



Application of global sensitivity analysis methods to Takagi-Sugeno-Kang rainfall-runoff fuzzy models

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This study analyses the sensitivity of the parameters of Takagi-Sugeno-Kang rainfall-runoff fuzzy models previously developed by the authors. These models can be classified in two types, where the first type is intended to account for the effect of changes in catchment wetness and the second type incorporates seasonality as a source of non-linearity in the rainfall-runoff relationship.

The sensitivity analysis is performed using two global sensitivity analysis methods, namely Regional Sensitivity Analysis (RSA) and Sobol's Variance Decomposition (SVD). In general, the RSA method has the disadvantage of not being able to detect sensitivities arising from parameter interactions. By contrast, the SVD method is suitable for analysing models where the model response surface is expected to be affected by interactions at a local scale and/or local optima, such as the case of the rainfall-runoff fuzzy models analysed in this study.

The data of six catchments from different geographical locations and sizes are used in the sensitivity analysis. The sensitivity of the model parameters is analysed in terms of two measures of goodness of fit, assessing the model performance from different points of view. These measures are the Nash-Sutcliffe criterion and the index of volumetric fit.

The results of the study show that the sensitivity of the model parameters depends on both the type of non-linear effects (i.e. changes in catchment wetness or seasonality) that dominates the catchment's rainfall-runoff relationship and the measure used to assess the model performance.

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