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## Glacio-hydrological modelling of partially debris-covered Dokriani Glacier in monsoon-dominated Garhwal Himalaya (India)

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Glacier-wide mass balances and catchment-wide runoffs are reconstructed over 1979-2018 for Dokriani Glacier catchment in the Garhwal Himalaya (India). A glacio-hydrological model including temperature-index, accumulation, rain and evapotranspiration modules is used for the reconstruction using daily air-temperature and precipitation fields from ERA5 data. Model is calibrated using 6 years of observed annual glacier-wide mass balances (1993-1995 and 1998-2000) and observed summer mean monthly runoff (1994, 1998-2000) data. Modelled mass wastage on Dokriani Glacier is moderate with annual loss of  $-0.28 \pm 0.38$  m w.e.  $a^{-1}$  over 1979-2018. The mean winter glacier-wide mass balance is  $0.62 \pm 0.38$  m w.e.  $a^{-1}$  while mean summer glacier-wide mass balance is  $-0.91 \pm 0.38$  m w.e.  $a^{-1}$  over 1979-2018. The mean annual catchment-wide runoff is  $1.38 \pm 0.11$   $m^3 s^{-1}$  over 1979-2018. Maximum runoff is produced during summer-monsoon months with a peak in August ( $5.35$   $m^3 s^{-1}$ ). Rainfall contributes the maximum to the total mean annual runoff with 44% share while snow melt and ice melt contribute 35% and 22%, respectively. The loss through evapotranspiration is only around 2% of the total runoff. The heterogeneous debris-cover distribution over lower ablation area (<5000 m a.s.l.) protects the glacier for higher melting. Decadal mass balances suggest that Dokriani Glacier was close to steady-state conditions over 1989-1997 because of negative temperature anomaly and positive precipitation anomaly over this period. Mass balance and runoff are the most sensitive for threshold temperature for melt with sensitivities of  $-0.71$  m w.e.  $a^{-1} ^\circ C^{-1}$  and  $0.18$   $m^3 s^{-1} ^\circ C^{-1}$ , respectively.