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Can NASA Power Climatic Data Fill the Gap of Climatic Data Required for Agriculture and Forest Ecosystems Modeling?

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Abstract

Modeling of agriculture and forest systems are widely practiced at present to make important decisions related to sustainable management of agriculture and forest ecosystems and to mitigate climate change impacts. Long-term climatic data is an essential component of such a modeling framework. However, acquiring reliable, consistent long-term climatic data across the country is expensive and as well as not readily available in Sri Lanka. The power project of the National Aeronautics and Space Administration (NASA power) of the United States provides climatic data freely across the world and data can be accessed from NASA power web page using geographic coordinates. Thus, climatic data from NASA power would be a useful database if it can be used to fill the gap in required climatic data. The objective of this study was to evaluate the reliability of long-term rainfall and temperature data obtained from NASA power to be used in the absence of observed data. Daily observed precipitation, maximum and minimum temperature data over a decade at meteorological centers in Batalagoda, Bombuwela and Mahaillupallama representing major climatic zones in Sri Lanka based on purposive selection and NASA power data in the same centers over the same period were compared in this analysis. Boxplot diagrams were used to compare above three weather parameters graphically. Paired *t*-test was applied to find out whether is there any significant difference between population means of two data sources. Further, regression analysis and correlation analysis were done to find out the relationship between two data sources and the accuracy of the predictive value of meteorological center data based on NASA power data was tested with mean squared error. Boxplot diagrams illustrate that there is a significant ($p<0.05$) difference in data distribution between two data sources in all three parameters in terms of central tendencies and dispersions. As per the paired *t*-test null hypothesis of no difference between the means is clearly rejected ($p<0.05$). Apart from that correlation coefficient, the linear regression analyses, and the accuracy measures of the predictive value of meteorological center data based on NASA power data shows more strength in daily maximum and minimum temperature compared to precipitation data. In conclusion, daily minimum and maximum temperature of NASA power data can be considered to fill the gap in required climate data whereas the precipitation data is not precise enough.

Keywords: NASA power, Observed data, Weather parameters, Comparison