

SITE ASSESSMENT · GILGIT-BALTISTAN · 20 OCTOBER 2026

Gilgit-Baltistan Glaciers & Water 2000–2026

How fast the ice is going, what is driving it, and what it means for water

RegenX.eco Geospatial Computational Model
Designed and prepared by Mr. Dinar Wali

RGI 7.0 · Hugonnet 2021 · GRACE/GRACE-FO · MODIS · ERA5-Land · CMIP6 · Sentinel-2 · Google Earth Pro



Baltoro Glacier, Sentinel-2 L2A, 29 Aug 2026

The ice is going faster, and heat is driving it

12,880 km²

Glacier area in GB

8,633 glaciers, RGI 7.0 (10,738 km² without the Siachen sector).

-0.120

Loss 2015–19, m w.e./yr

Up from +0.043 in 2000–04: loss grew every five years. -1.5 Gt of water a year.

-2.4 to -4.1

Stored water, km³/yr

GRACE total storage trend since 2018 (GFZ to CSR); 2026 is the lowest year.

+2.8 °C

Summer 2025 vs normal

Warmest GB summer on record (ERA5-Land); winters near-normal.

Gilgit-Baltistan is spending its ice buffer. Glacier loss has accelerated since 2000, stored water fell sharply after 2023, and every recent hot summer left the glaciers barer. Snowfall has not declined: the driver is heat, and the models say summers warm another 1.3–1.7 °C by mid-century.

1 Gt of ice melted = 1 km³ = 1 billion m³ of water.

Six independent satellite layers



Glaciers

RGI 7.0 outlines + Hugonnet et al. 2021 elevation change
8,633 glaciers · 2000–2019 · 100 m



Stored water

GRACE/GRACE-FO from UT-CSR, GFZ and NASA-JPL
Apr 2002 – Aug 2026 · ~300 km



Snow

MODIS Terra MOD10A1 snow cover
2001 – Sep 2026 · 500 m daily



Climate

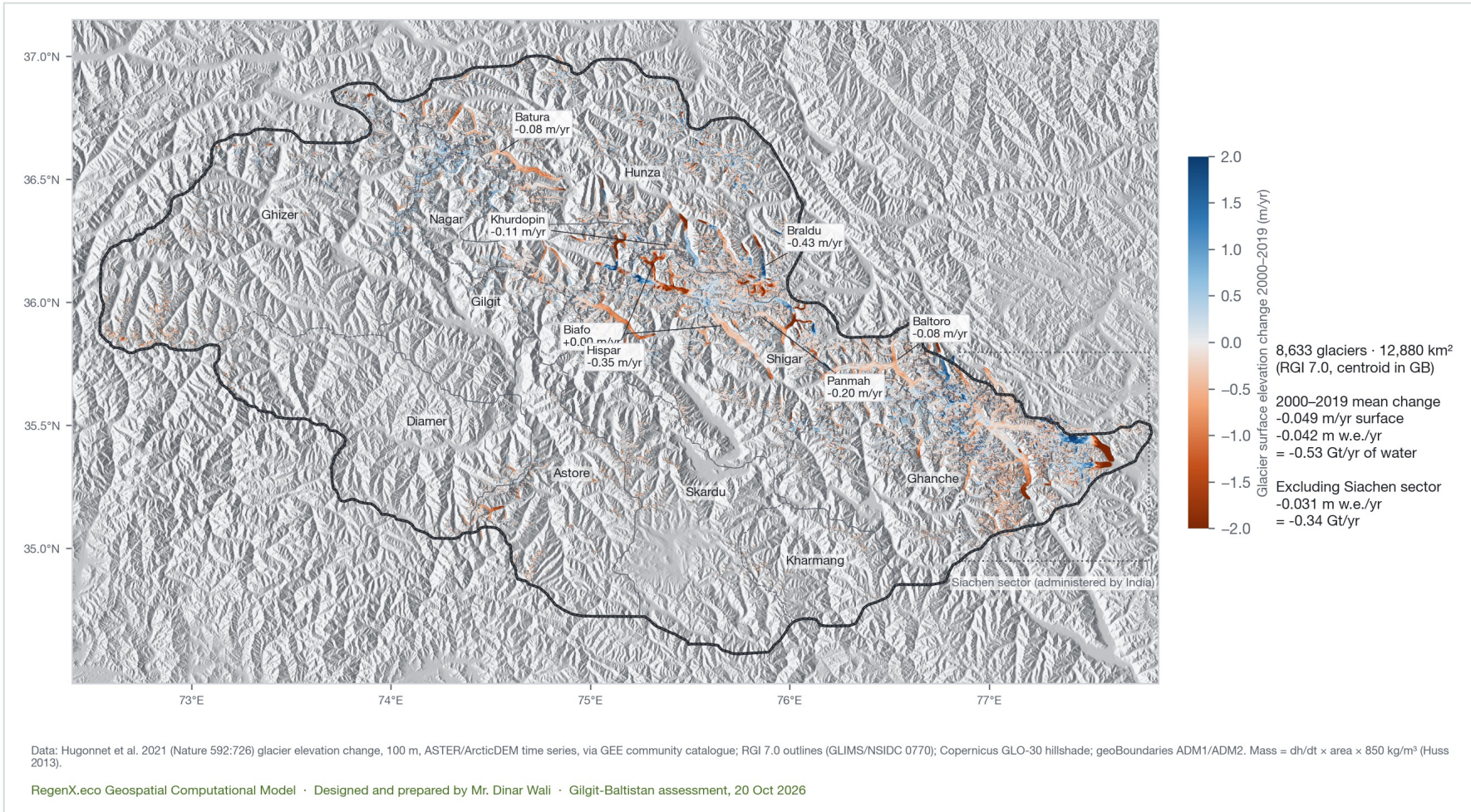
ERA5-Land observed; NEX-GDDP-CMIP6 projected (12 models)
2000–2026 · 1985–2100



