Table S1. Statistics of the snow/ice variables measured using an ISSW for each glacier.

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	f_{non-BC}^{est}	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
Region1. Qiyi Glacier (39°14’28” N, 97°45’27” E)														
1	1	2013.08.01	Warm	17	0	17	610	450	391(205,488)	36(12,64)	2.50	1.38	0.62	303.4
2	1	2013.08.02	Warm	5	0	5	2651	1541	721(—,1414)	73(41,—)	3.73	11.59	——	2414
3	1	2013.08.03	Warm	24	0	24	103	82	80(51,92)	22(2,46)	2.05	0.18	1.06	19.8
4	1	2013.08.15	Warm	8	0	8	160	128	68(23,93)	57(36,91)	2.98	0.60	3.98	85.45
5	1	2014.09	Warm	——	0	0	324	225	202(103,258)	38(12,65)	2.56	0.93	43.55	248.6
6	1	2014.09.01	Warm	9	16	25	47	35	28(15,37)	41(15,76)	2.51	0.12	3.54	42.08
7	1	2014.09.01	Warm	25	0	9	86	63	51(25,64)	41(17,70)	2.58	0.27	5.01	64.23
	2				9	17	47	34	25(13,35)	47(20,74)	2.65	0.15	2.25	52.04
	3				17	25	55	40	27(14,40)	52(20,76)	2.69	0.15	1.56	85.75
8	1	2014.09.01	Warm	23	0	11.5	212	158	137(69,168)	35(13,73)	2.52	0.54	——	90.35
	2				11.5	23	94	80	74(49,85)	21(—,53)	1.95	0.10	4.13	36.57
9	1	2014.09.01	Warm	35	0	9	120	87	63(32,89)	47(19,68)	2.69	0.35	2.04	138.5
	2				9	17.5	90	66	44(26,67)	51(17,66)	2.62	0.21	1.54	149.4
	3				17.5	26	75	60	42(27,60)	45(13,64)	2.38	0.13	1.32	104.3
	4				26	35	326	240	189(98,252)	42(15,66)	2.58	0.85	4.22	282.9
10	1	2014.09.01	Warm	38	0	22	218	157	138(57,162)	37(18,70)	2.69	0.77	——	36.46
	2				22	30	993	726	622(288,754)	37(17,68)	2.61	2.16	——	226
	3				30	38	749	552	497(229,579)	34(15,67)	2.57	2.09	——	110
11	1	2014.09.01	Warm	18	10	28	614	441	393(158,460)	36(18,73)	2.72	1.86	1.43	73.59
12	1	2014.09.01	Warm	30	0	23	140	102	90(43,108)	36(15,67)	2.56	0.45	——	53.25
	2				23	30	448	336	312(151,355)	30(13,63)	2.48	1.37	——	30.81
13	1	2014.09.01	Warm	25	0	12.5	2589	2230	1877(1182,2109)	28(10,49)	2.02	2.29	——	100.2
	2				12.5	25	802	555	418(128,500)	48(31,83)	2.95	3.44	——	112.4

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	f_{non-BC}^{est}	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
14	1	2014.09.01	Warm	——	0	0	176	112	96(33,124)	45(23,79)	2.91	0.71	9.68	93.94
15	1	2014.09.01	Warm	——	0	0	229	191	91(24,123)	60(41,88)	3.09	1.06	4.44	72.15
16	1	2015.09.01	Warm	36	0	12	26	29	——	——	0.80	——	——	51.25
	2				12	24	83	64	57(37,72)	32(5,51)	2.18	0.08	1.96	112.8
	3				24	36	112	87	81(49,96)	28(6,52)	2.20	0.25	——	45.19
17	1	2015.09.13	Warm	16	0	8	380	263	221(81,271)	42(22,76)	2.84	1.47	——	118.6
	2				8	16	1146	795	654(259,823)	43(21,75)	2.80	2.89	——	336.9
18	1	2015.09.13	Warm	10	0	10	239	175	149(67,180)	38(17,70)	2.64	0.79	——	81.72
19	1	2015.09.13	Warm	38	0	11	95	67	52(21,68)	45(21,79)	2.80	0.34	——	72.42
	2				11	22	92	60	38(12,61)	59(27,82)	3.08	0.34	——	133.7
	3				22	30	166	117	85(39,121)	49(20,72)	2.78	0.51	——	190.1
	4				30	38	196	132	98(34,136)	50(24,78)	2.95	0.74	——	176.4
Region2. Qiumianleiketage Glacier (36°41’47” N, 90°43’44” E)														
20	1	2014.05.11	Cold	35	0	22	995	662	558(143,678)	44(25,85)	3.06	3.97	——	156.2
	2				22	35	316	216	176(55,219)	44(24,81)	2.96	1.26	——	105.9
21	1	2014.05.11	Cold	24	0	8	763	561	442(223,584)	42(16,68)	2.61	2.08	——	625.2
	2				8	16	322	228	177(76,233)	45(20,77)	2.77	1.10	——	251.1
	3				16	24	297	214	167(72,216)	44(20,76)	2.75	1.01	——	194.4
22	1	2014.05.11	Cold	25	0	8.5	139	93	62(19,93)	56(27,86)	3.08	0.54	1.17	152.9
	2				8.5	16.5	264	202	165(92,211)	37(12,64)	2.45	0.64	2.56	193.6
	3				16.5	25	269	192	157(72,201)	42(18,69)	2.68	0.85	2.23	174.4
Region3.Meikuang Glacier (35°40’24” N, 94°11’10” E)														
23	1	2015.05.04	Cold	22	0	11	2107	1290	1055(102,1329)	50(31,95)	3.35	8.56	——	308.7
	2				11	22	4696	2817	2292(109,2938)	51(31,97)	3.43	16.89	——	662.3
24	1	2015.05.04	Cold	10	0	10	1291	746	553(—,772)	57(34,—)	3.56	6.04	——	507.9

