FAD: A computer based system for Frequency Analysis of Droughts

Abstract

Decision support systems are widely developed to assist water resources engineers, water managers and hydrologists in the design, operation and management of water resources structures. Unfortunately most decision support systems based on frequency analysis are not accepted by their projected users. The user’s conceptual representation of certain situations does not often correspond to the hydrological frequency analysis model representation as applied by most decision support systems. The main purpose of this paper is to present a software for hydrological frequency analysis with historical information. The FAD software (acronym for Frequency Analysis of Droughts) developed in a Windows platform and compiled by MATLAB 6.5, represents a user friendly tool that can be used by practitioners for solving frequency analysis problems in the field of hydrology in arid and semi-arid regions. The software represents also a decision support system for experts to assist water resources engineers and hydrologists and a didactic tool for students who approach this kind of problem for the first time.

FAD System Development

The chosen technical platform drew upon our development experience, in the area of graphical user interface (GUI) and decision support systems. The system is constructed with the use of pre-developed toolkits of MATLAB (Matlab 6.5). The system components such as toggle and push buttons, menus, edit texts, list boxes, popup menus, axes, etc., are all pre-programmed in MATLAB. The sole source for all program features and some tools is our development. MATLAB functions are not the only base for all graphical features of the system. The system is constructed in a modular fashion, comprising of a number of components, including hypertext, database, data graphing facilities, selected fitted drought frequency distributions and probability plotting position for all distributions available in the software. The FAD software objectives were to create a computer system that would support multidisciplinary decision making by water resources managers, ecologists, environmentalists and economists.

The advantage of a such computer program is that many different scientific and hydrological disciplines can be involved. The user can use it for drought frequency analysis, precipitation frequency analysis, etc. The resources and the input data of the system included gauged systematic records, Annual rains whose magnitudes can be accurately estimated such as most systematically gauged precipitation data, a second type of historical information to be considered is the annual rainfall whose magnitudes cannot be determined but which are known to have not exceeded an upper threshold and finally, all the rainfall values whose magnitude is known to be within a range described by an upper and a lower bound. To achieve these objectives, ease of system use, low platform costs, low maintenance costs and flexibility of the system components were key design priorities.

Analysis of the developed system

FAD system successfully creates a technical hydroinformatics system that it is attractive and easy to use by the noncomputer expert. As noted earlier, the system uses a proprietary GUI. Although this interface is well designed, it inevitably incurs an additional knowledge burden upon the user. This need for additional knowledge arises because the user has no prior experience with the interface and consequently no prior knowledge base to draw upon. The software successfully demonstrates the suitability of hydroinformatics system to modular development. Additional modules have been added to FAD at various points, to meet additional user requirements. In a next step of the project, to make a strategy to continuously improve the software. Ideally, the feedback of information from the user to the designer must be the basic element of the strategy. A phased implementation of a module can allow the system to provide an operational service. Once in this module, valuable feedback can be obtained from the end users. We will use this information to continuously improve the system.