

The hydrological data of Langtang Valley, Nepal Himalayas

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Abstract

Observations of the discharge from glacier-covered watersheds were carried out for a year starting in July of 1985 at three sites in Langtang Valley of Nepal Himalayas. The stream water temperature was also measured during the same period at a site of that ones. This paper explains the data shown in Table 4. The observation sites, the method, the instruments and the observers are mentioned.

1. Methods

1. 1. Topographical features of the observation sites

The discharge from glacier-covered watersheds was observed from July 1, 1985 to July 4, 1986 at three sites in Langtang Valley (86°E, 28°N), which is located 60 km north of Kathmandu, the capital city of Nepal. A topographical map is shown in Fig. 1. Table 1 shows the altitudes of the three sites and the basin areas. In Fig. 1 and Table 1, both S1 and S2 are the same sites as the stations observed by Yamada *et al.* (1984) in 1982. Stream water temperature was measured at S1 in Fig. 1.

Table 1. Topographical features at the three hydrological sites.

Site name	Altitude of the site (m)	Basin name	Basin area (km ²)
S1	3840	Langtang Khola W.	333
S2	4000	Lirung Khola W.	13.8
S3	4200	Khyimjung Glacier W.	6.6

1. 2. Observation methods of stream discharge and stream water temperature

The observation of water-levels at three sites were carried out by using continuous water-level recorders

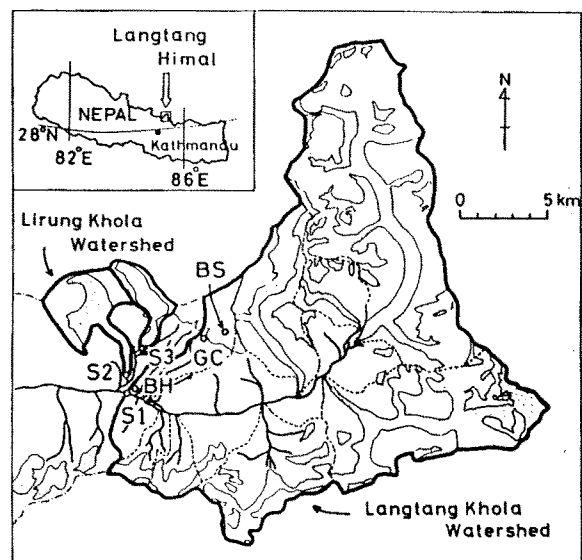


Fig. 1. A topographical map of the Langtang Valley, The thick solid lines indicate the boundaries of the Langtang Khola Watershed (observation site : S1), the Lirung Khola Watershed (observation site : S2) and the Khyimjung watershed (observation site : S3). BH: Base House for meteorological observations.

Table 2. Instruments

Item	Instrument	Specification
Continuous water-level recorder	Ikeda Co.,Ltd. KWH-10	Float type 14 days a chart Chart speed: 2.2 cm/day Range: 1 m Recorded scale: 1/5
Current meter	Toho Dentan Co., Ltd. Tk-102	Price type Range: 0.1-6.0 m/s
Current meter	Hiroi Elc.Co., Ltd.	Rotating cups type Range: 0.41-1.94 m/s
Water temperature recorder	Chino Co.,Ltd. ES200-01	Pt-resistance thermometer
Water temperature digital recorder	Grant Co.,Ltd. SQ-8	Thermistor
Handheld computer	Epson Co.,Ltd. HC-20	For analyzing the data in SQ-8

with float. The discharge was determined from the survey of the cross section at three sites, and the velocity of flow was determined by a water current meter. The surveys were carried out once or twice a month. The instruments used are shown in Table 2. A Price-type current meter was used in high water, and a rotating-cups-type current meter was used in low water. The relationships between the water-level and the discharge at the three sites are shown in Fig. 2.

Water temperature was measured at S1 in the period from July 10, 1985 to July 5, 1986, using two types of instruments, a Pt-resistance thermometer with a continuous recorder and a thermistor with a digital data logger and a handheld computer, which operated one set of instruments at a time. The records on a chart were calibrated by manual measurement with a mercury thermometer.

