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Supplement of

Temporal inventory of glaciers in the Suru sub-basin, western Himalaya: impacts of regional climate variability

Aparna Shukla et al.

Correspondence to: Aparna Shukla (aparna.shukla22@gmail.com)

The supplementary material file comprises of :

Table S1. Glacier inventory of Suru sub-basin, western Himalaya, Jammu and Kashmir for the year 2017. DC= debris cover, SLA= snow line altitude, SD= standard deviation.

Table S2. Results of Mann-Kendal test significance (S), Sen's slope estimator (ß), long term mean (M) and change in temperature (T_{max}, T_{min} and T_{avg}) and precipitation for annual, winter (November-March) and summer (April-October) period in the Suru sub-basin for the period 1901-2017.

Table S3. Details of basin scale studies conducted in the entire Himalaya with emphasis on the total number of glaciers in the basin, time duration and rate of area shrinkage. The period of glacier area gain is italicized and underlined.

Figure S1. Variation in glacier parameters (area, length, debris cover and SLA) in different time frames. (a) Percentage deglaciation, (b) change in length (m), (c) percentage increase in debris cover and (d) variations in mean SLA (masl) of the GHR and LR glaciers during the period 1971/1977-2017.

Figure S2. Changes in the glacier parameters (area, length) in the Suru-sub basin over the period 1971-2017. (a) Percentage deglaciation plotted for small (0-7 km^2), medium (7-15 km^2) and large (>15 km^2) glaciers. (b) Percentage length change plotted for small (0-2 km), medium (2-7 km) and large (>7 km) glaciers.

Text S1. Statistical significance of non-climatic factors to understand the spatial characteristics (size, debris cover, mean elevation and slope) on the GHR and LR glaciers.

Supplementary Tables

Table S1: Glacier inventory of Suru sub-basin, western Himalaya, Jammu and Kashmir for the year 2017. DC= debris cover, SLA= snow line altitude, SD= standard deviation.

Glacier Id/name	GLIMS ID	Area (km^2)	Length (km)	DC (km^2)	SLA (masl)		Elevation range (masl)		Mean Slope (°)	Aspect
					Mean	St.Dev	Min	Max		
G1(Pensilungpa)	G283710E33808N	15.57	8.31	2.46	5058	82.25	4650	5975	15.37	NE
G2	G283671E33837N	0.73	2.12	0.08	-	-	4924	5839	27.17	NW
G3 (Lalung)	G283781E33805N	44.90	13.19	7.50	5007.7	83.29	4195	6286	19.91	NE
G4	G283715E33847N	1.59	2.57	0.16	4921.1	74.05	4826	5753	21.21	N
G5	G283702E33863N	0.46	1.43	0.05	-	-	4720	5706	34.1	NW
G6	G283681E33871N	0.06	1.01	0.04	-	-	4826	5151	22.69	NE
G7 (Chilung)	G283811E33889N	10.67	4.35	0.76	4964.8	79.3	4462	5832	19.85	NE
G8	G283774E33878N	1.82	1.52	0.23	4925	71.33	4630	5570	23.55	N
G9	G283760E33888N	0.12	0.68	0.04	-	-	4752	5125	23.81	NW
G10	G283754E33884N	0.64	1.22	0.06	-	-	4842	5395	23.95	N
G11	G283746E33888N	0.31	0.98	0.04	-	-	4876	5227	22.39	NE
G12	G283737E33891N	0.16	1.15	0.05	-	-	4848	5187	21.97	NE
G13	G283732E33891N	0.03	0.33	0.01	-	-	5187	5347	33.33	NE
G14	G283727E33894N	0.09	0.84	0.03	-	-	4903	5174	23.89	NW
G15	G283717E33897N	0.17	0.89	0.06	-	-	4829	5348	31.6	N
G16	G283705E33899N	0.09	0.64	0.03	-	-	4981	5191	23.66	NE
G17 (Dulung)	G283805E33930N	14.42	6.49	1.08	5131.67	75.5	4419	5872	18.96	E
G18	G283763E33924N	1.96	1.96	0.20	5079.9	73.36	4910	5578	23.29	N
G19	G283738E33927N	0.40	0.84	0.07	-	-	4897	5357	19.11	NE
G20	G283757E33964N	0.41	1.17	0.02	-	-	5181	5539	18.34	SE
G21	G283734E33962N	0.04	1.19	0.01	-	-	5256	5542	17.52	NE
G22	G283738E33966N	0.40	0.66	0.02	-	-	5169	5360	22.2	E
G23	G283734E33973N	0.09	0.77	0.02	-	-	5414	5691	28.3	SE
G24	G283728E33974N	0.13	0.81	0.06	-	-	5160	5440	21.76	E
G25	G283725E33982N	0.08	0.48	0.02	-	-	5268	5438	24.41	SE
G26	G283722E33985N	0.13	0.60	0.03	-	-	5315	5533	21.2	SE
G27	G283711E33993N	0.66	1.91	0.10	-	-	5077	5764	21.85	SE
G28	G283709E34002N	0.51	1.23	0.08	-	-	4990	5552	22.67	N

