

Luanhe (Luan He)

Map of River

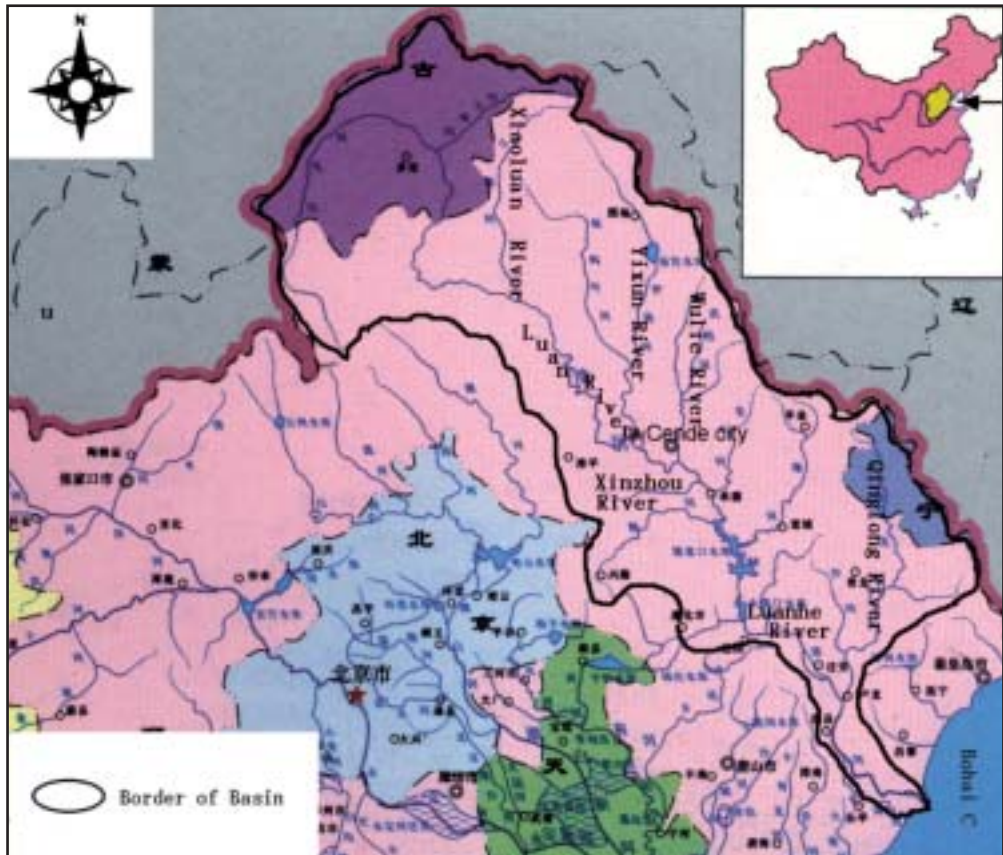


Table of Basic Data

Name(s): Luanhe (in Huanghe River)		Serial No. : China-13
Location: Hebei Province, Northern China	N 39° 27' ~ 42° 33'	E 115° 56' ~ 119° 08'
Area: 54,400 km ²	Length of the main stream: 888 km	
Origin: Mt. Bayantuguer (2,129 m)	Highest point: Mt. Bayan (2,129 m)	
Outlet: Bohai Bay	Lowest point: 5 m	
Main geological features: Massive intrusive rocks, group of hard massive metamorphic rocks		
Main tributaries: Xiaoluanhe, Xinzhouhe, Yixunhe, Laoniuhe, Qinglonghe, Baohe		
Main lakes: -----		
Main reservoirs: Panjiakou (2,930 × 10 ⁶ m ³ , 1975), Daheitin (473 × 10 ⁶ m ³ , 1973), Miaogong (183 × 10 ⁶ m ³ , 1962)		
Mean annual precipitation: 564 mm (1971 ~ 1990) (basin average)		
Mean annual runoff: 99.1 m ³ /s at Luanxian (44,100 km ²)		
Population: 3,509,600 (1998)	Main cities: Chengde, Qianan	
Land use: Forestry (21.8%), Rice paddy (6.0%), Other agriculture (29%), Urban (7.3%), Water surface (3.5%)		

1. General Description

The Luanhe River flows directly to the Bo Sea. Usually it is combined with the Haihe and is called the Hailuanhe, because both rivers are hydraulically connected. The Luanhe basin is mainly in Hebei province, with some flow coming from Inner Mongolia. The main river originates north of Mt. Bayanguer. The average annual precipitation is 564 mm. Annual discharge at the Luanxian station is 147 m³/s. From its source in Inner Mongolia it flows north into Hebei province. The general direction of Luanhe is from northwest to southeast. The river flows to the Bo Sea through Fengning, Chengde, Kuancheng, Qian'an, and Luan counties. The catchment area is 44,900 km² and the main channel length is 888 km. About 800 km² and 167 km of the river are in Inner Mongolia.

