



# OPEN Towards understanding various influences on mass balance of the Hoksar Glacier in the Upper Indus Basin using observations

Shakil Ahmad Romshoo<sup>✉</sup>, Khalid Omar Murtaza & Tariq Abdullah

Mass balance is a good indicator of glacier health and sensitivity to climate change. The debris-covered Hoksar Glacier (HG) in the Upper Indus Basin (UIB) was studied using direct and geodetic mass balances. During the 5-year period from 2013 to 2018, the glacier's mean in situ mass balance (MB) was  $-0.95 \pm 0.39$  m w.e.  $a^{-1}$ . Similarly, the glacier's mean geodetic MB from 2000 to 2012 was  $-1.20 \pm 0.35$  m w.e.  $a^{-1}$ . The continuously negative MB observations indicated that the HG is losing mass at a higher rate than several other Himalayan glaciers. The glacier showed increased mass loss with increasing altitude, in contrast to the typical decreasing MB with increasing elevation, due to the existence of thick debris cover in the ablation zone, which thins out regularly towards the accumulation zone. Rising temperatures, depleting snowfall and increasing black carbon concentration in the region, indicators of climatic change, have all contributed to the increased mass loss of the HG. During the lean period, when glacier melt contributes significantly to streamflow, the mass loss of glaciers has had a considerable impact on streamflow. Water availability for food, energy, and other essential economic sectors would be adversely affected, if, glaciers in the region continued to lose mass due to climatic change. However, long-term MB and hydro-meteorological observations are required to gain a better understanding of glacier recession in the region as climate changes in the UIB.