

Nam Han-gang

Map of River

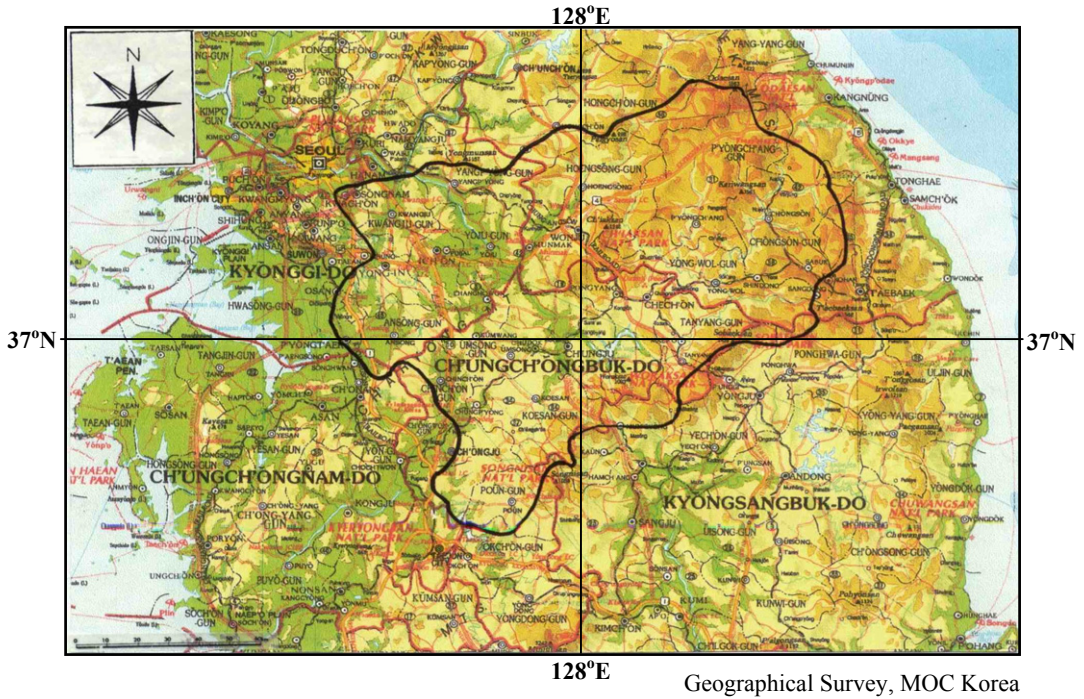


Table of Basic Data

Name: Nam Han-gang		Serial No.: Korea – 7
Location: Chungbuk Province, Korea	N 36°29'10"~37°49'08"	E 127°17'46"~129° 01'07"
Area: 12 343.7 km ²	Length of the main stream: 359.1 km	
Origin: Mt. Odae (1 563m)	Highest Pt.: Mt. Kebang (1 577 m)	
Outlet: Main Han River	Lowest Pt.: River mouth (2.066 m)	
Main geological features: Ordovician to Middle Mesozoic, Precambrian Basement Rock, Granite		
Main tributaries: Pyunchang River (1 781 km ²), Dalcheon River (1 625 km ²), Som River (1 485 km ²)		
Main lakes: None		
Main reservoirs: Chungju reservoir (2 750 × 10 ⁶ m ³ , built in 1985)		
Mean annual precipitation: 1 221 mm (1973~90)		
Mean annual runoff: 660.6 m ³ /s at Yeosu (11 104 km ²) (1963~94)		
Population: 831 000 (1994)	Main cities: Chungju, Wonju, Chechon	
Land use: Forest (73.5 %), Rice paddy (15.3 %), Others (11.3 %) (1991)		

1. General Description

The Han River consists of two tributaries, the North Han and the Nam (South) Han, which join about 35 km upstream from Seoul, the Capital City of Korea.

