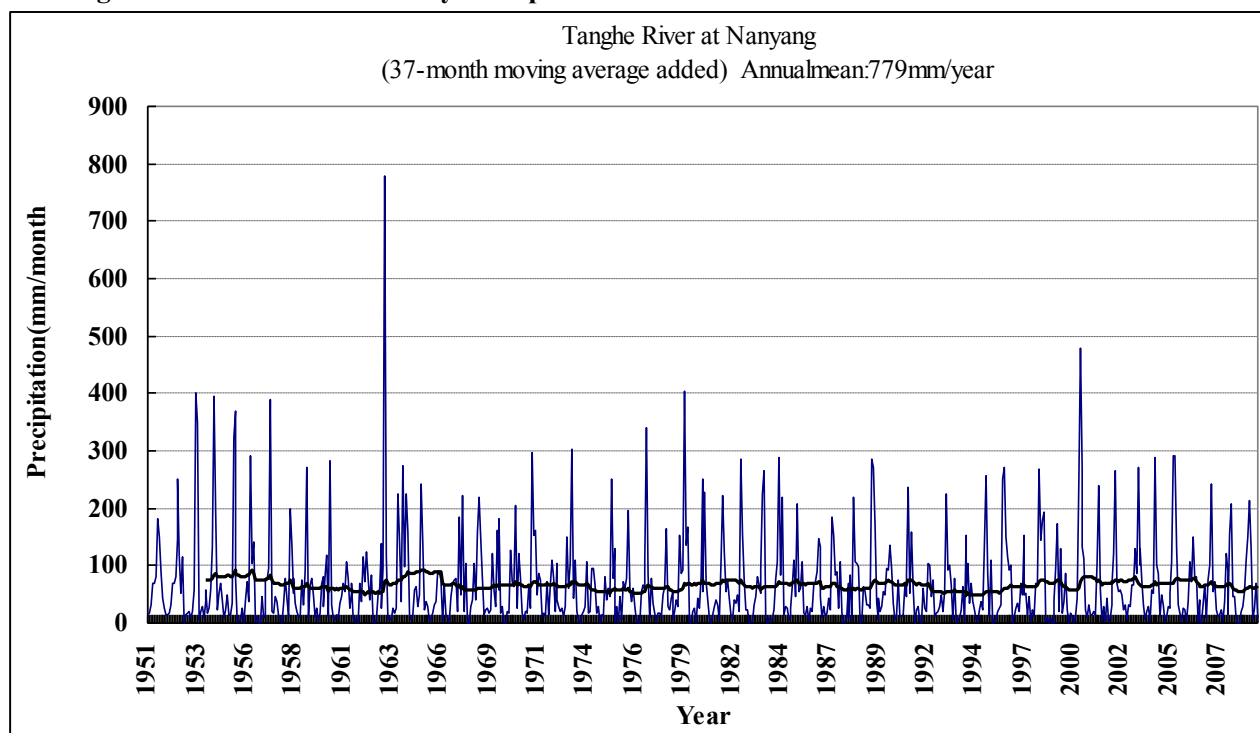
No.	Station	Elevation [m]		Location	Observation period	Mean annual precipitation [mm]	Observation items ¹⁾ (frequency)
57178	Nanyang	131	N E	33°00' 112°36'	1951~present	779	
57278	Xiangfan	70	N E	32°00' 69°48'	1959~2009	850	
57271	Xinye	89	N E	32°30' 112°24'	1971~2000	780	
57273	Tanghe	110	N E	32°42' 112°48'	1971~2000	905	
57281	Biyang	143	N E	32°42' 113°18'	1971~2000	933	
57187	Sheqi	123	N E	33°06' 112°54'			
57179	Fangcheng	162	N E	33°18' 113°00'			

1) P: Precipitation, E: Evaporation, TB: Tipping bucket with recording chart.

