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Nonlinear Prediction of Riverflow. The Paiva river case

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The analysis, modelling and prediction of a natural system like a River are of most importance for several reasons. Prevention of natural disasters and optimization of storage reservoirs for hydroelectric production among other reasons explain the influence of modelling and prediction in a natural system like a river. The river flow is a measurement of a complex system with many relevant variables: precipitation, inflow-runoff transformation, and the hydrogeological features of the basin, etc. The relevant data for this work is the daily mean runoff of the river Paiva measured in Fragas da Torre from October 1946 to September 1999. We will discuss the predictability of a future value and we will show the difficulties in trying to do point prediction. example, Dynamical Systems and Stochastic Processes.
The identification of chaos involves the use of nonlinear techniques including correlation-dimension estimation, false nearest neighbours method, nonlinear prediction, Lyapunov exponent and entropy estimation, among others, for characterization and prediction. In some of works, [PR97], [PR96], [JL94], [LIRIL98] and in others referenced within the authors were able to estimate the correlation-dimension for the reconstructed system. Here we also compute the correlation-dimension for the Paiva river runoff. The slopes of the correlation integral curve are computed for two different sets of data of Paiva runoff series, the original data set and for runoffs less than $20m^3/s$. The analysis led us to reason that for our data set an analogy may be established between the theoretical dynamical intermittence phenomena and the dynamics of the river Paiva. We also do a Singular Value Decomposition (SVD) analysis showing that the dynamics of runoffs are close to a segment line. Later we use the nearest neighbours method of prediction for one-step ahead prediction.

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