

Supplementary Table S1. List of five 5th order basin of Tista.

5th Order Basin of Tista	
1	Zemu
2	East Rathong
3	Changme Khangpu
4	Taung
5	Rangpo

Source: Raina and Srivastava (2008).

Supplementary Table S2. Details of the glacier inventory in the Changme Khangpu Basin, India (2016).

NAME	LONG	LAT	Length	Area	Perimeter	Type	Debris cov	Aspect	Supra Lake	Pro Lake	PL Area	PL2 Area	Mean slope	Min Ele (m)	Mean Ele (m)
Toklung Kangse	88.76334991	27.84248935	3.04	2.08 ± 0.05	10.94	2	3	S	NO	YES	0.04	0.00	18	4799	5242
Tenbawa Kangse	88.80617373	27.91774241	4.9	5.80 ± 0.11	21.65	1	2	SW	NO	YES	0.30	0.00	17	5124	5672
Sebu	88.65666238	27.91126613	2.4	1.74 ± 0.04	7.62	1	3	NE	NO	YES	0.10	0.00	22	4996	5360
Sanglapu	88.72177112	27.97289867	1.1	0.34 ± 0.02	3.09	2	1	E	YES	YES	0.02	0.03	28	5252	5433
Rula Kangse	88.66084436	27.8936931	4.22	3.35 ± 0.07	13.69	1	2	SE	NO	NO	0.00	0.00	18	4788	5117
Palo Chutang 1	88.69833714	27.96088216	1.3	0.64 ± 0.03	5.11	1	3	S	NO	YES	0.03	0.00	26	5220	5597
Lako Kangse	88.73988121	27.84987909	2.74	2.83 ± 0.07	14.20	1	3	SW	NO	NO	0.00	0.00	15	4896	5309
Khong Kyong Kangse2	88.82449477	27.90699165	4.76	5.4 ± 0.07	14.58	2	2	S	NO	NO	0.00	0.00	13	4735	5396
Khong Kyong Kangse1	88.84974911	27.89866211	8.2	13.79 ± 0.19	38.78	2	1	SW	YES	NO	0.00	0.00	19	4474	5448
Kangpup Kangse	88.75792054	27.86025355	1.8	1.51 ± 0.04	7.92	2	3	W	NO	YES	0.06	0.00	17	5123	5362
Illibu Kangse	88.78655747	27.92880275	0.85	0.29 ± 0.02	3.31	1	2	W	NO	YES	0.12	0.00	26	5423	5583
Changme Khangpu	88.68438105	27.95833278	5.7	4.94 ± 0.11	22.93	2	1	S	Yes	NO	0.00	0.00	15	4790	5233
Changme Kang	88.66908763	27.95211462	2.45	1.85 ± 0.04	7.16	1	3	SE	NO	NO	0.00	0.00	13	5198	5380
Palo Chutang 3	88.70482742	27.96222175	0.508	0.17 ± 0.01	1.93	15	3	SE	NO	NO	0.00	0.00	25	5389	5487
Palo Chutang 2	88.71052049	27.96703871	1.93	1.13 ± 0.03	8.04	2	1	SE	YES	YES	0.25	0.00	20	5108	5361
220	88.79024736	27.92788148	0.22	0.05 ± 0.0	0.86	1	3	W	NO	NO	0.00	0.00	30	5008	5090
