A SEMI-DISTRIBUTED CATCHMENT YIELD MODEL

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CERTIFICATE

This is to certify that the thesis entitled ***'A SEMI-DISTRIBUTED CATCHMENT YIELD MODEL'*** being submitted by ***A. Mani*** to the ***Indian Institute of Technology, Delhi*** for the award of the ***Degree of Philosophy*** is a record of bonafide research work carried out by her my guidance and supervision. The thesis work, in my opinion, has reached the standard, fulfilling the requirements for the said degree. The research report and the results presented in this thesis have not been submitted, in part or in full, to any other University or Institute, for the award of any degree or diploma.

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The semi-distributed catchment yield model has been developed which is an improvement on the lumped conceptual model. The model developed is physically based and can be used in ungauged catchments. The model has been tested on a catchment in Central Italy. In the process of testing the model a specific purpose application has been developed to study the impact of various scenarios of artificially connecting the adjoining basins to the Trasimeno lake on the lake levels. The model has two components. The first component is Soil-Water balance and the second one is lake balance. The soil-water balance considers various processes, namely, snowmelt, interception, infiltration, evapotranspiration, percolation and lateral flow. The lake balance computes evaporation and seepage taking into consideration the inflows into the lake and any outflow from the lake. The basin is conceptualised into different zones on the basis of landuse. The water yield at each of the landuse is summed up to attain the total yield of the basin. The model is physically based and does not require any conventional calibration.

The semi-distributed model is applied on the Trasimeno basin along with the four other already connected adjoining basins, namely, Tresa, Rigo Maggiore, Moiano and Maranzano to obtain the simulated lake levels. In order to enhance the flexibility and usability of the model, an interactive interface is developed using C++ object oriented programming approach. The interface is completely menu driven and controls all the operations like data input, processing, simulation and display of results through the menus. The entire data sets needed to operate the model are kept in different dBASE IV files which enhances the data security. The semi-distributed model is applied through the interface to simulate the Trasimeno lake levels using the data from 1967 to 1986. The simulated lake levels are compared against the observed lake levels, since there is no measured discharge data available for the individual basins.

The semi-distributed model is compared against the lumped model (SMAR) to ascertain the usefulness of the distributed models over the lumped model. The structure of the SMAR did not contain snowmelt component. The snowmelt component is incorporated in the model to make the comparison sensible. SMAR model needs calibration since it is a lumped model. The model is calibrated on the first three years of records (1967 to 1969) using modified Rosenbrock optimisation technique. The set of parameters obtained from optimisation are incorporated in the model to simulate the Trasimeno lake levels for the remaining years. The results so obtained are compared with that of semi-distributed model. The semi-distributed model performs comparably well with the SMAR model during the calibration, but outperforms during the non-calibration period.

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