

Table of Basic Data

Name: Chindwin River		Serial No. : Myanmar-1
Location: Sagaing Region	N 21° 30' ~ 27° 15'	E 93° 30' ~ 97° 10'
Catchment Area: 110 350 km ²	Length of main river: 900 km	
Origin: Saramali Mountain	Highest point: 3796 m	
Outlet: Ayeyarwady River	Lowest point: 57 m	
Main geological features: sand-stones of different hardness, clay with gypseous veins, shales and limes-stones		
Main tributaries: Myittha, Yu-Wa, U-Yu		
Main Reservoir: -		
Mean annual precipitation: 670 mm ~ 3740 mm (1967-2009)		
Mean annual runoff: 4750 m ³ /s at Monywa (1967-2009)		
Population: 5535035 (2004)	Main cities: Hkamti, Htamanthi, Homalin, Mawlaik, Kalewa, Kalaymyo, Mingin, Monywa	
Land use: approximately 120 000 acres of cultivated land. About 90 % of the basin is thickly forested by valuable species of wood.		

1. General Description

The Chindwin river basin is located in the North Western part of Myanmar. The Chindwin river is the third largest river in Myanmar. The Chindwin basin is located in Sagaing Region, where Meteorological & Hydrological data are available at the stations along this river, such as Hkamti, Homalin, Mawlaik, Kalewa and Monywa, which are situated between 21° 30' and 27° 15' N Latitude and between 93° 30' and 97° 10' E Longitude.

The source of Chindwin radiates from the Kachin plateau. The second highest mountain in Myanmar, Saramali with the elevation of 12553 ft, is also located on the upper Chindwin catchment area. Since it passes through the mountainous region there are numerous streams, flowing into the Chindwin river. These streams are small tributaries of the Chindwin river.

The upper part of Chindwin river is known as Tanai Hka that flows in north direction in its upper reach before entering into the Hukaung Valley, the Upper Chindwin Lowlands. Very clearly, rapids and water falls could often be seen along the river stretch within the 850 km water course from origin to Mawlaik. The large tributaries of Chindwin river are U Yu, Yu-wa and Myittha. Four miles below Homalin receives an important tributary on the left bank- the U Yu river, which rises in the Myitkyina district. On the right bank it receives the Yu-wa at Yu-wa and the Myittha at Kalewa, from which it receives the drainage of the Chin hills.

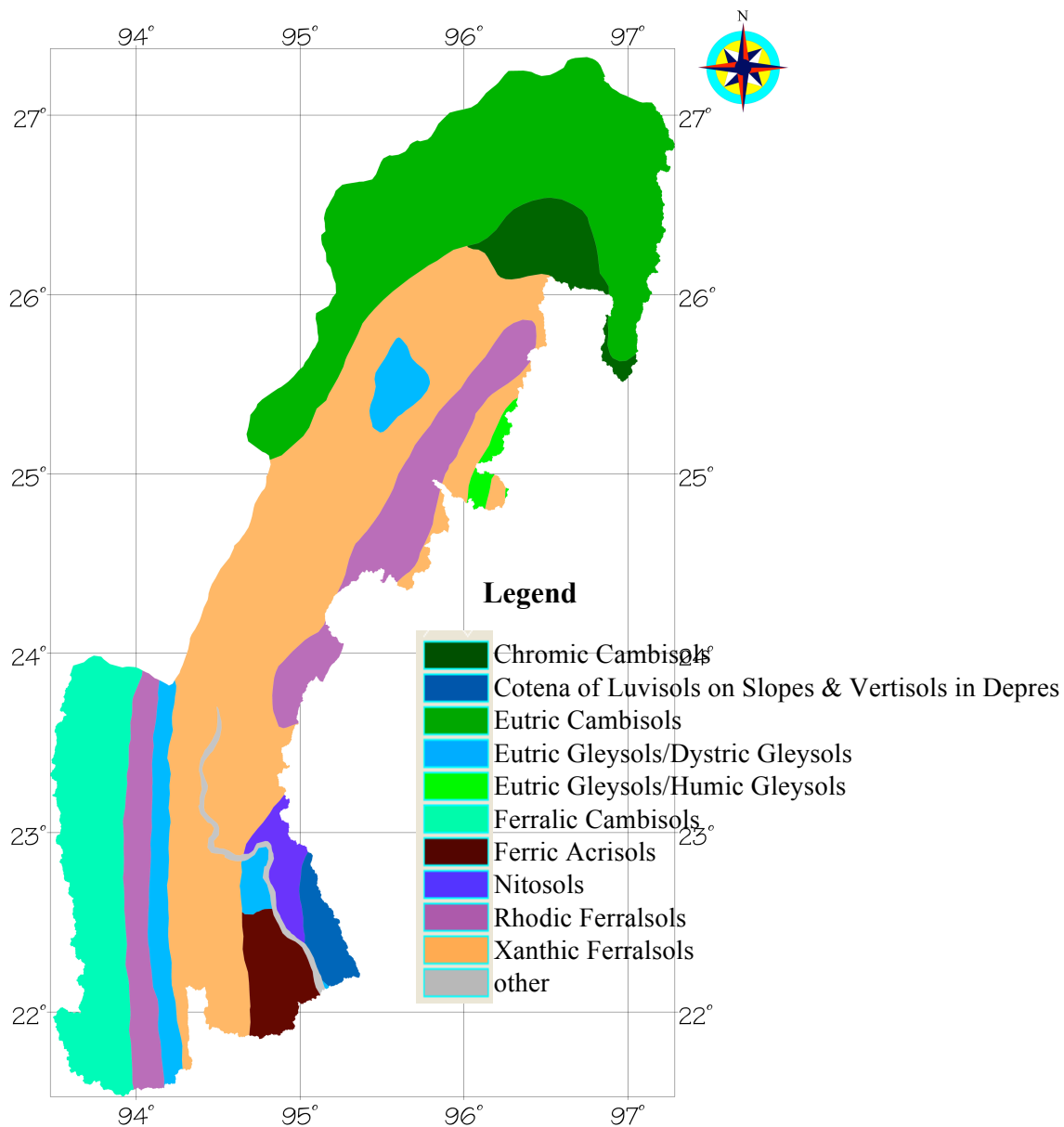
The main stream is navigable by light vessels throughout the year; in the rainy season the vessels ply up to Homalin. The basin of Chindwin river is, in general, a mountainous forested terrain with the only exception of its lowest southern part which is a vast plain. The highest mountains are to be found to the West and North of basin where they reach 10 000 feet more. From the East the watershed passes a mountain chain of 3000-5000 feet high. The source of the river, which in its upper reaches before entering the Hukawng Valley, bears the name of Tanai Hka, flowing at the height of 7000 feet, then within the distance of 80 miles it goes down to the height of 700 feet and enters the Hukawn Valley. The Chindwin river joins with the Ayeyarwaddy river near Myingyan situated in the central dry zone.