216	88.8507214	27.75480941	0.73	0.17 ± 0.01	2.37	3	3	W	NO	NO	0.00	0.00	38	4914	5221
215	88.85085892	27.75723761	0.39	0.06 ± 0.00	1.07	3	3	W	NO	NO	0.00	0.00	30	4928	5069
214	88.85228951	27.758807	0.46	0.07 ± 0.00	1.25	3	3	W	NO	NO	0.00	0.00	31	4963	5103
64	88.79537637	27.91874698	2.65	1.53 ± 0.04	7.90	1	3	SW	NO	NO	0.00	0.00	12	5375	5635
63	88.66990227	27.90890945	0.69	0.10 ± 0.01	1.78	3	3	N	NO	NO	0.00	0.00	25	5001	5143
62	88.67701428	27.91145039	0.66	0.14 ±	1.65	3	3	NW	NO	NO	0.00	0.00	23	5141	5284
61	88.68056425	27.91350753	0.89	0.18 ± 0.01	2.05	3	3	NW	NO	NO	0.00	0.00	32	5078	5307
60	88.68435889	27.90788185	0.75	0.13 ± 0.01	2.11	3	3	NE	NO	NO	0.00	0.00	27	5275	5425
59	88.68858319	27.89905534	0.51	0.20 ± 0.01	2.61	3	3	NE	NO	NO	0.00	0.00	25	5206	5327
58	88.68938613	27.8934334	0.3	0.07 ± 0.01	1.17	4	3	E	NO	NO	0.00	0.00	25	5279	5366
57	88.68422585	27.88262717	0.66	0.16 ± 0.01	1.83	3	3	W	NO	NO	0.00	0.00	21	4942	5035
56	88.68521129	27.88939063	0.8	0.33 ± 0.02	3.76	1	3	W	NO	NO	0.00	0.00	27	5130	5330
55	88.68285946	27.89420016	0.72	0.28 ± 0.01	2.10	4	3	W	NO	NO	0.00	0.00	22	5152	5255
54	88.67909364	27.90380411	1.06	0.44 ± 0.02	4.13	1	3	SW	NO	NO	0.00	0.00	19	5080	5333
53	88.66684875	27.90489988	0.6	0.29 ± 0.01	2.50	1	3	SW	NO	NO	0.00	0.00	15	5127	5228
52	88.65042723	27.87979449	1.56	0.9 ± 0.04	9.02	1	3	SE	NO	NO	0.00	0.00	26	5042	5354
51	88.6551283	27.86566813	0.6	0.31 ± 0.01	2.36	4	3	NW	NO	NO	0.00	0.00	22	5139	5230
50	88.66217273	27.86483791	0.53	0.10 ± 0.01	1.34	3	3	N	NO	NO	0.00	0.00	25	5044	5157
49	88.66542914	27.86589253	0.44	0.08 ± 0.01	1.18	3	3	N	NO	NO	0.00	0.00	25	5054	5119
48	88.65904224	27.85661068	0.842	0.28 ± 0.02	3.11	15	3	N	NO	NO	0.00	0.00	19	5072	5201
47	88.64880124	27.85574652	0.37	0.11 ± 0.01	1.28	15	3	S	NO	NO	0.00	0.00	20	5318	5375
46	88.64476106	27.8543033	0.47	0.13 ± 0.01	1.53	1	3	N	NO	NO	0.00	0.00	25	5412	5486
45	88.6520986	27.84702771	3.14	2.09 ± 0.05	9.60	1	3	E	NO	NO	0.00	0.00	15	4948	5277
44	88.66154144	27.83891157	1.87	0.74 ± 0.02	4.97	1	3	E	NO	NO	0.00	0.00	24	4780	5190