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	f_{non-BC}^{est}	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
25	1	2015.05.05	Cold	52	0	14	301	217	178(85,229)	41(16,70)	2.65	0.88	1.45	212.3
	2				14	25	49	34	26(11,35)	47(20,81)	2.78	0.16	0.87	50.55
	3				25	36	48	36	27(14,36)	44(16,70)	2.56	0.13	1.75	53.66
	4				36	44	66	50	36(21,51)	45(15,68)	2.53	0.16	0.86	89.35
	5				44	52	135	98	75(39,103)	44(16,69)	2.62	0.37	3.80	150.3
26	1	2015.05	Cold	40	0	8	96	72	55(31,75)	43(14,75)	2.52	0.22	3.40	95.4
	2				8	16	129	95	58(35,95)	55(19,71)	2.65	0.29	3.87	231
	3				16	24	158	118	96(47,120)	39(16,68)	2.58	0.47	4.21	88.61
	4				24	32	177	125	94(40,126)	47(21,74)	2.79	0.60	3.05	139.8
	5				32	40	361	311	256(190,322)	29(2,41)	1.91	0.29	3.79	385.6
27	1	2015.05.05	Cold	40	0	10	222	172	156(86,182)	30(10,60)	2.32	0.61	——	75.88
	2				10	20	233	176	150(78,183)	36(14,65)	2.47	0.67	——	127.8
	3				20	30	257	192	157(73,194)	39(17,70)	2.63	0.83	——	128.3
	4				30	40	440	320	260(119,331)	41(17,68)	2.68	1.39	——	273.8
28	1	2015.05.05	Cold	45	0	8	624	450	339(97,414)	46(27,84)	3.00	2.38	——	109.6
	2				8	19	184	132	102(38,127)	44(24,77)	2.83	0.67	——	68.18
	3				19	28	97	70	52(18,65)	47(26,83)	2.92	0.39	——	41.42
	4				28	36	83	60	43(14,55)	48(28,86)	2.95	0.34	——	32.24
	5				36	45	241	176	151(68,181)	37(17,71)	2.64	0.77	——	70.53
29	1	2015.05.11	Cold	60	0	13	122	81	61(20,83)	50(25,86)	2.99	0.50	——	92.64
	2				13	26	103	72	61(25,76)	41(20,77)	2.76	0.39	——	46.81
	3				26	37	181	141	133(76,153)	27(7,57)	2.25	0.44	——	47.69
	4				37	60	83	57	31(15,58)	62(23,85)	2.93	0.23	——	177.3
30	1	2015.10	Warm	43	0	11.5	34	33	29(26,36)	16(—,17)	1.37	——	0.62	119.1
	2				11.5	23	24	23	19(17,24)	20(—,22)	1.46	——	0.66	76.14

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	f_{non-BC}^{est}	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
	3				23	33	720	465	324(77,456)	55(30,88)	3.15	5.66	8.06	964.8
	4				33	43	1372	873	613(100,830)	55(34,92)	3.26	14.60	——	480.6
31	1	2015.10	Warm	8	0	8	882	659	460(272,686)	48(14,66)	2.56	1.83	——	1224
32	1	2015.10	Warm	40	0	10	197	156	132(75,159)	33(11,59)	2.34	0.47	——	107.6
	2				10	21	287	223	187(103,229)	35(12,62)	2.40	0.74	——	154.7
	3				21	30	277	208	175(86,212)	37(15,67)	2.55	0.83	——	125.5
	4				30	40	964	733	669(341,772)	31(12,62)	2.43	2.09	——	139.1
Region4. Yuzhufeng Glacier (35°38’43” N, 94°13’36” E)														
33	1	2014.04.11	Cold	30	0	10	953	671	520(212,691)	46(20,76)	2.82	2.70	——	539.8
	2				10	20	600	420	363(134,439)	40(20,76)	2.82	2.05	——	148.5
	3				20	30	167	115	91(31,117)	46(23,82)	2.92	0.65	——	89.43
34	1	2014.04.19	Cold	39	0	12	1147	787	634(216,817)	45(22,80)	2.93	4.06	——	567.7
	2				12	21	630	410	328(76,421)	48(26,87)	3.13	2.72	——	241.9
	3				21	30	125	75	50(1,74)	60(35,—)	3.47	0.65	1.23	91.94
	4				30	39	120	77	58(13,79)	52(28,86)	3.15	0.54	1.13	78.54
35	1	2014.05.18	Cold	15	0	7.5	171	113	95(30,118)	44(24,83)	2.95	0.71	4.34	58.04
	2				7.5	15	647	426	358(115,451)	45(23,80)	2.95	2.26	5.43	212.3
36	1	2014.05.19	Cold	24	0	12	92	64	50(22,67)	45(19,75)	2.77	0.31	1.19	80.49
	2				12	24	161	132	137(93,152)	15(—,37)	1.82	0.22	1.93	45.1
37	1	2014.05.19	Cold	43	0	8	274	182	117(36,185)	57(26,89)	3.10	1.02	——	355.8
	2				8	16	134	86	64(17,91)	53(25,87)	3.11	0.53	1.90	117.8
	3				16	24	62	40	28(6,41)	54(28,91)	3.18	0.28	2.06	54.85
	4				24	34	52	35	24(8,35)	53(25,86)	3.01	0.20	1.79	55.03
	5				34	43	163	106	87(28,114)	47(23,82)	2.98	0.67	3.59	100.8
38	1	2014.05.19	Cold	45	0	22	823	533	471(116,574)	43(23,85)	3.08	3.11	3.16	127.7

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	$f_{non\text{-}BC}^{est}$	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
	2				22	33.5	543	354	294(78,379)	46(23,85)	3.07	2.17	5.05	228.2
	3				33.5	45	522	340	292(73,362)	44(24,85)	3.08	2.16	3.65	137.2
39	1	2014.10	Warm	17	0	8	186	123	81(24,121)	56(29,86)	3.09	0.77	——	196.7
	2				8	17	417	292	233(94,295)	44(22,77)	2.79	1.51	——	212.3
40	1	2015.10	Warm	35	0	8	1022	660	502(182,721)	51(22,80)	2.96	3.15	——	778.6
	2				8	16	317	201	165(37,205)	48(29,88)	3.03	1.42	——	72.53
	3				16	23	392	201	162(—,210)	59(41,—)	3.70	2.38	——	53.25
	4				23	35	155	92	72(8,93)	54(34,—)	3.32	0.86	——	46.23
41	1	2015.10	Warm	36	0	8	2630	1608	1169(72,1603)	56(33,96)	3.41	9.16	——	751.4
	2				8	15	469	301	218(47,306)	53(28,90)	3.19	1.92	1.85	312
	3				15	25.5	824	650	——	93(13,63)	2.45	0.07	3.07	3513
	4				25.5	36	606	417	227(110,420)	63(24,81)	2.94	1.61	2.75	1005
42	1	2015.10	Warm	30	0	10	148	115	101(55,119)	32(12,59)	2.35	0.40	2.76	55.14
	2				10	20	220	190	158(116,197)	28(2,42)	1.90	0.18	2.96	227.3
	3				20	30	518	397	319(184,413)	38(12,61)	2.41	0.99	5.27	333
43	1	2015.10	Warm	39	0	12	698	529	445(236,553)	36(13,63)	2.48	1.52	4.20	317.7
	2				12	21	191	142	76(46,137)	60(22,74)	2.73	0.42	5.92	393
	3				21	30	294	206	140(56,203)	52(24,81)	2.90	1.02	——	304.7
	4				30	39	699	555	406(268,568)	42(11,58)	2.33	1.16	——	886
44	1	2015.10	Warm	24	0	8	82	63	43(25,63)	47(16,69)	2.55	0.19	0.80	116.6
	2				8	16	171	151	——	60(2,44)	1.92	——	0.88	794.5
	3				16	24	382	326	——	110(6,49)	2.05	——	1.48	3394
Region5. Hariqin Glacier (33°08’23” N, 92°05’34” E)														
45	1	2015.10	Warm	30	0	15	45	33	23(9,30)	50(25,88)	2.88	0.16	0.96	33.43
	2				15	22	47	34	23(7,30)	52(29,93)	3.01	0.19	1.16	26.69