General Climate and land use

The major contribution of rainfalls in the Chindwin basin is from rainfall over the catchment. The heavy rainfalls are generally caused by monsoon trough and strong monsoon. The average annual rainfall over the catchment varies from 670 mm to 4200 mm. The Chindwin river basin is contributed mainly by tertiary continental sediments. Among them more frequently found are sandstones of different hardness, less frequent are clay with gypseous veins, shales and limes-stones. The width of the river varies from 300 to 10 000 feet. Chindwin catchment area covers 110350 km². The Chindwin basin has approximately 120 000 acres of cultivated land. About 90 % of the basin is thickly forested by valuable species of wood.

2. Geological Informatin

2.1 Soil Type Map



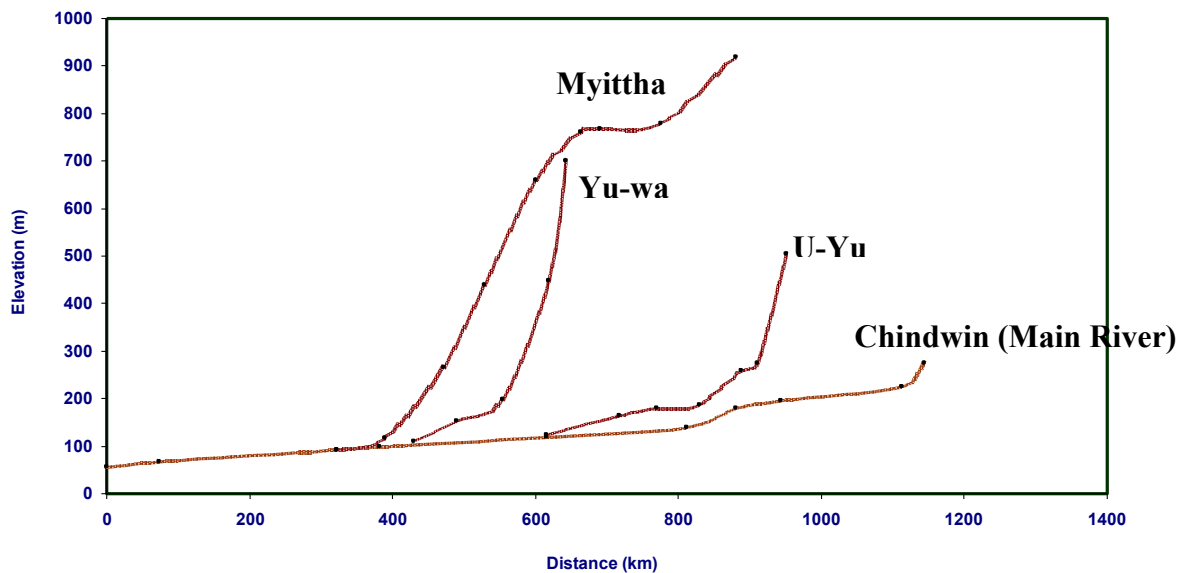
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2.2 Characteristics of River and Main Tributaries

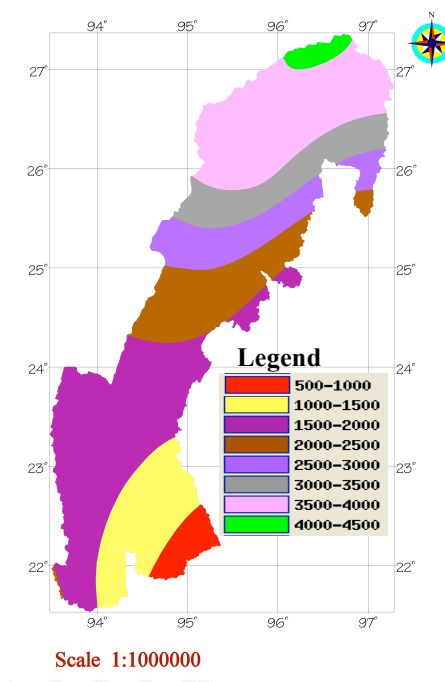
No.	Name of river	Length (km)	Height peak (m)
		Catchment area(km ²)	Lowest point (m)
1.	Chindwin (Main River)	900	3796
		110350	57
2.	Myittha (Tributary)	580	2643
		24225	92
3.	Yu-Wa (Tributary)	6125	2260
		225	119
4.	U-Yu (Tributary)	345	1650
		11150	123

2.3 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 Monthly Climate Data

Monthly Mean Temperature (°C)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Period for the Mean
Hkamti	16.6	18.9	22.5	25.6	27.3	27.9	26.4	27.1	27.1	25.8	21.9	16.9	1966-2000
Homalin	17.6	18.9	23.1	25.9	27.5	27.5	27.1	26.0	27.4	26.3	21.9	18.1	1966-2000
Kalewa	19.1	21.1	25.8	29.2	29.9	28.6	28.5	27.8	27.6	26.5	23.2	19.7	1968-2000
Monywa	20.8	23.4	27.5	30.9	31.6	30.5	30.3	29.7	29.1	27.7	24.7	21.2	1966-2000

Monthly Mean Precipitation (mm)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Period for the Mean
Hkamti	6	13	20	43	222	834	1197	769	491	225	26	6	1967-2009
Homalin	6	13	22	42	162	445	501	421	361	173	39	8	1967-2009
Mawlaik	3	5	16	40	147	274	262	331	341	178	40	6	1976-2005
Kalewa	2	4	13	35	157	278	260	333	329	186	51	7	1967-2005
Monywa	1	2	5	25	86	100	70	132	164	119	47	4	1971-2005