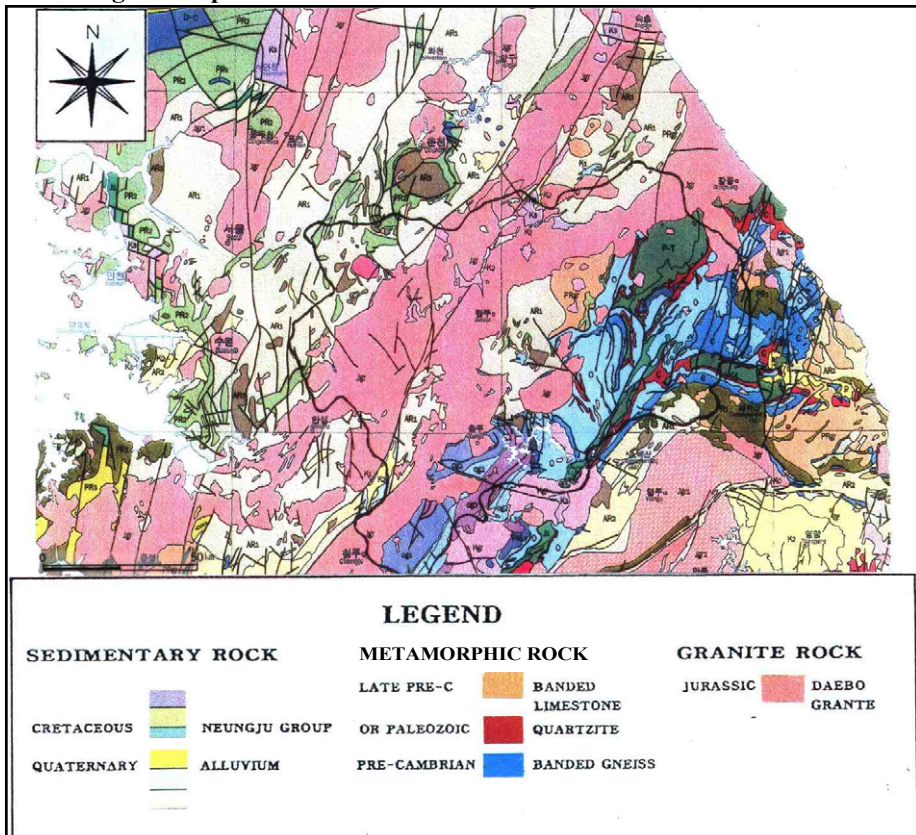
Descending from the high mountains with altitudes ranging from 1 000 ~ 1 500 m in the middle part of the Korean Peninsula, the Nam Han-gang runs southwards for about 230 km and reaches to the Chungju multi-purpose dam. Then it runs down north-westward for about 120 km and meets the Paldang dam and the North Han River.

The Nam Han-gang has a catchment area of 12 343.7 km² and a length of about of 359 km to the farthest point from the origin at Mt. Odae (1 563 m). The gradient of the river bed is 1/1 2000~1/230 and the width is about 600 m.

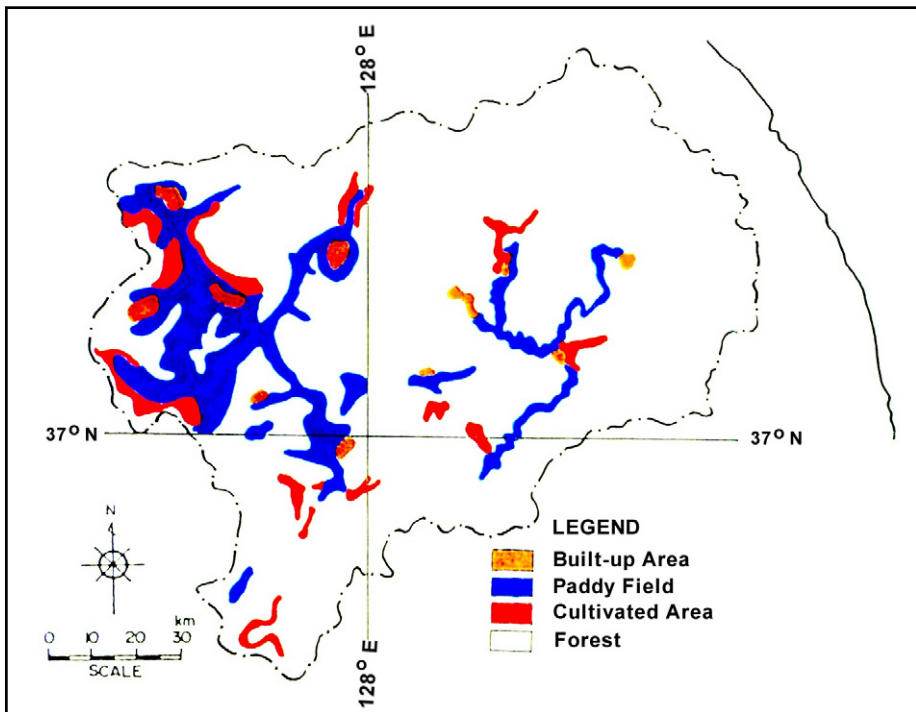
The precipitation in the basin varies from season to season and year to year. About two-thirds of the annual precipitation occurs during the summer monsoon from mid-June to mid-September. The average annual precipitation is 1 221 mm over the basin area and the average annual discharge at Yeosu gauging station (1 104 km²) was 660.6 m³/sec (59.8 m³/s/100/km²) during 1963~1994. The population of the basin was 831 000 in 1994.