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	$f_{non\text{-}BC}^{est}$	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
	3				22	30	55	35	20(—,30)	63(40,—)	3.52	0.29	0.99	35.14
46	1	2015.10	Warm	27	0	11	36	24	13(4,22)	64(32,84)	3.16	0.14	0.75	54.97
	2				11	19	38	28	21(12,29)	44(14,77)	2.47	0.08	1.17	40.47
	3				19	27	40	30	21(11,30)	47(18,84)	2.61	0.10	0.94	43.36
47	1	2015.05.30	Cold	——	0	0	53	38	24(17,41)	55(13,72)	2.54	0.08	3.72	107.1
48	1	2015.05.30	Cold	——	0	0	3990	2702	2131(682,2784)	47(23,81)	2.97	9.64	——	1049
49	1	2015.10.19	Warm	46	0	11	333	235	181(68,235)	46(22,77)	2.86	1.68	0.72	204.8
	2				11	22	797	547	412(131,534)	48(26,82)	2.98	6.11	——	322.1
	3				22	34	104	79	63(33,81)	39(14,65)	2.53	0.24	1.38	87.93
	4				34	46	171	140	138(92,159)	19(—,41)	1.96	0.31	4.92	49.32
Region6. Tanggula Glacier (33°04’08” N, 92°04’24” E)														
50	1	2013.05.23	Cold	14	0	14	337	236	186(84,252)	45(18,73)	2.75	1.00	——	290.9
51	1	2014.05.01	Cold	54	0	9	36	32	——	——	1.76	——	1.14	85.58
	2				9	18	77	63	54(37,68)	30(2,48)	2.08	0.09	1.34	81.07
	3				18	27	24	21	——	——	1.82	——	1.04	42.46
	4				27	36	38	33	——	——	1.86	——	0.99	60.48
	5				36	45	55	45	33(23,46)	40(8,59)	2.22	0.07	1.13	83.39
	6				45	54	105	84	68(45,89)	35(7,54)	2.21	0.17	1.39	110.9
52	1	2014.05	Cold	36	0	16	1188	663	267(—,696)	78(36,—)	3.63	4.91	——	2129
	2				16	26	233	158	136(56,176)	42(17,75)	2.79	0.76	2.97	151.7
	3				26	36	134	81	62(12,89)	54(27,94)	3.22	0.59	3.39	113.7
53	1	2014.05.23	Cold	36	0	9	2224	1447	1347(402,1606)	39(21,82)	2.96	5.91	——	178.1
	2				9	18	411	265	238(68,293)	42(22,83)	3.01	1.59	——	98.27
	3				18	27	255	157	85(22,169)	67(27,92)	3.24	0.88	——	491
	4				27	36	74	48	——	86(25,90)	3.04	0.09	——	319

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	f_{non-BC}^{est}	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
54	1	2014.05.23	Cold	23	0	5	2770	1849	1637(596,2031)	41(19,77)	2.86	6.97	——	670.2
	2				5	23	457	313	282(109,342)	38(18,74)	2.79	1.51	——	124.3
55	1	2014.05.19	Cold	39	0	10	37	27	24(12,29)	36(13,59)	2.51	0.12	——	20.01
	2				10	20	23	17	15(8,19)	34(12,57)	2.42	0.07	——	14.07
	3				20	30	24	18	16(11,20)	31(5,70)	2.14	0.04	——	20.28
	4				30	39	202	162	155(95,178)	23(3,47)	2.11	0.40	——	63.68
56	1	2015.05.11	Cold	63	0	8.5	38	37	30(28,39)	19(—,26)	1.38	——	3.22	60.41
	2				8.5	17	31	31	28(25,33)	8(—,19)	1.24	——	2.38	51.64
	3				17	30	16	18	18(15,19)	——	1.08	——	0.68	32.38
	4				30	43	36	33	32(25,36)	9(—,28)	1.53	——	1.04	22.19
	5				43	53	45	36	31(22,40)	32(3,49)	2.07	0.05	3.04	59.77
	6				53	63	111	77	71(33,86)	37(15,63)	2.59	0.39	5.91	51.59
57	1	2015.05.25	Cold	60	0	10	29	25	21(15,26)	26(1,52)	1.88	0.03	0.58	25.31
	2				10	20	18	17	17(13,19)	9(—,26)	1.40	——	0.92	14.41
	3				20	30	14	13	12(9,14)	16(—,39)	1.62	——	1.17	12.09
	4				30	40	16	14	12(10,15)	20(—,32)	1.59	——	1.98	19.61
	5				40	50	13	12	11(8,13)	17(—,44)	1.69	0.01	0.45	10.22
	6				50	60	143	120	116(78,132)	19(—,42)	1.90	0.19	1.89	48.31
58	1	2015.10	Warm	29	0	10	68	57	51(36,61)	25(1,44)	1.93	0.08	1.95	54.85
	2				10	20	116	107	98(79,115)	16(—,26)	1.49	——	1.62	117.8
	3				20	29	337	252	108(87,245)	68(20,72)	2.69	0.55	1.96	823
59	1	2015.10	Warm	30	0	10	54	31	15(—,29)	72(40,—)	3.63	0.27	1.26	75.39
	2				10	19	25	18	9(6,18)	65(20,91)	2.77	0.05	2.56	56.23
	3				19	30	56	45	31(21,46)	45(9,78)	2.41	0.09	1.43	63.8
60	1	2015.10	Warm	19	0	10	99	82	67(48,86)	32(4,50)	2.02	0.11	——	121.6