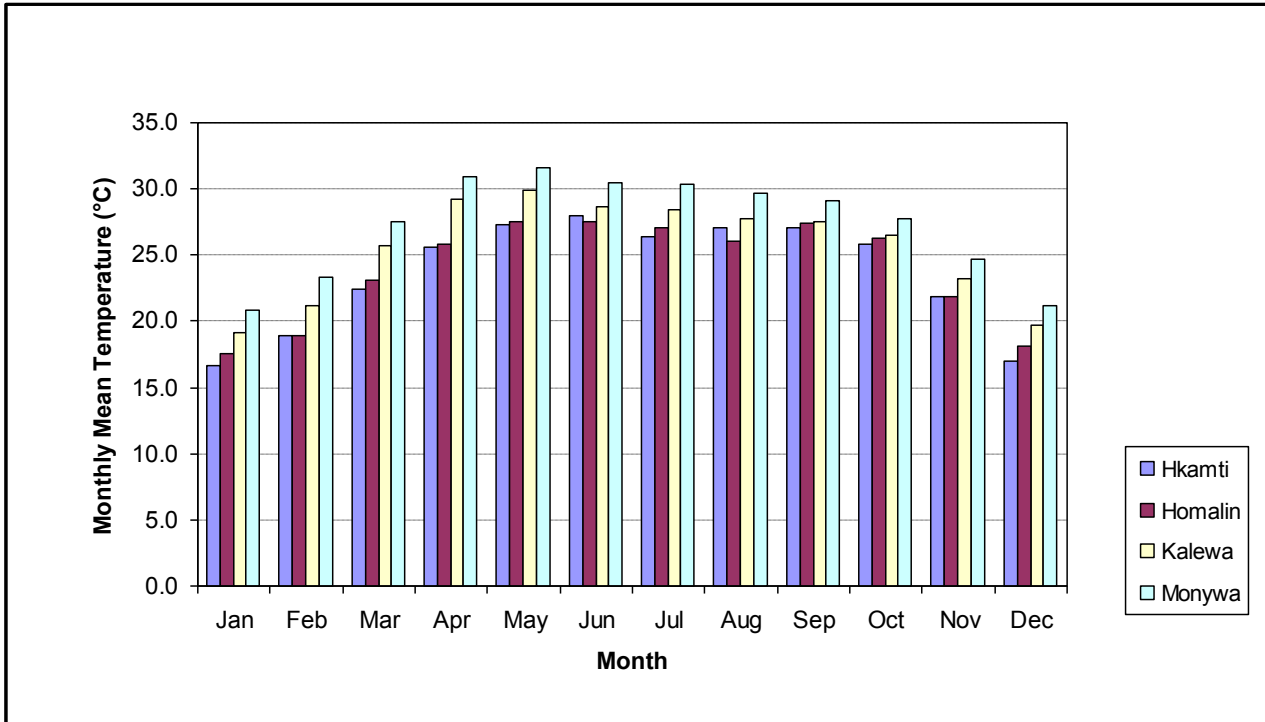
Monthly Relative Humidity (%)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Period for the Mean
Hkamti	78	74	69	68	73	87	91	89	87	83	81	82	1966-2000
Homalin	80	74	69	66	72	86	89	89	88	83	81	82	1966-2000
Kalewa	77	67	53	52	63	80	82	85	86	83	83	82	1968-2000
Monywa	68	59	48	50	61	69	71	75	78	78	75	72	1966-2000

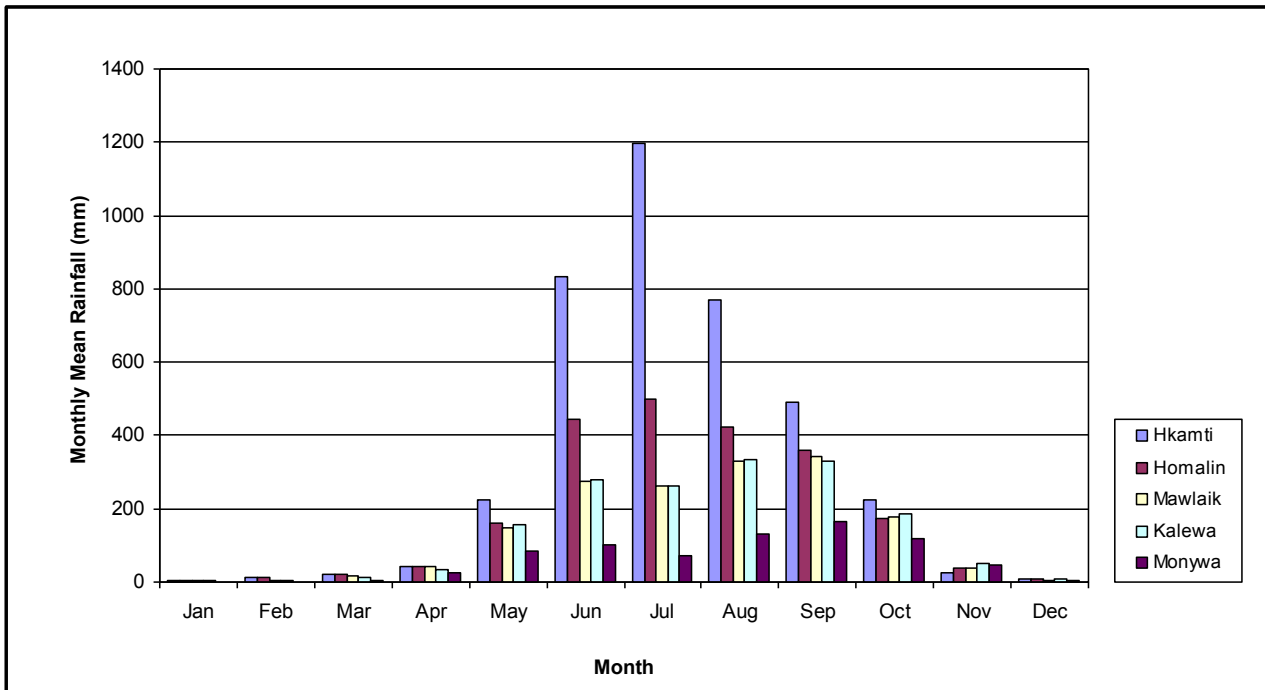
Monthly Evaporation (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the Mean
Kalewa	76.2	95.0	140.0	172.2	159.4	125.8	106.7	111.3	114.9	99.9	78.5	73.6	1360.8	1995-2006
Monywa	86.5	113.3	158.2	180.0	156.4	154.6	157.9	146.8	121.0	104.3	93.4	84.0	1591.2	2000-2006