2. Geographical Information

2.1. Geological Map



2.2. Land Use Map

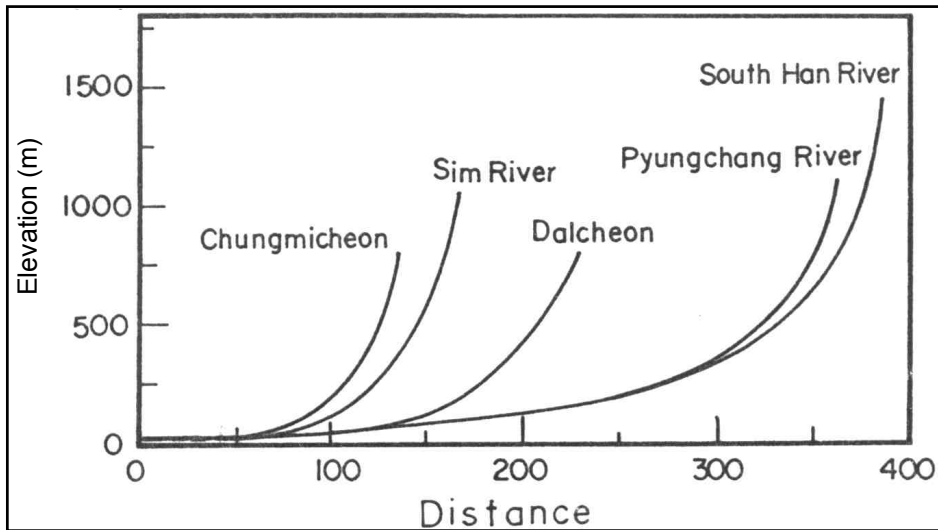


2.3. Characteristics of the River and the Main Tributaries

No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m]	Cities Population (1994)	Land use [%] (1994)
1	Nam Han-gang (Main river)	359.1 12 343.7	Mt. Kebang 1 577	Chungju 128 425	F (75.2) P (9.6) U (1.0) A (7.5) L (4.5) O (2.2)
2	Cheongmicheon (Tributary)	66.1 615.4	Mt. Surei 679	Wonju 162 415	
3	Som River (Tributary)	92.6 1 485.1	Mt. Chiak 1 283	Chechon 99 874	
4	Dalcheon River (Tributary)	119.3 1 625.3	Mt. Baikwha 1 063		
5	Pyungchang River (Tributary)	149.0 1 781.0	Mt. Kebang 1 577		

F : Forest L: Lake, River, Marsh P: Paddy field U : Urban
O: Orchard A : Agricultural field (vegetable field, grass field)

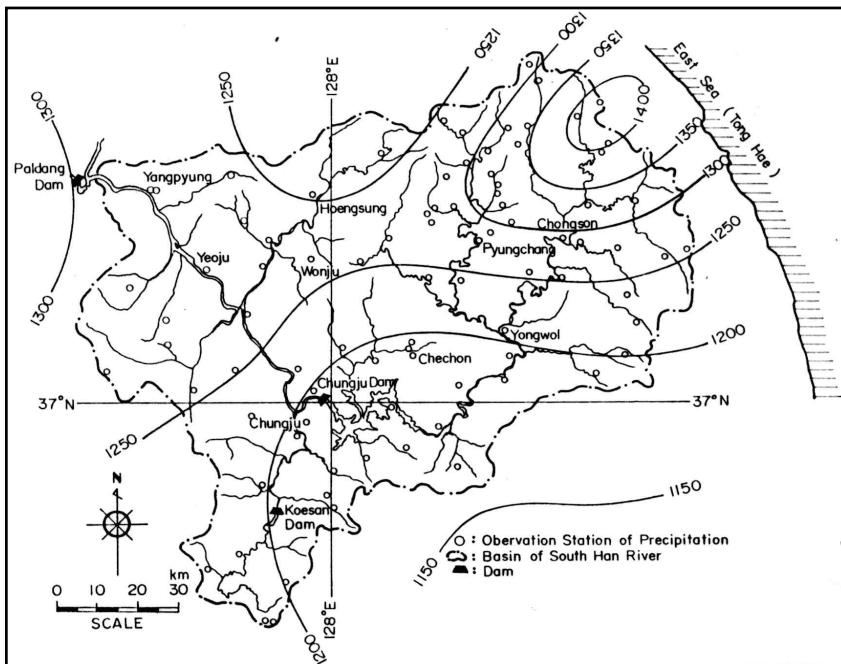
2.4. Longitudinal Profiles



3. Climatological Information

3.1. Annual Isohyetal Map and Observation Stations

Map and Legend



Based on the data of Ministry of Construction and Transportation

3.2. List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation ¹⁾ [mm]	Mean annual evaporation ²⁾ [mm]	Observation Items
8**	Wonju	150	N 37°20' E 127° 57'	1973~present	1 287.0	1 123	P(TB) E, DS
9**	Chechon	264	N 37° 09' E 128° 11'	1973~present	1 287.2	1 011	P(TB) E, DS
10**	Chungju	50	N 36° 58' E 127° 55'	1973~present	1 160.5		P(TB) E, DS
21***	Yongwol	200	N 37° 11' 28" E 128° 24' 25"	1985~present	958.5		P(TB)
23***	Pyungchang	295	N 37°22' 30" E 128° 23' 22"	1985~present	1 024.6		P(TB)

