Supplementary Materials

Supplementary Table 1: *Glacial erosion, sliding velocity and climate data. MAAT is Mean Annual Air Temperature, and MAP is Mean Annual Precipitation, both derived from ERA-Interim data.*

Location	Latitude	Dynamic context	Erosion rate (mm a^{-1})	Sliding velocity (m a^{-1})	MAAT (°C)	MAP (mm)	Nature and source of erosion data	Nature and source of velocity data
Alaska								
Bench	61	Land-terminating	1.50	1.5	-1.7	2293.0	Meltwater gauging from 1999-2002[1]	Sliding velocity from 1999-2002 glacier-wide velocity study[1]
Crillon	58.6	Tidewater	12.01	636.9	2.5	3157.1	Marine sediments from 1926-1961[2]	Modelled sliding velocity from 1983-1987 surface velocity near calving terminus[3] Surface velocity: 640 m a^{-1} Ice thickness: 160 m[(4)] Surface slope: 0.06 m/m
Grand Pacific	59	Tidewater	24.86	268.6	-1.0	2867.3	Marine sediments (unknown time period); Average of values from[2]	Modelled sliding velocity from 1988-1991 surface velocity near calving terminus[5] Surface velocity: 269 m a^{-1} Ice thickness: 120 m[(4)] Surface slope: 0.05 m/m
Hubbard	60	Tidewater	13.71	3199.5	-3.7	1990.7	Marine sediments from last 700 years[2]	Modelled sliding velocity from 1988-1989 surface velocity near calving terminus[6] Surface velocity: 3200 m a^{-1} Ice thickness: 150 m[(4)] Surface slope: 0.04 m/m
Johns Hopkins	58.8	Tidewater	47.24	787.1	2.2	3114.3	Marine sediments (unknown time period)[2]	Modelled sliding velocity from 1983-1987 surface velocity near calving terminus[3] Surface velocity: 800 m a^{-1} Ice thickness: 200 m[(4)] Surface slope: 0.07 m/m
Kennicott	61.5	Land-terminating	1.00	138.0	-5.8	909.5	Meltwater gauging from 1999 & 2000; Average of values from[7]	Modelled sliding velocity from 2000 surface velocity of lower glacier[8] Surface velocity: 146 m a^{-1} Ice thickness: 350 m[(8,9)] Surface slope: 0.03 m/m
Margerie	59	Tidewater	60.07	672.7	0.3	2986.5	Meltwater gauging (unknown time period; ~1994?)[2]	Modelled sliding velocity from 1988-1991 surface velocity near calving terminus[5] Surface velocity: 679 m a^{-1} Ice thickness: 200 m[(4)] Surface slope: 0.06 m/m
Muir	59	Tidewater	25.10	1697.5	-1.8	2632.7	Marine sediments representing ~2100 years in early Holocene; Average of values from[2]	Modelled sliding velocity from 1988-1991 surface velocity near calving terminus[5] Surface velocity: 1700 m a^{-1} Ice thickness: 100 m[(4)] Surface slope: 0.10 m/m