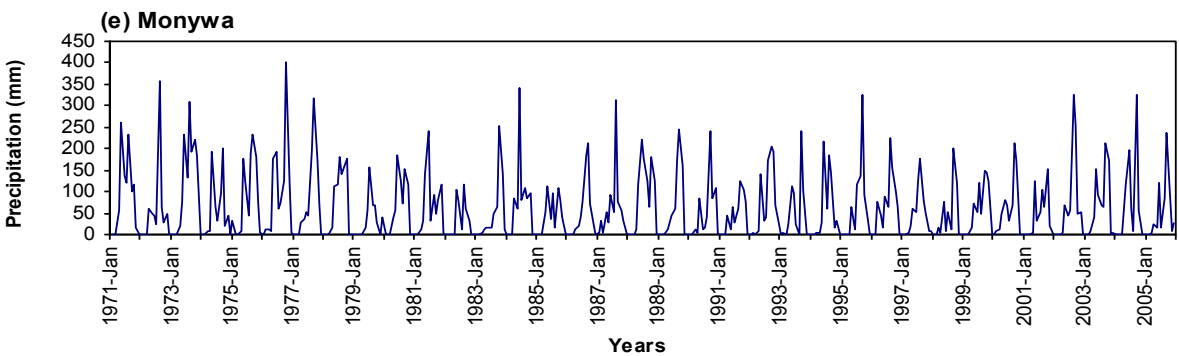
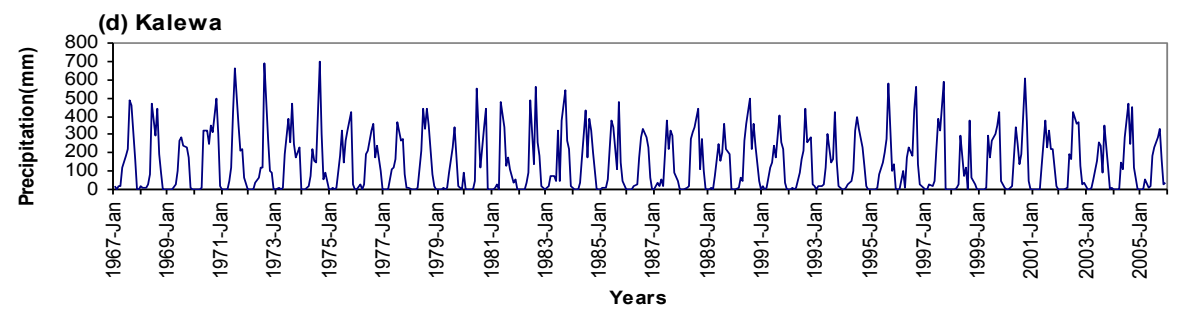
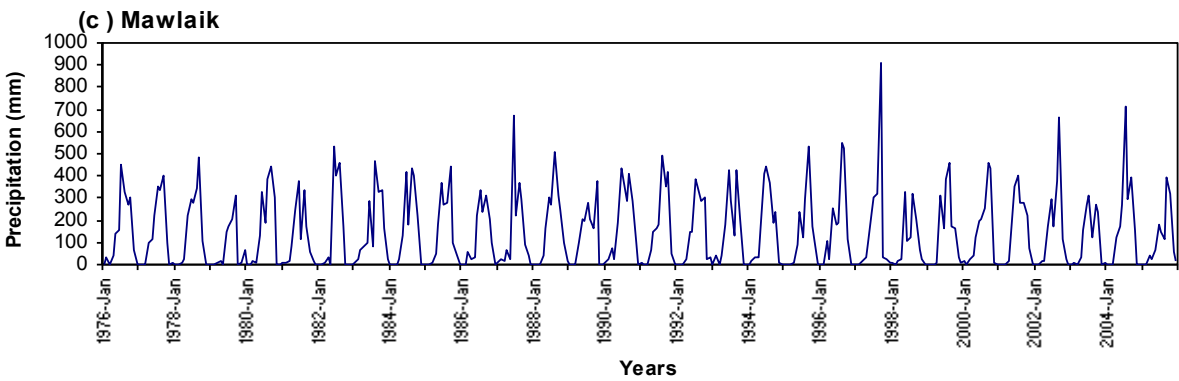
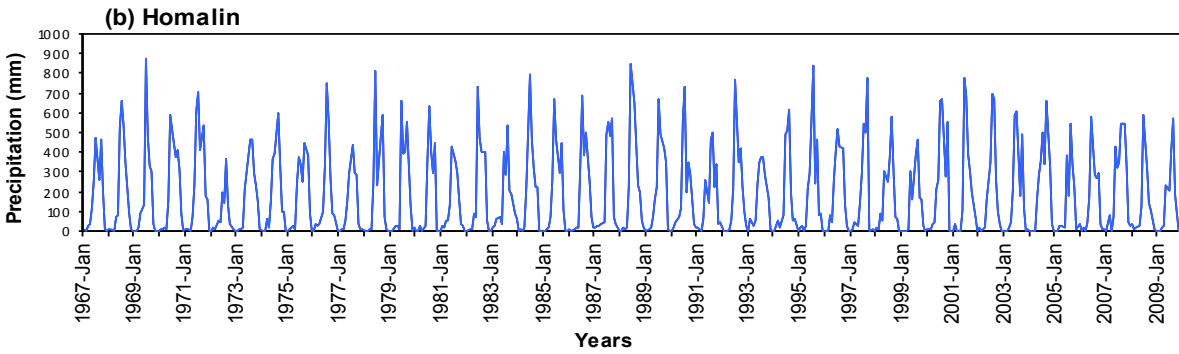
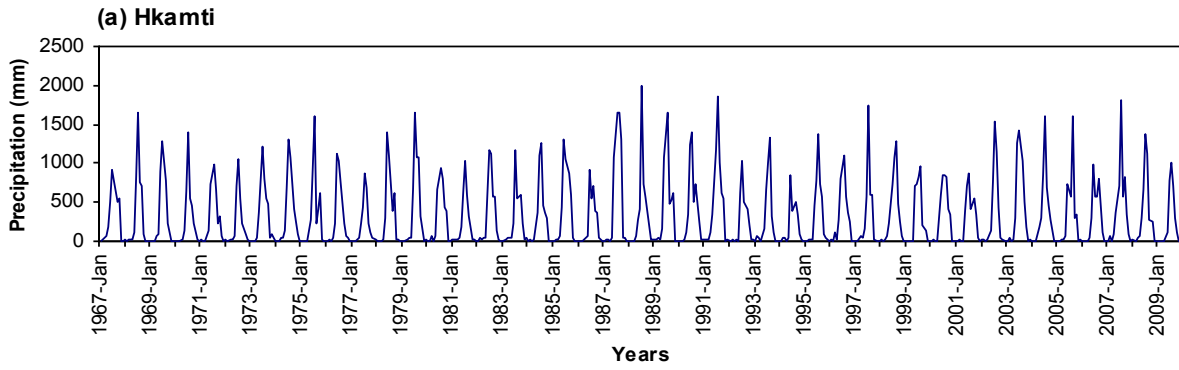
Monthly Temperature