G29	G283688E34008N	2.17	3.00	0.23	5063.0	71.96	4763	5863	22.22	NW
G30	G283669E34004N	0.63	2.15	0.11	-	-	4919	5454	18.87	NE
G31	G283675E34015N	0.06	0.61	0.02	-	-	5204	5547	35.74	SE
G32	G283756E33976N	4.67	4.36	0.54	5087.3	81.27	4901	5719	17.43	NE
G33	G283765E34002N	0.39	1.02	0.10	-	-	5016	5943	39.05	NW
G34	G283786E33981N	4.80	3.55	0.64	5080.2	79.35	4877	5812	19.13	N
G35	G283799E34004N	0.18	0.73	0.05	-	-	5002	5395	27.81	E
G36	G283796E34014N	0.15	0.86	0.06	-	-	4973	5392	32.24	SE
G37	G283793E34025N	0.42	1.78	0.19	-	-	4374	5086	24.22	NE
G38	G283805E34028N	0.16	0.83	0.05	-	-	4682	4992	22.61	N
G39	G283824E33963N	6.48	6.01	0.71	4969.6	82.12	4684	5622	15.63	N
G40	G283843E33983N	1.36	2.94	1.00	4933.3	73.01	4710	5292	19.32	N
G41(Shafat)	G283888E33980N	24.47	9.20	6.62	4990.9	80.35	4110	6736	24.5	NE
G42	G283847E34045N	0.20	0.80	0.08	-	-	4835	5120	22.81	NW
G43	G283855E34040N	0.28	1.50	0.19	-	-	4640	5547	31.45	NW
G44	G283882E34039N	3.10	4.11	1.56	4902.9	78.47	4357	5568	23.46	NE
G45	G283867E34024N	0.09	0.56	0.03	-	-	4895	5172	28.85	SE
G46	G283887E34055N	0.45	1.36	0.04	-	-	4730	5329	27	NE
G47	G283920E34046N	8.66	4.20	1.45	4942.2	81.04	4065	6369	30.16	N
G48	G283953E34044N	3.21	4.29	1.21	4902.9	81.41	4511	6060	24.65	N
G49	G283970E34056N	2.62	2.73	1.33	4942.2	81.31	4224	5843	35.08	N
G50(Kangriz)	G283980E34007N	53.10	16.34	4.75	5323.1	82.7	3599	7071	18.62	N
G51	G284024E34027N	0.18	1.16	0.06	-	-	4598	5480	35.99	N
G52	G284036E34020N	0.17	1.38	0.08	-	-	4647	5631	39.83	NW
G53 (Sentick)	G284048E33989N	4.24	3.84	1.1	4793.8	82.13	4403	5692	22.65	NW
G54(Rantac)	G284086E33998N	7.70	2.64	1.23	4799.7	80.04	4292	5361	19.99	N
G55(Tarangoz)	G284111E34027N	7.19	5.22	2.01	4866.3	81.81	4105	5663	24.88	NE
G56	G284114E34063N	0.57	1.51	0.31	-	-	4540	4942	21.19	NE
G57	G284110E34072N	0.13	0.92	0.05	-	-	4554	4980	30.07	NE
G58	G284124E34071N	0.35	0.96	0.18	-	-	4437	4794	18.84	NW
G59	G284125E34056N	0.41	1.44	0.14	-	-	4672	5336	28.01	NW
G60	G284127E34044N	0.22	1.15	0.18	-	-	4570	5285	31.82	W
G61	G284174E34030N	9.77	5.98	2.81	4705.5	79.41	4028	5753	19.31	NW
G62	G284169E34051N	0.36	1.43	0.10	-	-	4453	5171	29.17	E
G63	G284170E34055N	0.23	0.92	0.08	-	-	4591	5008	25.13	E
G64	G284179E34060N	0.07	0.50	0.03	-	-	4168	4554	35.34	NW
G65	G284188E34052N	0.74	1.85	0.20	4494.8	81.79	4066	5549	33.71	NW
G66	G284174E34011N	0.46	1.47	0.17	-	-	4398	5453	33.4	N

G67	G284210E34051N	4.10	5.12	2.62	4568.4	79.64	3989	5344	23.54	NE
G68	G284230E34061N	0.31	0.83	0.14	-	-	4225	4888	32.93	N
G69	G284264E34092N	8.03	7.12	1.53	5079.5	72.82	4187	5646	18.17	S
G70	G284236E34100N	0.13	0.67	0.03	-	-	4980	5352	27.2	S
G71	G284233E34096N	0.15	0.69	0.06	-	-	4846	5104	23.75	S
G72	G284225E34095N	0.26	1.08	0.04	-	-	4790	5176	24.97	S
G73	G284217E34096N	0.05	0.41	0.01	-	-	4886	5133	29.94	SW
G74	G284215E34092N	0.53	1.70	0.25	-	-	4707	5131	20.86	SW
G75	G284195E34097N	2.32	3.46	0.71	4950.7	73.37	4590	5622	18.67	SW
G76	G284188E34089N	0.82	1.57	0.38	4921	78.29	4587	5209	23.67	SW
G77	G284178E34097N	0.90	1.77	0.23	4958.3	70.96	4650	5265	23.39	SE
G78	G284173E34103N	0.28	1.20	0.11	-	-	4733	5186	23.16	SE
G79	G284163E34108N	0.24	0.77	0.11	-	-	4858	5143	23.07	S
G80	G284154E34112N	0.06	0.77	0.02	-	-	4914	5178	32.59	SE
G81	G284122E34131N	0.09	0.86	0.06	-	-	4656	5058	29.34	NE
G82	G284148E34131N	0.25	1.52	0.04	-	-	4642	5069	21.78	NE
G83	G284157E34124N	1.61	3.31	0.59	4743.2	71.29	4321	5481	20.61	NW
G84	G284192E34119N	7.92	3.58	1.93	4830.7	81.83	4191	5710	27.51	N
G85	G284190E34161N	0.91	2.35	0.22	4899.1	66.5	4329	5568	25.2	NE
G86	G284208E34157N	2.12	2.94	1.49	5039.2	76.09	4322	5570	29.61	NW
G87	G284221E34147N	1.63	4.30	0.75	4936.4	75.54	4375	5556	21.81	N
G88	G284281E34132N	37.07	10.93	7.99	4700.7	79.65	3861	5895	18.87	N
G89	G284306E34171N	0.57	1.78	0.29	-	-	4394	4932	19.91	NE
G90	G284307E34184N	0.78	1.46	0.09	-	-	4669	5174	24.38	NE
G91	G284303E34200N	1.30	1.92	0.15	4958.0	68.96	4371	5277	23.09	SE
G92	G284284E34218N	5.80	3.93	1.08	4780.8	70.72	4589	5455	16.46	SE
G93	G284256E34228N	5.75	3.39	0.37	5155.5	73.75	4473	5516	19.47	SE
G94	G284223E34250N	5.68	4.01	0.45	5108.1	75.03	4582	5688	18.25	S
G95	G284201E34231N	0.05	0.37	0.02	-	-	4996	5239	37.41	W
G96	G284199E34250N	2.13	1.96	0.86	5033.2	70.97	4585	5337	23.36	NE
G97	G284189E34273N	6.77	5.30	1.49	5085.6	74.26	4522	5752	16.89	S
G98	G284180E34290N	2.08	2.33	1.45	4878.7	74.65	4617	5531	20.9	NE
G99	G284184E34307N	0.55	1.37	0.28	-	-	4775	5036	20.54	NE
G100	G284148E34278N	0.12	0.60	0.07	-	-	4903	5205	27.86	NW
G101	G284147E34280N	0.03	0.34	0.02	-	-	4918	5033	22.24	NW
G102	G284144E34277N	0.10	0.41	0.05	-	-	4933	5227	30.01	NE
G103	G284149E34273N	0.03	0.30	0.01	-	-	5090	5237	32.45	E
G104	G284139E34268N	0.05	0.38	0.03	-	-	4792	4916	18.93	NE

