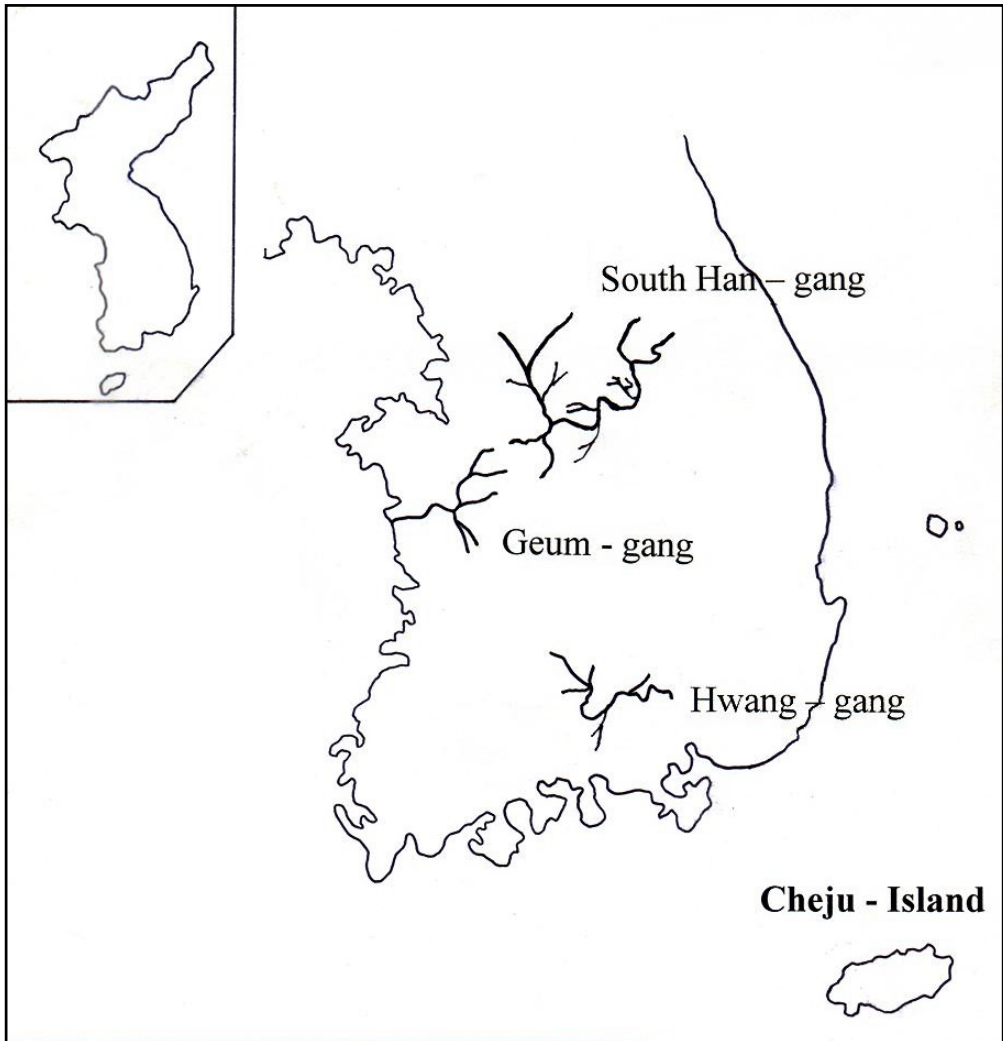


Republic of Korea

Korea-7: South Han-gang

Korea-8: Kwang-gang

Korea-9: Geum-gang



Introduction

The Korean peninsula, about 1 300 km long and 300 km wide, is located between the Yellow Sea and the East Sea on the eastern end of the Asian continent. The eastern coast line of the peninsula runs directly along the skirt of the steep mountain slope range, while the western and southern coast lines indicate curved shapes having wide alluvial plains in places. In general, rivers running to the eastern coast are short and steep in their riverbed gradients. Long stretching rivers with gentle slopes such as the Han River, the Geum River, the Nakdong River, and the Seomjin River, discharge to the southern or western coasts.

Korea is in the moderately humid zone of medium latitudes. It has a definite, seasonal climate which is greatly defined by dry, cold continental air masses during the winter, and humid warm air masses from the ocean during the summer. The average annual temperature is 14 °C (57 °F) along the southern coast, while it drops to as low as 11°C and 8°C (52°F and 46°F), respectively, over the mid and northern climatic zones. The yearly distribution of precipitation is determined by westerly and north-westerly dry winds from the Asian continent in the winter and south-easterly winds from the Pacific Ocean in the summer. Thus the rainfall is concentrated in the summer. Of the annual precipitation of 1 274 mm, approximately 66 % occur during the rainy season from June to September, 16 % during the transition period from April to May and the remaining 18 % during the six months from October to March. As of 1990, the population of Korea was 42 860 000 with a population density of 432 persons/km². Of a total land area 99 450 km², farm lands account for 21 379 km² while forest cover is about 63 762 km².

The three rivers catalogued in this volume are the Nam Han gang, the Hwang gang, and the Geum gang. They are also the representative rivers with typical hydrologic characteristics in Korea. The Nam Han gang joins the North Han River about 35 km upstream from Seoul, the Capital of Korea. It shows the characteristics of a typical forest basin covered by shadow well-drained soil layers. The Hwang gang is one of the main tributaries of the Nakdong River and is also a representative river flowing through forest, agricultural and urbanized areas of Kyongnam Province. It shows very typical conditions in water supply as well as in water quality. The Geum gang is one of the three main rivers of the country and runs through the central western part of the Korean Peninsula.

Acknowledgements

A working group was established for the preparation of the catalogue as part of the IHP project of 1995 which was supported by the Ministry of Construction and Transportation of the Republic of Korea. The working group members are as follows:

