

Taizi-he

Map of River

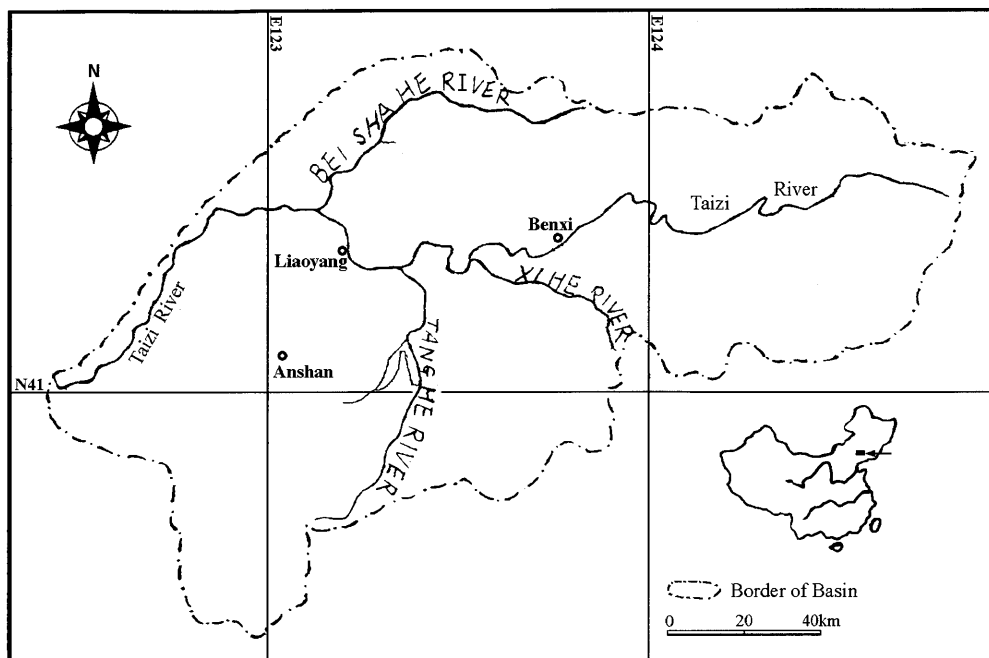


Table of Basic Data

Name: Taizi River (in Liaohe River)		Serial No.: China-5
Location: Northern China	N 40°29' - 41°40'	E 122°21' ~ 124°50'
Area: 13,883 km ²	Length of main stream: 425 km	
Origin: Mt. Pingdingshan (1,300 m)	Highest point: Mt. Tudingshan (1,325 m)	
Outlet: Liaohe River	Lowest point.: Yingkou (50 m)	
Main geological features: Metamorphic Rock, Friable Rock, Carbonatite		
Main tributaries: Tanghe River (1,228 km ²), Baishahe River (1,104 km ²), Xihe River (1,023 km ²)		
Main lakes: None		
Main reservoirs: Jinwo (791×10 ⁶ m ³ , 1972), Tanghe (723×10 ⁶ m ³ , 1969)		
Mean annual precipitation: 822.1 mm (1947~1979) (basin average)		
Mean annual runoff: 73.8 m ³ /s at Tangmazai (11,203 km ²) (1952 ~ 1985)		
Population: 5,970,000 (1990)	Main cities: Liaoyang, Benxi, Anshan etc.	
Land use: Forest (48.9%), Rice paddy (5.1%), Other agriculture (27.7%), Water surface (7.6%), Urban (5.1%) (1989)		

