Chaiyapong Thepprasit 2012: Watershed Runoff Prediction, Streamflow Analysis and River Modeling in The Chao Phraya River Basin. Doctor of Engineering (Water Resources Engineering), Major Field: Water Resources Engineering, Department of Water Resources Engineering. Thesis Advisor: Associate Professor Kobkiat Pongput, Ph.D. 267 pages.

The purposes of this research were to determine the trends of weather variables, reference evapotranspiration and evapotranspiration parameters. In addition, the antecedent precipitation index relationships were evaluated in order to develop a rainfall-runoff model. The rainfall-runoff model was applied to evaluate outflow hydrographs at each watershed and also at the major reach of the upper Chao Phraya River Basin thus a better river basin management could be achieved.

To achieve these purposes, the daily average of evapotranspiration and evapotranspiration parameters from 1977 to 2006 was computed for each weather station by using the FAO Penman-Monteith method. The trend analysis was determined by Mann-Kendall test. Furthermore, the daily antecedent precipitation index of 112 small watersheds in the Upper Chao Phraya river basin was evaluated using the relationship of Kohler & Linsley. The watershed runoff was predicted from the best fit performance of the original antecedent precipitation index model; The antecedent precipitation index model was adjusted by evapotranspiration and critical antecedent precipitation index range models. In addition, Hydrologic Engineering Center-Hydrologic Modeling System was used to route hydrographs through the major reach of the Upper Chao Phraya River Basin.

The results revealed the weather variables to have both increasing and decreasing trends in evaporation, sunshine, and rainfall, decreasing trends in wind speed, and increasing trends in temperature and relative humidity. The evapotranspiration parameters have increasing trends in the soil heat flux and actual vapor pressure, and decreasing trends in vapor pressure deficit, net radiation, as well as evapotranspiration. In the analysis, watershed areas vary from 22.36 to 5,583.44 square kilometers. As for the study results of the soil water recession coefficient vary from 0.791 to 0.883 and the antecedent precipitation index vary from 2.55 to 5,583.44 mm/day. The finding indicates that a 60 percentage range of the critical antecedent precipitation index range which is a nonlinear multiple cubic regression, will be more appropriate for the estimated watershed runoff than the original antecedent precipitation index model, the adjusted antecedent precipitation index model and the other percentage range of the critical antecedent precipitation index range model. The accuracy of hydrograph calculated for each watershed and each major reach by using the Nash-Sutcliffe Efficiency and the correlation coefficient indicates the reliability of the model used for prediction.

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