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TOPIC OF RESEARCH: CLIMATE CHANGE IMPACT ON MASS BALANCE AND RETREAT OF GLACIERS: A CASE STUDY OF SURU SUB BASIN

FINDINGS

The present study reveals significant climate-driven transformations in glacier dynamics within the Suru Sub Basin over the past three decades. Trend analysis of temperature and precipitation (1990–2020) indicates a clear warming signal, particularly in minimum temperatures, alongside increasing winter and pre-monsoon precipitation. These climatic shifts have played a decisive role in accelerating glacier retreat and mass loss across the basin.

Remote sensing–based glacier inventory shows a substantial reduction in glacier number and area between 1992 and 2023, with an overall glacier area loss of approximately 23%. Small and medium-sized glaciers experienced the highest rate of fragmentation, while large valley glaciers showed pronounced areal shrinkage. A marked increase in supraglacial debris cover further reflects enhanced ablation processes and glacier thinning. Retreat analysis confirms widespread frontal recession, elevation-dependent retreat, and strong orientation control, with north- and east-facing glaciers exhibiting higher vulnerability.

Mass balance assessment using Accumulation Area Ratio and Equilibrium Line Altitude proxies demonstrates a basin-wide transition from positive to negative mass balance conditions. The mean specific mass balance declined from +0.17 m w.e. in 1992 to −0.04 m w.e. in 2023, indicating a net mass loss and reduced accumulation efficiency. Concurrently, glacier lake inventory reveals a fourfold increase in lake number and significant expansion in lake area, particularly moraine-dammed lakes at mid-elevations. Several lakes were identified as highly susceptible to GLOF hazards, underscoring growing cryospheric risks. Overall, the findings highlight the strong sensitivity of Suru Sub Basin glaciers to ongoing climate change and emphasize the need for continuous monitoring and risk-informed adaptation strategies