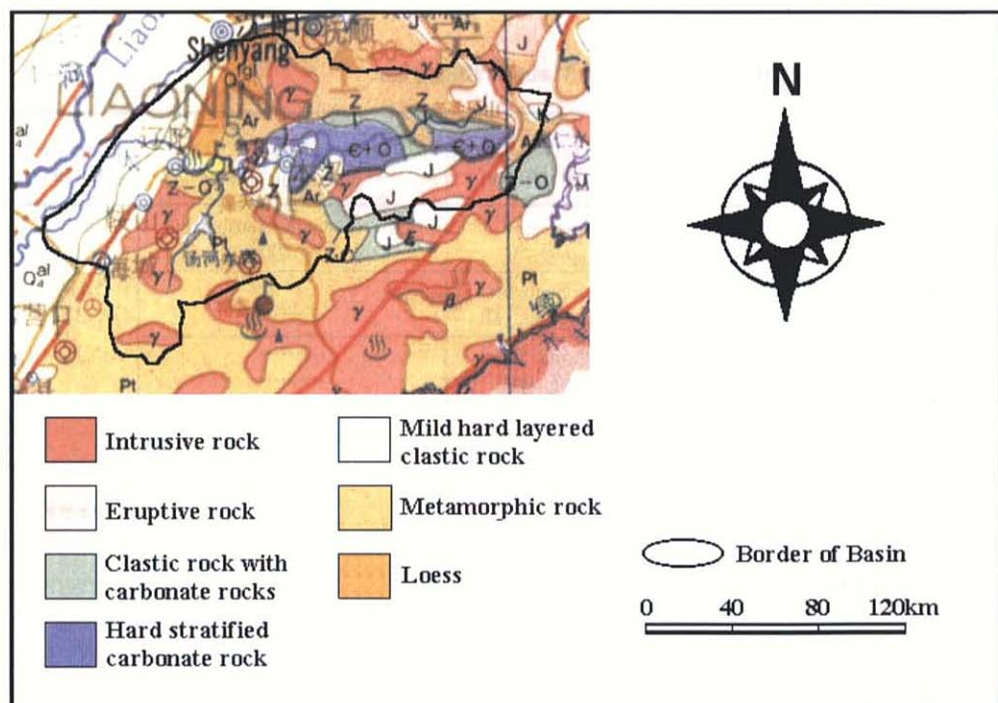
1. General Description

Taizi River is located in the south-eastern part of Liaoning province. The river which originates from Mt. Pingdingshan (1,300 m) is 425 km long and drains an area of 13,883 km². It is a tributary of Liaohe River in northern China. The annual precipitation for the catchment is 822 mm, and the annual discharge at Liaoyang station (8,082km²) was 18,100 m³/s in 1960. The river above Benxi is considered the upper reach, while that between Benxi and Liaoyang is considered the middle reach. The main crop is rice in the river basin. Large rice fields can be found along the downstream below Liaoyang.

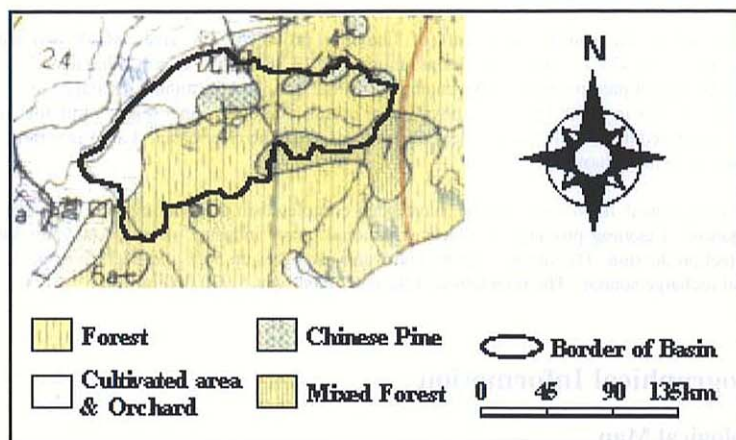
Two large reservoirs, named Jinwo and Tanghe, have been completed in the main stream for water supply, flood control and irrigation. Liaoning province is a base of national heavy industry. Benxi, Liaoyang and Angang are large cities for steel production. The surface and ground water use takes up 54% and 54.35% respectively of natural runoff and annual recharge source. The population of the catchment was 5,970,000 in 1990.