Imagery

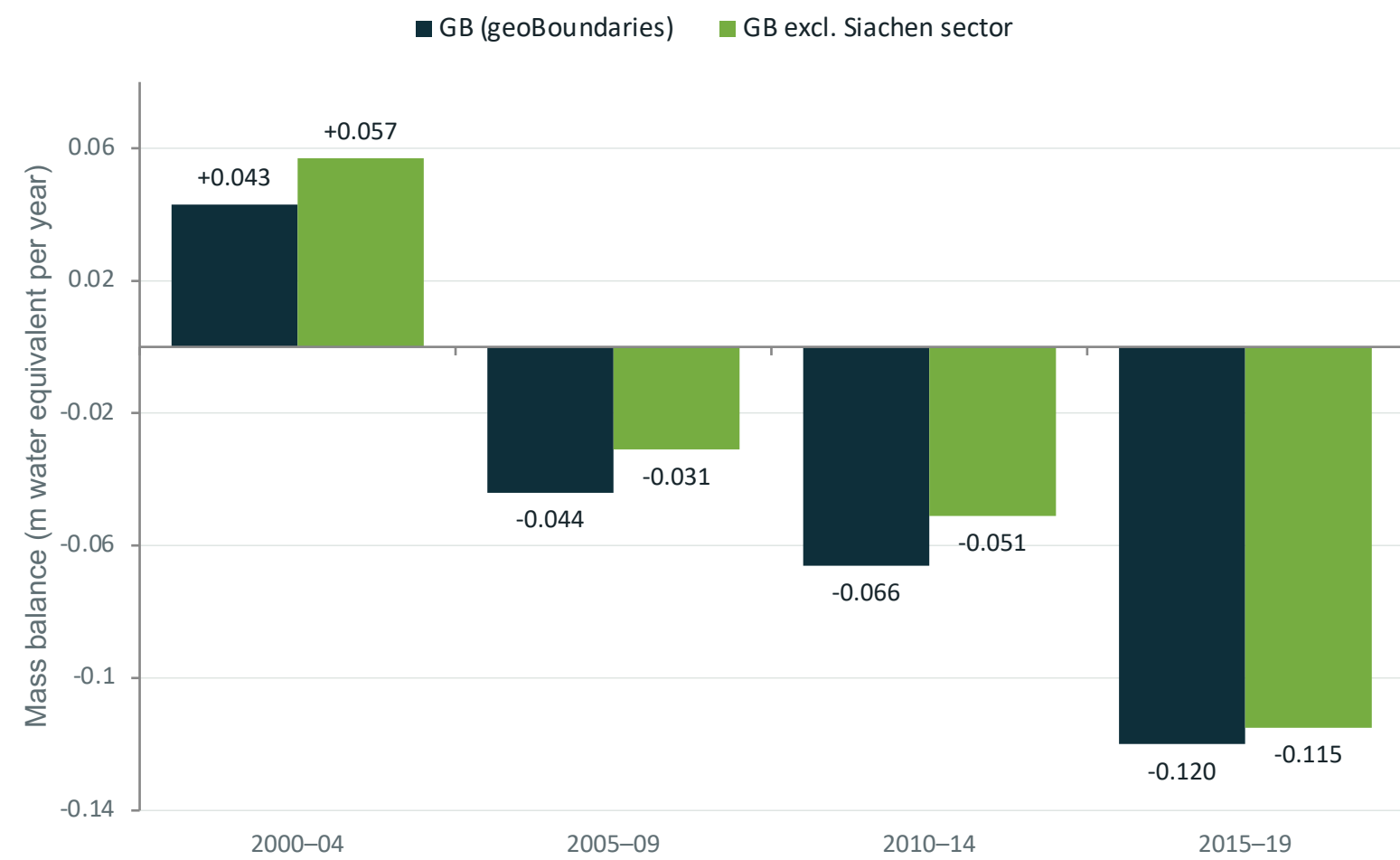
Sentinel-2 L2A (Copernicus Browser + Earth Engine); Google Earth Pro Airbus/Maxar
2010 – Oct 2026 · 0.5–10 m

Thinning is concentrated in the big Karakoram valleys



- **Hispar** -0.35 m/yr, **Braldu** -0.43, **Panmah** -0.20 (2000–19 means).
- **Baltoro and Batura** -0.08 m/yr: near balance, the 'Karakoram anomaly'.
- **Shigar, Ghanche, Hunza** hold most of the ice and most of the loss.

Glacier loss grew in every five-year period



-0.10

m w.e./yr per decade
The rate of acceleration, with or without the Siachen sector.

-1.5 Gt/yr

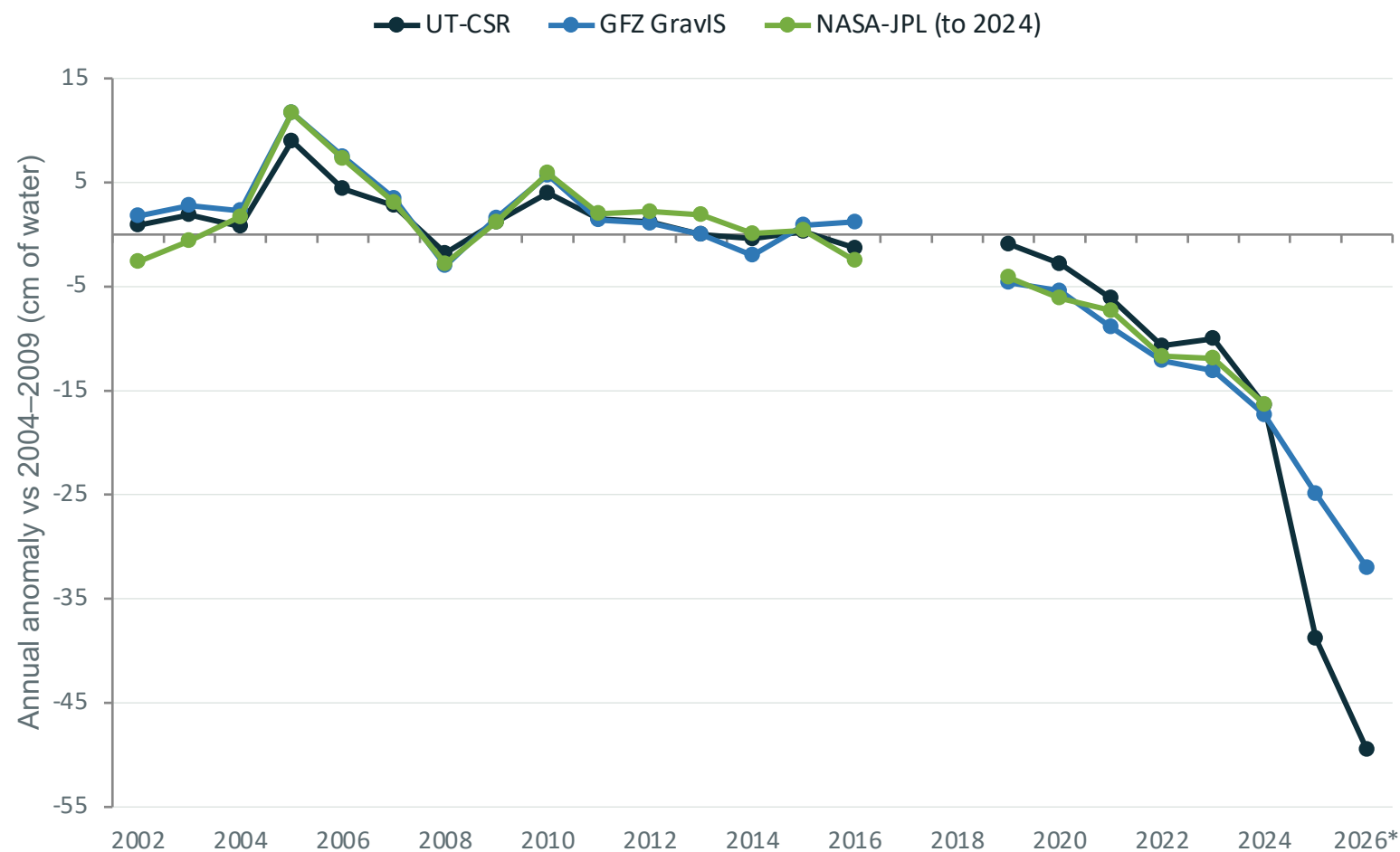
of water in 2015-19
Up from a small gain of +0.5 Gt/yr in 2000-04.

