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# Water level forecasting through neural network and fuzzy logic approaches: a comparison.

**S. Alvisi** (1), G. Mascellani (1), M. Franchini (1) and A. Bárdossy (2)

(1) Dipartimento di Ingegneria, Università degli Studi di Ferrara, Italia, salvisi@ing.unife.it, gmascellani@ing.unife.it, franchini@ing.unife.it

(2) Institut für Wasserbau, Universität Stuttgart, Deutschland, bardossy@iws.uni-stuttgart.de

In the last decades, several data-driven models have been developed to perform the real time flood forecasting. These models by-pass the description of the many sub-processes linked to the rainfall-runoff transformation and directly produces the variables of interest. Many of them are set up to be flow predictors. However, the knowledge of the water level is required within the framework of a flood warning system. Thus, a rating curve is needed to transform the forecasted flows into water levels. However, the data driven models can be designed to forecast the water levels directly, given their very nature.

In this study two data-driven water level forecasting models are presented and discussed: one is based on the artificial neural networks (ANN), while the other is based on the fuzzy logic approach. Both of them are parameterized with reference to flood events alone, where water levels are higher than a selected threshold. As a consequence, they can be applied to perform only the real time water level forecasting during flood events and not on a continuous time scale.

As regards the ANN model, a three layer feed-forward, back-propagation network structure with Levenberg-Marquardt training algorithm is used. As regards the fuzzy logic model, both Mamdani and Takagi-Sugeno approaches are considered. Different input variables sets are analyzed and the quality of the forecasting is evaluated up to 12 hours ahead. A comparison between the two models is performed with reference to the Reno river at Casalecchio (Bologna, Italy), highlighting the difficulties and advantages of both of them.