

Supplementary Information: Sensitivity of Andean Glaciers to ice-flow parameters in the Parallel Ice Sheet Model

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Notes:

Components (used in Tables S1 – 5).

E = Ice rheology enhancement factors

S = Sliding component

T = Till component

Till parameters (used in Tables S6 – 10)

C = Till water decay rate

W_{till}^{max} = Maximum till water thickness

ϕ = Till friction angle

Slide parameters (used in Tables S11 – 15)

q = Sliding exponent

$u_{threshold}$ = Velocity threshold

Initial sensitivity model runs

Table S3: Initial sensitivity analysis outputs detailing the default model run area and volume, and the maximum absolute percentage changes for area and volume for each region across all the model runs when components were varied between their maximum and minimum values.

Domain	Area (km ²)				Volume (km ³)			
	Default	Max	Min	Max abs change (%)	Default	Max	Min	Max abs change (%)
Santa	242.9	250.6	236.3	3.2	10.1	35.2	8.8	247.2
Vilcanota	71.3	71.9	67.7	5.0	3.1	5.1	2.5	64.1
Kaka & Boopi	49.1	50.3	45.3	7.6	2.2	3.8	1.6	71.8
Copiapó	28.5	29.3	26.3	7.6	1.1	1.9	0.6	68.5
Mendoza, Maipo & Rapel	442.9	449.0	419.6	5.3	17.6	34.4	12.1	95.2

Table S1: Initial sensitivity test of the Santa domain (1)

E	S	T	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	10.13	0	0.0	242.9	0.00	0.0
min	default	default	10.33	0.2	2.0	243.6	0.69	0.3
max	default	default	10.02	-0.11	1.1	244.9	2.07	0.9
default	min	default	10.95	0.82	8.1	244.0	1.16	0.5
default	max	default	8.93	-1.2	11.8	239.3	-3.59	-1.5
default	default	min	8.95	-1.18	11.6	237.4	-5.47	-2.3
default	default	max	12.52	2.39	23.6	244.7	1.80	0.7
min	min	min	9.26	-0.87	8.6	240.2	-2.70	-1.1
max	max	max	9.40	-0.73	7.2	239.3	-3.59	-1.5
min	min	max	8.76	-1.37	13.5	236.4	-6.52	-2.7
min	max	min	35.17	25.04	247.2	242.6	-0.24	-0.1
max	min	min	9.36	-0.77	7.6	241.9	-0.94	-0.4
max	max	min	14.41	4.28	42.3	238.5	-4.41	-1.8
max	min	max	8.90	-1.23	12.1	240.9	-1.96	-0.8
min	max	max	9.46	-0.67	6.6	238.8	-4.04	-1.7
default	min	min	9.28	-0.85	8.4	240.3	-2.57	-1.1
min	default	min	11.59	1.46	14.4	245.3	2.47	1.0
min	min	default	9.15	-0.98	9.7	236.3	-6.56	-2.7
default	max	max	9.51	-0.62	6.1	241.0	-1.88	-0.8
max	default	max	9.20	-0.93	9.2	240.1	-2.81	-1.2
max	max	default	15.29	5.16	50.9	248.7	5.79	2.4
default	max	min	32.55	22.42	221.3	242.6	-0.32	-0.1
default	min	max	8.88	-1.25	12.3	238.0	-4.92	-2.0
min	default	max	9.13	-1	9.9	236.6	-6.32	-2.6
max	default	min	11.36	1.23	12.1	245.0	2.17	0.9
max	min	default	9.26	-0.87	8.6	240.9	-2.02	-0.8
min	max	default	16.46	6.33	62.5	250.6	7.70	3.2

Table S2: Initial sensitivity test of the Vilcanota domain (2)

E	S	T	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
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default	default	default	3.09	0.00	0.0	71.3	0.00	0.0
min	default	default	3.14	0.05	1.6	71.0	-0.32	-0.4
max	default	default	3.00	-0.10	2.9	71.5	0.17	0.2
default	min	default	3.30	0.21	6.8	70.7	-0.61	-0.9
default	max	default	2.62	-0.50	15.2	68.6	-2.72	-3.8
default	default	min	2.65	-0.40	14.2	69.1	-2.22	-3.1
default	default	max	3.62	0.53	17.2	71.6	0.26	0.4
min	min	min	2.73	-0.40	11.7	69.2	-2.15	-3.0
max	max	max	2.73	-0.40	11.7	69.2	-2.15	-3.0
min	min	max	2.54	-0.60	17.8	67.7	-3.59	-5.0
min	max	min	5.07	1.98	64.1	70.2	-1.09	-1.5
max	min	min	2.72	-0.40	12.0	69.8	-1.55	-2.2
max	max	min	4.17	1.08	35.0	69.6	-1.69	-2.4
max	min	max	2.61	-0.50	15.5	69.2	-2.08	-2.9
min	max	max	2.72	-0.40	12.0	68.7	-2.65	-3.7
default	min	min	2.72	-0.40	12.0	69.3	-2.03	-2.8
min	default	min	3.14	0.05	1.6	71.6	0.33	0.5
min	min	default	2.67	-0.40	13.6	68.9	-2.37	-3.3
default	max	max	2.70	-0.40	12.6	69.2	-2.11	-3.0
max	default	max	2.64	-0.50	14.6	69.8	-1.49	-2.1
max	max	default	3.35	0.26	8.4	70.7	-0.58	-0.8
default	max	min	4.62	1.53	49.5	69.8	-1.50	-2.1
default	min	max	2.56	-0.50	17.2	68.2	-3.13	-4.4
min	default	max	3.15	0.06	1.9	71.0	-0.30	-0.4
max	default	min	2.64	-0.50	14.6	68.6	-2.71	-3.8
max	min	default	2.68	-0.40	13.3	69.5	-1.82	-2.6
min	max	default	3.87	0.78	25.2	71.9	0.57	0.8

Table S3: Initial sensitivity test of the Kaka and Boopi domain (3)

E	S	T	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	2.20	0.00	0.0	49.1	0.00	0.0
min	default	default	2.24	0.04	1.8	49.3	0.25	0.5
max	default	default	2.11	-0.10	4.1	49.3	0.27	0.6
default	min	default	2.56	0.36	16.4	49.8	0.78	1.6
default	max	default	1.75	-0.50	20.5	46.4	-2.66	-5.4
default	default	min	1.80	-0.40	18.2	46.5	-2.54	-5.2
default	default	max	2.72	0.52	23.6	50.0	0.96	2.0
min	min	min	1.85	-0.40	15.9	46.8	-2.29	-4.7
max	max	max	1.81	-0.40	17.7	47.7	-1.41	-2.9
min	min	max	1.66	-0.50	24.5	45.3	-3.74	-7.6
min	max	min	3.78	1.58	71.8	49.7	0.65	1.3
max	min	min	1.84	-0.40	16.4	47.8	-1.27	-2.6
max	max	min	2.82	0.62	28.2	48.8	-0.31	-0.6
max	min	max	1.73	-0.50	21.4	47.0	-2.07	-4.2
min	max	max	1.84	-0.40	16.4	46.6	-2.44	-5.0
default	min	min	1.89	-0.30	14.1	47.1	-1.96	-4.0
min	default	min	2.71	0.51	23.2	49.8	0.73	1.5
min	min	default	1.75	-0.50	20.5	46.0	-3.09	-6.3
default	max	max	1.80	-0.40	18.2	46.9	-2.20	-4.5
max	default	max	1.76	-0.40	20.0	47.3	-1.78	-3.6
max	max	default	2.33	0.13	5.9	49.2	0.15	0.3
default	max	min	3.31	1.11	50.5	49.3	0.28	0.6
default	min	max	1.64	-0.60	25.5	45.7	-3.35	-6.8

min	default	max	1.74	-0.50	20.9	45.7	-3.33	-6.8
max	default	min	2.31	0.11	5.0	49.3	0.26	0.5
max	min	default	1.77	-0.40	19.5	47.3	-1.78	-3.6
min	max	default	3.04	0.84	38.2	50.3	1.21	2.5

Table S4: Initial sensitivity test of the Copiapó domain (4)

E	S	T	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	1.11	0.00	0.0	28.5	0.00	0.0
min	default	default	1.17	0.06	5.4	28.3	-0.24	-0.8
max	default	default	1.00	-0.10	9.9	29.2	0.69	2.4
default	min	default	1.57	0.46	41.4	28.3	-0.18	-0.6
default	max	default	0.63	-0.50	43.2	26.4	-2.08	-7.3
default	default	min	0.66	-0.50	40.5	26.8	-1.68	-5.9
default	default	max	1.37	0.26	23.4	28.9	0.38	1.3
min	min	min	0.76	-0.40	31.5	27.7	-0.79	-2.8
max	max	max	0.65	-0.50	41.4	26.8	-1.75	-6.1
min	min	max	0.60	-0.50	45.9	26.3	-2.23	-7.8
min	max	min	1.87	0.76	68.5	26.6	-1.87	-6.6
max	min	min	0.76	-0.40	31.5	28.2	-0.34	-1.2
max	max	min	1.36	0.25	22.5	28.8	0.31	1.1
max	min	max	0.60	-0.50	45.9	26.3	-2.23	-7.8
min	max	max	0.65	-0.50	41.4	26.6	-1.88	-6.6
default	min	min	0.76	-0.40	31.5	28.0	-0.50	-1.8
min	default	min	1.75	0.64	57.7	27.4	-1.12	-3.9
min	min	default	0.66	-0.50	40.5	26.8	-1.70	-6.0
default	max	max	0.65	-0.50	41.4	26.7	-1.84	-6.5
max	default	max	0.63	-0.50	43.2	26.5	-2.05	-7.2
max	max	default	1.15	0.04	3.6	29.5	0.99	3.5
default	max	min	1.67	0.56	50.5	27.7	-0.83	-2.9
default	min	max	0.60	-0.50	45.9	26.3	-2.25	-7.9
min	default	max	0.63	-0.50	43.2	26.4	-2.14	-7.5
max	default	min	1.28	0.17	15.3	29.1	0.60	2.1
max	min	default	0.66	-0.50	40.5	27.0	-1.52	-5.3
min	max	default	1.48	0.37	33.3	28.5	-0.04	-0.1

Table S5: Initial sensitivity test of the Mendoza, Maipo, and Rapel domain (5)

E	S	T	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	17.64	0	0.0	442.9	0.00	0.0
min	default	default	18.46	0.82	4.6	443.2	0.30	0.1
max	default	default	16.81	-0.83	4.7	443.3	0.33	0.1
default	min	default	22.82	5.18	29.4	445.2	2.24	0.5
default	max	default	12.58	-5.06	28.7	426.0	-16.91	-3.8
default	default	min	12.80	-4.84	27.4	424.0	-18.99	-4.3
default	default	max	21.80	4.16	23.6	446.6	3.69	0.8
min	min	min	13.56	-4.08	23.1	430.8	-12.14	-2.7
max	max	max	13.20	-4.44	25.2	430.1	-12.89	-2.9
min	min	max	12.20	-5.44	30.8	420.0	-22.95	-5.2
min	max	min	34.43	16.79	95.2	444.6	1.63	0.4

max	min	min	13.58	-4.06	23.0	434.0	-8.97	-2.0
max	max	min	26.62	8.98	50.9	438.8	-4.12	-0.9
max	min	max	12.29	-5.35	30.3	422.9	-20.00	-4.5
min	max	max	13.15	-4.49	25.5	427.0	-15.98	-3.6
default	min	min	13.15	-4.49	25.5	427.9	-15.07	-3.4
min	default	min	24.77	7.13	40.4	446.6	3.68	0.8
min	min	default	12.80	-4.84	27.4	425.4	-17.55	-4.0
default	max	max	13.06	-4.58	26.0	429.4	-13.56	-3.1
max	default	max	12.80	-4.84	27.4	428.1	-14.86	-3.4
max	max	default	19.53	1.89	10.7	444.6	1.61	0.4
default	max	min	30.79	13.15	74.5	443.2	0.24	0.1
default	min	max	12.09	-5.55	31.5	419.6	-23.36	-5.3
min	default	max	12.78	-4.86	27.6	424.4	-18.51	-4.2
max	default	min	20.25	2.61	14.8	439.9	-3.05	-0.7
max	min	default	12.99	-4.65	26.4	428.3	-14.63	-3.3
min	max	default	23.77	6.13	34.8	449.0	6.09	1.4

Till sensitivity model runs

Table S6: Till sensitivity test of the Santa domain (1)

C	W_{till}^{max}	ϕ	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	10.13	0.00	0.0	242.87	0.00	0.0
min	default	default	9.99	-0.14	1.4	242.73	-0.14	-0.1
max	default	default	11.00	0.87	8.6	243.45	0.58	0.2
default	min	default	10.06	-0.07	0.7	243.44	0.57	0.2
default	max	default	10.48	0.35	3.5	243.91	1.04	0.4
default	default	min	8.95	-1.18	11.6	238.69	-4.18	-1.7
default	default	max	10.76	0.63	6.2	244.53	1.66	0.7
min	min	min	8.95	-1.18	11.6	237.40	-5.47	-2.3
max	max	max	12.52	2.39	23.6	244.67	1.80	0.7
min	min	max	10.53	0.40	3.9	244.72	1.85	0.8
min	max	min	9.01	-1.12	11.1	239.26	-3.61	-1.5
max	min	min	9.09	-1.04	10.3	239.09	-3.78	-1.6
max	max	min	9.11	-1.02	10.1	238.10	-4.77	-2.0
max	min	max	12.26	2.13	21.0	244.73	1.86	0.8
min	max	max	11.22	1.09	10.8	245.41	2.54	1.0
default	min	min	9.02	-1.11	11.0	238.55	-4.32	-1.8
min	default	min	8.95	-1.18	11.6	238.69	-4.18	-1.7
min	min	default	9.95	-0.18	1.8	242.34	-0.53	-0.2
default	max	max	11.47	1.34	13.2	244.82	1.95	0.8
max	default	max	12.35	2.22	21.9	244.31	1.44	0.6
max	max	default	11.09	0.96	9.5	243.84	0.97	0.4
default	max	min	8.98	-1.15	11.4	240.03	-2.84	-1.2
default	min	max	10.65	0.52	5.1	244.93	2.06	0.8
min	default	max	10.62	0.49	4.8	244.93	2.06	0.8
max	default	min	9.06	-1.07	10.6	238.44	-4.43	-1.8
max	min	default	10.93	0.80	7.9	243.35	0.48	0.2
min	max	default	10.13	0.00	0.0	242.87	0.00	0.0

Table S7: Till sensitivity test of the Vilcanota domain (2)

C	W_{till}^{max}	ϕ	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	3.09	0.00	0.0	71.31	0.00	0.0
min	default	default	3.05	-0.04	1.3	71.45	0.14	0.2
max	default	default	3.27	0.18	5.8	71.45	0.14	0.2
default	min	default	3.06	-0.03	1.0	71.26	-0.05	-0.1
default	max	default	3.18	0.09	2.9	71.42	0.11	0.2
default	default	min	2.64	-0.45	14.6	69.21	-2.10	-2.9
default	default	max	3.24	0.15	4.9	71.39	0.08	0.1
min	min	min	2.65	-0.44	14.2	69.09	-2.22	-3.1
max	max	max	3.62	0.53	17.2	71.57	0.26	0.4
min	min	max	3.17	0.08	2.6	71.32	0.01	0.0
min	max	min	2.66	-0.43	13.9	68.66	-2.65	-3.7
max	min	min	2.67	-0.42	13.6	68.79	-2.52	-3.5
max	max	min	2.68	-0.41	13.3	68.37	-2.94	-4.1
max	min	max	3.60	0.51	16.5	71.49	0.18	0.3
min	max	max	3.40	0.31	10.0	71.75	0.44	0.6
default	min	min	2.63	-0.46	14.9	69.32	-1.99	-2.8
min	default	min	2.64	-0.45	14.6	69.21	-2.10	-2.9
min	min	default	3.04	-0.05	1.6	71.22	-0.09	-0.1
default	max	max	3.46	0.37	12.0	72.18	0.87	1.2
max	default	max	3.59	0.50	16.2	71.48	0.17	0.2
max	max	default	3.26	0.17	5.5	71.37	0.06	0.1
default	max	min	2.70	-0.39	12.6	68.97	-2.34	-3.3
default	min	max	3.21	0.12	3.9	71.44	0.13	0.2
min	default	max	3.19	0.10	3.2	71.99	0.68	1.0
max	default	min	2.68	-0.41	13.3	68.37	-2.94	-4.1
max	min	default	3.25	0.16	5.2	71.47	0.16	0.2
min	max	default	3.09	0.00	0.0	71.31	0.00	0.0

Table S8: Till sensitivity test of the Kaka and Boopi domain (3)

C	W_{till}^{max}	ϕ	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	2.20	0.0	0.0	49.1	0.00	0.0
min	default	default	2.18	0.0	0.9	49.3	0.22	0.4
max	default	default	2.38	0.2	8.2	49.3	0.19	0.4
default	min	default	2.19	0.0	0.5	49.3	0.27	0.6
default	max	default	2.37	0.2	7.7	49.6	0.52	1.1
default	default	min	1.78	-0.4	19.1	46.9	-2.16	-4.4
default	default	max	2.44	0.2	10.9	49.9	0.82	1.7
min	min	min	1.80	-0.4	18.2	46.5	-2.54	-5.2
max	max	max	2.72	0.5	23.6	50.0	0.96	2.0
min	min	max	2.34	0.1	6.4	49.6	0.56	1.1
min	max	min	1.79	-0.4	18.6	46.2	-2.82	-5.7
max	min	min	1.77	-0.4	19.5	46.6	-2.45	-5.0
max	max	min	1.76	-0.4	20.0	46.3	-2.76	-5.6
max	min	max	2.71	0.5	23.2	50.1	0.99	2.0
min	max	max	2.68	0.5	21.8	50.2	1.14	2.3
default	min	min	1.77	-0.4	19.5	47.1	-1.95	-4.0
min	default	min	1.78	-0.4	19.1	46.9	-2.16	-4.4

min	min	default	2.17	0.0	1.4	49.2	0.10	0.2
default	max	max	2.72	0.5	23.6	50.2	1.18	2.4
max	default	max	2.72	0.5	23.6	50.1	1.00	2.0
max	max	default	2.38	0.2	8.2	49.3	0.24	0.5
default	max	min	1.76	-0.4	20.0	46.4	-2.71	-5.5
default	min	max	2.39	0.2	8.6	46.6	-2.43	-5.0
min	default	max	2.36	0.2	7.3	49.7	0.63	1.3
max	default	min	1.80	-0.4	18.2	46.7	-2.36	-4.8
max	min	default	2.39	0.2	8.6	49.4	0.32	0.7
min	max	default	2.20	0.0	0.0	49.1	0.00	0.0

Table S9: Till sensitivity test of the Copiapó domain (4)

C	W_{till}^{max}	ϕ	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	1.11	0.00	0.0	28.50	0.00	0.0
min	default	default	1.11	0.00	0.0	28.50	0.00	0.0
max	default	default	1.11	0.00	0.0	28.50	0.00	0.0
default	min	default	1.11	0.00	0.0	28.50	0.00	0.0
default	max	default	1.11	0.00	0.0	28.50	0.00	0.0
default	default	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
default	default	max	1.37	0.26	23.4	28.89	0.39	1.4
min	min	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
max	max	max	1.37	0.26	23.4	28.89	0.39	1.4
min	min	max	1.37	0.26	23.4	28.89	0.39	1.4
min	max	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
max	min	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
max	max	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
max	min	max	1.37	0.26	23.4	28.89	0.39	1.4
min	max	max	1.37	0.26	23.4	28.89	0.39	1.4
default	min	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
min	default	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
min	min	default	1.11	0.00	0.0	28.50	0.00	0.0
default	max	max	1.37	0.26	23.4	28.89	0.39	1.4
max	default	max	1.37	0.26	23.4	28.89	0.39	1.4
max	max	default	1.11	0.00	0.0	28.50	0.00	0.0
default	max	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
default	min	max	1.37	0.26	23.4	28.89	0.39	1.4
min	default	max	1.37	0.26	23.4	28.89	0.39	1.4
max	default	min	0.66	-0.45	40.5	26.84	-1.66	-5.8
max	min	default	1.11	0.00	0.0	28.50	0.00	0.0
min	max	default	1.11	0.00	0.0	28.50	0.00	0.0

Table S10: Till sensitivity test of the Mendoza, Maipo, and Rapel domain (5)

C	W_{till}^{max}	ϕ	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	default	17.64	0.00	0.0	442.94	0.00	0.0
min	default	default	17.57	-0.07	0.4	444.07	1.13	0.3
max	default	default	17.93	0.29	1.6	442.71	-0.23	-0.1
default	min	default	17.56	-0.08	0.5	442.42	-0.52	-0.1

default	max	default	18.00	0.36	2.0	443.00	0.06	0.0
default	default	min	12.81	-4.83	27.4	422.79	-20.15	-4.5
default	default	max	21.04	3.40	19.3	446.61	3.67	0.8
min	min	min	12.80	-4.84	27.4	423.95	-18.99	-4.3
max	max	max	21.80	4.16	23.6	446.63	3.69	0.8
min	min	max	20.66	3.02	17.1	446.14	3.20	0.7
min	max	min	12.84	-4.80	27.2	422.63	-20.31	-4.6
max	min	min	12.84	-4.80	27.2	423.57	-19.37	-4.4
max	max	min	12.91	-4.73	26.8	423.57	-19.37	-4.4
max	min	max	21.77	4.13	23.4	447.32	4.38	1.0
min	max	max	21.54	3.90	22.1	447.06	4.12	0.9
default	min	min	12.82	-4.82	27.3	424.52	-18.42	-4.2
min	default	min	12.81	-4.83	27.4	422.79	-20.15	-4.5
min	min	default	17.40	-0.24	1.4	442.92	-0.02	0.0
default	max	max	21.63	3.99	22.6	447.04	4.10	0.9
max	default	max	21.75	4.11	23.3	446.59	3.65	0.8
max	max	default	17.97	0.33	1.9	443.45	0.51	0.1
default	max	min	12.87	-4.77	27.0	423.10	-19.84	-4.5
default	min	max	20.93	3.29	18.7	446.39	3.45	0.8
min	default	max	20.92	3.28	18.6	446.66	3.72	0.8
max	default	min	12.86	-4.78	27.1	425.76	-17.18	-3.9
max	min	default	17.95	0.31	1.8	443.24	0.30	0.1
min	max	default	12.64	-5.00	28.3	442.94	0.00	0.0