2.7×

faster loss than 2005-09
From -0.044 to -0.120 m w.e. per year.

Hugonnet et al. 2021, 100 m, 92 % of glacier area with valid data; ice/firn density 850 kg/m³.

Stored water fell sharply after 2023



$r = 0.95-0.97$

Three solutions agree to 2024

2024: CSR -16.4, GFZ -17.3, JPL -16.3 cm.

-32 to -50 cm

2026 anomaly (Jan–Aug)

GFZ to CSR: same direction, 35 % apart in size.

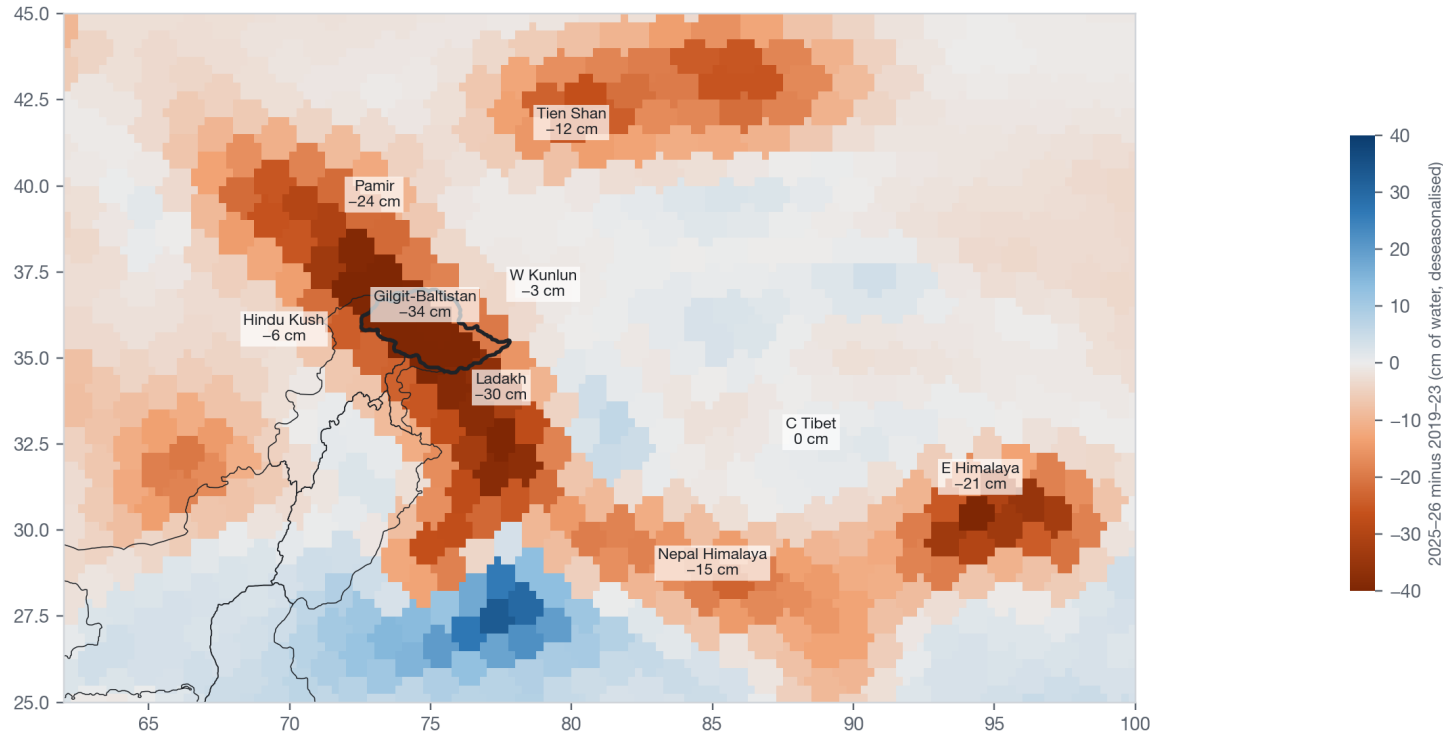
-2.4 to -4.1

km³ per year since 2018

GFZ -3.41 to CSR -5.93 cm/yr over 69,078 km².

Seasonal cycle removed. 2017–18: mission gap. *2026 = Jan–Aug. GB spans 1–2 GRACE mascons: read annual means only.

