SECTION 6.1

APPLICATION OF SHE TO NARMADA FOCUS BASINS

INTRODUCTION

By

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India with a geographical area of 329 million ha. has been blessed with large river systems, most of which are rainfed and seasonal. Physiographically, India can be divided into seven divisions, viz. (i) the northern mountains, (ii) great plains, (iii) central high lands, (iv) peninsular plateau, (v) east coast belt, (vi) west coast belt, (vii) islands. The Central highlands lie between the great plains of north India and the plateaus of the Deccan. Most of the rainfall in India takes place under the influence of south-west monsoon between June to September except in Tamil Nadu where it is under the influence of north-east monsoon during October and November. The rainfall in India shows great variations, unequal seasonal distribution, still more unequal geographical distribution and frequent departures from normal. The variations in temperature are also marked over the Indian subcontinent. Evaporation rates closely follow the climatic seasons and reach their peak in the summer months of April and May. Land use generally falls under various categories such as under (i) forest, (ii) cropped area, (iii) pastures and grasslands, (iv) non-agricultural uses, (v) barren and uncultivable land, (vi) fallow land, etc. The river system of India have been classified under four groups, viz. (i) Himalayan rivers, (ii) Deccan rivers, (iii) Coastal rivers, and (iv) rivers of the inland drainage basin.

The Narmada river system is an important river system in Deccan. The Narmada river originates in Amarkantak in State of Madhya Pradesh, flows westwards over a length of 1312 km into Arabian Sea draining an area of 98,796 sq.km. The total average annual water resources potential of Narmada basin has been estimated as 41.273 cubic km. The estimated utilisable flow excluding groundwater is 34.50 cubic km and utilisable groundwater 13.0 cubic km. As per the figures provides in C.W.C. publication No 30/88, completed projects in Narmada basin account for 3.216 cubic km of gross storage (2.806 cubic km of gross storage) while ongoing projects account for 20.214 cubic km of gross storage (14.106 cubic km of live storage). The river has 41 tributories penetrating the catchment in north-south direction and the major part of basin consists of a variety of black soils with a large content of clay. The vegetation in the basin includes a variety of agricultural crops on the plains and forests of varying densities in the upland areas. Areas of scrubland and bare soils are also widely observed.

The hydrological problems associated with the existing and proposed development in Narmada basin are complex and include:

(i) Estimation of runoff from ungauged catchments;

(ii) Surface water/groundwater interation;

(iii) Conjunctive use

(iv) Predictions of effect of land use change and irrigation on water yields, floods, low flows, soil erosion, etc.

The SHE Model with its deterministic, distributed, physically based structure provides a sophisticated hydrological modelling approach in simulating land use change impact, ungauged basins, spatial variability in catchment inputs and outputs, groundwater and soil moisture conditions and the water flows controlling the movement of pollutants and sediments. However, for obtaining any worthwhile realistic results, good quality data and information of various parameters both in space and in time are necessary. Any uncertainty in the spatial and temporal distribution of the rainfall input, runoff time series, and in the values and distributions of the hydrological parameters would affect the simulation result. The results of simulation studies using available data of sub-basins of Narmada basin, therefore, indicate potential of SHE Model with data limitations and assumptions made.

Despite the problems posed by uncertainty in the data and the parameter base, the simulation results being presented at this workshop are encouraging. These results have also indicated problem areas, particularly related with spatial and temporal distribution of rainfall, soil properties and parameters, rating curves and flow estimates leading to erroneous information for basin water balance, soil crack in clayey soils, etc. Further tests are planned to demonstrate the ability of SHE in predicting the impacts of land use change and in evolving different strategies for operation of irrigation command areas. It is hoped that availability of models like SHE, will lead to more widespread measurements of various hydrological parameters and improvement of data base for hydrological studies.