1. 3. Observers

The hydrological observations were actually carried out with the aid of all of the members related to this study. The members' names listed in Table 3 were mainly those who were primarily involved in the hydrological observation.

2. Results

2. 1. The discharge data

Table 4 shows the observed daily discharge data.

Table 3. List of observers.

Name	Period
Fukushima, Y. & K. Kawashima	30 Jun. 1985 - 16 Aug. 1985
Khoshama, S.	17 Aug. 1985 - 18 Sep. 1985
Suzuki, M.	19 Sep. 1985 - 21 Nov. 1985
Sadakane, A.	22 Nov. 1985 - 19 Dec. 1985
Ihda, H.	20 Dec. 1985 - 31 Dec. 1985
Ohta, T.	1 Jun. 1986 - 26 Feb. 1986
Motoyama, H.	27 Feb. 1986 - 26 Apr. 1986
Motoyama, H. & H. Kubota	27 Apr. 1986 - 3 May. 1986
Kubota, H.	4 May 1986 - 24 May. 1986
Fukushima, Y. & H. Kubota	25 May 1986 - 5 Jul. 1986

The data obtained was read from the recorded charts at intervals of an hour and was accumulated to obtain the daily amount. Though the continuous water-level recorder was not set at S1 from 1 to 10 July, 1985, manual measurements were carried out two times a day. Therefore, the daily discharge was estimated by using the relationships between the daily and hourly discharge in the continuously recorded period. In the winter, the observations were unobtainable due to the freezing of the water surface at S2 and S3.

2. 2. The water temperature data

In Table 4, the daily mean values calculated by using each of the 24 data items (one for every hour on the hours for a day) are presented. In the winter, stream water temperature was measured by manual twice a day, and not by a continuous recorder because of the shortage in battery supplies.

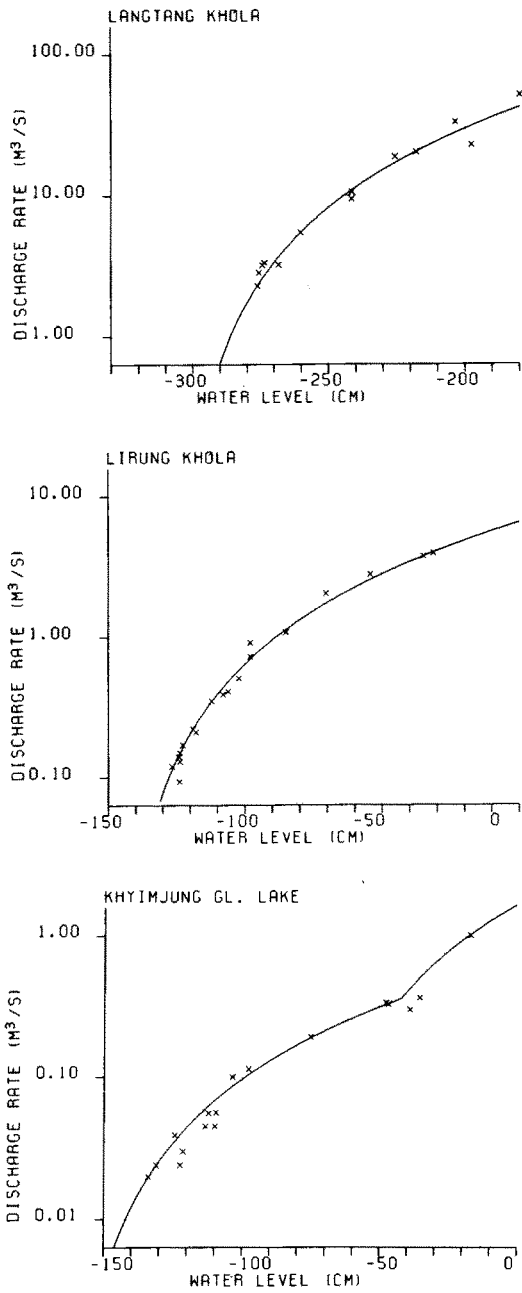


Fig. 2. Relationships between the water-level and the discharge of three watersheds.

