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Process-oriented Runoff Simulation from a glacierized Himalayan Head Watershed

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Process-oriented modelling of highly glacierized catchments in the Himalayan mountains is essential for an optimal management of the regional water resources, which to a large extent depend on melt water from snow and glaciers. The distributed, process-oriented catchment model TAC^D (tracer aided catchment model, distributed) was further developed for the application in highly glacierized catchments and applied to the Himalayan head watershed Langtang Khola (360 km^2), located in Nepal. The development work was focused on the implementation of physiographic information in order to compensate for the lack of detailed climate data and groundwater levels. This physiographic information derived from a digital terrain model enables a process-oriented runoff simulation based on a minimum of meteorological input data which are limited to daily mean temperature and precipitation. Snow and ice melt was calculated based on the temperature-index method using calculated daily potential sunshine durations of each grid cell (200x200 m^2) for its regionalization. Four hydrological response units (glacier covered areas, non-glacier areas, flat glacier parts, valley bottoms) were simulated with different reservoir characteristics. Simulation results demonstrated that the model is able to simulate reasonably well daily discharge

for a period of 12 years (Nash-Sutcliffe efficient during validation periods: 0.20-0.76) and point values of glacier mass balances measured in the research area. The modelling exercise showed requirements for future process research, and the need for a better understanding of the lateral redistribution of snow (avalanches and wind drift) as well as of flow and storage of water in glaciers and the underlying bedrock.