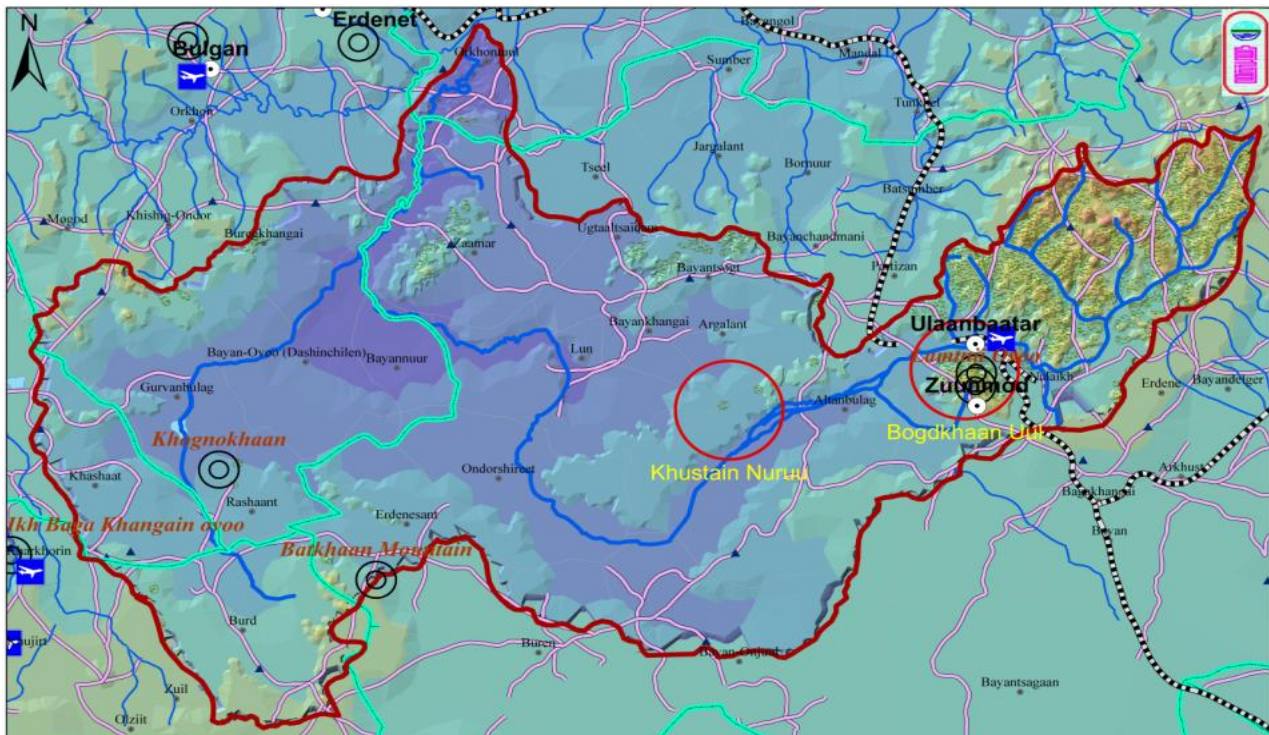


Tuul River

Map of the River



Hydrology section, Institute of Meteorology and Hydrology, Mongolia

Table of basic data

Name (s) : Tuul river		Serial No : Mongolia -1	
Location: Tuv province and Ulaanbaatar city, Mongolia		N 48° 56' 53"	E 104° 47' 55"
Area : 49766 km ²		Length of the main stream : 898 km	
Origin: Southern slope of Baga Khentey saridag (2000m)	Highest point : Asralt khairkhan (2800m), Khiidiin saridag (2665m), Baga Khentey saridag (2534m), Bogdkhaan Mountain (2226 m)		
Outlet : Orkhon river		Lowest point : River mouth (780m)	
Main base rocks : Cenozoic sand, gravel, clay; Mesozoic granites, sandstone and siltstones and Palaeozoic shales and conglomerates			
Main tributaries : Terelj, Uliastai, Selbe, Kharbukh			
Main lakes : Khagiin Khar nuur (29.45 km ²)			
Main reservoirs: There aren't reservoirs.			
Mean annual precipitation : 232 mm			
Mean annual runoff : 26.6 m ³ /sec at Ulaanbaatar, 25.8 m ³ /sec at Songino, 24.1 m ³ /sec at Undurshireet			
Population : 1,148,911 (2009-12-31)		Main cities : Ulaanbaatar, Zuuinmod	
Land use: Pasture (80.2%), Forest (2.9%), Agriculture (1.4%), Urban area (4.8%), Irrigated area (0.1%), Others (10.6%)			