G105	G284139E34263N	0.12	0.72	0.02	-	-	4860	5187	27.89	NE
G106	G284078E34252N	0.29	1.30	0.20	-	-	4455	5086	27.52	NE
G107	G284094E34243N	0.62	1.70	0.31	-	-	4694	5183	20.72	N
G108	G284105E34239N	0.79	1.73	0.41	4866.4	69.39	4681	5313	19.93	N
G109	G284139E34240N	3.26	2.24	1.16	4931.4	79.18	4488	5513	24.66	NE
G110	G284149E34266N	0.06	0.51	0.03	-	-	4991	5096	15.39	NW
G111	G284153E34260N	0.90	1.17	0.16	-	-	5017	5257	35.88	NW
G112	G284168E34253N	0.12	0.66	0.08	-	-	4945	5120	29.21	SW
G113	G284157E34253N	0.09	0.71	0.04	-	-	5072	5361	28.78	SW
G114	G284159E34250N	0.05	0.59	0.02	-	-	5062	5339	29.88	NW
G115	G284164E34248N	0.01	0.15	0.01	-	-	4907	4943	14.22	SW
G116	G284161E34245N	0.08	0.65	0.03	-	-	4945	5269	25.26	NW
G117	G284160E34242N	0.02	0.26	0.01	-	-	5017	5074	13.63	NW
G118	G284156E34241N	0.13	0.69	0.06	-	-	5033	5379	27.58	W
G119	G284121E34219N	2.31	2.11	0.29	5105	69.86	4699	5552	22.76	E
G120	G284119E34197N	1.43	2.14	0.56	5006.1	68.35	4743	5371	20.77	NE
G121	G284115E34187N	0.20	0.78	0.05	-	-	4988	5334	32.1	NE
G122	G284114E34181N	0.06	0.31	0.03	-	-	4867	4975	19.22	SE
G123	G284129E34184N	0.65	1.85	0.25	-	-	4737	5129	18.51	NW
G124	G284137E34206N	1.84	2.41	0.25	4949.8	67.1	4809	5511	19.36	NW
G125	G284156E34213N	0.07	0.66	0.03	-	-	4827	5048	25.63	NW
G126	G284136E34217N	0.13	0.79	0.05	-	-	4908	5249	25.34	NW
G127	G283980E34338N	1.13	2.51	0.19	5156.7	75.69	3970	5869	38.73	NW
G128	G283958E34338N	1.67	3.17	0.99	4759.8	78.51	4208	5319	21.68	NW
G129	G283934E34337N	2.21	2.28	0.64	4715.5	76.73	4447	5136	16.88	NE
G130	G283919E34337N	0.19	0.77	0.11	-	-	4665	5209	31.71	NE
G131	G283955E34321N	0.07	0.59	0.02	-	-	4995	5273	26.25	S
G132	G283965E34324N	0.12	1.09	0.02	-	-	5121	5688	27.44	S
G133	G283979E34325N	0.04	0.38	0.01	-	-	5080	5247	23.69	S
G134	G284010E34182N	0.18	0.78	0.05	-	-	4546	4806	23.77	NE
G135	G283967E34193N	0.04	0.29	0.02	-	-	5098	5447	35.65	NW
G136	G283960E34193N	0.09	0.70	0.08	-	-	4907	5163	24.07	N
G137	G283958E34186N	0.16	0.55	0.09	-	-	4806	5254	24.87	N
G138	G283963E34177N	0.52	1.53	0.06	-	-	4943	5444	24.01	NW
G139	G283960E34169N	0.06	0.56	0.03	-	-	5243	5484	29.5	NE
G140	G283955E34164N	0.19	1.09	0.06	-	-	4952	5389	23.47	NE
G141	G283951E34157N	0.07	0.49	0.04	-	-	4886	5115	28.75	NE
G142	G283992E34153N	0.12	0.79	0.09	-	-	4849	5120	19.97	N

G143	G283987E34151N	0.15	0.89	0.06	-	-	4997	5241	21.78	N
G144	G283980E34149N	0.44	1.03	0.11	-	-	4914	5272	20.52	NE
G145	G283968E34148N	1.54	1.85	0.24	4912.5	72.18	4836	5404	20.19	NW
G146	G283946E34128N	4.78	5.45	1.72	4924.6	82.52	4648	5852	25.23	N
G147	G283922E34157N	0.12	0.46	0.09	-	-	5142	5572	41.32	NW
G148	G283973E34119N	3.78	3.37	0.68	4839	77.86	4622	5585	20.73	NW
G149	G283918E34131N	3.10	4.14	0.35	5108.7	74.67	4816	5805	16.17	N
G150	G283907E34124N	0.12	0.64	0.02	-	-	5276	5603	29.91	SE
G151	G283914E34118N	0.44	1.29	0.05	-	-	5253	5596	16.38	SE
G152	G283920E34113N	0.55	2.22	0.28	-	-	4985	5788	24.73	SE
G153	G283924E34104N	0.41	1.65	0.24	-	-	5060	5535	27.11	E
G154	G283933E34114N	0.16	0.61	0.06	-	-	5232	5436	17.95	S
G155	G283882E34186N	0.03	0.39	0.02	-	-	5059	5395	39.41	N
G156	G283888E34142N	0.70	2.03	0.26	-	-	4689	5509	27.46	NE
G157	G283872E34123N	3.9	1.69	0.40	5111.5	79.43	4947	5833	19.37	N
G158	G283848E34170N	0.04	0.31	0.02	-	-	5139	5437	39.42	NW
G159	G283852E34155N	0.11	0.62	0.04	-	-	5250	5740	38.81	NW
G160	G283847E34156N	0.18	0.92	0.03	-	-	5374	5733	30.92	NE
G161	G283841E34151N	0.10	1.01	0.06	-	-	5022	5392	24.77	NE
G162	G283850E34146N	0.04	0.31	0.02	-	-	5708	5916	36.61	SE
G163	G283844E34130N	0.61	2.34	0.11	5122.3	73.17	5019	5831	28.17	NE
G164	G283834E34114N	3.34	3.23	0.45	5195.8	74.67	4984	5736	16.54	N
G165	G283809E34159N	0.03	0.25	0.01	-	-	5202	5477	36.98	NW
G166	G283809E34096N	3.18	2.45	0.41	5170.8	71.27	4876	5747	19.68	N
G167	G283778E34090N	4.15	2.96	0.58	5071.9	72.46	4830	5660	16.36	N
G168	G283750E34103N	1.50	2.67	0.29	5094.3	80.45	4950	5670	22.99	N
G169	G283734E34135N	0.14	0.61	0.04	-	-	5124	5466	26.57	NW
G170	G283730E34106N	0.54	1.64	0.40	-	-	4961	5465	23.09	NE
G171	G283749E34088N	1.19	2.72	0.36	5184.5	70.34	5050	5560	19.64	NE
G172	G283756E34084N	0.57	1.63	0.09	-	-	5170	5614	18.55	SE
G173	G283764E34075N	0.78	1.60	0.12	-	-	5113	5548	20.94	NE
G174	G283722E34079N	0.68	2.21	0.55	-	-	4870	5312	17.64	NE
G175	G283655E34240N	0.46	1.39	0.10	-	-	4892	5580	27.12	NW
G176	G283644E34238N	0.43	1.03	0.06	-	-	5050	5588	29.1	NE
G177	G283645E34216N	0.19	0.69	0.09	-	-	5161	5442	27.7	W
G178	G283667E34157N	0.47	1.66	0.03	-	-	5098	5648	27.52	W
G179	G283655E34128N	0.08	0.25	0.01	-	-	5368	5527	33.94	W
G180	G283676E34132N	1.80	1.68	0.31	5112.4	74.61	5002	5625	20.92	N