3. Acknowledgments

These glacio-hydrological observations were carried out with the co-operation of both Japan and Nepal. We thank all of the members of the Glaciological Expedition of Nepal/Langtang Project for their kind support in the field. We would also like to thank Dr. T. Yamada of Hokkaido University for his assistance. This work was aided by a Crant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japanese Government.

Reference

Yamada, T., Motoyama, H. and Thapa, K. B. (1984) : Role of glacier meltwater in discharge from the glaciated watersheds of Langtang Valley, Nepal Himalaya. *Glacial Studies in Langtang Valley*, Data Center for Glacier Research, Japanese Society of Snow and Ice, Publ. No. 2, 61-71.

Table 4. The observed daily discharge rate at the three sites, S1 (Langtang Khola Watershed), S2 (the Lirung Khola Watershed) and S3 (the Khyimjung Glacier Watershed), and the observed data of the daily mean water temperature at S1, the Langtang Khola site. The discharge, $Q(\text{m}^3 \text{ day}^{-1})$ can be calculated from the each basin area, $A(\text{km}^2)$ and the discharge rate, $Q_r(\text{mm}^1 \text{ day}^{-1})$: $Q = A \cdot Q_r \times 10^8$

					Table 4-1				
Jul. 1985	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)	Aug. 1985	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)
1	9.31	.	.	.	1	8.11	14.56	8.46	.
2	8.82	.	.	.	2	8.14	14.17	8.96	.
3	8.60	.	.	.	3	7.84	14.27	8.73	.
4	10.04	.	.	.	4	7.66	15.92	8.90	.
5	8.78	.	.	.	5	7.86	13.66	9.39	.
6	9.62	.	.	.	6	7.77	12.34	10.58	4.82
7	9.68	.	.	.	7	7.88	12.67	10.75	5.17
8	8.86	.	.	.	8	8.43	16.31	11.27	5.18
9	8.89	.	.	.	9	9.08	17.00	11.74	5.27
10	8.91	.	.	.	10	9.22	15.71	11.32	4.63
11	8.24	.	.	5.52	11	9.53	14.27	11.38	4.50
12	8.49	.	.	.	12	9.46	17.37	12.13	4.64
13	9.47	.	.	.	13	9.05	17.22	11.92	4.65
14	8.95	22.94	.	.	14	9.14	17.59	10.93	4.53
15	8.62	19.93	.	4.43	15	8.62	15.98	10.86	4.80
16	8.63	17.97	.	4.60	16	9.12	16.10	11.16	4.28
17	8.23	19.62	7.59	5.22	17	9.38	18.32	10.71	4.22
18	7.96	20.28	.	4.57	18	10.24	23.91	11.41	4.49
19	7.46	17.69	.	4.56	19	10.87	28.81	12.15	3.91
20	7.36	17.51	.	4.85	20	10.60	21.91	12.14	4.22
21	8.13	17.34	.	4.38	21	10.61	24.18	12.16	4.55
22	8.15	16.82	.	4.60	22	11.28	28.97	12.80	4.16
23	8.78	22.21	.	4.18	23	11.77	.	10.90	4.02
24	8.62	.	.	4.45	24	10.32	16.68	10.06	4.16
25	8.98	.	.	4.57	25	9.60	.	10.05	4.47
26	8.98	.	.	.	26	9.39	.	10.35	5.05
27	9.33	.	.	4.29	27	9.69	.	10.14	5.38
28	9.17	.	.	5.40	28	10.24	.	10.82	4.76
29	8.45	.	9.08	.	29	10.59	19.05	11.28	4.69
30	7.87	16.15	8.53	.	30	10.12	.	12.39	4.44
31	7.92	14.26	8.27	.	31	9.59	.	10.14	4.71
Total	269.31	222.71	33.47		Total	291.20	426.95	336.00	
Sep. 1985	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)	Oct. 1985	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)
1	10.19	.	11.88	.	1	4.54	8.48	4.19	4.70
2	9.79	.	10.93	.	2	4.39	.	4.89	4.67
3	10.16	.	10.66	.	3	4.20	.	5.32	4.28
4	9.81	.	9.27	.	4	4.04	.	4.94	4.38
5	9.11	.	8.72	.	5	3.87	.	3.74	4.16
6	8.06	.	8.59	.	6	3.61	.	2.70	3.97
7	7.75	.	8.34	.	7	3.41	.	2.28	3.87
8	7.77	.	8.96	.	8	3.24	.	2.02	3.52
9	7.77	.	8.65	.	9	3.17	.	2.02	3.32
10	7.82	.	8.21	.	10	3.58	.	2.08	1.97
11	7.86	.	8.53	.	11	3.32	.	2.34	4.77
12	7.58	.	7.66	.	12	3.23	.	2.61	4.53
13	6.78	.	6.99	.	13	3.10	.	2.63	5.30
14	6.47	.	7.41	.	14	3.04	.	2.81	4.75
15	6.03	.	6.66	.	15	2.97	.	3.01	4.50
16	6.97	.	7.78	.	16	2.92	5.30	2.47	4.01
17	7.21	.	7.19	.	17	3.71	12.44	6.34	2.84
18	6.24	.	4.31	.	18	4.57	16.01	6.15	4.72
19	5.67	9.57	3.85	.	19	4.14	9.50	3.36	5.81
20	5.24	10.17	4.39	.	20	3.67	7.20	2.66	5.07
21	5.19	9.83	4.72	5.65	21	3.38	6.26	2.27	4.09
22	5.31	10.14	4.87	5.34	22	3.18	6.10	2.19	3.67
23	5.59	9.93	4.39	4.78	23	3.01	5.97	2.04	3.69
24	5.49	8.25	3.82	5.10	24	2.87	5.44	1.97	3.74
25	5.40	8.12	3.69	3.78	25	2.71	5.44	1.82	3.66
26	5.23	9.40	4.16	5.42	26	2.61	5.34	1.95	3.54
27	5.46	10.86	5.59	5.19	27	2.47	5.49	2.21	3.58
28	5.57	9.70	5.40	4.62	28	2.57	5.44	2.12	3.41
29	5.22	8.48	4.49	4.30	29	2.66	5.52	2.05	3.66
30	4.80	8.52	4.68	4.79	30	2.60	5.44	2.06	3.57
					31	2.54	5.11	1.82	3.70
Total	207.53	112.98	204.79		Total	103.32	120.47	91.09	

