Geophysical Research Abstracts, Vol. 8, 04000, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04000

Forecasting river discharges using MAR models: a study from the Odra River

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The poster outlines the application of multivariate time series techniques to model river discharges. Multivariate autoregressive models (MAR) are shown as tools for understanding the spatio-temporal river dynamics on the regional scale. The techniques in question allow one to find and to evaluate the significant spatio-temporal relationships between discharges measured at the dissimilar gauges. The data applied herein are daily discharges measured at the locations distributed within the Odra River basin, in its upper and middle reach (SW Poland). The time series of length 12 years exhibits a time resolution of one day. In particular, the left tributaries of the Odra River are analysed extensively due to the location of their headwaters in the Sudetes Mountains (SW Poland). Indeed, floods in the lowland are often caused by the extreme hydrologic events, which happen in the mountainous catchments. Thus, understanding the responses of the lowland part of the basin to the extreme rainfall and flooding at the upstream locations appears to be of particular interest. The results indicate that there exist essential self- and cross-dependencies between discharges at the gauging stations considered. The fitted models are applied for forecasting discharges at the sites located in the Silesian Lowland, thus downstream of the studied headwaters. It is shown that the forecasts based on MAR models are more accurate than the predictions derived by means of the univariate autoregressive models (AR). It is argued that this is caused by (1) the precisely fitted multivariate stochastic model to the residuals and (2) the deterministic information on the time lag involved in the passage of flood wave, both included in the MAR analysis. Furthermore, floods can be predicted more accurately by MAR modelling due to the application of the explanatory variables. To perform forecasting the function in ‘R 2.1.1’ is developed by the author.