G181	G283659E34118N	0.38	0.82	0.11	-	-	5021	5393	20.48	SE
G182	G283632E34123N	0.07	0.77	0.04	-	-	5065	5302	21.89	SE
G183	G283637E34133N	1.46	2.02	0.57	5184.7	77.6	4955	5483	23.86	NE
G184	G283648E34143N	1.58	2.59	0.31	5099.8	68.04	4908	5703	18.18	N
G185	G283626E34157N	0.32	0.96	0.06	-	-	5076	5662	27.65	NW
G186	G283625E34170N	0.04	0.40	0.01	-	-	5191	5438	31.83	NW
G187	G283596E34150N	0.10	0.43	0.06	-	-	5254	5603	35.33	NE
G188	G283599E34147N	0.18	0.66	0.06	-	-	5266	5753	33.96	NW
G189	G283597E34139N	0.33	1.05	0.06	-	-	5259	5585	20.77	SW
G190	G283579E34140N	0.65	1.24	0.29	-	-	4981	5513	25.93	NW
G191	G283586E34132N	0.37	0.99	0.09	-	-	5174	5497	20.98	SE
G192	G283595E34132N	0.17	0.49	0.04	-	-	5296	5711	38.4	SE
G193	G283559E34131N	0.27	0.61	0.17	-	-	5122	5586	26.99	NE
G194	G283547E34126N	0.05	0.41	0.02	-	-	4989	5254	30.07	N
G195	G283562E34123N	0.64	1.20	0.10	-	-	5118	5482	20.15	W
G196	G283561E34109N	0.54	0.18	0.18	5242.3	69.86	4955	5482	19.33	W
G197	G283580E34099N	1.23	2.16	0.13	5171.5	72.57	4946	5589	20.47	W
G198	G283511E34129N	0.63	0.88	0.25	-	-	5048	5443	23.76	N
G199	G283504E34143N	0.33	0.86	0.14	-	-	5089	5665	32.12	NW
G200	G283541E34109N	0.63	1.56	0.14	-	-	5009	5707	25.64	SE
G201	G283540E34101N	0.46	0.96	0.09	-	-	5207	5580	21.56	SE
G202	G283506E34136N	0.16	0.80	0.09	-	-	5220	5621	27.77	NW
G203	G283407E34065N	0.85	1.69	0.12	-	-	5007	5552	22.6	NE
G204	G283420E34053N	1.14	1.79	0.20	5151.5	69.67	4945	5617	23.55	NW
G205	G283414E34044N	0.28	1.17	0.08	-	-	5177	5587	25.79	E
G206	G283420E34020N	1.10	2.04	0.41	5325.9	70.2	5011	5501	22.66	NW
G207	G283422E34010N	0.37	0.82	0.05	-	-	5152	5488	20.36	W
G208	G283432E34006N	0.10	0.82	0.05	-	-	5054	5468	28.94	NW
G209	G283476E33993N	6.73	3.62	0.58	5203.5	75.43	4842	6010	22.99	N
G210	G283476E33973N	0.58	1.62	0.07	-	-	5266	5685	19.67	SW
G211	G283489E33978N	0.62	1.54	0.14	-	-	5194	5684	22.23	SW
G212	G283517E33992N	1.07	2.29	0.17	-	-	5087	5853	26.05	E
G213	G283510E34001N	1.09	2.35	0.18	5160.1	71.44	5033	5669	19.64	NW
G214	G283493E34007N	0.73	0.42	0.11	-	-	4673	5836	30.89	NE
G215	G283485E34025N	0.04	0.29	0.01	-	-	5402	5537	24.9	NE
G216	G283476E34030N	0.04	0.44	0.02	-	-	5193	5359	27.08	NW
G217	G283485E34036N	0.14	0.66	0.05	-	-	5113	5479	29.84	N
G218	G283506E34017N	3.18	2.20	0.47	5182.5	72.46	4989	5746	21.93	NE