The average precipitation is 564 mm. Between 75% and 85% of the annual basin precipitation occurs in June-September. The coefficient of variation of annual precipitation is 0.27. The maximum annual precipitation is 3.5 times the minimum. The annual discharge at the Luanxian station is 147 m³/s.

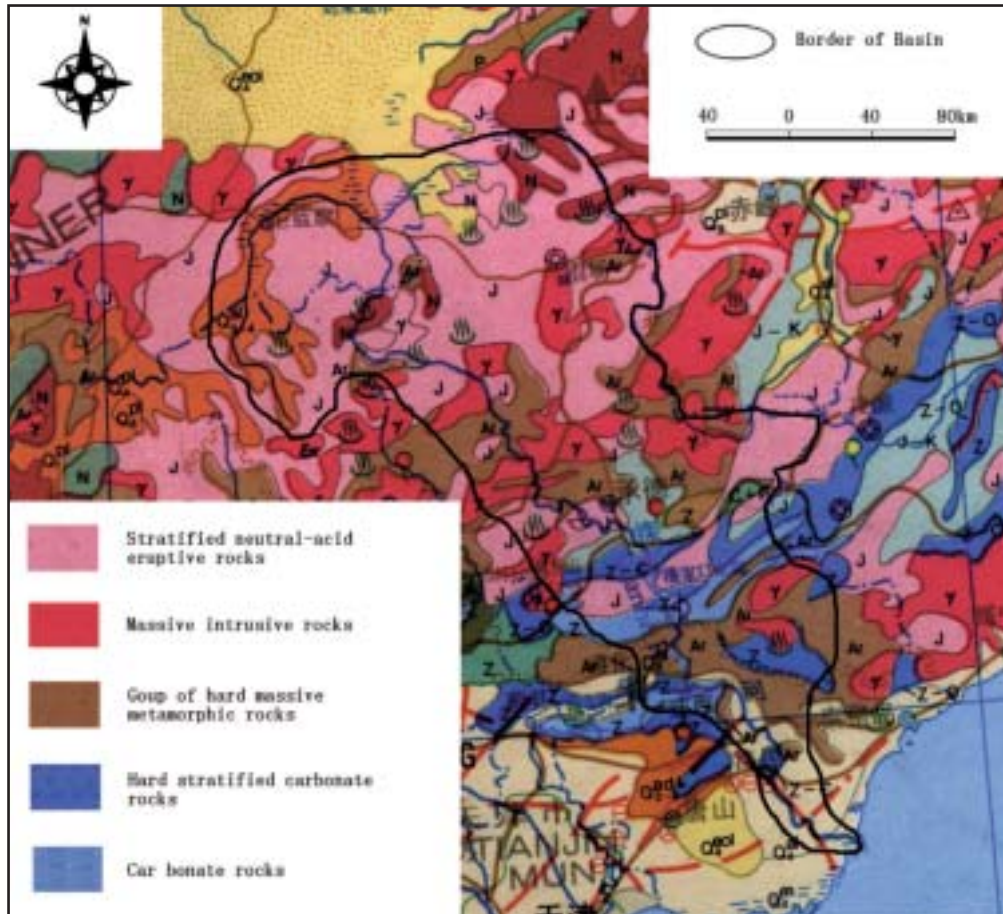
There are two large cascading reservoirs, the Panjiakou and the Daheting, located in the middle part of the Luanhe. To solve water shortages in Tianjin city, a water transfer project from the Panjiakou and Daheting reservoirs to Tianjin was constructed in 1983. Another water transfer project from the Luanhe to Tangshan city was completed in 1984.

Floods in the basin are often caused by summer storms of more than two days duration, e.g., in 1962 a serious flood was experienced in northern China including the Luanhe basin.

Irrigated agriculture is very important in the Luanhe basin. The difference in unit production with and without sufficient irrigation was 6,000 kg/ha in 1984. The cropping patterns are wheat, corn, bean, potato, paddy rice, etc. Grain is the main crop in the downstream reaches of the Luanhe.