Monthly Precipitation

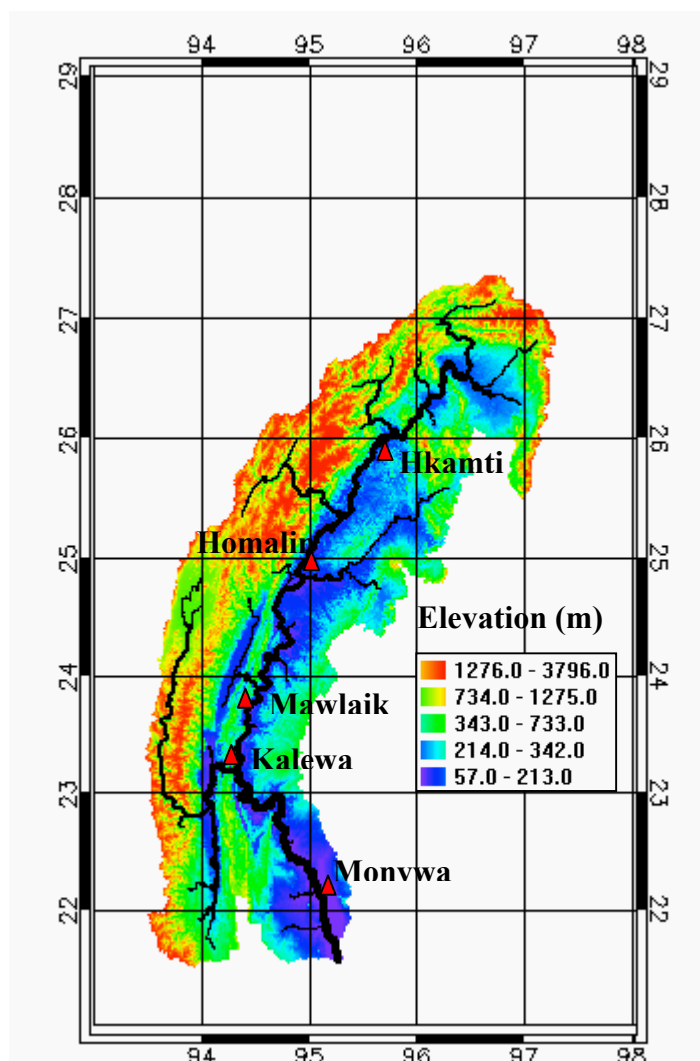


Long-term Variation of Monthly Precipitation



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 ¹⁾
		Latitude	Longitude			
1	Hkamti	26° 00'	95° 42'	27420	1972-2009	H, Q
2	Homalin	24° 52'	94° 55'	43124	1973-2009	H, Q
3	Mawlaik	23° 38'	94° 25'	69339	1972-2009	H, Q
4	Kalewa	23° 12'	94° 18'	72848	1966-2009	H, Q
5	Monywa	22° 06'	95° 08'	110350	1966-2009	H, Q

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
1	2290	19720	14150	109	8.36	71.92	1972-2009
2	3170	21320	16437	352	7.35	49.44	1973-2009
3	4007	26790	19732	342	5.78	38.64	1972-2009
4	4147	26370	20530	509	5.69	36.20	1966-2009
5	4637	27550	19935	649	4.20	24.97	1966-2009

1) H: water level, Q: discharge, Q is obtained from rating curve.

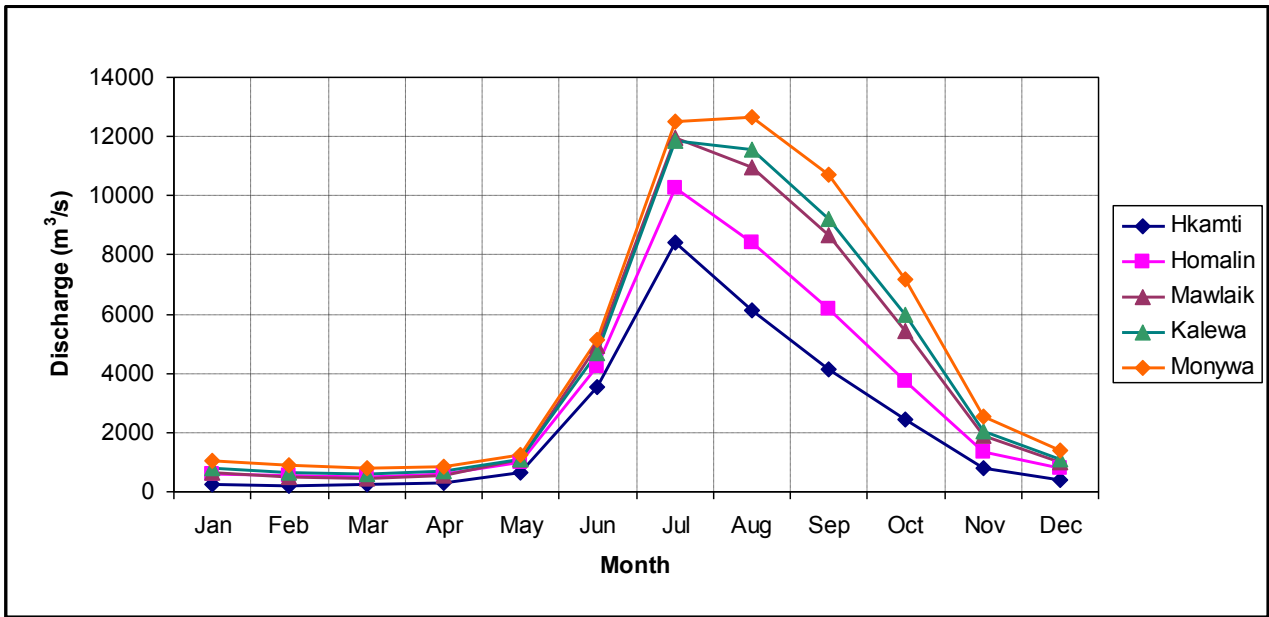
3) Q max : Maximum discharge.

5) \bar{Q} min: Mean minimum discharge.