1. General Description

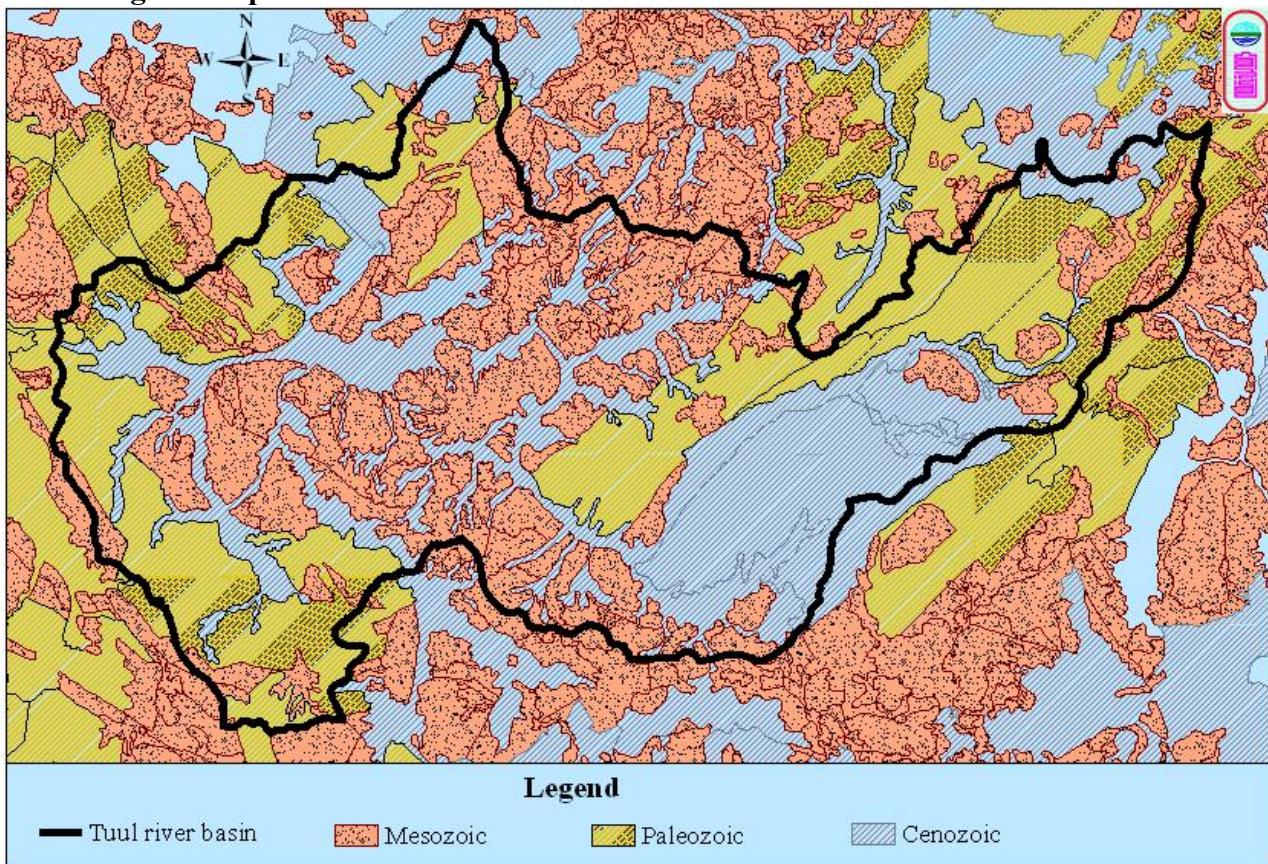
The Tuul River originates at south-western slope of the Khentey range, in particular at southern slope of the Baga Khentey, elevated up to 2000-m a.s.l. It is formed by the confluence of Namiya and Nergui streams. Catchment area to Ulaanbaatar is 6300 sq.km, totally 49766 km², 898 km long, covering forest and steppe area. Hydrological station was operating on the Tuul River at Ulaanbaatar since 1945.

There are three runoff components, such as rainfall, snowmelt water and groundwater. Therefore, annual runoff composes of 69 % of rainfall water, 6 % of snow melting water and 25 % of groundwater. Annual mean river flow in Ulaanbaatar site is 26.6 cub.m/sec. Ulaanbaatar is fully dependent on it's groundwater resources hydraulically connected with river water.

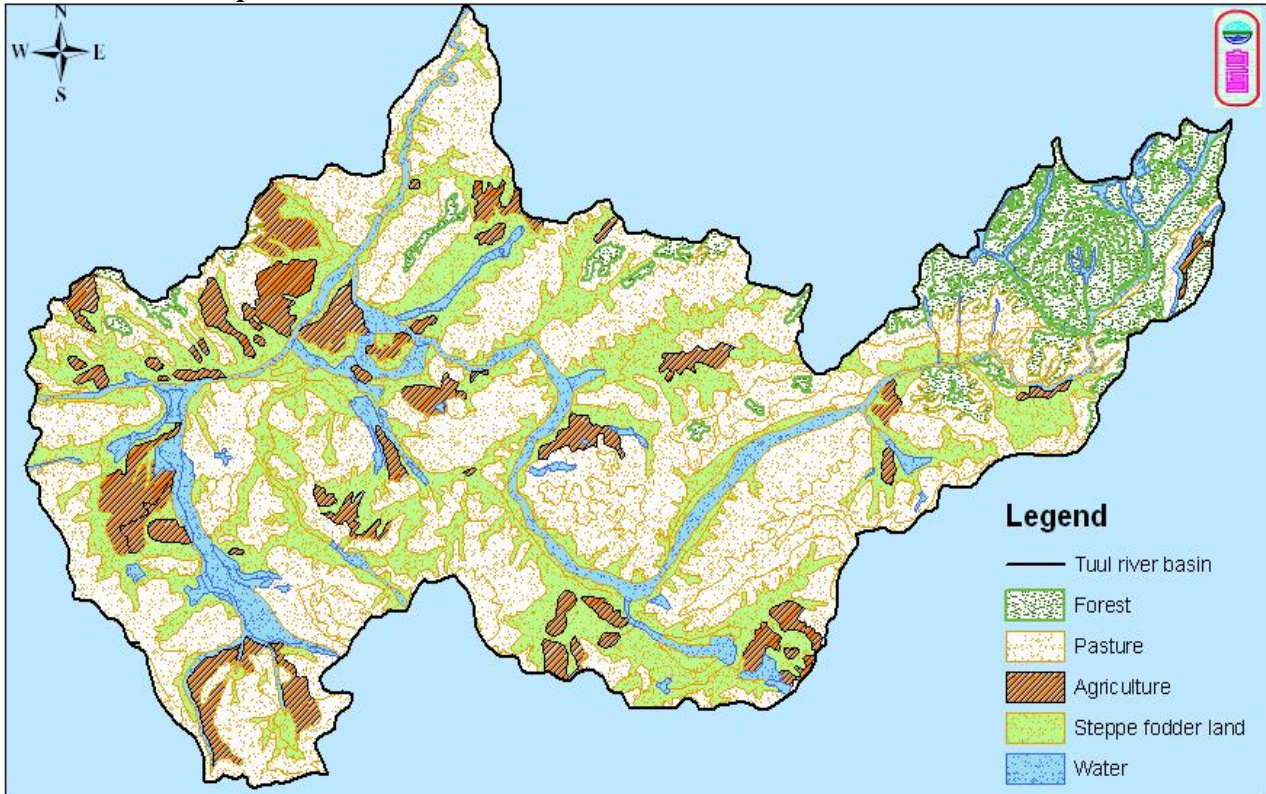
Tuul river water is fresh and calcium and bicarbonate type of water. Total dissolved solids of the river water range from 100-210 mg/l along its reach. Along the Tuul have been monitored water quality and pollution since 1980-th. in addition to basic chemical compositions, there analyzed such parameters as ammonium, nitrite, nitrate, phosphate, pH, permanganate value, dissolved oxygen, BOD and heavy metals like iron, manganese, chromium and others. Tuul river water is fresh in upper reach upper than Ulaanbaatar and polluted after Ulaanbaatar.