2. Geographical Information

2.1 Geological Map

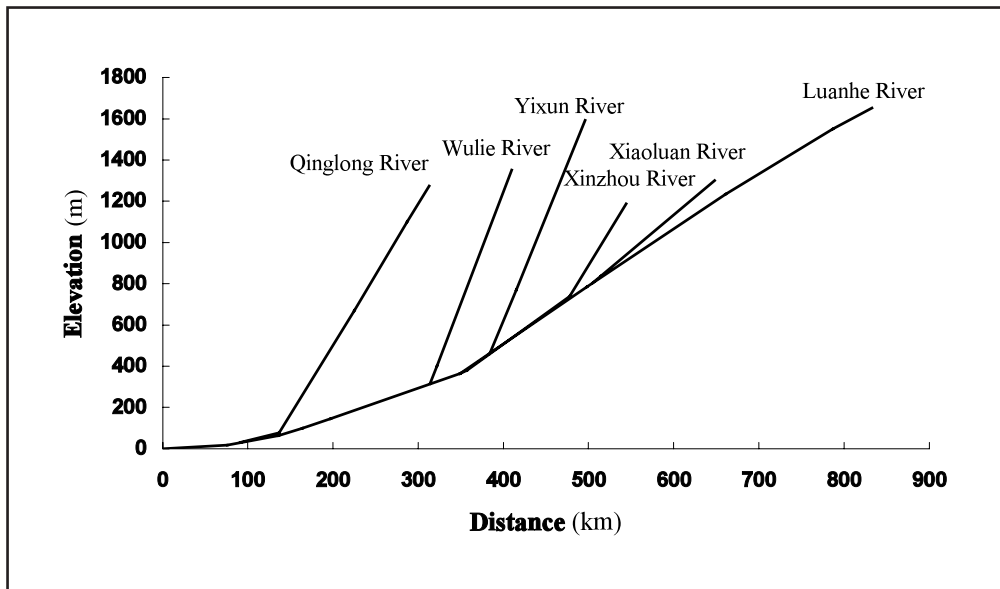


2.3 Characteristics of the River and the Main Tributaries

No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m] Lowest point [m]	Cities Population (1990)	Land use [%] (1985)
1	Luanhe (Main River)	888 54,400	2,341 365.8		F (21.8%) P (6.0%) OA (29%) U (7.3%) L (3.5%) O (31.4%)
2	Xiaoluanhe (Tributary)	143 2,070	1,420 1,117		
3	Xinzhouhe (Tributary)	112 2,070	1,150 758.5		
4	Yixunhe (Tributary)	195 7,060	1,450 752		
5	Qinglonghe (Tributary)	222 6,500	1,040 730		
6	Wuliehe (Main River)	96 2,200	1,410 438.2	Chengde 417,200	
7	Baohé (Tributary)	120 1,950	1,130 386		

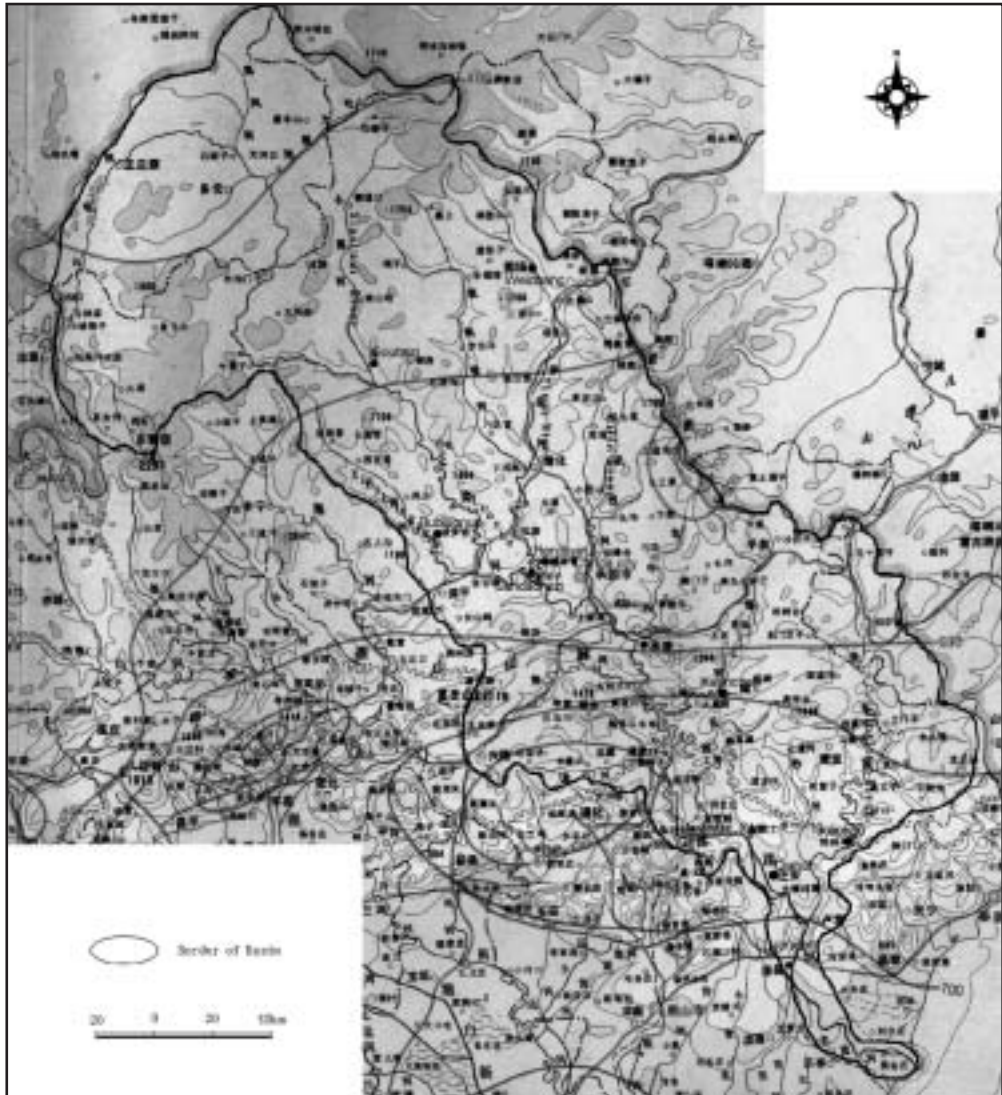
F: Forest L: Lake, River, Marsh P: Paddy Field OA: Other agricultural field (vegetable field, grass field)
U: Urban, O: Others (grass, bare land, oasis)