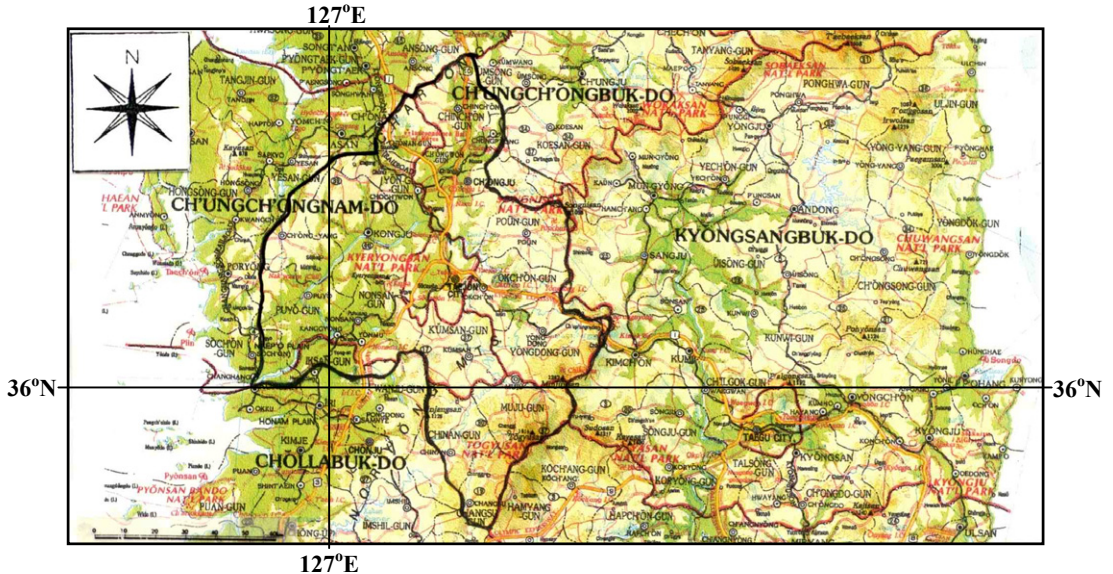
Lee, Soontak (Chair), Yeungnam University,
Ahn, Sang-Jin, Choongbuk University, and
Chun, Byung-Ho, Korea Military Academy.

The organizations which have contributed include:

River Planning Division, Water Resources Bureau, Ministry of Construction and Transportation,
Han River Flood Control Office, Ministry of Construction and Transportation,
Nakdong River Flood Control Office, Ministry of Construction and Transportation,
Geum River Flood Control Office, Ministry of Construction and Transportation,
Korea Water Resources Association, and
Korea Water Resources Corporation.

Geum-gang

Map of River



Geographical Survey, MOC Korea

Table of Basic Data

Name: Geum-gang		Serial No.: Korea – 9
Location: Chung Chong Province, Korea	N 35° 34' 47" ~ 37°03'03"	E 126° 40' 25" ~ 128°03'53"
Area: 9 885.80 km ²	Length of the main stream: 401.40 km	
Origin: Mt. Sin Mu (896.8 m)	Highest Pt.: Mt. Sin Mu (896.8 m)	
Outlet: West Sea (Yellow Sea)	Lowest Pt.: River mouth (-2.985 m)	
Main base rocks: Pre-cretaceous granitic rocks, granite gneiss & crystalline schists		
Main tributaries: Miho stream (1 860.9 km ²), Bo Chong stream (496.3 km ²)		
Main lakes: None		
Main reservoirs: Dae Chong Dam (1 490 × 10 ⁶ m ³ , 1980)		
Mean annual precipitation.: 1 293.2 mm (1969 ~ 1987) (basin average)		
Mean annual runoff: 273.10 m ³ /s at Gong Ju (6 836.9 km ²) (1970-1993)		
Population: 2 998 634 (1992)	Main cities: Tae Jon, Chong Ju	
Land use: Forest (63.7 %), Paddy fields (24.5 %), Urban areas (1.9 %), Others (9.9 %) (1988)		

