



Comparative analysis of glacier inventories and vicennial glacier changes (2000–2020) in the Northwestern Himalaya

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Abstract This study evaluates global and regional glacier inventories (RGI, GAMDAM, ICIMOD) against the newly generated Kashmir University Glacier Inventory (KUGI) for the Jhelum, Suru, and Chenab basins in the northwestern Himalaya. The KUGI, comprising 2096 glaciers with an area of $\sim 3300.0 \pm 117.8 \text{ km}^2$, was created by manually delineating glacier boundaries from Landsat satellite data, supplemented by a Digital Elevation Model (DEM), Google Earth images, and limited field surveys. The inventory includes 154 glaciers in the Jhelum basin ($85.9 \pm 11.4 \text{ km}^2$), 328 in the Suru basin ($487 \pm 16.2 \text{ km}^2$), and 1614 in the Chenab basin ($2727 \pm 90.2 \text{ km}^2$). While estimates of glacier area, altitude, slope, and aspect of the individual glaciers varied significantly among the four inventories, a

broad similarity was found among the evaluated inventories in terms of distribution of the most common glacier size, elevation, and slope classes. Majority of the glaciers were smaller than 1 km^2 , while the $1\text{--}5 \text{ km}^2$ size class accounted for the largest share of the total glacier area. The GAMDAM ($R_A^B=0.75$) and RGI ($R_A^B=0.73$) inventories were relatively consistent with the KUGI; however, significant discrepancies were noted in the debris-covered and shadowed glaciers, particularly in the ICIMOD inventory. Furthermore, the study revealed differential glacier area changes across the three basins from 2000 to 2020. The Jhelum basin experienced the largest area loss (8%), followed by the Suru (4%) and Chenab basins (3%). These area losses are largely explained by the prevailing topographic and morphological settings of the glaciers. The development of a multi-date KUGI with improved attributes and enhanced accuracy in the data-scarce Himalaya offers a reliable database, fostering research in hydrology, glaciology,

Tariq Abdullah and Mustafa Hameed Bhat contributed equally to this work.

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