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⁾
5	Sandaohezi	380	N 40° 58' E 117° 42'	1953 ~ present	580	900	P (TB)
13	Luanxian	30	N 39° 44' E 118° 45'	1929 ~ present	699	1,100	P (TB), E
36	Chengde	320	N 40° 58' E 117° 56'	1934 ~ present	536	1,468	P (TB), E
24	Goutaizi	850	N41° 39' E 117° 03'	1958 ~ present	490	900	P (TB), E
25	Boluonuo	525	N 41° 06' E 117° 18'	1959 ~ present	570	900	P (TB), E
30	Hanjiaying	380	N 41° 01' E 117° 44'	1953 ~ present	570	930	P (TB), E
26	Weichang	850	N 41° 57' E 117° 46'	1934 ~ present	473	920	P (TB), E
41	Kuancheng	300	N 40° 37' E 118° 30'	1936 ~ present	673	1,000	P (TB), E
44	Taolinkou	98	N 40° 08' E 119° 03'	1956 ~ present	734	1,050	P (TB), E

Evaporation used with 20 Evaporation vessel

1) Period for the mean is from 1956 to 1979

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

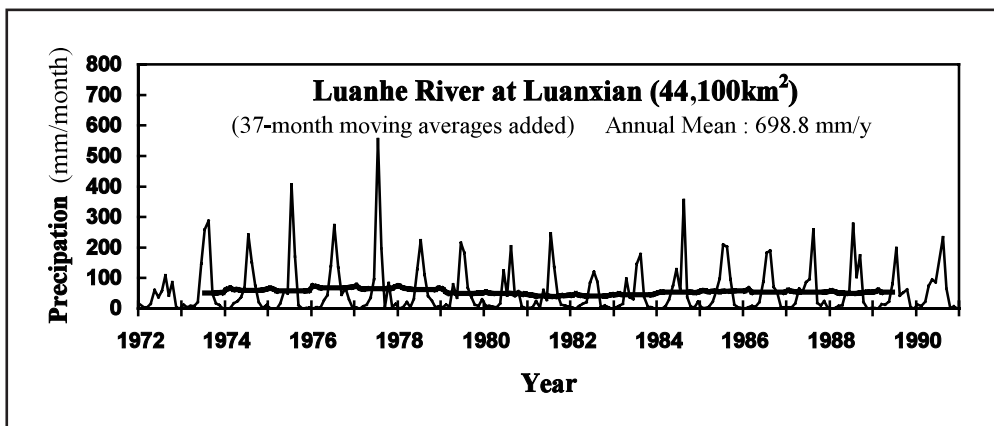
3.3 Monthly Climate Data

Station: Chengde

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	-9.3	-5.7	2.3	11.7	18.7	22.5	24.3	22.7	17.2	10.1	6.0	-7.1	9.4	1961~1990
Precipitation [mm]	2.1	4.8	8.3	21.2	44.5	83.2	144.1	136.2	50.3	18.9	6.0	2.1	521.7	1961~1990
Evaporation [mm]	26.9	37.8	96.7	191.7	259.6	237.8	188.8	156.4	131.5	100.2	49.4	28.2	1,505.1	1961~1990
Solar radiation [MJ/m ² /day]*	8.46	9.83	15.0	17.9	17.7	17.1	17.7	16.2	15.2	11.3	8.24	7.49	13.50	1982~1985
Duration of sunshine [hr]	200.1	203.7	251.1	257.7	286.3	271.3	237.8	239.6	248.3	235.8	199.0	184.1	2,814.8	1961~1990

