Supplement of

Local topography increasingly influences the mass balance of a retreating cirque glacier

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Supplement contents:

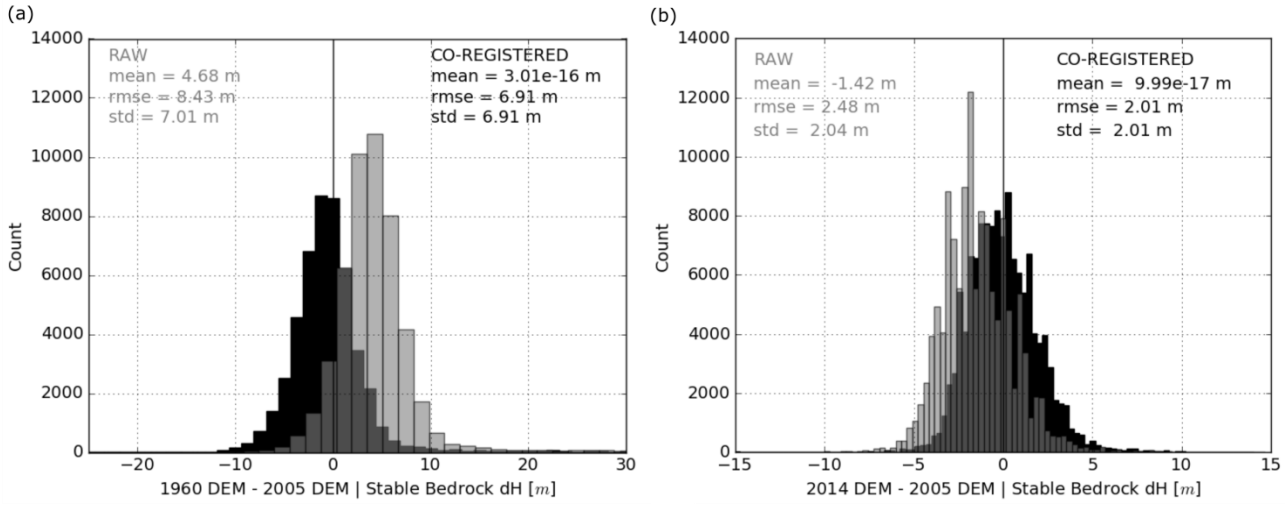

Figure S1: Elevation differences over stable bedrock terrain before (gray bars) and after (black bars) co-registration of the (a) 1960/2005 and (b) 2005/2014 DEMs. Plots show the magnitude (x-axis) and pixel count (y-axis) of elevation differences over stable bedrock terrain that is low-sloping (<30°), and free of vegetation, snow, and ice. Text on the plots reports mean, root mean square error (rmse), and standard deviation (std) of these elevation differences for the raw (gray text) and co-registered (black text) results. The number of pixels used for co-registration for 1960/2005 (n = 23,951) was fewer than for 2005/2014 (n = 127,440) due to the 2005 and 2014 DEMs covering more bedrock terrain.

