Supporting information for

Impacts of black carbon and mineral dust on radiative forcing and glacier melting during summer in the Qilian Mountains, northeastern Tibetan Plateau

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Table S1. Parameters for sensitivity analysis with SNICAR. 1. Elevation (m a.s.l); 2. Solar zenith angle; 3. Snowpack density (kg m-3); 4. Snowpack thickness (cm); 5. Snow grain effective radius (μm); 6. BC concentration (ng g^{-1}, Surface-coated); 7. MD concentration (μg g^{-1}); 8. Simulated albedo of snow including both BC and MD; 9. Simulated albedo of snow including BC only; 10. Simulated albedo of pure snow; 11 and 12 are the contributions of BC and MD to the total reduction of the albedo (%), respectively.13. RF by MD; 14. RF by BC;

Date	site	1	2	3	4	5	6	7	8	9	10	11	12	13	14
130727	A	4452	38	280	5	200	63.5	5.1	0.723	0.733	0.735	4.3	15.0	1.4	4.8
130727	B	4547	47	370	10	200	85.2	5.1	0.744	0.761	0.766	4.7	18.8	2.2	8.9
130727	C	4644	59	380	14	200	75.1	12.3	0.762	0.776	0.788	10.0	12.6	5.9	7.4
130727	D	4749	65	390	19	200	79.6	9.1	0.773	0.787	0.794	5.7	11.4	3.5	7.0
130727	E	4847	59	380	18	200	50.7	2.5	0.773	0.787	0.791	3.1	12.0	1.9	7.2
130727	F	4899	50	320	21	200	30.7	2.4	0.765	0.775	0.779	3.6	9.7	1.9	5.3
130727	G	4953	37	280	36	200	38.4	5.4	0.745	0.758	0.767	9.7	13.5	4.7	6.5
	Avg.	4727	51	343	18	200	60.5	6	0.755	0.768	0.774	5.9	13.3	3.1	6.7
130728	A	4452	44	430	5	225	127.5	13.6	0.777	0.802	0.813	8.0	17.7	5.7	12.7
130728	B	4547	49	400	10	225	189.4	13.7	0.774	0.807	0.817	7.1	22.4	5.2	16.5
130728	C	4644	59	400	14	225	308.7	37.9	0.771	0.813	0.840	16.5	24.7	14.0	21.1
130728	D	4749	62	300	19	225	235.2	22.8	0.792	0.829	0.849	11.4	20.9	10.3	18.7
130728	E	4847	63	300	18	225	121.1	14.5	0.754	0.774	0.786	10.4	18.0	6.0	10.4
130728	F	4899	64	330	21	225	116.2	16.4	0.756	0.775	0.790	12.7	16.8	7.6	10.1
130728	G	4953	60	250	36	225	22.8	3.4	0.774	0.780	0.784	3.7	5.9	2.1	3.4
	Avg.	4727	57	344	18	225	160.1	17.5	0.771	0.797	0.811	10.0	18.1	7.3	13.3
130729	A	4452	37	250	5	100	915.4	78.8	0.746	0.816	0.859	23.4	37.4	22.2	35.5
130729	B	4547	44	270	10	100	1604.7	100.7	0.723	0.816	0.867	26.0	48.0	25.7	47.5
130729	C	4644	55	250	14	100	967.6	67.5	0.777	0.842	0.879	17.8	31.3	18.6	32.9
130729	D	4749	59	230	19	100	818.7	62.7	0.794	0.850	0.884	16.2	26.3	17.4	28.3
130729	E	4847	64	260	18	100	741.4	48.8	0.811	0.862	0.889	12.6	23.5	13.9	26.0
130729	F	4899	56	240	21	100	527.6	64.3	0.803	0.845	0.881	17.5	19.8	18.6	21.0
130729	G	4953	53	250	36	100	369.5	52.7	0.811	0.845	0.879	16.6	16.1	17.5	17.0
	Avg.	4727	52	250	18	100	849.3	67.9	0.781	0.839	0.877	18.6	28.9	19.1	29.7

