



Possibilistic uncertainty analysis of a snow and glacier melt runoff model

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Water resources management studies usually involve the application of computer-based hydrological models. The discharge estimates provided by these models are affected by uncertainties in hydrological data, model structure and model parameters, which jointly determine the overall uncertainty of the model predictions or predictive uncertainty. This study presents the analysis of predictive uncertainty of a snow and glacier melt runoff model using a possibilistic approach. As opposed to probability theory, possibility theory is meant to model uncertainties caused by imprecise or incomplete knowledge about a real system rather than by randomness. The method applied relies on Monte Carlo sampling for empirically deriving possibility distributions of the model predictions. Prediction uncertainty bounds are finally derived using the inference rules of possibility theory.

The model analysed is a lumped conceptual type watershed model that operates at a monthly time step. The model divides the catchment into five elevation zones, where the fifth zone corresponds to the catchment glaciers. The study area is Olivares River upstream of junction with Colorado River, located in the Andean region of Central Chile. It has a surface of approximately 531[Km²], where approximately 13% corresponds to glaciers.

First of all, the possibility distribution of the model predictions is obtained through evaluation of the goodness of fit of the estimated discharge hydrographs. Prediction uncertainty bounds are subsequently derived. Secondly, the likelihood of the simulated snow cover and glacier mass balance at the end of the evaluation period are used for further assessing model performance. The results of the study indicate that the use of this additional information allows a reduction of predictive uncertainty and an improvement in the location of the uncertainty bounds, with respect to the case where only the model errors are used for evaluating model performance.

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