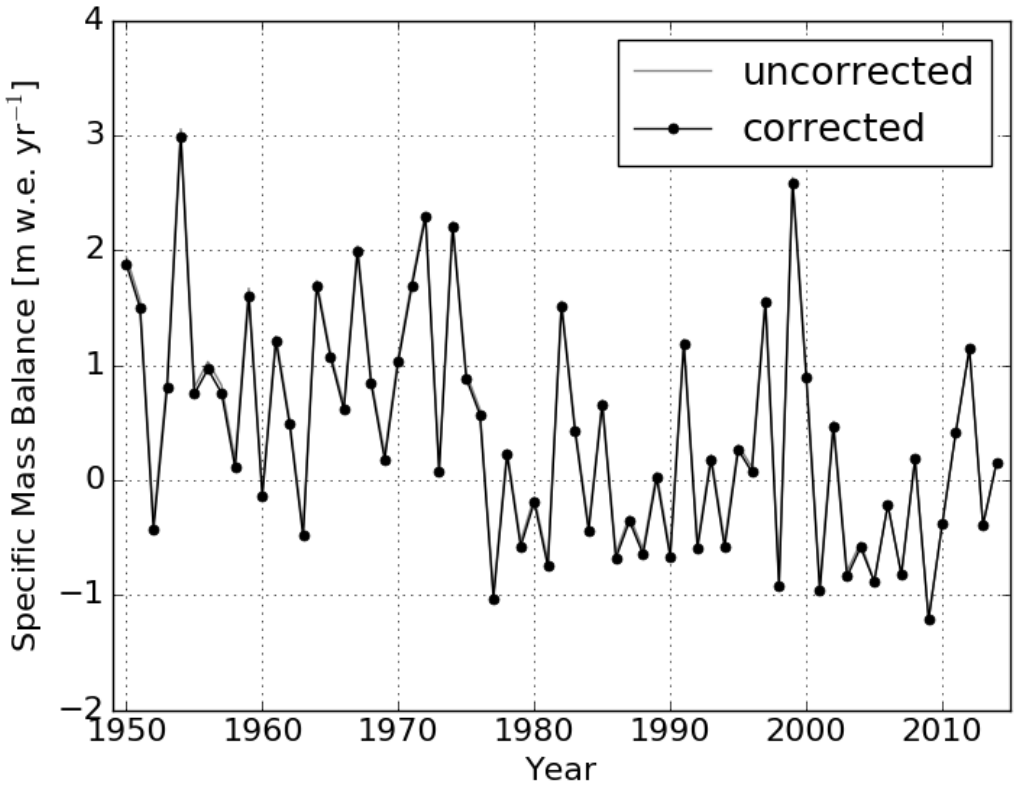

Figure S2: Regression results for 1950-2014 mass balance before (gray line) and after (black line, black dots) correcting for the increasing average glacier elevation through the study period (1950-2014).

Table S1. Digital elevation model (DEM) results for the truncated glacier. Differences from the full glacier results (see Table 2), where 2005-2014 values were used to fill in the missing upper section, are reported in italics.

	Area (m^2 x 10^6)	Mean Elevation (m)	Mean Slope (°)	Mean Aspect (°)
1950 DEM	1.16	2379	15	340 NNE
	-0.14	*-23*	*-2*	*+4*
	-11 %	*-1 %*	*-12 %*	*+1 %*
1960 DEM	1.10	2385	17	339 NNE
	-0.13	*-17*	*-2*	*+4*
	-12 %	*-1 %*	*-11 %*	*+1 %*

Table S2: Geodetic mass balance results for the truncated glacier. The net change in volume (ΔV) and mass (ΔM) are listed, as are mass change rates ($dH\ dt^{-1}$). Differences from full glacier results, where 2005-2014 values were used to fill in the missing upper section (see Table 3), are reported in italics.

	Net Volume Change ΔV ($m^3 \times 10^6$)	Net Mass Change ΔM ($kg \times 10^9$)	Mass Change Rate $dH\ dt^{-1}$ ($m\ w.e.\ yr^{-1}$)
1950-1960	-3.54	-3.00	-0.26
	-0.21	*-0.18*	*-0.04*
	-6 %	*-6 %*	*-18 %*
1960-2005	-12.3	-10.5	-0.21
	-1.00	*-0.82*	*-0.03*
	-9 %	*-9 %*	*-17 %*

Table S3: Snow data that were assessed, but not used in the linear model. Correlation coefficients between glaciological winter mass balance and peak SWE measured at the snow measurement site for 2005-2014. Map distance from Sperry Glacier, snow measurement site elevation, and start of the historical record of the snow data are also listed.

Site	Measurement	r	m_w (unitless)	Distance (km)	Elevation (m)	First Year
Sperry Glacier	-	1	1	0	2450	-
Flattop Mountain	SNOTEL	0.990	2.32	~15	1920	1970
Mount Allen	Snow Course	0.973	2.99	~14	1737	1922
Desert Mountain	Snow Course	0.960	7.93	~27	1707	1937
Piegan Pass	Snow Course	0.959	3.28	~14	1676	1922
Marias Pass	Snow Course	0.939	6.68	~46	1600	1934
Mineral Creek	Snow Course	0.945	7.24	~13	1219	1939