** : Serial number used by Weather Office, Korea Meteorological Agency

*** : Serial number used by Korea Water Resources Corporation

P : Precipitation, E : Evaporation, DS : Duration of sunshine

TB : Tipping bucket with recording chart

1) Period for the mean is from the beginning of the observation period to 1995

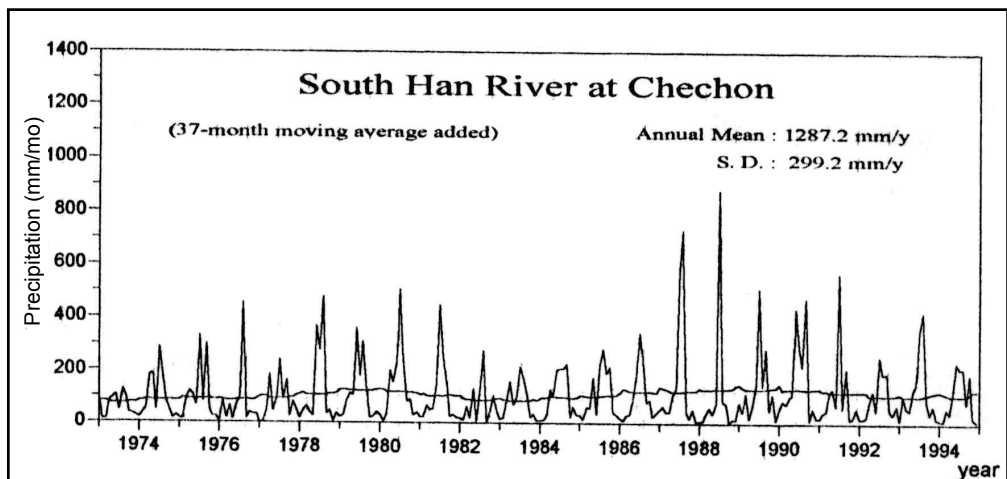
2) Measured by 20cm pan

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]	Chechon	-5.4	-2.5	3.2	10.6	16.0	20.5	23.7	23.9	18.3	11.3	4.1	-2.4	10.1	1973~1994
Precipitation [mm]	Chechon	25.8	31.1	54.6	88.3	98.7	150.8	326.4	246.8	141.5	51.5	41.6	30.2	1 287.2	1973~1994
Evaporation [mm]*	Chechon	30.6	39.9	71.3	115.1	146.4	138.3	116.6	122.3	90.7	70.4	40.6	28.9	1 011.1	1973~1990
Solar radiation [MJ/ m ² /day]	Wonju	6.9	8.8	11.3	13.9	16.0	15.4	13.3	13.8	12.4	10.4	6.9	6.1	11.3	1973~1990
Duration of sunshine [hr]	Chechon	154	153	186	212	234	208	174	193	177	189	142	137	2 159	1973~1994

