

Supplement of

**Technical note: Evaluating a geographical information system (GIS)-based approach for determining topographic shielding factors in cosmic-ray exposure dating**

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## BN-23a-1

**Table S1.** Strike and dip of the sampling surface on the BN-23a boulder.

<b>Strike</b>	280
<b>Dip</b>	5

**Table S2.** Recorded pairs of azimuth and elevation angles at the BN-23a boulder.

<b>Azimuth</b>	0	30	60	85	120	150	180	210	250	270	290	310	330
<b>Elevation</b>	7	9	7	2	2	1	3	3	4	4	2	4	3

## BN-23a-2

**Table S3.** Strike and dip of the sampling surface on the BN-23a boulder.

<b>Strike</b>	0
<b>Dip</b>	0

**Table S4.** Recorded pairs of azimuth and elevation angles at the BN-23a boulder.

<b>Azimuth</b>	0	30	60	85	120	150	180	210	250	270	290	310	330
<b>Elevation</b>	7	9	7	2	2	1	3	3	4	4	2	4	3

## FS-1a

**Table S5.** Strike and dip of the sampling surface on the FS-1a boulder.

<b>Strike</b>	210
<b>Dip</b>	10

**Table S6.** Recorded pairs of azimuth and elevation angles at the FS-1a boulder.

<b>Azimuth</b>	0	40	80	90	115	140	170	225	260	290	325
<b>Elevation</b>	36	22	5	2	5	11	11	19	18	35	37

## FS-2a

**Table S7.** Strike and dip of the sampling surface on the FS-2a boulder.

<b>Strike</b>	160
<b>Dip</b>	30

**Table S8.** Recorded pairs of azimuth and elevation angles at the FS-2a boulder.

<b>Azimuth</b>	0	60	90	130	170	190	230	260	280	315
<b>Elevation</b>	36	10	3	15	13	17	19	18	25	35

## FS-2b

**Table S9.** Strike and dip of the sampling surface on the FS-2b boulder.

<b>Strike</b>	190
<b>Dip</b>	10

**Table S10.** Recorded pairs of azimuth and elevation angles at the FS-2b boulder.

<b>Azimuth</b>	0	40	60	80	120	150	180	205	235	260	280	330
<b>Elevation</b>	23	10	2	2	15	17	14	18	17	14	15	25

## FS-2c

**Table S11.** Strike and dip of the sampling surface on the FS-2c boulder.

<b>Strike</b>	100
<b>Dip</b>	5

**Table S12.** Recorded pairs of azimuth and elevation angles at the FS-2c boulder.

<b>Azimuth</b>	0	20	40	80	120	155	185	225	240	270	300	320
<b>Elevation</b>	16	11	4	1	5	16	24	22	20	15	15	17

## FS-2d

**Table S13.** Strike and dip of the sampling surface on the FS-2d boulder.

<b>Strike</b>	20
<b>Dip</b>	15

**Table S14.** Recorded pairs of azimuth and elevation angles at the FS-2d boulder.

<b>Azimuth</b>	0	20	50	90	110	150	200	240	295	325
<b>Elevation</b>	16	10	5	0	5	17	21	18	15	19

## FS-3d

**Table S15.** Strike and dip of the sampling surface on the FS-3d boulder.

<b>Strike</b>	0
<b>Dip</b>	0

**Table S16.** Recorded pairs of azimuth and elevation angles at the FS-3d boulder.

<b>Azimuth</b>	0	45	70	115	150	185	220	250	270	300	330
<b>Elevation</b>	21	5	2	4	15	20	17	15	12	18	23

### FS-3e

**Table S17.** Strike and dip of the sampling surface on the FS-3e boulder.

<b>Strike</b>	320
<b>Dip</b>	35

**Table S18.** Recorded pairs of azimuth and elevation angles at the FS-3e boulder.

<b>Azimuth</b>	0	50	90	110	155	180	215	250	280	325
<b>Elevation</b>	15	4	1	2	17	16	19	17	14	20