The 2025–26 drop follows the Karakoram belt

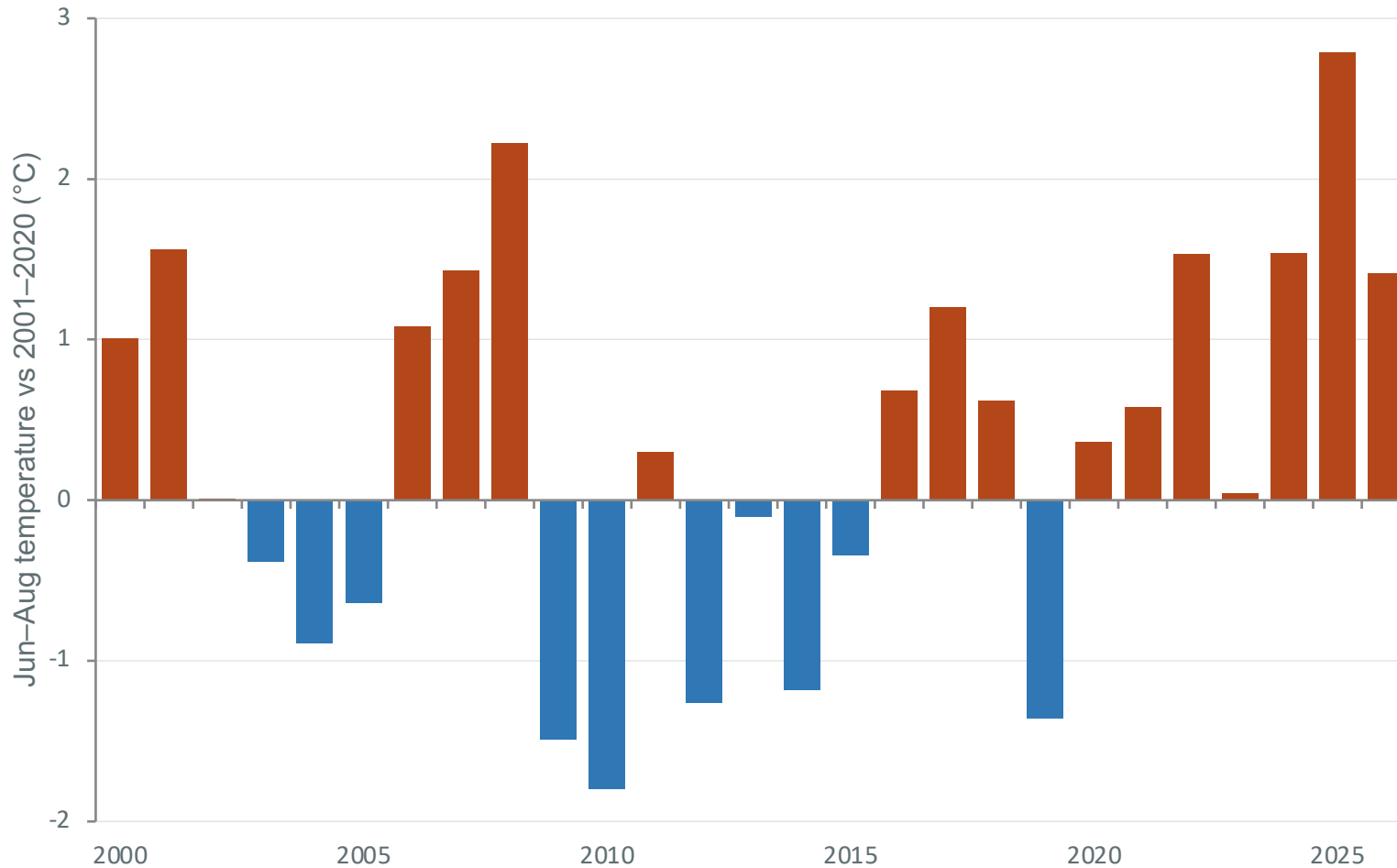


Data: UT-CSR RL06.3 mascons, monthly 2019–2026; per-cell monthly climatology 2004–2022 removed; mean Jan 2025–Aug 2026 minus mean 2019–2023. Box values are area means of the named boxes.

RegenX.eco Geospatial Computational Model · Designed and prepared by Mr. Dinar Wali · Gilgit-Baltistan assessment, 20 Oct 2026

- **Biggest falls:** GB –34 cm, Ladakh –30, Pamir –24.
- **Little change:** western Kunlun –3, central Tibet 0.
- **So it is real:** a uniform satellite offset would move every region alike.

Hot summers, not missing snow, drive the melt



+2.8 °C

Summer 2025

Warmest in the record; 2026 +1.4 °C.

-5 %

Winter precipitation 2025, 2026

Near normal: missing snowfall does not explain the low.

