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The value of hydrograph partitioning curves for calibrating hydrological models in glacierized basins

Zhihua He (1), Sergiy Vorogushyn (1), Katy Unger-Shayesteh (1), Abror Gafurov (1), Bruno Merz (1,2)

(1) GFZ German Research Centre for Geosciences, Section 5.4: Hydrology, Telegrafenberg, 14473 Potsdam, Germany, (2) University Potsdam, Institute of Earth and Environmental Science, Potsdam, Germany

This study uses a novel method for calibrating a glacio-hydrological model based on hydrograph partitioning curves (HPC), and evaluates its value in comparison to multi-criteria optimization approaches which use glacier mass balance, satellite snow cover images and discharge. The HPCs are extracted from the observed flow hydrographs using additionally catchment precipitation and temperature gradients. They indicate the periods when the various runoff processes dominate the basin hydrograph. The annual cumulative curve of the difference between average daily temperature and melt threshold temperature over the basin, as well as the annual cumulative curve of average daily snowfall on the glacierized areas are used to identify the start and end dates of snow and glacier ablation periods. Model parameters characterizing different runoff processes are calibrated on different HPCs in a stepwise and iterative way. Results show that 1) the HPC-based method guarantees model-internal consistency comparable to the multi-criteria calibration methods; 2) the HPC-based method presents higher parameter identifiability and improves the stability of calibrated parameter values across various calibration periods; and 3) the HPC-based method outperforms the other calibration methods in simulating the share of groundwater, as well as in reproducing the seasonal dynamics of snow and glacier melt. Our findings indicate the potential of HPCs to substitute multi-criteria methods for hydrological model calibration in glacierized basins where other data than discharge are often not available or very costly to obtain.