remote sensing

MDPI

Article

Elevation and Mass Changes of the Southern Patagonia Icefield Derived from TanDEM-X and SRTM Data

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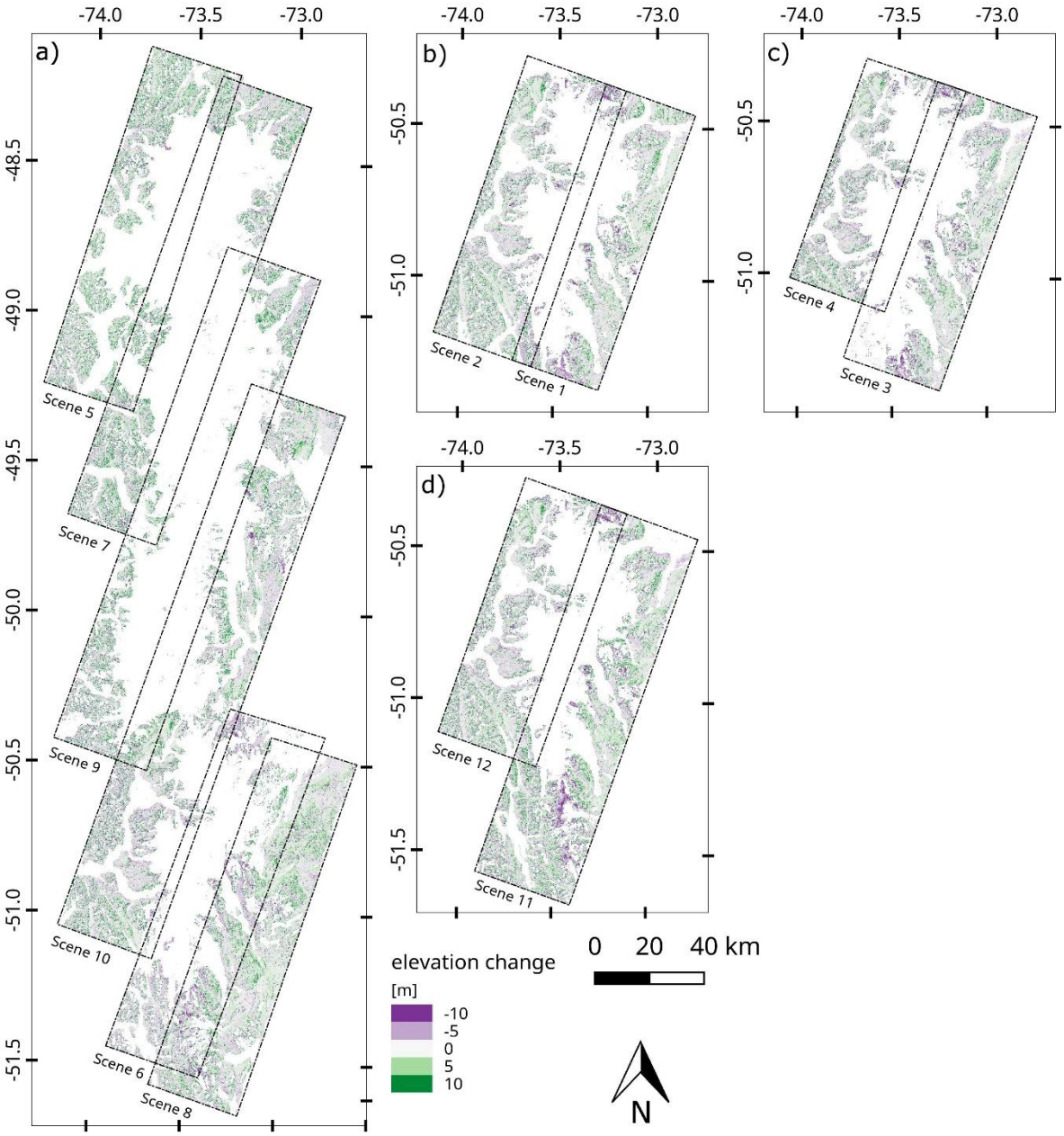

Figure S1. Distribution of elevation changes on off-glacier areas for the different mosaics. The panels show the absolute changes for the timesteps of (**a**) summer 2015/16 (**b**) summer 2012 (**c**) autumn 2014 and (**d**) winter 2015/16.