G219	G283535E34019N	1.46	2.78	0.22	5074.3	71.43	4968	5592	19.74	NE
G220	G283554E34016N	3.10	3.37	0.49	5074.1	69.27	4876	5660	16.74	NW
G221	G283558E34032N	0.19	0.88	0.02	-	-	4715	5836	21.9	NW
G222	G283565E34026N	0.72	2.04	0.12	-	-	4673	5308	21.34	N
G223	G283576E34030N	0.35	1.54	0.21	-	-	4715	5836	25.18	W
G224	G283470E33954N	0.46	1.32	0.05	-	-	5068	5719	21.3	NW
G225	G283471E33930N	1.29	2.10	0.15	5135.2	75.68	4877	5836	20.85	N
G226	G283485E33922N	3.46	0.38	0.38	5153.7	74.51	5046	5692	23.39	NE
G227	G283506E33927N	1.52	2.75	0.09	5193.1	71.72	4975	5691	17.56	N
G228	G283518E33925N	1.61	0.27	0.27	5140.7	76.91	5267	5592	19.8	NE
G229	G283530E33939N	0.12	0.39	0.05	-	-	5007	5682	33.97	NW
G230	G283535E33930N	0.53	1.17	0.04	-	-	4828	5613	29.86	N
G231	G283545E33919N	1.19	2.70	0.14	5075.8	67.48	5054	5557	21.44	NE
G232	G283570E33924N	0.20	0.97	0.09	-	-	4861	5614	30.71	N
G233	G283590E33912N	3.54	3.60	0.89	5073.6	71.04	5051	5685	16.16	NE
G234	G283605E33924N	1.36	2.01	0.32	5171.5	64.61	5126	5621	18.03	NW
G235	G283613E33928N	0.31	0.95	0.06	-	-	5082	5567	31.37	N
G236	G283607E33938N	0.55	1.93	0.11	-	-	5181	5448	18.96	NE
G237	G283608E33962N	0.14	0.64	0.06	-	-	4901	5607	25.16	N
G238	G283635E33933N	1.92	1.32	0.51	5341	71.84	4715	5518	24.19	NW
G239	G283651E33942N	0.82	1.88	0.38	-	-	5060	5556	30.9	SW
G240	G283623E33921N	0.54	1.56	0.14	-	-	4650	5975	21.18	NE
G241	G283714E34002 N	0.02	0.45	0.01	-	-	4859	5171	17.5	N
G242	G283901E34018 N	7.30	0.64	1.23	5064.8	61.56	4114	6747	25.6	NE
G243	G283962E34040 N	0.53	1.7	0.03	-	-	5385	6059	20.8	N
G244	G284060E33987 N	0.79	1.73	0.13	-	-	4696	5084	12.79	NW
G245	G283949E34340 N	0.28	1.49	0.2	-	-	4715	5010	13.71	NW
G246	G283887E34129 N	0.96	1.82	0.08	-	-	5222	5775	15.28	N
G247	G283646E34143 N	0.36	1.21	0.02	-	-	5021	5395	15.9	N
G248	G283556E34111 N	0.68	2.36	0.36	-	-	5025	5444	11.22	W
G249	G283498E33924 N	0.28	1.06	0.03	-	-	5172	5495	18.03	NE
G250	G283527E33926 N	0.17	0.62	0.02	-	-	5373	5673	23.25	NE
G251	G283555E33916 N	0.71	2.4	0.16	-	-	4997	5592	19.32	NE
G252	G283570E33915 N	0.75	1.85	0.05	-	-	5050	5596	17.35	NE

Table S2: Results of Mann-Kendal test significance (S), Sen's slope estimator (ß), long term mean (M) and change in temperature (T_{max}, T_{min} and T_{avg}) and precipitation for annual, winter (November-March) and summer (April-October) period in the Suru sub-basin for the period 1901-2017.

CRU TS 4.02 Grids	Annual				Winter				Summer			
	S	ß	M (°C)/mm	Change	S	ß	M (°C)/mm	Change	S	ß	M (°C)/mm	Change
Grid1 T_{max}	0.01	0.006	6.34	0.11	0.01	0.009	-1.66	-0.63	0.01	-0.002	12.08	-0.02
Grid1 T_{min}	0.01	0.006	-5.05	-0.14	0.01	0.013	-12.36	-0.12	0.01	0.007	0.37	1.88
Grid1 T_{avg}	0.01	0.006	0.65	1.06	0.01	0.011	-7	-1.82	0.01	0.002	6.11	0.04
Grid1 Ppt	0.05	0.700	442	0.18	0.05	0.259	162.33	0.19	0.05	0.441	279.64	0.18
Grid2 T_{max}	0.01	0.006	7.01	0.10	0.01	0.009	-1.3	-0.80	0.01	-0.002	12.96	-0.02
Grid2 T_{min}	0.01	0.006	-4.19	-0.17	0.01	0.014	-11.53	-0.14	0.01	0.008	1.05	0.88
Grid2 T_{avg}	0.01	0.006	1.41	0.49	0.01	0.012	-6.4	-0.22	0.01	0.002	6.99	0.03
Grid2 Ppt	0.01	0.893	449	0.23	0.01	0.427	170.75	0.29	0.01	0.466	277.85	0.2
Grid3 T_{max}	0.01	0.007	6.32	0.13	0.01	0.010	-2.15	-0.54	0.01	-0.001	12.37	-0.009
Grid3 T_{min}	0.01	0.007	-5.39	-0.15	0.01	0.014	-12.96	-0.12	0.01	0.007	0.57	1.42
Grid3 T_{avg}	0.01	0.007	0.46	1.77	0.01	0.012	-7.54	-0.19	0.01	0.003	6.18	0.06
Grid3Ppt	0.01	0.741	373	0.23	0.01	0.348	147.31	0.27	0.01	0.392	225.47	0.2
Grid4 T_{max}	0.01	0.008	7.85	0.12	0.01	0.012	-0.91	-1.52	0.01	0	14.13	0
Grid4 T_{min}	0.01	0.008	-4.45	-0.21	0.01	0.016	-12.33	-0.15	0.01	0.008	1.17	0.79
Grid4 T_{avg}	0.01	0.008	1.7	0.54	0.01	0.013	-7.16	-0.21	0.01	0.003	6.42	0.05
Grid4 Ppt	0.05	0.500	383	0.15	0.05	0.165	136.87	0.14	0.05	0.334	245.96	0.16
Grid5 T_{max}	0.01	0.007	6.72	0.12	0.01	0.010	-1.53	-0.75	0.01	0	12.65	0

Grid5 T_{min}	0.01	0.007	-5.22	-0.16	0.01	0.015	-12.8	-0.13	0.01	0.008	0.30	3.09
Grid5 T_{avg}	0.01	0.007	0.75	1.08	0.01	0.014	-6.6	-0.25	0.01	0.004	7.64	0.06
Grid5 Ppt	0.01	0.600	318	0.22	0.01	0.250	119.26	0.24	0.01	0.349	198.42	0.2

Table S3: Details of basin scale studies conducted in the entire Himalaya with emphasis on the total number of glaciers in the basin, time duration and rate of area shrinkage. The period of glacier area gain is italicized and underlined.