Slide sensitivity model runs

Table S11: Slide sensitivity test of the Santa domain (1)

q	$u_{threshold}$	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	10.13	0.00	0.0	242.87	0.00	0.0
min	default	10.88	0.75	7.4	246.21	3.34	1.4
max	default	9.09	-1.04	-10.3	239.68	-3.19	-1.3
default	min	10.53	0.40	3.9	244.38	1.51	0.6
default	max	9.92	-0.21	-2.1	242.30	-0.57	-0.2
min	min	8.98	-1.15	-11.4	238.62	-4.25	-1.7
max	max	10.97	0.84	8.3	244.24	1.37	0.6
min	max	9.92	-0.21	-2.1	242.30	-0.57	-0.2
max	Min	10.53	0.40	3.9	244.38	1.51	0.6

Table S12: Slide sensitivity test of the Vilcanota domain (2)

q	$u_{threshold}$	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	3.09	0.00	0.0	0.0	71.31	0.00
min	default	3.27	0.18	5.8	5.8	71.66	0.35
max	default	2.64	-0.45	-14.6	14.6	69.64	-1.67
default	min	3.21	0.12	3.9	3.9	71.44	0.13
default	max	3.03	-0.06	-1.9	1.9	71.21	-0.10
min	min	3.29	0.20	6.5	6.5	71.01	-0.30
max	max	2.63	-0.46	-14.9	14.9	69.11	-2.20
min	max	3.25	0.16	5.2	5.2	71.48	0.17

max	Min	2.88	-0.21	-6.8	6.8	70.38	-0.93
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Table S13: Slide sensitivity test of the Kaka and Boopi domain (3)

q	$u_{threshold}$	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	2.20	0.00	0.0	0.0	49.06	0.00
min	default	2.52	0.32	14.5	14.5	49.82	0.76
max	default	1.78	-0.42	-19.1	19.1	46.69	-2.37
default	min	2.37	0.17	7.7	7.7	49.88	0.82
default	max	2.14	-0.06	-2.7	2.7	48.98	-0.08
min	min	2.56	0.36	16.4	16.4	49.83	0.77
max	max	1.73	-0.47	-21.4	21.4	45.80	-3.26
min	max	2.51	0.31	14.1	14.1	49.94	0.88
max	Min	1.98	-0.22	-10.0	10.0	48.36	-0.70

Table S14: Slide sensitivity test of the Copiapó domain (4)

q	$u_{threshold}$	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	1.11	0.00	0.0	0.0	28.51	0.00
min	default	1.55	0.44	39.6	39.6	28.36	-0.15
max	default	0.64	-0.47	-42.3	42.3	26.63	-1.88
default	min	1.30	0.19	17.1	17.1	28.78	0.27
default	max	1.03	-0.08	-7.2	7.2	28.35	-0.16
min	min	1.57	0.46	41.4	41.4	28.26	-0.25
max	max	0.62	-0.49	-44.1	44.1	26.38	-2.13
min	max	1.54	0.43	38.7	38.7	28.41	-0.10
max	Min	0.78	-0.33	-29.7	29.7	27.94	-0.57

Table S15: Slide sensitivity test of the Mendoza, Maipo, and Rapel domain (5)

q	$u_{threshold}$	Volume	Vol dif	Vol dif %	Area	Area dif	Area dif %
default	default	17.64	0.00	0.0	0.0	442.94	0.00
min	default	21.69	4.05	23.0	23.0	442.40	-0.54
max	default	12.76	-4.88	-27.7	27.7	423.45	-19.49
default	min	20.04	2.40	13.6	13.6	445.60	2.66
default	max	16.83	-0.81	-4.6	4.6	441.22	-1.72
min	min	22.48	4.84	27.4	27.4	443.19	0.25
max	max	12.34	-5.30	-30.0	30.0	418.89	-24.05
min	max	21.41	3.77	21.4	21.4	442.03	-0.91
max	Min	14.78	-2.86	-16.2	16.2	430.77	-12.17

Initial sensitivity tests ice thickness and velocities

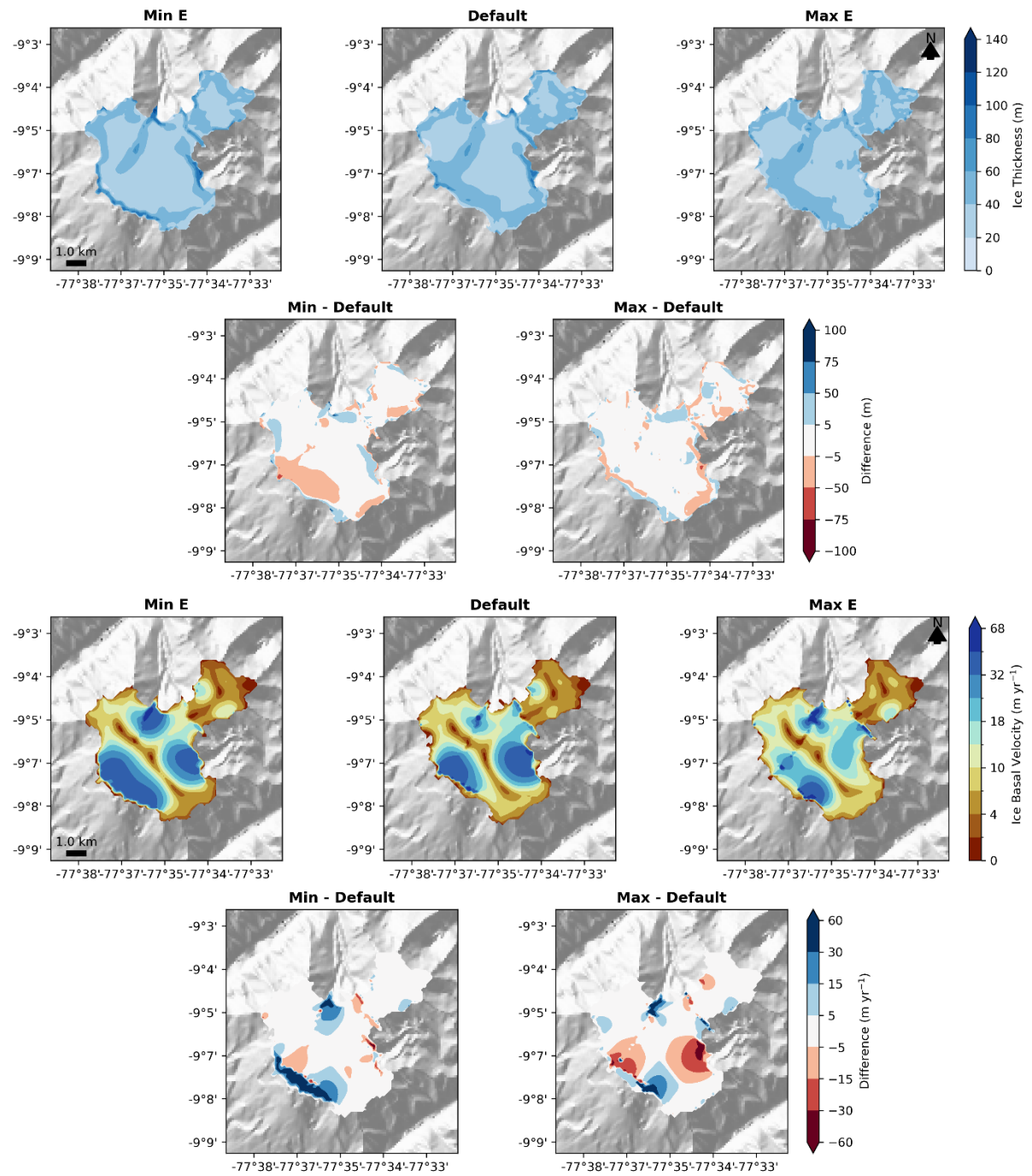


Figure S1: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

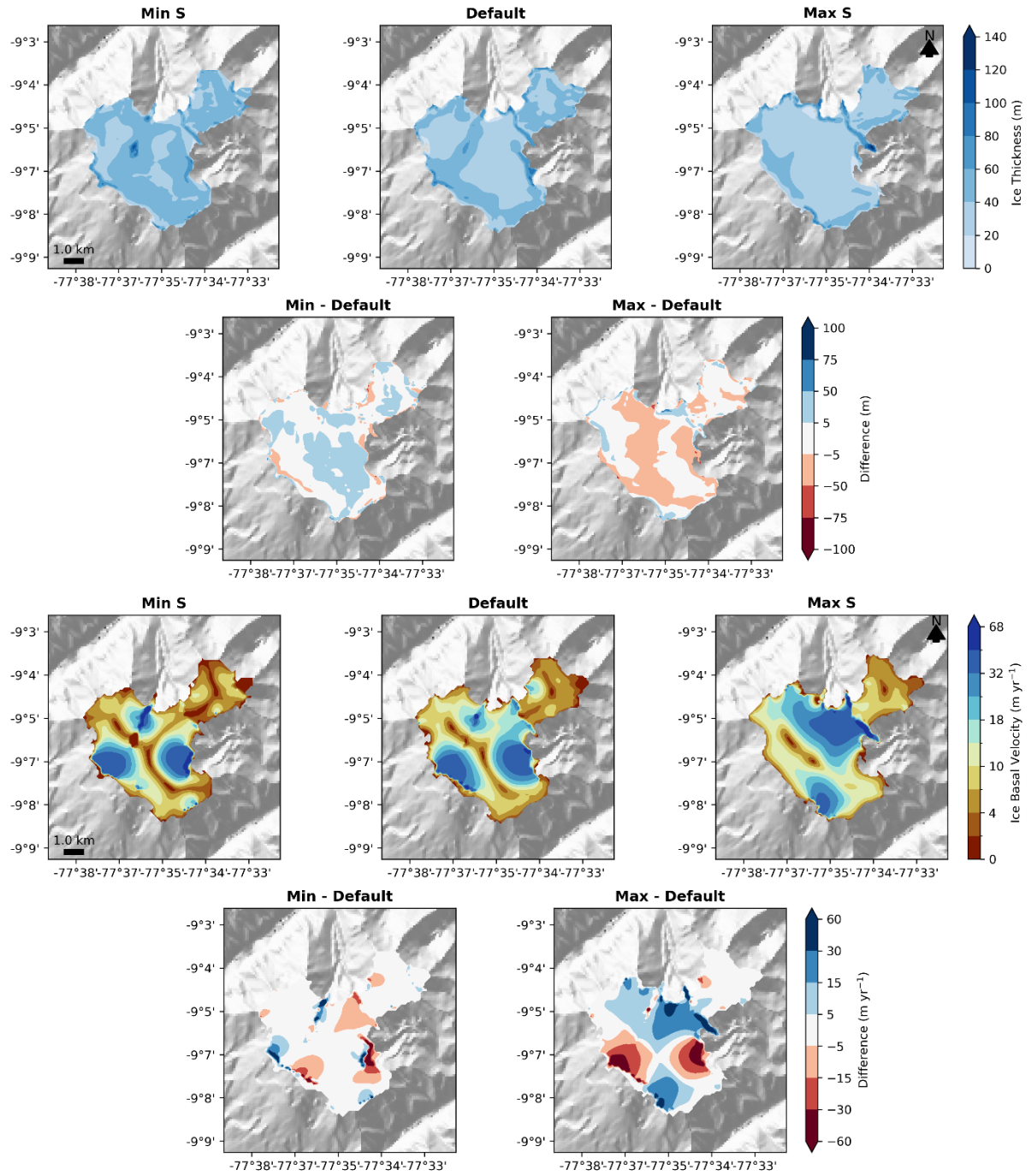


Figure S2: Thickness and velocity outputs, and subsequent difference between minimum and maximum S values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

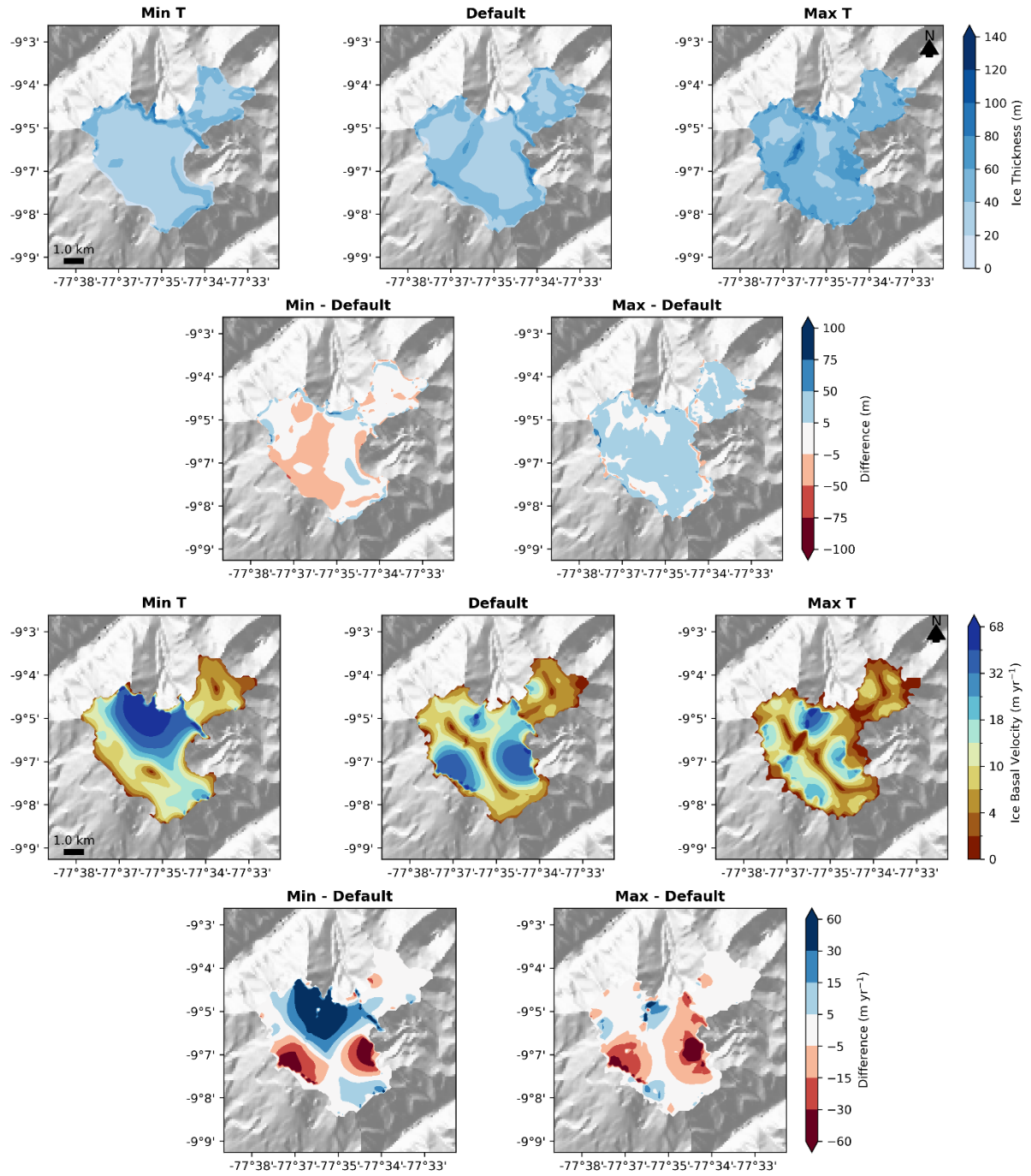


Figure S3: Thickness and velocity outputs, and subsequent difference between minimum and maximum T values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

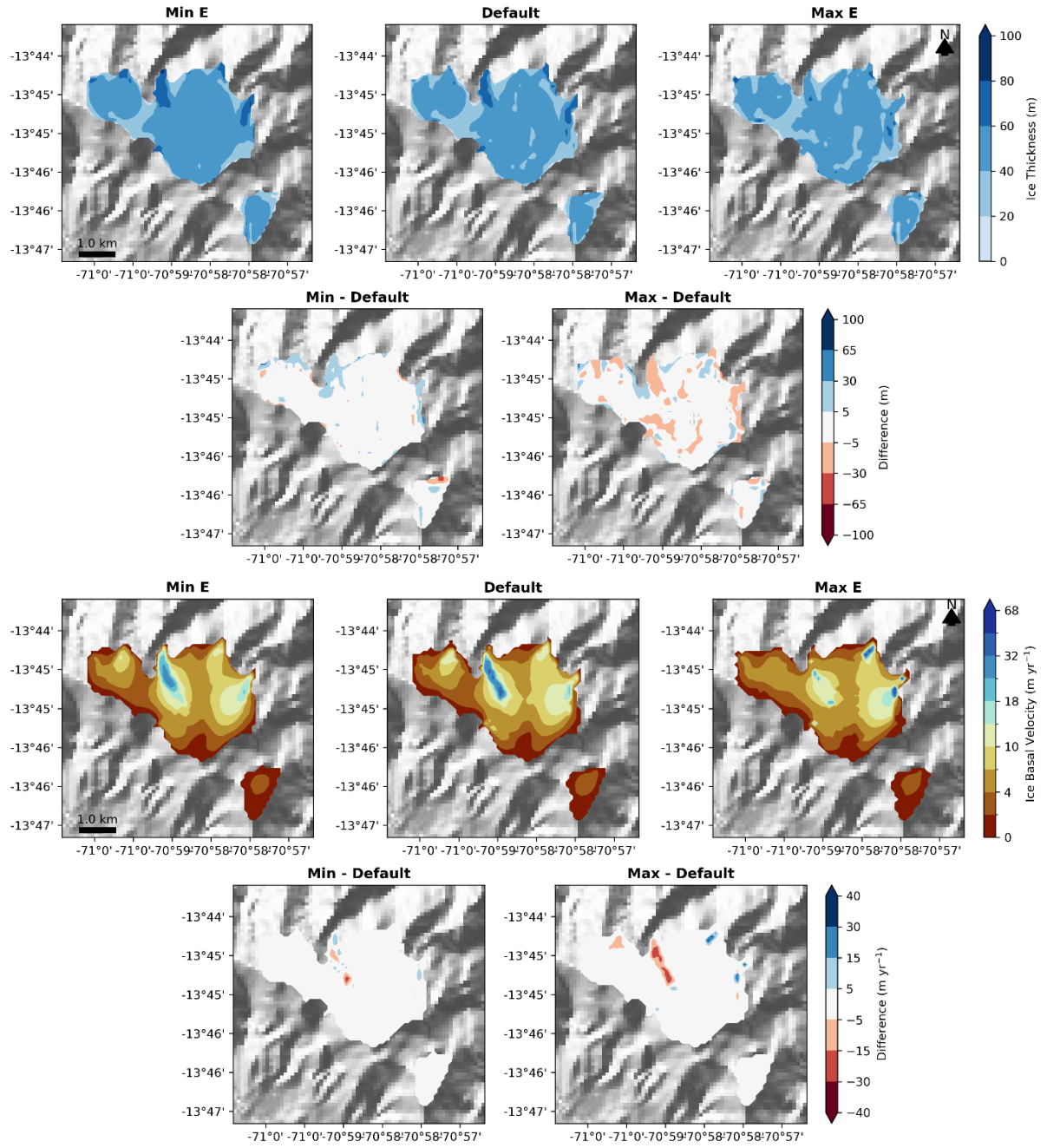


Figure S4: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

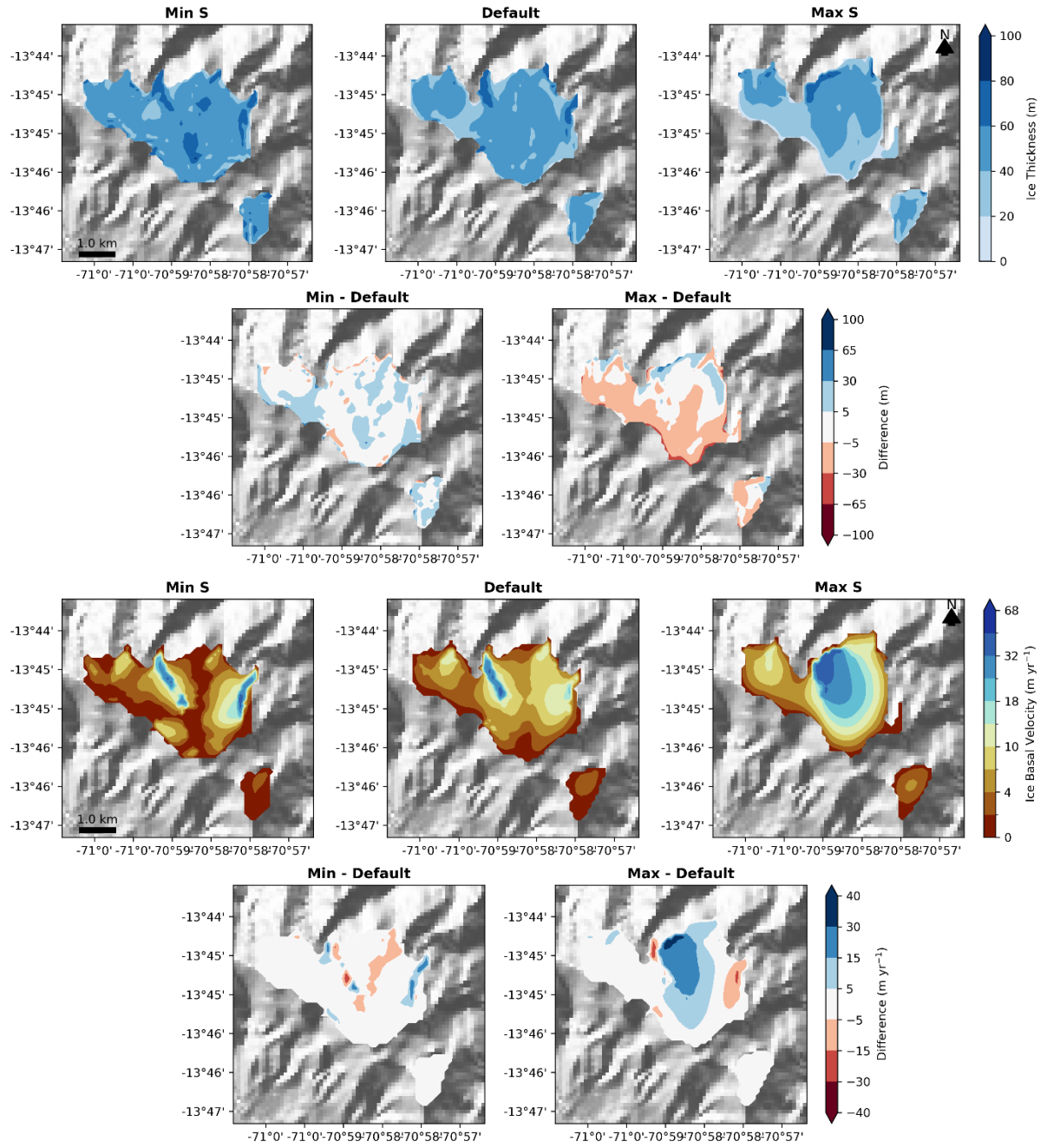


Figure S5: Thickness and velocity outputs, and subsequent difference between minimum and maximum S values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