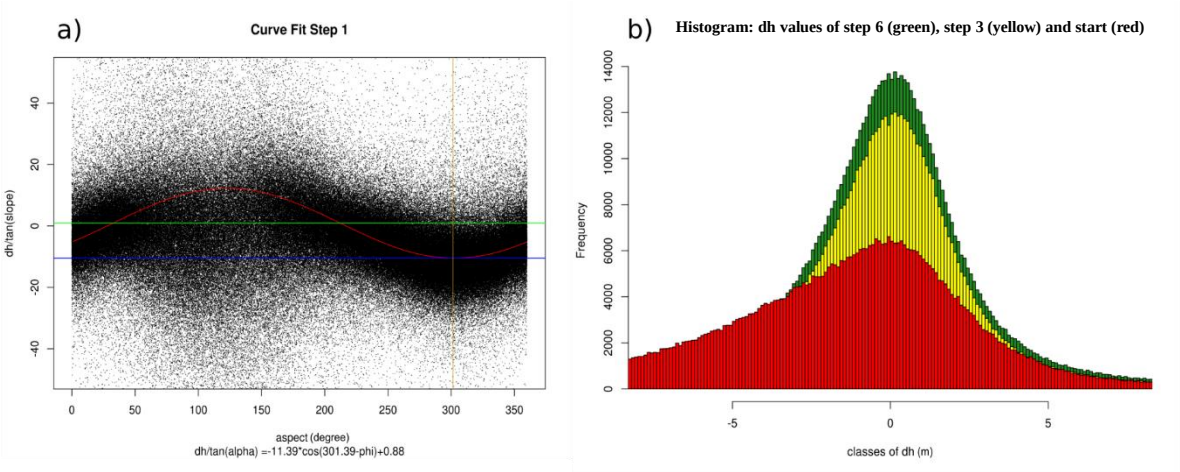

Figure S2. Every Scene as shown in Figure S1 is horizontally co-registered following Nuth and Kääb [24]. (**a**) Curve fit of scene 3 (summer 2012) for the first of 6 iterative steps to horizontally align the respective TDX to the reference SRTM dataset. Colored lines visualize the fitted function parameters (formula at plots bottom): beige vertical is angular offset, blue horizontal: amplitude, green horizontal: oscillation center. (**b**) Histogram showing the improvement of dh offset on non-glaciated ground during the coregistration steps.

