



## **Errors analysis in real time flow forecasting for 10-days lead time in the Parana river**

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Detailed analysis of 10-days-ahead flow predictions errors in the Parana River is performed, after two models: an ARMAX model and a multilayer feedforward artificial neural network (ANN). Input variables are daily flows at one upstream section and those for the reference section, and daily rainfall for an intermediate rain gauge. The basin area in between river sections is 350,000 km<sup>2</sup>, and available records are from 1994 to 1998. Different alternatives for model structure (ARMAX) and topologies (ANN) were tested and compared, selecting those ones providing best performance. Results show high quality 10-days ahead forecasts, giving ANN model slightly better statistics, with a validation Nash-Sutcliffe efficiency coefficient of 0.947. The potential showed by these tools represents an actual opportunity to significantly improve flood alert system nowadays employed in the affected areas. This increased reliability of flow forecasts can launch with the right anticipation appropriate measurements to avoid important damages and economical losses in the area. In spite of such practical value for a better management of the system, a closer analysis of prediction errors reveals interesting hints for further improvements, together with several opened questions with far-reaching implications for uncertainty analysis.

Once the overall error distribution is subdivided into two different groups (rising limbs or recession curves of hydrographs), skewed distributions are found, pointing towards future modelling refinements opportunities by using alternatively activated modelling schemes depending on the real time observed flows trend, through automatic selection procedure (i.e. classification ANN schemes). Moreover, analysis of errors conditioned to the flow values (either the predicted or the actual observed ones) is performed. Error variance is estimated in each case, and interesting conclusions are also reported about it, showing key aspects concerning uncertainty assessment to be considered.