Variegated	60	Land-terminating	5.19	51.9	-3.9	2631.8	Meltwater gauging from 1982-1984[10]	Sliding velocity assumed from 1982-1984 surface velocity of upper glacier[10]
European Alps								
Argentiere	46.0	Land-terminating	36.00	250.0	5.3	1300.5	Direct measurement from subglacial experiments[11]	Unclear; assumed to be measured sliding velocity[11]
Bossons	45.9	Land-terminating	1.28	76.5	5.4	1286.0	Meltwater gauging (unknown time period); Average of values from[12]	Modelled sliding velocity from 1958 surface velocity close to ELA[13] Surface velocity: 310 m a^{-1} Ice thickness: 134 m[(4)] Surface slope: 0.32 m/m
Gornergletscher	45.9	Land-terminating	1.11	8.4	5.1	1200.7	Meltwater gauging from 1970-1980; Average of values from[2]	Modelled sliding velocity from 2005 surface velocity of lower glacier[14] Surface velocity: 24 m a^{-1} Ice thickness: 250 m[(14)] Surface slope: 0.05 m/m
Haut Glacier d'Arolla	45.95	Land-terminating	2.26	5.3	5.0	1230.1	Meltwater gauging from 1989-1990; Average of values from[7]	Modelled sliding velocity from 1995-1996 surface velocity of lower glacier[15] Surface velocity: 10 m a^{-1} Ice thickness: 103 m[(15)] Surface slope: 0.12 m/m
St Sorlin	45.2	Land-terminating	2.20	7.2	6.4	1146.4	Meltwater gauging (unknown time period)[12]	Modelled sliding velocity from 1958-1967 glacier-wide velocity study[16] Surface velocity: 8 m a^{-1} Ice thickness: 50 m[(4)] Surface slope: 0.18 m/m
Tsanfleuron	46.3	Land-terminating	0.50	4.4	5.7	1331.4	Englacial sediment samples collected from across glacier in 2007[(17)]	Sliding velocity from 2004-2006 borehole survey of lower glacier[18]
Central Asia								
Batura	36.5	Land-terminating	5.85	169.0	-8.1	911.9	Meltwater gauging during 1990 ablation season; Average of values from[12]	Modelled sliding velocity from 1974-1975 surface velocity in middle reaches of glacier[19] Surface velocity: 170 m a^{-1} Ice thickness: 200 m[(4)] Surface slope: 0.03 m/m
Fedchenko	39	Land-terminating	4.36	155.4	-8.6	724.9	Meltwater gauging from 1925-1959[2]	Modelled sliding velocity from 1958 surface velocity in middle reaches of glacier[20] Surface velocity: 263 m a^{-1} Ice thickness: 582 m[(20)] Surface slope: 0.03 m/m
Gangotri	30.9	Land-terminating	1.80	45.4	1.2	1648.5	Meltwater gauging from 2000-2003[(12)]	Modelled sliding velocity from 2007-8 surface velocity close to ELA[21] Surface velocity: 47 m a^{-1} Ice thickness: 210 m[(4)] Surface slope: 0.03 m/m
Raikot	35.4	Land-terminating	5.75	138.9	-2.1	1495.8	Meltwater gauging (unknown time period)[12]	Modelled sliding velocity from 1954 surface velocity in middle reaches of glacier[22]

								Surface velocity: 178 $m\ a^{-1}$ Ice thickness: 235 m[(4)] Surface slope: 0.08 m/m
Siachen	35.3	Land-terminating	0.25	43.0	-11.8	452.19	Meltwater gauging from 1986-1991[(12)]	Modelled sliding velocity from 2008-2009 glacier-wide surface velocity study[23] Surface velocity: 44.9 $m\ a^{-1}$ Ice thickness: 235 m[(4)] Surface slope: 0.03 m/m
Greenland								
Leverett	67	Land-terminating	4.80	150.3	-10.6	332.0	Meltwater gauging from 2009-2010[(24)]	Modelled sliding velocity from 2010 surface velocity of lower glacier[25] Surface velocity: 155 $m\ a^{-1}$ Ice thickness: 405 m[(24)] Surface slope: 0.02 m/m
Mittivakat	65.7	Land-terminating	0.13	6.7	-6.5	1416.6	Proglacial lake sediments from 1970-1994[(12)]	Modelled sliding velocity from 1996-2011 glacier-wide surface velocity study[26] Surface velocity: 8 $m\ a^{-1}$ Ice thickness: 235 m[(4)] Surface slope: 0.09 m/m
Norway								
Bondhusbreen	60	Land-terminating	0.44	29.2	3.0	2004.6	Meltwater gauging from 1968-1986[(2)]	Sliding velocity from 1980-1982 subglacial tunnel instrumentation study[27]
Engabreen	66.7	Land-terminating	0.27	47.5	1.3	1507.4	Meltwater gauging from 1968-1986; Average of values from[2,12,28]	Basal ice velocity from 1996-1997 subglacial tunnel instrumentation study[29]
Nigardsbreen	61.7	Land-terminating	0.13	81.7	0.9	1727.9	Meltwater gauging from 1968-1986; Average of values from[2,12,28]	Modelled sliding velocity from 1968-1969 surface velocity of middle reaches of glacier[30] Surface velocity: 220 $m\ a^{-1}$ Ice thickness: 200 m[(30)] Surface slope: 0.16 m/m
Svalbard								
Broggerbreen	78.9	Land-terminating	0.27	1.8	-8.7	479.6	Meltwater gauging (unknown time period)[2]	Modelled sliding velocity from 1970-1988 surface velocity close to ELA[31] Surface velocity: 2 $m\ a^{-1}$ Ice thickness: 100 m[(32)] Surface slope: 0.04 m/m
Erikbreen	79.5	Lake-terminating	0.19	3.8	-9.5	414.5	Meltwater gauging 1989-1992[(2)]	Sliding velocity from 1990-1991 glacier-wide velocity study[32]
Finsterwalderbreen	77	Land-terminating	1.45	8.2	-5.5	609.9	Meltwater gauging from 1999-2000; Average of values from[33]	Modelled sliding velocity from 1950-1952 surface velocity close to ELA[32] Surface velocity: 14.3 $m\ a^{-1}$ Ice thickness: 260 m[(32)] Surface slope: 0.04 m/m