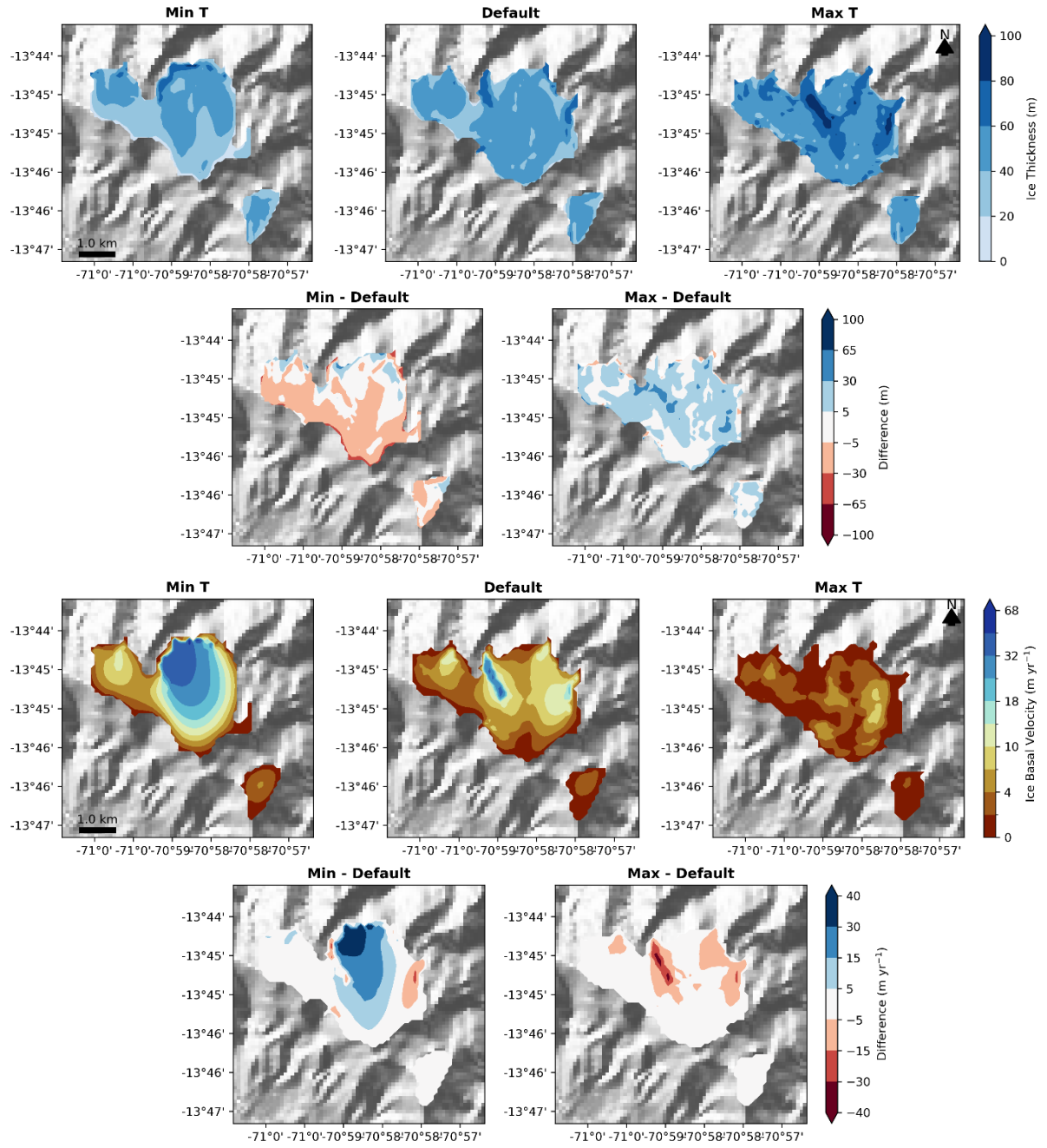


Figure S6: Thickness and velocity outputs, and subsequent difference between minimum and maximum T values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

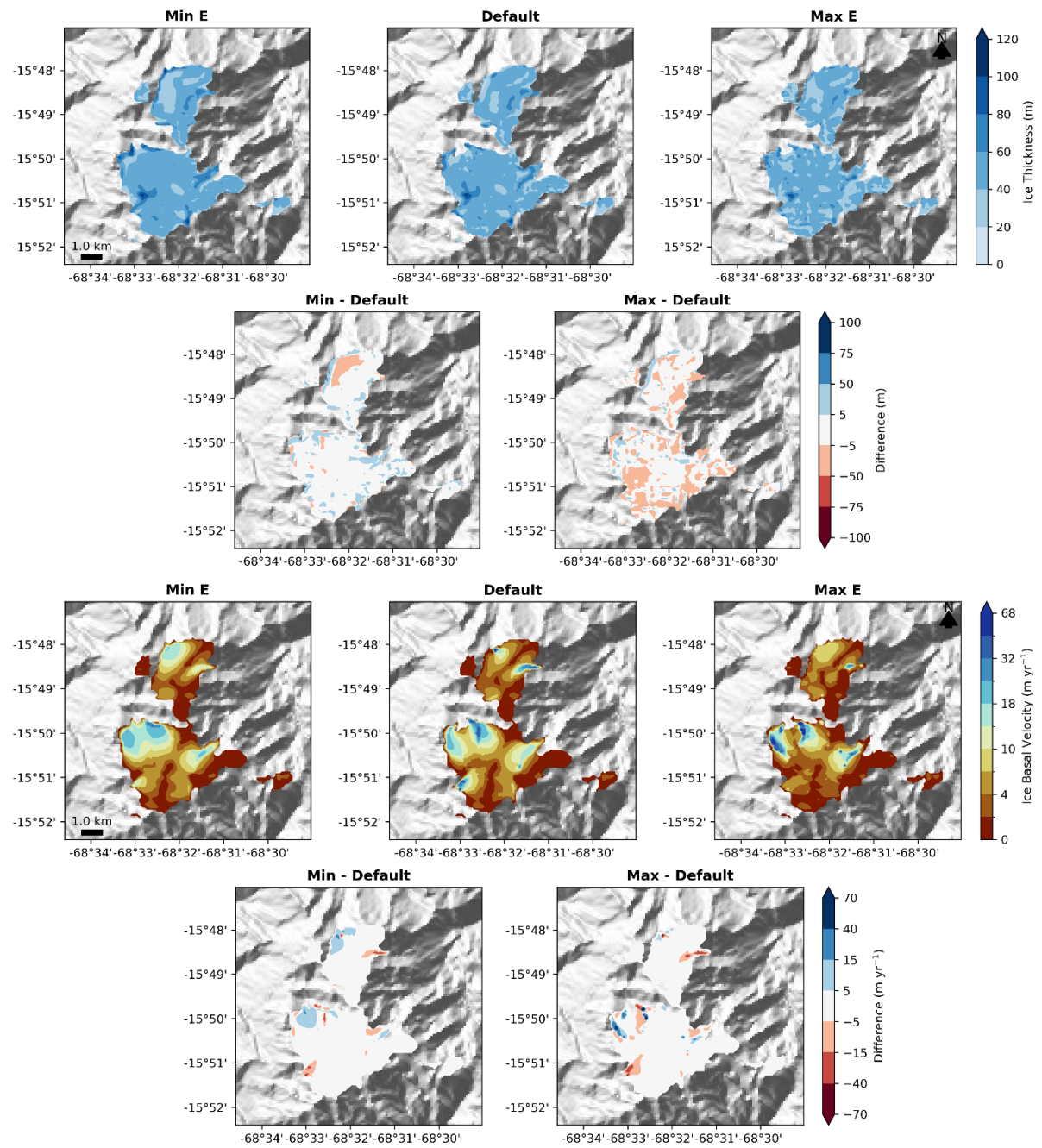


Figure S7: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Kaka & Boopi (#3) domain (Ancohumá Ice Caps).

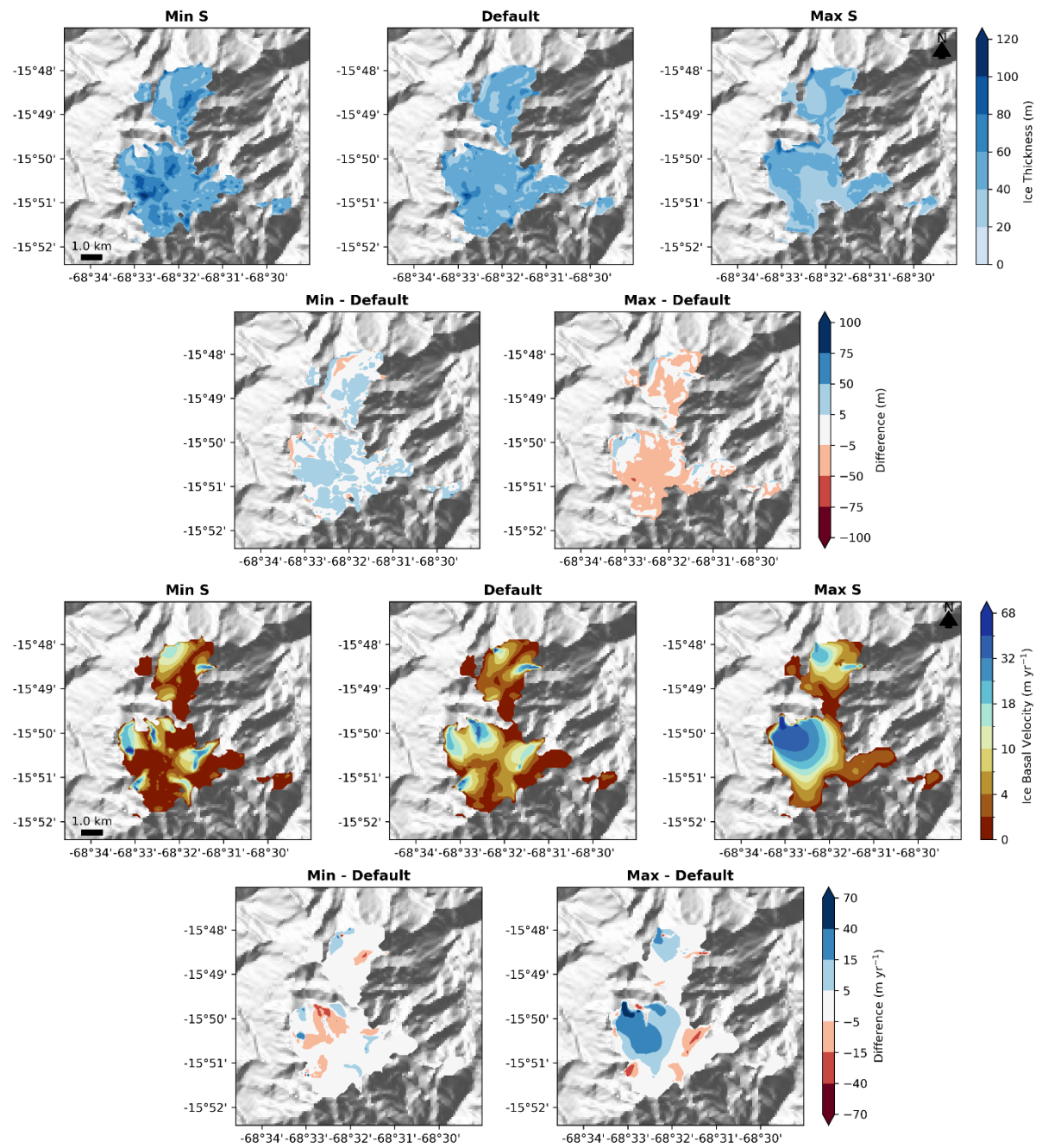


Figure S8: Thickness and velocity outputs, and subsequent difference between minimum and maximum S values with the default value within the Kaka & Boopi (#3) domain (Anchohuma Ice Caps).

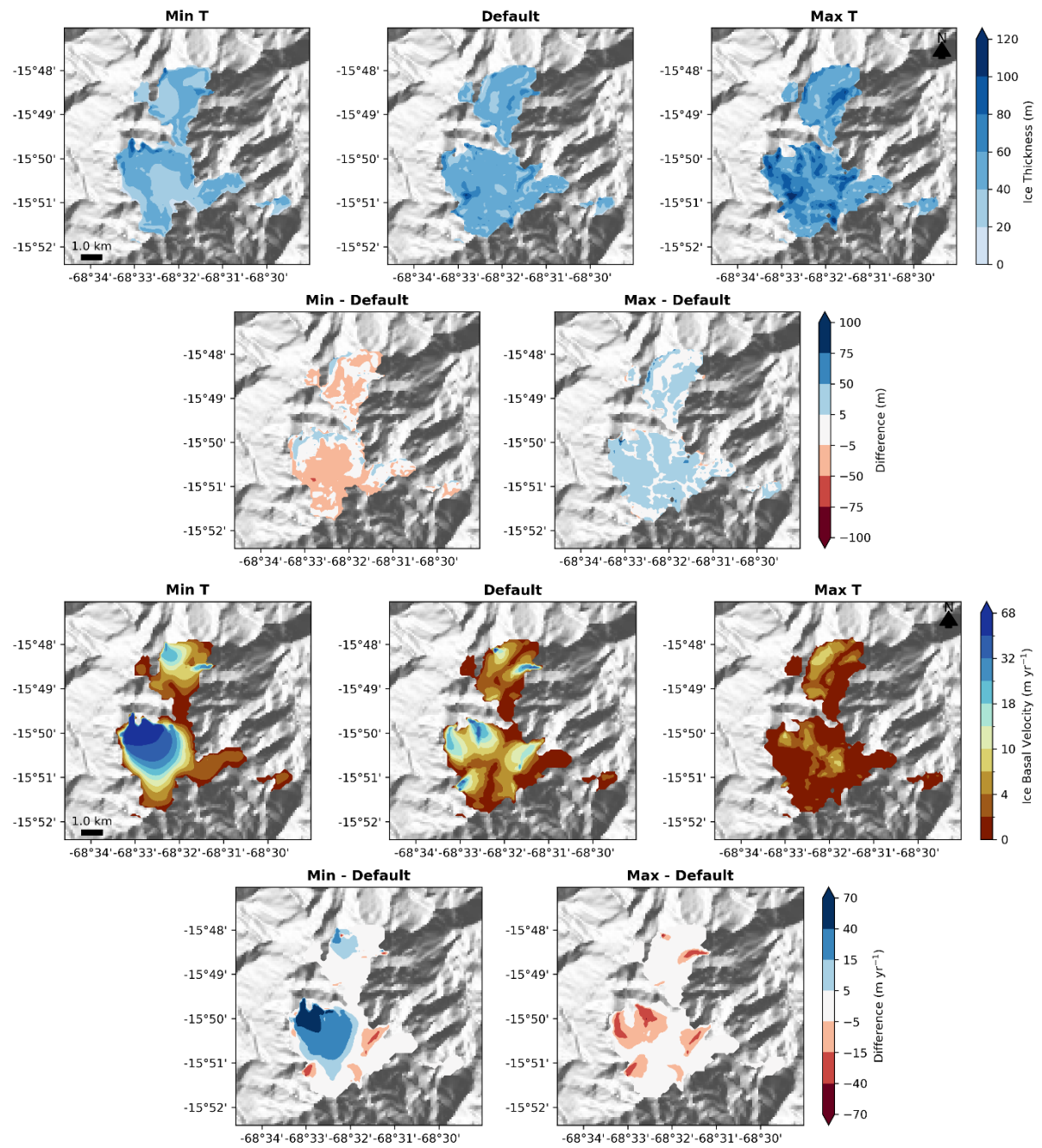


Figure S9: Thickness and velocity outputs, and subsequent difference between minimum and maximum T values with the default value within the Kaka & Boopi (#3) domain (Ancohumá Ice Caps).

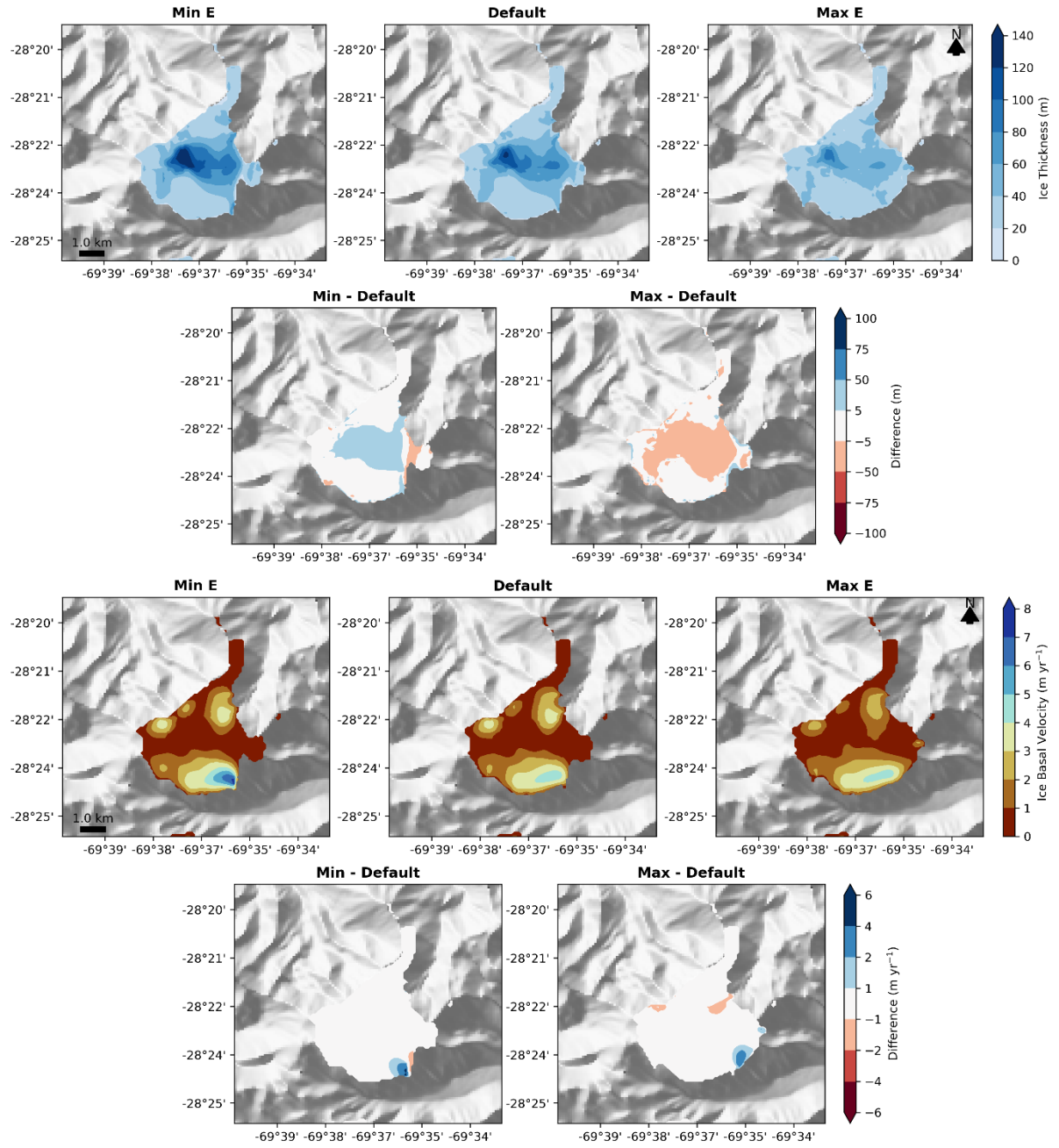


Figure S10: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

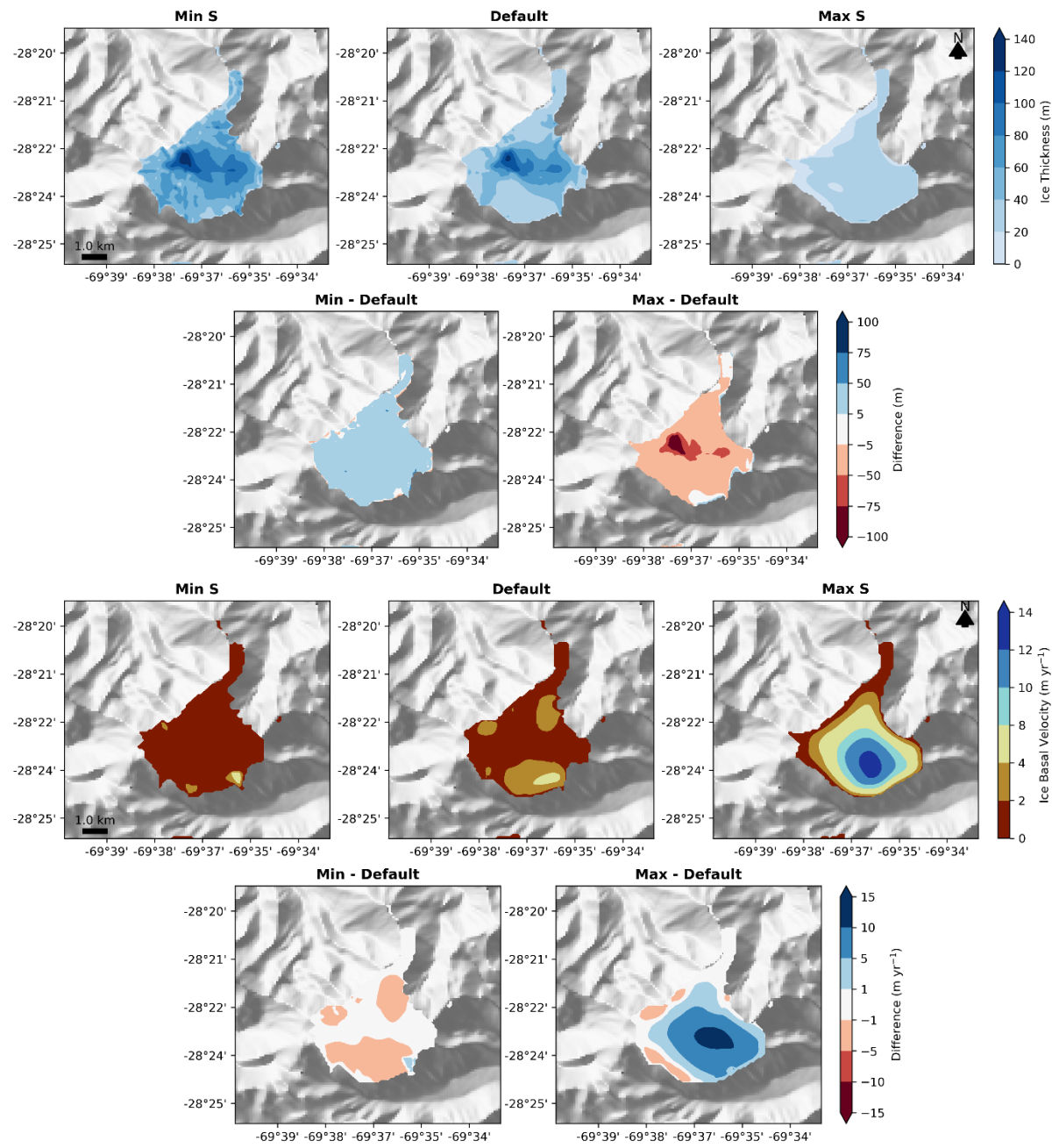


Figure S11: Thickness and velocity outputs, and subsequent difference between minimum and maximum S values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