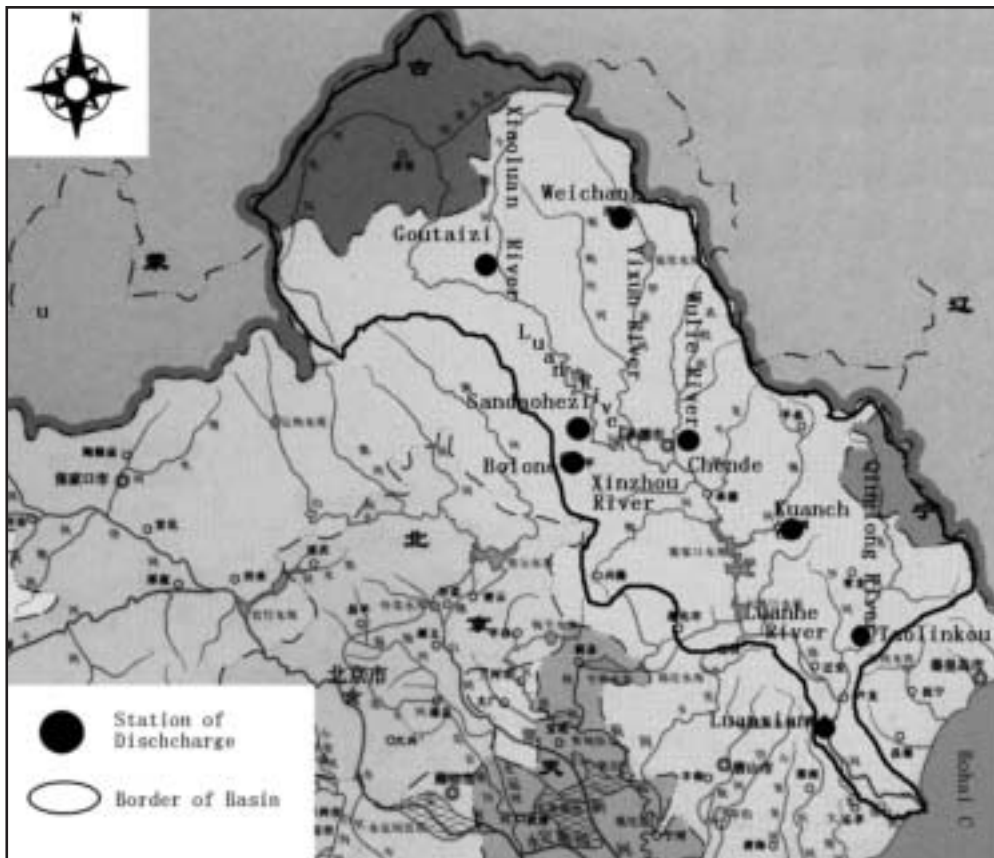
* Observed at Beijing.

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)
5	Sandaozezi	N 40° 58' E 117° 42'	17,100	1953 ~ present	H2, Q
13	Luanxian	N 39° 44' E 118° 45'	44,100	1929 ~ present	H2, Q
36	Chengde	N 40° 58' E 117° 56'	2,200	1934 ~ present	H2, Q
24	Goutaizi	N 41° 39' E 117° 03'	1,890	1958 ~ present	H2, Q
25	Boluonuo	N 41° 06' E 117° 18'	1,378	1959 ~ present	H2, Q
30	Hanjiaying	N 41° 01' E 117° 44'	6,761	1953 ~ present	H2, Q
41	Kuancheng	N 40° 37' E 118° 30'	1,661	1940 ~ present	H2, Q
44	Taolinkou	N 40° 08' E 119° 03'	5,250	1956 ~ present	H2, Q