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map

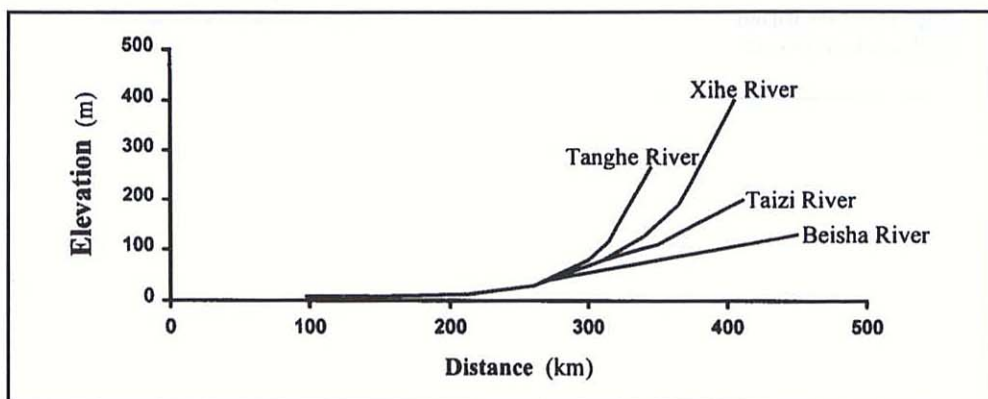


2.3 Characteristics of River and Main Tributaries

Name of river	Length [km] Catchment area [km ²]	Highest Peak [m] Lowest Point [m]	Cities Population (1990)	Land use ¹⁾ [%] (1988)
Taizi (Main river)	425 13,883	Mt. Tudingshan 1,325 Yingkou 50	Benxi, Liaoyang, Aanshan etc. 3,010,000	F (48.9) L (7.6)
Tanghe (Tributary)	92 1,228	Mt. Jidonggu 900 Dongjingling 150	----- -----	P (5.1) OA (27.7)
Baishahe (Tributary)	117 1,104	Mt. Anjia 500 Shaling 100	----- -----	U (5.1)
Xihe (Tributary)	91 1,023	Mt. Mutianling 969 Guangmenshan 200	----- -----	

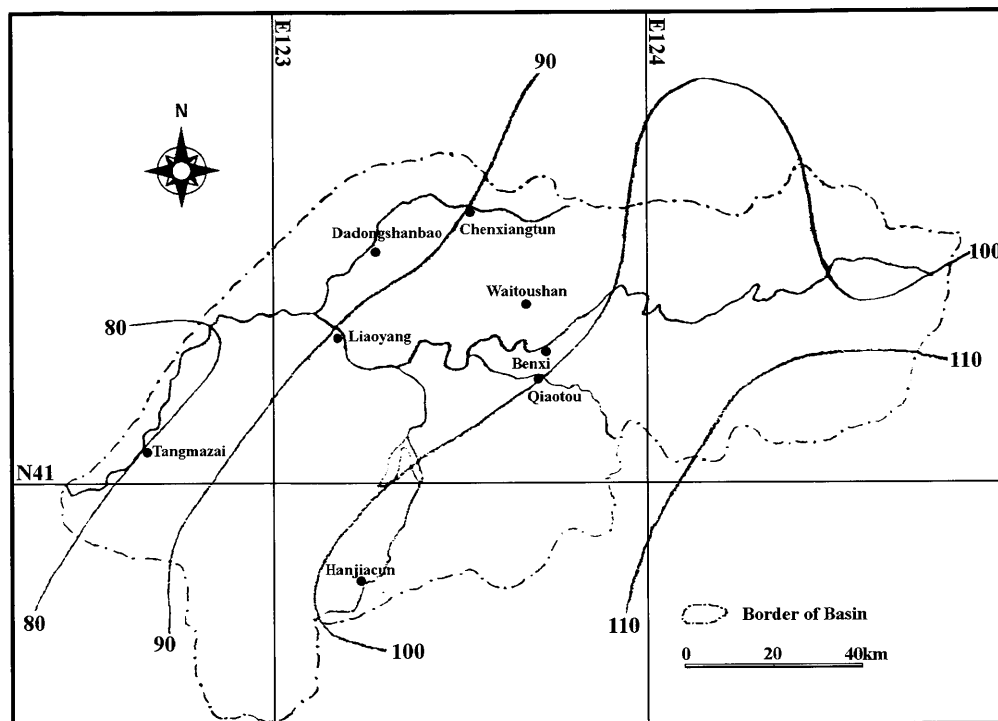
F: Forest L: Lake, River, Marsh P: Paddy Field
OA: Other agricultural field (vegetable field, grass field) U: Urban