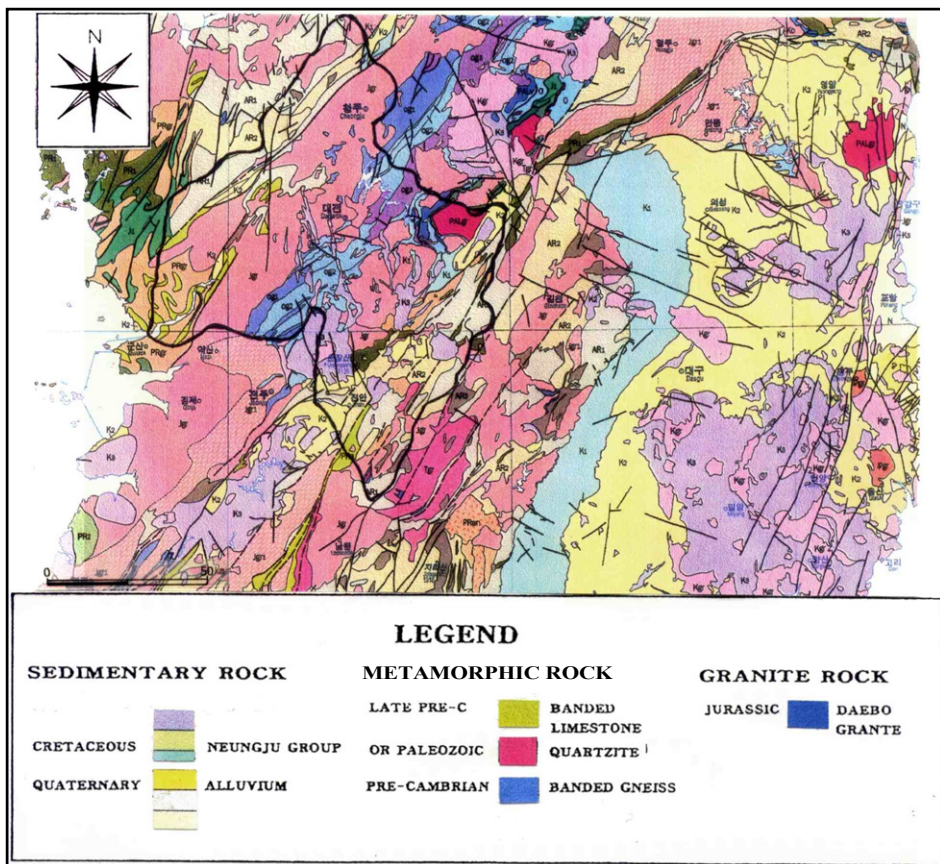
1. General Description

1.1. General Description

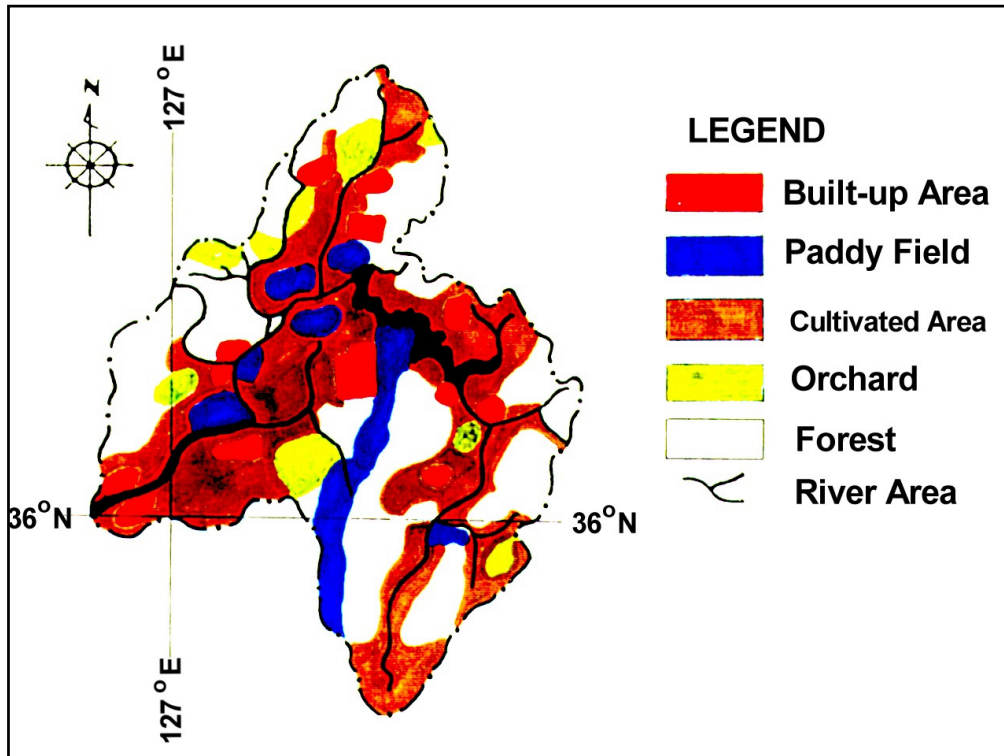
The Geum-gang is one of the three largest rivers in Korea. It flows through the central western part of the Korean Peninsula. The basin has a catchment area of 9 885.8 km² and the river, which is 401.4 km long, originates from Mt. Sin Mu (896.8 m) and flows to the West Sea. The average annual precipitation in the basin is 1 293.2 mm and the average annual runoff at Gong Ju (6 836.9 km²) is 273.1 m³/s. In 1992, the population in the basin was 2 998 634. Dae Chong multi-purpose dam, which has a storage capacity of 1 490x10⁶ m³ was constructed in 1980. The basin consists of relatively mountainous areas in the upper stream and well developed plain areas in the downstream of Dae Chong Dam. Tae Jon and Chong Ju are the urban areas of the basin, and the river can be considered as a typical urban stream in Korea.

2. Geographical Information

2.1. Geological Map



2.2. Land Use Map

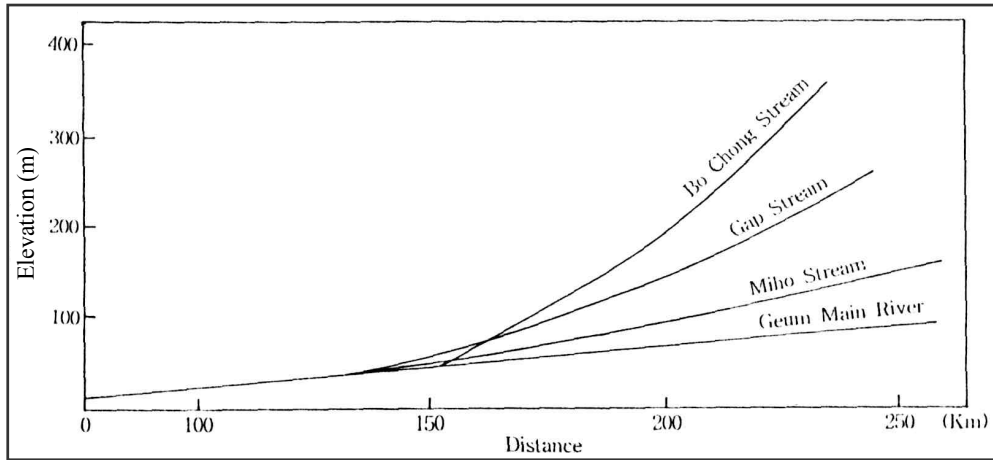


2.3. Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m]	Cities Population (1992)	Land use [%]
1	Geum-gang (Main river)	401.4 9 885.2	Mt. Sinmu 896.8	Whole area 2 998 634	F (63.7) P (24.5) U (1.9) A (-) L (-) O (9.9)
2	Miho stream (Tributary)	82 1 159.2	Mt. Mae 472	Chong Ju City 482 142	
3	Gap stream (Tributary)	62.8 646.6	Mt. Daedun 878	Tae Jon City 1 021 000	
4	Nonsan stream (Tributary)	53.6 655.1	Mt. Daedun 878	Non San City 178 358	
5	Bochong stream (Tributary)	65.5 541.0	Mt. Sokni 1 058	Poun City 63 774	
6	Cho stream (Tributary)	61.0 299.5	Chupungnyong 743	Young Dong City 63 014	
7	Namdae stream (Tributary)	52.1 461.3	Mt. Minju 1 242	Mu Ju City 49 750	

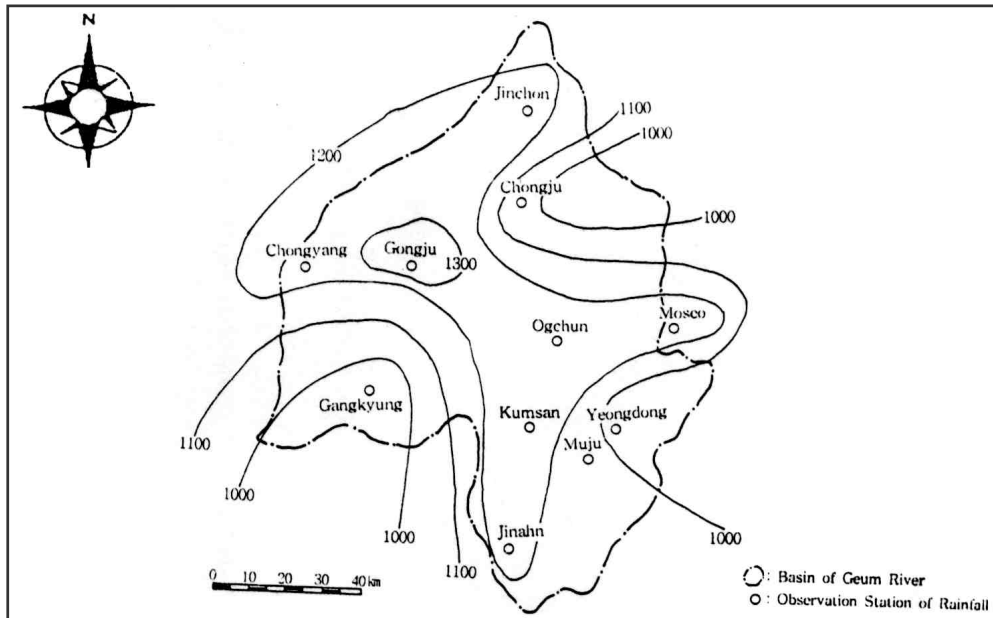
F : Forest L: Lake, river, marsh P: Paddy field U : Urban; O: Orchard A : Agricultural field (vegetable field, grass field)

