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Implementation of a process-based catchment model in a poorly gauged, highly glacierized Himalayan headwater

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Abstract. The paper presents a catchment modeling approach for remote glacierized Himalayan catchments. The distributed catchment model TAC^D, which is widely based on the HBV model, was further developed for the application in highly glacierized catchments on a daily timestep and applied to the Nepalese Himalayan headwater Langtang Khola (360 km^2). Low laying reference stations are taken for temperature extrapolation applying a second order polynomial function. Probability based statistical methods enable bridging data gaps in daily precipitation time series and the redistribution of cumulated precipitation sums over the previous days. Snow and ice melt was calculated in a distributed way based on the temperature-index method employing calculated daily potential sunshine durations. Different melting conditions of snow and ice and melting of ice under debris layers were considered. The spatial delineation of hydrological response units was achieved by taking topographic and physiographic information from maps and satellite images into account, and enabled to incorporate process knowledge into the model. Simulation results demonstrated that the model is able to simulate daily discharge for a period of 10 years and point glacier mass balances observed in the research area with an adequate reliability. The simple but robust data pre-processing and modeling approach enables the determination of the components of the water balance of a remote, data scarce catchment with a minimum of input data.

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