INTRODUCTION OF A GLM TO THE RAINFALL SIMULATION FOR THE MANAGEMENT OF THE NESTOS RIVER BASIN

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ABSTRACT

Obtaining the necessary data for research or design projects is one of the most common problems in hydrologic simulation. Data are scarce, difficult to obtain from the respective authorities or cover a narrow time span. This often results in difficulties when conducting simulations of any kind which are greater when a basin area is shared by two or more countries.

Since 1982 the use of Generalized Linear Models (GLMs) has provided hydrologists with a tool to overcome this problem. The GLMs are statistical models and research has shown that they can be used in creating stochastic data series for rainfall or for filling already existing but incomplete series of rainfall data. The Departments of Civil Engineering and Statistics of Imperial College London have recently introduced GlimClim for research purposes in Hydrology, which is easy-to-use software based on the theory of GLMs. GlimClim incorporates a Logistic and Gamma distribution model which are fitted on existing series of data. The logistic model is used in order to determine the occurrence of events and the Gamma model to determine their magnitude. In this paper the application of GlimClim as a tool for research in the transboundary basin of the Nestos River is presented.

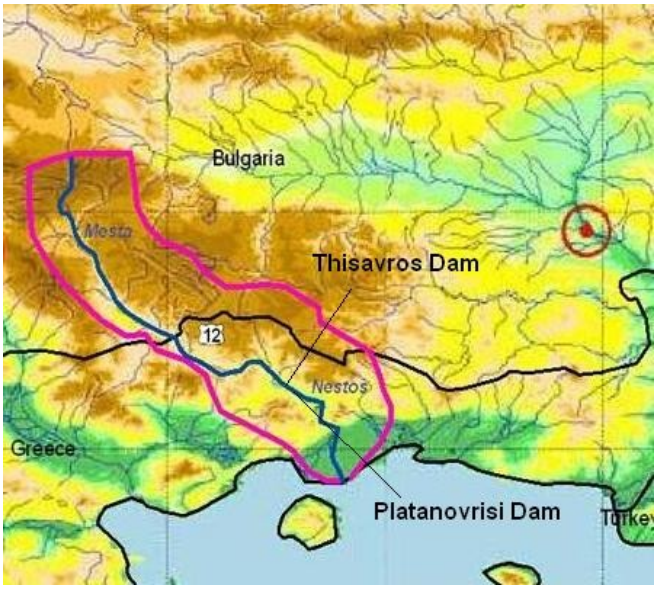

Fig 1. Map of the Nestos River basin

The basin of the Nestos River is shared between Greece and Bulgaria. The river has been the object of extended research by both countries. One of the most common problems was the lack of rainfall data which could be used for hydrologic simulations of any kind for the river's basin. Conclusions from this research could be used in Water Management decisions by both countries.

GlimClim has been used to produce stochastic rainfall series based on a limited set of daily data for a period of 15 years. At first the two models (Logistic and Gamma) have been calibrated and then the stochastic data series have been produced. The rainfall series which have been produced cover the period from 2000 to 2099. Statistical checks show that these series are reliable and that they can be used in hydrologic simulations. The check has been conducted by examining whether the values of selected statistical parameters for the real data fall within the envelope of maximum and minimum values of the same parameters in the stochastically produced datasets. The results where not only encouraging but have also shown that GlimClim is capable of producing a reliable number of extreme values. This should not create the false impression that GlimClim is error free. Its accuracy depends on the accuracy and quantity of the input data.

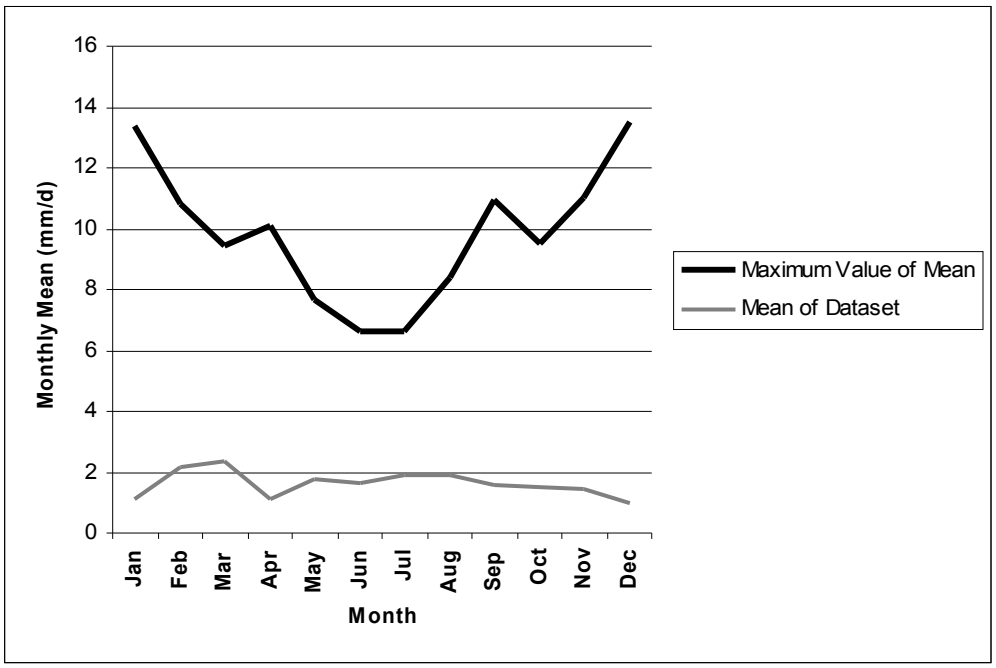

Fig 2. Statistical check of the results

In addition to producing rainfall series for future simulations, GlimClim was used to fill the gaps in a dataset with missing values. Once more, statistical checks have shown that the results which are produced are reliable albeit the fact that the source dataset was not extensive enough. This has shown that GlimClim behaves in a reliable manner even with real field data which might not be complete.

In this paper we have demonstrated the reliability of GlimClim even when the available datasets are limited. It can be used to produce stochastic rainfall series for neighboring rain gauges, provided that climatic and weather conditions are similar for the entire area of study GlimClim can be used for research purposes in transboundary basins, in order to obtain stochastic datasets of rain gauges in cases where data are unavailable, restricted or incompatible. This could give a better insight to the behavior of the basins under study since water boundaries do not always coincide with national or administrative boundaries. However, the use of such models in order to produce stochastic datasets should be considered as an auxiliary tool and not as a reason to deny international co-operation over the issues of water management.

The results of this work have shown that GlimClim could be considered as a helpful tool for research in the Nestos River basin or any other transboundary basin. The size of the research area is within the specification of reliable functionality of GlimClim and this has been proven by the production of

stochastic data series which can be used in hydrologic simulations. It also addresses the ever-present problem of restricted data release from various administration services, which exists even when the research areas in question are not shared by different countries.

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