### FS-3f

**Table S19.** Strike and dip of the sampling surface on the FS-3f boulder.

<b>Strike</b>	160
<b>Dip</b>	20

**Table S20.** Recorded pairs of azimuth and elevation angles at the FS-3f boulder.

<b>Azimuth</b>	0	50	90	110	155	180	215	250	280	325
<b>Elevation</b>	15	4	1	2	17	16	19	17	14	20

## KS-1a

**Table S21.** Strike and dip of the sampling surface on the KS-1a boulder.

<b>Strike</b>	270
<b>Dip</b>	15

**Table S22.** Recorded pairs of azimuth and elevation angles at the KS-1a boulder.

<b>Azimuth</b>	0	15	45	65	120	155	190	240	255	280	310	320	350
<b>Elevation</b>	3	5	0	20	25	22	24	27	22	15	17	10	0

## KS-1b

**Table S23.** Strike and dip of the sampling surface on the KS-1b boulder.

<b>Strike</b>	310
<b>Dip</b>	25

**Table S24.** Recorded pairs of azimuth and elevation angles at the KS-1b boulder.

<b>Azimuth</b>	20	45	60	75	90	122	150	180	190	210	235	250	270	350
<b>Elevation</b>	6	3	7	5	15	17	17	20	28	26	27	23	32	20

## KS-2a

**Table S25.** Strike and dip of the sampling surface on the KS-2a boulder.

<b>Strike</b>	265
<b>Dip</b>	5

**Table S26.** Recorded pairs of azimuth and elevation angles at the KS-2a boulder.

<b>Azimuth</b>	15	30	45	65	75	90	110	130	140	160	185	200	210	215	230	260	285	350
<b>Elevation</b>	7	6	3	5	5	12	20	16	17	15	19	20	23	21	23	22	31	15

## KS-2b

**Table S27.** Strike and dip of the sampling surface on the KS-2b boulder.

<b>Strike</b>	320
<b>Dip</b>	5

**Table S28.** Recorded pairs of azimuth and elevation angles at the KS-2b boulder.

<b>Azimuth</b>	20	45	60	70	105	135	150	180	200	215	250	285	350
<b>Elevation</b>	6	2	6	5	20	19	19	16	20	22	19	20	3



## KS-2c

**Table S29.** Strike and dip of the sampling surface on the KS-2c boulder.

<b>Strike</b>	210
<b>Dip</b>	15

**Table S30.** Recorded pairs of azimuth and elevation angles at the KS-2c boulder.

<b>Azimuth</b>	0	18	29	45	54	61	65	70	108	144	164	175	195	228	240	256	283	346
<b>Elevation</b>	4	6	4	3	5	6	5	6	23	19	17	15	16	19	17	16	21	0

## KS-2d

**Table S31.** Strike and dip of the sampling surface on the KS-2d boulder.

<b>Strike</b>	200
<b>Dip</b>	10

**Table S32.** Recorded pairs of azimuth and elevation angles at the KS-2d boulder.

<b>Azimuth</b>	0	18	28	44	53	61	65	73	110	145	171	200	217	234	258	280	345
<b>Elevation</b>	4	6	3	3	5	6	5	6	22	18	16	16	19	19	16	21	0

## KS-2e

**Table S33.** Strike and dip of the sampling surface on the KS-2e boulder.

<b>Strike</b>	90
<b>Dip</b>	20

**Table S34.** Recorded pairs of azimuth and elevation angles at the KS-2e boulder.

<b>Azimuth</b>	0	20	40	60	70	120	180	220	265	290	350
<b>Elevation</b>	3	6	2	5	5	23	17	20	17	22	0

## KS-2f

**Table S35.** Strike and dip of the sampling surface on the KS-2f boulder.

<b>Strike</b>	180
<b>Dip</b>	10

**Table S36.** Recorded pairs of azimuth and elevation angles at the KS-2f boulder.

<b>Azimuth</b>	0	20	35	45	55	70	85	100	135	145	165	195	220	245	270
<b>Elevation</b>	5	6	3	2	5	5	5	18	16	17	15	19	23	20	31