2. Geographical Information

2.1 Geological Map



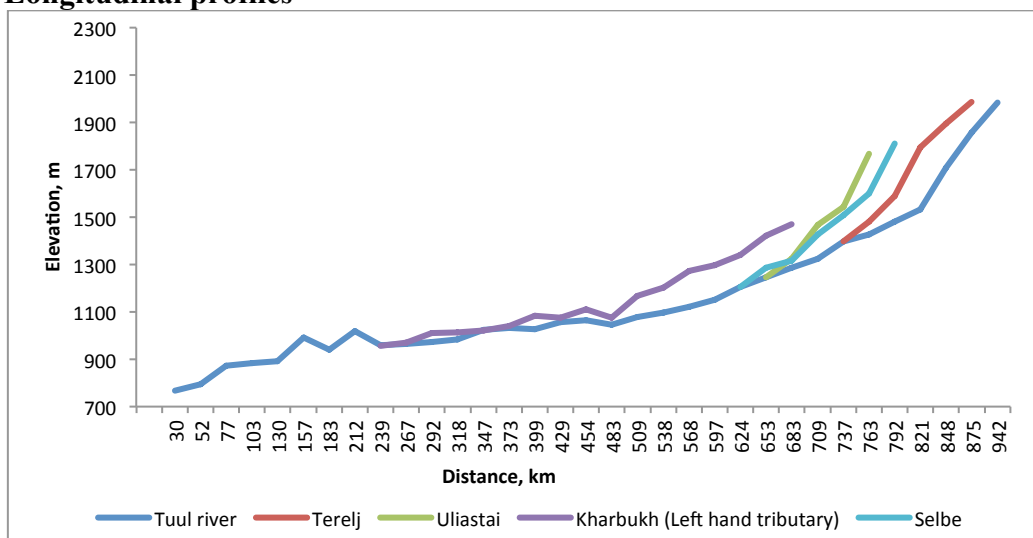
2.2 Land Use Map



2.3 Characteristics of the River and the Main Tributaries

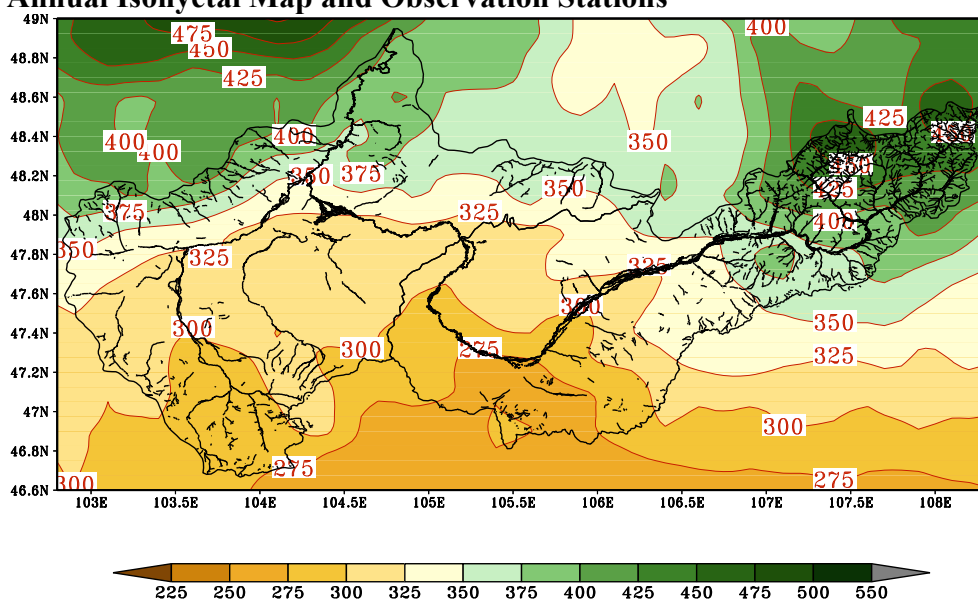
No	Name of river	Length,(km)/ catchment area, (km ²)	Highest peak discharge, m ³ /sec	Land use (%)				
				F	W	P	A	S
1	Selbe	41.3/300.4	168	57.94	11.52	24.63	No	5.91
2	Uliastai	3.1/3.42	20	63.89	6.27	28.46	No	1.38
3	Terelj	110.3/1281.9	564	79.54	16.41	4.05	No	No
4	Kharbukh	183.5/17178.9	No data	0.65	28.16	38.14	19.49	13.56

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)	Mean annual Evaporation	Observation Items
47803500	Bulgan-Gurvanbulag	1093.027	N 103 ⁰ 28' 52.68" E 47 ⁰ 44' 40.2"	1982~present	226.1	959*	P
48305400	Tuv-Ugtaal	1150.586	N 105 ⁰ 24' 17.64" E 48 ⁰ 15' 30.06"	1979~present	262.6	527*	P
47204200	Tuv-Erdenesant	1339.078	N 104 ⁰ 29' 34" E 47 ⁰ 20' 0.88"	1962~present	269.4	582*	P
4770700	Tuv-Zuun mod	1516.482	N 106 ⁰ 57' 6.12" E 47 ⁰ 42' 47.92"	1965~present	270.3	-	P
47905300	Tuv-Lun	995.5643	N 105 ⁰ 15' 17.57" E 47 ⁰ 52' 1.02"	1994~present	188.2	-	P
47606300	Tuv-Altanbulag	1260	N 106 ⁰ 24' 33.98" E 47 ⁰ 41' 49.99"	1994~present	199.0	-	P
47907000	Ulaanbaatar	1279.432	N 106 ⁰ 50' 52.44" E 47 ⁰ 55' 7.43"	1969~present	262.4	572**	P
47806800	Buyant-Uhaa	1271.5	N 106 ⁰ 27' 0.00" E 47 ⁰ 30' 36"	1940~present	241.4	-	P
47906900	Ikh surguuli	1341.1745	N 106 ⁰ 55' 12.45" E 47 ⁰ 55' 22.19"	1983~present	267.5	-	P
48007510	Terelj	1508.22	N 107 ⁰ 27' 23.004" E 47 ⁰ 59' 18.99"	1986~present	331.5	-	P