S.No	Location	Study area	No. of glaciers	Study period	Rate of area shrinkage (% per annum)		References
					Pre 2000	Post 2000	
1.	Eastern Himalaya	Teesta basin	39	1989/90-2010	0.13	0.21	Basnett et al., 2013
			57	1997-2004	0.06	-	Kulkarni et al., 2011
2.		Sikkim	186	1962-2006	0.52	-	Racoviteanu et al., 2015
3.		Nepal	162		0.44	-	
4.		Bhutan	885	1980-2010	0.89	0.67	Bajracharya et al., 2014
5.	Central Himalaya	Mt. Everest region	-	1962-2011	0.35	0.48	Thakuri et al., 2014
6.		Koshi River basin	2206	1976-2009	0.66	0.44	Shangguan et al. 2014
			1832	1975-2010	0.24	0.47	Xiang et al. 2018
7.		Hidden valley	10	1980-2010	0.83	0.63	Lama et al., 2015
8.		Dhauliganga basin	104	1962/69-2001/04/05	0.37	-	Kasturirangan et al. 2013
9.		Goriganga basin	41	1962-2001/ 2004	0.5	-	Kulkarni et al., 2011
10.		Bhagirathi basin	212		0.33	-	
					0.09	-	Bhambri et al., 2011
11.		Alaknanda basin	82-88	1968-2006	0.15	-	
12.		Bhilangna basin	33	1965-2014	0.2		Raj et al., 2017
13.	Western Himalaya	Miyar basin	166	1962-2001/2004	0.2	-	Kulkarni et al., 2011
			29	1989-2014	0.04	0.24	Patel et al., 2018
14.		Chenab basin	359	1962-2001/ 2004	0.53	-	Kulkarni et al., 2007
15.		Parbati basin	90		0.5	-	Kulkarni et al., 2011
16.		Baspa	19		0.48	-	

		basin	103-97	1976-2011	0.53	0.55	Mir et al., 2017
			19	1962-2014	0.45	0.6	Gaddam et al., 2016
17.		Ravi basin	285	1971-2010/13	0.11	0.2	Chand and Sharma, 2015
18.		Warwan basin	230-250	1962-2001/2002	0.48	-	Brahmbhatt et al., 2012
19.		Bhut basin	140-145		0.22	-	
20.		Chandra-Bhaga basin	15	1980-2010	0.06	0.13	Pandey and Venkataraman, 2013
			127	1971-2016	0.13	0.24	Das and Sharma, 2018
21.		Bhaga basin	231	2001-2011	-	0.16	Birajdar et al., 2014
			111	1962-2001/2004	0.8	-	Kulkarni et al., 2011
22.		Chandra basin	116		0.5	-	
23.		Zanskar basin	671		0.2	-	
24.		Liddar valley	9	1980-2013	0.45	0.77	Murtaza and Romshoo, 2015
25.		Doda basin	13	1962-2001	0.46	-	Rai et al., 2013
26.		Drass basin	150	1965-2013	0.43	0.093	Koul et al. 2016
27.		Ladakh Range	>1800	1969-2016	0.3	0.7	Schmidt and Nusser, 2017
28.		Central section of Ladakh Range	657	1991-2014	0.58	1.06	Chudley et al., 2017
29.		Upper Shyok basin	136	1973-2011	0.04	*0.04*	Bhambri et al., 2013

30.		Yarkant Basin	565	1968-1999	0.13	-	Liu et al., 2006
31.		Central Karakoram	711	2001-2010	-	*0.06*	Minora et al., 2013
32.		Suru basin	215	1962/69-2001/04/05	0.49		Kasturirangan et al., 2013
			240	1971-2017	0.04	0.19	Present study

Supplementary Figures

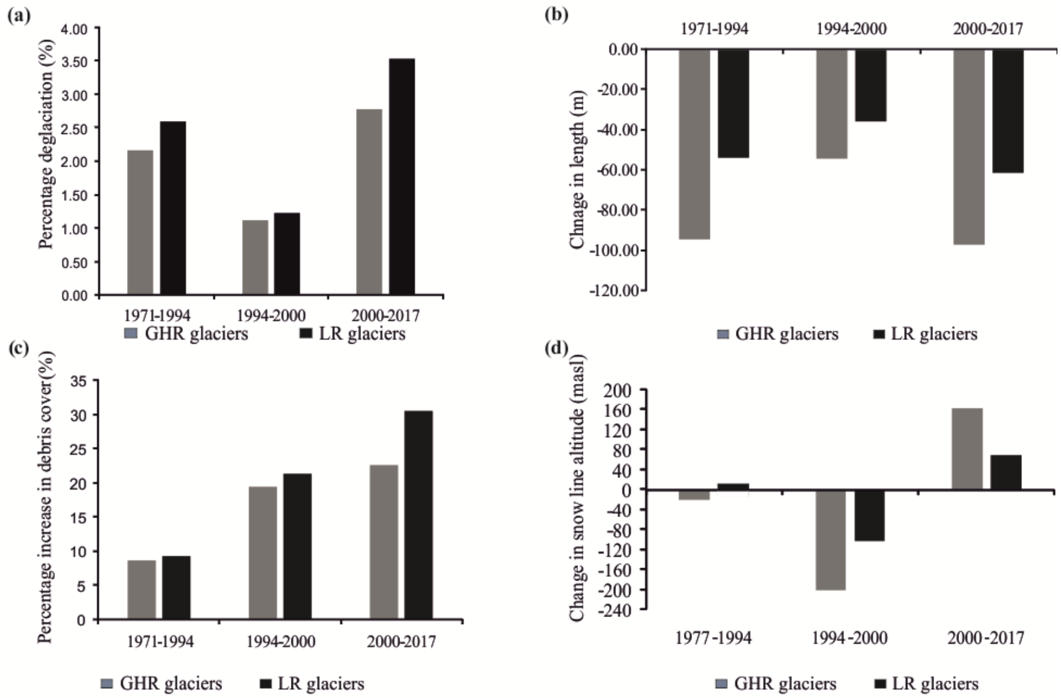

Figure S1: Variation in glacier parameters (area, length, debris cover and SLA) in different time frames. (a) Percentage deglaciation, (b) change in length (m), (c) percentage increase in debris cover and (d) variations in mean SLA (masl) of the GHR and LR glaciers during the period 1971/1977-2017.