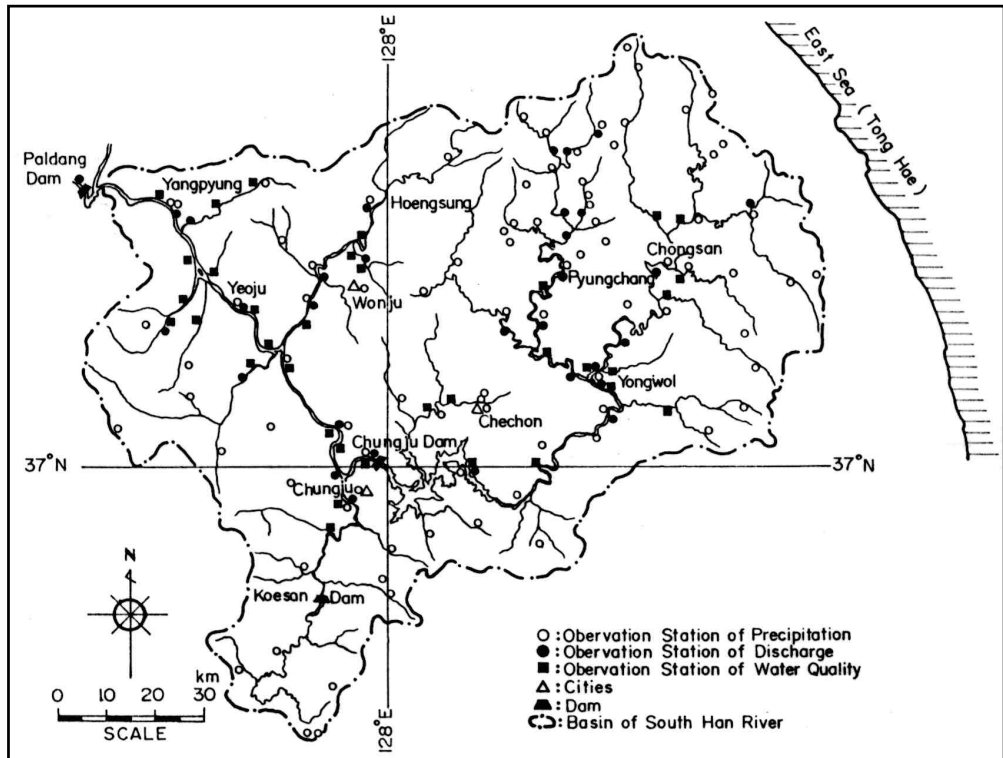
*measured by 20 cm pan

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

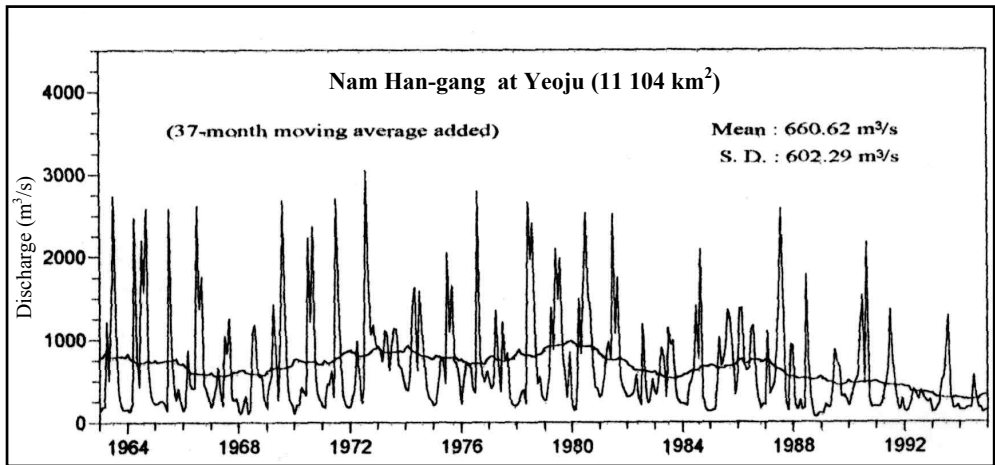
No.	Station	Location	Catchment area (A) [km ²]	Observation period	Observation items 1)
12*	Yeouju	N 37° 17' 30" E 127° 39' 00"	11 104.4	1913 ~ present	H1
18*	Cheongmi	N 37° 09' 30" E 127° 38' 10"	525.6	1985 ~ present	H1
19*	Munmag	N 37° 18' 50" E 127° 49' 30"	1 336.0	1980 ~ present	H1
7*	Dalchon	N 36° 48' 28" E 127° 47' 35"	1 353.6	1985 ~ 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]	Qmax / A [m ³ /s/100km ²]	Period of statistics
12*	660.6	17 847	7 889	114.4	5.9	160.7	1963~1994

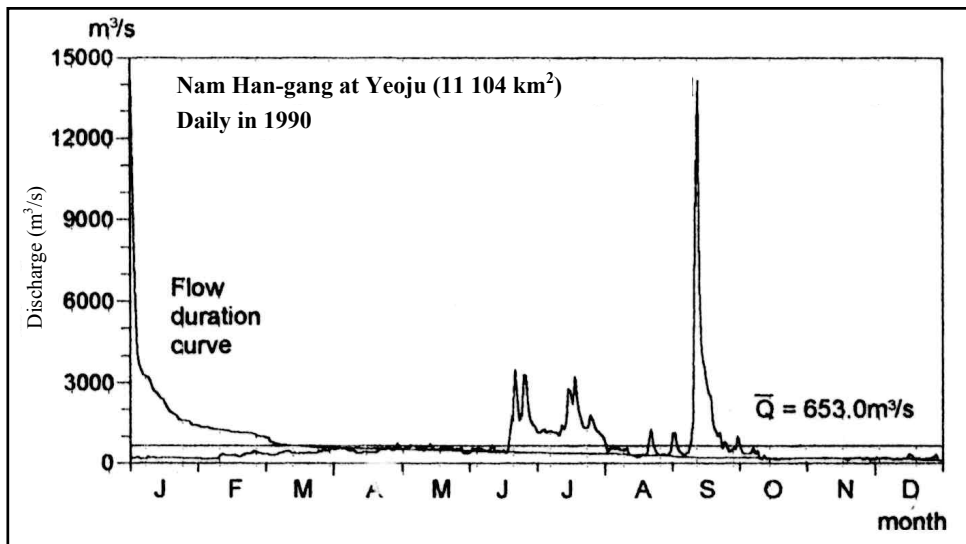
* : Serial number used by Ministry of Construction
 H1 : water level in recording chart
 H2 : water level by manual

