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Influence of snow accumulation and annual glacier mass balance on the calibration results of a spatially distributed conceptual hydrological model

E. Mayr (1), W. Hagg (1), C. Mayer (2), and L. Braun (2)

(1) University of Munich, Department for Geography, Luisenstraße 37, D-80333 Munch, Germany (E.Mayr@geographie.uni-muenchen.de), (2) Bavarian Academy of Sciences and Humanities, Commission for Geodesy and Glaciology, Alfons-Goppel-Straße 11, D-80539 Munich, Germany

This contribution uses a conceptual hydrological model to investigate the interdependence of additional calibration criteria and attempts to find more realistic parameter sets for model calibration.

In the Vernagt basin, Oetztal Alps, a spatially distributed runoff model was set up and 10,000 random parameter sets have been generated and tested. The best set was selected using runoff as well as winter accumulation and annual glacier mass balances as objective functions. The incorporation of additional criteria leads to different parameter sets and slightly poorer runoff simulation compared to a calibration by runoff only. The relation between these different variables shows an interesting pattern. While the quality of glacier mass balance and runoff simulations clearly depend on each other and therefore good runoff simulations are connected with good mass balance simulations and vice versa, good runoff or annual mass balance simulations have no influence on the quality of simulated winter accumulation. On the other hand, a proper description of winter accumulation induces fairly good runoff or annual mass balance simulations.

Runoff, the glacier-wide winter accumulation and the annual mass balance in the ablation area could be simulated well, while the annual balance in the accumulation area showed larger inaccuracies. The simulations show a systematic overestimation of snow water equivalent in the accumulation area in the ablation period. Possible reasons for this error are discussed. The proper simulation of the processes during the 2003 heat wave proves that the model delivers reliable results also for meteorological conditions different from those during calibration.