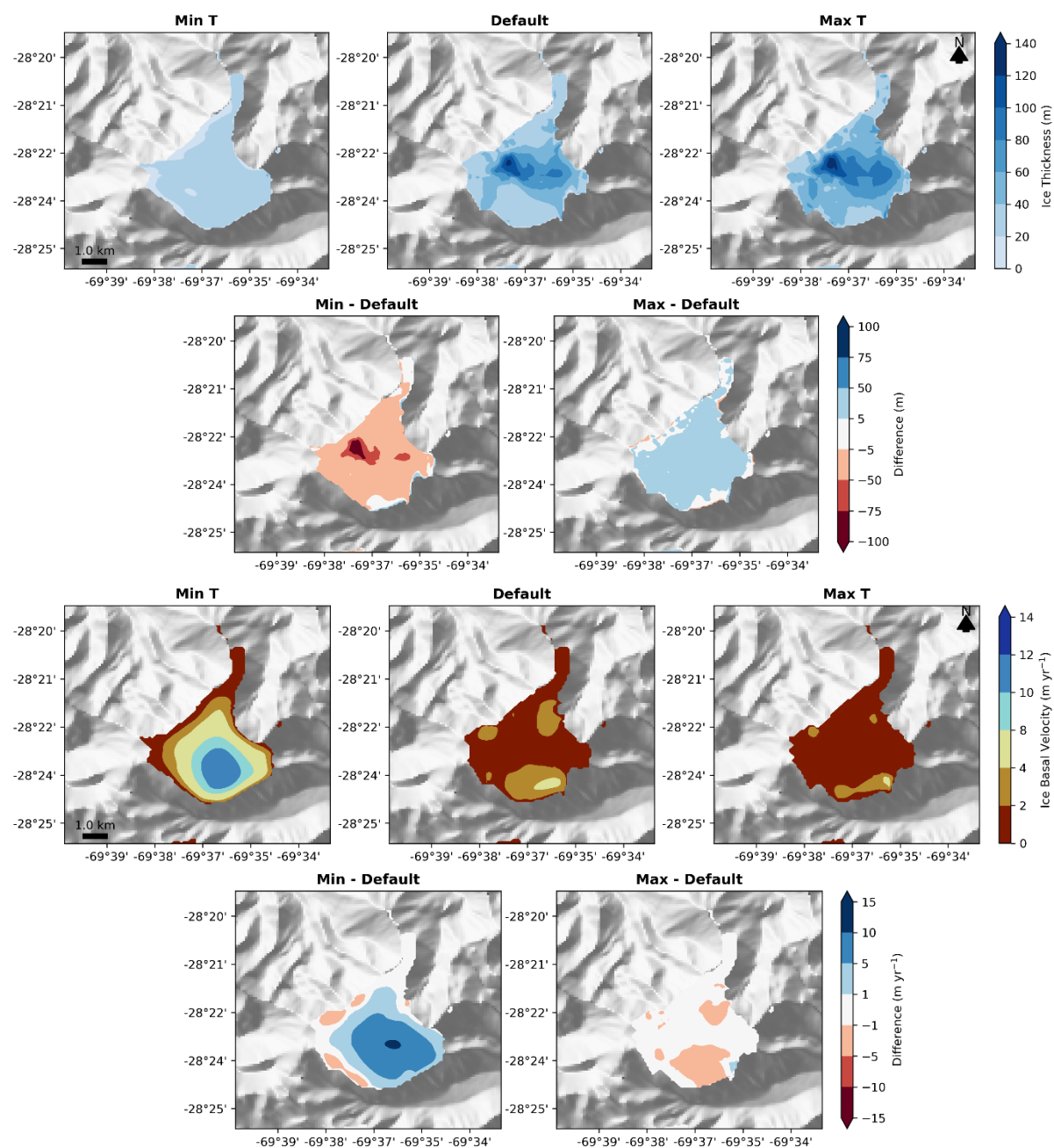


Figure S12: Thickness and velocity outputs, and subsequent difference between minimum and maximum T values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

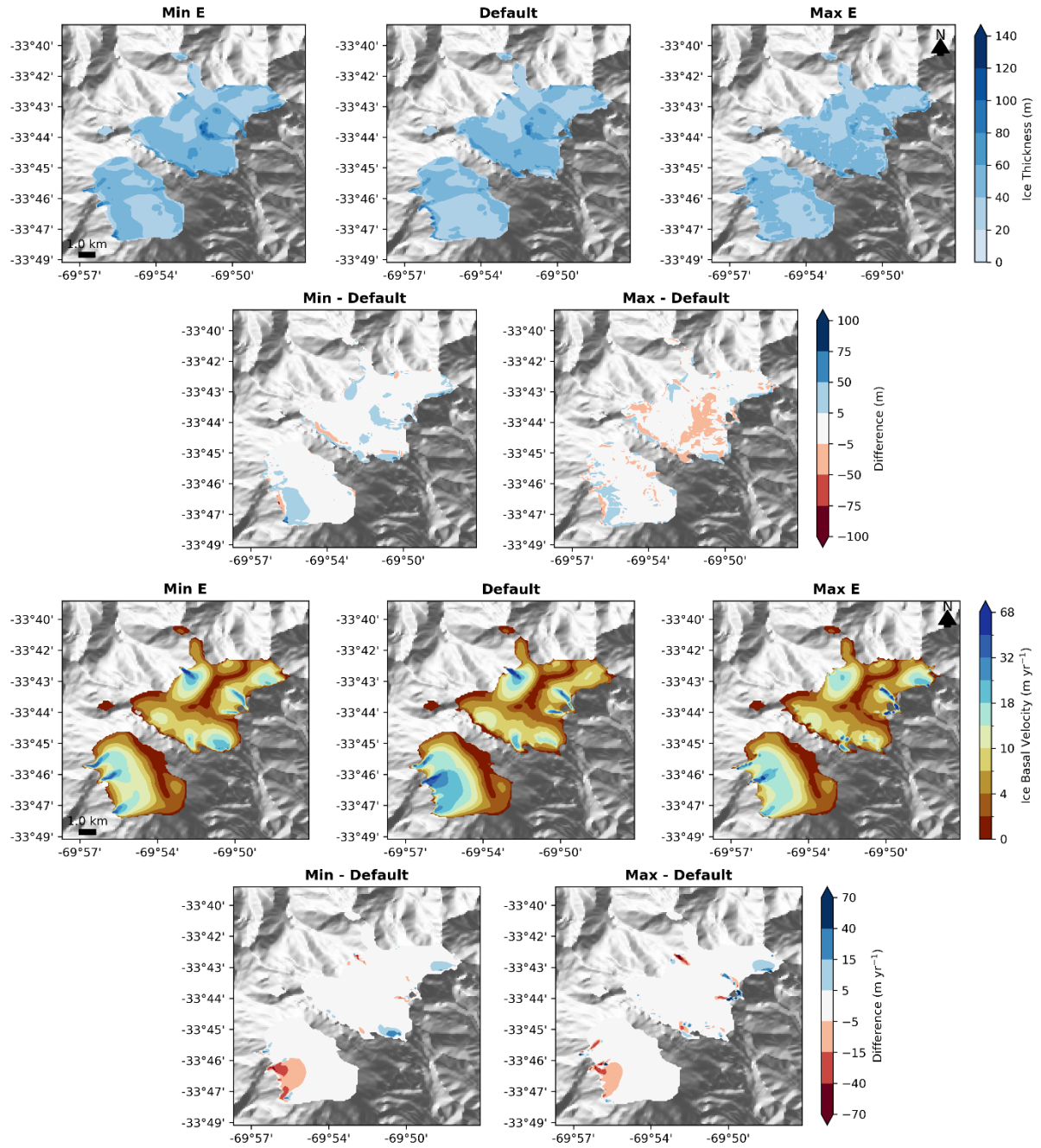


Figure S13: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

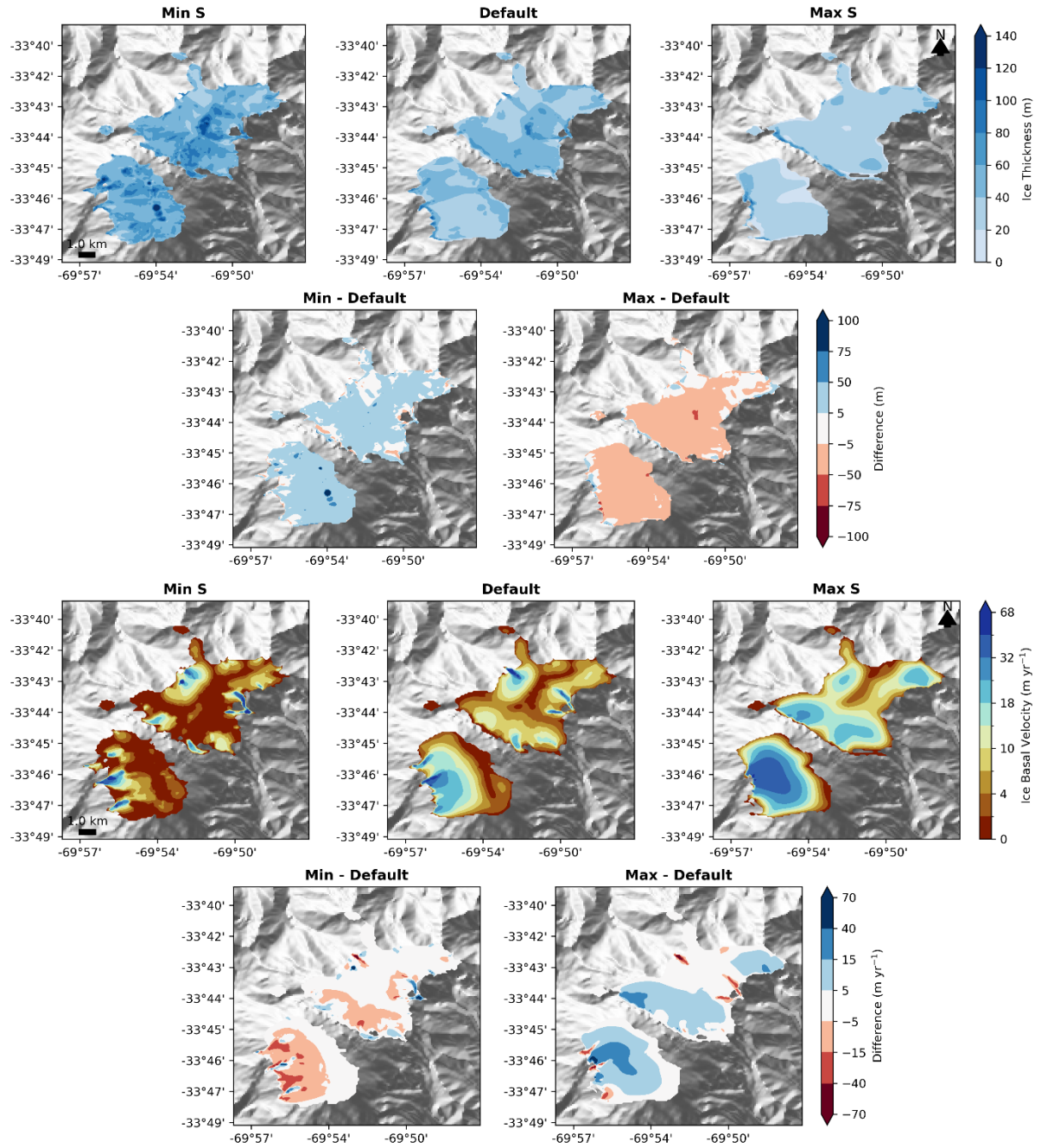


Figure S14: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

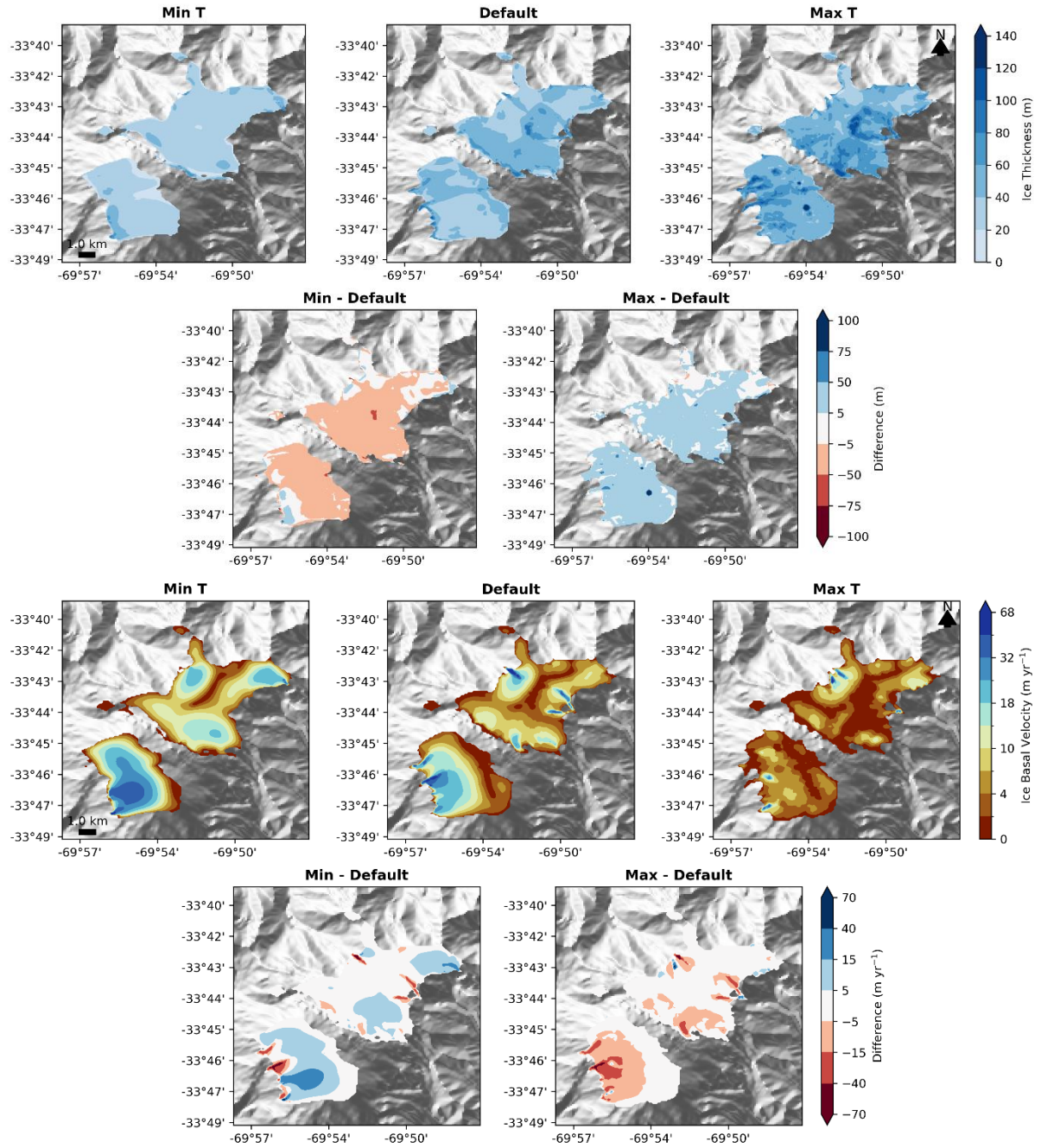


Figure S15: Thickness and velocity outputs, and subsequent difference between minimum and maximum E values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

Till sensitivity tests ice thickness and velocities

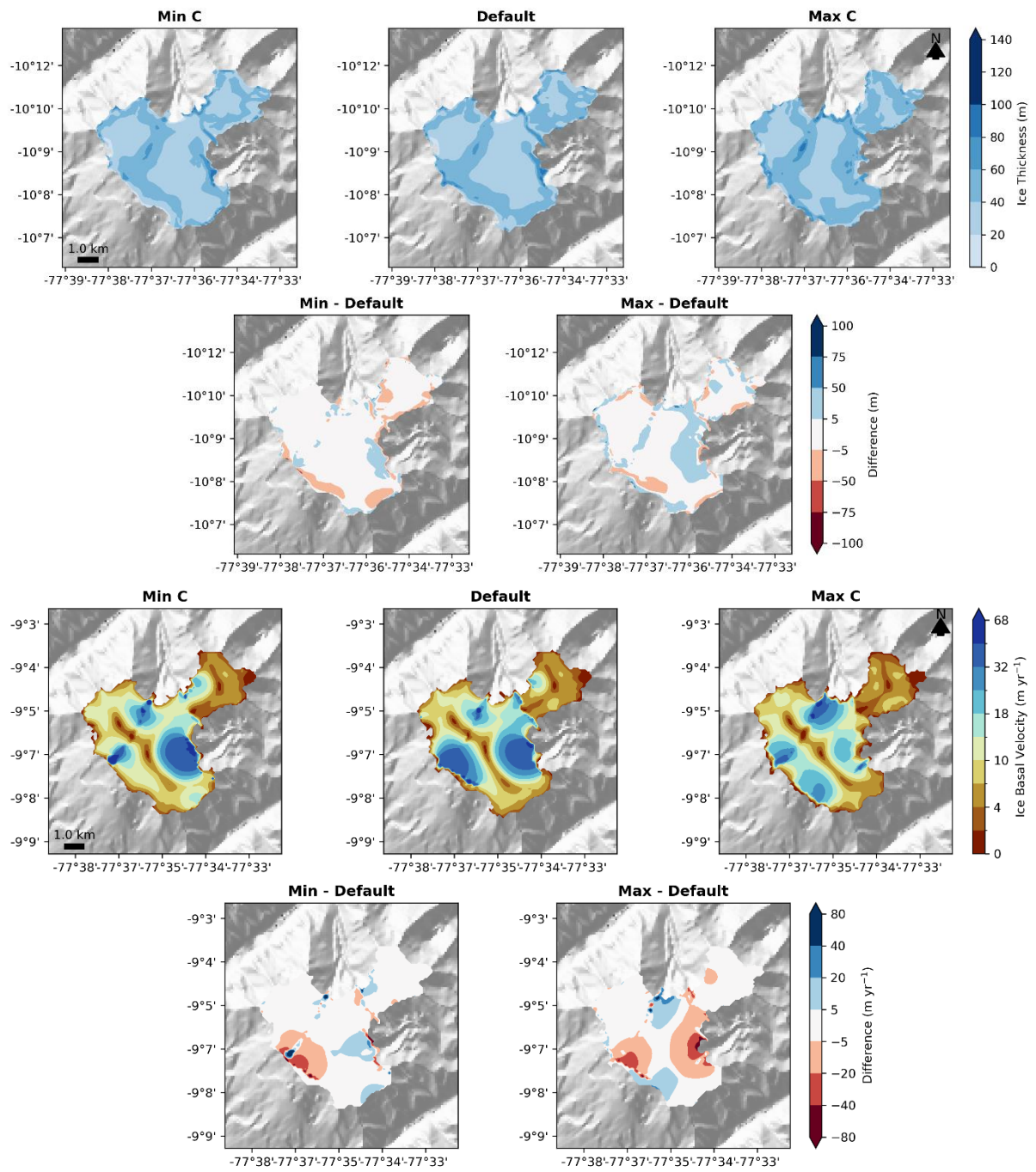


Figure S16: Thickness and velocity outputs, and subsequent difference between minimum and maximum C values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

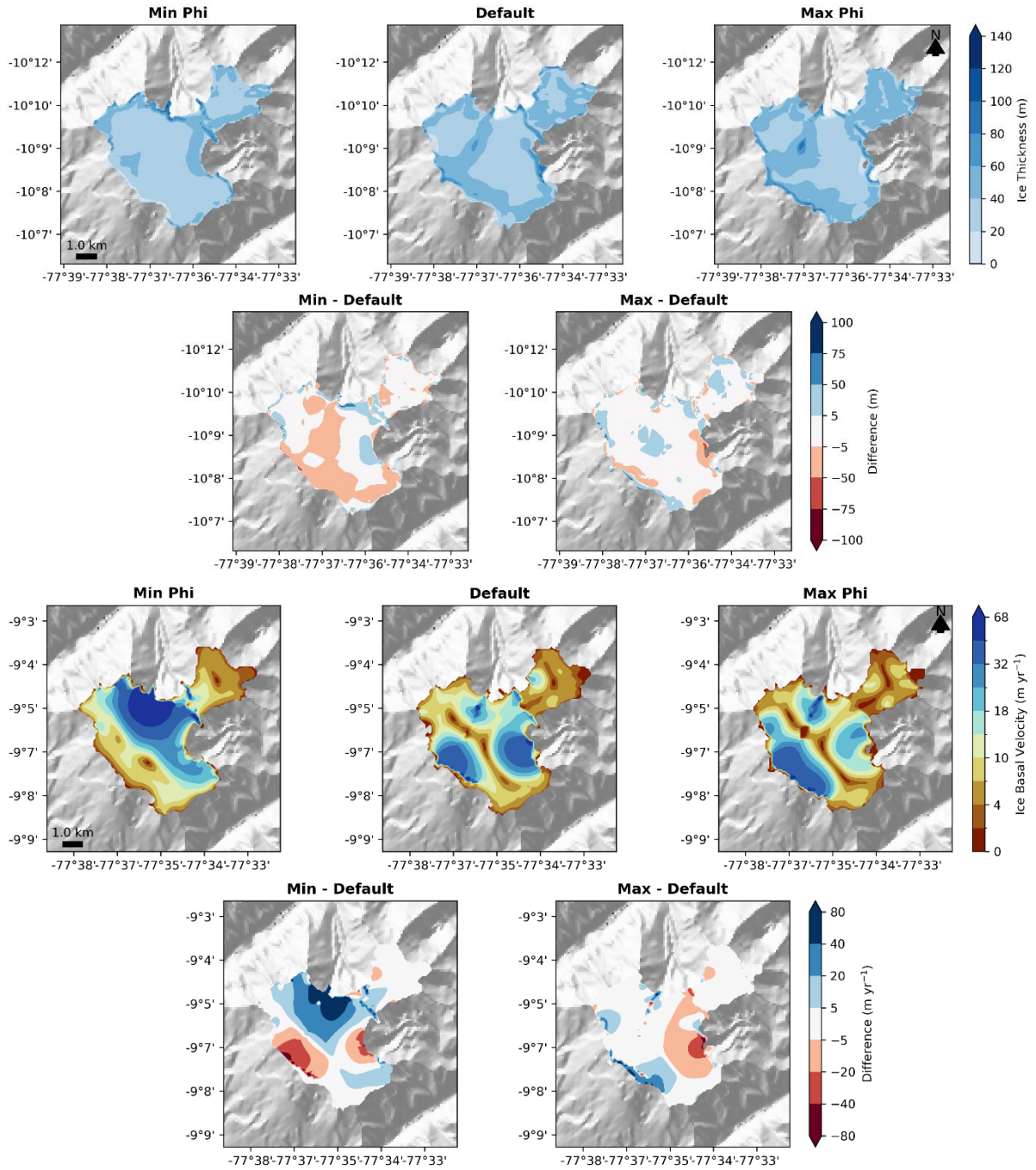


Figure S17: Thickness and velocity outputs, and subsequent difference between minimum and maximum ϕ (Phi) values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