Hannabreen	79.5	Land-terminating	0.08	1.9	-7.2	517.6	Meltwater gauging 1992[(2)]	Sliding velocity assumed to be ~0.3 times the 1990-1991 surface velocity of lower glacier based on similar observations at Erikbreen[32] Surface velocity: 6.2 $m\ a^{-1}$
Western USA & Canada								
Arapaho	40	Land-terminating	0.13	5.2	2.0	678.1	Proglacial sediments (moraine, lake outlet) sampled during 1972 & 1973[(34)]	Modelled sliding velocity from 1972-1973 surface velocity close to ELA[34] Surface velocity: 5.2 $m\ a^{-1}$ Ice thickness: 11 m[(35)] Surface slope: 0.35 m/m
Nisqually	46.9	Land-terminating	5.00	144.0	7.1	1315.4	Meltwater gauging in 1976[(36)]	Sliding velocity from 1968-1970 surface velocity close to ELA[37]
Washmawupta	51	Land-terminating	0.70	2.7	-1.1	749.5	Meltwater gauging in 2007[(38)]	Sliding velocity from 2006-2008 glacier-wide surface velocity study[38,39]
Iceland								
Breiðamerkurjökull	64.1	Tidewater	2.41	15.0	-1.4	1533.8	Direct measurement; Average of values from[11]	Sliding velocity from subglacial instrumentation study[11]
Hoffellsjökull	64.4	Land-terminating	2.77	294.7	-1.1	1369.4	Meltwater gauging (unknown time period); Average of values from[2]	Modelled sliding velocity from 2002-2003 surface velocity of middle reaches of glacier[40] Surface velocity: 360 $m\ a^{-1}$ Ice thickness: 300 m[(4)] Surface slope: 0.07 m/m
Jökulsa	63.5	Land-terminating	3.00	80.0	3.2	1703.7	Meltwater gauging from 1988-1990; Average of values from[2,12,28]	Sliding velocity below ELA from glacier flow modelling study[41]
Arctic Canada								
Coronation	67	Tidewater	0.86	51.5	-15.6	320.4	Marine sediments representing ~2100 years in early Holocene;[2]	Modelled sliding velocity from 2011-2012 glacier-wide surface velocity study[42] Surface velocity: 52.1 $m\ a^{-1}$ Ice thickness: 301 m[(4)] Surface slope: 0.01 m/m
New Zealand								
Ivory	43.1	Lake-terminating	5.60	29.7	8.6	1943.5	Proglacial lake sediments from 1976-1985[(2)]	Modelled sliding velocity from 1986(?) surface velocity near calving terminus[43] Surface velocity: 30 $m\ a^{-1}$ Ice thickness: 50 m[(4)] Surface slope: 0.13 m/m
Antarctica								

Meserve	77.5	Land-terminating	2.00×10^{-3}	8.0×10^{-3}	-28.7	53.7	Englacial sediment sampled in 1995-1996[(44)]	Sliding velocity from 1995-1996 subglacial instrumentation study[45]

Supplementary Table 2: *Regression relationships of glacier sliding velocity against erosion rate for our dataset combined with averaged data from the Franz Josef Glacier[46] and data from Patagonian and Antarctic tidewater glaciers[47].*

Dataset	**Number of datapoints**	**Exponent (*l*)**	**Correlation coefficient (r^2)**	**p-value**
Our data	38	0.69	0.67	< 0.01
Our data excluding Meserve Glacier outlier	37	0.65	0.54	< 0.01
Our data including Franz Josef Glacier average[8]	39	0.70	0.67	< 0.01
Our data incuding Patagonian tidewater glaciers[20]	43	0.58	0.56	< 0.01
Our data incuding Franz Josef Glacier[8] and Patagonian tidewater glaciers[20]	44	0.58	0.56	< 0.01
Our data including Franz Josef Glacier[8], Patagonian and Antarctic tidewater glaciers[20]	52	0.28	0.10	0.02

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