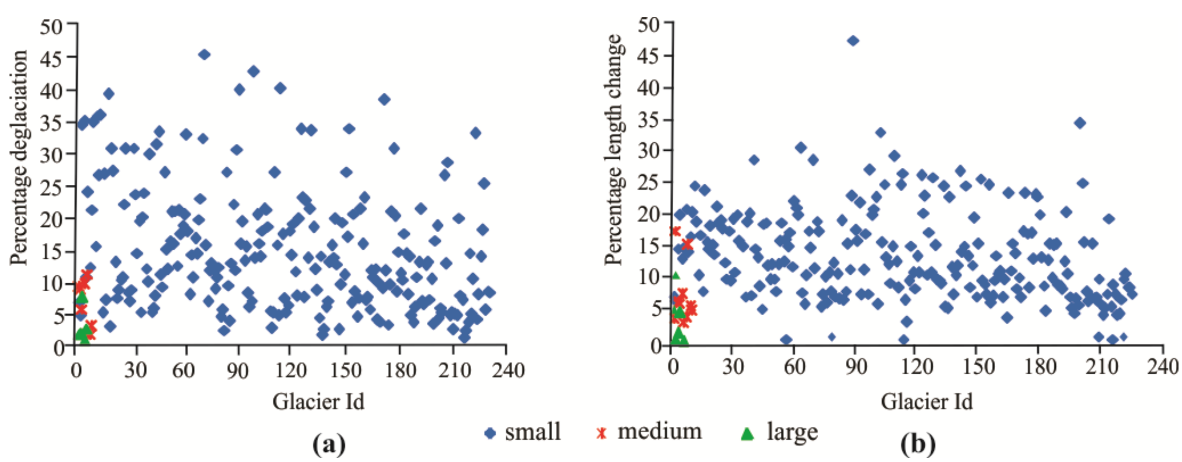

Figure S2: Changes in the glacier parameters (area, length) in the Suru-sub basin over the period 1971-2017. (a) Percentage deglaciation plotted for small (0-7 km^2), medium (7-15 km^2) and large (>15 km^2) glaciers. (b) Percentage length change plotted for small (0-2 km), medium (2-7 km) and large (>7 km) glaciers.

Supplementary Text

Text S1. Statistical significance of non-climatic factors to understand the control of spatial characteristics (size, debris cover, mean elevation and slope) on the GHR and LR glaciers.

Greater Himalayan Range (GHR) and Ladakh Range (LR) comprises of different glaciers having distinct morphology. Therefore, statistical significance becomes necessary to explain the effect of spatial characteristics (size, slope, debris cover and elevation) over LR and GHR. For this, the non-climatic factors were subsequently correlated with the change in glacier dimensional parameters, i.e., area change and retreat using some statistical tests (Figure R4a,b; Table RT2). In the statistical analysis, the variables were initially tested for normality and visual inspection of the histogram. The test showed normal distribution for nearly all the variables and the correlations were found to be significant at $\alpha < 0.05$ (except for mean elevation). These correlations also showed the presence of few outliers (not removed in this study), which indicate the possible role of any other factor due to which these glaciers have deviated from the general trend of area loss and retreat (Figure R4a;b).

Table S4: Correlation (r) and Pearson's correlation (p) coefficient computed between non-climatic factors (size, slope, debris cover and elevation) and glacier changes (% deglaciation & retreat rate). These relationships were found to be significant at $\alpha < 0.05$ (Except for mean elevation: Italicized).

Parameters	**% deglaciation**		**Retreat rate (ma^{-1})**	
	GHR	**LR**	**GHR**	**LR**
Size	r= -0.385	r= -0.5	r= 0.475	r= 0.524
	p<0.00001	p<0.00001	p<0.0001	p<0.00001
Slope	r= 0.27	r= 0.339	r= -0.18	r= -0.389
	p<0.0022	p<0.0002	p<0.043	p<0.00002
Mean elevation	*r= -0.048*	*r= 0.002*	*r= 0.091*	*r= -0.152*
	p= 0.593	*p= 0.98*	*p= 0.31*	*p= 0.106*
Debris cover	r= -0.334	r= -0.249	r= 0.337	r= 0.245
	p<0.00013	p<0.0075	p<0.0001	p<0.0088