Table 4-2

Nov. 1985	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)	Jan. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)
1	2.51	4.98	1.46	3.21	1	0.91	.	.	.
2	2.41	4.09	1.51	2.89	2	0.89	.	.	.
3	2.28	4.35	1.51	2.67	3	0.88	.	.	.
4	2.18	4.01	1.62	2.57	4	0.88	.	.	.
5	2.08	2.37	1.49	2.59	5	0.89	.	.	.
6	1.99	3.07	1.35	2.77	6	0.90	.	.	.
7	1.96	3.31	1.49	3.48	7	0.89	.	.	.
8	1.98	3.11	1.48	3.64	8	0.86	.	.	.
9	1.95	2.67	1.31	3.72	9	0.88	.	.	.
10	1.89	2.34	1.34	3.68	10	0.89	.	.	.
11	1.79	2.88	1.45	3.53	11	0.90	.	.	.
12	1.72	3.11	1.44	3.56	12	0.89	.	.	.
13	1.65	3.96	1.60	3.57	13	0.89	.	.	.
14	1.59	3.97	1.64	3.49	14	0.88	.	.	0.72
15	1.54	4.95	1.76	3.56	15	0.88	.	.	.
16	1.47	4.25	2.52	3.47	16	0.85	.	.	.
17	1.45	4.13	4.01	.	17	0.84	.	.	.
18	1.46	.	.	.	18	0.82	.	.	.
19	1.43	.	.	.	19	0.84	.	.	.
20	1.44	.	.	.	20	0.83	.	.	.
21	1.42	.	.	.	21	0.82	.	.	.
22	1.41	.	.	.	22	0.83	.	.	.
23	1.39	.	.	.	23	0.83	.	.	.
24	1.38	.	.	.	24	0.83	.	.	.
25	1.36	.	.	.	25	0.81	.	.	.
26	1.34	.	.	.	26	0.78	.	.	.
27	1.32	.	.	.	27	0.79	.	.	.
28	1.32	.	.	.	28	0.78	.	.	.
29	1.32	.	.	.	29	0.79	.	.	.
30	1.31	.	.	.	30	0.78	.	.	1.28
31	31	0.76	.	.	.
Total	50.35	61.54	28.99		Total	26.31	0.00	0.00	