*Pan evaporation estimated by empirical formulae

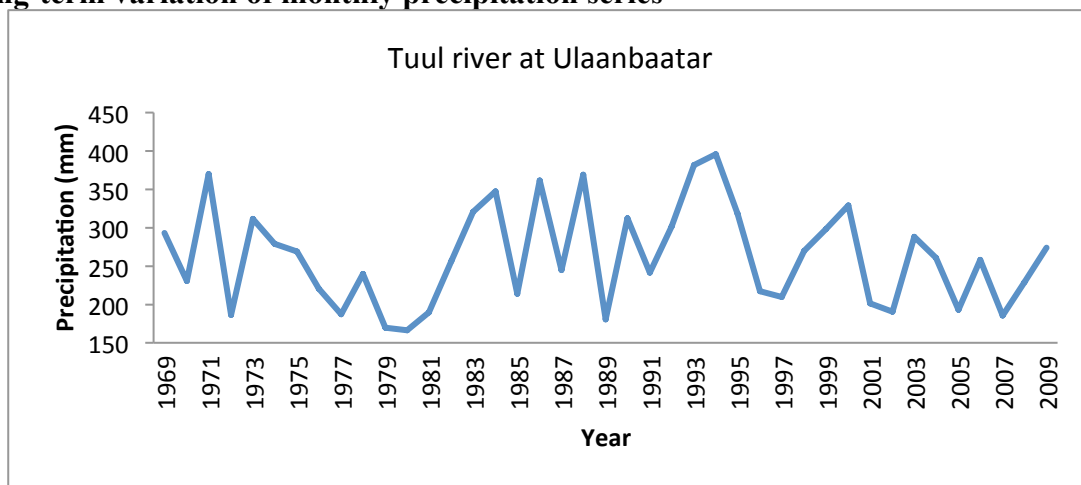
P: Precipitation, E: Evaporation, DS: Duration of sunshine

3.3 Monthly Climate Data (Observation station : Ulaanbaatar)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	-21.5	-16.8	-8.2	1.3	9.6	14.9	17.1	15.2	8.6	0.0	-11.1	-18.8	-0.8	1969~present
Precipitation [mm]	2.3	2.4	3.5	8.19	18.1	47.8	64.8	68.8	30.2	7.9	4.9	3.5	262.4	1969~present
Solar radiation [MJ/ m ² /day]	271	443	527	636	618	583	515	420	321	189	138	138	172	1962~present
Duration of sunshine[hr]	201	257	255	289	267	253	249	241	228	173	145	2725	168	1962~present