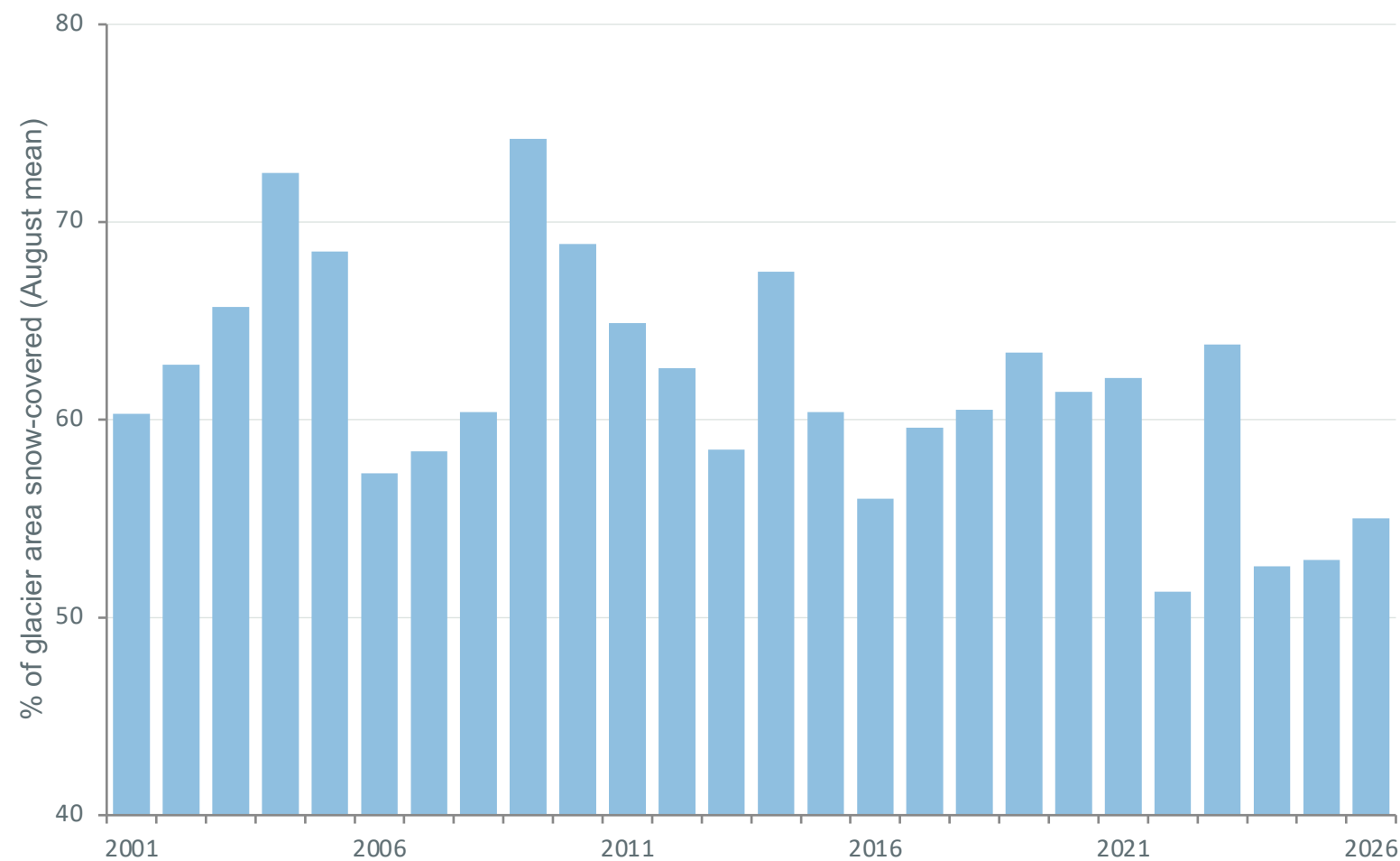
$r = -0.79$

Warm summer ↔ bare glaciers

ERA5 vs MODIS, 26 years, $p \approx 10^{-6}$.

ERA5-Land monthly, GB area mean.

Less snow survives on the ice each August



MODIS Terra MOD10A1 v6.1, NDSI snow cover ≥ 40 , cloud-free days, RGI 7.0 glacier area.

-0.4 pts/yr

August glacier snow trend

Mann-Kendall $p = 0.04$; OLS $p = 0.005$.

2022 · 2024 · 2025

The three barest Augusts

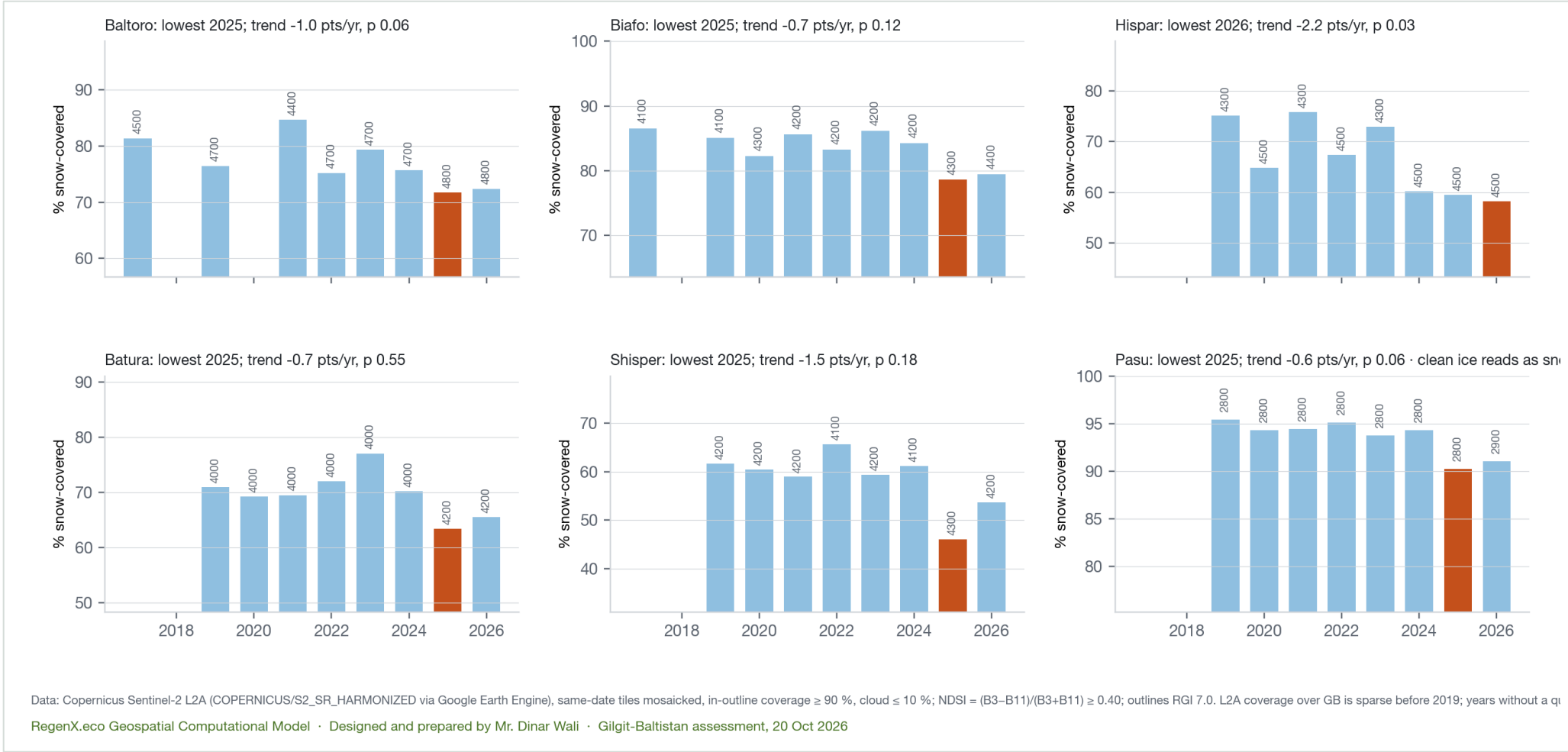
51–53 % snow against a 63 % normal.

No trend

in seasonal snow over GB

Spring varies $\pm 20\%$ a year; 2025 -14% , 2026 normal.

Six key glaciers: 2025–26 are the barest yet



Bars: % snow-covered at the scene nearest 1 September; numbers: snow-line altitude (m). Only Hispar's decline is significant (p 0.03). Passu is clean ice: not interpretable.