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Mean 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⁾²⁾ [mm]	Observation items ³⁾
76	Benxi	70	N 41° 19' E 123° 46'	1962 ~ present	778.5	-----	P(TB)
96	Liaoyang	65	N 41° 16' E 123° 12'	1965 ~ present	741.5	1,509	P(TB),E
115	Tangmazai	62	N 41° 16' E 122° 43'	1934 ~ present	700.6	-----	P(TB)
81	Qiaotou	35	N 41° 13' E 123° 42'	1935 ~ present	778.6	-----	P(TB)
86	Hanjiacun	27	N 40° 48' E 123° 14'	1953 ~ present	798.8	-----	P(TB)
97	Waitoushan	18	N 41° 29' E 123° 41'	1964 ~ present	785	-----	P(TB)

*: these numbers are assigned by the provincial hydrological service

1) Period for the mean is from 1970 to 1987.

2) Evaporation used with 20 Evaporation pan.

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

3.3 Monthly Climate Data

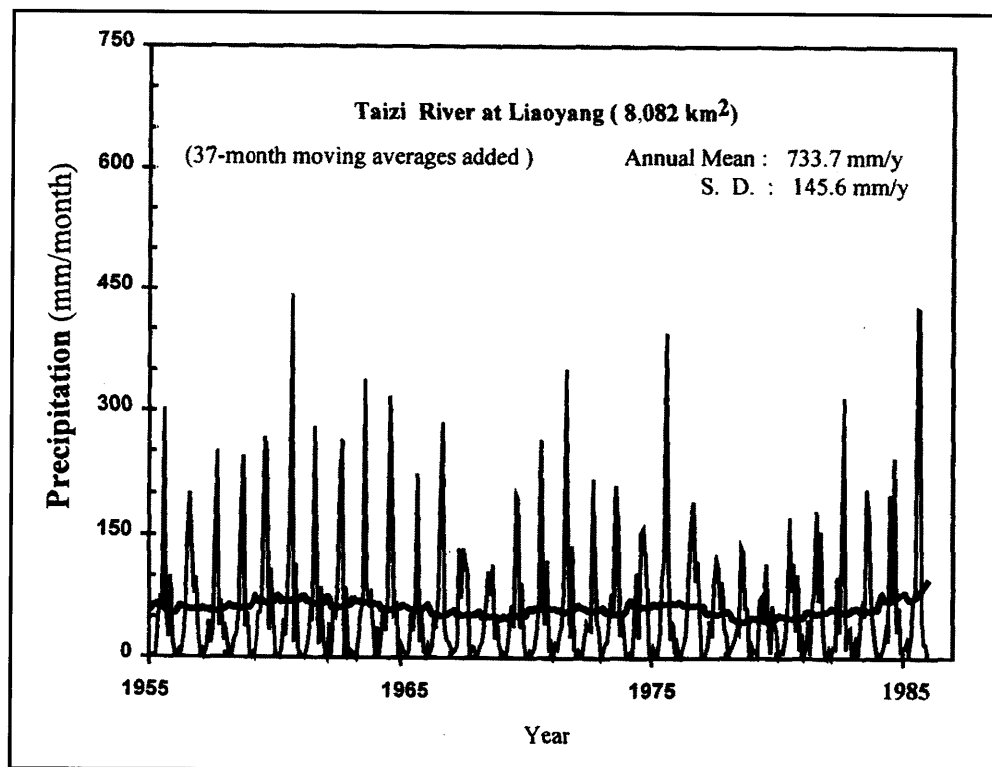
Station: Liaoyang

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	-11.3	-7.76	0.48	9.90	17.6	21.8	24.8	22.8	17.6	10.1	0.7	-7.59	8.36	1971 ~ 80
Precipitation [mm]	5.9	7.7	15.0	37.1	59.9	81.7	191.1	169.5	75.3	46.6	23.0	11.2	724	1922 ~ 80
Evaporation ¹⁾ [mm]	31.0	47.6	102.3	219	310	240	195.3	158.1	138	111.6	60	37.2	1,650	1950 ~ 80
Solar radiation [MJ/m ² /day]*	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 ~ 85
Duration of sunshine [hr]**	158.8	183.0	217.9	225.3	259.0	220.4	191.6	202.7	217.9	202.8	160.5	141.7	2,381.6	1954 ~ 80