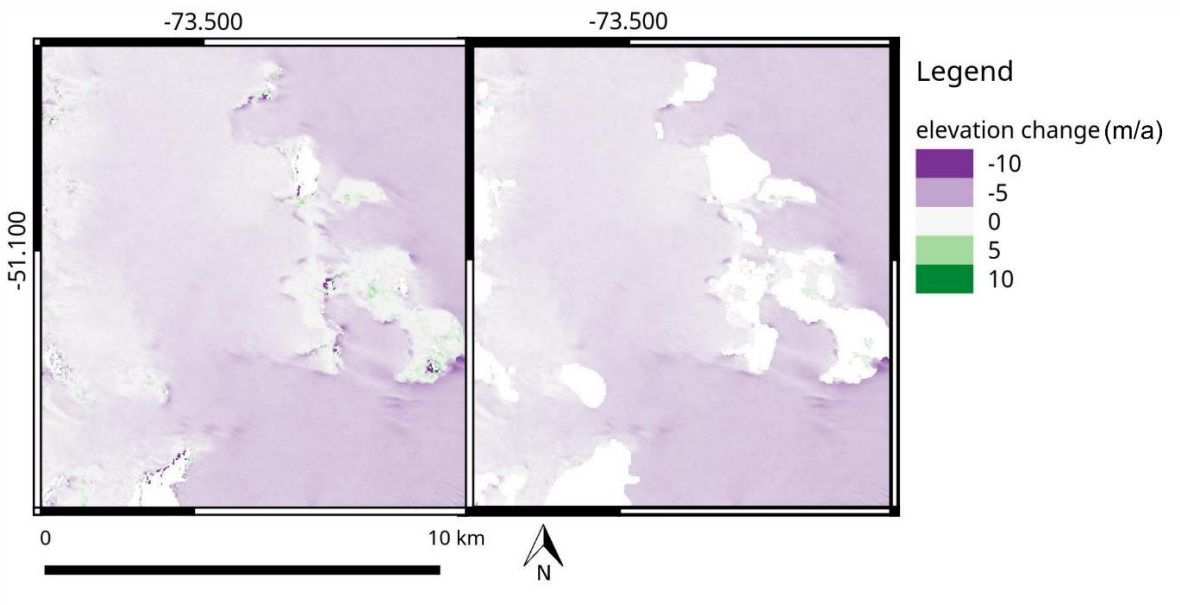

Figure S3. Scene on Tyndall glacier showing dataset before (**left**) and after filtering (**right**). The filter cuts out disproportionately high (low) values in relation to its surrounding.

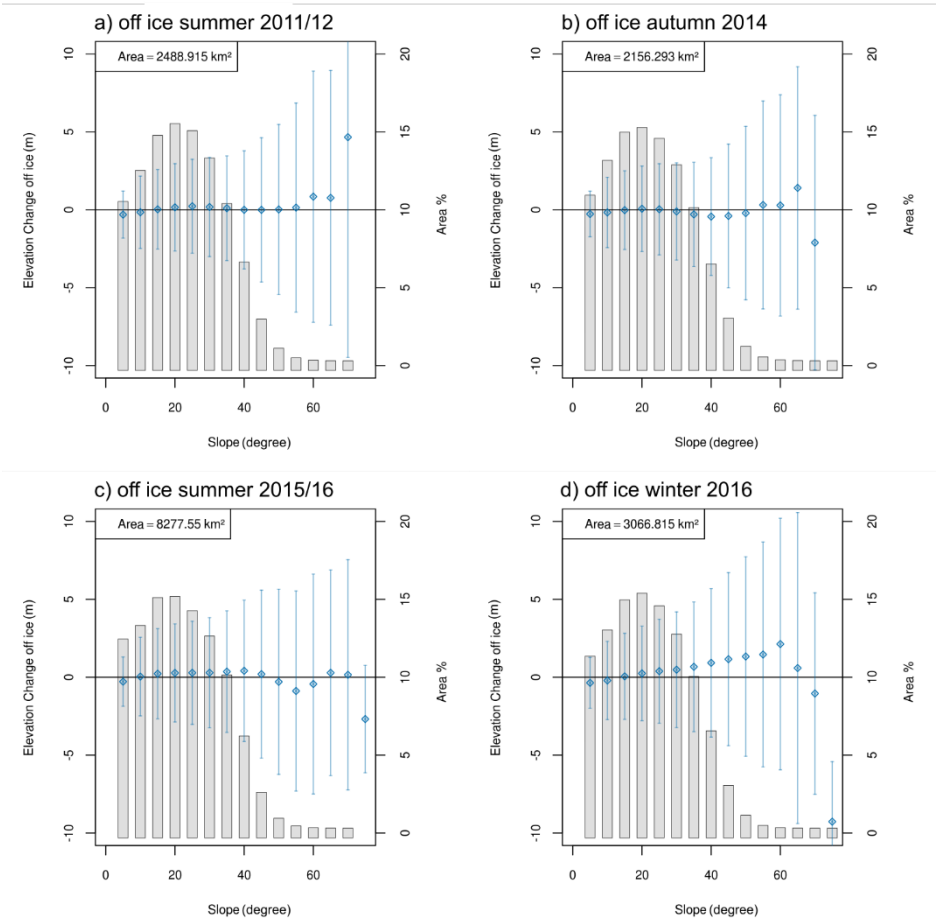

Figure S4. Off-ice elevation changes for different slope bins. Grey bars indicate the area covered while the blue diamonds refer to the median elevation change off ice. Median absolute deviations of elevation changes are given as blue bars. Area weighted mean absolute deviations: (**a**) 2.85 m (**b**) 2.80 m (**c**) 3.14 m (**d**) 3.22 m.

