Geophysical Research Abstracts
Vol. 12, EGU2010-14321-2, 2010
EGU General Assembly 2010


# Spatiotemporal drought forecasting using nonlinear models

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Spatiotemporal data mining is the extraction of unknown and implicit knowledge, structures, spatiotemporal relationships, or patterns not explicitly stored in spatiotemporal databases. As one of data mining techniques, forecasting is widely used to predict the unknown future based upon the patterns hidden in the current and past data. In order to achieve spatiotemporal forecasting, some mature analysis tools, e.g., time series and spatial statistics are extended to the spatial dimension and the temporal dimension, respectively. Drought forecasting plays an important role in the planning and management of natural resources and water resource systems in a river basin. Early and timelines forecasting of a drought event can help to take proactive measures and set out drought mitigation strategies to alleviate the impacts of drought. Despite the widespread application of nonlinear mathematical models, comparative studies on spatiotemporal drought forecasting using different models are still a huge task for modellers. This study uses a promising approach, the Gamma Test (GT), to select the input variables and the training data length, so that the trial and error workload could be greatly reduced. The GT enables to quickly evaluate and estimate the best mean squared error that can be achieved by a smooth model on any unseen data for a given selection of inputs, prior to model construction. The GT is applied to forecast droughts using monthly Standardized Precipitation Index (SPI) timeseries at multiple timescales in several precipitation stations at Pinios river basin in Thessaly region, Greece. Several nonlinear models have been developed efficiently, with the aid of the GT, for 1-month up to 12-month ahead forecasting. Several temporal and spatial statistical indices were considered for the performance evaluation of the models. The predicted results show reasonably good agreement with the actual data for short lead times, whereas the forecasting accuracy decreases with increase in lead time. Finally, the developed nonlinear models could be used in an early warning system for risk and decision analyses at the study area.