Dec. 1985	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)	Feb. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)
1	1.30	.	.	.	1	0.78	.	.	.
2	1.27	.	.	.	2	0.74	.	.	.
3	1.25	.	.	.	3	0.75	.	.	.
4	1.25	.	.	.	4	0.73	.	.	.
5	1.25	.	.	.	5	0.70	.	.	.
6	1.23	.	.	.	6	0.70	.	.	.
7	1.22	.	.	.	7	0.72	.	.	.
8	1.21	.	.	.	8	0.72	.	.	.
9	1.21	.	.	.	9	0.72	.	.	.
10	1.19	.	.	.	10	0.71	.	.	.
11	1.18	.	.	.	11	0.72	.	.	.
12	1.18	.	.	.	12	0.73	.	.	.
13	1.13	.	.	.	13	0.69	.	.	.
14	1.11	.	.	.	14	0.67	.	.	.
15	1.11	.	.	.	15	0.67	.	.	.
16	1.10	.	.	.	16	0.66	.	.	.
17	1.08	.	.	.	17	0.66	.	.	.
18	1.06	.	.	.	18	0.67	.	.	.
19	1.05	.	.	.	19	0.67	.	.	.
20	1.03	.	.	.	20	0.68	.	.	.
21	1.01	.	.	.	21	0.67	.	.	.
22	1.02	.	.	.	22	0.66	.	.	.
23	0.99	.	.	.	23	0.64	.	.	.
24	1.01	.	.	.	24	0.62	.	.	.
25	1.00	.	.	.	25	0.62	.	.	.
26	0.98	.	.	.	26	0.61	.	.	.
27	0.94	.	.	.	27	0.54	.	.	2.47
28	0.96	.	.	.	28	0.58	.	.	2.38
29	0.99	.	.	.					
30	0.99	.	.	.					
31	0.95	.	.	.					
Total	34.27	0.00	0.00		Total	19.04	0.00	0.00	