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

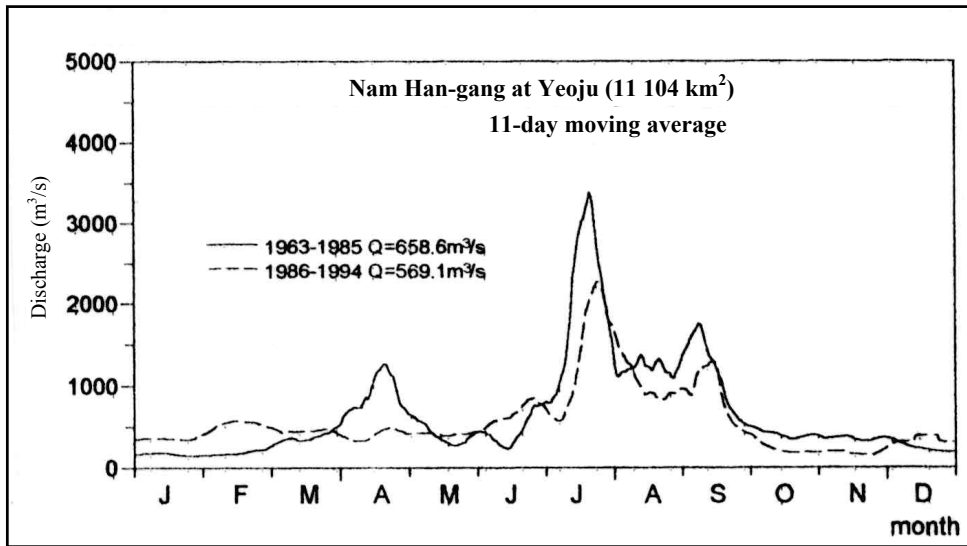
4.3. Long-term Variation of Monthly Discharge Series



4.4. Annual Pattern of Discharge Series



4.5. Unique Hydrological Features



Note that the Chung-ju Dam was constructed in 1986

4.6. Annual Maximum and Minimum Discharges

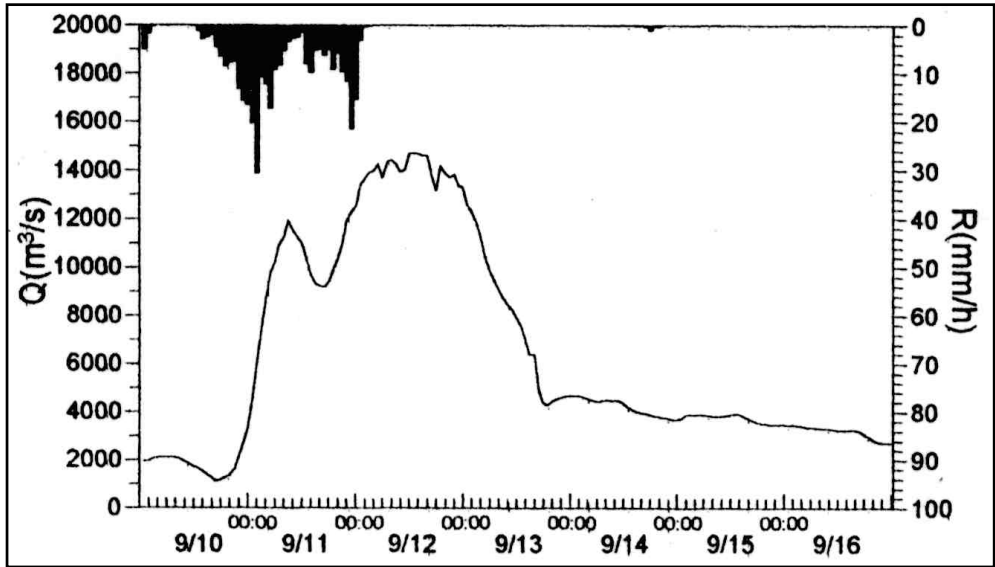
At Yeosu gauging station (11 104.4 km²)

Year	Maximum		Minimum		Year	Maximum		Minimum	
	Date	Discharge ¹ [m ³ /s]	Month	Discharge ² [m ³ /s]		Date	Discharge ¹ [m ³ /s]	Month	Discharge ² [m ³ /s]
1963	7.26	8 390	1	57.0	1979	8.05	11 659	12	196.3
1964	8.09	8 692	2	101.0	1980	7.23	13 280	2	97.3
1965	7.16	10 029	12	137.0	1981	7.03	8 931	9	63.1
1966	7.24	10 167	2	112.5	1982	8.28	6 003	7	79.5
1967	7.09	6 306	2	86.4	1983	7.20	4 199	6	137.0
1968	7.17	8 157	5	79.5	1984	9.02	11 586	11	104.8
1969	8.04	10 305	12	124.5	1985	10.13	4 922	1	128.6
1970	7.17	6 928	1	12.2	1986	7.19	6 575	11	116.5
1971	7.22	7 228	2	79.5	1987	7.22	9 240	11	63.1
1972	8.20	17 847	1	97.3	1988	7.19	8 305	10	30.2
1973	7.01	2 965	12	427.4	1989	7.29	4 631	1	45.5
1974	7.09	8 348	12	211.2	1990	9.12	14 717	12	104.8
1975	9.16	9 846	1	149.9	1991	7.26	4 530	11	57.0
1976	8.15	12 273	1	191.5	1992	8.27	3 800	3	69.5
1977	7.13	6 192	10	167.9	1993	7.13	5 966	2	60.0
1978	8.20	12 672	5	186.6	1994	7.01	4 281	8	86.4