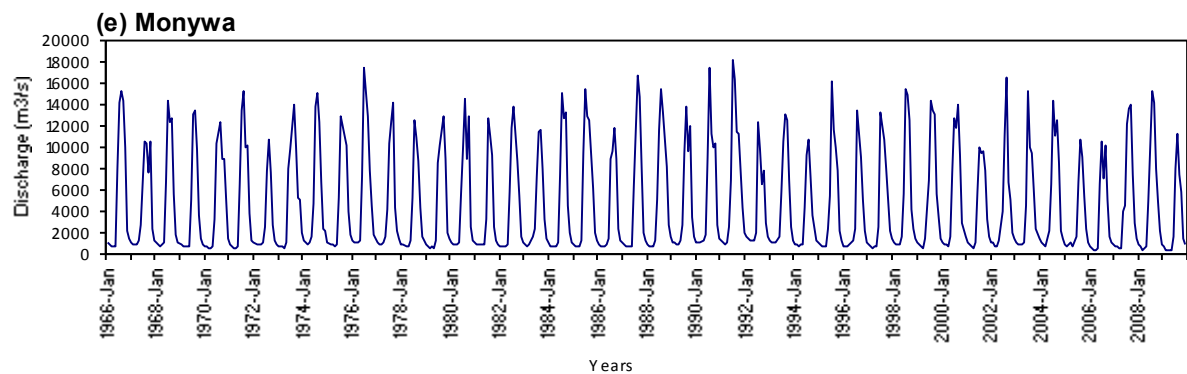
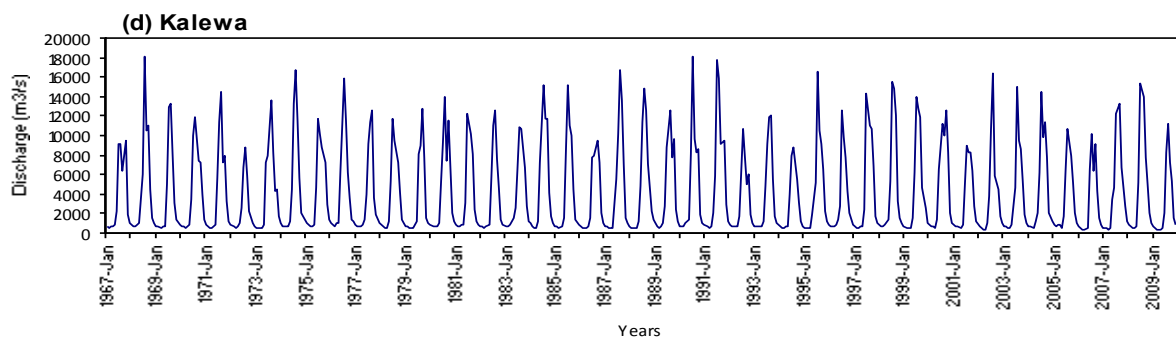
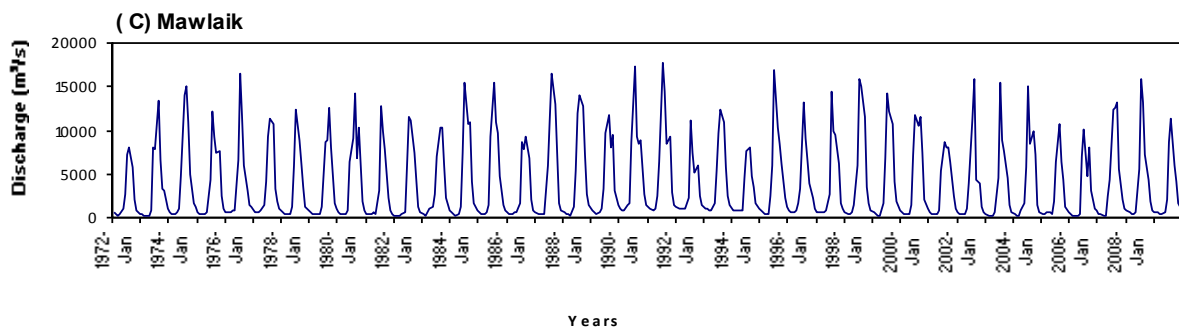
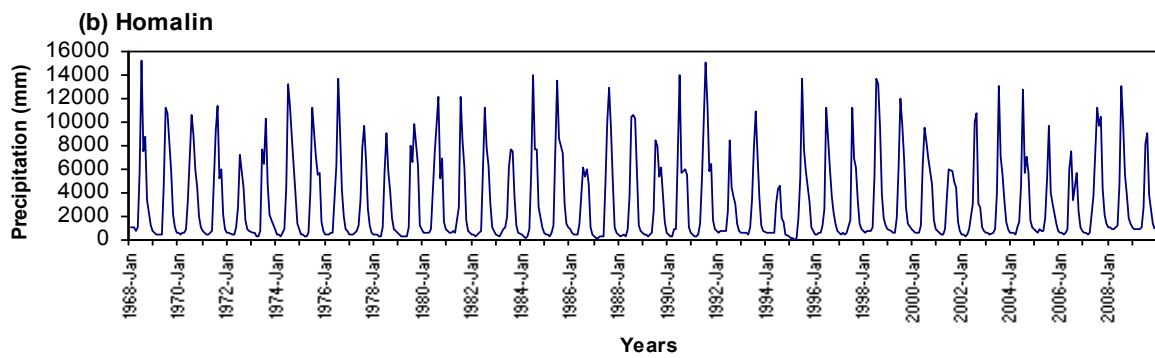
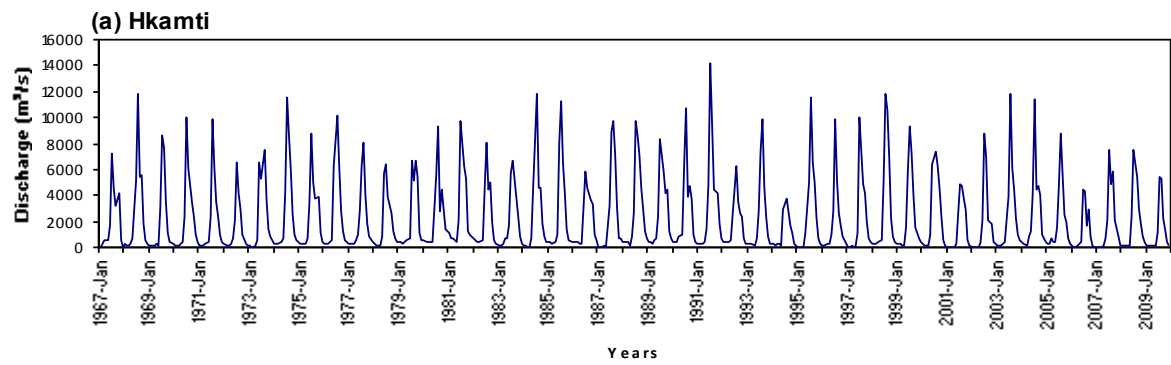
2) \bar{Q} : Mean annual discharge.

4) \bar{Q} max: Mean maximum discharge.

