

## **USING FUZZY SETS TO IMPROVE RUNOFF PREDICTION WITH NEURAL NETWORKS**

Nils Thorsten Lange

Department of Hydraulic Engineering and Water Management, University of Kaiserslautern, Germany. [nlange@rhrk.uni-kl.de](mailto:nlange@rhrk.uni-kl.de)/ Fax: +49 631 205 3904

Input data for neural network modelling in hydrology often are very scarce and not very exact, so the idea of this study is to combine input parameters of a neural network with the help of fuzzy rules. The advantage of this approach is that the different fuzzy sets can be combined with rules based upon hydrologic knowledge. Another big advantage is the reduction of input parameters of the neural network. The reduction of input parameters helps to reduce the number of connections of the network structure.

In this study it is shown that with different combination of input parameters the runoff prediction by the neural network can be improved. The neural network of this study is a feedforward network with the Backpropagation learning algorithm. One example of a new input parameter is the combination of a precipitation index and a seasonal factor. In this way this new parameter gives an idea about the soil moisture at the beginning of the rainfall event. This new input parameter together with the rainfall sum and a base flow height index the neural network was able to give a very robust runoff prediction even with a low number of training and validation events.