Site	Layer	Sampling Time	Season	Ice Depth	Sample Depth (cm)		C_{BC}^{equiv}	C_{BC}^{max}	C_{BC}^{est}	f_{non-BC}^{est}	$Å_{tot}$	ISOC 450nm	WSOC	Fe
				(cm)	Top	Bottom	(ng g^{-1})	(ng g^{-1})	(ng g^{-1})	(%)		(ppm)	(ppm)	(ppb)
	2				10	19	148	99	84(29,104)	43(23,76)	2.89	0.60	——	52.06
Region7. Yangbajing Glacier (30°11’17” N, 90°27’23” E)														
61	1	2014.05.28	Cold	10	0	10	4674	3634	3080(1876,3884)	34(9,55)	2.29	5.22	——	911.2
62	1	2014.05.28	Cold	19	0	9	255	182	153(73,192)	40(17,70)	2.62	0.80	1.01	150.8
	2				9	19	173	131	115(66,142)	34(10,60)	2.36	0.42	4.65	118.8
63	1	2015.10	Warm	10	0	10	1281	941	736(350,944)	43(19,70)	2.64	2.61	0.84	397
64	1	2015.10	Warm	60	0	22	38	29	23(13,30)	40(14,59)	2.43	0.10	——	36.12
	2				22	35	30	23	15(10,24)	52(14,79)	2.46	0.05	——	54.78
	3				35	47.5	38	29	17(14,30)	55(12,73)	2.37	0.04	——	86.74
	4				47.5	60	63	52	46(29,54)	27(7,52)	2.09	0.13	——	31.51
65	1	2015.10	Warm	65	0	7	35	30	25(19,32)	28(1,57)	1.86	0.03	1.17	44.6
	2				7	15	50	35	20(9,33)	61(26,85)	2.90	0.15	0.79	85.85
	3				15	22	37	29	19(12,28)	48(18,75)	2.51	0.09	0.67	49.95
	4				22	29	28	29	——	——	1.34	——	1.77	102.3
	5				19	40	49	36	26(16,38)	47(14,71)	2.49	0.10	2.01	85.54
	6				40	48	41	33	19(16,33)	54(11,72)	2.30	0.02	0.63	113.4
	7				48	56.5	58	46	30(19,44)	48(16,72)	2.45	0.12	0.88	91.93
	8				56.5	65	152	113	73(40,109)	52(21,74)	2.66	0.40	0.86	215.5
66	1	2015.10	Warm	25	0	10	334	235	154(75,238)	54(22,77)	2.80	0.95	0.63	446.7
	2				10	17	102	76	49(30,77)	52(17,81)	2.60	0.21	0.63	145.5
	3				17	25	63	45	26(11,42)	58(27,88)	2.92	0.21	0.41	93.67
67	1	2015.10	Warm	10	25	35	144	115	72(59,119)	50(10,61)	2.25	0.08	——	379.5

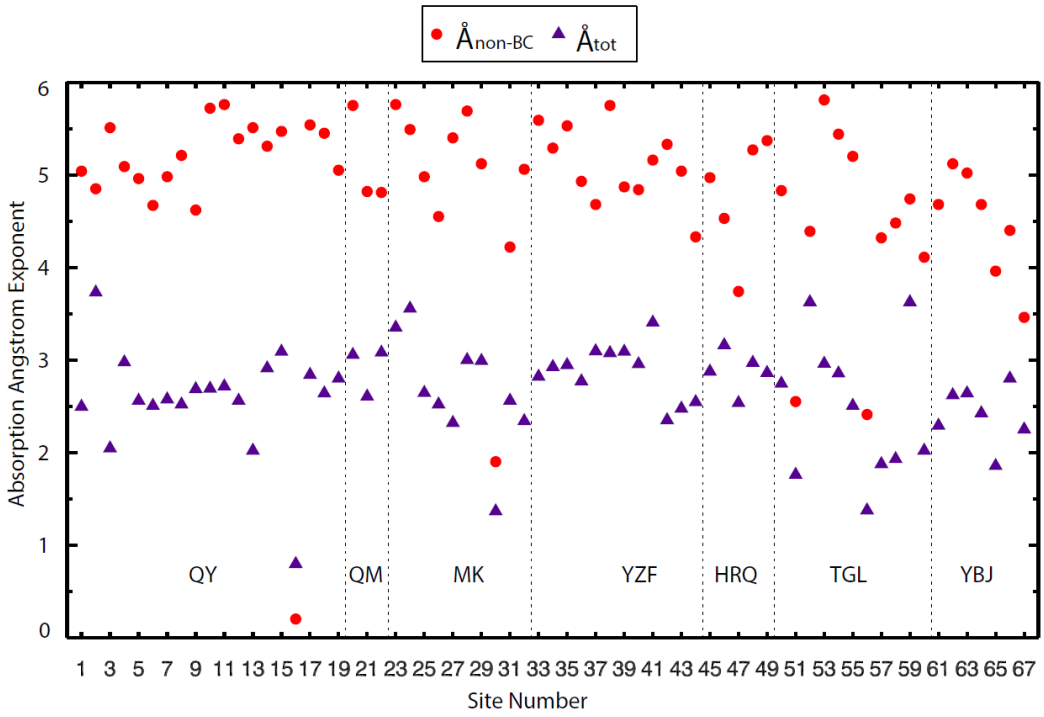

Figure S1. The absorption Ångström exponent of snow/ice samples for non-BC particulate constituents ($Å_{non\text{-}BC}$, red dots), and total particulate constituents ($Å_{tot}$, blue triangles) in each site.