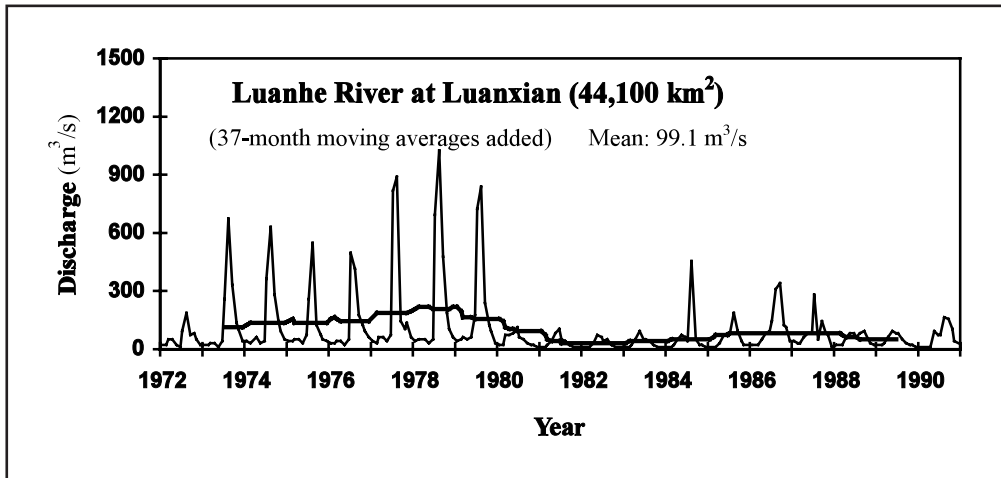
H2: water level by manual, Q: discharge

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]	Q_{max}/A [m ³ /s/100km ²]	Period of statistics
5	15.13	742	263	1.72	0.088	4.34	1972 ~ 1990
13	99.11	9,340	2,627	13.89	0.225	21.18	1972 ~ 1990
36	5.89	584	247	0.18	0.268	26.55	1972 ~ 1990
24	2.35	97.9	33.57	0.136	0.124	5.18	1972 ~ 1990
25	2.28	359	134	0.203	0.165	26.05	1972 ~ 1990
30	8.72	792	373	0.566	0.129	11.71	1972 ~ 1990
41	5.79	876	259	0.498	0.349	52.74	1972 ~ 1990
44	22.73	6,290	1,271	2.39	0.433	119.81	1972 ~ 1990

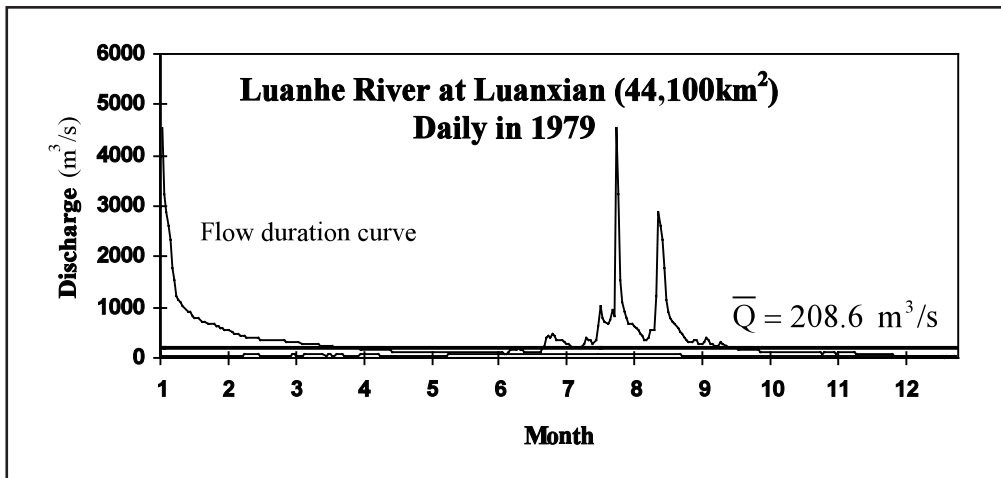
1) Mean annual discharge
3) Mean maximum discharge