2.4. Longitudinal Profiles



3. Climatological Information

3.1. Annual Isohyetal Map and Observation Stations



Based on the data of Ministry of Construction

3.2. List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation ¹⁾ [mm]	Mean annual evaporation ²⁾	Observation items
202*	Gong ju	10.0	N 36°27' 20" E127° 07' 20"	1913~present	1 321.4	1 124.1	P(TB)
208*	Jinchun	70.0	N 36° 46' 45" E127° 27' 32"	1973~present	1 229.4		P(TB)
219*	Chong ju	15.0	N 36° 01' 34" E127° 29' 03"	1993~ present	1 250.5	1 056.5	P(TB)
223*	Ogchun	80.0	N 36° 05' 21" E127° 34' 33"	1931~present	1 257.0		P(TB)
239*	Muju	230.0	N 36°00' 35" E127° 40' 00"	1916~present	1 141.3		P(TB)
244*	Jinan	290.0	N 35° 47' 17" E127° 25' 31"	1916~present	1 230.9		P(TB)
248*	Gangkyung	48.0	N36° 09' 17" E127° 00' 43"	1911~present	998.4		P(TB)
200*	Chongyang	100.0	N 36° 27' 00" E126° 48' 32"	1929~present	1 224.2		P(TB)
236*	Moseo	220.0	N 36° 20' 25" E127° 57' 42"	1962~present	1 249.6		P(TB)
**	Yeongdong	110.0	N 36° 11' 00" E127° 47' 00"	1960~present	1 048.7		P(TB)
**	Kumsan	163.0	N 36° 06' 00" E127° 30' 00"	1962~present	1 277.3		P(TB)

* : Serial number used by Ministry of Construction and Transportation

** : Weather Office, Korea Meteorological Agency

P: Precipitation, TB: Tipping bucket with recording chart

1) Period for the mean is from the beginning of the observation period to 1992

2) Measured by 20 cm pan

3.3. Monthly Climate Data

Station: Taejon

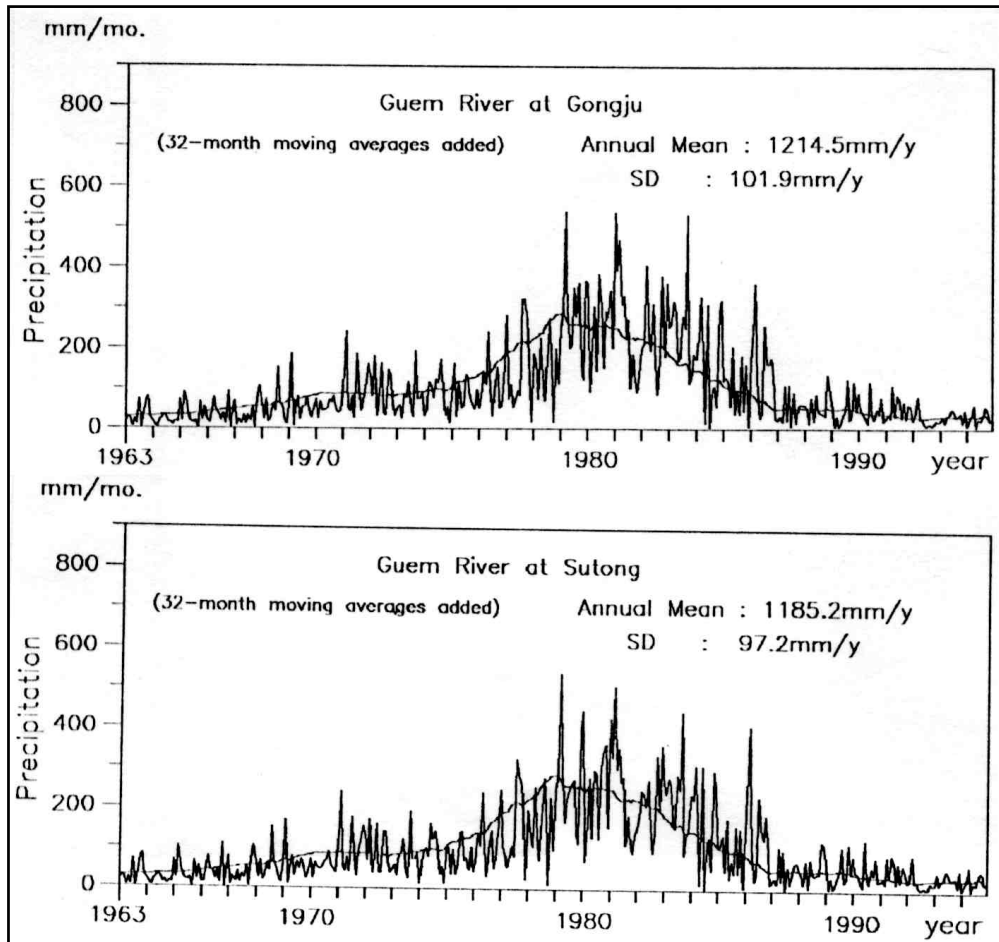
Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	-2.3	-0.1	4.9	12.2	17.5	21.9	24.5	25.4	20.2	13.6	6.5	0.9	12.2	1970~1991
Precipitation [mm]	33.9	42.9	64.7	95.7	96.9	164.3	320.8	275.9	156.9	56.7	50.5	32.0	1 391.1	1970~1991
Evaporation [mm]*	35.9	45.1	79.8	119.4	147.4	140.1	121.4	130.7	102.3	80.9	46.5	36.4	1 086.9	1980~1991
Duration of sunshine[hr]	153.6	149.2	197.2	219.6	241.3	199.7	161.1	190.3	182.0	199.9	149.4	143.5	2 186.6	1970~1991

Station: Chongju

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	-3.4	-0.8	4.5	11.9	17.5	21.9	25.1	25.3	19.9	13.0	5.7	-0.7	11.7	1970 ~1991
Precipitation [mm]	30.8	33.3	55.7	83.6	89.1	153.2	303.3	240.7	150.7	49.8	50.1	28.3	1 268.6	1970 ~1991
Evaporation [mm]*	31.9	42.0	74.5	115.8	143.1	142.8	121.6	132.0	100.8	76.2	43.2	34.1	1 058.0	1980 ~1991
Duration of sunshine[hr]	160.4	153.1	199.4	220.8	243.5	198.9	165.7	191.7	181.7	198.1	150.5	150.6	2 213.9	1970 ~ 1991