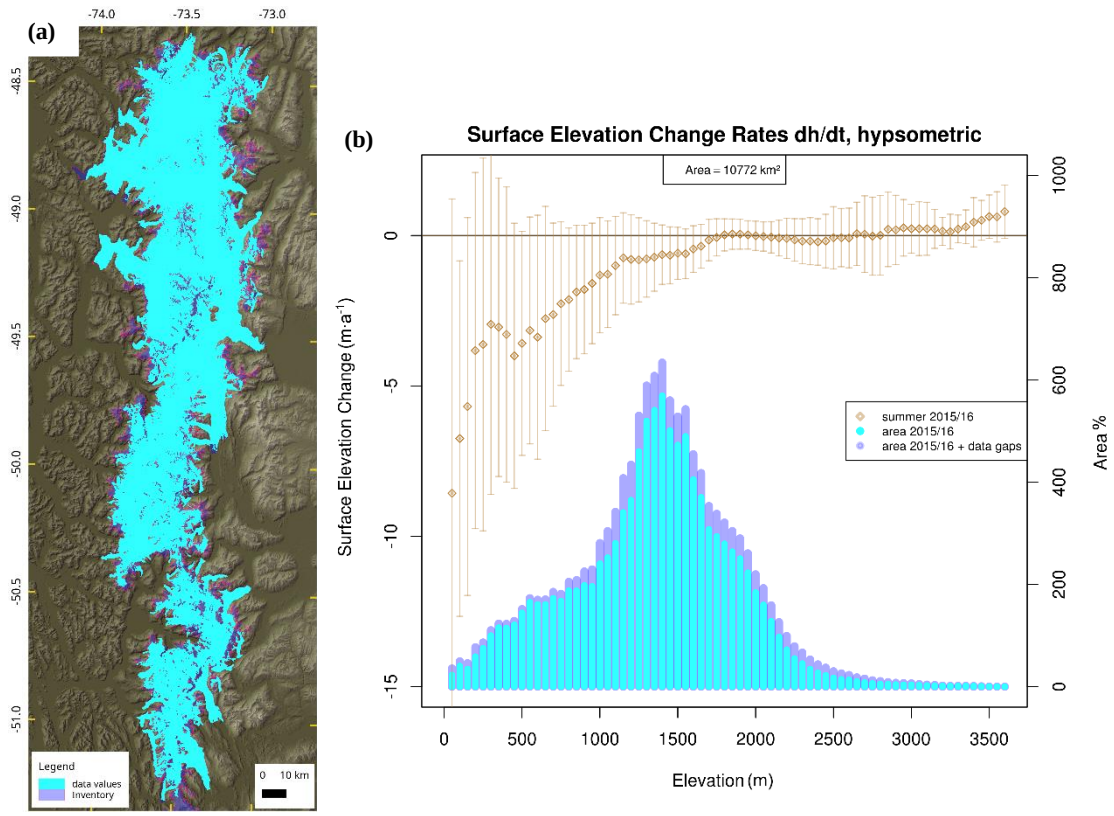

Figure S5. (**a**) Cyan showing coverage of SRTM and TDX data for dh/dt differencing and data gaps to extrapolate for in the inventory. (**b**) hypsometric area distribution; colors similar to a, diamonds and bars draw mean dh/dt and respective sd for each altitudinal bin.

Table S1. List of Landsat scenes used for semiautomatic outline mapping.

