



Spatio-temporal variability of Climatic factors and Short-term forecasting of Reference Evapotranspiration across Punjab, Pakistan

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Abstract

Reference Evapotranspiration (ET_o) is one of the key parameters to calculate crop water requirements of an agricultural land. Climate change in any region has seriously impact on crop water requirements. For this purpose, spatiotemporal variability of climatic parameters and reference evapotranspiration in Punjab, Pakistan were assessed. The monthly average data of five climatic parameters such as minimum and maximum temperature, humidity, windspeed and sunshine hours were acquired from year 1950 to 2016. The spatial and temporal variations of the climate data in Punjab were delineated using GIS and reference evapotranspiration (ET_o) was measured with CROPWAT model. The relationship between climatic parameters and ET_o were developed using regression analysis. The study area is divided into five different spatial zones to obtained the strong relationship such as i) One Punjab ii) Two North and South Punjab iii) Six Agro-climatic zones iv) Nine Administrative Divisions and v) Thirty-Six Districts. The data of years 1950-1980 were used for calibration and 1980-2016 were used for validation of the developed regression models. The results showed that temperature is the more influencing factor among climatic parameters on reference evapotranspiration. Hot regions were identified with high values of annual total ET_o in Southern-Punjab and the relative cold regions were highly clustered in most parts of Northern-Punjab. The average annual temperature and ET_o for the whole Punjab increased by 2°C (23.6 to 25.6 °C) and 160mm/year (2197 to 2357mm/year), respectively from year 1950 to 2016. It was observed that the exponential regression equation represents the highest coefficient of correlation in each category. It was concluded from the results that the prediction of ET_o from temperature is best at district level with R² of 0.93 followed by division level with R² of 0.91.

Keywords: Reference evapotranspiration, Spatiotemporal variability, Climate Change, Punjab-Pakistan