CALIBRATION AND APPLICATION OF SWATRE MODEL FOR LOCAL CONDITIONS

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ABSTRACT

The main aim of the study was to see whether the model SWATRE could be applied to the local conditions or not. SWATRE is one dimensional model for the unsaturated zone with addition of water uptake function for the roots. The model is capable of simulating drainage flux, capillary flux, net bottom flux and predicts soil water content under various conditions in the soil profile under consideration.

Three soil hydraulic parameters (residual volumetric soil water content θ_r, volumetric soil water content at saturation θ_s, saturated hydraulic conductivity K_s) were determined in the laboratory. Rest of the three soil hydraulic parameters (α, which is reciprocal of mean air entry value, parameter n, which is a measure of the width of the pore size distribution, l, which is correlation between pores and the flow path tortuosity) were determined by the optimization by the model SFIT. Crop parameters (root depth, soil cover) were estimated from field experimentation. Weather data and net bottom flux data was obtained from lysimeter.

Sensitivity analysis was carried out to determine the influence of various input parameters and to determine which parameters could be used for calibration. Sensitivity analysis showed that the model was most sensitive to the soil hydraulic parameters which were later used to calibrate the model. The model was calibrated on the wheat crop grown in lysimeter having a specific water table depth. Calibration was based on the comparison of net bottom flux from the lysimeter studies and the simulations made by the model.

Initially the model was simulation very high net bottom flux. Therefore soil hydraulic parameters were changed in fixed increments until a reasonable match was obtained between the actual and simulated net bottom flux curves. The net bottom flux obtained finally was -3.3 cm as compared to the value of -2.1 cm reported by the lysimeter station. These results indicate that model is capable of simulating unsaturated flow satisfactory. For model SWATRE use of cumulative data neglects some of the very important observations such as start of drainage and peak drainage. Therefore use of cumulative data should be avoided for model studies. Soil hydraulic parameters were extremely flexible and their was no criteria regarding the limits of the parameters for various types of soils. So a limiting criteria for various soil types is basic necessity. Use of actual soil sample is necessary as it may remove many doubts regarding the fluxes being effected by the structure and properties of the selected soil.

After calibration the model was applied to three other lysimeters having same crop, soil and water table depth but the year, irrigation depths and frequencies were different. Application results were also within a practical range.

Calibration and application results showed that model SWATRE is capable of simulating the soil water flow conditions fairly good. Therefore the procedure developed in this study for the determination, calibration and evaluation of parameters may confidently be applied for practical conditions.