

Supplementary data

Water sources	Places	Sites	Samples
Rivers	Vacas, Cuevas, Tupungato and Mendoza rivers in Punta de Vacas. Cuevas River in Puente del Inca. Horcones Superior and Horcones rivers at Mt. Aconcagua Confluencia Camp.	7	42
Ice bodies	Horcones Inferior Glacier and Mt. Tolosa Rock Glaciers conglomerate.	2	34
Groundwaters	Vertiente del Inca, La Salada Stream, Confluencia Nueva Spring, Confluencia Vieja Spring and geothermal waters of "Copa de Champagne" and "Viejo Túnel", both in "Puente del Inca".	6	41
Precipitations	Collectors at Laguna de Horcones and Confluencia, both in the Mt. Aconcagua Park	2	4
Snow basins	Valle Azul, Los Puquios and Santa María	3	33

Table S1 Sampling along the melting period 2013-2014 in Cordillera Principal geological province. Ice body type classification corresponds to the official inventory of glaciers (IANIGLA-ING, 2015a and b). Sites refers to quantity of sampling sites for each water source.

Francia WE and HI Glacier streamflow	MDS HI m3/s	Soil MDT °C	Air MDT °C	DMaxT °C	DMinT °C	max-min °C
Mean	2.09	7.17	4.90	3.55	0.77	2.72
SD	0.95	3.15	3.35	4.35	3.30	3.02
VC%	45.34	43.90	68.31	122.56	430.53	111.07
Max	4.88	11.60	10.68	11.27	6.41	11.27
Min	0.52	1.35	-3.65	-5.95	-7.28	-5.95
Rock glacier streamflow	MDS Tolosa m3/s					
Mean	0.02					
SD	0.01					
VC%	70.80					
Max	0.05					
Min	0.00					
Lagu WE	Atm Press hPa	Air MDT °C	DMaxT °C	DMinT °C	RH%	
Mean	706.44	11.12	17.82	4.74	37.27	
SD	1.55	2.88	3.41	2.66	17.39	
VC%	0.22	25.89	19.15	56.17	46.67	
Max	710.04	16.57	24.84	11.20	97.60	
Min	703.11	2.89	6.25	-0.53	13.60	

Lagu WE	Soil DMT °C	Wind Dir.°	W mean vel.	W max vel.	SWE (mm)	Incid. Rad.
Mean	12.58	173.07	1.87	15.83	0.00	274.66
SD	2.71	55.19	1.16	3.09	0.00	54.84
VC%	21.57	31.89	62.08	19.53		19.97
Max	17.25	349.05	6.04	22.80	0.00	330.99
Min	6.39	16.36	0.14	7.94	0.00	64.56

Table S2 Mean values (Mean), standard deviation (SD), % variation coefficient (VC %) and maximum (Max) and minimum values (Min) for Francia and Lagu weather stations (WE). Mean daily streamflow (MDS) of Horcones Inferior Glacier (HI) and Tolosa rock glacier conglomerate (Rock glacier). Atmospheric pressure in hPa (Atm Press hPa), air mean daily temperature in °C (Air MDT), daily maximum and minimum temperature in °C (DMaxT and DMinT, respectively), maximum and minimum mean daily temperature (max-min), relative humidity in % (RH%), mean daily soil temperature in °C (Soil MDT), wind direction in degrees (Wind Dir °), mean and maximum wind velocity in m/s (W mean/max vel.), snow water equivalent in mm (SWE) and incident solar radiation in W/m² (Incid. Rad.)

Site-water source / (mean/range)	$\delta^{18}\text{O}$ ‰	$\delta^2\text{H}$ ‰	D‰
Cuevas River Pte. del Inca	-17.5/-18.2- to -16.9	-134.3/-136.5 to -132.2	3.9/0.0-8.9
Cuevas River PV	-18.2/-18.8 to -17.9	-136.8/-141.3 to -134.0	6.8/0.0-9.4
Tupungato River PV	-19.3/-19.6 to -18.9	-144.9/-147.5 to -142.5	6.3/0.0-9.9
Vacas River PV	-19.3/-19.5 to -19.1	-145.5/-147.5 to -143.8	7.1/0.0-9.0
Horcones Inferior Glacier	-20.2/-21.0 to -18.8	-151.1/-157.3 to -139.4	10.7/8.2-12.8
Tolosa rock glaciers conglomerate	-17.0/-17.5 to -15.6	-129.7/-131.6 to -127.6	4.2/-3.1 a 8.9
Valle Azul stream	-17.2/-17.6 to -16.1	-131.8/-133.4 to -129.6	2.3/-4.7 a 7.6
Los Puquios stream	-17.0/-17.5 to -16.0	-129.9/-131.6 to -123.4	4.9/0.0-8.4
Santa María stream	-18.1/-18.5 to -17.35	-138.3/-141.3 to -134.8	5.12/4.3-8.1
Springs	-18.4/-20.2 to -17.4	-139.8/-154.3 to -132.8	6.3/-1.8 a 10.3
Puente del Inca groundwater	-18.3/-18.4 to -18.2	-141.3/-141.8 to -140.8	4.3/4.4-6.26
Precipitation	-12.8/-18.8 to -8.7	-86.2/-143.9 to -48.5	16.0/6.2-21.0

Table S3 Mean and range water stable isotopes and deuterium excess (D) composition values for different water sources. PV refers to the samples taken in “Punta de Vacas” site. Pte. del Inca refers to the samples in “Puente del Inca” location.