Shisper surged far beyond its 1997 outline

Shisper Glacier — the tongue then and now

Same camera (9 km range, top-down) at each historical imagery date available in Google Earth Pro



Imagery date 2010-11-09 · provider credit on image



Imagery date 2016-06-19 · provider credit on image



Imagery date 2026-08-29 · provider credit on image

— RGI 7.0 glacier outline, drawn by Google Earth from KML — mapped 1997-08-10 (historical snapshot)

Shisper Glacier: 36.8 km², 2,586–7,542 m · surface change +0.16 m/yr (2000–04) to -0.05 m/yr (2015–19), Hugonnet et al. 2021 · Sentinel-2 end-of-summer snow 62 % (2019) to 54 % (2026)

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- **2010 and 2016:** the tongue ends near its 1997 RGI outline (yellow).
- **2026:** ice has pushed well past that outline into the main valley — the 2018–20 surge.
- **Why it matters:** surging ice dammed the valley and caused the Hassanabad outburst floods, even while GB as a whole loses ice.

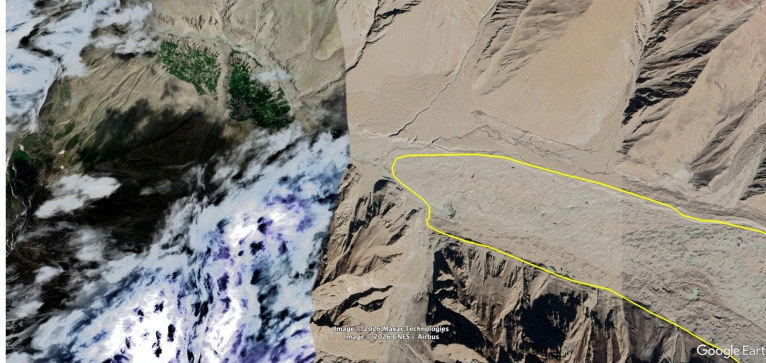
Hispar: the fastest thinning of the six

Hispar Glacier — the tongue then and now

Same camera (9 km range, top-down) at each historical imagery date available in Google Earth Pro



Imagery date 2010-11-03 · provider credit on image



Imagery date 2013-10-08 · provider credit on image



Imagery date 2022-09-03 · provider credit on image

— RGI 7.0 glacier outline, drawn by Google Earth from KML — mapped 1997-08-10 (historical snapshot)

Hispar Glacier: 450.0 km², 3,078–7,839 m · surface change +0.07 m/yr (2000–04) to -0.86 m/yr (2015–19), Hugonnet et al. 2021 · Sentinel-2 end-of-summer snow 75 % (2019) to 58 % (2026)

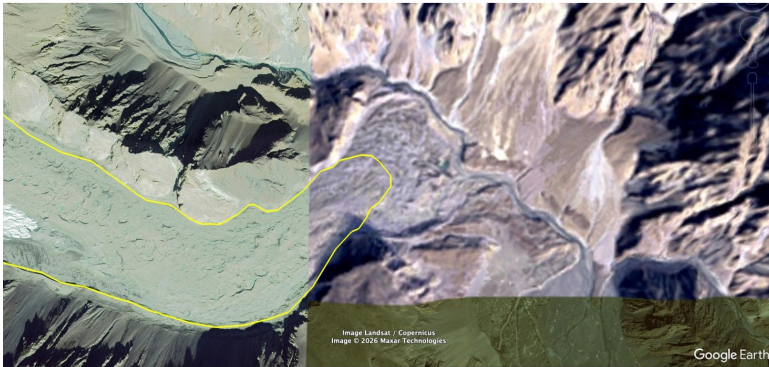
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- **2010/2013/2022:** the terminus sits near its 1997 outline at all three dates; no clear length change at this scale.
- **Thinning:** +0.07 m/yr in 2000–04 became -0.86 m/yr in 2015–19, the fastest of the six key glaciers.
- **Snow:** end-of-summer snow fell from 75 % (2019) to 58 % (2026), the only statistically significant decline (p 0.03).

Batura: the tongue keeps its length, loses height

Batura Glacier — the tongue then and now

Same camera (9 km range, top-down) at each historical imagery date available in Google Earth Pro



Imagery date 1985-12-31 · provider credit on image



Imagery date 2016-09-28 · provider credit on image



Imagery date 2022-05-27 · provider credit on image

— RGI 7.0 glacier outline, drawn by Google Earth from KML — mapped 1997-08-10 (historical snapshot)

Batura Glacier: 269.1 km², 2,618–7,743 m · surface change +0.12 m/yr (2000–04) to -0.26 m/yr (2015–19), Hugonnet et al. 2021 · Sentinel-2 end-of-summer snow 71 % (2019) to 65 % (2026)

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- **1985/2016/2022:** the debris-covered tongue fills its 1997 outline to the end at every date; the earliest frame is a mixed Landsat and Maxar mosaic.
- **Thinning:** surface change went from +0.12 m/yr (2000–04) to -0.26 m/yr (2015–19).
- **Snow:** end-of-summer snow on the glacier fell from 71 % (2019) to 65 % (2026); 2025 was the lowest.

Baltoro: GB's largest glacier holds near balance

Baltoro Glacier — the tongue then and now

Same camera (9 km range, top-down) at each historical imagery date available in Google Earth Pro



Imagery date 2010-03-20 · provider credit on image



Imagery date 2016-11-01 · provider credit on image



Imagery date 2019-09-25 · provider credit on image

— RGI 7.0 glacier outline, drawn by Google Earth from KML — mapped 2002-07-10 (historical snapshot)

Baltoro Glacier: 790.2 km², 3,390–8,564 m · surface change -0.06 m/yr (2000–04) to -0.05 m/yr (2015–19), Hugonnet et al. 2021 · Sentinel-2 end-of-summer snow 81 % (2017) to 72 % (2026)

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- **2010/2016/2019:** the debris-covered snout sits on its 2002 outline at every date (2019 is Earth's newest high-resolution tile here).
- **Near balance:** surface change -0.06 m/yr (2000–04) and -0.05 m/yr (2015–19) — the 'Karakoram anomaly' at work.
- **But the snow line is rising:** end-of-summer snow fell from 81 % (2017) to 72 % (2026); the snow line rose to 4,800 m in 2025–26.