2) Maximum discharge
4) Mean minimum discharge

4.3 Long-term Variation of Monthly Discharge Series



4.4 Annual Pattern of Discharge Series



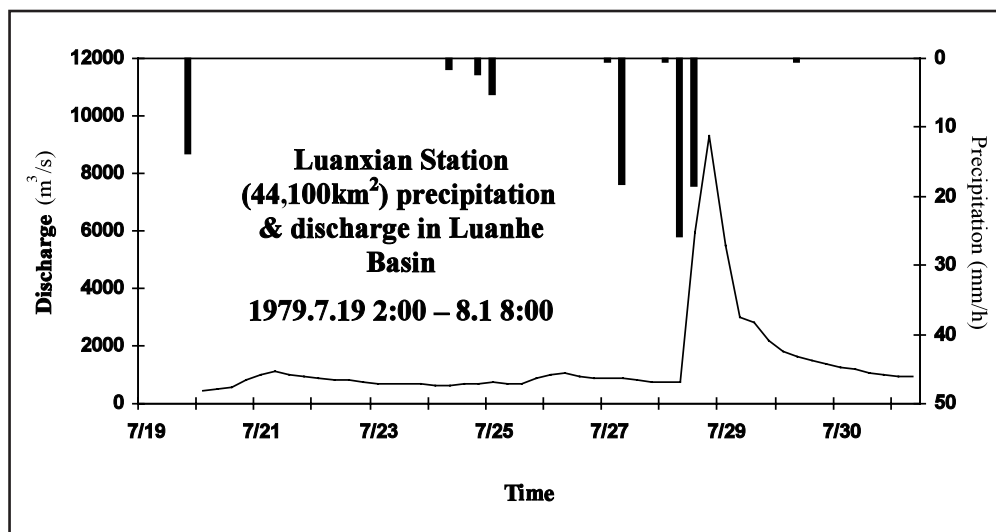
4.6 Annual Maximum and Minimum Discharges

Station: Luanxian (44,100 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]
1972	7.29	738	7	7.94	1982	8.07	159	1	4.49
1973	8.22	3,530	5	8.90	1983	8.07	217	11	4.48
1974	8.10	2,820	5	16.9	1984	8.10	8,850	1	4.71
1975	8.13	3,930	5	14.3	1985	8.26	952	4	8.10
1976	8.25	3,680	6	10.6	1986	9.09	879	1	14.5
1977	8.03	5,820	5	22.3	1987	7.05	795	2	21.8
1978	7.29	6,760	5	18.5	1988	7.01	241	1	15.1
1979	7.28	9,340	12	18.7	1989	7.20	183	12	10.2
1980	6.20	273	12	11.1	1990	8.14	453	4	44.8
1981	7.04	300	12	6.50					

1), 2) Instantaneous observation by recording chart

4.7 Hyetographs and Hydrographs of Major Floods



5. Water Resources

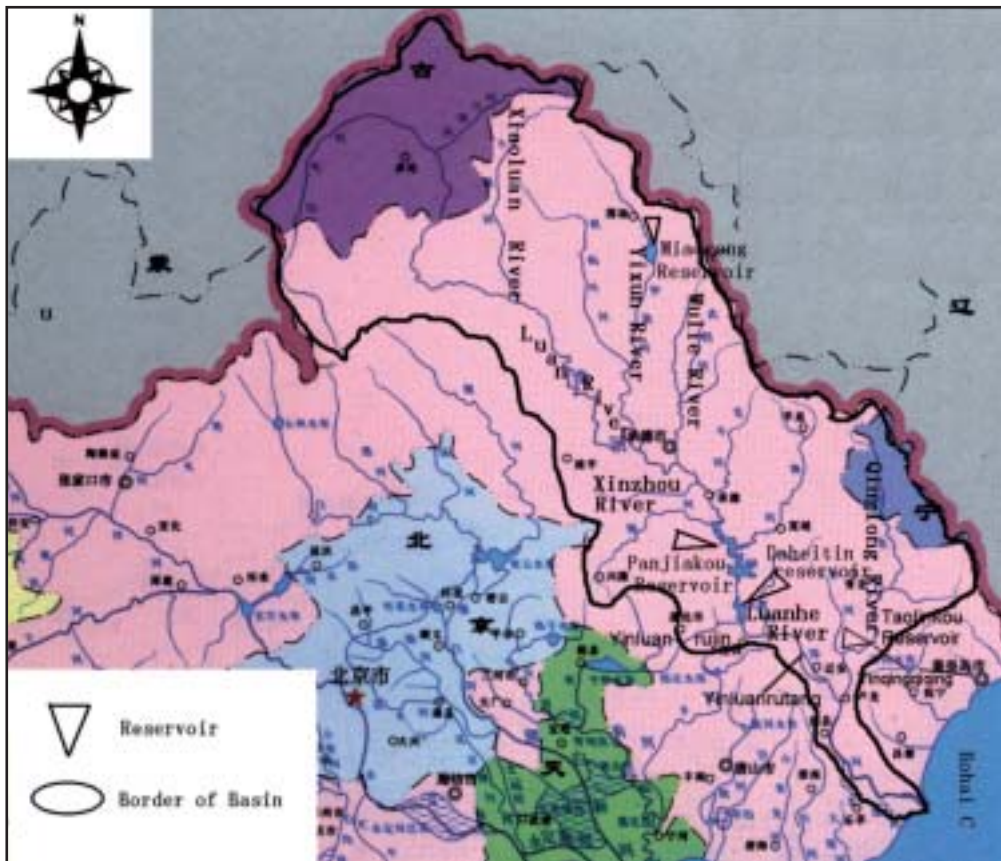
5.1 General Description

The Luanhe River flows directly to the Bo Sea. The main river originates in the mountains of Hebei province. In many documents, the Luanhe River is recognized as a part of the Hai or Hailuan river basins, one of the 7 largest river basins in China.