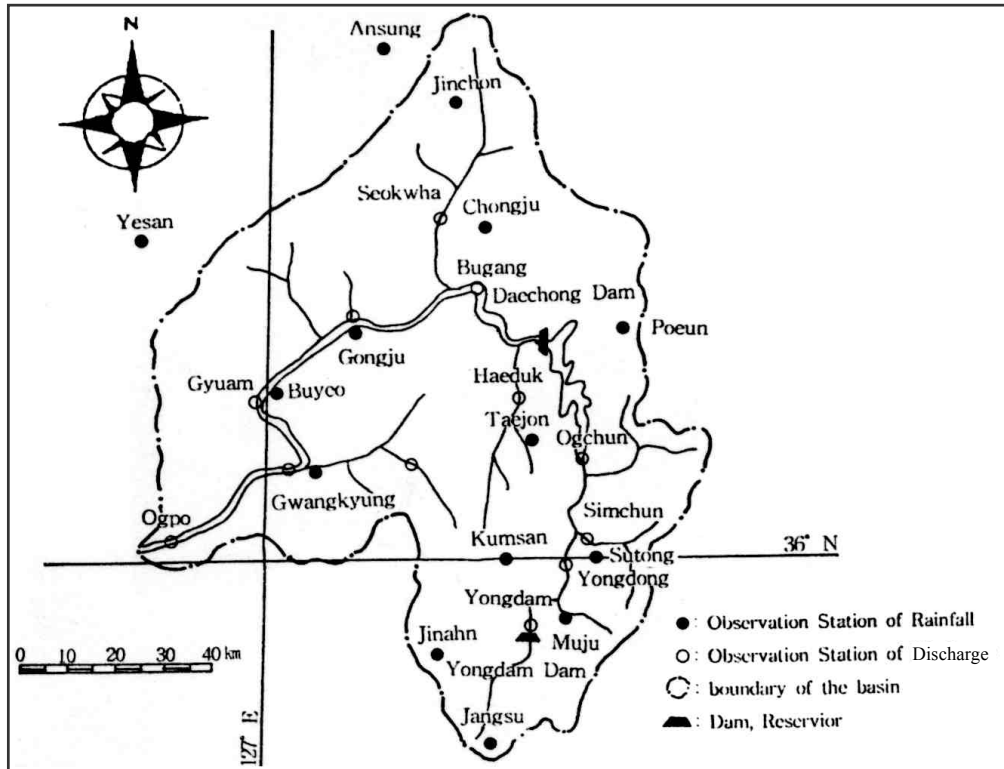
*measured by 20 cm pan

3.4. Long-term Variation of Monthly Precipitation Series



4. Hydrological Information

4.1. Map of Streamflow Observation Stations



4.2. List of Hydrological Observation Stations

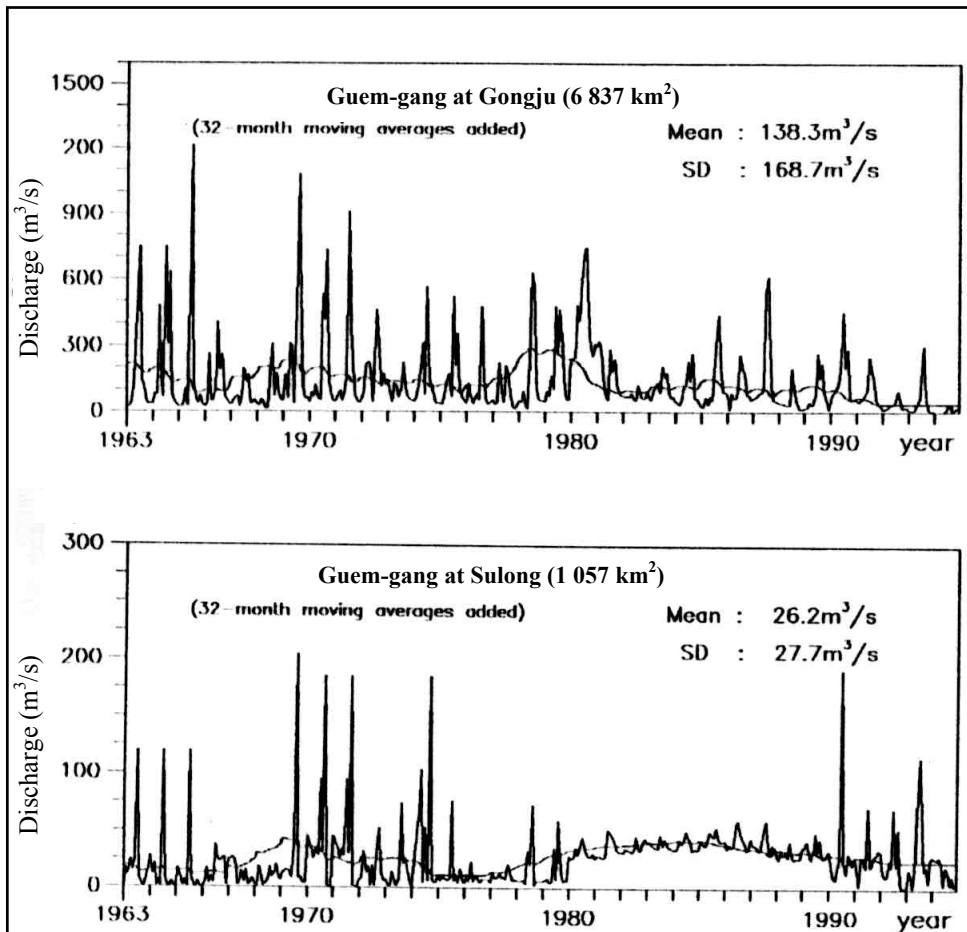
No. *	Station	Location	Catchment area (A) [km ²]	Observation Period	Observation Items (frequency)
124*	Gyuam	N 36° 15' 23" E 126° 53' 37"	8 152.3	1915~95	H1
140*	Gongju	N 36° 27' 52" E 127° 07' 38"	6 836.9	1915~95	H1
129*	Seokwaha	N 36° 37' 11" E 127° 21' 15"	1 180.0	1918~95	H1
29*	Ogchun	N 36° 16' 09" E 127° 39' 06"	2 843.0	1979~present	H1
145*	Sutong	N 36° 02' 48" E 127° 35' 52"	1 056.6	1962~present	H1
146*	Yongdam	N 36° 57' 44" E 127° 36' 47"	909.5	1962~present	H1

