Geophysical Research Abstracts, Vol. 9, 01117, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01117

Generalized neuron models for hydrological forecasting

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Hydrological forecasts are needed in the efficient planning, design, operation, and management of existing and proposed water resources systems. In the past, hydrologists have employed conceptual methods or stochastic approaches for hydrological forecasting. Recently, the data-driven approaches of soft-computing such as artificial neural networks (ANNs) have been proposed as efficient tools for this purpose. The elementary building block in the ANN models has been McCulloch and Pitts Artificial Neuron (MPAN). The MPAN suffers from being linear in nature due to the linear aggregation of the inputs. The ANN models based on MPAN also require a large number of hidden neurons in one or more hidden layers to model the complex, dynamic, and highly non-linear hydrological process. More recently, a flexible, non-linear, and more robust Generalized Neuron (GN) has been proposed by some researchers. The GN has been used successfully in classification and control problems in electrical engineering. The GN model is capable of employing non-linear discriminant functions for aggregation of the inputs providing us the powerful means of modeling the non-linearity of the physical system being modeled. In this study, we investigate the use of generalized neuron models for hydrological forecasting. The rainfall and flow data derived from a 2344 km^2 Bird Creek catchment in Kansas, USA are used. The preliminary results obtained in this study indicate that the GN based models can provide very good accuracy in hydrological forecasting, and they need to be exploited by hydrologists for efficient water resources management.