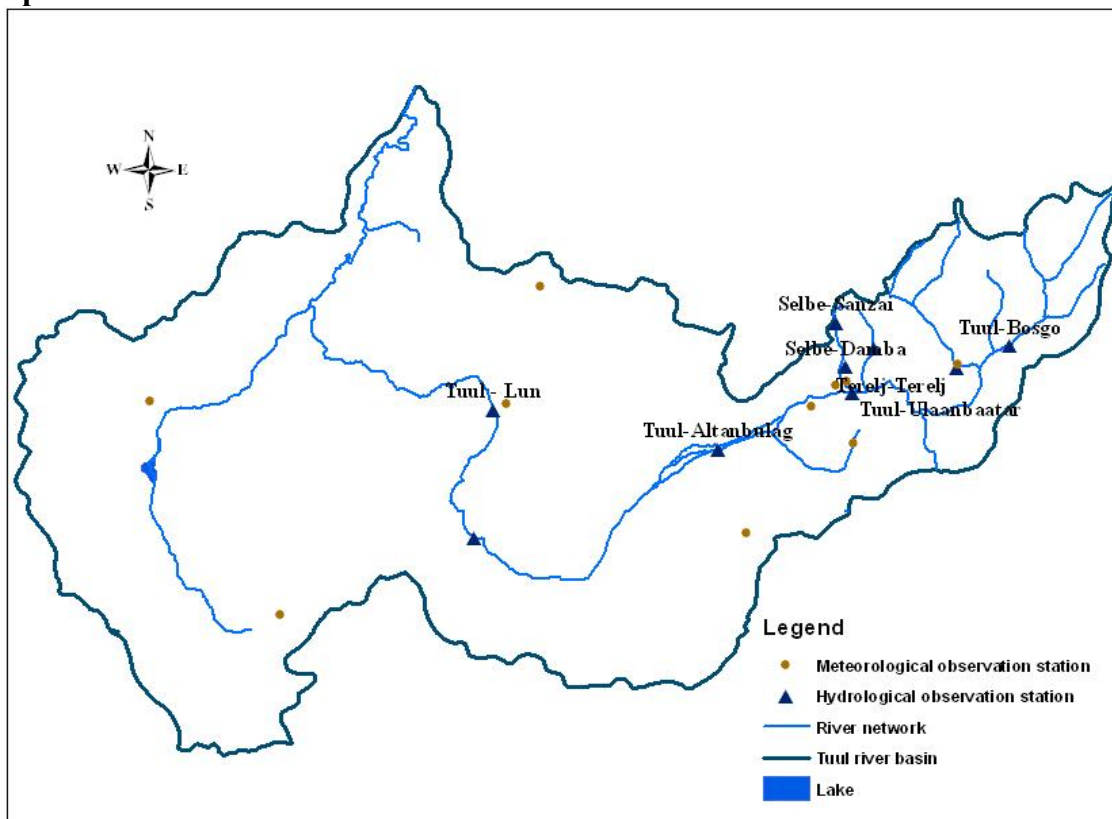
Fr - Freezes

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	Elevation [m]	Catchment area (A) [km ²]	Observation period	Observation items [Frequency]
1	Tuul-Lun	N 105 ⁰ 10' 59.98" E 47 ⁰ 51' 0.00"	1009	23574	1998~present	H2
2	Tuul-Altanbulag	N 106 ⁰ 16' 59.98" E 47 ⁰ 40' 59.98"	1172	9987	2002~present	H2
3	Tuul-Ulaanbaatar	N 106 ⁰ 55' 59.98" E 47 ⁰ 52' 59.98"	1400	6450	1945~present	H2
4	Tuul-Bosgo	N 107 ⁰ 43' 59.98" E 48 ⁰ 1' 59.98"	1501	2193	2003~present	H2
5	Terelj-Terelj	N 107 ⁰ 28' 0.012" E 47 ⁰ 58' 0.012"	1550	1281	1972~present	H2
6	Selbe-Damba	N 106 ⁰ 55' 12" E 47 ⁰ 58' 48"	1369	192	1983~present	H2
7	Selbe-Sanzai	N 106 ⁰ 52' 59.98" E 48 ⁰ 7' 59.98"	1597	33.1	1983~present	H2
8	Uliastai-Uliastai	N 107 ⁰ 3' 45.18" E 48 ⁰ 2' 28.68"	1471	228	1969~present	H2

No	\bar{Q} m ³ /s 2)	Q _{max} 3) m ³ /s	\bar{Q}_{max} 4) m ³ /s	\bar{Q}_{min} 5) m ³ /s	\bar{Q}_{min} m ³ /s	\bar{Q}/A [m ³ /s/km ² *1000]	Q _{max} /A [m ³ /s/km ² *1000]	Period of statistics
3	25.64	1580	334.9	0.0	0.0	4.07	250.8	1945~present

