ABSTRACT

A physically based distributed hydrological modelling system – DHM-IIT was developed to bridge the gap between the requirement and the inaccessibility of the already developed hydrological models because of their high cost and unavailability of code especially in Indian sub-continent. The model has modular structure with Graphic User Interface and GIS capabilities, and solves finite difference forms of 1-D Richards' equation for infiltration, 1-D and 2-D Saint Vanant equation with kinematic approximation for channel and overland flow respectively, FAO Penman Montieth equation for evapotranspiration and 2-D Boussinesq equation for groundwater modelling. To test the efficacy of the developed model, necessary data were obtained from a test watershed. The model code was tested for simulation time steps and its ability to simulate extreme weather conditions. The model performed well, with maximum mass balance error of 0.31 percent for one hour time step. Simulations were carried out for one month period for model calibration and twenty days period for model validation. The model was calibrated for Manning's roughness coefficient for overland and channel flows, saturated hydraulic conductivity and specific yield. Modelling efficiency (ME) and coefficient of residual mass (CRM) were used as the performance criteria. The ME and CRM were 0.75 and 0.07 respectively for calibration period, whereas for validation, ME and CRM were 0.86 and 0.35 respectively. From sensitivity analysis, it was observed that model is sensitive to Manning's n, with a value of 0.035 giving best results and the channel shape had effect on hydrograph peaks, with parabolic section performing better than trapezoidal section.

Keywords: Hydrological modelling, modelling efficiency, coefficient of residual mass, Infiltration, overland, channel, groundwater modelling.