3.3 Monthly Climate Data (Observation station: NanYang)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	1.4	3.8	8.6	15.5	20.5	25.3	27.0	26.1	21.3	15.9	9.1	3.4	14.8	1971~2000
Precipitation [mm]	13.7	16.3	35.3	48.5	72.9	124.6	177.6	111.6	75.9	61.3	29.4	11.6	778.7	1971~2000
Solar radiation [MJ/m ² /d]	7.7	9.3	11.8	15.2	16.7	17.5	16.7	15.3	13.1	10.4	8.3	6.7	12.4	1971~2000
Duration of sunshine [hr]	124.8	123.3	145.7	172.2	189.9	201.6	194.8	206.2	156.2	158.5	140.6	133.3	1947.1	1960~2005

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



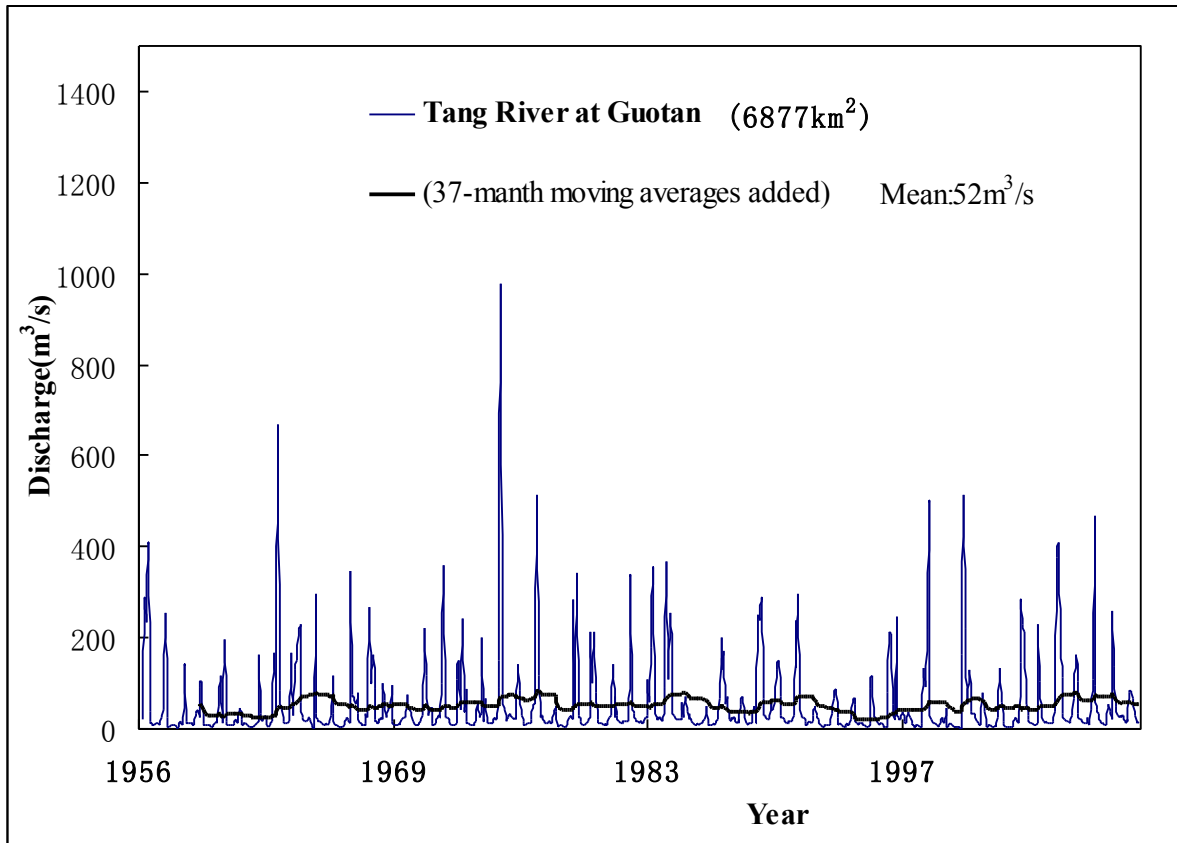
4.2 List of Hydrological Observation Stations

No.	Station	Location	Catchment area (A) [km ²]	Observation period	Observation items (frequency)
62016400	Guotan	N112° 36' E32° 31'	6877	1956~present	H, Q ¹
62017800	Pingshi	N 113° 03' E 32° 33'	748	1953~present	H, Q
62016200	Tanghe	N 112° 49' E 32° 42'	4771	1936~present	H, Q
62017100	Biyang	N 113° 18' E 32° 43'	635	1952~present	H, Q
62016000	Sheqi	N 112° 58' E 33° 01'	1044	1951~present	H, Q