130729	A	4452	37	400	1	400	47126.1	4778.2	0.154	0.334	0.541	66.4	57.6	105.6	91.6
130729	B	4547	44	400	1	400	71735.1	6880	0.150	0.326	0.563	0.709	0.526	120.5	89.5
130729	C	4644	55	400	1	400	22255	2494	0.260	0.444	0.604	0.428	0.489	81.9	93.5
130729	D	4749	59	400	1	400	24385	3369	0.269	0.438	0.621	46.7	43.1	93.3	86.2
130729	E	4847	64	400	1	400	15582.3	2893.3	0.330	0.473	0.644	41.2	34.5	87.0	73.0
130729	F	4899	56	400	1	400	18441.1	4220.5	0.276	0.408	0.609	52.9	34.5	102.3	66.7
130729	G	4953	53	400	1	400	930.7	66.1	0.547	0.552	0.596	12.0	1.3	22.5	2.5
	Avg.	4727	52	400	1	400	28636.5	3528.7	0.284	0.425	0.597	47.6	39.0	87.6	71.8
140804	A1	4453	39	230	5	200	296.4	28.7	0.740	0.774	0.788	8.0	20.9	7.3	18.8
140804	A2	4453	39	230	5	200	314.4	34.7	0.736	0.772	0.788	9.6	21.6	8.6	19.5
140804	A3	4453	39	230	5	200	305.6	32	0.738	0.773	0.788	8.9	21.2	8.0	19.2
140804	B1	4501	43	245	4	200	200.4	35.3	0.748	0.769	0.782	8.3	12.9	7.3	11.3
140804	B2	4501	43	245	4	200	317.9	38.7	0.736	0.768	0.782	9.1	19.6	7.9	17.1
140804	B3	4501	43	245	4	200	216.1	25.3	0.750	0.772	0.782	6.1	14.2	5.3	12.4
140804	C1	4549	51	280	6	200	136.7	18.1	0.790	0.811	0.822	5.5	10.3	6.0	11.2
140804	C2	4549	51	280	6	200	165.5	28.7	0.782	0.805	0.822	8.4	11.6	9.2	12.6
140804	C3	4549	51	280	6	200	297.2	39.7	0.763	0.800	0.822	11.1	18.3	12.2	20.0
140804	D1	4600	55	260	7	200	126.3	18	0.800	0.819	0.831	5.4	9.2	6.2	10.5
140804	D2	4600	55	260	7	200	180.7	32.7	0.787	0.811	0.831	9.2	11.7	10.5	13.3
140804	D3	4600	55	260	7	200	315.7	55.8	0.765	0.801	0.831	14.4	17.1	16.3	19.4
140804	E1	4651	59	330	6	200	115.8	23.3	0.807	0.825	0.839	6.7	7.9	7.9	9.3
140804	E2	4651	59	330	6	200	269.5	39.3	0.783	0.816	0.839	10.4	15.1	12.3	17.8
140804	E3	4651	59	330	6	200	182.6	24	0.799	0.824	0.839	6.9	11.7	8.1	13.9
140804	F1	4699	63	270	10	200	130.9	20.7	0.816	0.837	0.852	6.6	9.0	8.3	11.2
140804	F2	4699	63	270	10	200	281.4	28.1	0.795	0.832	0.852	8.6	16.0	10.7	20.0
140804	F3	4699	63	270	10	200	146.5	23.7	0.813	0.835	0.852	7.4	9.6	9.3	12.1
140804	G1	4750	66	260	8	200	174.5	37.4	0.810	0.831	0.851	8.9	9.2	11.1	11.4
140804	G2	4750	66	260	8	200	127.7	35.8	0.815	0.832	0.851	8.6	7.0	10.7	8.7
140804	G3	4750	66	260	8	200	96.6	22.7	0.824	0.838	0.851	5.8	5.9	7.2	7.4
140804	H1	4802	67	250	11	200	192.5	30	0.813	0.839	0.858	8.3	10.7	10.7	13.7
140804	H2	4802	67	250	11	200	111.4	20.7	0.827	0.844	0.858	6.1	7.2	7.9	9.2
140804	H3	4802	67	250	11	200	175.7	24.7	0.817	0.842	0.858	7.1	10.3	9.2	13.2
140804	I1	4848	68	230	13	200	268.2	34.3	0.807	0.839	0.861	9.4	13.4	12.2	17.4
140804	I2	4848	68	230	13	200	177.1	17	0.822	0.848	0.861	5.3	10.9	6.9	14.2
140804	I3	4848	68	230	13	200	216.4	28.7	0.814	0.842	0.861	8.2	11.7	10.6	15.2
140804	J1	4904	67	225	12	200	145.4	24	0.821	0.842	0.858	6.9	8.8	8.8	11.3
140804	J2	4904	67	225	12	200	82.5	14.7	0.834	0.847	0.858	4.5	5.8	5.8	7.5
140804	J3	4904	67	225	12	200	81.3	14	0.834	0.848	0.858	4.3	5.8	5.6	7.4
140804	K1	4948	62	250	14	200	89.7	13.6	0.824	0.842	0.855	5.4	7.5	6.9	9.5
	Avg.	4684	58	258	8	200	191.6	27.9	0.794	0.819	0.835	7.7	12.0	8.9	13.4
140806	A1	4453	47	400	1	400	49512.5	7203.3	0.180	0.333	0.531	71.1	54.9	107.2	82.7
140806	B2	4453	47	400	1	400	36856.8	4900	0.195	0.362	0.531	60.7	59.8	91.5	90.2
140806	B3	4501	55	400	1	400	60541	6340	0.192	0.372	0.560	61.1	58.5	101.7	97.5