NAME	LONG	LAT	Length	Area	Perimeter	Type	Debris cov	Aspect	Supra Lake	Pro Lake	PL Area	PL2 Area	Mean slope	Min Ele (m)	Mean Ele (m)
43	88.6610154	27.83054232	0.69	0.11 ± 0.01	1.67	3	3	S	NO	NO	0.00	0.00	18	5268	5324
42	88.64964358	27.83337158	2.73	1.51 ± 0.04	8.77	1	3	S	NO	YES	0.00	0.00	18	4825	5232
41	88.6555062	27.81079223	0.62	0.15 ± 0.01	1.73	3	3	N	NO	NO	0.00	0.00	28	4990	5080
40	88.80173226	27.70873158	0.77	0.14 ± 0.01	1.96	3	3	E	NO	NO	0.00	0.00	20	5120	5140
39	88.79521098	27.70993801	0.497	0.07 ± 0.0	1.31	3	3	W	NO	NO	0.00	0.00	24	5170	5198
38	88.79566724	27.71212853	0.32	0.04 ± 0.0	0.96	3	3	W	NO	NO	0.00	0.00	22	5010	5040
35	88.88282324	27.85448742	0.95	0.16 ± 0.02	3.49	1	3	SW	NO	NO	0.00	0.00	44	5166	5423
34	88.88179721	27.85879914	1.6	0.48 ± 0.02	4.87	1	3	W	NO	YES	0.02	0.05	33	5055	5433
33	88.87653274	27.86149589	1.1	0.37 ± 0.02	3.30	1	3	W	NO	YES	0.03	0.00	23	5058	5290
32	88.87042266	27.87486858	2	1.47 ± 0.04	7.53	1	3	SW	NO	YES	0.14	0.00	31	4862	5426
31	88.86351508	27.87678391	0.58	0.15 ± 0.01	1.82	1	3	SW	NO	NO	0.00	0.00	24	5217	5389
30	88.85959816	27.87775262	0.54	0.17 ±	1.84	3	3	SW	NO	YES	0.05	0.00	22	5283	5393
29	88.81161811	27.89412333	0.69	0.17 ± 0.01	2.15	3	3	E	NO	NO	0.00	0.00	32	5270	5493
28	88.80427931	27.88806629	0.26	0.09 ± 0.01	1.33	1	3	E	NO	NO	0.00	0.00	27	5410	5529
27	88.81039892	27.88453567	0.61	0.36 ± 0.02	3.16	1	3	SE	NO	NO	0.00	0.00	11	5121	5190
26	88.80311588	27.88165796	0.3	0.15 ± 0.01	1.97	1	3	E	NO	NO	0.00	0.00	22	5306	5438
25	88.80588962	27.87514206	0.84	0.24 ± 0.01	2.18	1	3	W	NO	YES	0.05	0.00	19	5131	5257
24	88.79947743	27.89127578	3.9	2.55 ± 0.06	12.21	1	3	SW	NO	NO	0.00	0.00	16	5105	5448
23	88.79026622	27.89438197	0.69	0.17 ± 0.01	1.76	4	3	SW	NO	NO	0.00	0.00	18	5360	5504
22	88.76570958	27.87416078	1.41	0.53 ± 0.02	4.16	1	3	E	NO	NO	0.00	0.00	18	5157	5254
21	88.7720012	27.86259723	1.43	0.4 ± 0.02	4.29	1	3	SE	NO	NO	0.00	0.00	19	5059	5142
20	88.76844558	27.85398965	1.35	0.41 ± 0.02	3.38	1	3	SE	NO	NO	0.00	0.00	26	4964	5136
19	88.77557335	27.83661655	1.29	0.37 ± 0.02	3.57	1	3	SE	NO	NO	0.00	0.00	17	5042	5204
18	88.75131917	27.82605292	0.18	0.03 ± 0.00	0.65	4	3	E	NO	NO	0.00	0.00	23	5149	5177
17	88.74927236	27.81992591	1	0.26 ± 0.02	3.14	3	3	S	NO	NO	0.00	0.00	22	4977	5186
16	88.74407093	27.81451381	0.59	0.10 ± 0.01	1.47	3	3	S	NO	NO	0.00	0.00	33	4987	5071
15	88.74672402	27.8323989	3.58	3.22 ± 0.08	16.39	1	3	S	NO	NO	0.00	0.00	18	4862	5210
14	88.74058963	27.83866997	1.57	0.6 ± 0.03	5.24	1	3	SW	NO	NO	0.00	0.00	19	5033	5270
13	88.73050276	27.85705963	1.66	0.57 ± 0.03	5.07	1	3	W	NO	NO	0.00	0.00	14	5061	5243
12	88.74957333	27.87831074	1.06	0.44 ± 0.02	3.45	1	3	W	NO	NO	0.00	0.00	14	5303	5432
11	88.75391319	27.88446705	1.46	0.91 ± 0.02	4.63	1	3	W	NO	NO	0.00	0.00	15	5335	5497
10	88.73946174	27.88986407	0.43	0.08 ± 0.00	1.09	4	3	NW	NO	NO	0.00	0.00	21	5429	5486
9	88.76413589	27.88897284	0.54	0.45 ± 0.02	4.98	15	3	W	NO	NO	0.00	0.00	19	5276	5410
8	88.77281738	27.88893682	0.71	0.36 ± 0.01	2.83	1	3	E	NO	NO	0.00	0.00	14	5304	5382
7	88.79126665	27.92262231	1.22	0.22 ± 0.02	2.09	1	3	SW	YES	NO	0.00	0.00	16	5260	5400
6	88.7810116	27.91663242	1.3	0.31 ± 0.01	3.03	15	3	SW	NO	NO	0.00	0.00	22	5190	5280
5	88.77742759	27.91819374	0.75	0.21 ± 0.01	2.07	1	3	W	NO	NO	0.00	0.00	19	5414	5495
4	88.78091109	27.92343409	1.2	0.37 ± 0.02	3.38	1	3	W	NO	NO	0.00	0.00	21	5334	5518
3	88.80114115	27.95148747	1.4	0.96 ± 0.03	4.59	3	1	W	NO	NO	0.02	0.00	20	5080	5138
2	88.80559394	27.96972324	2.05	1.54 ± 0.04	7.73	1	3	W	NO	YES	0.18	0.11	32	5380	5710
1	88.73122272	27.97851231	0.57	0.11 ± 0.01	1.54	1	1	E	YES	NO	0.00	0.00	20	5060	5198