No.	$\bar{Q}^{2)}$ [m ³ /s]	$Q_{\max}^{3)}$ [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
124*	9.00	4 583.60	1 895.50	0.06	0.11	56.22	1970~1994
140*	273.10	5 363.00	4 126.30	3.15	3.99	78.44	1970~1994
129*	49.50	1 142.50	193.00	4.83	2.66	96.822	1970~1994
145*	3.50	2 912.70	1 173.10	-	0.33	275.70	1970~1994
146*	16.46	1 703.30	684.00	8.98	1.81	187.30	1970~1994

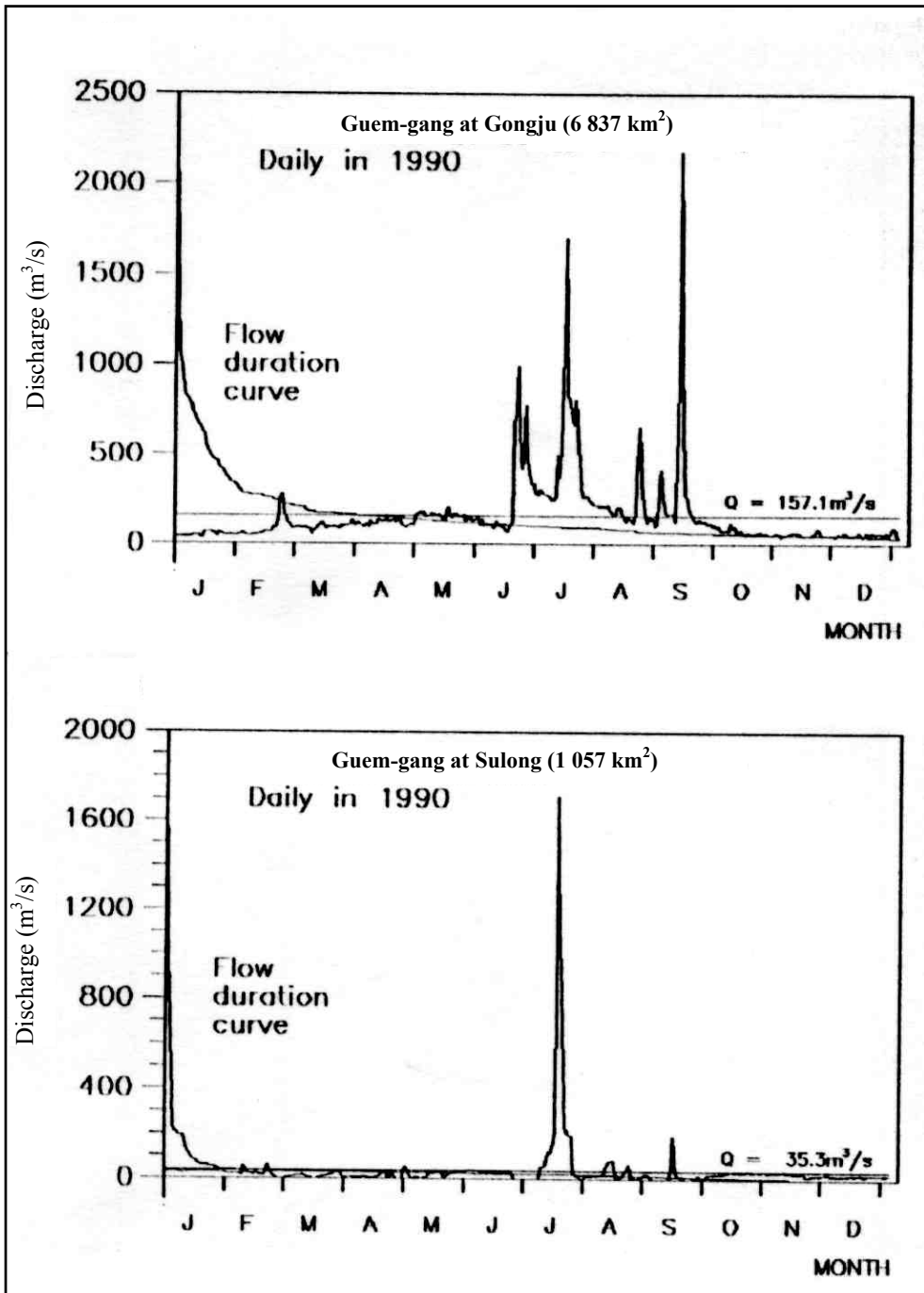
*: Serial number used by Ministry of Construction
H1: water level in recording chart,

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

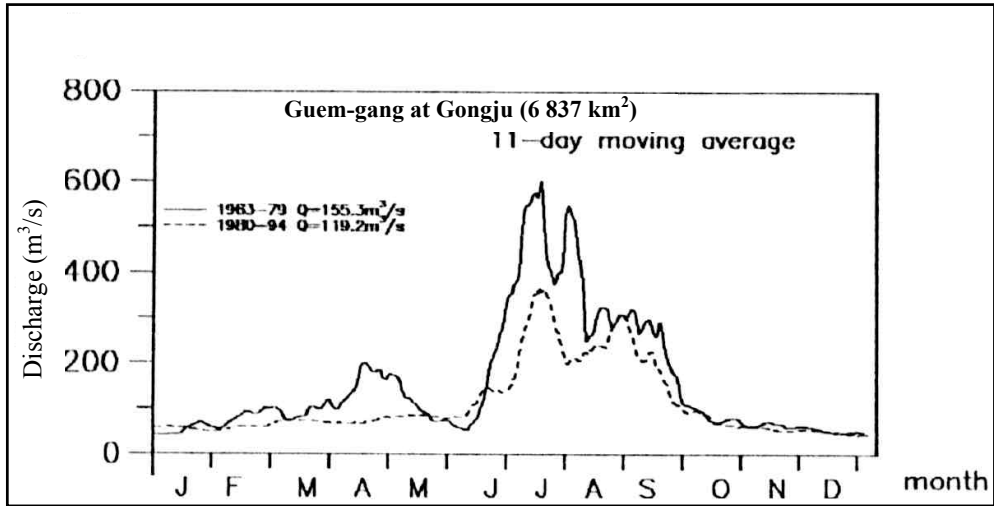
4.3. Long-term Variation of Monthly Discharge Series