Site-water source / (mean/range)	(me/L) Na ⁺	(me/L) K ⁺	(me/L) Ca ⁺²	(me/L) Mg ⁺²
Cuevas River Pte del Inca	8.67/5.00-11.00	0.03/0.00-0.10	10.30/8.40- 13.80	3.67/2.80-5.30
Cuevas River PV	6.08/2.20-15.00	0.05/0.00-0.10	9.80/5.70-12.50	3.26/1.30-7.40
Tupungato River PV	3.85/1.30-13.00	0.00/0.00-0.00	6.33/4.00-15.20	2.77/1.90-3.30
Vacas River PV	0.83/0.70-1.10	0.00/0.00-0.00	3.64/2.40-4.70	1.57/1.20-2.00
Horcones Inferior glacier	1.44/0.80-3.00	0.05/0.00-1.00	4.52/2.30-10.30	1.67/0.80-5.30
Tolosa rock glaciers	0.27/0.10-0.40	0.00/0.00-0.00	5.86/4.00-8.10	2.82/0.60-4.50
Valle Azul stream	0.36/0.30-0.40	0.00/0.00-0.00	2.46/1.40-3.60	1.35/0.60-2.10
Los Puquios stream	0.80/0.50-1.10	0.00/0.00-0.00	1.05/0.40-3.00	0.26/0.20-1.20
Santa María stream	0.55/0.20-1.10	0.00/0.00-0.00	1.41/0.80-2.30	0.56/0.30-0.80
Springs	1.29/0.20-10.00	0.01/0.00-0.30	21.29/3.30- 29.60	6.29/1.00- 10.50
Puente del Inca groundwater	275.20/110.00- 550.00	3.50/1.00-5.00	47.65/40.50- 57.90	8.67/2.60- 15.60
Precipitation	na/na	na/na	na/na	na/na

Table S4 Mean and range cations values for the different water sources

Site-water source / (mean/range)	(me/L) HCO₃⁻	(me/L) SO₄⁻²	(me/L) Cl⁻
Cuevas River Pte del Inca	2.51/1.97-2.78	10.90/9.60-12.10	8.20/6.10-11.00
Cuevas River PV	1.99/1.73-2.44	9.51/7.70-14.20	5.51/3.10-12.30
Tupungato River PV	1.87/1.73-2.03	6.88/4.40-14.20	3.28/1.10-12.10
Vacas River PV	1.63/1.42-1.84	3.63/2.50-5.00	0.54/0.30-1.30
Horcones Inferior glacier	1.42/0.96-3.55	5.33/2.50-11.70	0.70/0.10-1.30
Tolosa rock glaciers	1.74/1.09-2.40	6.80/4.40-9.20	0.34/0.00-1.70
Valle Azul stream	1.48/1.13-1.80	2.30/1.00-3.30	0.27/0.00-1.20
Los Puquios stream	1.42/1.09-2.33	0.44/0.10-1.90	0.15/0.00-0.70
Santa María stream	1.47/1.22-1.80	0.74/0.10-1.30	0.24/0.10-0.70
Springs	3.16/1.84-4.62	23.10/1.00-31.30	1.13/0.00-7.30
Puente del Inca groundwater	27.09/23.80- 28.11	83.70/26.00- 343.80	213.80/77.20- 311.3
Precipitation	na/na	na/na	na/na

Table S5 Mean and range anions values for the different water sources

Site-water source / (mean/range)	pH	EC ($\mu\text{S/cm}$)
Cuevas River Pte del Inca	7.72/7.68-7.75	1839/1473-2205
Cuevas River PV	8.0/7.80-8.15	1461/544-2094
Tupungato River PV	7.60/6.87-8.03	834/626-1031
Vacas River PV	7.82/7.13-8.10	566/391-665
Horcones Inferior glacier	7.41/7.41-7.41	674/424-1033
Tolosa rock glaciers	7.74/6.84-8.19	809/640-1093
Valle Azul stream	8.05/7.28-8.90	431/286-515
Los Puquios stream	8.12/7.72-8.64	144/98-176
Santa María stream	7.87/6.59-8.41	238/121-324
Springs	7.63/6.72-8.60	2187/1340-2950
Puente del Inca groundwater	6.24/6.19-6.29	22682/20500-23440
Precipitation	na/na	na/na

Table S6 pH and electric conductivity (EC) for the different water sources

Weather event	Date	MODIS	Rangers	Lagu	France	Cache.	Polv.	PV
Light snowfall in Tolosa rock glaciers conglomerate (and something in Horcones Inferior Glacier) areas	November 14th & 19th to 21 st 2013	X	X					
Rain	11/25/2013		X			X		
Rain	12/25/2013		X			10.5mm		
Rain	January 16th to 18th 2014		X			X	X	X
Rain	January 26th to 27 2014		X					
Rain and light snowfall	February 14th to 18th 2014	X	X			X	X	
light snowfall (less than 10 cm)	February 24th & 25th 2014	X	X			X	X	
light snowfall	March 1st & 2nd 2014	X	X			X	X	

Table S7 Precipitation records from weather stations, MODIS satellite imagery and Mt. Aconcagua Rangers daily records. Cache., Polv. and PV refers to Cacheuta, Polvaredas and Punta de Vacas National Hydric Resources Secretariat weather stations, respectively.