

Dynamically constrained steady-state mass balance of Trambau Glacier, Rolwaling region, Nepal Himalaya

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We evaluate the steady-state mass balance of debris-free Trambau Glacier in the Rolwaling region, Nepal Himalaya, using in situ observations (surface flow velocity, ice-thickness, and dGPS measurements) acquired over the 2016–2019 period. We calculate emergence velocities via the flux-box, stake, and residual methods. The respective emergence velocities are derived from satellite-derived and surface velocity and modelled ice thickness, in situ observations, and the residuals associated with previously reported (2000–2018) elevation changes and mass-balance data. The estimated emergence velocities are converted to mass-balance profiles, suggesting dynamic equilibrium (i.e., no elevation change), and are compared with the recent stake measurements. The estimated emergence velocities in the lower ablation zone of the glacier differ between the 2000–2018 and 2016–2019 periods, with these differences being attributed primarily to ice thinning and a deceleration in the surface flow velocity. A comparison of the observed and steady-state mass balances suggests that Trambau Glacier has been dynamically imbalanced since before 2000.

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