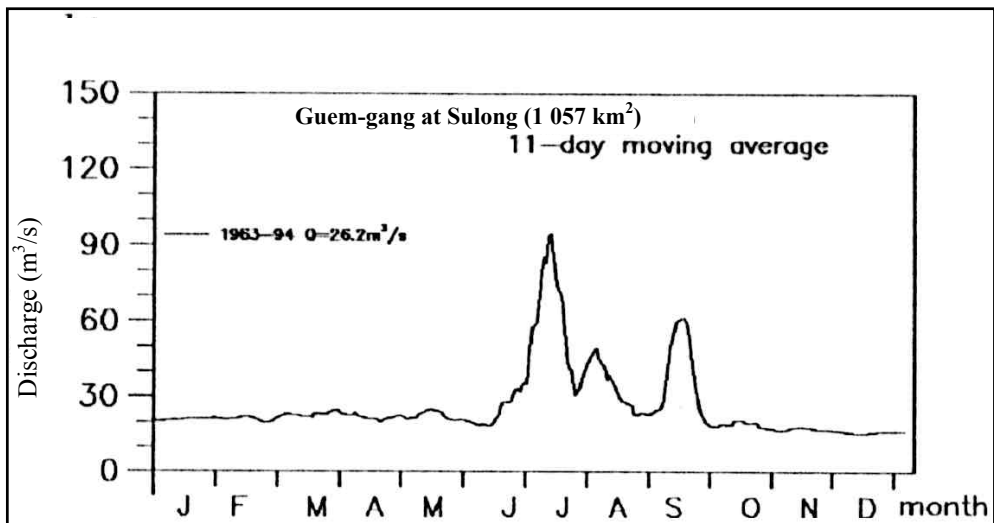
4.4. Annual Pattern of Discharge Series



4.5. Unique Hydrological Features



Note that Daechong Dam was constructed in 1880.



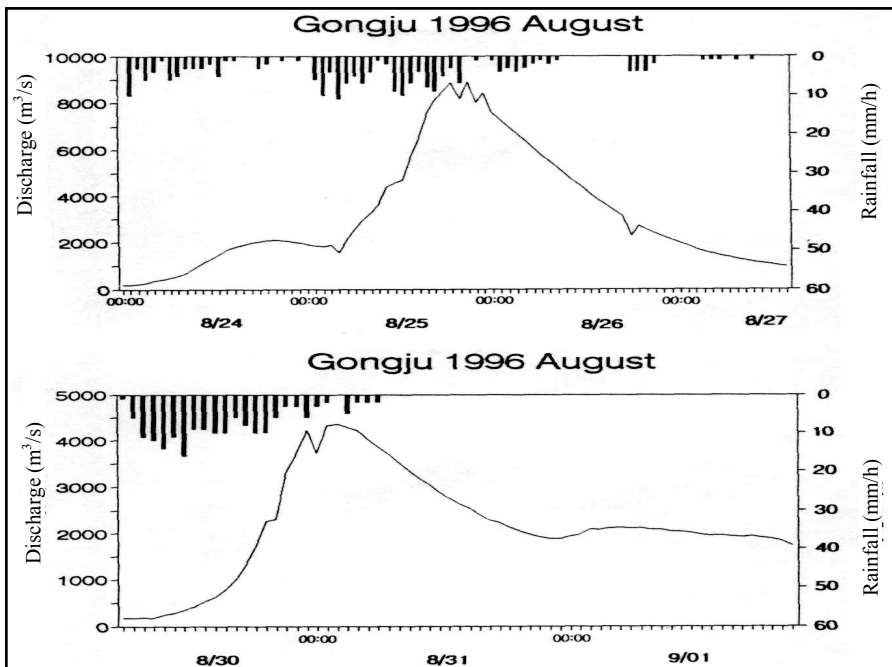
Note that Daechong Dam was constructed in 1880.

4.6. Annual Maximum and Minimum Discharges

At Gongju (6 836.9 km²)

Year	Maximum		Minimum		Year	Maximum		Minimum	
	Date	Discharge [m ³ /s]	Month	Discharge [m ³ /s]		Date	Discharge [m ³ /s]	Month	Discharge [m ³ /s]
1963	5.31	4 375.81	1	13.86	1979	6.26	5 070.69	1	47.06
1964	8.9	3 300.34	12	16.22	1980	7.23	2 670.98	11	42.99
1965	7.23	5 303.86	3	8.49	1981	8.30	1 782.95	6	13.94
1966	7.24	4 362.84	1	22.42	1982	7.21	1 238.70	7	4.50
1967	8.17	1 033.89	10	10.61	1983	7.20	1 371.89	2	32.41
1968	7.17	2 071.13	5	0.34	1984	9.3	3 285.78	12	7.27
1969	8.8	5 972.11	6	4.43	1985	9.20	5 095.30	5	0.00
1970	8.8	3 417.62	1	36.61	1986	7.19	2 437.30	2	0.54
1971	7.27	4 164.26	12	40.37	1987	7.23	7 027.07	12	15.72
1972	8.20	79.81	6	11.70	1988	7.15	1 593.61	12	0.28
1973	8.4	2 386.18	3	30.74	1989	7.28	4 755.66	1	1.17
1974	7.9	3 453.20	12	26.42	1990	9.12	3 555.33	1	18.58
1975	7.7	2 278.69	1/5	29.63	1991	7.26	1 630.63	11	7.91
1976	8.31	1 856.01	11/5	25.39	1992	8.28	1 346.40	7	1.17
1977	8.9	2 327.24	11/5	0.05	1993	8.9	1 734.62	12	4.11
1978	8.20	5 362.97	6/5	0.18	1994	8.29	639.29	12	86.28