## KS-2g

**Table S37.** Strike and dip of the sampling surface on the KS-2g boulder.

<b>Strike</b>	300
<b>Dip</b>	5

**Table S38.** Recorded pairs of azimuth and elevation angles at the KS-2g boulder.

<b>Azimuth</b>	20	50	60	70	100	145	180	215	260	290	355
<b>Elevation</b>	6	3	6	5	22	19	18	22	18	23	0

## KS-3a

**Table S39.** Strike and dip of the sampling surface on the KS-3a boulder.

<b>Strike</b>	290
<b>Dip</b>	5

**Table S40.** Recorded pairs of azimuth and elevation angles at the KS-3a boulder.

<b>Azimuth</b>	0	17	30	45	54	61	65	67	114	175	200	220	235	255	280	345
<b>Elevation</b>	4	6	4	3	6	6	5	5	26	16	16	19	19	15	20	0

## SH-1c

**Table S41.** Strike and dip of the sampling surface on the SH-1c boulder.

<b>Strike</b>	250
<b>Dip</b>	50

**Table S42.** Recorded pairs of azimuth and elevation angles at the SH-1c boulder.

<b>Azimuth</b>	0	40	70	90	125	160	180	215	260	290	325
<b>Elevation</b>	16	5	2	2	5	20	17	20	16	14	18

## SW-10

**Table S43.** Strike and dip of the sampling surface on the SW-10 boulder.

<b>Strike</b>	80
<b>Dip</b>	15

**Table S44.** Recorded pairs of azimuth and elevation angles at the SW-10 boulder.

<b>Azimuth</b>	0	33	51	81	96	105	110	125	160	187	200	220	230	240	254	282	290	300	315
<b>Elevation</b>	27	25	25	19	11	9	10	10	24	19	14	16	19	18	18	9	5	6	6

## SW-11a

**Table S45.** Strike and dip of the sampling surface on the SW-11a boulder.

<b>Strike</b>	340
<b>Dip</b>	15

**Table S46.** Recorded pairs of azimuth and elevation angles at the SW-11a boulder.

<b>Azimuth</b>	0	50	80	85	107	110	122	143	175	180	240	278	290	296	310	317	323
<b>Elevation</b>	23	30	17	18	8	10	10	19	20	16	19	12	5	6	6	5	9

## SW-11b

**Table S47.** Strike and dip of the sampling surface on the SW-11b boulder.

<b>Strike</b>	200
<b>Dip</b>	5

**Table S48.** Recorded pairs of azimuth and elevation angles at the SW-11b boulder.

<b>Azimuth</b>	0	60	90	107	112	124	145	175	180	244	275	290	295	310	316	320
<b>Elevation</b>	23	31	17	9	10	10	18	19	16	21	13	5	6	6	5	9

## SW-11c

**Table S49.** Strike and dip of the sampling surface on the SW-11c boulder.

<b>Strike</b>	60
<b>Dip</b>	15

**Table S50.** Recorded pairs of azimuth and elevation angles at the SW-11c boulder.

<b>Azimuth</b>	0	55	85	108	112	120	150	174	180	244	280	291	296	312	315	324
<b>Elevation</b>	19	29	16	9	10	10	20	19	17	21	13	5	6	6	5	8

## SW-11d

**Table S51.** Strike and dip of the sampling surface on the SW-11d boulder.

<b>Strike</b>	90
<b>Dip</b>	40

**Table S52.** Recorded pairs of azimuth and elevation angles at the SW-11d boulder.

<b>Azimuth</b>	0	60	83	110	112	120	145	174	180	250	280	291	295	310	317	325
<b>Elevation</b>	21	30	18	9	10	10	18	19	16	20	14	5	6	6	5	9

## SW-12a

**Table S53.** Strike and dip of the sampling surface on the SW-12a boulder.

<b>Strike</b>	40
<b>Dip</b>	20

**Table S54.** Recorded pairs of azimuth and elevation angles at the SW-12a boulder.

<b>Azimuth</b>	0	48	77	82	104	110	120	144	172	175	245	280	295	310	320	325
<b>Elevation</b>	17	26	16	17	8	9	9	19	20	17	21	12	5	6	4	9