Path	Row	Acquisition Date	ID
231	94	02.04.2000	LE07_L1TP_231094_20000402_20170212_01_T1
231	95	01.03.2000	LE07_L1TP_231095_20000301_20170213_01_T1
231	95	07.05.2001	LE07_L1TP_231095_20010507_20170205_01_T1
231	95	27.10.2000	LE07_L1TP_231095_20001027_20170209_01_T1
231	96	07.05.2001	LE07_L1TP_231096_20010507_20170205_01_T1
231	96	27.10.2000	LE07_L1GT_231096_20001027_20170209_01_T2
231	94	19.02.2005	LT05_L1TP_231094_20050219_20161128_01_T1
231	94	22.02.2006	LT05_L1TP_231096_20060222_20161123_01_T1
231	95	19.02.2005	LT05_L1TP_231095_20050219_20161128_01_T1
231	95	22.02.2006	LT05_L1TP_231095_20060222_20161123_01_T1
231	96	19.02.2005	LT05_L1TP_231096_20050219_20161127_01_T1
231	96	22.02.2005	LT05_L1TP_231096_20060222_20161123_01_T1

Table S2. Mean glacier elevation change 2000–2015/16 for various SPI glaciers. ELA, AAR and type are taken from DeAngelis [1], as is Area except for [1]: Upsala was summed up with tributaries Cono and Bertachi (not listed).Unnamed glaciers in [1] where named with corresponding RGI-ID through spatial join with our RGI-based inventory.

Name	Lat (degree)	Lon (degree)	Area (km^2)	ELA (m)	AAR	Dh/dt ($m \cdot a^{-1}$)	Type
HPS12	−49.620	−73.581	165 ± 2.5	1150 ± 30	0.71 ± 0.05	−4.278	E
Jorge Montt	−48.474	−73.509	488 ± 5.9	930 ± 40	0.71 ± 0.04	−4.028	E
Upsala	−49.684	−73.349	834 ± 8.4[1]	1170 ± 30	0.65 ± 0.05	−3.237	D
Tyndall	−51.113	−73.427	309 ± 4.0	940 ±10	0.57 ± 0.05	−2.448	E
Ameghino	−50.442	−73.293	70 ± 2.1	940 ± 40	0.55 ± 0.10	−2.302	E