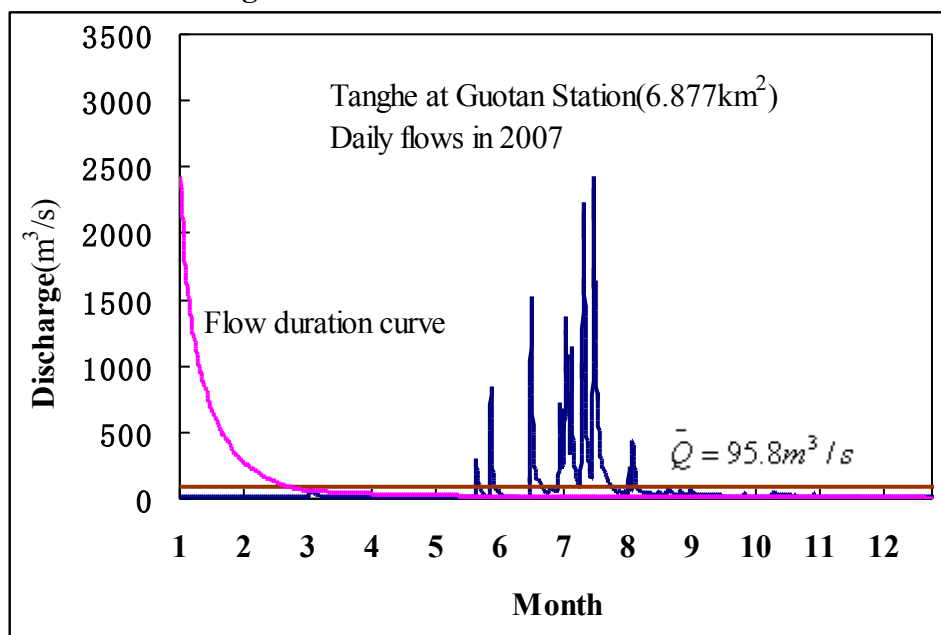
No.	\bar{Q} ² [m ³ /s]	Qmax ³ [m ³ /s]	\bar{Q} max ⁴ [m ³ /s]	\bar{Q} min ⁵ [m ³ /s]	\bar{Q} / A [m ³ /s/100km ²]	Q max / A [m ³ /s/100km ²]	Period of statistics
62016400	52	13400	2325	5	0.76	195	1956~2009
62017800	7.83	4330	876	0.58	1.05	579	1997~2009
62016200	37.86	13100	2180	4	0.79	275	1997~2009
62017100	4.68	4550	529	0.7	0.74	717	1997~2009
62016000	7.53	4210	820	1	0.72	403	1997~2009

1. H: water level, Q: discharge
2. \bar{Q} : Mean annual discharge.
3. Q_{max} : Maximum discharge.
4. \bar{Q}_{max} : Mean maximum discharge.
5. \bar{Q}_{min} : Mean minimum discharge.