1) H1 : water level in recording chart H2 : water level by manual

2) Mean annual discharge

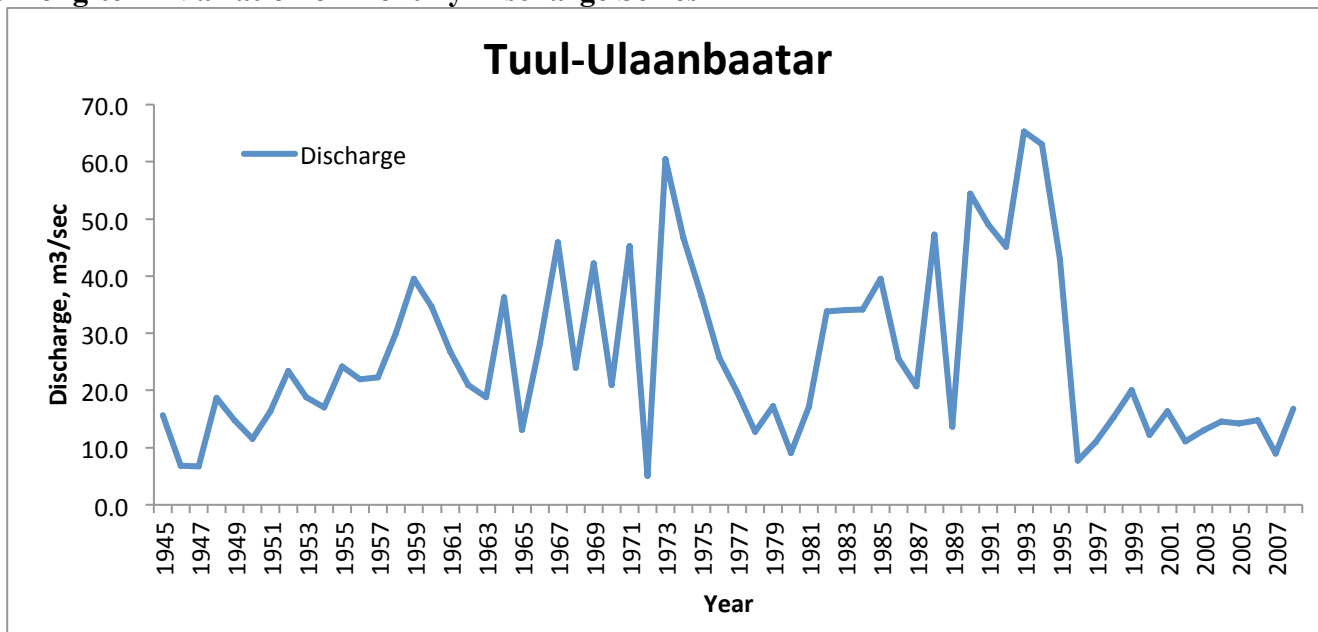
3) Maximum discharge

4) Mean annual maximum discharge

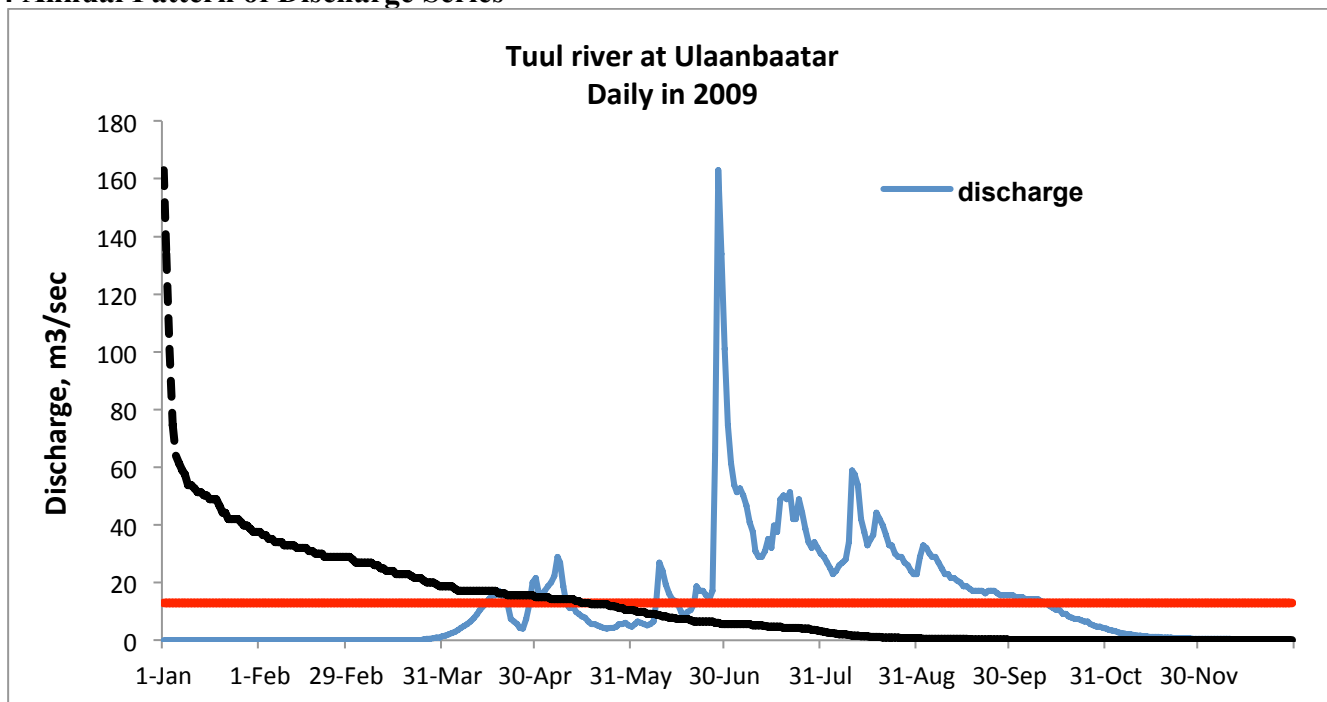
5) Mean annual minimum discharge

Q : discharge, P: precipitation, WQ : BOD etc., S : sedimentation 10d:10-daily, m: monthly, d : daily

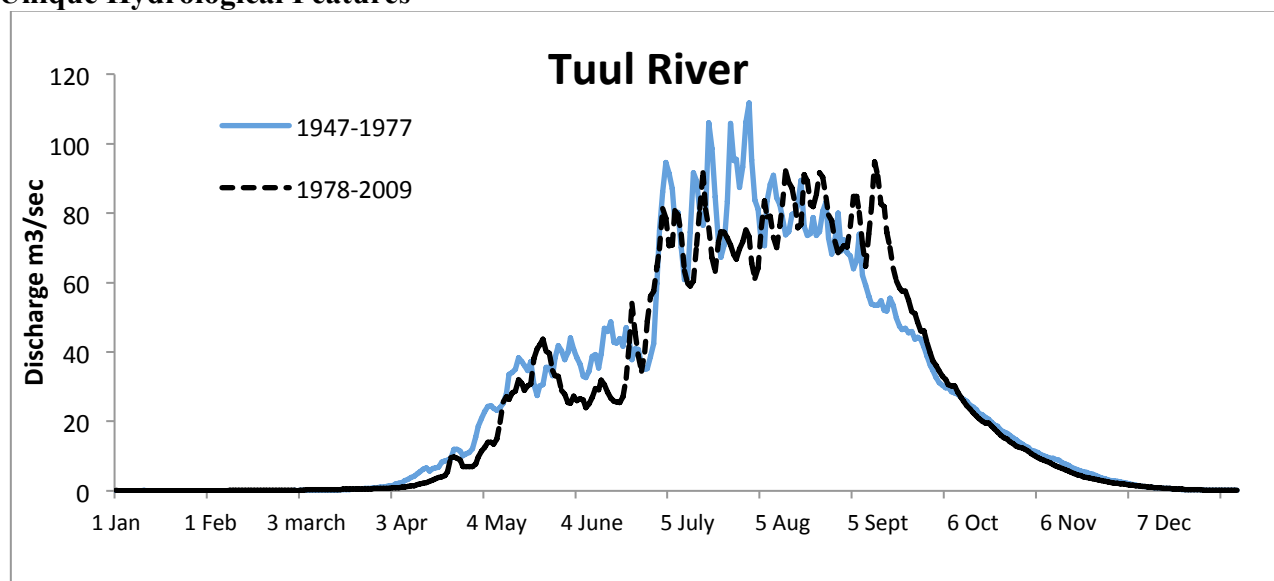
4.3 Long-term Variation of Monthly Discharge Series