* Observed at Shenyang. Observed at Benxi

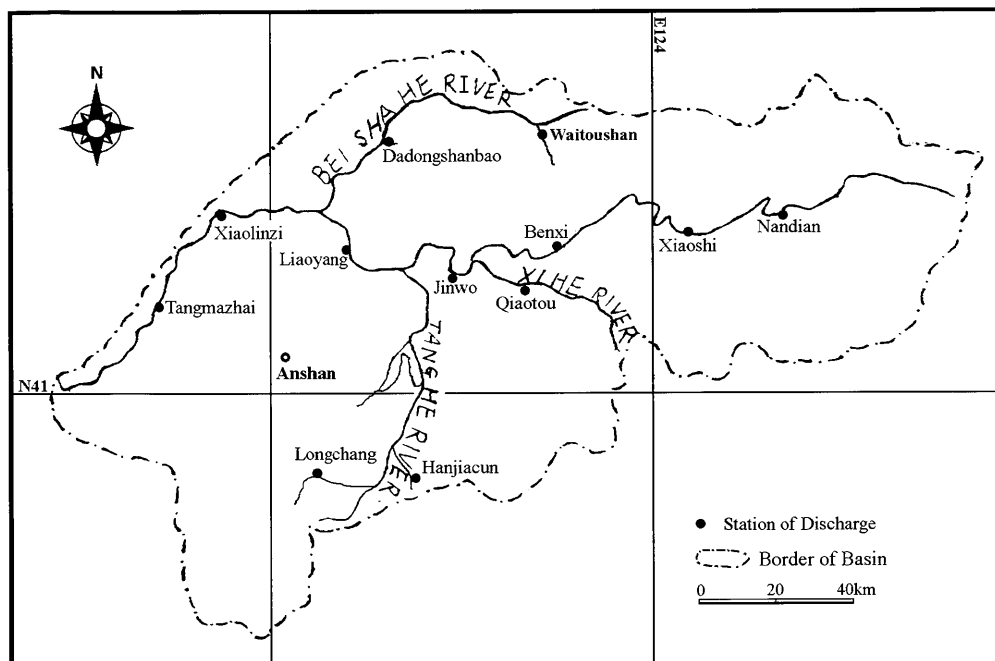
1) Evaporation used with 20 Evaporation pan.

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)
115	Tangmazai	N 41°11' E 123°43'	11,203	1934 ~ present	H2,Q
76	Benxi	N 41°19' E 123°46'	4,324	1963 ~ present	H2,Q
96	Liaoyang	N 41°16' E 123°12'	8,082	1965 ~ present	H2,Q
81	Qiaotou	N 41°13' E 123°42'	1,023	1935~ present	H2,Q

No.*	\bar{Q} ¹⁾ [m ³ /s]	Q max ²⁾ [m ³ /s]	\bar{Q} max ³⁾ [m ³ /s]	\bar{Q} min ⁴⁾ [m ³ /s]	\bar{Q} / A [m ³ /s/100km ²]	Qmax / A [m ³ /s/100km ²]	Period of statistics
115	83.7	3,660	1,170	6.55	0.747	32.7	1970 ~ 1987
76	47.9	4,110	1,551	2.10	1.108	95.1	1970 ~ 1987
96	61.6	4,400	1,158	0.17	0.762	54.1	1970 ~ 1987
81	11.5	2,370	667	0.79	1.12	231.7	1970 ~ 1987