4.7. Hyetographs and Hydrographs of Major Floods



Based on the data of Ministry of Construction and transportation

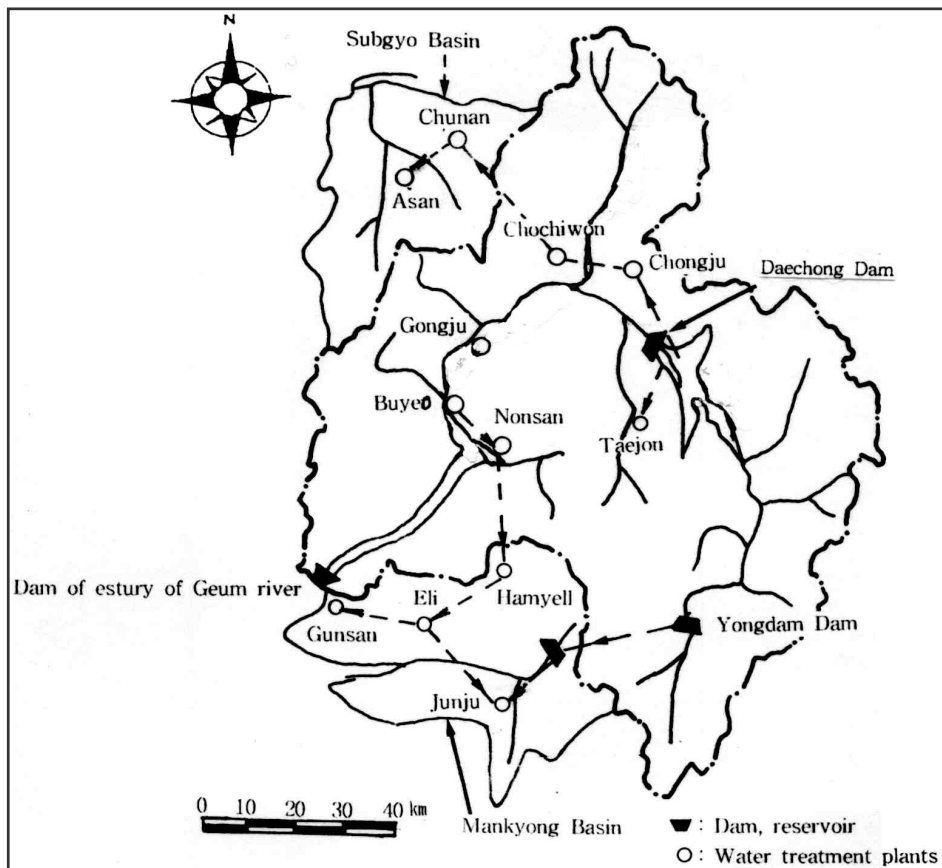
5. Water Resources

5.1. General Description

The Geum-gang, which has a catchment area of 9 885.8 km² consists of mountainous areas in the upstream and a plain area in the downstream. The agricultural and forest areas in the basin respectively occupy about 63.7 % and 24.5 % of the total area. The dry weather flow in the river is very small whereas the flood flow in the rainy season can be substantial. The Daechong Reservoir provides almost all the drinking water needs of the large cities located in the upstream of the basin.

The demands for drinking water in Taejon and Chongju, which are the largest cities in the watershed are about 400 000 m³/day and 150 000 m³/day respectively. The raw water from Daechong Reservoir is treated in four treatment plants before it is delivered to the consumers. The Daechong Reservoir, which is multi-purpose, has a gross storage capacity of about 1 490 x10⁶ m³, a flood control capacity of about 250x10⁶ m³ and an annual energy output of about 240 x10⁶ kWh. The dam is located 12 km northeast of Taejon. Drinking water for cities such as Buyeo, Junju and Gusan, downstream of the dam, are provided directly from the river via the Buyeo water treatment plant.

5.2. Map of Water Resources 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]	Purpose ¹⁾	Year of completion
Geum(main)	Daechong	4 134	1 490	790	F,A,I,W,P	1980

Major Interbasin Transfer

Name of transfer line	Name of rivers connected		Length [km]	Maximum capacity[m ³ /s]	Purpose ¹⁾	Year of completion
	From	To				
Chongju - Intake tower	Daechong Dam	Jibuk Filter Plant				
Daechong wide area watersupply	Daechong Dam	Chunan	89.80	2.89	W	1988
Daechong wide area water supply	Daechong Dam	A-san	115.0	11.34	W	1985
Geumriver wide area water supply	Bu-yeo	Gunsan Junju	126.03	3.47	W	2000
Junju systematical wide area water supply	Yongdam Dam	Junju Gunsan	93.4	8.10	W	1998

1) F: Flood control; A: Agricultural use; I: Industrial use; W: Municipal water supply, P: Hydro-electric power.

5.4. Major Flood and Drought Experiences

Major Floods at Gongju (Catchment area 6 8346.9 km²)

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration Period	Meteorological cause	Dead and missing	Major damages (Districts affected)
1970. 7.21	1 950.00	424 7.21 ~22	Storm	80 19	Poun
1987. 7.21	7 510.26	344 7.21 ~23	Storm	1 -	Chongju, Chongwon
1988. 7.13	1 945.82	180 7.13 ~15	Storm	- -	Gongju
1987. 9.9	1 296.98	54 9.10 ~11	Storm	- -	Buyeo
1995. 8.29	2 862.00	184 9.30	Storm	- -	Taejon

Major Droughts

Period	Areas affected	Major damages and counteractions
1977 January ~ July	Youngdong Poun	Crop damage 10%
1981 ~ 1982	Gongju	Supply cut ratio at the first stage: 10%
1981 May ~ September	Poun	Supply cut ratio at the first stage: 10%
1987 ~ 1988	Youngdong Poun	Crop damage 10%
1994 ~ 1995	Muju Youngdong	Supply cut ratio at the first stage: 30%

5.5. Groundwater and Water Quality

River Water Quality¹⁾ at Gongju Bridge²⁾, 1995

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH	7.4	7.2	7.2	7.5	7.5	7.7	7.3	7.3	6.9	7.6	7.5	7.1
BOD [mg/l]	5.6	5.2	4.2	6.2	5.2	5.1	6.2	3.8	2.5	5.2	3.9	2.9
COD _{Mn} [mg/l]	7.2	6.2	7.0	8.0	9.1	8.5	6.8	7.1	5.9	7.1	4.7	5.5
SS [mg/l]	11.8	15.2	13.5	15.5	15.5	15.5	15.1	7.2	6.8	6.9	7.1	7.7
Coliform group ³⁾ [MPN/100 ml]	3.7× 10 ³	4.7× 10 ²	4.3× 10 ²	4.5× 10 ²	4.5× 10 ²	5.1× 10 ²	2.7× 10 ²	1.6× 10 ²	1.7× 10 ²	183	660	907
Discharge [m ³ /s] ⁴⁾	29.35	25.55	26.36	24.54	32.82	67.14	52.34	110.31	90.16	36.83	7.85	18.94

1) Observed once a month on a dry day normally several days after rainfall.

2) Located near Chongju City 12km from the river mouth.

3) Measurement method: BGLB (brilliant green lactose bile) method.

4) Discharge on the water quality observation date.

6. Socio-cultural Characteristics

The Geum-gang is located in the mid-west of the country. It plays a very important role in the main transport systems in the country (Seoul-Pusan highway, Seoul-Taejon highway, Seoul-Pusan railway and Seoul-Kwangju railway). Taejon, which is the capital city of the Chung Nam province is also the centre of administrative, economic, social and cultural activities in the middle part of the country. The city hosted the 1993 EXPO, and it has eight administration halls of administrative organizations in the country. Chongju, which is the capital city of the Chungbuk province, is the centre of political, economic, social and cultural activities in the middle part of the country. The city has two impressive museums where an antique first metal printing letters in the world are preserved.

7. References, Databooks and Bibliography

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