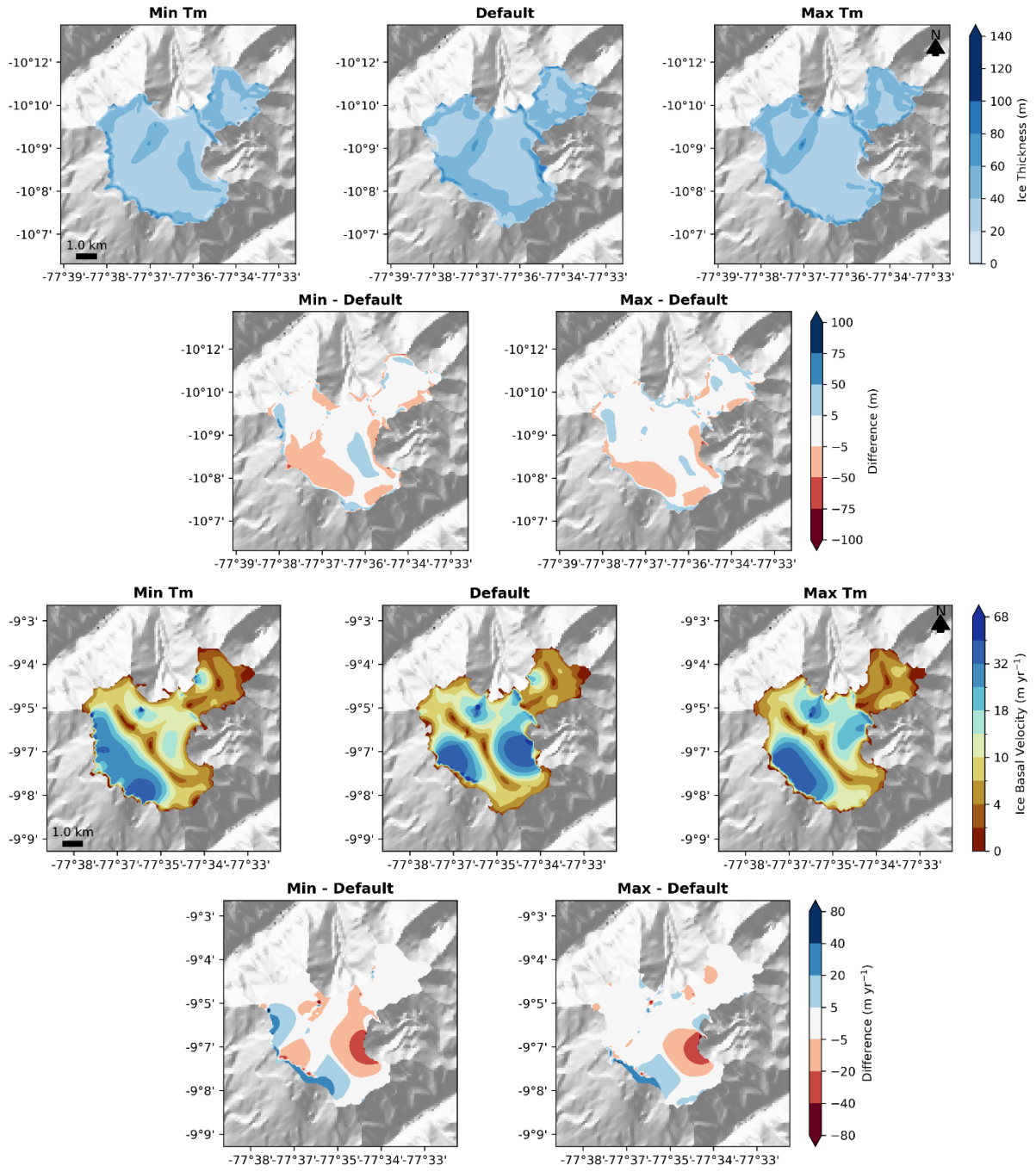


Figure S18: Thickness and velocity outputs, and subsequent difference between minimum and maximum W_{till}^{max} (Tm) values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

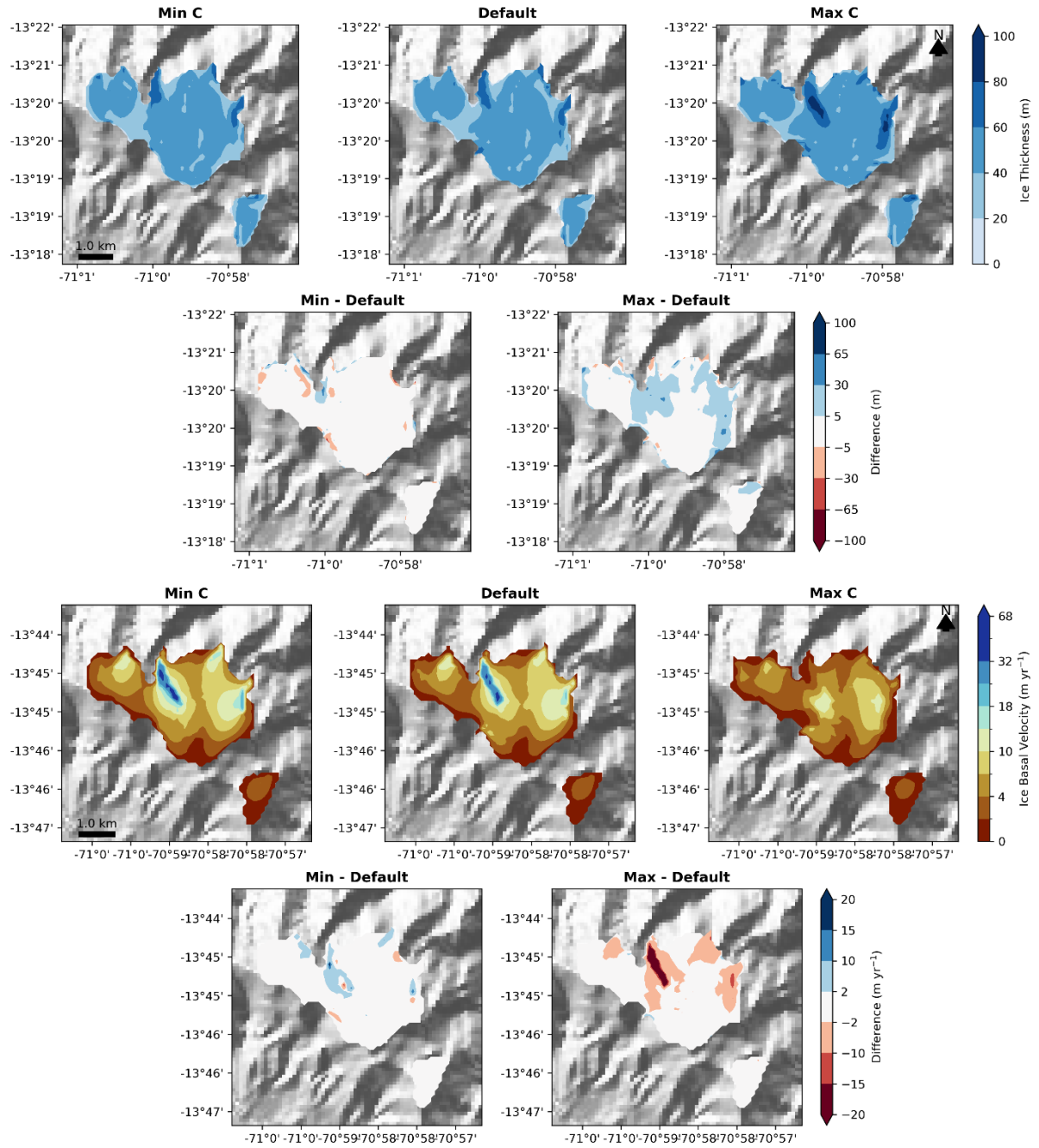


Figure S19: Thickness and velocity outputs, and subsequent difference between minimum and maximum C values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

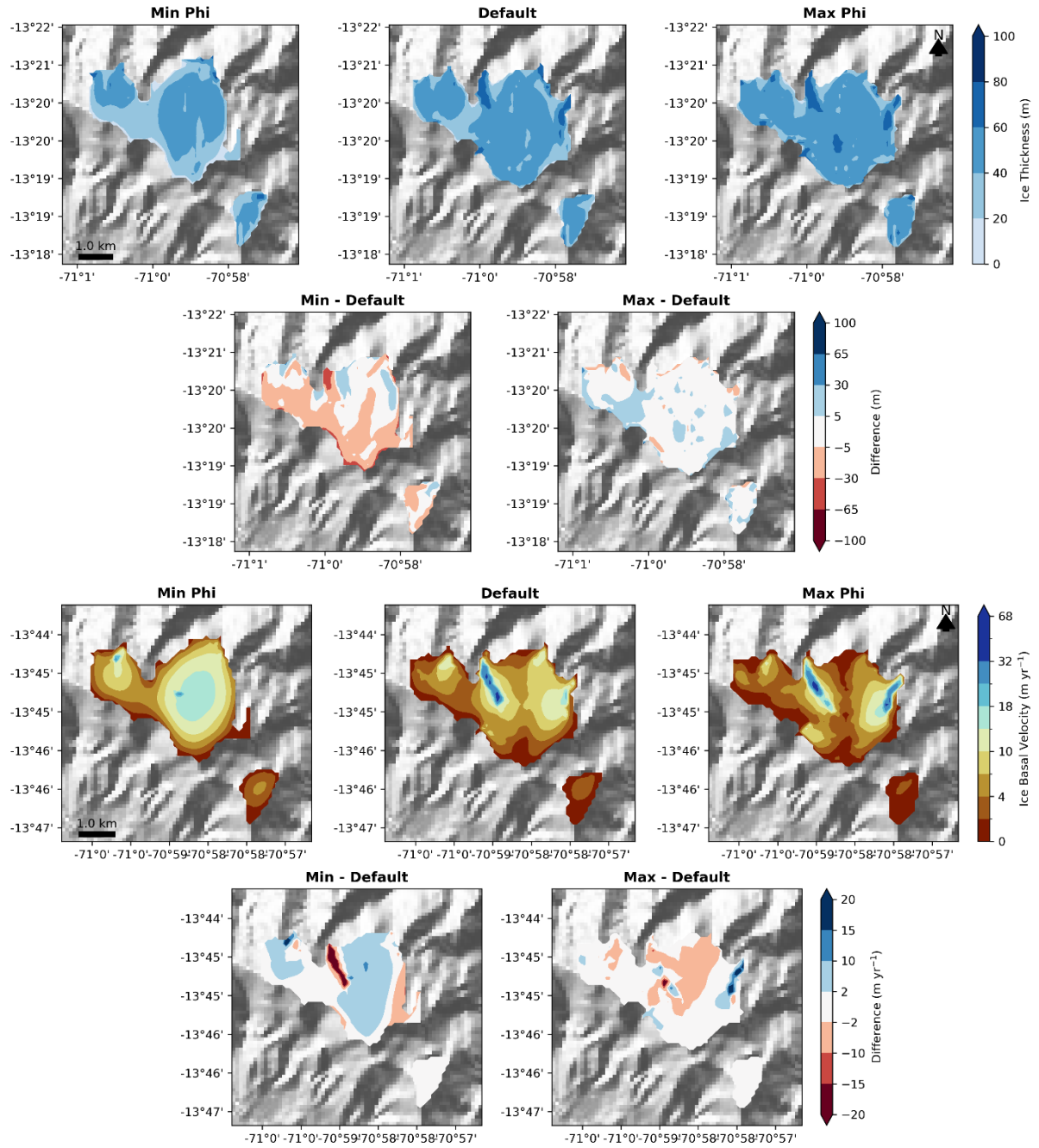


Figure S20: Thickness and velocity outputs, and subsequent difference between minimum and maximum ϕ (Phi) values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

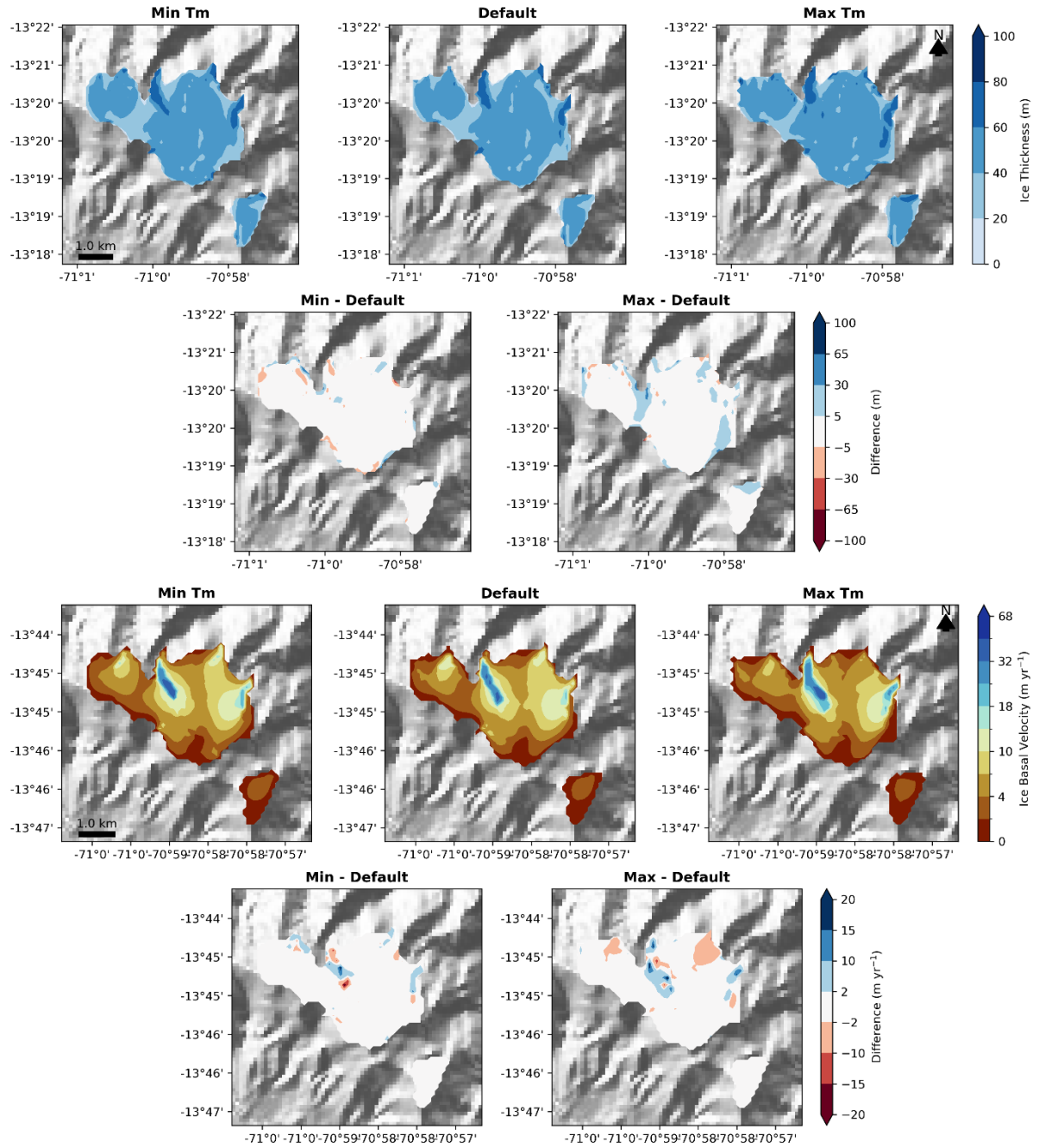


Figure S21: Thickness and velocity outputs, and subsequent difference between minimum and maximum W_{till}^{max} (Tm) values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

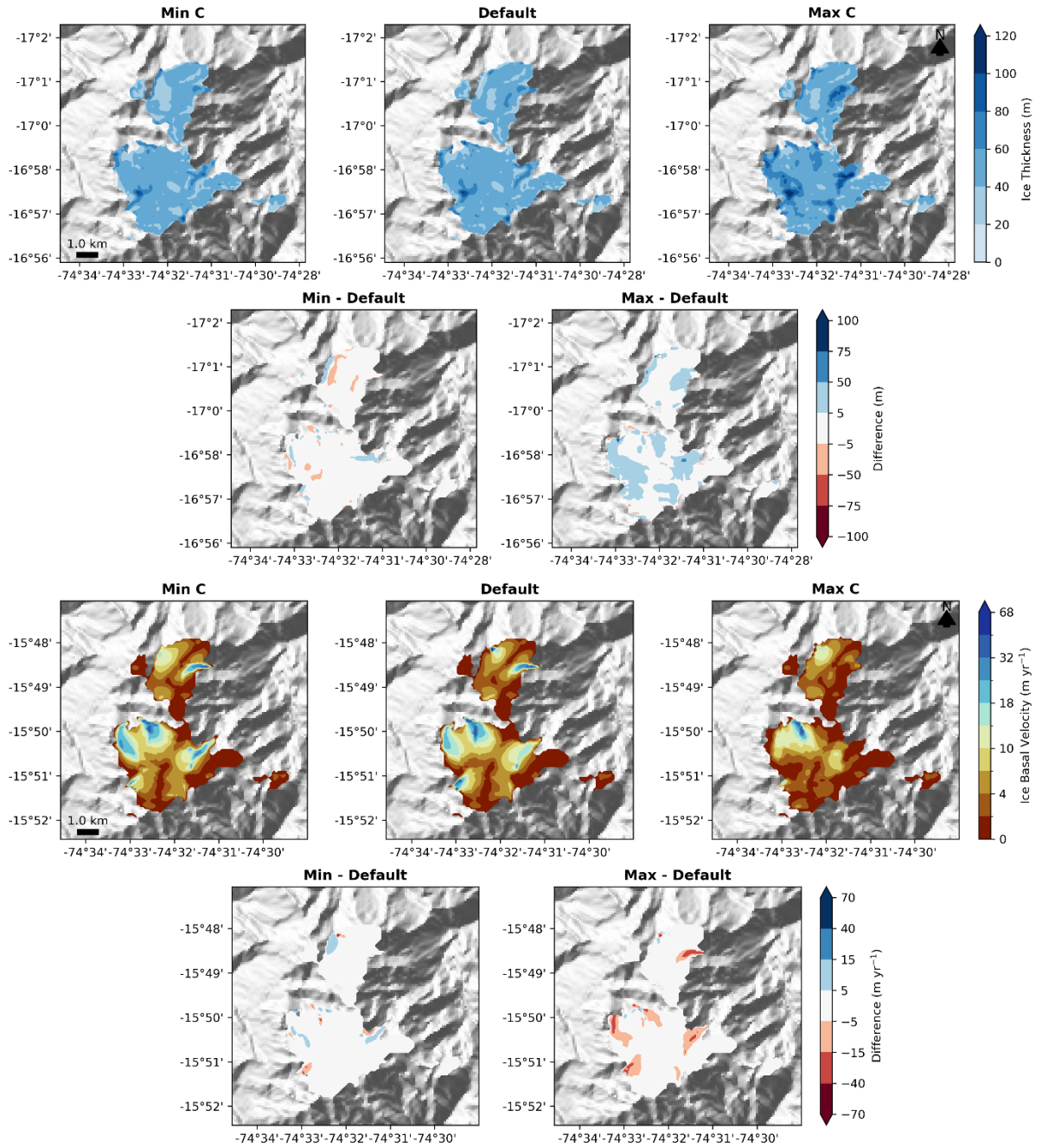


Figure S22: Thickness and velocity outputs, and subsequent difference between minimum and maximum C values with the default value within the Kaka & Boopi (#3) domain (Ancohuma Ice Caps).

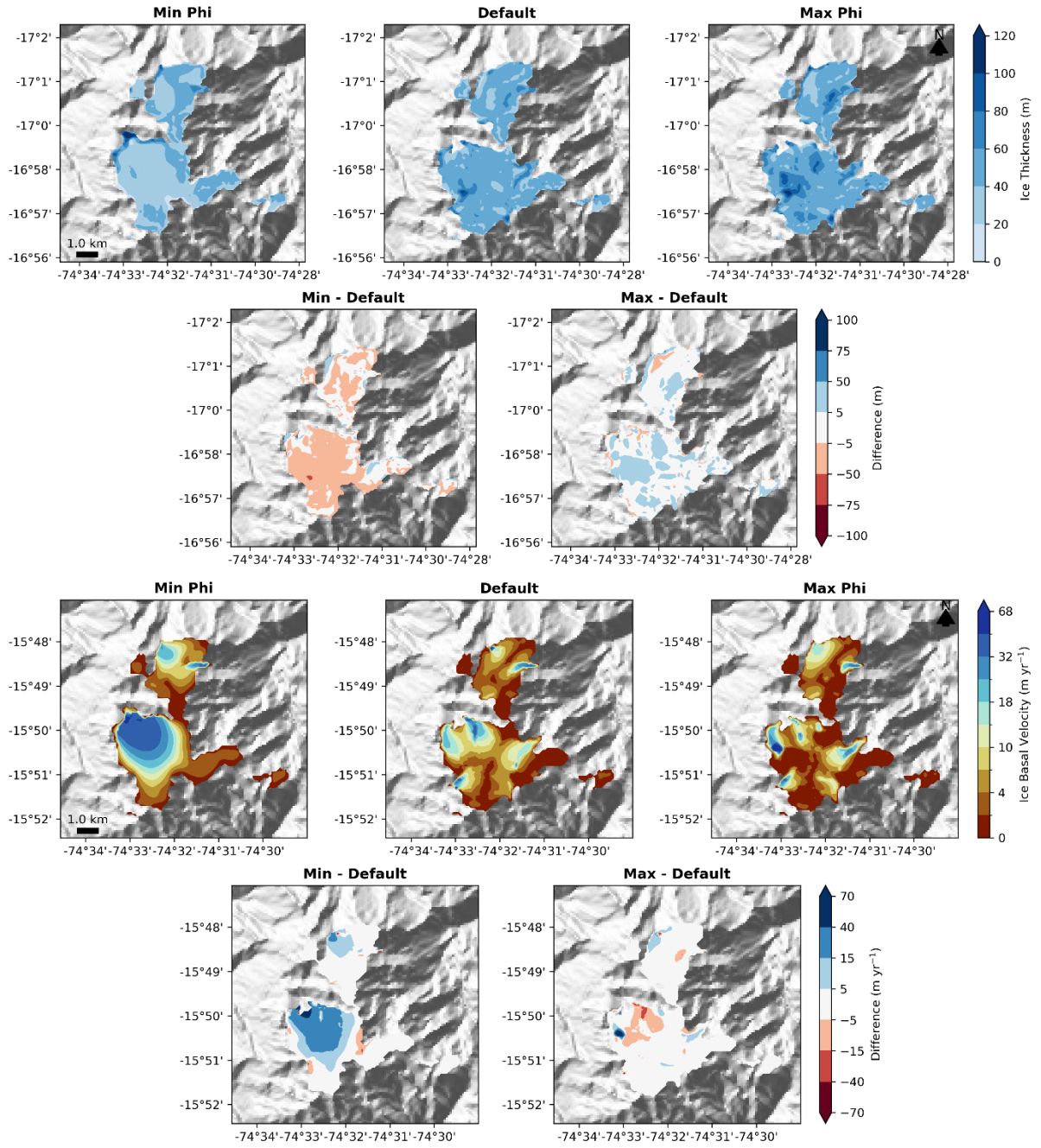


Figure S23: Thickness and velocity outputs, and subsequent difference between minimum and maximum ϕ (Phi) values with the default value within the Kaka & Boopi (#3) domain (Ancohuma Ice Caps).

