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# Global sensitivity analysis of a snow and glacier melt runoff model

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This work presents the application of Sobol's variance decomposition (SVD) to the sensitivity analysis of a snow and glacier melt runoff model. Being a global sensitivity analysis method, SVD is able to determine to what the extent the model response is affected by unilateral variations of the model's input factors across their feasible ranges. Furthermore, SVD accounts for the effect of interactions between these input factors, evaluating the impact of simultaneous variations in their values.

The model analysed is a lumped conceptual type watershed model that operates at a monthly time step. The hydrological information required by the model includes precipitation, number of rain days, evaporation, temperature, air humidity, wind speed and cloudiness, while the model output is given by the discharge at the catchment's outlet. The model divides the catchment into five elevation zones, where the fifth zone corresponds to the catchment glaciers. Independent water balances are performed within each elevation zone. In the case of the fifth zone, glaciers are seen as an inexhaustible source of water that melts when the snow cover is depleted. With a total of 20 parameters, the calibration of the model is difficult due to the presence of local minima and parameter interactions.

The results of the study indicate that several of the model parameters do not have great influence in determining the model performance, if only unilateral variations in their values are allowed. However, it was found that most of the model parameters can have a great impact if the effect of interactions with other parameters is considered. In the case of the catchment used as case study, it was observed that five of the model parameters have a negligible effect in the model performance. Accordingly, these parameters could be fixed at convenient values within their feasible ranges, in order to reduce the dimensionality of the calibration process.

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