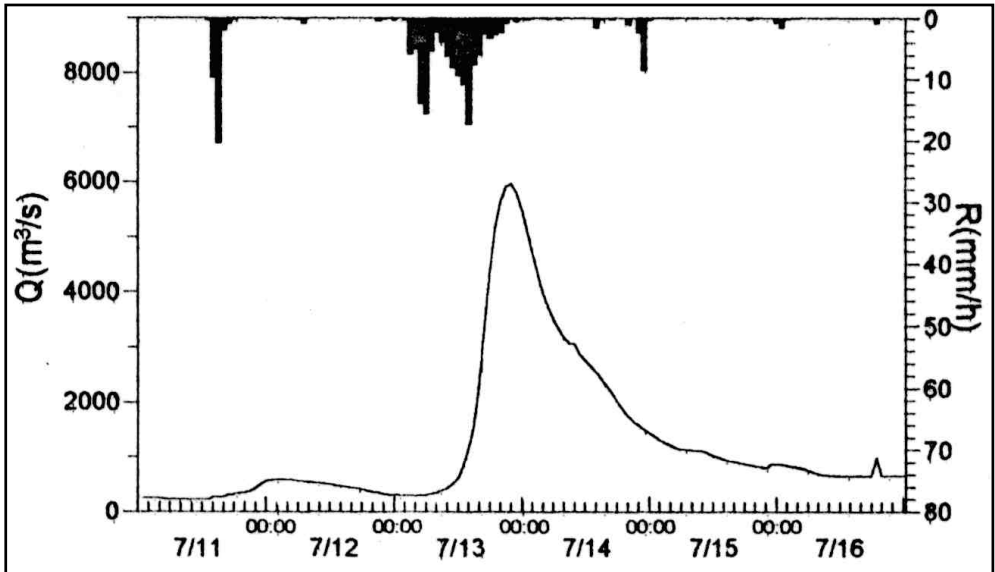
1, 2) Instantaneous observation by recording chart

4.7. Hyetographs and Hydrographs of Major Floods

Yeosu 1990 September



Yeosu 1993 July



Based on the data of Ministry of Construction

5. Water Resources

5.1. General Description

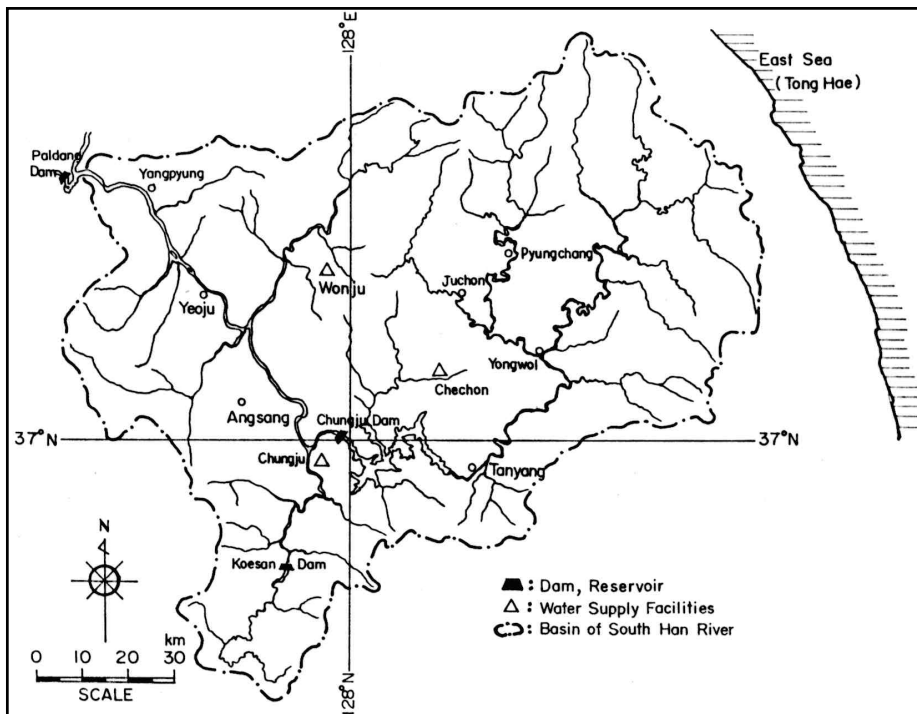
Most of the runoff in this catchment occurs during the summer months, and a much lesser amount during the spring. About 70 percent of the annual runoff occurs during July, August, and September.

