Journal of Hydrology 617 (2023) 129019

Contents lists available at ScienceDirect

Journal of Hydrology

journal homepage: www.elsevier.com/locate/jhydrol

Research papers

Direct, geodetic and simulated mass balance studies of the Kolahoi Glacier in the Kashmir Himalaya, India

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ARTICLE INFO

This manuscript was handled by Emmanouil Anagnostou, Editor-in-Chief.

Keywords:
Glaciological mass balance
Mass balance reconstruction
Kashmir Himalaya
Hydrology

ABSTRACT

Knowledge of glacier mass balance (MB) is critical for understanding glacier-climate interactions and projecting future water availability in the data-scarce Himalayan region. In this study, we present the glaciological (2014–2019), geodetic (2000–2014) and reconstructed (1980–2019) MB of the Kolahoi Glacier (KG) in the Kashmir Himalaya, India. During the five-year observation period, the average *in situ* MB of the Glacier was -0.83 ± 0.34 m w.e. a^{-1}, with significant inter-annual variation. The mean annual geodetic MB of the KG between 2000 and 2014 was -0.90 ± 0.09 m w.e. The reconstructed MB revealed four distinct glacier recession episodes since 1980. The Period I (1980–1990) showed a reduced mass loss of -0.27 ± 0.42 m w.e. a^{-1}, with four years of positive mass balance. The Period II (2000–2010), on the other hand, experienced the highest mass loss of -1.18 m w.e. a^{-1} throughout the entire reconstructed MB series. All three MB measurement- in situ, geodetic and simulated agreed well. The MB showed an excellent correspondence with the observed temperature and precipitation. Analysis of the data revealed that the MB is sensitive to temperature at the rate of -0.65 m w.e. a^{-1} $^{\circ}C^{-1}$, but the sensitivity is only 0.13 m w.e. a^{-1} for a 10% change in precipitation. Furthermore, there is a good correlation between the simulated glacier mass loss and depleting glacier-melt in the autumn streamflow. The mass loss of the KG is expected to exacerbate in future as a result of the projected climate change, and thus further diminishing the streamflow of the transboundary rivers emanating from the region. It is envisaged that the findings will contribute to a better understanding of glacier-climate interactions and their implications for future water availability in the Kashmir Himalaya.