4.3 Long-term Variation of Monthly Discharge



4.5 Annual Pattern of Discharge

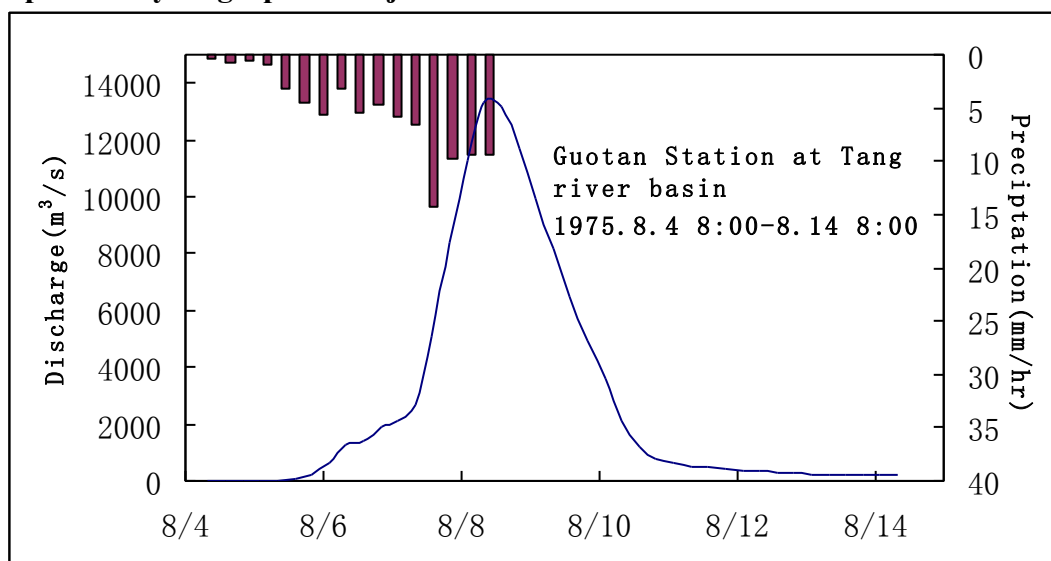


4.6 Annual Maximum and Minimum Discharges

At Station Guotan (drainage area 6,877 km²)

Year	Maximum		Minimum		Year	Maximum		Minimum	
	Date	[m ³ /s]	Date	[m ³ /s]		Date	[m ³ /s]	Date	[m ³ /s]
1956	8.23	4260	12	6.93	1983	10.6	2230	4	8.1
1957	7.7	2730	1	0.25	1984	7.27	3390	4	11.2
1958	8.14	1060	3	0.11	1985	7.16	643	10	10.7
1959	7.1	1830	9	2.8	1986	9.10	347	5	4.31
1960	9.5	1640	1	1.9	1987	6.6	1440	3	6.7
1961	7.6	600	4	6.1	1988	7.25	1010	7	6.6
1962	8.6	1140	3	2.42	1989	6.7	2780	2	6.2
1963	8.3	3510	2	2.27	1990	6.20	1510	12	11.3
1964	5.25	2010	3	9.5	1991	8.6	3480	2	9.68
1965	8.4	3980	6	4.08	1992	7.16	440	12	3.85
1966	7.23	1900	12	2.86	1993	8.25	788	2	3.8
1967	7.12	3560	1	2.1	1994	7.13	912	6	2.63
1968	9.19	2870	3	7.15	1995	7.26	1130	5	3.24
1969	9.3	1100	12	6.75	1996	11.8	2200	4	2.84
1970	7.26	1360	4	4.97	1997	7.18	216	12	5.12
1971	7.2	2160	4	4.91	1998	8.16	4000	2	4.88
1972	7.2	4710	2	2.4	1999	7.7	542	10	3.2
1973	4.30	3250	4	5.68	2000	7.5	3410	5	0.56
1974	8.6	2680	1	5.5	2001	7.30	1180	7	1.5
1975	8.8	13400	2	8	2002	6.28	1840	4	2.86
1976	7.22	1200	12	7.72	2003	8.30	3510	2	3.23
1977	7.19	4260	2	5.8	2004	7.18	3060	5	6.4
1978	6.27	663	10	2.57	2005	7.10	3630	4	4.2
1979	7.25	2390	1	3.37	2006	6.23	913	4	12.2
1980	6.24	3000	2	5.95	2007	7.20	2460	12	7.7
1981	8.23	1110	5	5.3	2008	7.23	3510	2	6
1982	7.23	1950	3	8.23	2009	6.20	630	5	6.2

