STOCHASTIC SIMULATION MODELS

FOR

SOLAR RADIATION

&

EVAPOTRANSPIRATION

THESIS

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ABSTRACT

The objective of this study was two fold. The first was to develop a model for daily solar radiation to extend the available record which can be used to compute daily ET. The second was to analyse the structure of evapotranspiration (ET) time series to formulate a stochastic model for ET prediction.

In the first phase, a stochastic model (STRGEN) for daily solar radiation generation was formulated by using 3 years (1972-1974) daily observed data of average temperature, sunshine hours, and solar radiation for Sargodha station. This model consists of two parts i) deterministic, and ii) stochastic. Deterministic part was evaluated by multiple regression approach which includes daily average temperature and sunshine hours as an input independent variables; while, the dependent variable was daily solar radiation. Stochastic part is the use of standard error of solar radiation to define its random component or errors due to seasonal affect. These two parts were computed separately and then combined in one single equation which was used to generate daily solar radiation. The purpose of this generation was to extend solar radiation record which is the input in computing ET used in the second phase of study. The adequacy of the model was checked at three widely separated locations, the results of which were very close to the daily observed solar radiation values.

In the second phase, the modelling of ET was performed by using 20 years of ET data computed by Jensen-Haise method at Sargodha station. The modelling of ET was based on decomposition of series into deterministic and stationary stochastic components. Each component was identified and removed from the series. To test whether a trend component was present or not. A hypothesis of no trend was made and through Turning point and Kendalls'Rank Correlation tests it was fouund that ET time series was trend free. Periodicities in the parameters were removed by using both parametric and non parametric approaches. The dependent stochastic component was found to be well expressed by the first order autoregressive model.

The model was used to generate ET for 25 years at Sargodha station. The generated values were very close to the historical values in terms of 10 daily means and standard deviations. Model accuracy was checked by generating ET for 25 years using 12 years historical data of Farooqa Abad station which had not been previously used in parameter estimation. The generated values were very close to the historical when compared. Therefor, model can be used confidently to generate ET values for 25 years and it may also be extended to any desired period.