Hydrol. Earth Syst. Sci. Discuss., 3, S1159–S1162, 2006
www.hydrol-earth-syst-sci-discuss.net/3/S1159/2006/

Hydrology and Earth System Sciences Discussions

Interactive comment on "A time delay artificial neural network approach for flow routing in a river system" *by* M. J. Diamantopoulou et al.

Anonymous Referee #2

Received and published: 11 October 2006

General comment

The paper addresses an important topic in hydrology, namely river flow forecasting. In particular, in this paper a Time Delay Artificial Neural Network (TDANN) model has been proposed for forecasting daily flows on the subsequent day on the basis of the time-lagged daily flows observed at two upstream measurement stations over a period of up to 10 days preceding the relevant day in question. The paper is well written and well structured, the title clearly reflects the contents of the paper and the abstract provides a concise and complete summary, but overall, the paper doesn't appear to provide any new significant scientific contributions. In fact, the model presented is based on techniques, i.e. Time Delay Artificial Neural Network (TDANN) and cascade

correlation algorithms, which are already in use in the hydrology field (see for example, Sajikumar and Thandaveswara, 1999; ASCE, 2000; Imrie et al., 2000; Thirumalaiah and Deo, 2000; Coulibaly et al., 2001; Kneale et al., 2001; Luk et al., 2001) and thus the paper seems to represent more a case study rather than a presentation of novel concepts. However, the paper addresses topics which are definitely within the scope of HESS and it can be considered for publication, provided that the authors clearly convey to the reader the relevance of their paper to the advancement of hydrological forecasting. In particular, the following specific points should be addressed.

Specific comments

Sec.1, Pag. 2737, lines 11-20: the authors list many references to applications of Artificial Neural Network models in the field of hydrology, water resources and hydrologic time series. They subsequently state that three layer Time Delay Artificial Neural Network models were developed to forecast the daily flow values. The authors, prior to introducing their model, should highlight some references to applications of Time Delay Artificial Neural Network in the field of hydrology and time series forecasting (see for example, Sajikumar and Thandaveswara, 1999; Coulibaly et al., 2001; Kneale et al., 2001; Luk et al., 2001) and highlight the new contribution provided by their paper compared to these models and applications.

Sec.2, Pag. 2739, lines 2-8: the same symbol e is used in equation (1) as “exp” and in equation (2) as global error. One of the two should be changed.

Sec.2, Pag. 2739, lines 14-20: this paragraph seems to be quite repetitive and could be improved. In addition, a schematic representation of the cascade correlation TDANN architecture and of the training algorithm might help the reader to better understand Section 2.

Sec.3, Pag. 2742, lines 7-8: the authors state that the correlograms presented in figure 2 “indicate that the delayed memory of the system corresponding to the ith input series appears to be equal to 10 days”. Previously, in Sec.2, Pag. 2740, line 25-27 they

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said: “The first minimum positive value of the correlogram approximately indicates the delayed memory. Therefore, personal judgement must be exercised in interpreting the correlogram.” According to this statement, it is not completely clear why 10 days was chosen as delayed memory. Looking at figure 2, the first minimum positive value of the correlogram does not seem to be 10 days. Did the authors try to choose different delayed memory, and thus different input variables? Since it doesn’t seem to be very clear from the correlograms what exactly was the delayed memory of the system, a comparison of the results obtained using different input variables based on slightly different delayed memories should be developed and presented.

Sec.3, Pag. 2742, lines 13-15: The authors use the notation QSt, QS(t-1), etc and QGt, QG(t-1), etc. for the flow values recorded respectively at stations Siatista and Gravena at times t, t-1, etc. and QI for the daily flow values forecasted at Ilarionas station. For the sake of clarity and coherence, the same notation should also be used for the forecasted daily flows values at Ilarionas station, i.e. QI(t+1). Moreover, the authors forecast the daily flow values for the next time interval only, i.e. one day ahead, but, for flood control systems to be effective, longer time horizons are important too. Thus, an analysis of the efficiency of the model to forecast the daily flow values 2, 3, etc. days ahead (QI(t+2), QI(t+3), etc.) could be developed and relevant considerations added in the conclusions.

Sec.3, Pag. 2744, lines 8-11: the results “clearly demonstrate the ability of the selected TDANN model to forecast very well daily flow values”. A point that is not addressed by the authors is whether or not there is any advantage in using the proposed model rather than, for example, multilayer feedforward artificial neural networks, radial basis neural networks etc. In fact, in the introduction, the authors list some references to applications of Artificial Neural Network models in the field of hydrologic time series forecasting. What motivated the authors to develop a new forecasting model, was it that they just wanted to develop “another” model? What are the advantages of the proposed TDANN model over the models cited in the introduction? The authors should compare

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the results obtained using their model with those obtained by other models, such as three layer feedforward ANN, and their comment on the results of these comparisons should be added to the discussion of the results and to the conclusions.

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