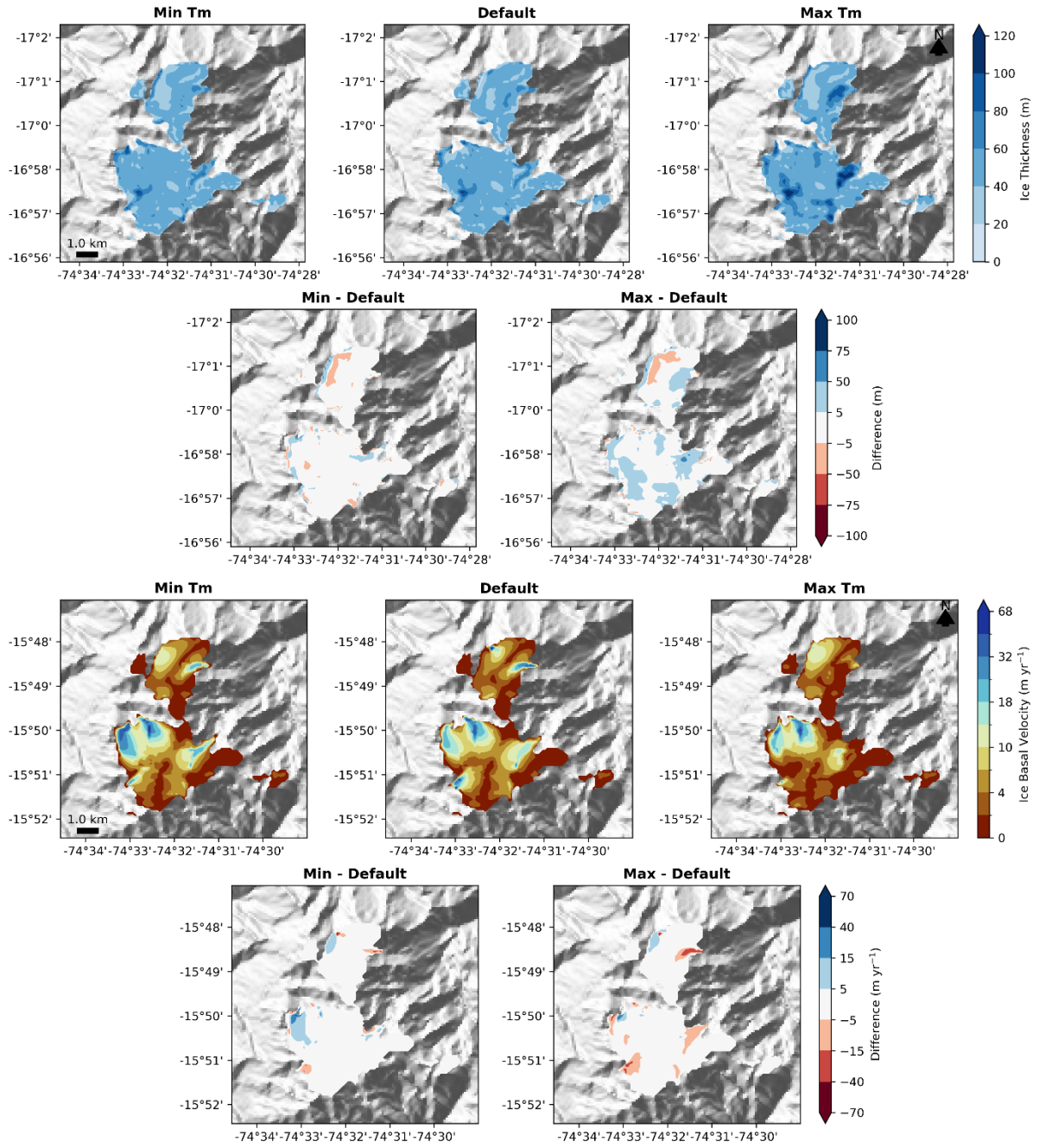


Figure S24: Thickness and velocity outputs, and subsequent difference between minimum and maximum W_{till}^{max} (Tm) values with the default value within the Kaka & Boopi (#3) domain (Ancohuma Ice Caps).

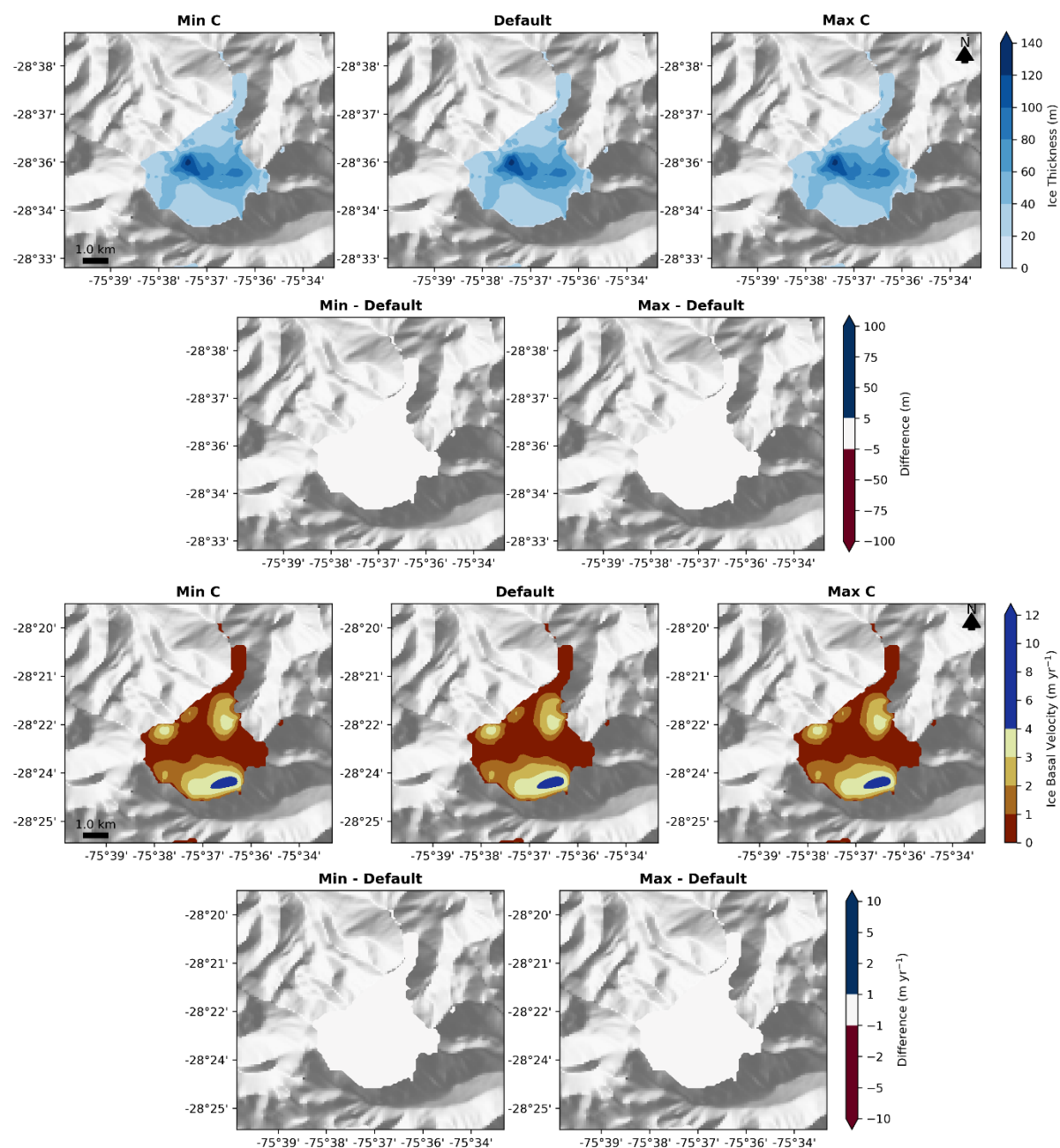


Figure S25: Thickness and velocity outputs, and subsequent difference between minimum and maximum C values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

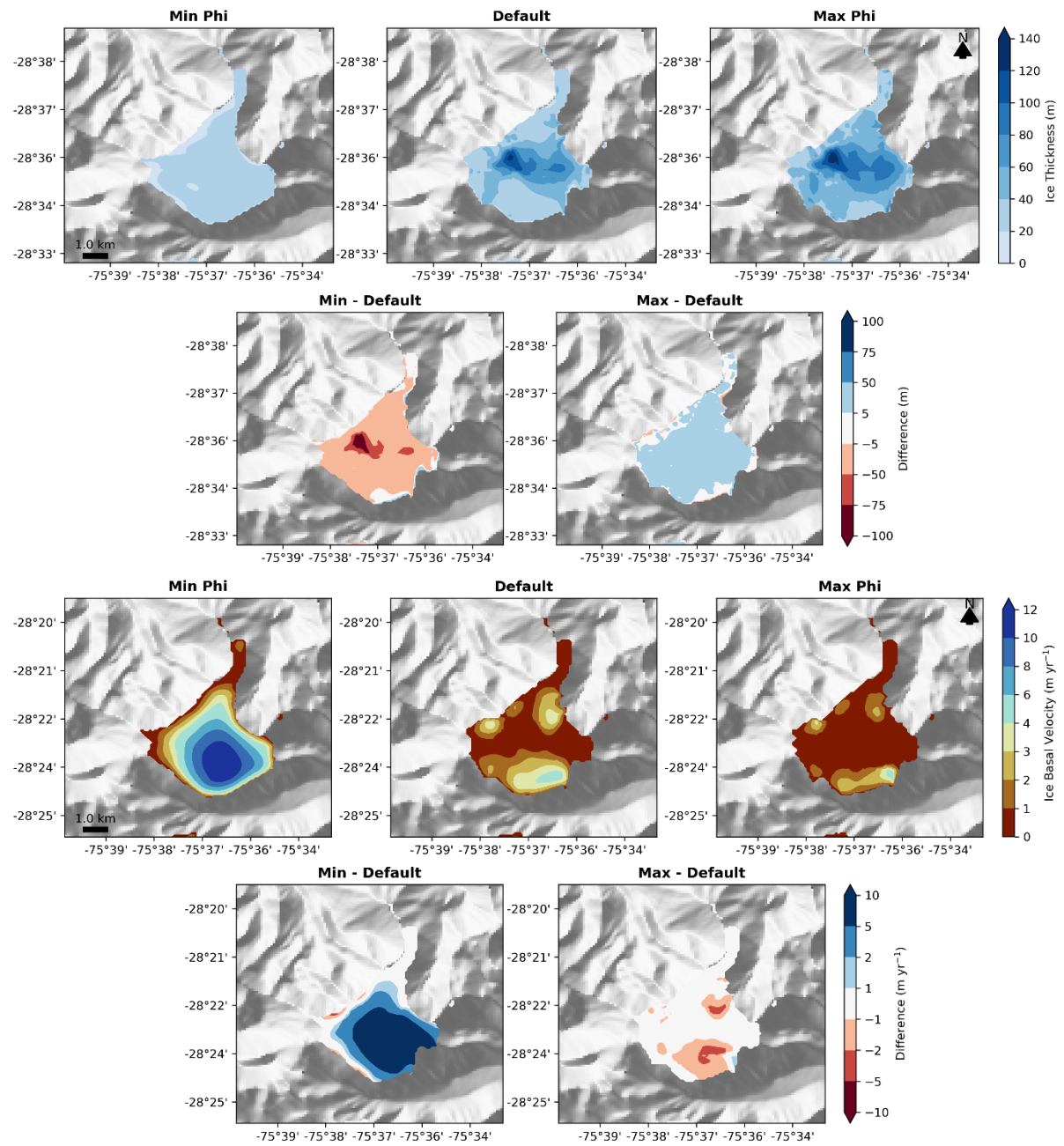


Figure S26: Thickness and velocity outputs, and subsequent difference between minimum and maximum ϕ (Phi) values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

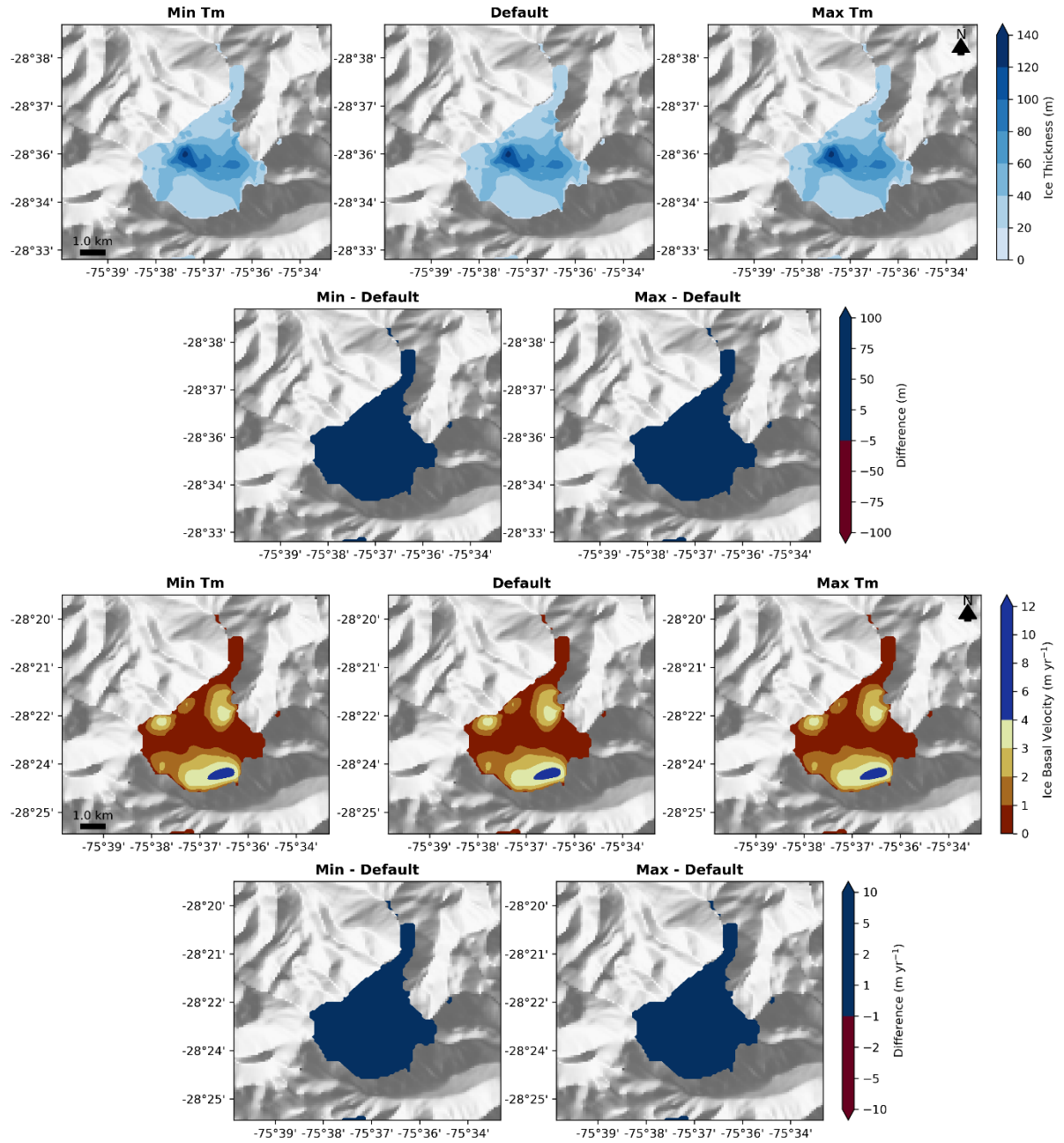


Figure S27: Thickness and velocity outputs, and subsequent difference between minimum and maximum W_{till}^{max} (Tm) values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

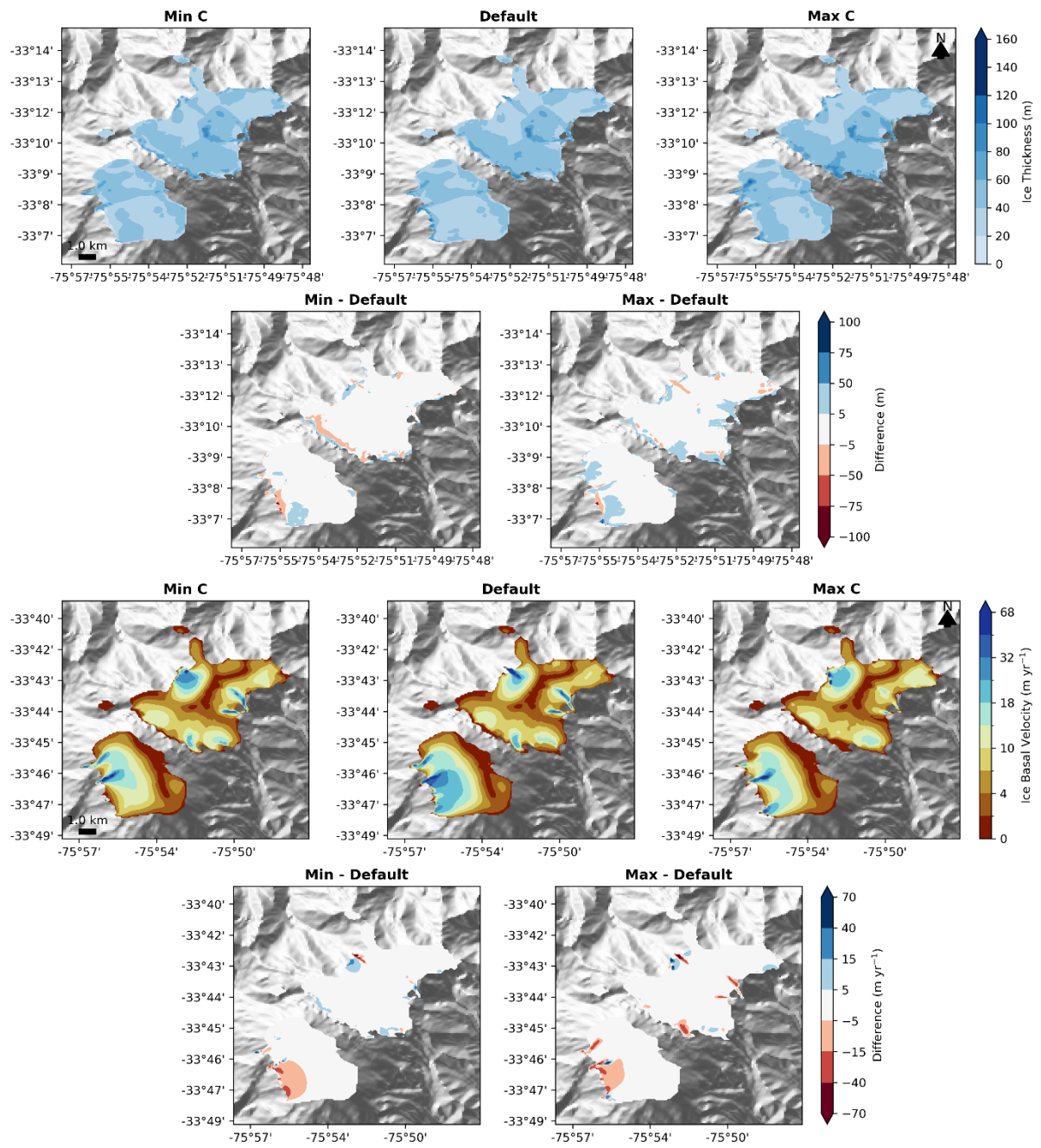


Figure S28: Thickness and velocity outputs, and subsequent difference between minimum and maximum C values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