**: H2: water level by manual,
1) Mean annual discharge
3) Mean maximum discharge

Q: discharge
2) Maximum annual discharge
4) Mean minimum discharge

*: these numbers are assigned by the provincial hydrological service

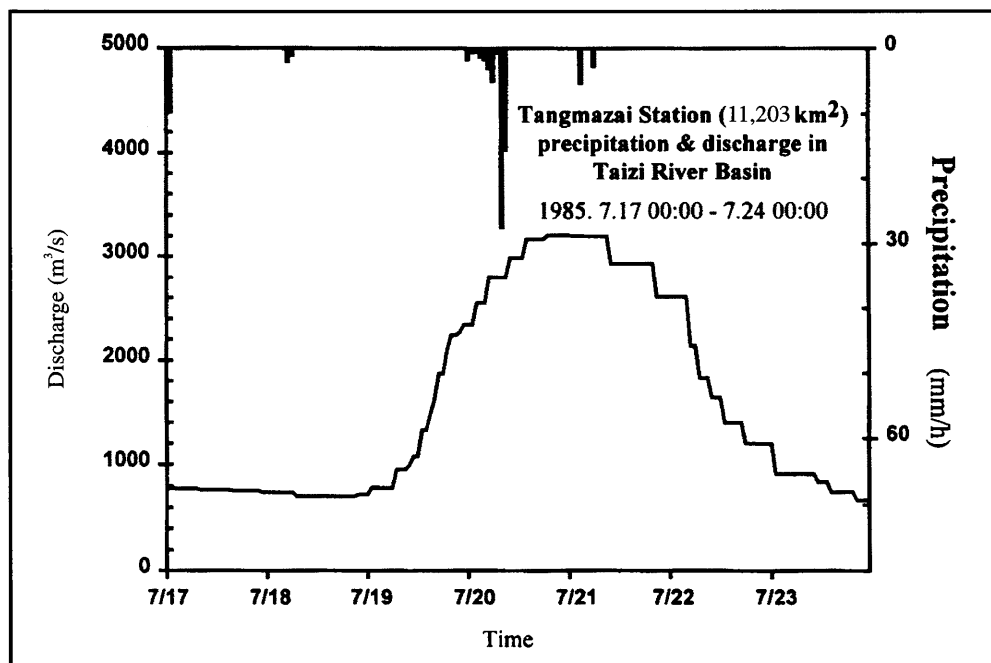
4.6 Annual Maximum and Minimum Discharges

At Tangmazai [11,203 km²]

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]
1970	8.05	1,610	5	5.4	1979	7.29	645	1	4.3
1971	8.04	3,660	2	9.0	1980	5.07	138	4	3.14
1972	10.30	234	7	5.6	1981	7.22	655	2	4.0
1973	7.20	1,210	2	4.49	1982	8.20	719	5	3.0
1974	10.25	550	9	5.28	1983	7.21	642	4	4.32
1975	8.01	2,250	12	9.49	1984	8.15	836	5	5.47
1976	7.31	305	1	7.19	1985	8.20	3,210	2	5.98
1977	8.05	814	2	7.6	1986	8.04	2,910	3	11.5
1978	5.19	195	12	3.45	1987	4.26	644	2	18.7