## SW-15a

**Table S55.** Strike and dip of the sampling surface on the SW-15a boulder.

<b>Strike</b>	100
<b>Dip</b>	20

**Table S56.** Recorded pairs of azimuth and elevation angles at the SW-15a boulder.

<b>Azimuth</b>	0	17	40	59	66	72	85	95	100	110	113	118	125	147	173	220	280	336
<b>Elevation</b>	8	9	11	11	9	5	9	7	4	6	7	6	12	13	11	27	18	0

## SW-15b

**Table S57.** Strike and dip of the sampling surface on the SW-15b boulder.

<b>Strike</b>	110
<b>Dip</b>	25

**Table S58.** Recorded pairs of azimuth and elevation angles at the SW-15b boulder.

<b>Azimuth</b>	0	16	43	50	58	73	84	100	110	115	140	170	225	285	337
<b>Elevation</b>	8	8	11	10	11	6	8	5	6	7	13	11	28	11	0

## SW-16

**Table S59.** Strike and dip of the sampling surface on the SW-16 boulder.

<b>Strike</b>	290
<b>Dip</b>	25

**Table S60.** Recorded pairs of azimuth and elevation angles at the SW-16 boulder.

<b>Azimuth</b>	0	15	25	46	65	80	90	105	115	122	137	155	195	250	298	338
<b>Elevation</b>	6	9	9	11	10	5	8	5	6	5	11	13	25	23	12	0



## SW-18a

**Table S61.** Strike and dip of the sampling surface on the SW-18a boulder.

<b>Strike</b>	160
<b>Dip</b>	40

**Table S62.** Recorded pairs of azimuth and elevation angles at the SW-18a boulder.

<b>Azimuth</b>	0	20	45	55	70	95	100	115	165	210	275	310
<b>Elevation</b>	4	20	20	21	23	12	14	6	35	40	17	19

## SW-18b

**Table S63.** Strike and dip of the sampling surface on the SW-18b boulder.

<b>Strike</b>	90
<b>Dip</b>	25

**Table S64.** Recorded pairs of azimuth and elevation angles at the SW-18b boulder.

<b>Azimuth</b>	0	30	45	60	70	100	110	115	170	210	270	310
<b>Elevation</b>	1	22	24	21	23	14	14	8	32	39	15	19

## SW-18c

**Table S65.** Strike and dip of the sampling surface on the SW-18c boulder.

<b>Strike</b>	100
<b>Dip</b>	45

**Table S66.** Recorded pairs of azimuth and elevation angles at the SW-18c boulder.

<b>Azimuth</b>	0	45	65	75	90	100	120	175	210	270	315
<b>Elevation</b>	0	24	22	23	14	14	6	34	39	18	21

## SW-2

**Table S67.** Strike and dip of the sampling surface on the SW-2 boulder.

<b>Strike</b>	0
<b>Dip</b>	0

**Table S68.** Recorded pairs of azimuth and elevation angles at the SW-2 boulder.

<b>Azimuth</b>	0	30	55	80	95	123	160	175	195	215	260	303	335
<b>Elevation</b>	22	29	33	33	35	25	17	15	15	25	22	2	14

## SW-9

**Table S69.** Strike and dip of the sampling surface on the SW-9 boulder.

<b>Strike</b>	250
<b>Dip</b>	35

**Table S70.** Recorded pairs of azimuth and elevation angles at the SW-9 boulder.

<b>Azimuth</b>	0	51	72	80	92	105	113	127	155	205	253	290	310
<b>Elevation</b>	26	26	21	22	14	9	11	11	24	13	15	7	11