HPS38	−50.989	−73.635	52 ± 1.6	670 ± 50	0.56 ± 0.10	−2.254	D
RGI50-17.04863	−51.051	−73.590	75 ± 2.0	830 ± 80	0.55 ± 0.08	−2.181	E
Viedma	−49.359	−73.284	974 ± 8.8	1260 ± 30	0.67 ± 0.06	−2.174	D
Bernardo	−48.757	−73.692	334 ± 4.7	860 ± 30	0.69 ± 0.05	−2.083	E
Olvidado	−50.842	−73.235	21 ± 0.9	1000 ± 30	0.66 ± 0.12	−1.731	D
Pascua	−48.436	−73.180	75 ± 2.3	910 ± 30	0.64 ± 0.10	−1.660	D
Occidental	−48.832	−73.868	235 ± 3.8	910 ± 60	0.26 ± 0.06	−1.590	C
Marconi	−49.230	−73.125	19 ± 0.9	1190 ± 80	0.65 ± 0.14	−1.583	E
Dickson	−50.761	−73.226	61 ± 1.4	1010 ± 12.0	0.64 ± 0.07	−1.362	E
Grey	−50.861	−73.337	243 ± 3.7	980 ± 50	0.62 ± 0.06	−1.362	E
RGI50-17.05796	−48.579	−73.678	34 ± 1.1	1110 ± 50	0.84 ± 0.10	−1.171	B
O'Higgins	−48.907	−73.347	762 ± 6.9	1200 ± 20	0.84 ± 0.04	−1.037	D
HPS41	−51.237	−73.506	75 ± 2.3	940 ± 13.0	0.63 ± 0.11	−1.037	E
RGI50-17.16040	−50.767	−73.683	17 ± 0.7	790 ± 60	0.74 ± 0.15	−1.025	D
RGI50-17.04993	−49.776	−73.769	19 ± 0.9	750 ± 30	0.71 ± 0.15	−1.012	D
Chico	−49.102	−73.184	239 ± 4.3	1280 ± 20	0.67 ± 0.06	−0.989	D
Bravo	−48.590	−73.267	103 ± 3.3	1390 ± 70	0.76 ± 0.08	−0.937	B
Grande del Torre	−49.303	−73.072	29 ± 1.0	1370 ± 60	0.58 ± 0.11	−0.800	E
Lucia	−48.451	−73.298	164 ± 4.3	1040 ± 50	0.70 ± 0.08	−0.791	B
Onelli	−50.134	−73.472	49 ± 1.9	1210 ± 120	0.62 ± 0.12	−0.669	E
HPS9	−49.038	−73.615	53 ± 1.4	1130 ± 90	0.63 ± 0.07	−0.632	E
RGI50-17.06038	−48.352	−73.613	14 ± 0.8	920 ± 40	0.69 ± 0.17	−0.614	D
Oriental	−48.496	−73.096	46 ± 1.4	1200 ± 60	0.67 ± 0.08	−0.611	E
Ofhidro	−48.478	−73.698	83 ± 1.9	970 ± 50	0.76 ± 0.07	−0.528	B
RGI50-17.04904	−50.430	−73.837	49 ± 1.3	870 ± 20	0.67 ± 0.08	−0.512	D
Frias	−50.681	−73.119	49 ± 1.7	950 ± 50	0.56 ± 0.10	−0.489	C
RGI50-17.05338	−48.986	−73.206	27 ± 0.8	1220 ± 20	0.68 ± 0.07	−0.489	E
Mayo	−50.433	−73.379	44 ± 1.5	1340 ± 10.0	0.54 ± 0.09	−0.482	E
Amalia	−50.913	−73.529	163 ± 2.8	930 ± 40	0.77 ± 0.05	−0.432	B
RGI50-17.04933	−50.139	−73.864	21 ± 0.8	950 ± 70	0.68 ± 0.12	−0.402	E
RGI50-17.05130	−49.169	−73.102	33 ± 1.0	1470 ± 30	0.71 ± 0.14	−0.392	D
RGI50-17.04906	−50.400	−73.421	12 ± 0.7	690 ± 90	0.53 ± 0.16	−0.357	C
HPS10	−49.525	−73.688	67 ± 1.8	1100 ± 80	0.63 ± 0.07	−0.242	E
Pingo	−50.972	−73.391	70 ± 2.1	970 ± 60	0.78 ± 0.08	−0.202	B
RGI50-17.16039	−50.721	−73.638	33 ± 1.0	860 ± 30	0.82 ± 0.09	−0.199	B
RGI50-17.05439	−48.824	−73.142	14 ± 0.6	1360 ± 30	0.74 ± 0.11	−0.177	D
RGI50-17.05549	−48.760	−73.238	25 ± 1.2	1480 ± 30	0.72 ± 0.11	−0.161	D
HPS8	−48.978	−73.685	35 ± 1.4	970 ± 20	0.88 ± 0.10	−0.116	B
Mayo Norte	−50.307	−73.345	26 ± 0.8	1340 ± 10	0.76 ± 0.08	−0.104	D
RGI50-17.04946	−50.020	−73.810	12 ± 0.6	940 ± 50	0.70 ± 0.15	−0.088	B
RGI50-17.04905	−50.371	−73.736	21 ± 0.8	860 ± 10	0.80 ± 0.11	−0.082	D
RGI50-17.04931	−50.175	−73.857	15 ± 0.6	1150 ± 40	0.72 ± 0.11	−0.059	B
Asia	−50.818	−73.614	114 ± 1.8	800 ± 20	0.77 ± 0.06	−0.058	B
Calvo	−50.696	−73.286	104 ± 1.8	1250 ± 10.0	0.78 ± 0.06	−0.049	B
HPS28	−50.438	−73.475	68 ± 1.5	1270 ± 90	0.68 ± 0.07	−0.042	B
Mellizo Sur	−48.561	−73.167	37 ± 1.0	1730 ± 60	0.72 ± 0.08	−0.041	B
RGI50-17.04891	−50.542	−73.602	32 ± 1.1	950 ± 30	0.72 ± 0.11	−0.019	B
RGI50-17.05363	−48.944	−73.719	41 ± 1.2	960 ± 20	0.92 ± 0.08	−0.005	D
Europa	−50.216	−73.658	404 ± 3.2	940 ± 30	0.94 ± 0.03	0.001	D
RGI50-17.04916	−50.308	−73.468	24 ± 1.0	1460 ± 12.0	0.85 ± 0.09	0.014	E
RGI50-17.05128	−49.163	−73.034	9 ± 0.6	1300 ± 30	0.71 ± 0.18	0.016	E
RGI50-17.16014	−50.346	−73.676	12 ± 0.5	770 ± 30	0.83 ± 0.11	0.030	D
Perito Moreno	−50.563	−73.214	259 ± 3.9	1230 ± 40	0.70 ± 0.04	0.046	B
HPS34	−50.766	−73.482	153 ± 2.0	1240 ± 10.0	0.73 ± 0.06	0.067	D
RGI50-17.04915	−50.350	−73.500	37 ± 1.2	1370 ± 70	0.62 ± 0.10	0.082	B
RGI50-17.04926	−50.208	−73.869	19 ± 0.7	940 ± 40	0.82 ± 0.09	0.087	B
RGI50-17.16035	−50.698	−73.595	27 ± 1.1	690 ± 30	0.71 ± 0.13	0.094	C
Agassiz	−50.030	−73.401	54 ± 1.5	1350 ± 90	0.79 ± 0.09	0.101	D