1), 2) Instantaneous observation by recording chart

4.7 Hyetographs and Hydrographs of Major Floods



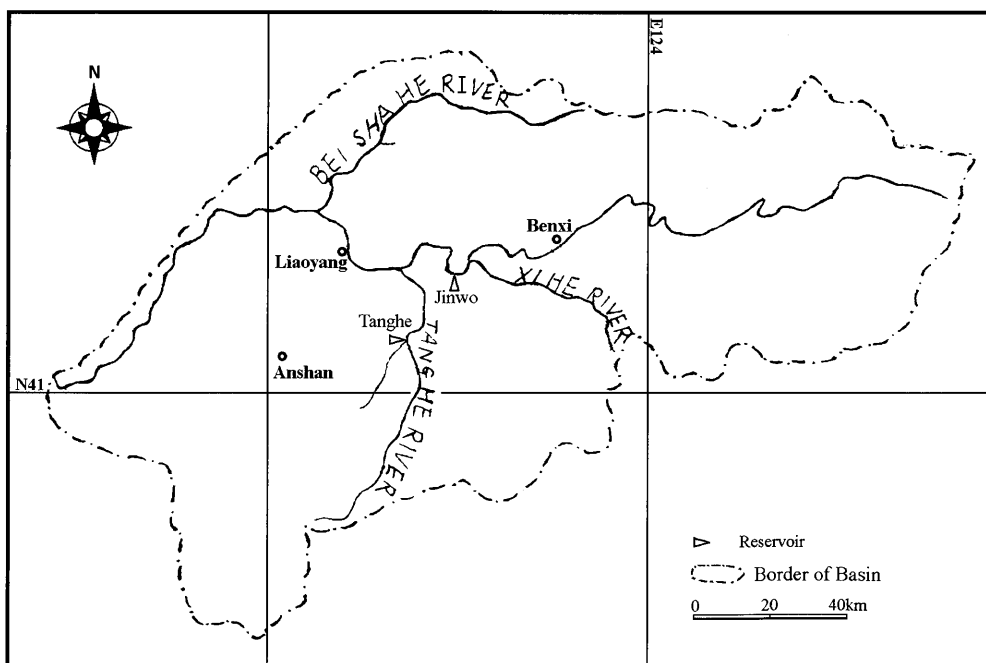
5. Water Resources

5.1 General Description

The Taizi is a tributary of Liaohe River in the Liaoning province. The river originates from the east and flows towards the southeast, joins Liaohe River at Sanchakou and out into the Bohai Bay. Along the river there are many diversion stations and transmission canals for irrigation purposes. Most of water diversions are gravity driven. The industrial water supply mainly depends on groundwater withdrawals. There are 7 reservoirs using Taizi River water, mostly built for irrigation and flood control. Two of them, Jinwo and Tanghe, were completed in 1972 and 1969 with capacities of $50 \times 10^6 \text{ m}^3$ and $52 \times 10^6 \text{ m}^3$ respectively. The average surface runoff is $3.68 \times 10^9 \text{ m}^3/\text{year}$. The water use rate reaches 54% of natural sources, which is much higher than the average of the province (24% only). The groundwater use rate (52.13%) is also higher than the average of the province (32.98%).

The climate is typical continental type. In summer (June - August), the precipitation is about 60~70% of annual total. The main factor causing floods is the high intensity precipitation in summer. During the 50 year period from 1935~1985, there were 3 occurrences of floods with discharges greater than $5,000 \text{ m}^3/\text{s}$ at Liaoyang station. The main river of downstream has been cleared for flooding since 1960's. It can pass a peak flood discharge of $5,000 \text{ m}^3/\text{s}$, which corresponds to a flood of twenty-year return period.

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
Taizi	Jinwo	6,175	791	533	P,F,A	1972
Tanghe	Tanghe	1,228	723	425	P	1969

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

5.4 Major Floods and Droughts

Major Floods at Tangmazai [Catchment area 11, 203 km²]

Date	Peak discharge [m ³ /s]	Rainfall [mm]. Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1935.7.29	10,400	166.3 7.20 ~ 29	Frontal	---	Liaoyang , Anshan etc.
1942.7.22	7,460	250 7.15 ~ 22	Frontal	---	Liaoyang , Anshan etc.
1960.8.4	18,100	471.4 8.2 ~ 4	Frontal	---	Liaoyang , Anshan etc.

Major Droughts

Period	Affected area	Major damages and counteractions
1957.5 ~ 6	Benxi City	Water supply cut ratio 10%
1987.6 ~ 8	Benxi City	Water supply cut ratio 15%
1988.6 ~ 8	Benxi City	Water supply cut ratio 15%
1989.5 ~ 9	Benxi City	Water supply cut ratio 30%

6. Socio-cultural Characteristics

Taizi means prince, son of emperor. It is said that a prince was relegated here in ancient times. He did a lot of things for reducing natural disasters, especially flood disasters. Anshan is widely known as the capital of steel. Anshan Steel Corporation was a famous enterprise during 1960's. The Constitution of Anshan Steel Corporation was confirmed by Mao Zedong and is used as the enterprise model in industry. A community of Korean nationals has formed its centre around Liaodong peninsula.

7. References, Databooks and Bibliography

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