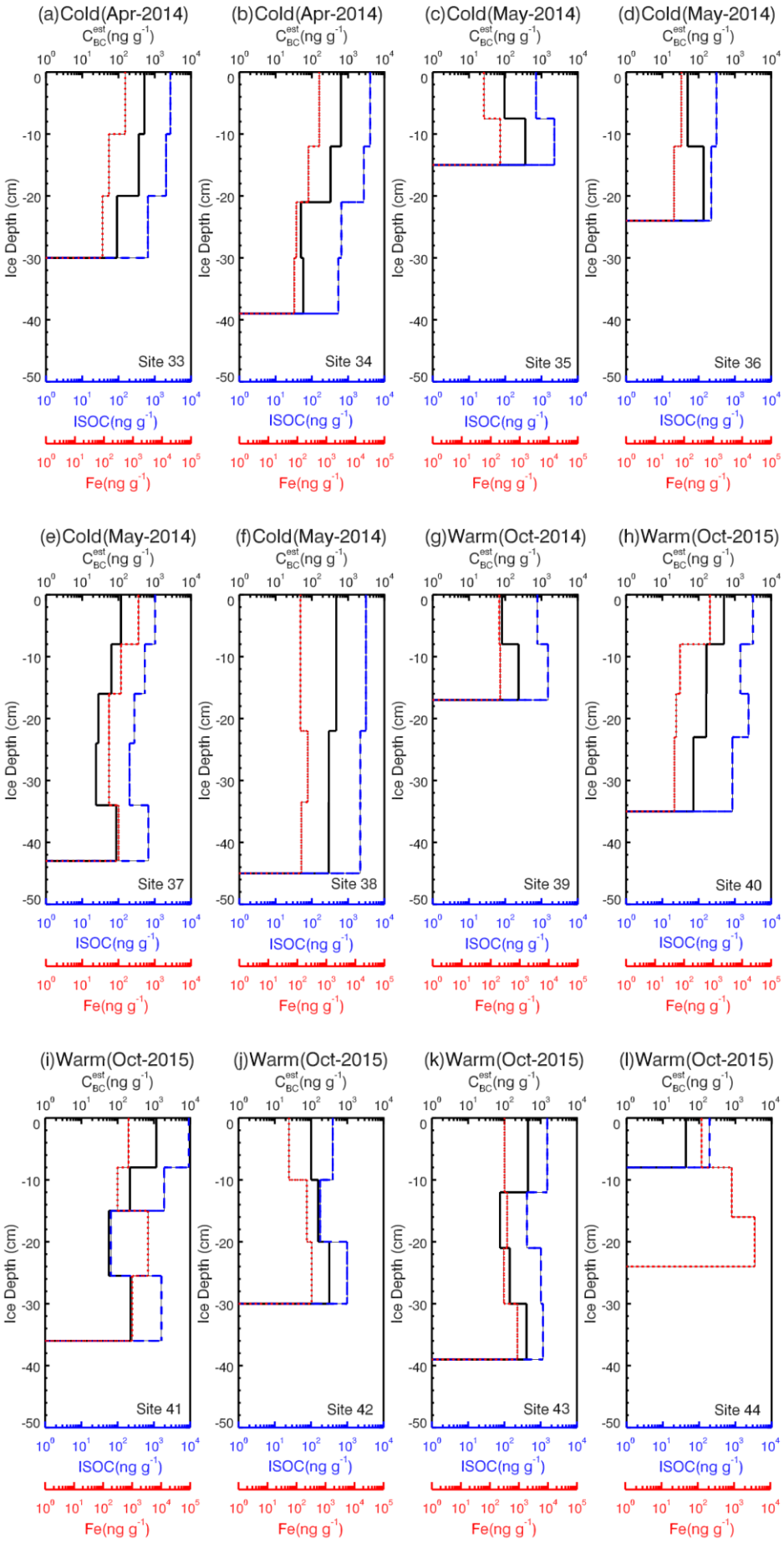
(a)Cold(Apr-2014)
(b)Cold(Apr-2014)
(c)Cold(May-2014)
(d)Cold(May-2014)
(e)Cold(May-2014)
(f)Cold(May-2014)
(g)Warm(Oct-2014)
(h)Warm(Oct-2015)
(i)Warm(Oct-2015)
(j)Warm(Oct-2015)
(k)Warm(Oct-2015)
(l)Warm(Oct-2015)
C_{BC}^{est}(ng g^{-1})
Ice Depth (cm)
Site 33
Site 34
Site 35
Site 36
Site 37
Site 38
Site 39
Site 40
Site 41
Site 42
Site 43
Site 44
ISOC(ng g^{-1})
Fe(ng g^{-1})

Figure S2. Vertical profiles of mass mixing ratios of BC, ISOC, and Fe for each sample in the Yuzhufeng glacier. Note that the snow/ice samples for more than one layer are plotted in this figure.

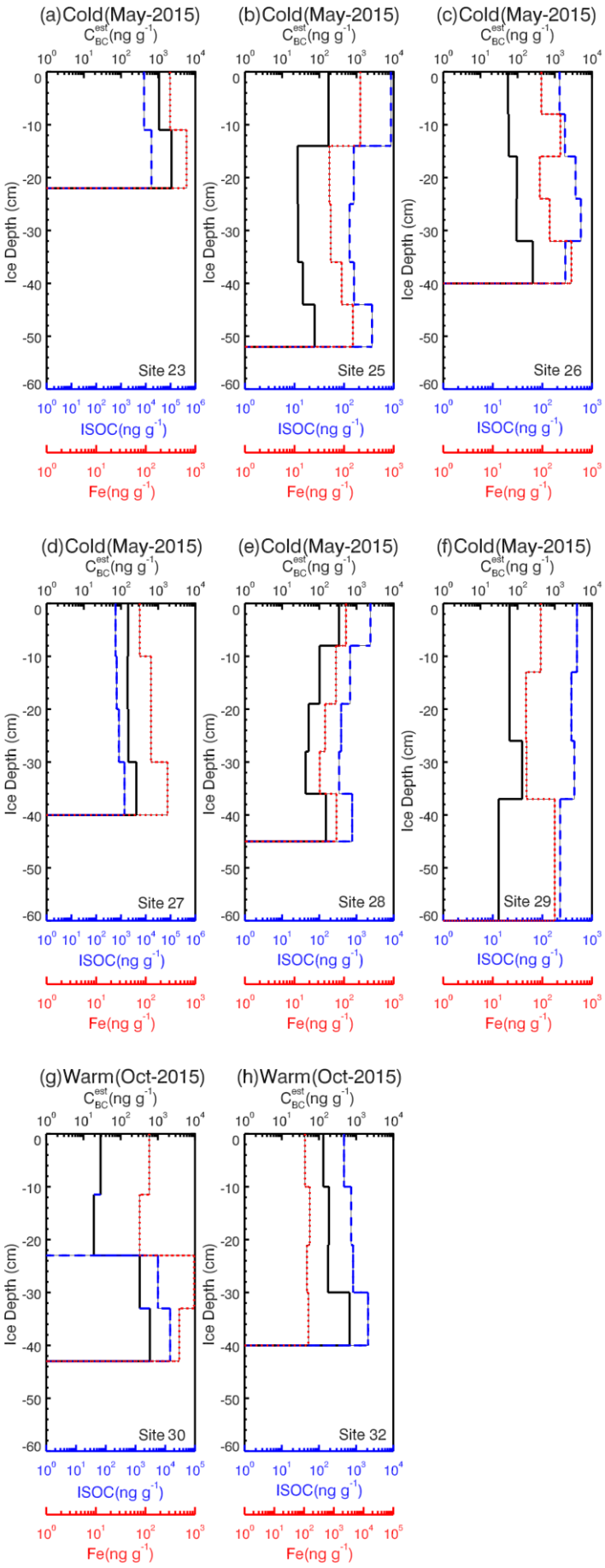
(a)Cold(May-2015)
(b)Cold(May-2015)
(c)Cold(May-2015)
(d)Cold(May-2015)
(e)Cold(May-2015)
(f)Cold(May-2015)
(g)Warm(Oct-2015)
(h)Warm(Oct-2015)
C_{BC}^{est}(ng g^{-1})
Ice Depth (cm)
Site 23
Site 25
Site 26
Site 27
Site 28
Site 29
Site 30
Site 32
ISOC(ng g^{-1})
Fe(ng g^{-1})