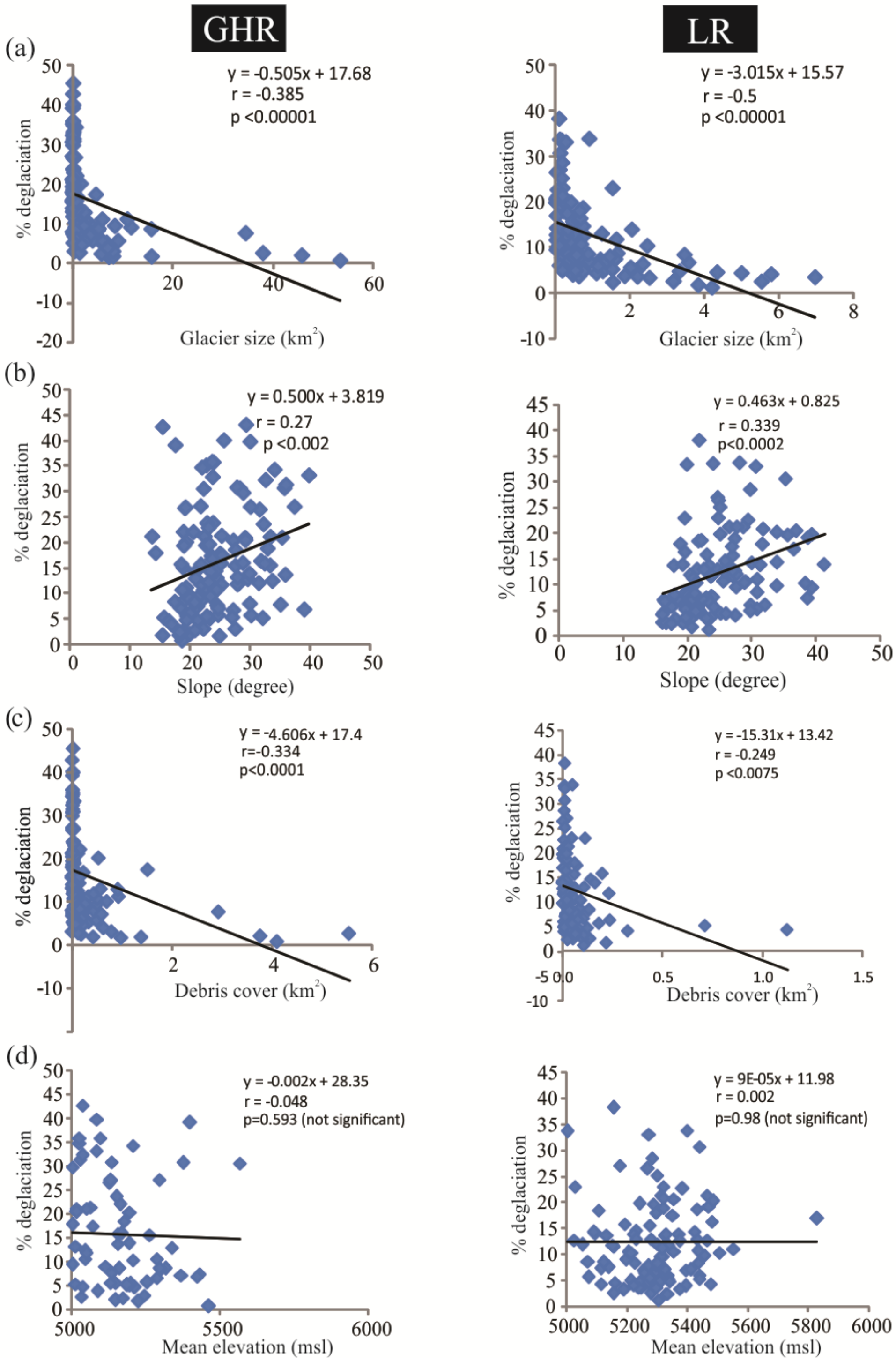

Figure S3a. Scatter plots displaying the relation between topographic factors with percent deglaciation during the period 1971-2017. All the relationships were found to be significant at confidence level, i.e., α<0.05 (Except mean elevation).

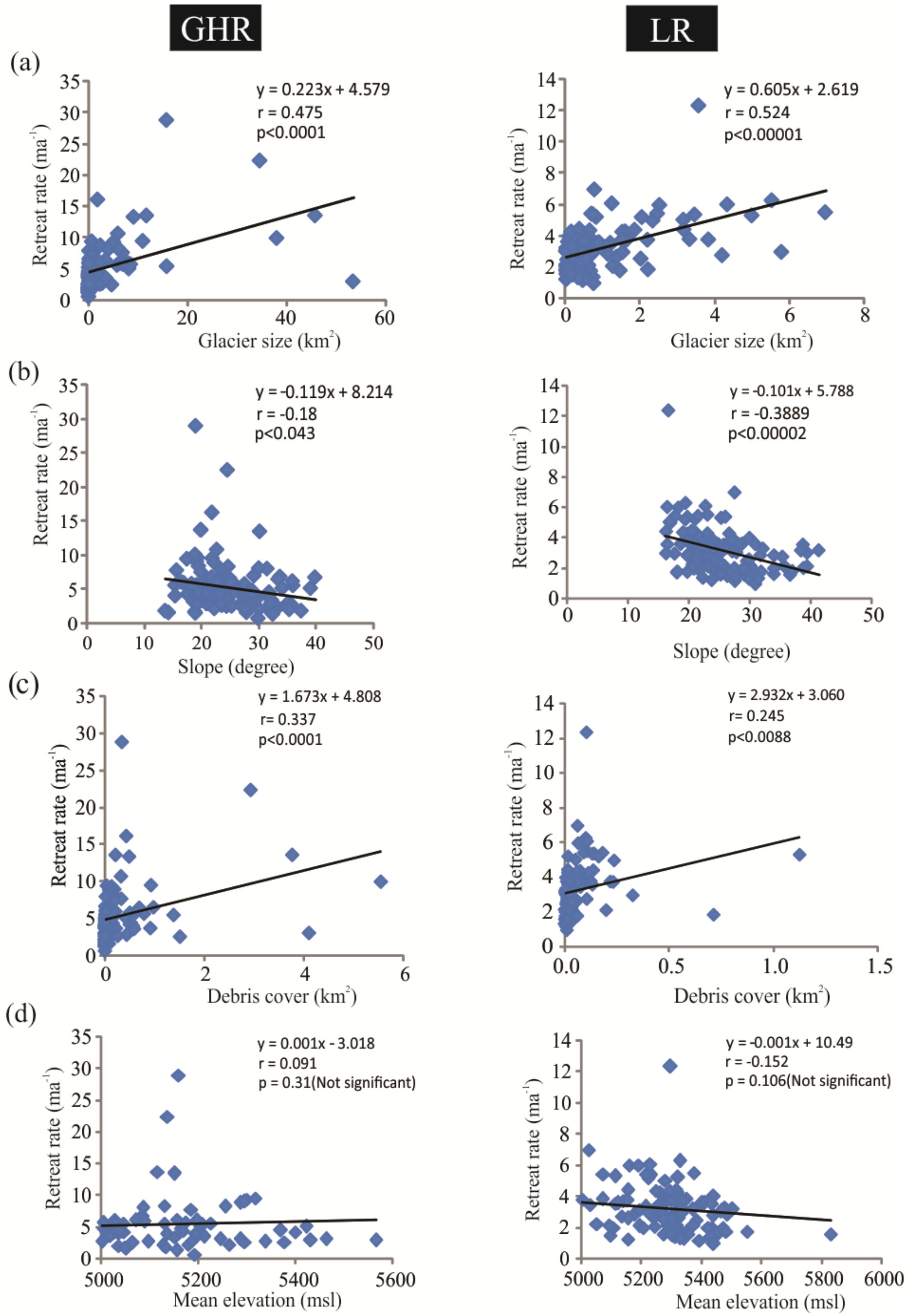

Figure S3b. Scatter plots displaying the relation between topographic factors with retreat rate during the period 1971-2017. All the relationships were found to be significant at confidence level, i.e., α<0.05 (Except mean elevation).

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