Meteorological Time Series Reconstruction: The Artificial Neural Network (ANN) Approach.

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The climate system has a very complex and non linear behaviour for which consistent and robust mathematical models are needed, for example the use of artificial neural network models, since they allow the modelling of non-linear dynamic problems. The aim of the present work is the application of reliable and robust procedures for monthly reconstruction of surface air temperature, insolation, precipitation, and relative humidity time series. Time series is a special case of symbolic regression we can use Artificial Neural Network (ANN) to explore the spatiotemporal dependence of meteorological attributes as a function of space-time on inputs for computer simulations. It is very well-known that a common problem in numerical climate characterization is the spatiotemporal processing (integration or interpolation) of data from different types and different origins or accuracies - the space-time change of support problem). The ANN using Empirical Bayesian Updating seems to be an important tool for the propagation of the related weather information to provide practical geostatistics solution of uncertainties associated with the interpolation, capturing the spatiotemporal structure of the data. The basic idea is to import the entire posterior distribution from other locations allowing prediction of unsampled weather parameters using spatial related sampled information. In effect, we determine the embedding dimension (number of past observations) of the time series attractor (delay time that determine how data are processed) and uses these number to define the network's architecture; physically, the attractor is the object to which the time series in a phase space (space in which each point describes the state of a dynamical system as a function of the non-constant parameters of the system) is attracted to; meteorological attributes can be accurately predicted by the spatiotemporal ANN model architecture: designing, training, validation and testing; the best generalization of new data is obtained when the mapping represents the systematic aspects of the data, rather capturing the specific details (e.g., noise contribution) of the particular training set. This methodology provides mean squared errors less than those associated to the temporal interpolaton using ARIMA or cubic splines once the time series have a considerable number of consecutive missing values.