Between 75% and 85% of the annual basin precipitation occurs in June-September. The annual variation of precipitation is higher than most rivers in China. Floods, droughts and water pollution problems exist in the basin. Agriculture is the dominant land use in the basin. To solve water shortage problems in the nearby cities, three large-scale water transfer projects for domestic water supply have been constructed. Floods are mainly caused by storms in summer. Usually, floods are of short duration with high peaks. The flood volume over a 30-day period can be 60%-90% of the flood season discharge.

There are four large constructed reservoirs in the basin. Two on the main stream, the Panjiakou and the Daheitan, were completed in 1983 and 1984 with capacities of $2,390 \times 10^6 \text{ m}^3$ and $473 \times 10^6 \text{ m}^3$ respectively. The main purposes of the reservoirs are flood control, irrigation, and hydropower generation. In the channel of the upper and middle stream, potential hydropower is abundant. Currently, water supply to Tianjin and Tangshan is becoming the main objective. The Taolinkou reservoir is a key project in the Qinglonghe, a downstream tributary of Luanhe. Water from this reservoir can irrigate 45,000 ha with suitable canal projects. The water transfer from the Taolinkou reservoir to Qinghuangdao will basically solve the water shortage problems of this beach city.

5.2 Map of Water Resource Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of river	Name of dam	Catchment area [km ²]	Gross capacity [10 ⁶ m ³]	Effective capacity [10 ⁶ m ³]	Purposes ¹⁾	Year of completion
Luanhe River	Panjiakou	33,700	2,930	2,920	F, P	1975
Luanhe River	Daheitin	35,100	473	359	F, P	1973
Qinglonghe River	Taolinkou	5,060	2,083	1,613	F, P, S	2000
Yixunhe River	Miaogong	2,400	183	152	A, F, P	1962

1) F: Flood control P: Hydro-power A: Agriculture S: Water Supply

Major Inter-basin Transfer

Name of transfer line	Name of rivers and places connected		Length [km]	Maximum capacity [m ³ /s]	Purposes ¹⁾	Year of completion
	From	To				
Yinluanrujin	Luanhe	Tianjin	70	60	WS	1983
Yinluanrutang	Luanhe	Tangshan	27	80	WS	1984
Yinqingjiqin	Qinglonghe	Qinhuangdao		6	WS	2000

1) WS: Water Supply

5.4 Major Floods and Droughts

Major Floods at Luanxian (Catchment area 44,100 km²)

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and Missing	Major damages (Districts affected)
1977.7.25 ~ 27	5,820	493 7.25 ~ 7.27	Frontal rain	---	Chengde, Qianan City

Major Droughts

Period	Affected area	Major damages and counteractions
1972.3 ~ 8	Chengde, Kuanchang cities	Water supply cut to 66%
1984.3 ~ 4	Luanping, Kuanchang cities	Water supply cut to 30%

6. Socio-cultural Characteristics

Chengde city is located in the northern part of the Luanhe River basin. Near Chengde are large-scale royal constructions from the Qing Dynasty. The Summer Palace, also called the Bishu Shanzhuang in Chinese, is the most famous construction. It is in the north of Chengde city and was constructed in a mountainous area. During summer emperors of the Qing Dynasty resided at, and ruled from, the Summer Palace. Palace construction was begun in 1703 and completed in 1790. It includes 36 scenic points including artificial mountains, lakes, plains, forests, springs, and ancient constructions. The Summer Palace occupies twice the area of the comparable Beijing Summer Palace. The Chengde Summer Palace is also the largest, well-preserved, ancient royal construction in China. A lot of temples were also constructed around Chengde at about the same time as the Summer Palace was being built.

In Luanping and Weichang counties, in the upper reaches of the Luanhe, there are many royal antiquities, such as the Mulan hunting area, stone inscriptions, and temples.

Tangshan and Qinghuangdao are important coal mining and tourist cities in Hebei province. Both cities depend on water transferred from the Luanhe, even though they are not in the basin. Tangshan experienced an earthquake on the 28 July 1975 which killed 240,000 people. So the new Tangshan City is only 25 years old. Qinghuangdao is a famous tourism city with the Beidaihe, a summer vacation place, and the Shanhaiguan, the starting point of Great Wall in North China.

7. References, Databooks and Bibliography

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