140806	C1	4501	55	400	1	400	22424.7	2360	0.259	0.448	0.560	36.5	61.2	60.8	101.9
140806	C2	4501	55	400	1	400	22011.6	2465	0.261	0.444	0.560	37.5	59.7	62.5	99.4
140806	C3	4549	59	400	1	400	40265.8	3300	0.229	0.440	0.576	42.1	65.0	73.8	113.9
140806	D1	4549	59	400	1	400	45310.6	5232	0.224	0.404	0.576	53.1	55.5	93.1	97.3
140806	D2	4549	59	400	1	400	48110.3	5292	0.220	0.403	0.576	53.4	56.5	93.6	99.0
140806	D3	4600	63	400	1	400	19317.7	2590	0.307	0.476	0.593	34.3	49.6	63.1	91.4
140806	E1	4600	63	400	1	400	31203.1	3290.3	0.267	0.458	0.593	39.5	56.2	72.8	103.6
140806	E2	4600	63	400	1	400	3421.2	340	0.481	0.570	0.593	6.7	26.0	12.4	47.9
140806	E3	4651	65	400	1	400	5871.6	700	0.439	0.558	0.602	12.4	34.1	23.4	64.4
140806	F1	4651	65	400	1	400	12431.3	1450	0.362	0.524	0.602	22.3	46.4	42.1	87.8
140806	F2	4651	65	400	1	400	9054.1	1230	0.393	0.533	0.602	19.6	40.1	37.1	75.9
140806	F3	4699	67	400	1	400	9231.4	926.9	0.405	0.556	0.611	15.1	42.1	29.4	81.7
140806	G1	4699	67	400	1	400	9603.8	1075	0.400	0.549	0.611	17.1	41.7	33.1	81.0
140806	G2	4699	67	400	1	400	6242.3	910	0.440	0.557	0.611	14.9	32.6	28.9	63.3
140806	G3	4699	67	400	1	400	6829.8	1175	0.428	0.545	0.611	18.3	32.6	35.5	63.2
140806	H1	4750	67	400	1	400	22013.6	2446.4	0.317	0.500	0.611	30.8	51.1	59.8	99.2
140806	H2	4750	67	400	1	400	30089.4	3425.8	0.290	0.475	0.611	37.7	51.7	73.2	100.2
140806	H3	4750	67	400	1	400	17450.3	2173.1	0.338	0.508	0.611	28.6	47.5	55.4	92.2
140806	H4	4802	66	400	1	400	44764.1	4985.7	0.262	0.447	0.606	45.0	52.4	86.1	100.3
140806	I1	4802	66	400	1	400	18641.4	2043.8	0.332	0.512	0.606	26.5	50.9	50.7	97.4
140806	I2	4802	66	400	1	400	43921.2	2600	0.258	0.496	0.606	31.2	67.2	59.7	128.8
140806	I3	4848	65	400	1	400	10337.4	3270	0.364	0.469	0.602	38.0	29.9	71.9	56.6
140806	J1	4848	65	400	1	400	3294.7	578.1	0.486	0.565	0.602	10.5	22.7	19.9	42.9
140806	J2	4848	65	400	1	400	3435.6	504	0.485	0.569	0.602	9.3	24.0	17.6	45.4
140806	K3	4904	60	400	1	400	3526.8	526.1	0.459	0.546	0.580	10.5	26.4	18.6	46.8
	Avg.	4668	62	400	1	400	22704.1	2619	0.331	0.486	0.590	31.6	46.3	56.2	84.0