Table 4-3

Mar. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)	May. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)
1	0.54	.	.	2.84	1	1.06	1.63	1.88	5.67
2	0.55	.	.	2.14	2	1.34	3.03	2.13	5.48
3	0.51	.	.	2.64	3	1.49	.	.	4.15
4	0.52	.	.	2.57	4	1.40	.	.	4.19
5	0.54	.	.	3.65	5	1.17	4.24	0.91	4.34
6	0.53	.	.	3.58	6	1.10	3.57	0.80	5.19
7	0.53	.	.	3.35	7	1.10	3.33	1.00	5.64
8	0.54	.	0.90	3.87	8	1.26	4.13	1.67	5.54
9	0.56	.	1.19	4.30	9	1.65	5.09	2.44	4.55
10	0.59	.	1.37	4.46	10	1.96	5.91	2.47	3.78
11	0.59	.	1.24	4.20	11	1.95	5.73	1.72	4.10
12	0.57	.	0.84	3.89	12	1.95	4.62	1.71	4.18
13	0.56	.	0.78	4.21	13	2.00	4.38	1.88	4.48
14	0.56	.	0.79	3.38	14	1.94	4.11	1.24	3.84
15	0.57	.	.	1.34	15	1.77	3.15	1.22	5.33
16	0.55	.	.	.	16	1.88	3.15	1.21	5.72
17	0.56	.	.	.	17	1.90	2.92	1.09	4.23
18	0.55	.	.	.	18	1.74	2.59	1.05	4.85
19	0.54	.	.	.	19	1.66	2.30	1.10	3.16
20	0.56	.	.	.	20	1.64	2.13	1.39	3.96
21	0.54	.	.	.	21	1.79	2.58	1.95	3.39
22	0.54	.	0.67	.	22	1.92	3.71	2.10	2.13
23	0.54	.	0.62	.	23	1.92	3.95	1.72	1.65
24	0.52	.	0.63	3.13	24	1.93	4.12	1.84	.
25	0.51	.	0.67	2.87	25	2.09	4.38	2.09	.
26	0.56	.	0.75	3.28	26	2.03	4.33	1.52	.
27	0.54	.	1.07	4.23	27	1.84	3.74	1.13	.
28	0.58	.	1.53	5.19	28	1.77	3.62	1.72	.
29	0.60	.	1.48	5.23	29	1.95	4.12	2.38	.
30	0.59	.	1.31	4.62	30	2.30	4.29	1.94	4.09
31	0.59	.	0.87	3.55	31	2.42	4.21	2.12	5.74
Total	17.12	0.00	16.72		Total	53.92	109.07	47.43	
Apr. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)	Jun. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)
1	0.60	.	0.61	3.50	1	2.95	4.94	2.43	4.49
2	0.59	.	0.57	3.17	2	3.04	4.70	2.25	5.47
3	0.60	.	0.37	0.44	3	3.10	4.71	2.84	5.74
4	0.60	.	0.38	1.93	4	3.52	6.01	3.40	5.81
5	0.54	.	0.38	3.35	5	4.17	8.07	3.46	5.71
6	0.54	.	0.36	3.58	6	4.76	9.92	3.90	5.61
7	0.57	.	0.35	4.22	7	4.46	9.72	4.44	5.82
8	0.61	.	0.58	5.71	8	6.13	9.66	4.07	4.92
9	0.63	.	1.11	6.35	9	6.36	8.68	3.53	5.32
10	0.66	.	1.38	6.30	10	6.87	8.71	3.99	5.56
11	0.67	.	1.00	5.28	11	7.54	10.36	4.59	5.32
12	0.69	.	1.05	5.92	12	8.59	12.79	4.60	5.17
13	0.75	.	1.51	6.12	13	8.75	15.43	3.96	4.20
14	0.80	.	1.62	5.93	14	8.39	13.53	4.25	5.24
15	0.84	.	1.77	5.72	15	9.11	14.79	5.21	5.40
16	0.88	.	1.68	5.11	16	9.52	16.20	5.23	5.24
17	0.90	.	1.31	4.72	17	10.22	19.59	6.65	5.21
18	0.91	3.09	1.28	4.18	18	11.43	21.55	6.83	5.10
19	0.93	3.26	1.32	4.42	19	12.63	23.31	6.97	4.61
20	0.98	3.35	1.49	.	20	12.46	20.75	7.10	4.91
21	0.95	3.69	1.25	4.52	21	12.47	24.03	8.16	5.11
22	1.10	3.78	1.36	4.62	22	12.71	27.51	11.15	5.15
23	1.23	4.87	1.39	3.09	23	13.06	.	8.86	4.74
24	1.33	4.00	1.36	.	24	12.70	.	10.37	4.36
25	1.22	.	0.99	.	25	11.72	.	13.13	4.27
26	0.94	.	0.59	.	26	11.19	.	13.38	4.31
27	0.86	.	0.79	.	27	11.56	.	12.49	3.86
28	0.92	.	0.89	3.98	28	10.30	.	9.71	3.97
29	0.91	1.42	0.62	3.28	29	10.38	.	7.90	3.79
30	0.89	1.52	1.00	4.45	30	9.35	.	8.50	4.76
Total	24.64	28.98	30.36		Total	260.46	294.96	193.36	
					Yearly total	1357.48	1377.66	982.21	
Jul. 1986	Discharge at S1 (mm/day)	Discharge at S2 (mm/day)	Discharge at S3 (mm/day)	Water temp at S1 (°C)					
1	10.63	.	8.06	4.19					
2	8.96	.	.	5.01					
3	8.37	.	.	5.55					
4	8.66	.	.	5.77					
Total	36.62	0.00	8.06						