## WH-1a

**Table S71.** Strike and dip of the sampling surface on the WH-1a boulder.

<b>Strike</b>	250
<b>Dip</b>	15

**Table S72.** Recorded pairs of azimuth and elevation angles at the WH-1a boulder.

<b>Azimuth</b>	0	20	50	70	90	110	140	190	240	245	260	275	285	295	310	340
<b>Elevation</b>	5	6	3	2	11	17	26	14	20	17	16	8	8	9	7	6

## WK-1a

**Table S73.** Strike and dip of the sampling surface on the WK-1a boulder.

<b>Strike</b>	335
<b>Dip</b>	30

**Table S74.** Recorded pairs of azimuth and elevation angles at the WK-1a boulder.

<b>Azimuth</b>	0	10	25	60	80	100	130	155	180	205	240	265	290	330	345
<b>Elevation</b>	0	3	1	0	1	6	11	14	13	19	25	30	20	14	9

**Table S75.** Location of moraine boulders, topographic shielding factors determined with the toolbox of Li (2018) and shielding factors derived from field measurements with an online calculator (Balco, 2018).

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Topographic shielding factor (TanDEM-X data)</b>	<b>Topographic shielding factor (TanDEM-X data and height field)</b>	<b>Topographic shielding factor (High- resolution DEM)</b>	<b>Topographic shielding factor (High- resolution DEM and height field)</b>	<b>Topographic shielding factor (derived from field data)</b>
BN-23a-1	47.934784	8.072590	0.999822	0.999826	0.997936	0.999661	0.999765	0.999809	0.999600
BN-23a-2	47.934784	8.072590	0.999874	0.999879	0.997990	0.999715	0.999815	0.999862	0.999649
FS-1a	47.872193	8.033919	0.956331	0.958990	0.963798	0.964928	0.954577	0.956557	0.941791
FS-2a	47.872164	8.035611	0.946817	0.947617	0.935683	0.947396	0.946074	0.946673	0.932007
FS-2b	47.871428	8.037746	0.987605	0.987803	0.986538	0.986864	0.987097	0.987291	0.982220
FS-2c	47.869931	8.036674	0.989416	0.989699	0.989447	0.989705	0.987293	0.987584	0.984843
FS-2d	47.870075	8.037022	0.989279	0.989702	0.989780	0.990044	0.988169	0.988466	0.986562
FS-3d	47.871280	8.038474	0.991355	0.991496	0.990953	0.991101	0.989339	0.989687	0.985519
FS-3e	47.870467	8.038263	0.960567	0.960651	0.960484	0.960568	0.960149	0.960239	0.958662
FS-3f	47.870475	8.038298	0.986353	0.986567	0.986325	0.986544	0.985503	0.985737	0.982962
KS-1a	47.880995	7.950002	0.970222	0.971875	0.968826	0.970622	0.959061	0.975953	0.969944
KS-1b	47.882771	7.947639	0.948268	0.954312	0.949944	0.954334	0.967673	0.969799	0.961717

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Topographic shielding factor (TanDEM-X data)</b>	<b>Topographic shielding factor (TanDEM-X data and height field)</b>	<b>Topographic shielding factor (High- resolution DEM)</b>	<b>Topographic shielding factor (High- resolution DEM and height field)</b>	<b>Topographic shielding factor (derived from field data)</b>
KS-2a	47.883475	7.948489	0.960457	0.966693	0.970289	0.972154	0.976071	0.978910	0.973091
KS-2b	47.883464	7.949545	0.982755	0.983164	0.979861	0.980352	0.983240	0.984179	0.984485
KS-2c	47.883693	7.950439	0.983243	0.983565	0.980054	0.983335	0.983867	0.986933	0.986273
KS-2d	47.883615	7.950471	0.983384	0.983632	0.983652	0.983894	0.986963	0.987163	0.987129
KS-2e	47.883608	7.950357	0.977945	0.978205	0.977942	0.978196	0.980931	0.981146	0.978584
KS-2f	47.883602	7.948615	0.973202	0.975617	0.971776	0.973288	0.979447	0.980254	0.977411
KS-2g	47.883334	7.949847	0.982740	0.983222	0.979012	0.980397	0.983138	0.984505	0.981684
KS-3a	47.883767	7.950995	0.980522	0.981793	0.982632	0.982955	0.985285	0.986439	0.984652
SH-1c	47.869967	8.038701	0.888865	0.888957	0.887837	0.888540	0.887713	0.888004	0.885943
SW-10	47.891928	7.957121	0.970066	0.970372	0.967071	0.967562	0.972170	0.972448	0.974701
SW-11a	47.892901	7.954207	0.967424	0.967773	0.966216	0.966582	0.971408	0.971680	0.974568
SW-11b	47.893093	7.953907	0.967019	0.967538	0.965497	0.966037	0.971243	0.971633	0.971608
SW-11c	47.893038	7.953808	0.965915	0.966533	0.964446	0.965088	0.970068	0.970529	0.975586
SW-11d	47.893185	7.953791	0.927850	0.928144	0.926251	0.926720	0.929501	0.930088	0.931333