RGI50-17.04890	−50.552	−73.535	16 ± 0.7	780 ± 18.0	0.75 ± 0.11	0.107	B
RGI50-17.04879	−50.705	−73.413	20 ± 0.6	890 ± 30	0.77 ± 0.09	0.109	B
HPS31	−50.590	−73.403	166 ± 2.2	990 ± 50	0.85 ± 0.04	0.111	B
RGI50-17.04982	−49.844	−73.757	61 ± 1.3	890 ± 80	0.77 ± 0.08	0.117	D
RGI50-17.05505	−48.781	−73.165	11 ± 0.7	1800 ± 10	0.66 ± 0.13	0.124	D
RGI50-17.05835	−48.540	−73.119	28 ± 1.2	1480 ± 40	0.69 ± 0.11	0.134	D
Spegazzini	−50.241	−73.419	119 ± 3.2	1350 ± 40	0.74 ± 0.07	0.147	E
Penguin	−50.060	−73.653	465 ± 3.7	1070 ± 70	0.93 ± 0.03	0.148	D
HPS13	−49.779	−73.546	213 ± 2.3	1140 ± 60	0.92 ± 0.03	0.154	B
HPS29	−50.504	−73.466	79 ± 1.6	1170 ± 70	0.80 ± 0.06	0.179	B
RGI50-17.04963	−49.918	−73.750	39 ± 0.9	1150 ± 10.0	0.80 ± 0.09	0.195	D
HPS15	−49.852	−73.656	99 ± 1.4	950 ± 50	0.86 ± 0.05	0.200	D
RGI50-17.04991	−49.778	−73.630	13 ± 0.5	1000 ± 90	0.72 ± 0.13	0.209	B
HPS19	−49.959	−73.703	163 ± 2.1	1070 ± 60	0.88 ± 0.04	0.245	D
RGI50-17.04959	−49.961	−73.408	12 ± 0.5	1260 ± 50	0.64 ± 0.10	0.303	B
RGI50-17.04884	−50.642	−73.395	16 ± 0.7	1200 ± 23.0	0.61 ± 0.15	0.314	E
RGI50-17.05181	−49.433	−73.708	32 ± 1.1	830 ± 12.0	0.66 ± 0.09	0.657	B
Pío XI	−49.261	−73.625	1234 ± 8.6	930 ± 50	0.81 ± 0.02	0.657	B
RGI50-17.04901	−50.410	−73.739	16 ± 0.7	870 ± 50	0.62 ± 0.13	0.669	B

Reference

1. De Angelis, H. Hypsometry and sensitivity of the mass balance to changes in equilibrium-line altitude: The case of the Southern Patagonia Icefield. *J. Glaciol.* **2014**, *60*, 14–28, doi:10.3189/2014JoG13J127.