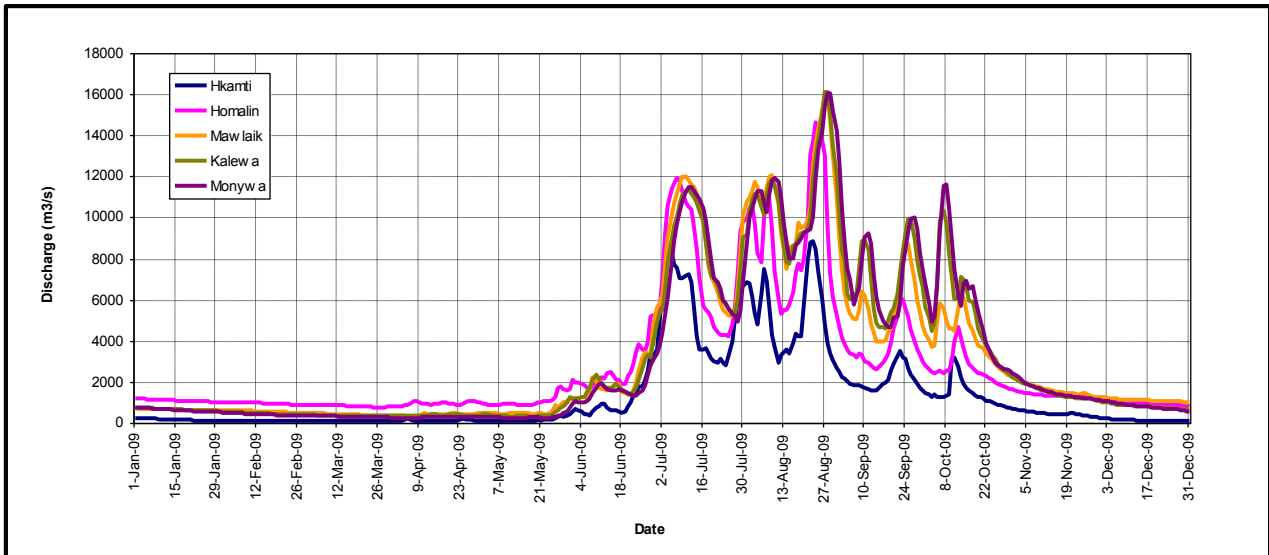
Monthly Mean Flow



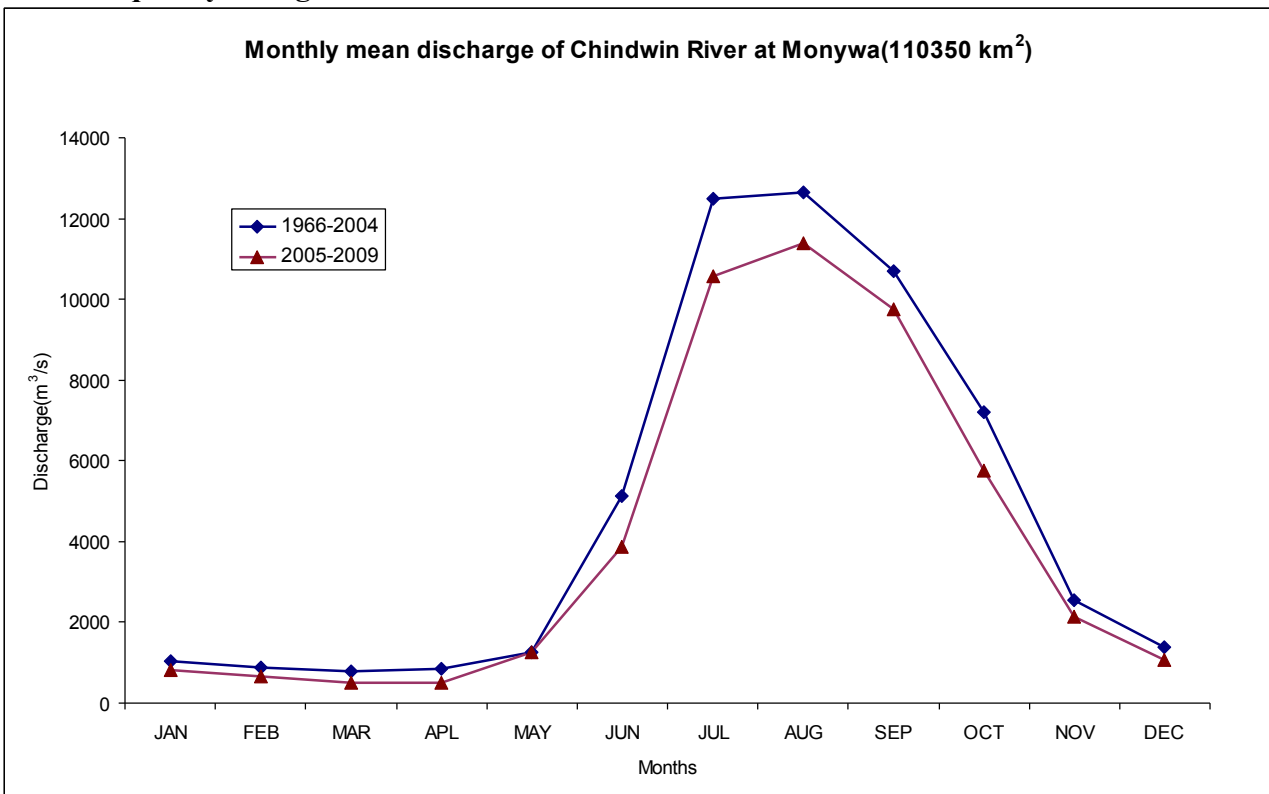
4.3 Long-term Variation of Monthly Discharge Series



4.4 Annual Pattern of Discharge Series(2009)



4.5 Unique Hydrological Features

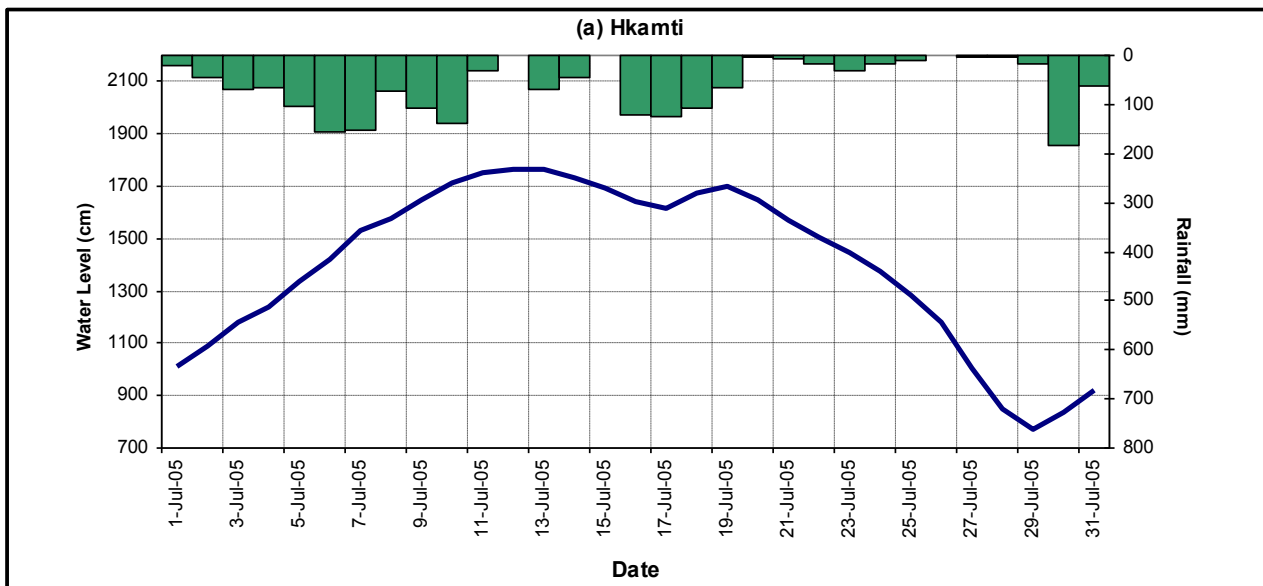


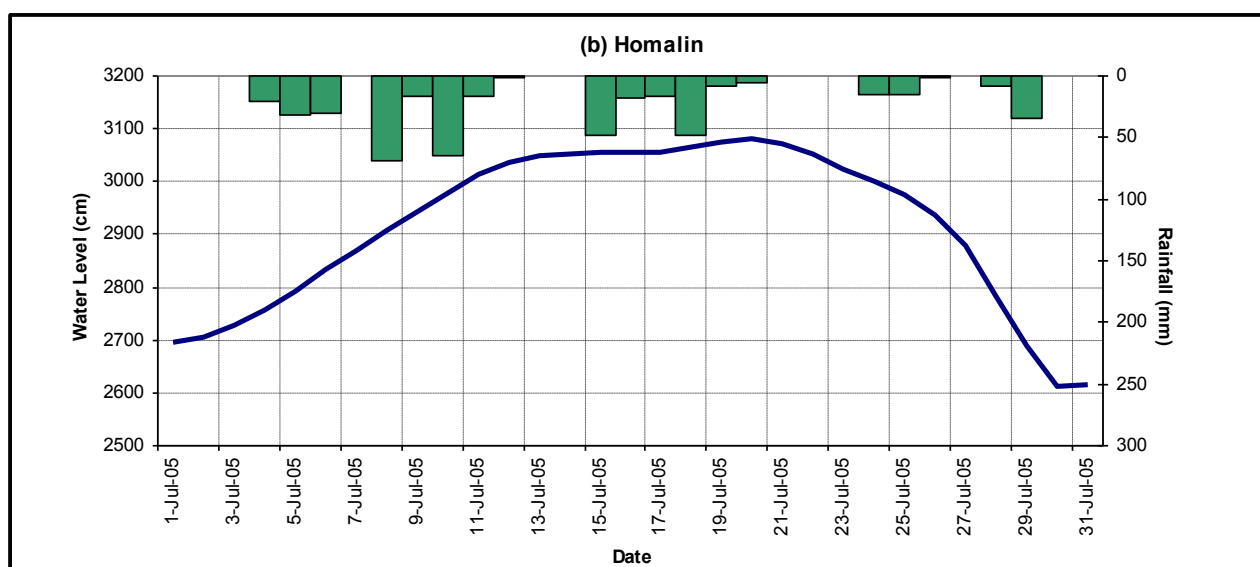
4.6 Annual Maximum and Minimum Discharges