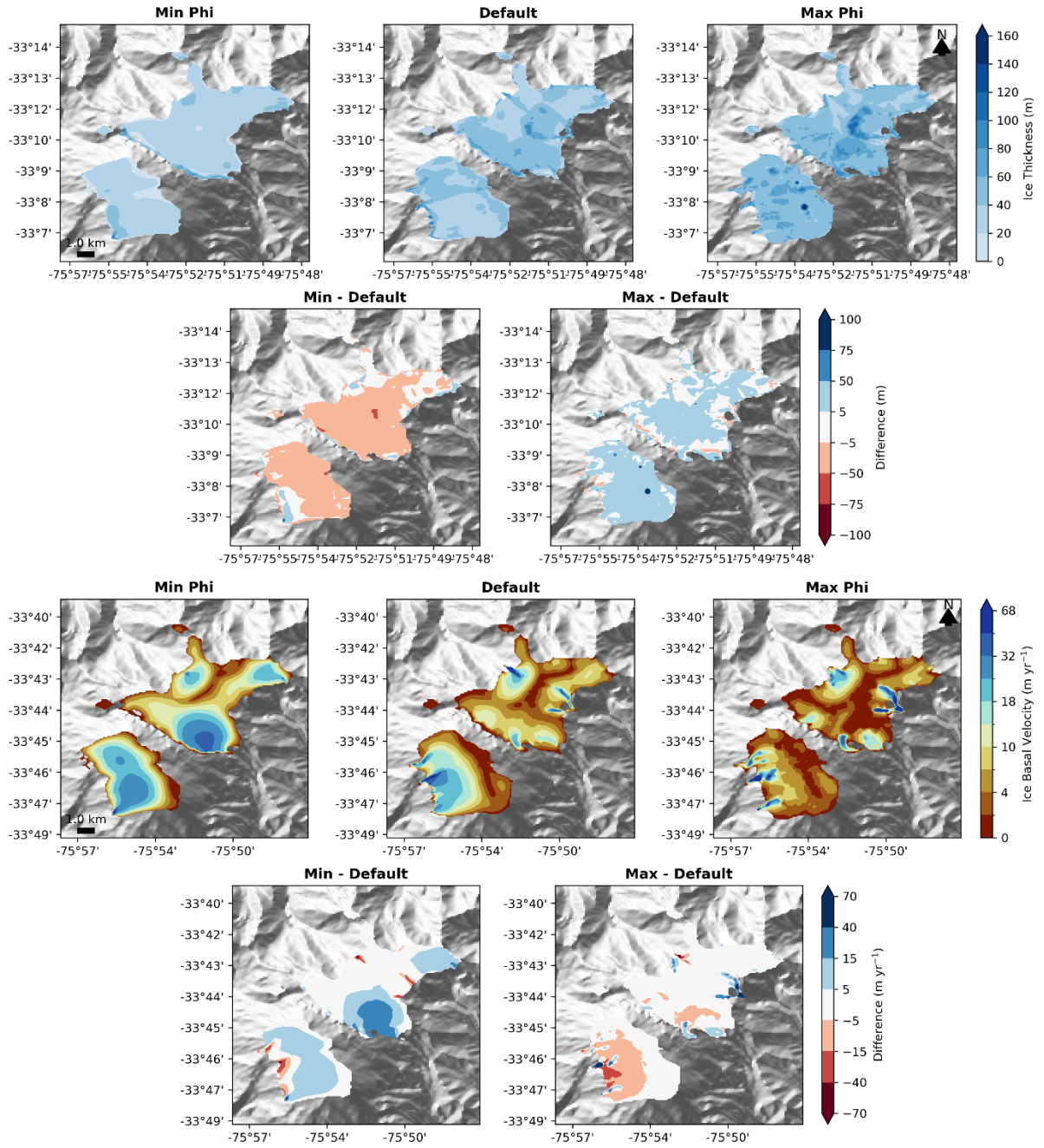


Figure S29: Thickness and velocity outputs, and subsequent difference between minimum and maximum ϕ (Phi) values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

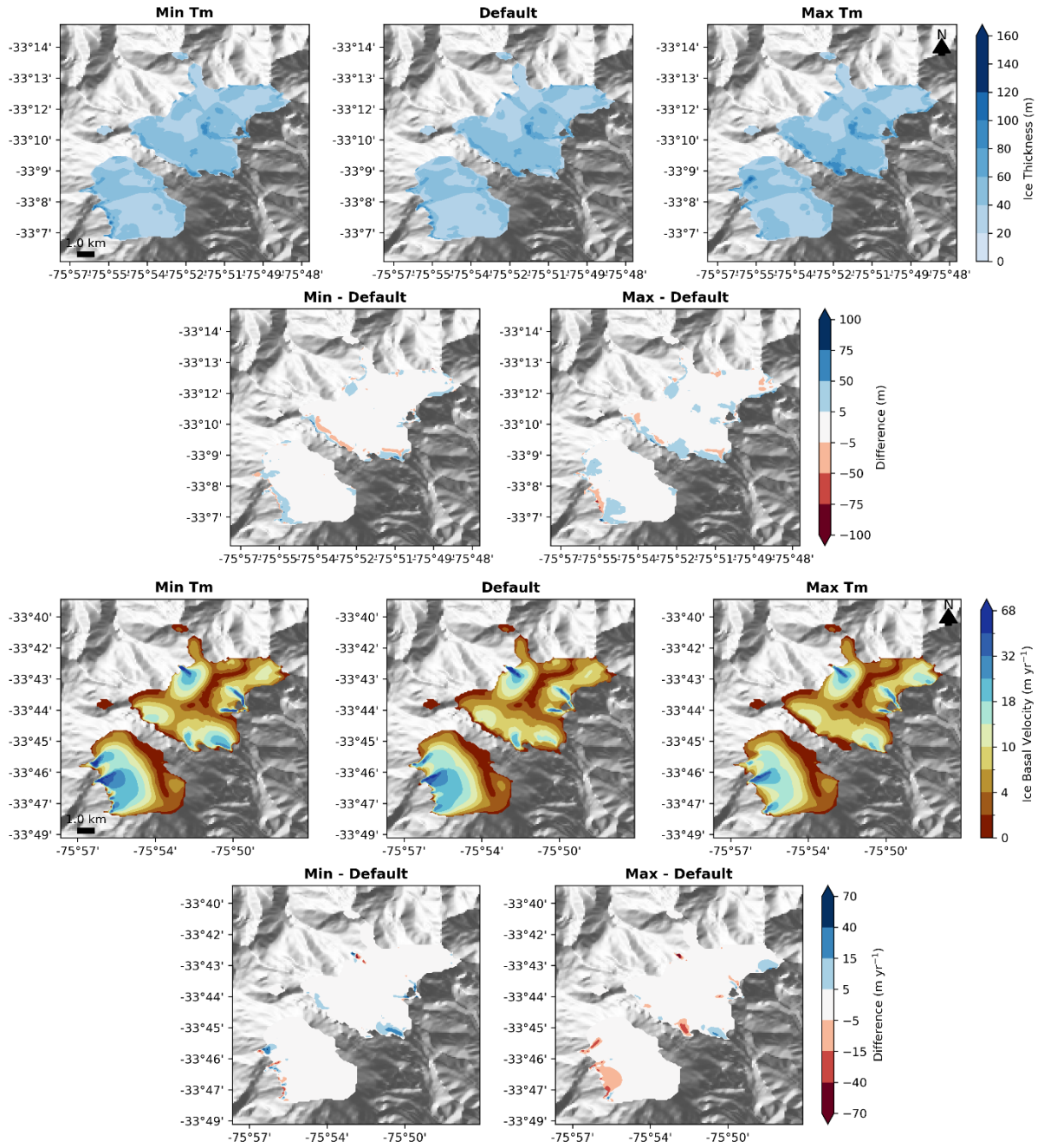


Figure S30: Thickness and velocity outputs, and subsequent difference between minimum and maximum W_{till}^{max} (Tm) values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

Slide sensitivity tests ice thickness and velocities

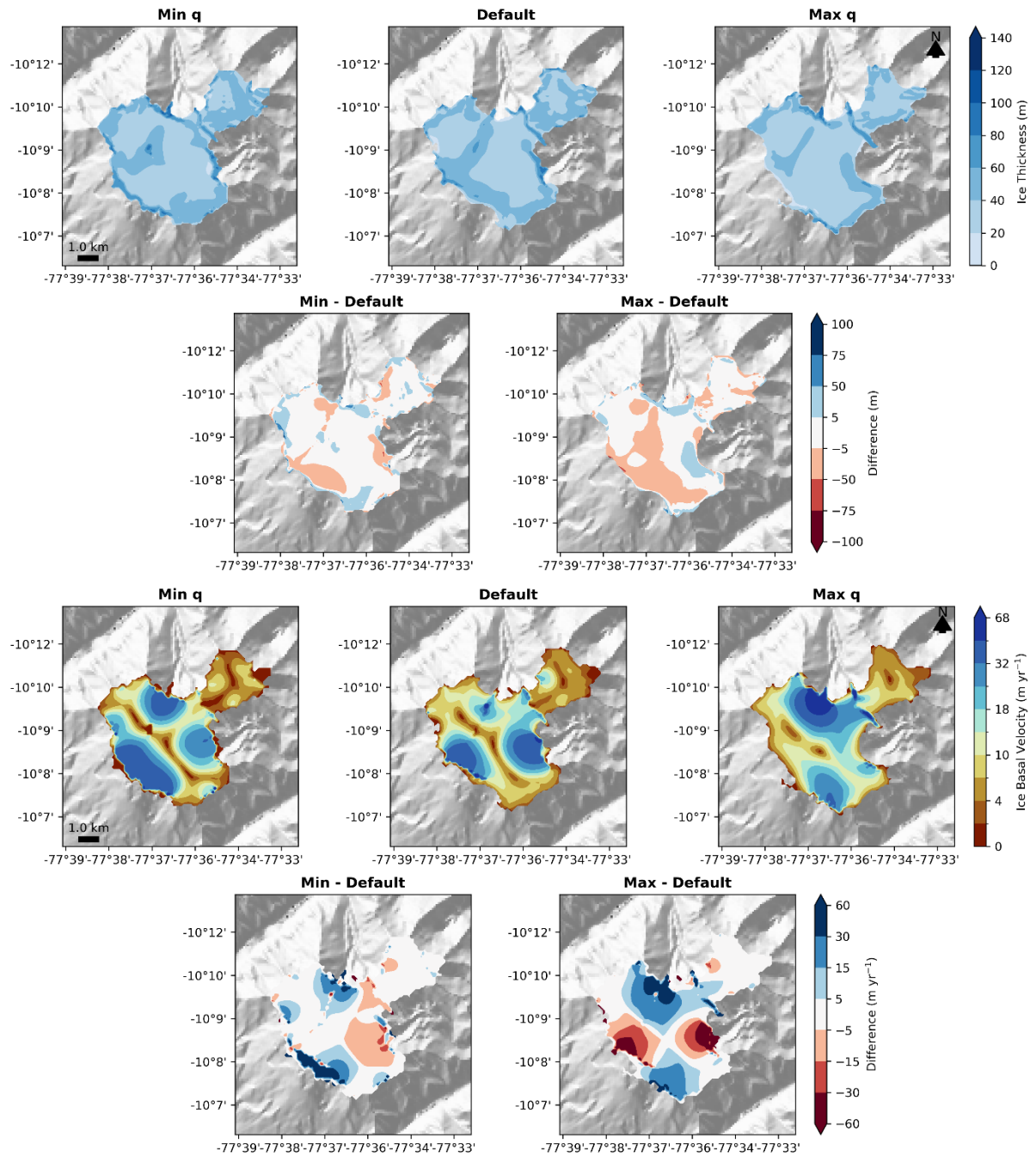


Figure S31: Thickness and velocity outputs, and subsequent difference between minimum and maximum q values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

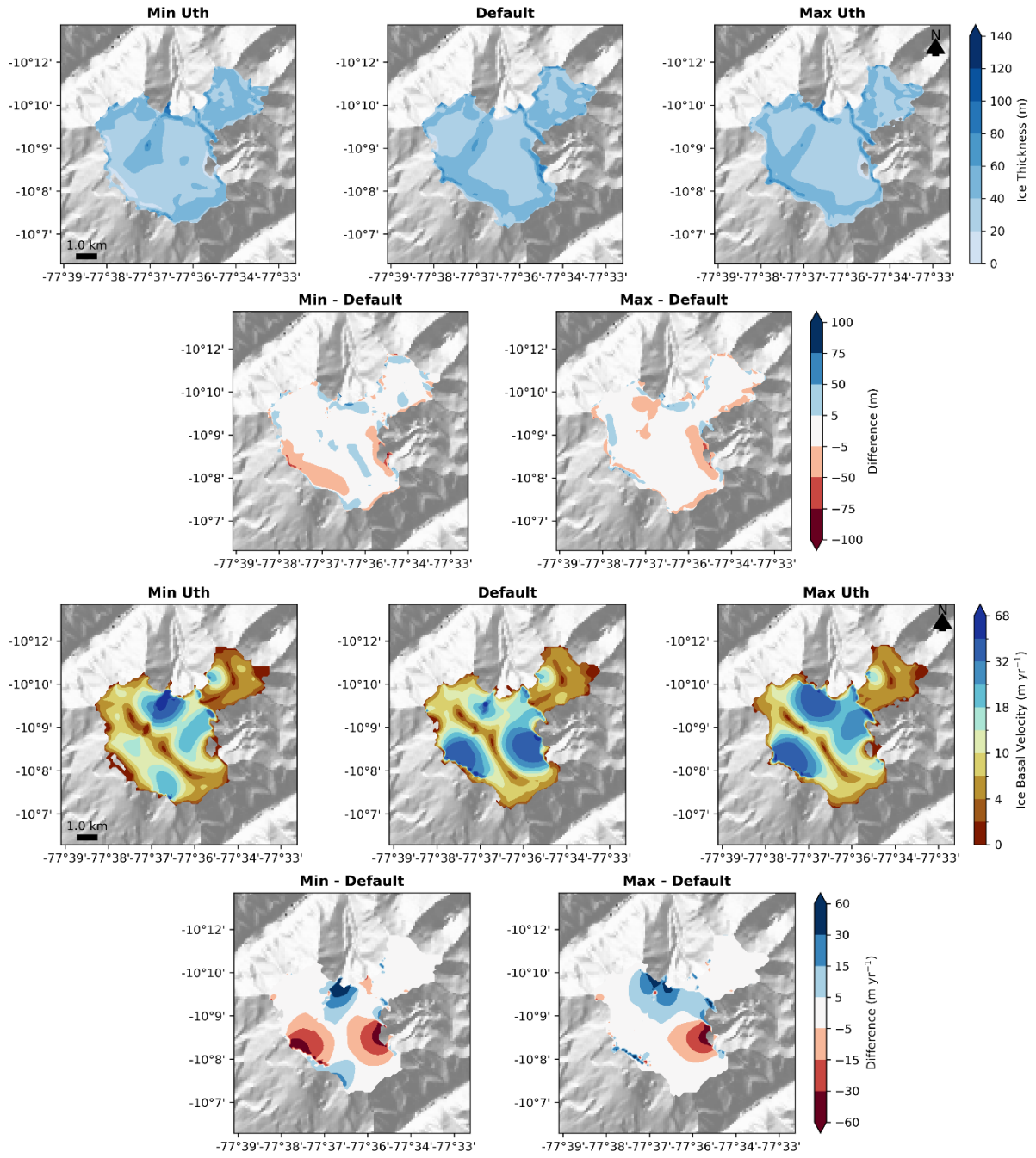


Figure S32: Thickness and velocity outputs, and subsequent difference between minimum and maximum $u_{threshold}$ values with the default value within the Santa (#1) domain (Huascarán Ice Cap).

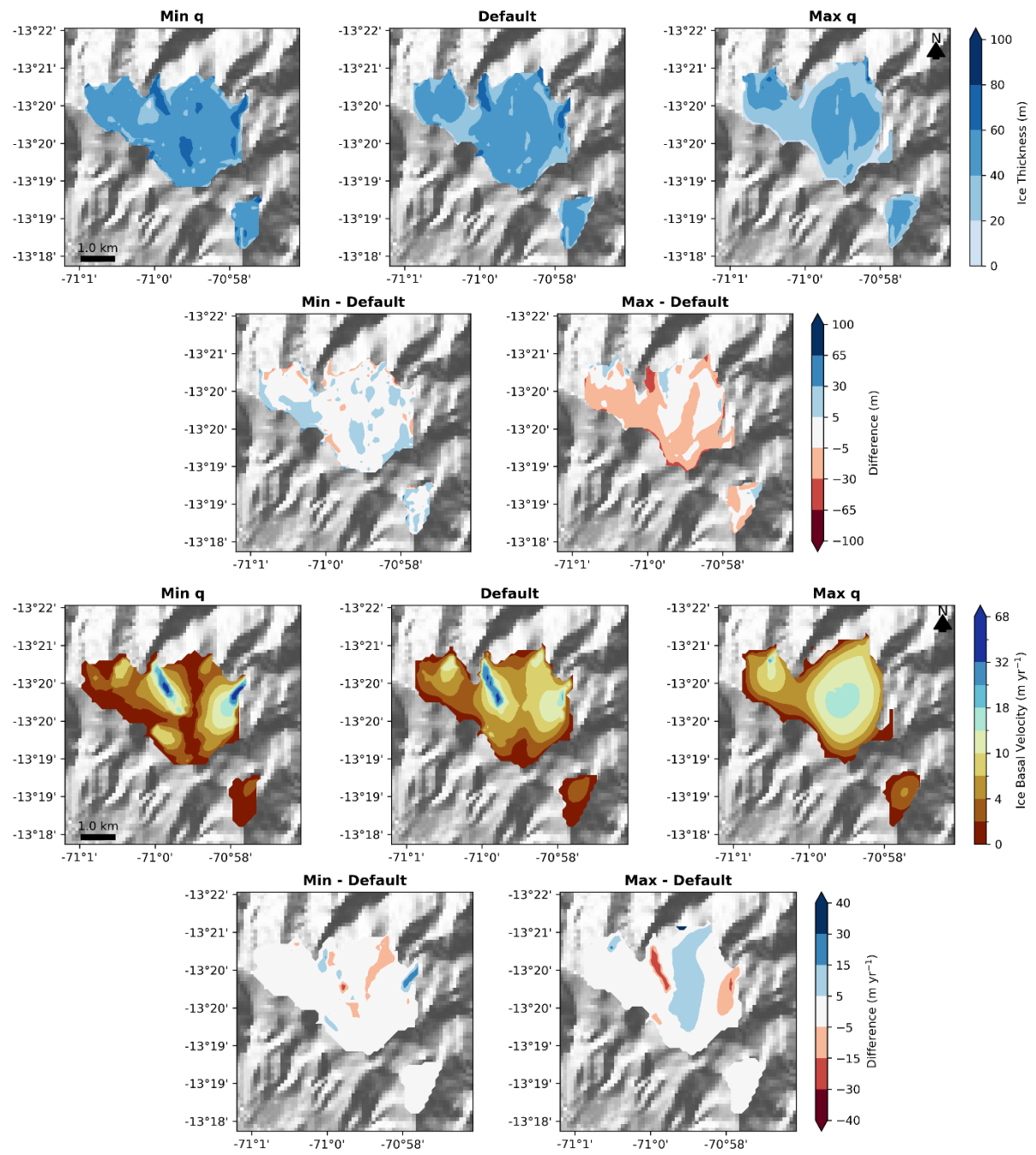


Figure S33: Thickness and velocity outputs, and subsequent difference between minimum and maximum q values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

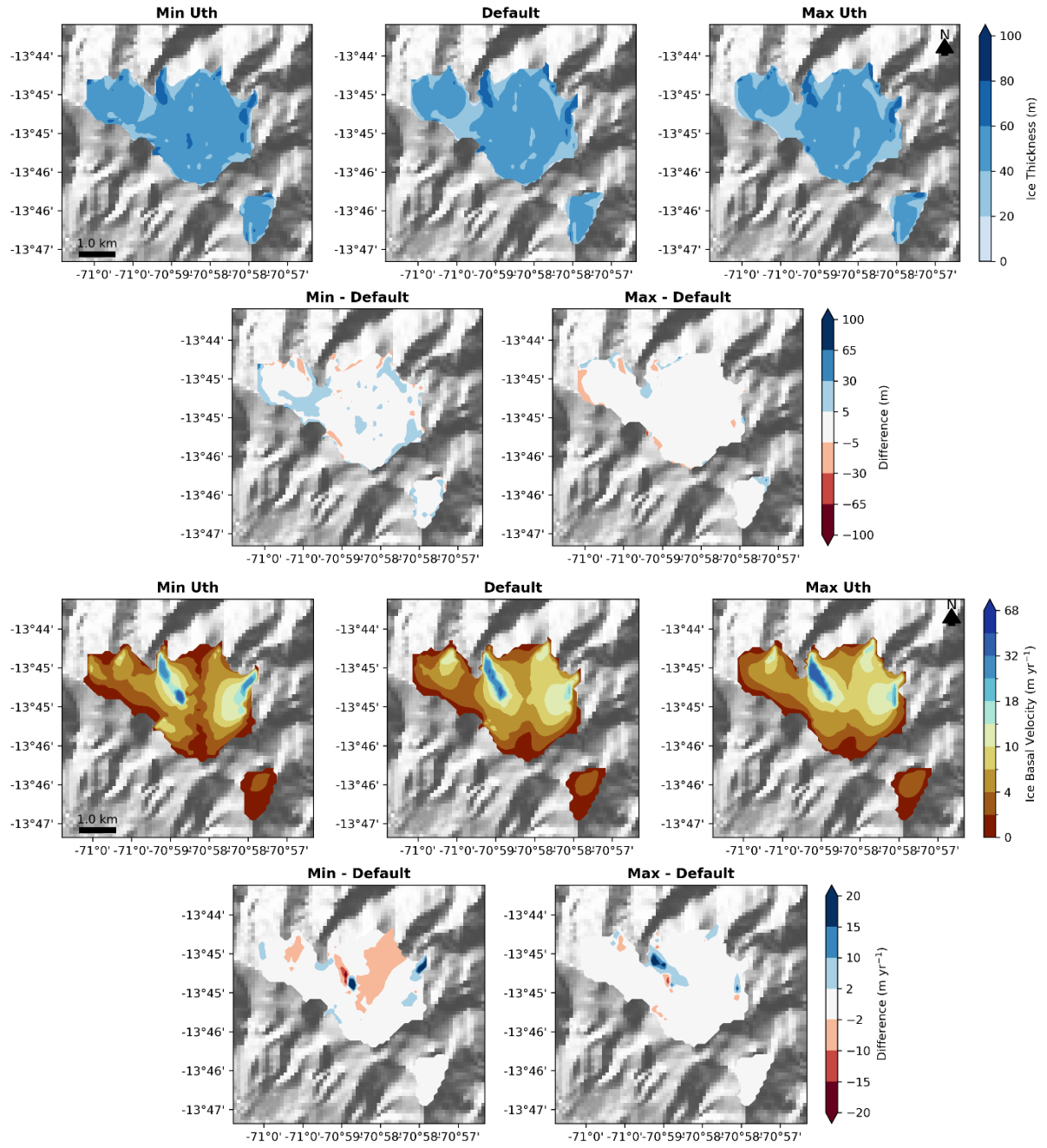


Figure S34: Thickness and velocity outputs, and subsequent difference between minimum and maximum $u_{threshold}$ values with the default value within the Vilcanota (#2) domain (Quelccaya Ice Cap).