Note: LONG, Longitude; LAT, Latitude; Debris Cov, Debris cover; Supra, Supraglacial; Pro, Proglacial; PL, Proglacial lake; Ele, Elevation; N, North; NE, North-East; E, East; SE, South-East; S, South; SW, South-West; W, West; NW, North-West.

Type of glacier coded as 1, 2, 3, 4 and 15 that referred to the mountain glacier, valley glacier, niche glacier, cirque glacier and fragmented glacier, respectively.

Debris cover has been assigned as 1, 2 and 3 that denotes the glacier having maximum part of the ablation area under supraglacial debris, a part of the ablation area under debris and debris-free glaciers, respectively.

The units of the glacier parameters have been represented in the following manner-.

Length= km; area= km², perimeter= km², mean slope= ° and elevation= m.

Supplementary Table S3. Correlation between glacier size (km²) and minimum elevation (m) of glaciers.

			Area	Minimum Elevation
Kendall's tau_b	Area	Correlation Coefficient	1.000	-0.188 *
		Sig. (2-tailed)		0.014
	Minimum elevation	Correlation Coefficient	-0.188*	1.000
		Sig. (2-tailed)	0.014	

*. Correlation is significant at the 0.05 level (2-tailed).

Supplementary Table S4. Correlation between glacier size (km²) and mean slope of glaciers (°).

			Area	Mean Slope
Kendall's tau_b	Area	Correlation Coefficient	1.000	-0.323 **
		Sig. (2-tailed)		0.000
	Mean Slope	Correlation Coefficient	-0.323 **	1.000
		Sig. (2-tailed)	0.000	

** . Correlation is significant at the 0.01 level (2-tailed).

Supplementary Table S5. Significance test statistics for glacier area change (1975–2016).

5a. Wilcoxon Signed Ranks Test			
		Mean Rank	Sum of Ranks
Area1974–Area 2016	Negative Ranks	62.00	62.00
	Positive Ranks	39.72	3098.00
a. Area1974 < Area_16			
b. Area1974 > Area_16			
c. Area1974 = Area_16			
5b. Test Statistics ^a			
		Area1974–Area 2016	
Z		-7.419 ^b	
Asymp. Sig. (2-tailed)		0.000	
a. Wilcoxon Signed Ranks Test			
b. Based on negative ranks.			

Note: Asymp. Sig, asymptotic p-values and P-values associated with the probability.

Supplementary Table S6. Correlation between glacier size (km²) and glacier area change (1975–2016).

			Area1974	AC 75–16
Kendall's tau_b	Area1974	Correlation Coefficient	1.000	-0.582*
		Sig. (2-tailed)		0.000
		N	79	79
	AC 75-16	Correlation Coefficient	-0.582**	1.000
		Sig. (2-tailed)	0.000	
		N	79	79

** . Correlation is significant at the 0.01 level (2-tailed); AC refers to area change of glaciers.

Supplementary Table 7. Correlation between glaciers minimum elevation (m) and percentage of glacier area change (1975–2016).

			Minimum elevation	% AC (1975–2016)
Kendall's tau_b	Minimum elevation	Correlation Coefficient	1.000	-0.314 **
		Sig. (2-tailed)		0.000

% AC (1975-2016)	Correlation	-0.314**	1.000
	Coefficient		
	Sig. (2-tailed)	1.000	

** . Correlation is significant at the 0.01 level (2-tailed).