Figure S3. Vertical profiles of mass mixing ratios of BC, ISOC, and Fe for each sample in the Meikuang glacier.

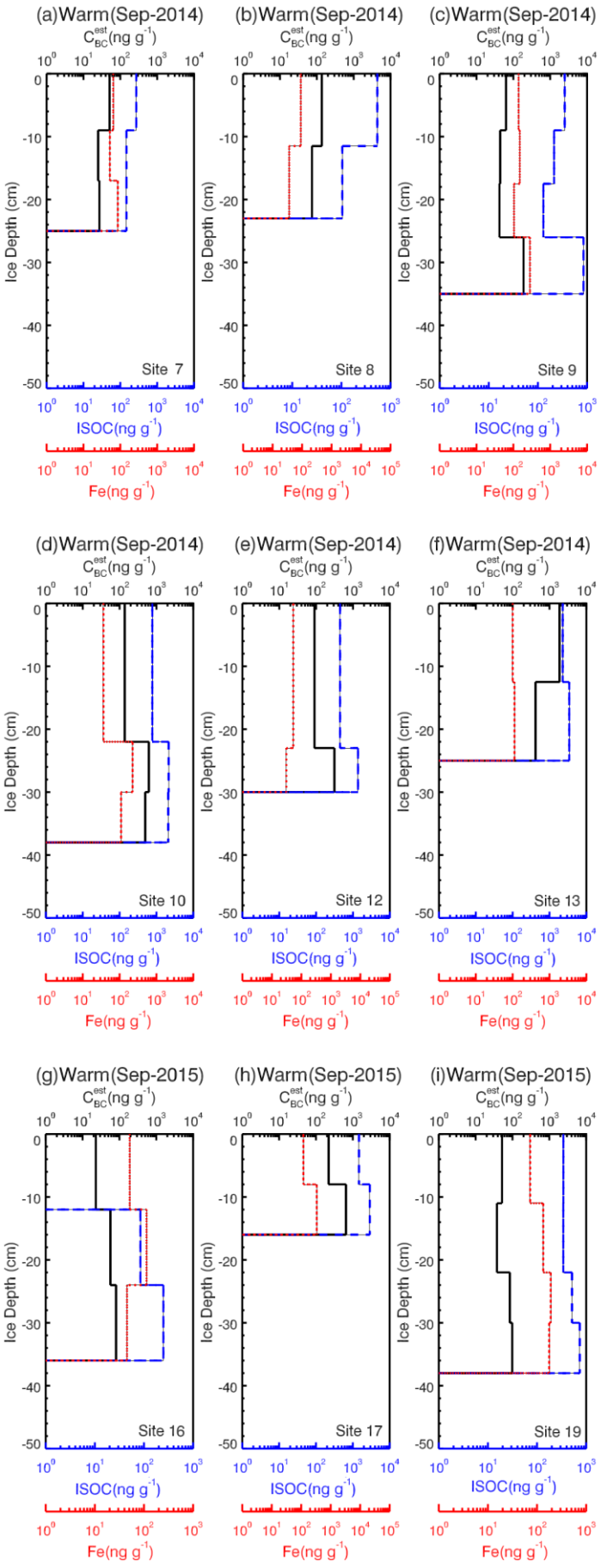
(a)Warm(Sep-2014)
(b)Warm(Sep-2014)
(c)Warm(Sep-2014)
(d)Warm(Sep-2014)
(e)Warm(Sep-2014)
(f)Warm(Sep-2014)
(g)Warm(Sep-2015)
(h)Warm(Sep-2015)
(i)Warm(Sep-2015)
C_{BC}^{est}(ng g^{-1})
Ice Depth (cm)
Site 7
Site 8
Site 9
Site 10
Site 12
Site 13
Site 16
Site 17
Site 19
ISOC(ng g^{-1})
Fe(ng g^{-1})

Figure S4. Vertical profiles of mass mixing ratios of BC, ISOC, and Fe for each sample in the Qiyi glacier.