4.4 Annual Pattern of Discharge Series



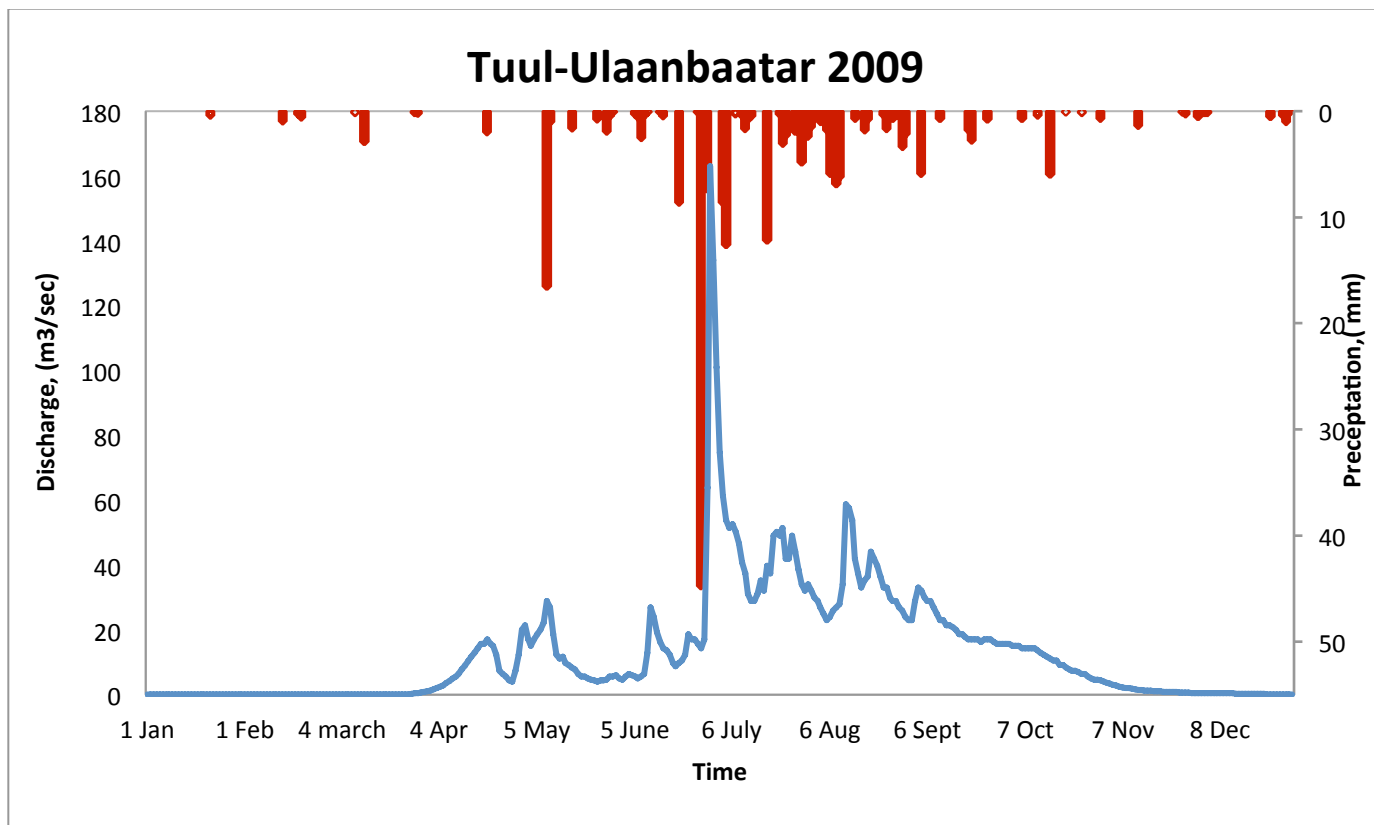
4.5 Unique Hydrological Features



4.6 Annual Maximum and Minimum Discharges

Year	Maximum		Minimum		Year	Maximum		Minimum	
	Date	(m ³ /s)	Month	(m ³ /s)		Month	(m ³ /s)	Month	(m ³ /s)
1945	No data	No data	No data	No data	1978	28-Jun	223	Winter	0.0
1946	8-Jun	137	Winter	0.0	1979	17-Aug	172	Winter	0.0
1947	2-Jul	184	Winter	0.0	1980	16-Jun	83.2	Winter	0.0
1948	30-Aug	480	Winter	0.0	1981	8-Aug	137	Winter	0.0
1949	25-Aug	264	Winter	0.0	1982	1-Jul	327	Winter	0.0
1950	7-Jul	138	Winter	0.0	1983	30-Jul	518	Winter	0.0
1951	15-Jul	128	Winter	0.0	1984	29-Aug	400	Winter	0.0
1952	24-Jul	319	Winter	0.0	1985	27-Jun	772	Winter	0.0
1953	26-Jun	157	Winter	0.0	1986	22-Jun	323	Winter	0.0
1954	13-Jul	183	Winter	0.0	1987	8-Aug	255	Winter	0.0
1955	4-Sep	137	Winter	0.0	1988	4-Sep	678	Winter	0.0
1956	9-Aug	112	Winter	0.0	1989	16-Aug	174	Winter	0.0
1957	12-Jul	211	Winter	0.0	1990	28-Aug	507	Winter	0.0
1958	26-Jul	533	Winter	0.0	1991	30-Jul	415	Winter	0.0
1959	15-Aug	500	Winter	0.0	1992	5-Sep	397	Winter	0.0
1960	28-Jun	370	Winter	0.0	1993	10-Jul	721	Winter	0.0
1961	11-Aug	174	Winter	0.0	1994	21-Aug	591	Winter	0.0
1962	No data	No data	Winter	0.0	1995	12-Aug	424	Winter	0.0
1963	14-Sep	182	Winter	0.0	1996	14-Jun	48.2	Winter	0.0
1964	23-Aug	1120	Winter	0.0	1997	9-Aug	118	Winter	0.0
1965	11-Aug	121	Winter	0.0	1998	6-Aug	148	Winter	0.0
1966	12-Jul	1580	Winter	0.0	1999	12-Jul	105	Winter	0.0
1967	28-Jun	1180	Winter	0.0	2000	28-Aug	135	Winter	0.0
1968	25-Jul	243	Winter	0.0	2001	18-Aug	92.4	Winter	0.0
1969	25-Aug	311	Winter	0.0	2002	1-Jul	124.6	Winter	0.0
1970	2-Aug	300	Winter	0.0	2003	18-Aug	158.1	Winter	0.0
1971	10-Jun	563	Winter	0.0	2004	4-Jul	106.4	Winter	0.0
1973	3-Aug	15.9	Winter	0.0	2005	15-Jun	133	Winter	0.0
1974	2-Jul	717	Winter	0.0	2006	6-Jun	149	Winter	0.0
1975	19-Aug	459	Winter	0.0	2007	26-Aug	55.4	Winter	0.0
1976	8-Jul	485	Winter	0.0	2008	25-Jun	197	Winter	0.0
1977	6-Jul	432	Winter	0.0	2009	29-Jun	170	Winter	0.0