Hyetograph and Hydrograph of Major Flood



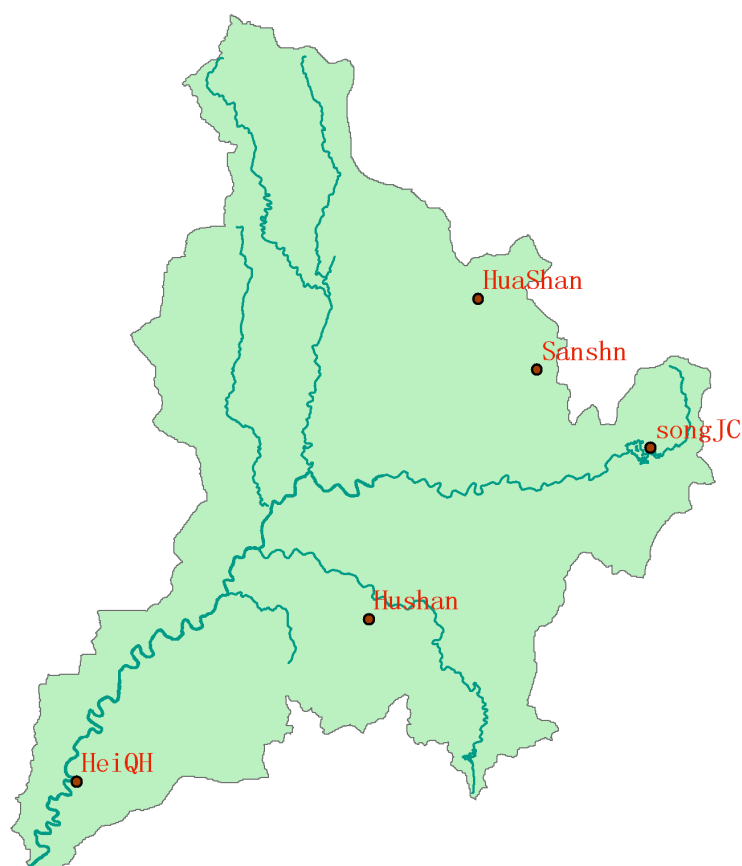
5. Water Resources

5.1 General Description

The Tanghe River is a branch of Tangbai River which flowing the Han River. The river is located in Henan and Hubei Province. The precipitation is concentrated in April-September when 80%-85% of the annual precipitation is recorded. The annual variation of precipitation is large. For example, the maximum precipitation at Guotan was 1,097 mm in 2000 but the minimum was only 309 mm in 1992. Correspondingly, the annual runoff shows similar characteristics. In general high precipitation occurs in the mountain areas. Water availability in Tanghe is relatively abundant in comparing with other areas in China. However, due to the high density of population, average water availability per capita is limited.

There are one large reservoir Songjiachang and four medium and small size reservoirs of Huashan, Sanshan, Hushan and Heiqinghe in the river basin. These reservoirs were mainly completed in the 1950s-1980s. The main purpose of these reservoirs is hydropower generation and flood control.

Map of Water Resource 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
Bihe	Huashan	76	41.5		A,F,P	1958
Lianghe	Sanshan	20.5	12.96	5.79	A,F,P	1959
Shibadaoe	Songjiachang	186	132	92	A,F,P	1969

Chouhe	Hushan	199	87.36		A,F,P	1978
Heqinghe	Heiqinghe	141	25.63		A,F,P	1961

1) A: Agricultural use; F: Flood control; I: Industrial use; N: Maintenance of normal flows; P: Hydropower; W: Municipal water supply

Major Water Transfer

5.4 Major Floods and Droughts

Major Floods at Guotan station

Date	Peak discharge [m ³ /s]	Rainfall [mm], Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1975.8	13400	325 (4days)			
1972.7	4710				
1977.7	4260	74 (2days)			

Major Droughts

Period	Affected area	Major damages and counteractions
2008.11~2009.3	Tanghe, Sheqi	Water suspension for high water consumption industries
2010.11~2011.1	Tanghe, Sheqi, Biyang	River dry, no water for part of irrigation land

5.5 River Water Quality

River Water Quality ¹⁾ at Guotan Station ²⁾ in 2000

Date	1/1	2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1	12/1
pH		8.74		8.20		8.14	7.83	8.44	8.37	8.85	7.87	8.81
BOD [mg/l]		5.7		3.6		2.9	3.1	2.7	3.3	3.0	3.0	1.4
COD _{Mn} [mg/l]		7.2		5.1		3.7	5.8	4.2	3.6	3.2	3.4	2.2
Do [mg/l]		13.22		8.15		8.08	6.32	7.41	7.86	11.04	9.39	9.70
Discharge ³⁾ [m ³ /s]		11.3		9.64		16.1	29.7	80.3	48.7	17.4	8.85	1.44

1) Observed once a month

2) Located near Osaka City 25 km upstream from the river mouth.

3) Discharge on the water quality observation date.

6 Socio-cultural Characteristics

The Tang River area is located in the middle part of China. It has a long history and is a very important area for Chinese Revolution. In the past two decades the GDP in the area has increased dramatically. It is also a base for agriculture and fruits, such as Seedless Watermelon, pear etc. The development of livestock industry especially for cattle has been growing continuously in recently years.

7 References, Databooks and Bibliography

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China Population Investigation, China Statistical Press, 1994.