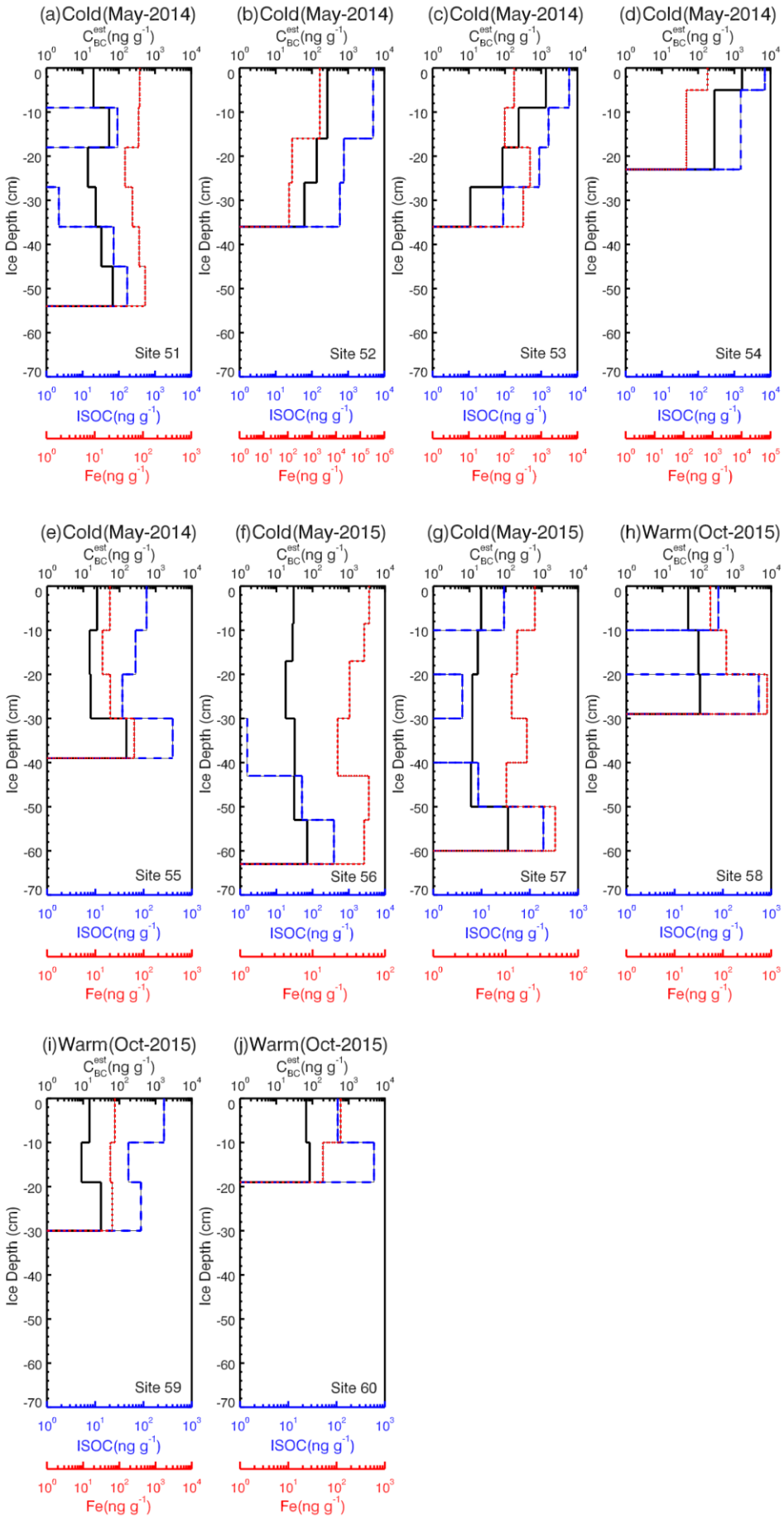
(a)Cold(May-2014)
(b)Cold(May-2014)
(c)Cold(May-2014)
(d)Cold(May-2014)
(e)Cold(May-2014)
(f)Cold(May-2015)
(g)Cold(May-2015)
(h)Warm(Oct-2015)
(i)Warm(Oct-2015)
(j)Warm(Oct-2015)
C_{BC}^{est}(ng g^{-1})
Ice Depth (cm)
Site 51
Site 52
Site 53
Site 54
Site 55
Site 56
Site 57
Site 58
Site 59
Site 60
ISOC(ng g^{-1})
Fe(ng g^{-1})

Figure S5. Vertical profiles of mass mixing ratios of BC, ISOC, and Fe for each sample in the Tanggula glacier.

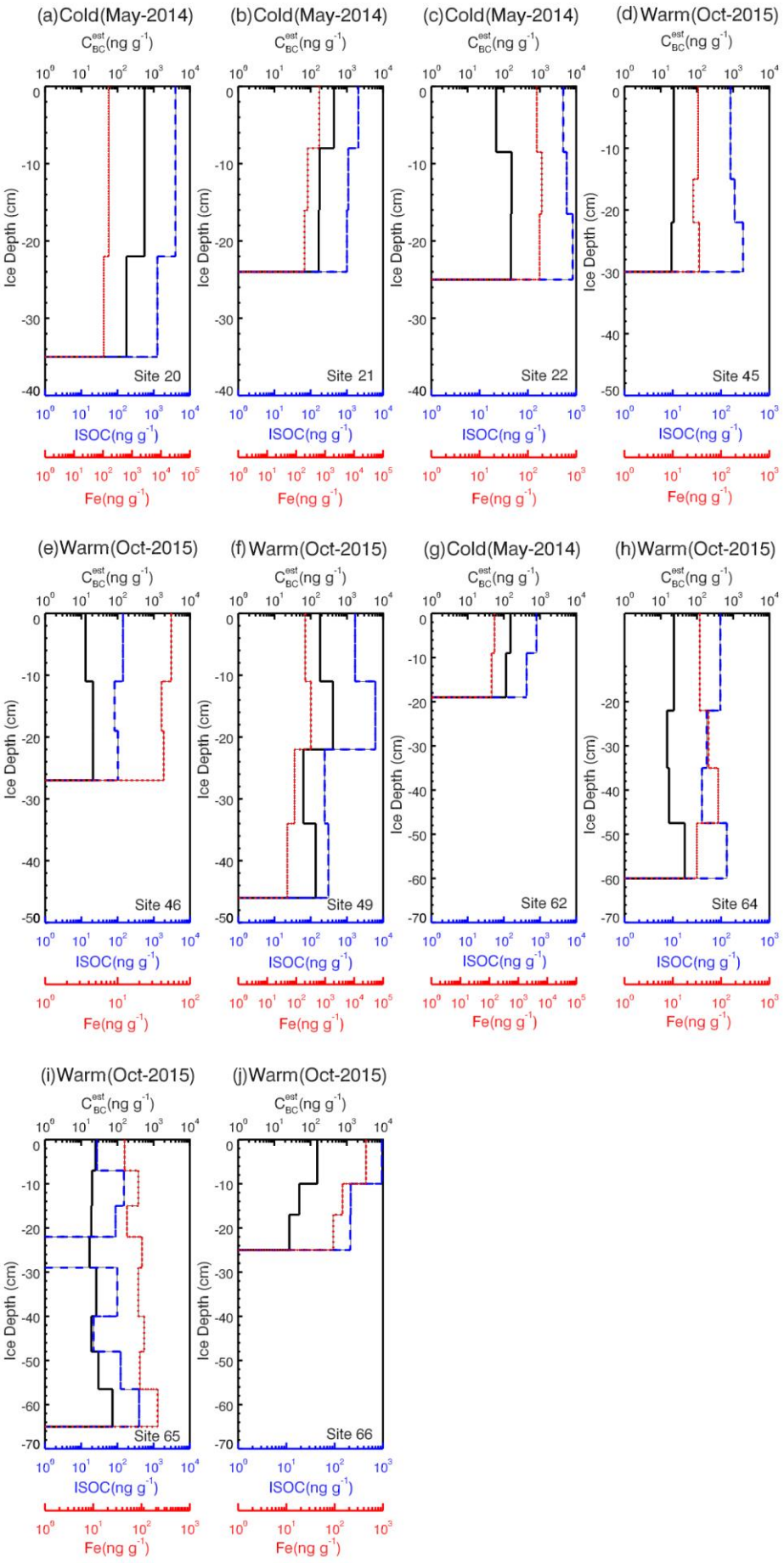
(a)Cold(May-2014)
(b)Cold(May-2014)
(c)Cold(May-2014)
(d)Warm(Oct-2015)
(e)Warm(Oct-2015)
(f)Warm(Oct-2015)
(g)Cold(May-2014)
(h)Warm(Oct-2015)
(i)Warm(Oct-2015)
(j)Warm(Oct-2015)
C_{BC}^{est}(ng g^{-1})
Ice Depth (cm)
ISOC(ng g^{-1})
Fe(ng g^{-1})
Site 20
Site 21
Site 22
Site 45
Site 46
Site 49
Site 62
Site 64
Site 65
Site 66