Biafo: a debris-covered snout that hides its losses

Biafo Glacier — the tongue then and now

Same camera (9 km range, top-down) at each historical imagery date available in Google Earth Pro



Imagery date 2010-09-20 · provider credit on image



Imagery date 2016-09-28 · provider credit on image



Imagery date 2019-09-25 · provider credit on image

— RGI 7.0 glacier outline, drawn by Google Earth from KML — mapped 1997-08-10 (historical snapshot)

Biafo Glacier: 532.0 km², 3,049–6,687 m · surface change +0.17 m/yr (2000–04) to -0.17 m/yr (2015–19), Hugonnet et al. 2021 · Sentinel-2 end-of-summer snow 87 % (2017) to 79 % (2026)

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- **2010/2016/2019:** the rubble-covered terminus sits on its 1997 outline at every date (2019 is Earth's newest high-resolution tile here).
- **Thinning:** +0.17 m/yr in 2000–04 turned to -0.17 m/yr in 2015–19: debris cover slows retreat, so loss shows up as lowering.
- **Snow:** end-of-summer snow on the glacier fell from 87 % (2017) to 79 % (2026), with 2025 the lowest.

Passu: the tongue holds its place but thins

Pasu Glacier — the tongue then and now

Same camera (9 km range, top-down) at each historical imagery date available in Google Earth Pro



Imagery date 2010-04-14 · provider credit on image



Imagery date 2016-06-19 · provider credit on image



Imagery date 2026-07-20 · provider credit on image

— RGI 7.0 glacier outline, drawn by Google Earth from KML — mapped 1997-08-10 (historical snapshot)

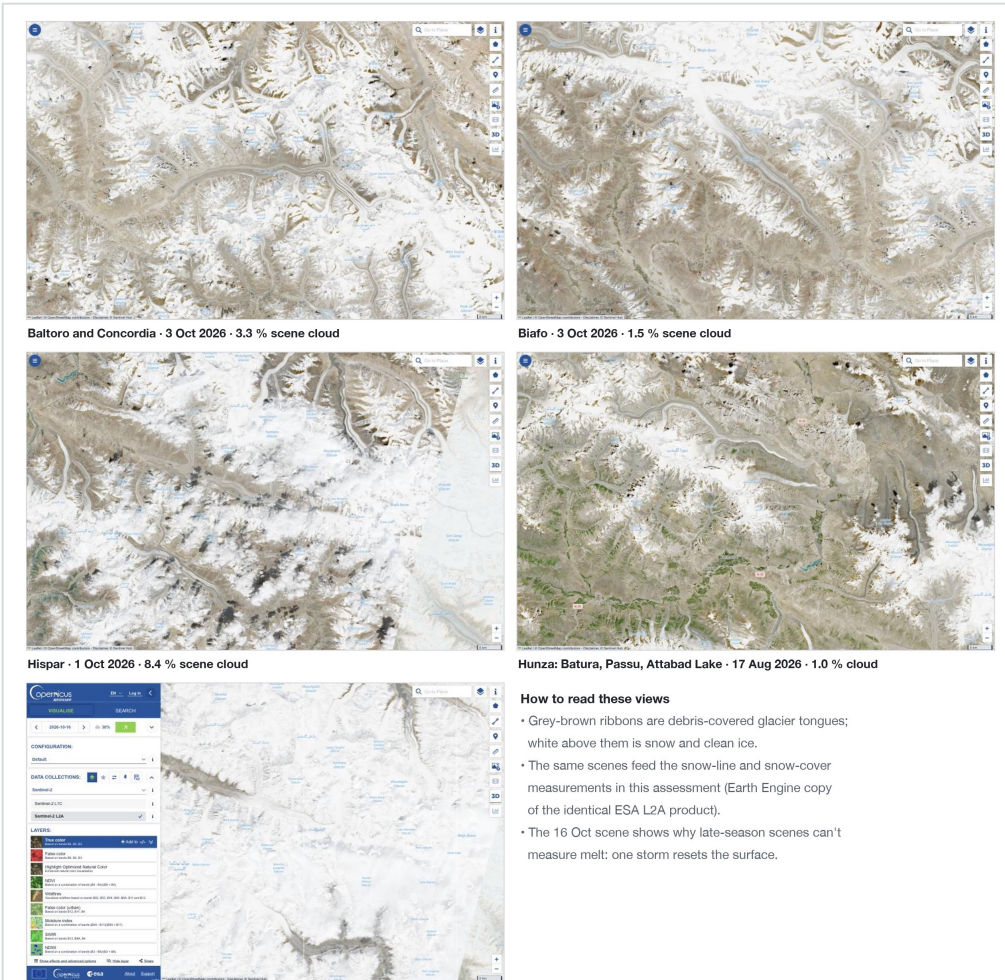
Pasu Glacier: 61.9 km², 2,572–7,544 m · surface change +0.02 m/yr (2000–04) to -0.42 m/yr (2015–19), Hugonnet et al. 2021 · Sentinel-2 end-of-summer snow 95 % (2019) to 91 % (2026)

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- **2010, 2016, 2026:** the clean-ice tongue ends close to its 1997 outline at all three dates; no clear advance or retreat at this zoom.
- **Thinning:** surface change went from +0.02 m/yr (2000–04) to -0.42 m/yr (2015–19) — the ice is losing height, not length.
- **Caveat:** Passu is clean ice, so its Sentinel-2 snow percentages are not interpretable.

Latest clear scenes in the Copernicus Browser

- **3 Oct 2026:** Baltoro and Biafo, 1.5–3.3 % cloud.
- **1 Oct 2026:** Hispar, 8.4 % cloud.
- **17 Aug 2026:** Batura, Passu and Attabad Lake, 1 % cloud.
- **16 Oct 2026:** first autumn snow buries Hispar, so melt is measured nearest 1 September.