Station: Monywa

Year	Maximum ¹⁾		Minimum ²⁾		Year	Maximum ¹⁾		Minimum ²⁾	
	Date	[m ³ /s]	Date	[m ³ /s]		Date	[m ³ /s]	Date	[m ³ /s]
1966	5-9-66	24550	11-4-66	575	1988	5-8-88	25450	18-4-88	610
1967	7-10-67	17740	22-4-67	775	1989	7-8-89	22490	21-4-89	783
1968	15-7-68	25450	24-3-68	757	1990	3-8-90	20580	26-3-90	907
1969	25-7-69	20130	24-5-69	582	1991	22-7-91	25600	1-4-91	852
1970	4-8-70	19790	13-4-70	548	1992	13-7-92	14470	18-5-92	1039
1971	29-8-71	19450	6-4-71	509	1993	6-9-93	21140	24-3-93	981
1972	5-8-72	16490	29-4-72	757	1994	1-9-94	13410	27-4-94	644
1973	12-8-73	21700	19-4-73	530	1995	23-7-95	20580	2-4-95	684
1974	15-8-74	25000	3-3-74	921	1996	27-7-96	16080	29-4-96	616
1975	6-8-75	17840	23-4-75	709	1997	2-10-97	20400	14-5-97	432
1976	21-7-76	26650	16-4-76	892	1998	10-9-98	19600	27-3-98	736
1977	3-9-77	23800	31-3-77	798	1999	2-9-99	21530	5-5-99	480
1978	7-7-78	16540	27-4-78	672	2000	5-10-00	18740	26-4-00	632
1979	13-9-79	18920	8-6-79	530	2001	8-8-01	14040	22-5-01	512
1980	9-10-80	20300	18-4-80	806	2002	20-8-02	24300	26-4-02	672
1981	25-7-81	15010	18-5-81	790	2003	12-7-03	18460	21-4-03	744
1982	3-8-82	23160	31-3-82	650	2004	27-7-04	19770	1-4-04	608
1983	7-8-83	18840	1-3-83	653	2005	1-9-05	16200	1-5-05	552
1984	5-9-84	22710	7-4-84	600	2006	21-9-06	16520	12-4-06	242
1985	4-8-85	19450	28-3-85	613	2007	1-8-07	19740	13-4-07	318
1986	14-9-86	15420	9-6-86	591	2008	11-7-08	23270	8-5-08	288
1987	24-8-87	20010	27-5-87	659	2009	28-8-09	16160	13-5-09	257

Hyetographs and Hydrographs of Major Floods (1991)





5. Water Resources

5.1 General Description

Chindwin catchment area covers 110350 km². The basin of Chindwin river is, in general, a mountainous forested terrain with the only exception of its lowest southern part which is a vast plain. The Chindwin basin has approximately 120 000 acres of cultivated land. About 90 % of the basin is thickly forested by valuable species of wood. Generally, floods arise from the source of the river and the flood waves move down stream, causing damage to the crops and properties. Major floods generally occur from July to September. Potential surface water resource of Chindwin river basins is 149.7 km³/year and there are 4 Under Construction Hydro Electric Power Projects which are Htamanthi, Shwesaryay, Manipu and Myitthar.

5.2 Major Flood and Drought experiences

No major drought has been experienced in Chindwin River basin in the past.

Major Flood at Hkamti

Date	Peak discharge [m ³ /s]	Rainfall [mm], Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
26. 6.78	17140	911, 21-6-78 ~26-6-78	Vigorous Monsoon	-	Hkamti
13. 7.91	19720	1478, 2-7-91~19~7-91	Vigorous Monsoon	-	Hkamti
12. 7.97	19460	1496, 2-7-97~15-7-97	Vigorous Monsoon	-	Hkamti
5. 7.03	17650	1162, 25-6-03~5-7-03	Vigorous Monsoon	-	Hkamti
21. 7.04	17770	1465, 7-7-04~21-7-04	Vigorous Monsoon	-	Hkamti

5.3 Water Quality

The values of pH for rain water at Monywa (2004 & 2005)

Date of Measurement	pH
9-4-2004	6.8
15-5-2004	6.9
8-6-2004	5.9
13-7-2004	8.1
9-9-2004	7.6
3-10-2004	7.7
28-4-2005	7.7
6-5-2005	7.5

6. Socio-cultural Characteristics

The Chindwin River is a river in Myanmar and the major tributary of the Ayeyarwaddy River. It runs through misty-blue mountains and charming towns and villages, proudly running through a region of abundant natural resources and fertile meadows. The Chindwin Valley is a place of deep jungles and lofty mountains.

Temperatures fall to freezing point in winter on Pakkoi and Naga mountain ranges where coldness remains in summer. Winter temperatures falls as low as 4 °C in northern low lands. In Monywa, temperatures rise as high as 43 °C in summer and falls to 10 °C in the cold season.

Principal agricultural crops are paddy, wheat, maize, <http://www.myanmars.net/myanmar/images/sagaing.jpg>millet, groundnut, sesame, cotton, pulses.

Timber extraction work is the principal industry as valuable teak forests are widespread in the basin. In the Chindwin basin live Myanmars, Kachins, Chins, Nagas, and Shans.

Sagaing Region of Chindwin Basin has over 3 million acres of total cultivated area. Paddy is cultivated on 1.4 million acres and other crops are on 1.5 million acres. Others are alluvial- land cultivation, garden farms and hillside cultivation.

Capital of Sagaing Region is Sagaing, a town boast for its belonging of World's third biggest bell (Minngun Bell). Sagaing Hill, Kaunghmudaw Pagoda, Minngun, Monywa Powun Hill, Phowin, Htamanthi Wild life sanctuary, Nyaungkan Bronze Age Archaeological Site, Twinn Hill, Kyaukka Lacquer ware village are famous in this area.

7. References, Databooks and Bibliography

Department of Meteorology and Hydrology: Meteorological and Hydrological Data

Agricultural Atlas of the Union of Myanmar by Food and Agriculture Organization of the United Nations, (2004): Land use, Land cover and Geological information