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Topographic shielding factor (TanDEM-X data)</b>	<b>Topographic shielding factor (TanDEM-X data and height field)</b>	<b>Topographic shielding factor (High- resolution DEM)</b>	<b>Topographic shielding factor (High- resolution DEM and height field)</b>	<b>Topographic shielding factor (derived from field data)</b>
SW-12a	47.892540	7.953460	0.967233	0.967983	0.965972	0.966701	0.972777	0.973144	0.976411
SW-15a	47.891977	7.946590	0.970801	0.976005	0.968930	0.974374	0.979869	0.980522	0.981034
SW-15b	47.891899	7.946578	0.963284	0.970889	0.950631	0.968840	0.971465	0.972592	0.976074
SW-16	47.893502	7.944610	0.984396	0.984706	0.980150	0.983635	0.979350	0.985009	0.982982
SW-18a	47.901610	7.932353	0.898356	0.899502	0.898430	0.899288	0.899708	0.900512	0.893304
SW-18b	47.901672	7.932376	0.940322	0.941390	0.939660	0.940626	0.939924	0.940878	0.941312
SW-18c	47.901887	7.931987	0.880233	0.881297	0.877517	0.878447	0.880215	0.881019	0.876899
SW-2	47.882025	7.983656	0.956356	0.957627	0.955106	0.956412	0.950471	0.953444	0.938348
SW-9	47.891912	7.959058	0.941010	0.941612	0.908292	0.914840	0.939428	0.940059	0.944719
WH-1a	47.866716	8.054920	0.991425	0.991572	0.932147	0.951459	0.990703	0.990955	0.987775
WK-1a	47.862308	8.063162	0.970936	0.971228	0.970889	0.971170	0.968701	0.969007	0.975204

**Table S76.** Topographic shielding factors for boulders in the southern Black Forest determined with the high-resolution DEM and two resampled versions of the elevation model. Field data-based shielding factors are shown for comparison. Field data-based shielding factors from Hofmann et al. (2022).

<b>Boulder</b>	<b>Shielding factor (30 m-DEM)</b>	<b>Shielding factor (12 m-DEM)</b>	<b>Shielding factor (1 m-DEM)</b>	<b>Field data-based shielding factor</b>
BN-23a-1	0.999810	0.999809	0.999765	0.999600
BN-23a-2	0.999863	0.999862	0.999815	0.999649
FS-1a	0.959739	0.957519	0.954577	0.941791
FS-2a	0.948477	0.947219	0.946074	0.932007
FS-2b	0.987684	0.987455	0.987097	0.982220
FS-2c	0.987865	0.987687	0.987293	0.984843
FS-2d	0.988808	0.988541	0.988169	0.986562
FS-3d	0.990124	0.989821	0.989339	0.985519
FS-3e	0.960313	0.960282	0.960149	0.958662
FS-3f	0.985854	0.985832	0.985503	0.982962
KS-1a	0.976226	0.976248	0.959061	0.969944
KS-1b	0.970363	0.970144	0.967673	0.961717
KS-2a	0.979185	0.979200	0.976071	0.973091
KS-2b	0.984644	0.984320	0.983240	0.984485
KS-2c	0.987232	0.986961	0.983867	0.986273