The Chungju Multi Purpose Dam, which is a concrete gravity dam, is located near Chungju City, about 80 km east of Seoul. This dam has a height of 21 m, a crest length of 480.7 m, a reservoir with gross and active capacities of $2\,750 \times 10^6 \text{ m}^3$ and $1\,789 \times 10^6 \text{ m}^3$, respectively, a flood control capacity of $616 \times 10^6 \text{ m}^3$, and an installed hydropower capacity of 844.1 MW.

This reservoir contributes to various purposes: reduction of flood damages in downstream areas including the Capital City of Seoul; the supply of water for municipal, industrial and irrigation purposes; and the accommodation of the peak demand in the electric supply network. A grand plan for the municipal water supply from the Chungju dam reservoir to many cities such as Chungju, Wonju, Eumsung, Keosan, Jinchon and Jeungpyong has been drawn up. The plan which will cover the length of 184 km and capacity of 250 000 ton/day will be completed in 2001.

Keosan dam is on the Dalcheon River, a tributary of the South Han River, southeast of the city of Chungju. It is a concrete gravity dam 32 m high, with a gated spillway, and was completed in 1957. The power plant consists of two 1.3 megawatt units.

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
Nam Han-gang	Chungju Dam	6 648	2 750	1 789	W, F, I, N	1985
Dalcheon River	Koearn Dam	671	15	15	P	1957

1) W: Municipal water supply, F: Flood control, I: Industrial use, N: Maintenance of normal flows, P: Hydro - power

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				
Juchon – Chechon Conveyance Pipe	Pyungchang River	Chechon	10.5	0.37	W	1982
Jangkok – Chechon Conveyance Pipe	Pyungchang River	Chechon	10.3	0.61	W	1995
Tanyang Conveyance Pipe	Nam Han-gang	Tanyang	3.0	0.14	W	1985
Chungwon Conveyance Channel	Chungju Dam Site	Angsang	14.2	3.92	A	1970
Wonju Conveyance Pipe	Som River	Wonju	3.8	0.81	W	1972

1) Municipal water supply, A: Agricultural use
Note: There are many channels with short length

5.4. Major Flood and Drought Experiences

Major Floods

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1980. 07.21	7 170	321.0 7.21~7.22	Heavy storm	49	Boeun
1984. 09.02	11 586	350.4 8.31~9.03	Typhoon	36	Yeosu, Wonju
1987. 07.22	9 240	250.0 7.21~7.22	Typhoon	31	Chechon
1990. 09.12	14 717	384.7 9.10~9.13	Heavy storm	25	Tanyang

Major Droughts

Period	Areas affected	Major damages and counteractions
1979. 9 ~ 11	Tanyang	Supply cut ratio at the first stage : 15 %
1982. 5 ~ 10	Yongwol	Supply cut ratio at the first stage : 30 %
1994. 6 ~ 9	Koesan, Chungwon	Supply cut ratio at the first stage : 25 %

5.5. Groundwater and Water Quality

River Water Quality¹⁾ at Yeosu²⁾ in 1995

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH ³⁾	-	-	-	-	-	-	-	-	-	-	-	-
BOD [mg/l]	1.6	1.7	1.3	1.4	1.3	1.5	1.3	1.8	1.7	1.8	1.0	1.7
COD _{Mn} [mg/l]	2.0	2.5	2.1	3.1	2.8	3.0	3.9	4.9	2.9	3.3	2.5	3.5
SS [mg/l]	4.0	4.7	7.0	6.7	9.7	9.3	8.7	38.5	21.7	12.5	4.5	10.0
Coliform group ⁴⁾ [MPN/100ml]	1.5× 10 ²	9.0× 10 ²	1.3× 10 ²	2.3× 10 ²	8.0× 10 ²	2.3× 10 ²	3.0× 10 ²	3.0× 10 ²	2.3× 10 ²	1.1× 10 ²	5.0× 10 ²	3.0× 10 ²
Discharge[m ³ /s] ⁵⁾	89.4	93.6	82.7	80.1	82.7	82.7	128.2	664.0	256.4	96.5	89.4	84.0

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

2) Located at the Yeosu city.

3) pH was not measured in 1995. (pH was averaged at 7.8 from 1983 to 1990).

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

5) Discharge on the observation date.

6. Socio-cultural Characteristics

The two big cities, Wonju and Chungju, are located in this basin area. The Youngdong Highway, which passes through Wuwon to Kangriung, is an important infrastructure of national transportation connecting east and west.

In and around this basin area, there are four beautiful national parks: Chiaksan to the north of this area, Sobaiksan to the east, Wolaksan to the southeast, and Sokrisan to the south. To the east there is the Tanyang tourist zone, famous for its "Eight Beautiful Sceneries." Many tourist attractions such as the Suanbo springs, Jangreung tomb, Kossu cave, Uirim lake and Tangeumdae sites are also in this basin area.

7. References, Databooks and Bibliography

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