



## **The ‘Galway flow modeling and forecasting system (GFMFS)’ – a versatile software package for rainfall-runoff modeling, flow simulation and forecasting**

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GFMFS (the ‘Galway Flow Modelling and Forecasting System’), Version 2.0, is a software package developed for use within the MS-Windows environment on standard PCs. It comprises a suite of deterministic hydrological rainfall-runoff transformation models for river flow simulation and forecasting. These models were developed at the Department of Engineering Hydrology of the National University of Ireland, Galway, over a period of nearly two decades, in tandem with the series of seven ‘International Workshops on River Flow Forecasting’ and the (sadly now defunct) International Post-Graduate Courses run by that department. Continuing research activities in Galway have contributed to the further development of some of the models incorporated in the GFMFS, greatly enhancing and extending its functionality and its scope of application. While the present authors are responsible for its current Graphical User Interface (GUI) and for most of the more recent innovations of the GFMFS, the package naturally reflects also the contributions of many former staff members, workshop participants and present and past postgraduate students.

The GFMFS incorporates 5 versions of lumped system-theoretic models, and 3 variants of a model of the quasi-physical conceptual type. Facilities are provided to generate simulated discharge values using observed (historic) input data by choosing a model from the suite of models available in the package. Following the ‘multi-model’ approach, 3 techniques are included for the combination of model outputs with the purpose of obtaining ‘*consensus forecasts*’, in simulation mode. The updating models in the GFMFS are grouped into two broad categories, namely, i) those not requiring forecasts of input variables for lead-time discharge forecasting, and ii) those utilizing

forecasts of the input variables over the lead-times of the flow forecasts, 4 models of the first category being represented and 6 of the second. Also included are 3 techniques for combining the corresponding lead-time discharge forecasts obtained from a number of different individual updating models to produce consensus forecasts over the forecast lead-times. A total of 63 different options are provided for real-time flow forecasting, reflecting various combinations of models and techniques.

This wide range of options in the package provides considerable versatility and flexibility. Demonstration files are provided to enable users to gain familiarity with the functionalities of the GFMFS, a number of utility functions being provided. On-line 'HELP' is available, providing on-screen assistance to the user, and an effective error detection system incorporated which provides information on the source of the error, warning the user when an improper data entry is made or an invalid action initiated. The Graphical User Interface (GUI) gives the conventional Windows appearance and feel to the software.

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