Figure S6. Vertical profiles of mass mixing ratios of BC, ISOC, and Fe of (a), (b), and (c) in the Qiumianleiketage glacier, (d), (e), and (f) in the Hariqin glacier, (g), (h), (i), and (j) in the Yangbajing glacier.

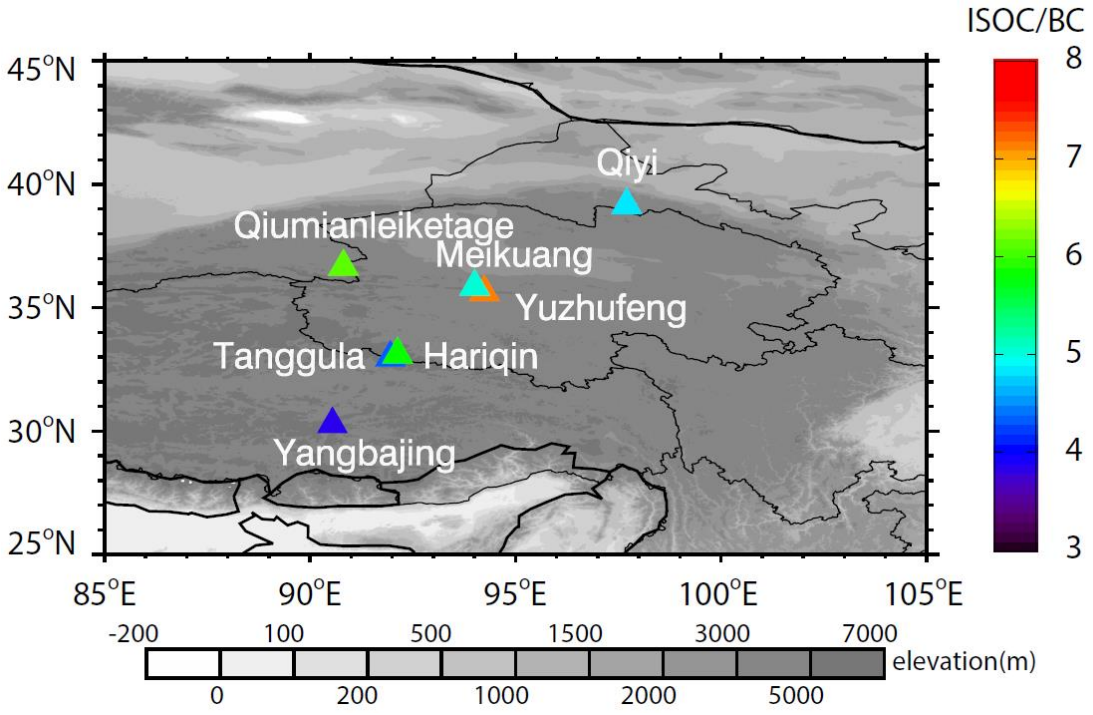

Figure S7. The median of mass mixing ratios of ISOC and BC for each snow/ice sample.

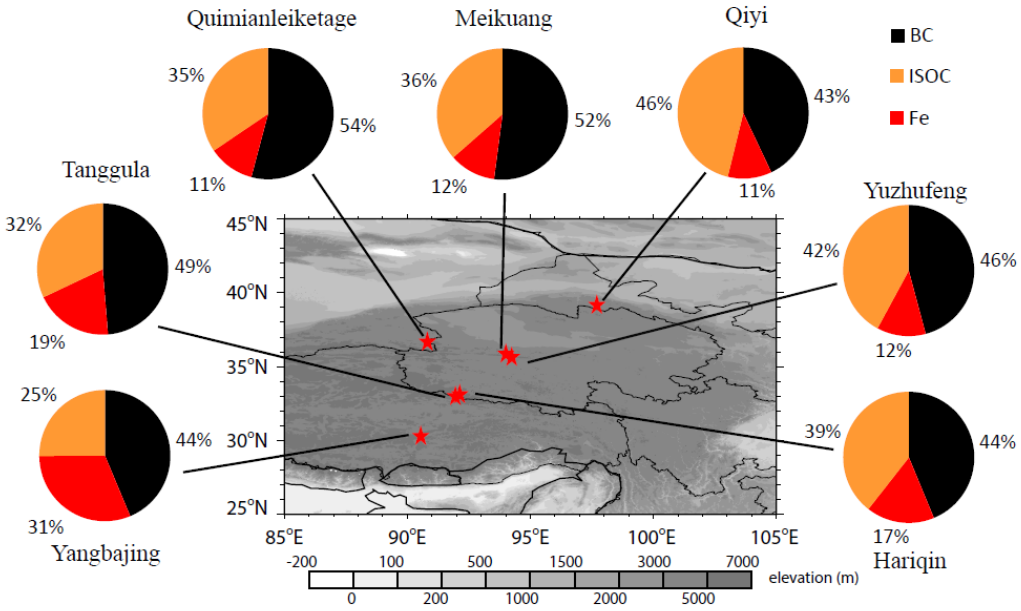

Figure S8. The median of relative contributions to total light absorption by BC, ISOC, and Fe for snow/ice samples in each glacier.