<b>Boulder</b>	<b>Shielding factor (30 m-DEM)</b>	<b>Shielding factor (12 m-DEM)</b>	<b>Shielding factor (1 m-DEM)</b>	<b>Field data-based shielding factor</b>
KS-2d	0.987419	0.987133	0.986963	0.987129
KS-2e	0.981489	0.981197	0.980931	0.978584
KS-2f	0.981037	0.980573	0.979447	0.977411
KS-2g	0.985087	0.984648	0.983138	0.981684
KS-3a	0.986642	0.986612	0.985285	0.984652
SH-1c	0.888128	0.888047	0.887713	0.885943
SW-10	0.972877	0.972600	0.972170	0.974701
SW-11a	0.972209	0.971854	0.971408	0.974568
SW-11b	0.971955	0.971742	0.971243	0.971608
SW-11c	0.970845	0.970635	0.970068	0.975586
SW-11d	0.930439	0.930210	0.929501	0.931333
SW-12a	0.973607	0.973292	0.972777	0.976411
SW-15a	0.981808	0.981150	0.979869	0.981034
SW-15b	0.974469	0.973634	0.971465	0.976074
SW-16	0.985185	0.985083	0.979350	0.982982
SW-18a	0.901332	0.900973	0.899708	0.893304

<b>Boulder</b>	<b>Shielding factor (30 m-DEM)</b>	<b>Shielding factor (12 m-DEM)</b>	<b>Shielding factor (1 m-DEM)</b>	<b>Field data-based shielding factor</b>
SW-18b	0.942020	0.941519	0.939924	0.941312
SW-18c	0.882095	0.881504	0.880215	0.876899
SW-2	0.955080	0.954025	0.950471	0.938348
SW-9	0.940230	0.940207	0.939428	0.944719
WH-1a	0.991074	0.990940	0.990703	0.987775
WK-1a	0.969382	0.969161	0.968701	0.975204

**Table S77.** Location of the moraine boulders chosen for the second experiment and topographic shielding factors for these boulders. *xy*-coordinates and field-data based topographic shielding factors from Le Roy et al. (2017).

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Field data-based topographic shielding factor</b>
RAT01	45.018202	6.285005	0.934800	0.935099	0.922
RAT02	45.018125	6.285001	0.935252	0.935469	0.922
RAT04	45.018282	6.285259	0.936812	0.937164	0.922
RAT05	45.016606	6.284437	0.934289	0.934451	0.924
RAT06	45.016990	6.284280	0.931858	0.932026	0.921
RAT07	45.017344	6.284831	0.935084	0.935252	0.924
RAT08	45.019633	6.286424	0.935286	0.935602	0.903
RAT09	45.020154	6.286780	0.928459	0.929878	0.903
RAT10	45.018670	6.285508	0.936888	0.937082	0.922
LAU01	45.013394	6.350837	0.830158	0.837863	0.848
BON00	44.935358	6.325778	0.951099	0.951853	0.954
BON02	44.935748	6.324149	0.949709	0.950290	0.955
BON03	44.935888	6.324073	0.947426	0.948391	0.955
BON04	44.935833	6.324965	0.946295	0.947503	0.932
BON05	44.935540	6.324488	0.952073	0.952471	0.955

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Field data-based topographic shielding factor</b>
BON06	44.935798	6.323495	0.950281	0.950750	0.955
BON07	44.935262	6.325607	0.951895	0.952234	0.951
BON08	44.936101	6.322237	0.948458	0.949038	0.951
BON09	44.936275	6.321760	0.946453	0.947096	0.949
BON10	44.936307	6.321639	0.945000	0.946198	0.949
BON11	44.935287	6.325250	0.952089	0.952417	0.955
BON12	44.935227	6.325597	0.952252	0.952510	0.951
ETA01	44.909085	6.259764	0.898708	0.899023	0.920
ETA02	44.909090	6.259700	0.898460	0.898742	0.920

**Table S78.** Location of the moraine boulders chosen for the third experiment and topographic shielding factors for these boulders. *xy*-coordinates and field-data based topographic shielding factors from Schimmelpfennig et al. (2014).