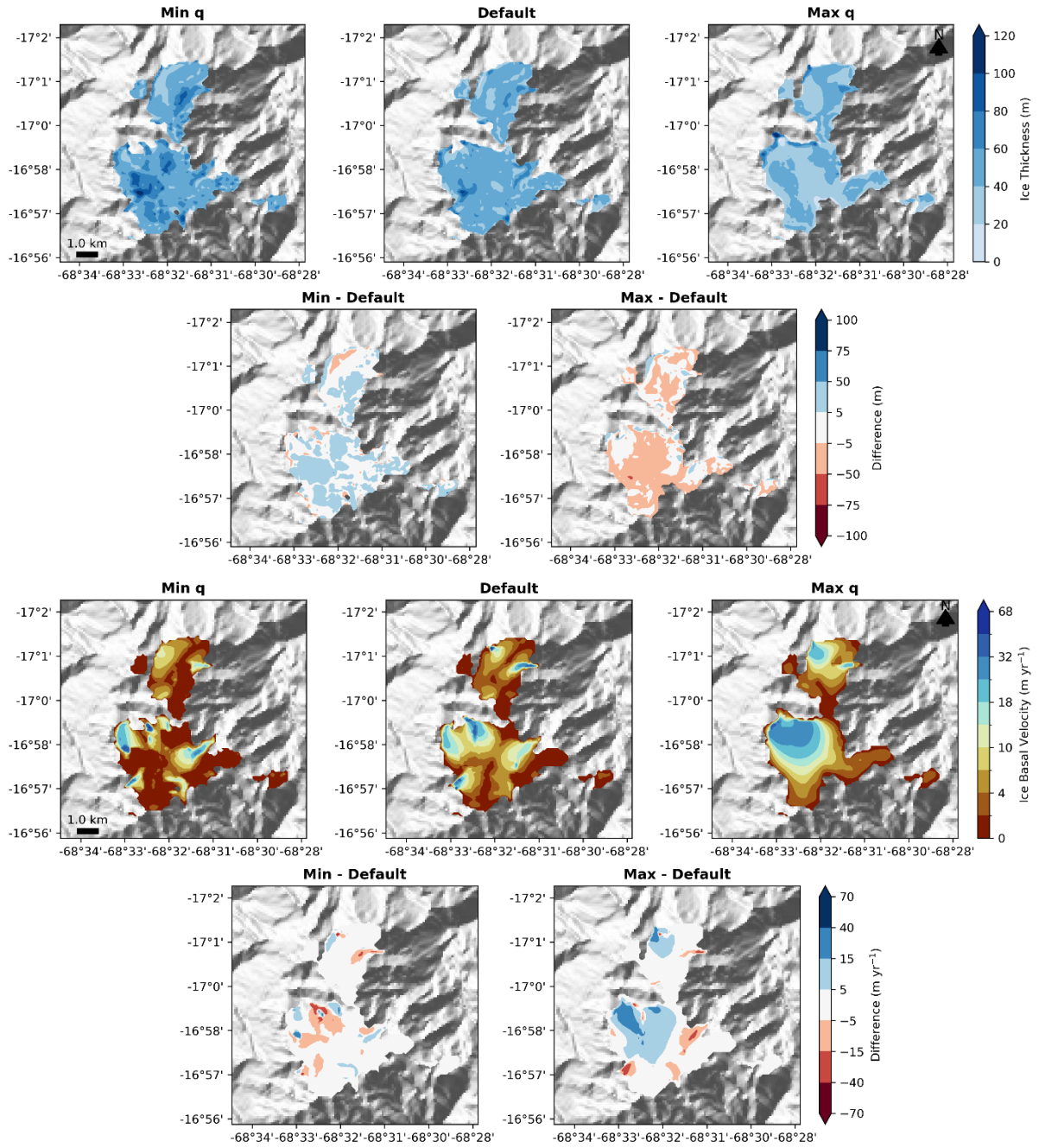


Figure S35: Thickness and velocity outputs, and subsequent difference between minimum and maximum q values with the default value within the Kaka & Boopi (#3) domain (Ancohuma Ice Caps).

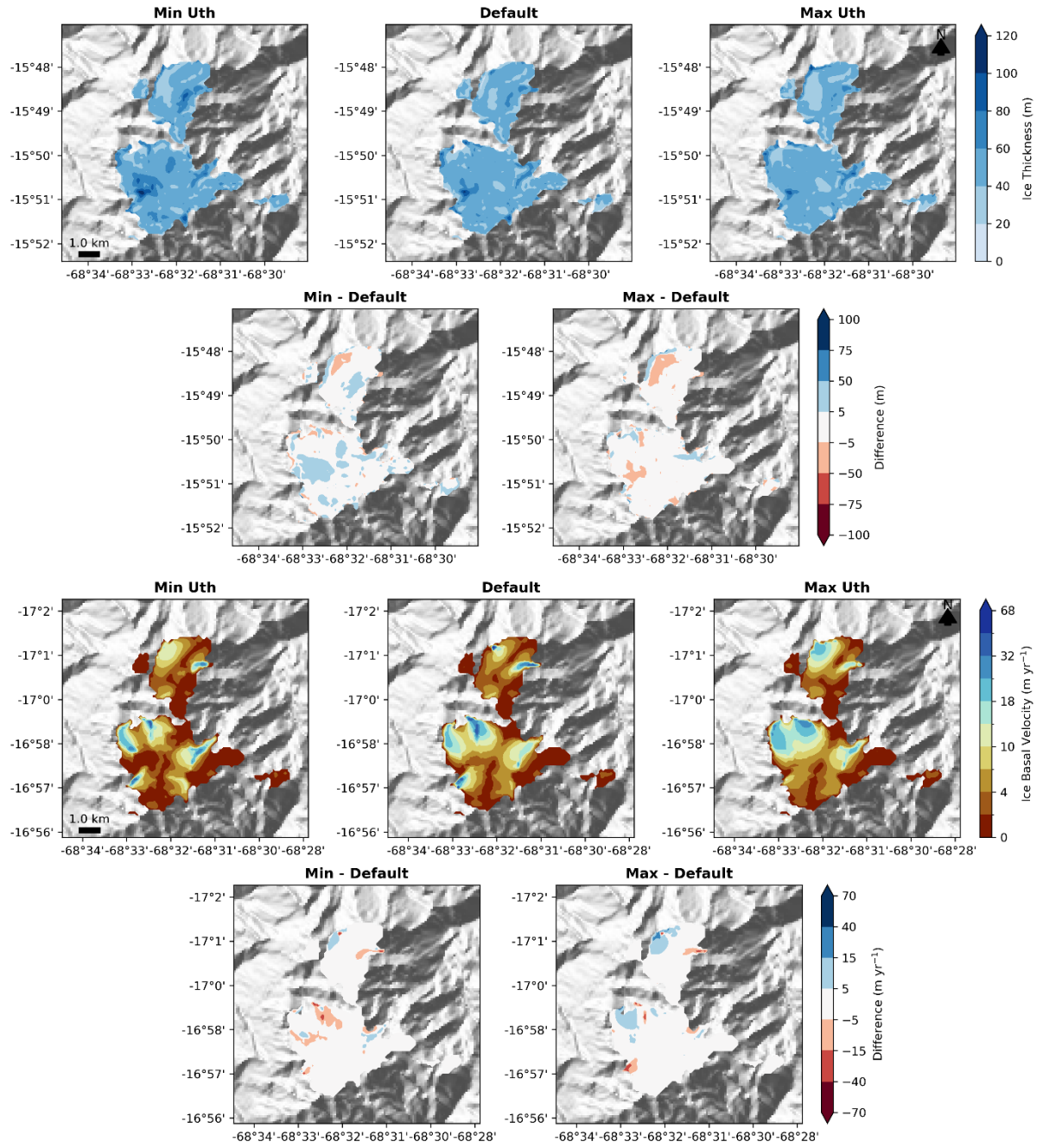


Figure S36: Thickness and velocity outputs, and subsequent difference between minimum and maximum $u_{threshold}$ values with the default value within the Kaka & Boopi (#3) domain (Ancohuma Ice Caps).

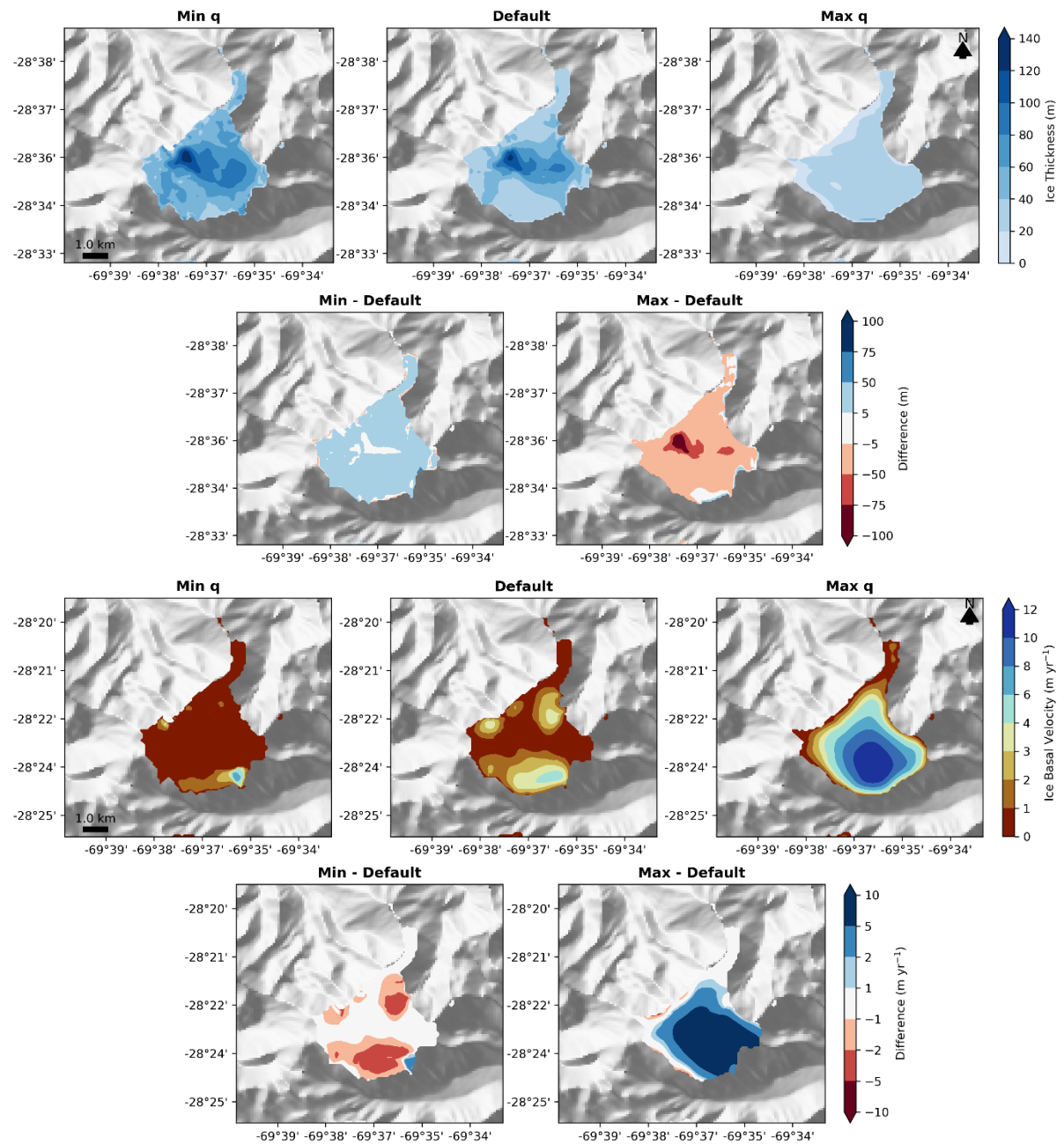


Figure S37: Thickness and velocity outputs, and subsequent difference between minimum and maximum q values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

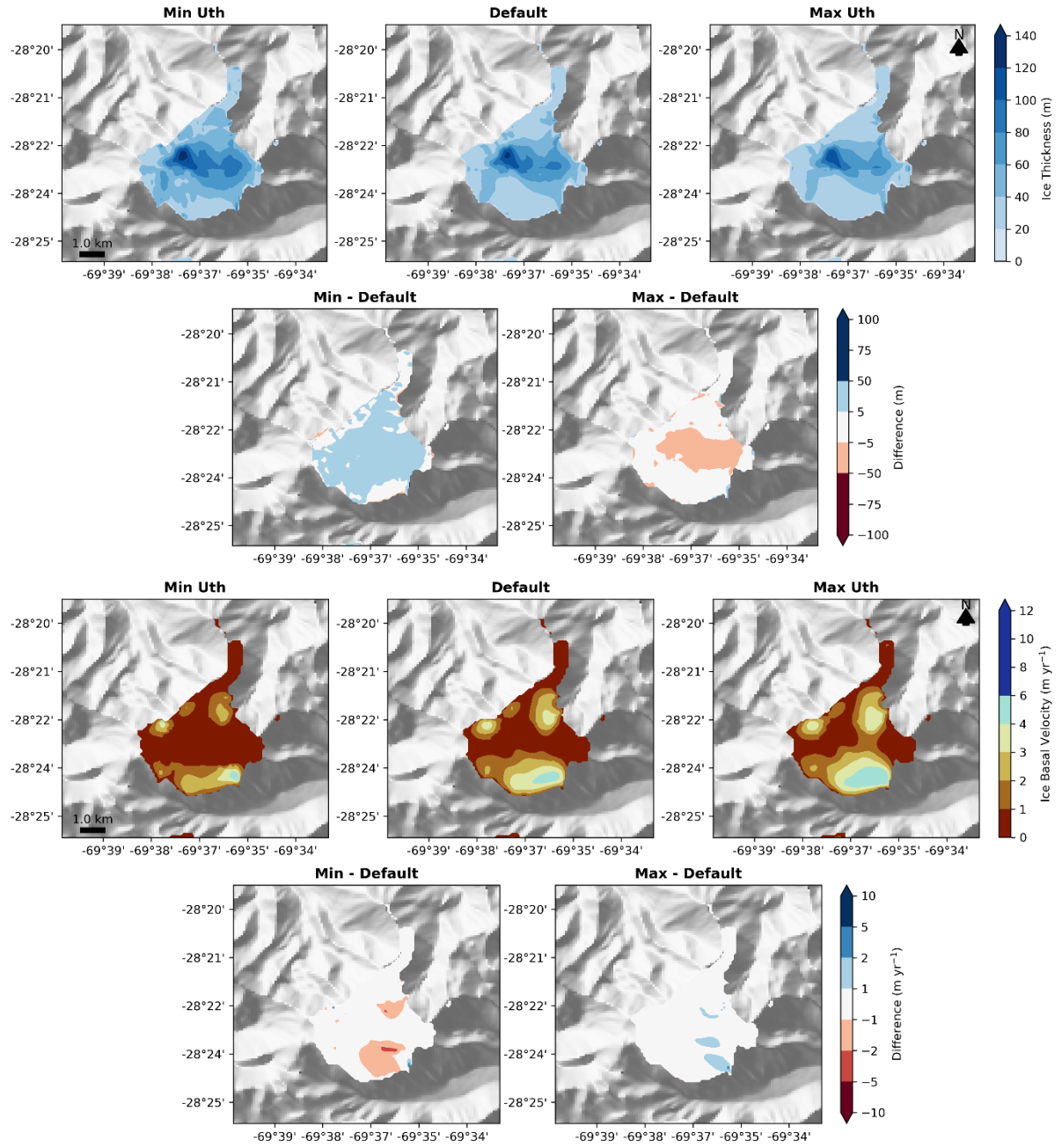


Figure S38: Thickness and velocity outputs, and subsequent difference between minimum and maximum $u_{threshold}$ values with the default value within the Copiapó (#4) domain (Glaciar Blanco).

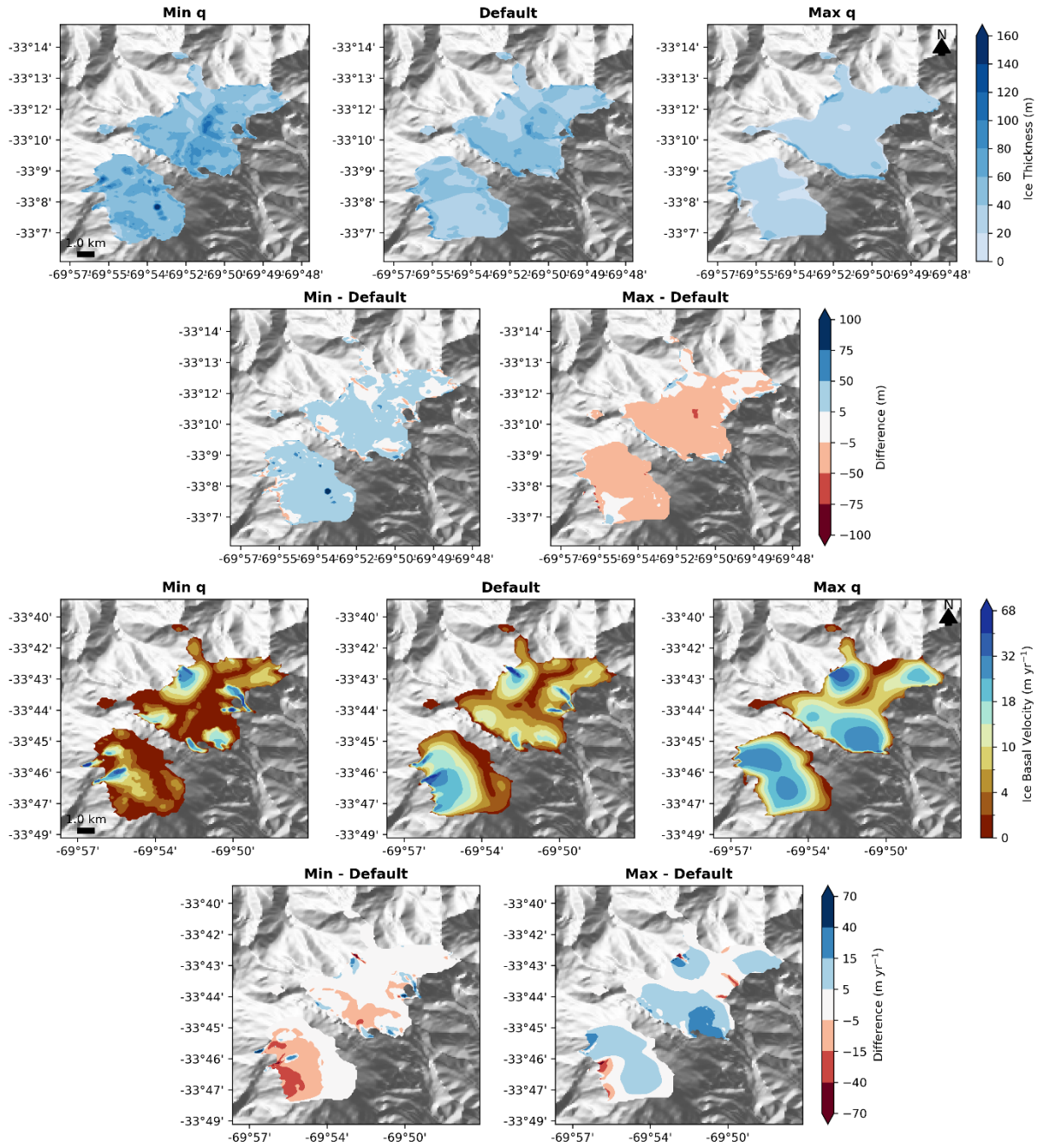


Figure S39: Thickness and velocity outputs, and subsequent difference between minimum and maximum q values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).

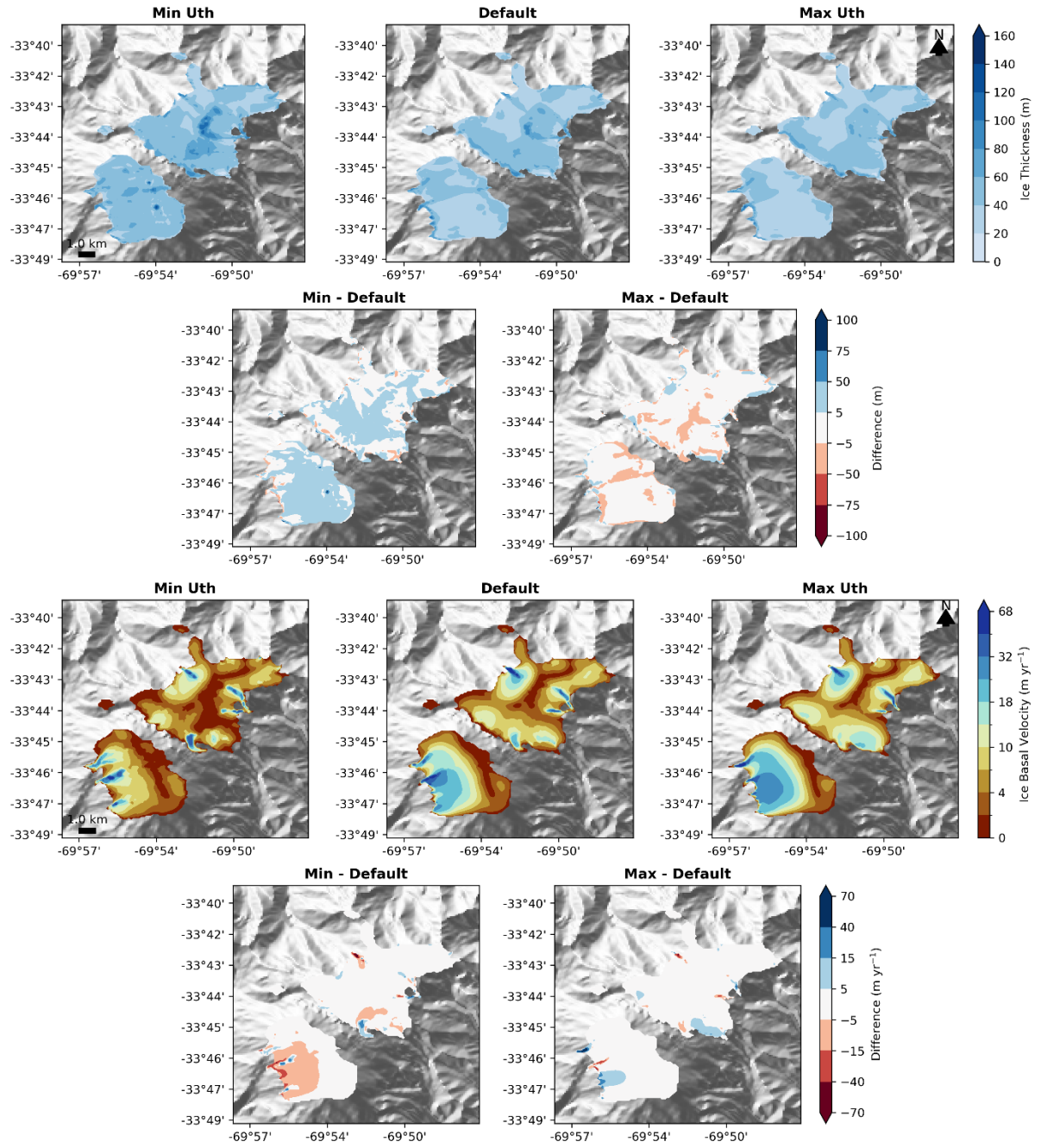


Figure S40: Thickness and velocity outputs, and subsequent difference between minimum and maximum $u_{threshold}$ values with the default value within the Mendoza, Maipo, and Rapel (#5) domain (Volcán Marmolejo).