Baltoro and Concordia · 3 Oct 2026 · 3.3 % scene cloud

Biafo · 3 Oct 2026 · 1.5 % scene cloud

Hispar · 1 Oct 2026 · 8.4 % scene cloud

Hunza: Batura, Passu, Attabad Lake · 17 Aug 2026 · 1.0 % cloud

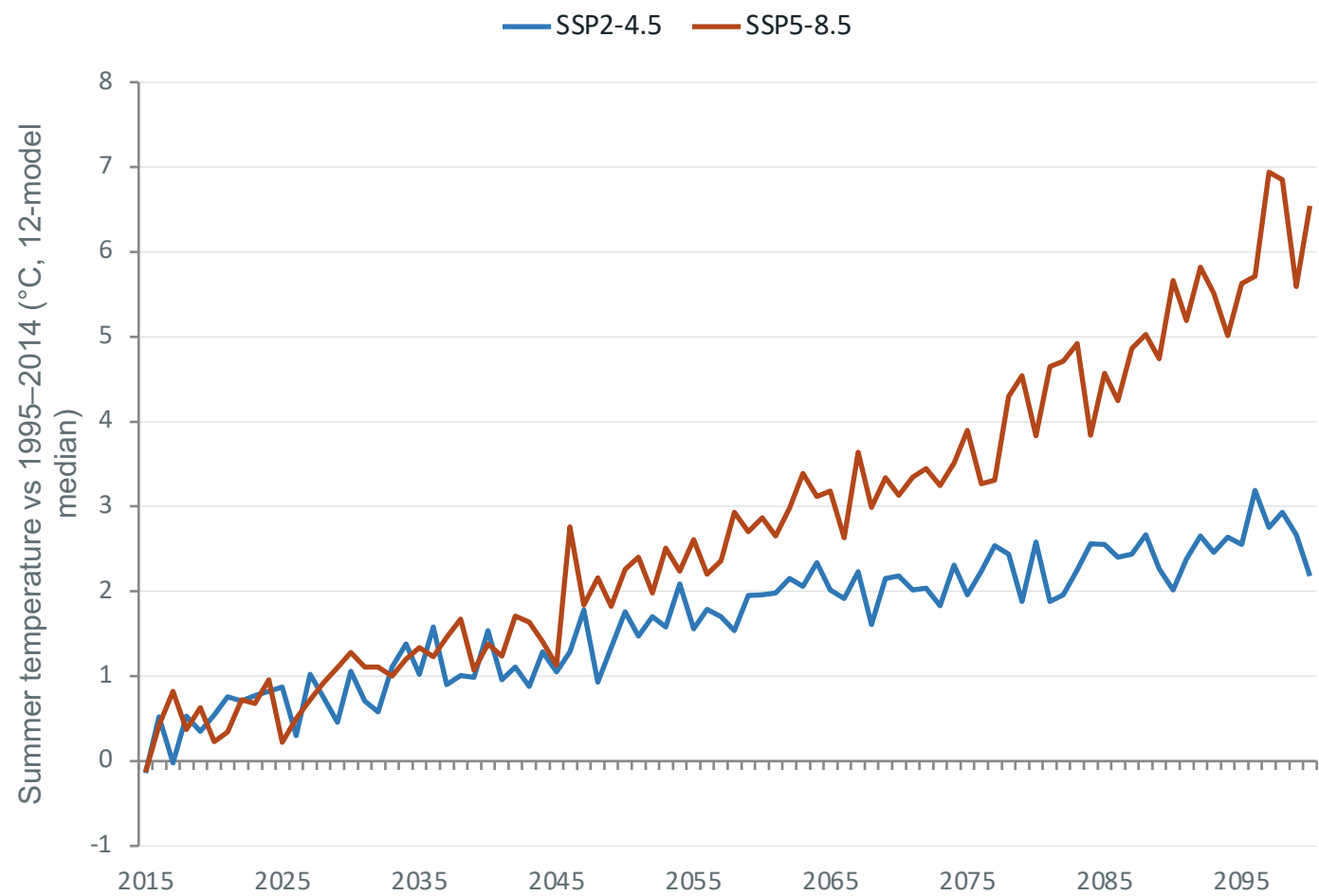
Hispar · 16 Oct 2026 · first autumn snow buries the ice (panel open)

How to read these views

- Grey-brown ribbons are debris-covered glacier tongues; white above them is snow and clean ice.
- The same scenes feed the snow-line and snow-cover measurements in this assessment (Earth Engine copy of the identical ESA L2A product).
- The 16 Oct scene shows why late-season scenes can't measure melt: one storm resets the surface.

Contains modified Copernicus Sentinel data 2026, processed by ESA. Browser captures at 800 x 500 px; full-resolution renders are in the report.
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Going forward: summers warm 1.3–1.7 °C by mid-century



NASA NEX-GDDP-CMIP6, GB mean; each model vs its own 1995–2014. Modelled, not a forecast.

	2041–60	2081–2100
SSP2-4.5 summer °C	+1.3 (+0.8...+3.0)	+2.4 (+1.6...+5.2)
SSP5-8.5 summer °C	+1.7 (+1.5...+4.3)	+4.8 (+3.3...+9.4)
SSP2-4.5 precip %	+11 (-5...+24)	+15 (+0...+40)
SSP5-8.5 precip %	+15 (-2...+35)	+45 (+5...+61)

- **More melt first:** warmer summers spend more ice, as 2025 showed.
- **Then less:** flow falls once there is too little ice left — timing not modelled here.
- **Rain or snow:** models disagree, even on sign before 2060.

Validation scorecard: what passed, what did not

Test	Evidence	Outcome
RGI 7.0 copy vs NSIDC download	Shisper identical: 36.83 km ² , 1997-08-10, surge 3	PASS
Three GRACE solutions	$r = 0.95\text{--}0.97$; 2024 within 1 cm	PASS
2025–26 drop in GFZ too	Same direction, 35 % smaller	PARTLY
Drop is regional, not an offset	GB –34, Pamir –24; Tibet 0 cm	PASS
Robust without Siachen sector	Acceleration –0.10 vs –0.11 m w.e./yr/decade	PASS
Warm summers ↔ bare glaciers	$r = -0.79$, $p \approx 10^{-6}$ (two sensors)	PASS
Models vs observed warming	ERA5 +0.31 inside model range 0.10–1.74 °C/dec	PASS
Sentinel-2 record low 2025–26	6 of 6 glaciers	PASS
Snowfall explains 2025–26?	Winters –5 %; spring snow 2026 normal	NO
GRACE closes glacier budget	–0.33 km ³ /yr vs –1.17 Gt/yr glaciers (2010–19)	FAIL

What the evidence supports next



Add river gauges

Pair Indus and Hunza discharge with this storage record to measure, not infer, the melt contribution.



Plan for hot years

Summers like 2025 (+2.8 °C) strip the glaciers. Treat them as the planning case, not the outlier.



Watch the surging glaciers

Shisper's surge shows ice can advance and dam valleys even while GB loses mass.



Refresh every season

Re-run GRACE, MODIS and Sentinel-2 each autumn as new months land.