INVESTIGATING LIKELY IMPACT OF CLIMATIC CHANGE ON QUALITY AND QUANTITY OF SURFACE WATERS IN THE SEYHAN RIVER BASIN

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ABSTRACT

The nature of surface water quality and quantity in a region is mainly related to the rainfall characteristics and basin geomorphology. Extensive knowledge of land uses, topography, conveyans systems and real-time climatic information are important factors affecting flood forecasting in flood studies. It is also preferable to use more than one method to forecast flood and to compare results so that there is no only method giving accurate results every time.

Objectives of this project which will be carried out in a size of drainage area of 21,500 km^2 of Seyhan River Basin are providing hydrologic databases in parallel of project goals by using GIS, investigating possible change in trend for the long time records of hydro-meteorological data (precipitation, temperature, flow, water quality), developing deterministic and stochastic prediction equations for flood studies.

1. INTRODUCTION

1.1. General Introduction

The estimates of future flood magnitudes of a given return period in areas where no flow gauging stations exist or where gauge records are very short are required for economical planning and design of river basin projects meant for conservation and utilization of water for various purposes (Garde and Kothyari, 1990). However, the method of estimation employed depends upon the quantity and quality of the available data and the nature and the economic life of the project (Acreman, 1985).

At a site with a long record of measured floods, estimates may be derived by statistical analysis of the flow series. Alternatively the storm magnitude of an appropriate duration, areal coverage and return period may be estimated and converted into the flood of a given return period using a unit hydrograph. However, in cases where adequate flow records are not available at or near the site of interest, regional studies can be useful such as regional flood frequency analysis, regional regression analysis using GIS based physiographic and climatic characteristics of the basin (Farquharson *et al.*, 1992).

GIS can provide digital representation of basin characterization. GIS also provides automatic layers for perspective viewing, slope analysis, terrain analysis, hydrography analysis and flood simulation by using Digital Elevation Model (DEM).

All data collected and analysed, and data base to be established is planned to be used as input data for the comprehensive HYDROBEAM model developed by Kojiri and Fujinawa of RIHN-Japan.

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1.2. Objectives of the study

Objectives of this study are summarized in the following:

- Possible changes in trend for the long time records of hydro-meteorological data (precipitation, temperature, flow, water quality) will be investigated in Seyhan River Basin,
- Hydrologic data base in parallel of project goals will be provided by using GIS.
- Deterministic and stochastic prediction equations for flood studies in Seyhan River Basin will be developed.

2. MATERIAL

2.1. Study Area

The study area is located in southern Turkey; bounded by latitudes 36° 30' N and 39° 15' N, longitudes 34° 45' E and 37° 00' E. It covers an area of approximately 21 470 km^2 which is 2.7% of Turkey. There are two main dams, the Seyhan and Catalan, in this area bounded by Ceyhan basin in the east, Kizilirmak basin in the north, the East Mediterranean sea basin in the west, Konya basin in the northwest and the Mediterranean sea in the south.

2.1. Archived Data

Material used in this study is archived data that collected from different institutions of Turkey.

These are:

- Annual maximum flows and water quality observations of Seyhan river basin.
- Precipitation and temperature records of meteorological observation stations.
- Original 1/25 000, 1/50 000 and 1/100 000 scale topographic and digital maps.

Data required for this research will be obtained from State Hydraulic Works, Turkish State Meteorological Service, Ministry of Rural Affairs and Map General Headquarter.

3. METHODOLOGY

This research is planned to be carried out in the Seyhan River Basin. Methods in consideration will be used in this study were given as follows:

Non-parametric statistics: Flow, precipitation and other raw data will be tested by trend, dependence, homogeneity, etc. (Wall and Englott, 1985; Lye and Lin, 1994). These tests could be done by SPSS and Minitab package programs.

Probability studies: Probability and statistics can use random variables for determining future values of hydrometeorologic events such as flow and precipitation (Chow, 1964, Tülücü, 1996). Flow and precipitation data will be evaluated according to Haktanır (1991) who prepared a Q-T.exe. package program

Regional Flood Frequency Analyses: Observation stations aiming at providing flood records are generally new established, have sampling errors and different record periods. Moreover, there is no enough observation station. Also, necessary information about frequency would be needed in the out of area where measurements have done (Zirinji and Burn, 1994). In this study, Dalrymple (1960) method will be used regarding these issues.

Database Development: The GIS software used in the present study is Integrated land and Water Information System (ILWIS). The boundary of the Seyhan River Basin and all the streams will be mapped from archived data. A contour map will be prepared from topography map. Both these maps will then be converted to digital form using digitization and stored in ILWIS.

Strahler's ordering system will be applied through ILWIS over the entire drainage network of the study area. Lenght of each stream will be stored in a table, then total stream lenghts of each order will be evaluated.

DEM will be generated from interpolation of contour heights, drainage network map of the study area will be prepared and flow direction determined by using DEM.

Database that includes precipitation, land use, characteristics of soil groups will be prepared by using GIS.

Regression Analyses: Multiple regression and best subset analysis related to basin characteristics and flow and precipitation features will be used for determining mathematical relations of flood according to Arıkan, (1979), Bilgin (1981) Mimikou and Gordios (1989); Pitlick (1994). Minitab (Version, 13.1) package program will again be used for this aim.

Stochastic Models: Structure of time series of annual instantaneous maximum flow values will also be determined by the rules given by Box and Jenkins 1976). Minitab (Version, 13.1) package program will also be used for determination of stochastic models such as autoregressive and moving averages models.

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