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Calibration of hydrological models in glacierized catchments

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Glacierized catchments are important source regions for water, and detailed knowledge of water availability is a prerequisite for good resource management strategies. Reliable and physically consistent runoff simulations become even more important if climate change impacts on alpine water resources are to be assessed. However, hydrological modeling of glacierized catchments is challenging ice melt which represents an additional source of water. Thus, adequate calibration strategies are needed especially in data scarce regions. An important question is how powerful a limited amount of data might be for model calibration. Accordingly, we analyzed the calibration power of limited discharge measurements, mass balance observations and the combination of by means of both Monte Carlo analyzes and multi-criteria model performance evaluation. Ensembles of 100 parameter sets were selected by evaluating the simulations based on a limited and discrete number of discharge measurements, glacier mass balance, and the combination of discharge and mass balance observations. Using these ensembles then the runoff was simulated and evaluated for the entire runoff series. The results for the Vernagtferner catchment and the Venter Ache catchment in Austria indicated that a single annual glacier mass balance observation contained useful information to constrain hydrological models. Combining mass balance observations with a few discharge data improved the internal consistency and significantly reduced the uncertainties compared to parameter set selections based on discharge measurements alone. Information on discharge was required for at least 3 days during the melting season to obtain good ensemble predictions.