

Glacier Mass Change

1. Products

Glacier-wide mass balance/budget and cumulative mass balance for individual glaciers at annual scale in the High Mountain Asia (HMA). Glacier-wide mass balance is a core variable in WIGOS Manual for monitoring changes of the cryosphere and climate system. These products provide long-term indicators of glacier response to climate variability and change in HMA and in a global context.

2. Products specifications

	Glacier-wide mass balance	Cumulative mass balance
Areal coverage	TPRCC-Network service domain (25°–50°N, 65°–105°E)	
Spatial resolution	individual glacier	
Temporal resolution	Annual (hydrological year)	
Projection	Regular latitude-longitude projection	
Availability	2019/20 to present	1979/80 to present
Timeliness	Annually updated after the end of the previous hydrological year	
Format	PNG figures	
Units	millimeters water equivalent (mm w.e.)	meters water equivalent (m w.e.)

3. Data sources

World Glacier Monitoring Service ([WGMS](#)) and the Northwest Institute of Eco-Environment and Resources ([NIEER](#)) of Chinese Academy of Sciences (CAS), with the original observations from Bhutan, China, India, Kazakhstan, Kyrgyzstan, Nepal, the Russian Federation, Tajikistan and Uzbekistan.

4. Methodology

Glacier mass balance is defined as the algebraic sum between the mass input to the ice body (accumulation) and the mass loss (ablation) over a stated period of time, which is often a year or a season. Point mass balance refers to the mass balance at a particular location on the glacier. Surface mass balance is the difference between surface accumulation (snowfall, deposition of hoar, freezing rain, other types of solid precipitation, gain of wind-blown snow, and avalanching) and surface mass loss (ablation, sublimation, loss of wind-blown snow and avalanching).

For the annual mass balance product, mass budget of each individual glacier over a hydrological year, where negative values represent a net loss of glacier mass (ablation exceeding accumulation), whereas positive values represent a net gain of glacier mass (accumulation exceeding ablation).



For the cumulative mass balance product, cumulative values are given relative to the 1979/80 hydrological year (or the first year with reliable observations). The cumulative mass balance of each reference glacier at a given hydrological year is obtained by adding the specific mass balance of the current hydrological year to the cumulative mass balance of the previous hydrological year. Time series for the four reference glaciers within the TPRCC-Network service domain, together with the average of about 60 global reference glaciers, are presented to document regional glacier changes in a global context.

The afore-mentioned estimations of glacier mass balance are consistent with WMO and WGMS practices.

5. References

WGMS, 2023. Global Glacier Change Bulletin No. 5 (2020-2021). Zemp, M., Gärtner-Roer, I., Nussbaumer, S.U., Welty, E.Z., Dussailant, I., and Bannwart, J. (eds.), ISC(WDS)/IUGG(IACS)/UNEP/UNESCO/WMO, World Glacier Monitoring Service, Zurich, Switzerland, 134 pp., publication based on database version: doi:10.5904/wgms-fog-2023-09.

Yao, T., Xue, Y., Chen, D., et al, 2019. Recent Third Pole's Rapid Warming Accompanies Cryospheric Melt and Water Cycle Intensification and Interactions between Monsoon and Environment: Multidisciplinary Approach with Observations, Modeling, and Analysis. *Bulletin of the American Meteorological Society*, 100 (3), 423–444.

Xu, C., Li, H., Wang, F., et al, 2024. Heatwaves in summer 2022 forces substantial mass loss for Urumqi Glacier No.1, China. *Journal of Glaciology*, 70, e77, 1–5.

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