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Topographic shielding factor (TanDEM-X data)</b>	<b>Topographic shielding factor (TanDEM-X data and height field)</b>	<b>Field data-based topographic shielding factor</b>
STEI-12-23	46.716180	8.429570	0.965590	0.965997	0.965998	0.966448	0.968
STEI-23	46.730850	8.429800	0.954912	0.955365	0.947140	0.947867	0.954
STEI-12-13	46.715050	8.430600	0.955158	0.955555	0.954560	0.955041	0.957
STEI-26	46.730690	8.429320	0.956856	0.957928	0.948430	0.950307	0.951
STEI-12-05	46.714070	8.430920	0.929461	0.934256	0.928284	0.933067	0.928
STEI-12-14	46.715320	8.430420	0.957729	0.958054	0.959736	0.960014	0.960
STEI-18	46.721120	8.429680	0.961246	0.964358	0.969709	0.970670	0.960
STEI-15	46.718480	8.430050	0.960669	0.960713	0.960487	0.960536	0.960
STEI-12-21	46.716050	8.430050	0.963348	0.963601	0.964499	0.964777	0.967
STEI-12-11	46.714750	8.430900	0.950062	0.950782	0.949357	0.950181	0.944
STEI-12-07	46.714450	8.431020	0.941125	0.942397	0.939790	0.941093	0.935
STEI-12-04	46.714100	8.431370	0.917353	0.920861	0.923861	0.926657	0.929
STEI-17	46.719480	8.430420	0.974428	0.976691	0.975926	0.976702	0.976
STEI-12-20	46.715750	8.430267	0.961294	0.961559	0.961933	0.962239	0.965

<b>Boulder</b>	<b>Latitude (° N WGS 1984)</b>	<b>Longitude (° E WGS 1984)</b>	<b>Topographic shielding factor (SRTM data)</b>	<b>Topographic shielding factor (SRTM data and height field)</b>	<b>Topographic shielding factor (TanDEM-X data)</b>	<b>Topographic shielding factor (TanDEM-X data and height field)</b>	<b>Field data-based topographic shielding factor</b>
STEI-16	46.718300	8.431050	0.965189	0.966303	0.960368	0.961780	0.966
STEI-7	46.723260	8.432680	0.962523	0.962754	0.955883	0.956185	0.934

**Table S79.** Topographic shielding factors for boulders in the forefield of Steingletscher determined with three resampled versions of the swissALTI<sup>3D</sup> DEM. Field data-based shielding factors are shown for comparison. Field data-based shielding factors from Schimmelpennig et al. (2014).

<b>Boulder</b>	<b>Shielding factor (30 m-DEM)</b>	<b>Shielding factor (12 m-DEM)</b>	<b>Shielding factor (1 m-DEM)</b>	<b>Field data-based shielding factor</b>
STEI-12-23	0.964309	0.963683	0.963492	0.968
STEI-23	0.946343	0.944919	0.943952	0.954
STEI-12-13	0.952931	0.952774	0.952111	0.957
STEI-26	0.952133	0.950503	0.950319	0.951
STEI-12-05	0.930316	0.928804	0.927522	0.928
STEI-12-14	0.957414	0.956699	0.956360	0.960
STEI-18	0.972317	0.971217	0.971306	0.960
STEI-15	0.960227	0.959891	0.959845	0.960
STEI-12-21	0.962648	0.962169	0.961940	0.967
STEI-12-11	0.946802	0.946761	0.946386	0.944
STEI-12-07	0.938764	0.937113	0.936028	0.935
STEI-12-04	0.924334	0.922219	0.920521	0.929
STEI-17	0.976911	0.976641	0.976567	0.976
STEI-12-20	0.960414	0.959685	0.959364	0.965
STEI-16	0.965303	0.962199	0.962428	0.966

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