4.7 Hyetographs and Hydrographs of Major



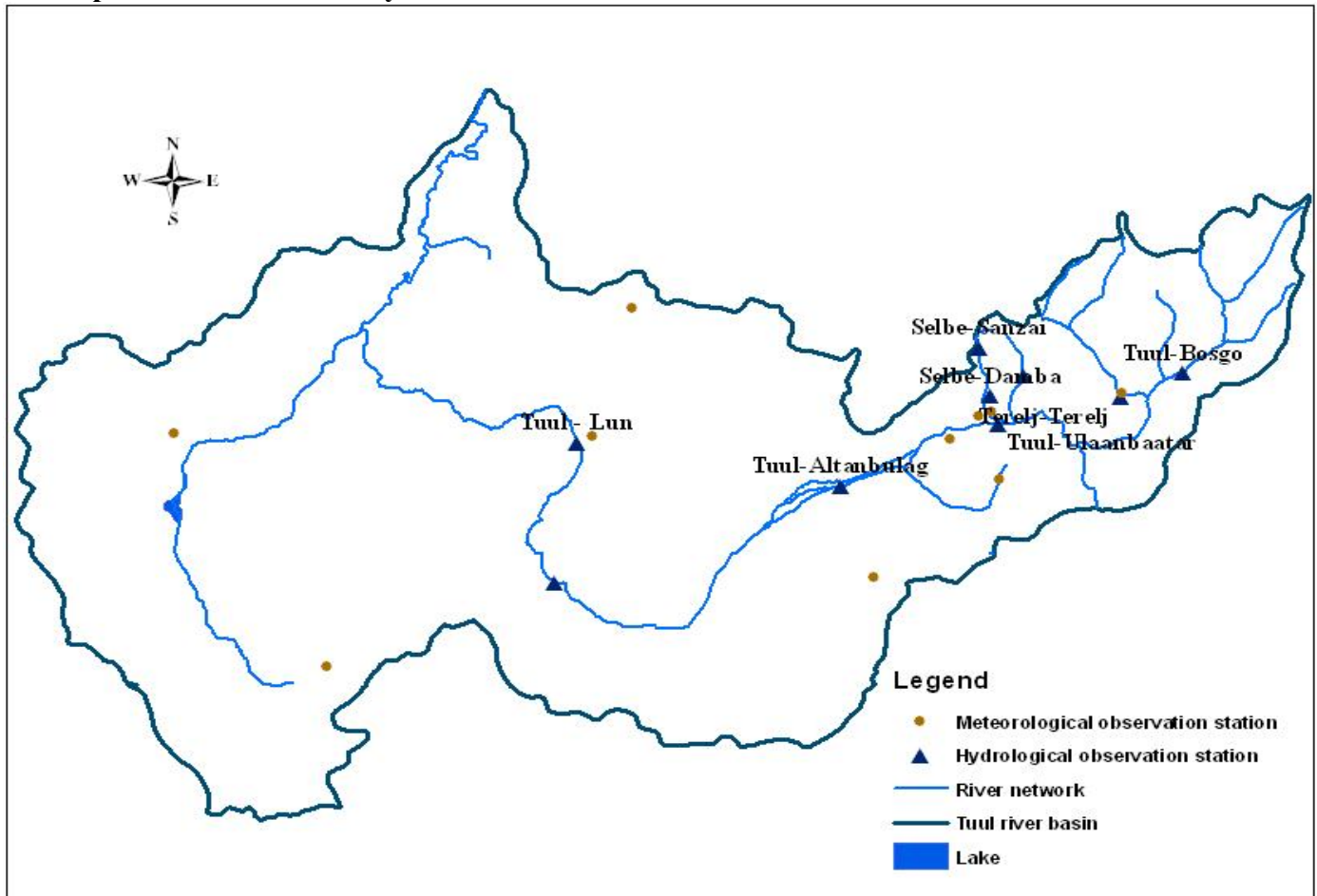
Source: Institute of Meteorology and Hydrology

5. Water Resources

5.1 General Description

The Tuul River, which occupies 49766 km² watershed, consisting of the upper stream that is forest, mountainous area, midstream inter-mountainous valley and the lower stream that is a hilly steppe area. The agricultural and forest area in the basin occupy about 20% and 65% of total area in the watershed basin respectively. Pasture, forest, agriculture, urban area, irrigated land and others occupy 80.2, 2.9, 1.4, 4.8, 0.1 and 10.6 percents, respectively. The runoff in the river in the dry and winter seasons is very low even though the flood in the rainy season is often occurred. To meet the agricultural water demand, 12 small irrigation systems were constructed.

5.2 Map of Water Resource Systems



5.3 Major Flood and Drought Experiences

Major Floods (Catchment area 49766 km²)

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages [Districts affected]
1966.07.10-11	1700	103.5	Storm caused rainfall flood	13000 household	239617\$
1982.08.15-16	-	44	Storm caused flash flood	87 people died 119 households	91447 \$

Major Droughts

Period	Areas affected	Major damage and counteractions
1972	Whole catchment	Livestock loss and hay making
1999-2002	Whole catchment	Livestock loss and

5.4 Groundwater and Water Quality

River Water Quality ¹⁾ at Tuul River ²⁾, 2009

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PH				-	6.64	7.63	7.35	8.17	9.80	6.92	7.23	
BOD [mg/l]				2.3	1.4	3.6	4.0	0.8	1.2	2.6	1.1	
COD _{Mn} [mg/l]				15.0	3.4	1.6	4.8	2.0	2.3	1.6	6.1	
SS [mg/l]				2.0	-	18.7	66.8	-	4.6	-	-	
Discharge [m ³ /s] ⁴⁾	0.006	-	0.13	8.68	11.2	23.2	44.6	33.7	21.4	10.5	1.58	0.31

1) Observed once a month.

2) Located near Ulaanbaatar City.

3) Measurement method: Chemical analyses.

4) Discharge on the observation date.

6. Socio-cultural Characteristics

The population is 1098771 in the basin, in 2008. There are Ulaanbaatar, founded in 1639 as a movable (nomadic) Buddhist monastic centre, capital city of the country, Zuunmod, central part of the Tuv province and its soums (counties) Mongolia. Ulaanbaatar is located in north central Mongolia, the city lies at an elevation of about 1,310 m. in a valley on the Tuul River. It is the cultural, industrial, and financial center of the country. It is the center of Mongolia's road network, and is connected by rail to both the Trans-Siberian Railway in Russia and the Chinese railway system.

7. References, Databooks and Bibliography

Institute of Meteorology and Hydrology, National Agency for Meteorology, Hydrology and Environment Monitoring, Mongolia, Annual Meteorological Database, Water Quality report, 2009 and Annual Hydrological Yearbook, 1945-2009 (<http://www.tsag-agaar.mn>) and

Statistical reports, Mongolian National Statistical Office, Ulaanbaatar, Mongolia (<http://www.nso.mn>)

Thematic maps on Geology and Land uses.

Catalogue of the Tuul river has been prepared by Dr. G. Davaa, Head, Hydrology section and Ms. J. Odgarav, researcher, Hydrology section, Institute of Meteorology and Hydrology, National Agency for Meteorology, Hydrology and Environment Monitoring, Mongolia