503/E1

A study of the relationship between the sunspot number and some aspects of weather patterns in Sri Lanka using artificial neural networks

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The sun plays an important role on the heating of earth's atmosphere and generating associated wind patterns. Several researches in the past have attempted to find a relationship between the solar activity and terrestrial weather in view of using it as a tool for forecasting unexpected weather changes. However, only theoretical and statistical approaches have been used at various temporal and spatial scales. Although several results have been obtained, no model is identified as reliable up to date. This study attempted to understand the influence of solar activity on monthly weather in Sri Lanka using artificial neural networks.

In this study local weather data on monthly average temperature, monthly average rainfall and monthly average sunshine hours were collected from the Department of Meteorology, Sri Lanka for a period of 600 months starting from January, 1965 to December, 2014. The sunspot number was used as an indicator of the solar activity and those data were extracted from the database of SILSO data/image, Royal Observatory of Belgium.

Data pre-processing was done with the help of MS Excel software. The MATLAB software was used for data analysis of data segmentation, constructing the supervised artificial neural network and obtaining results. Data of the first 550 months were used to create and train the neural network in capturing a relationship if exists, and the remaining data were used for testing. The accuracy of the artificial neural network was finally calculated by comparing the results generated by the network for the last 50 months of the data set with the actual collected data.

The correlation between sunspot number and the average temperature was found to be 26%, while that of the sunspot number and average rainfall was 34%. After incorporating sunshine hours, those correlations reduced to 20% and 26%, respectively. With the low accuracy levels received from the neural network for predictions, it can be concluded that there is no significant correlation between sunspot number and monthly weather patterns in Sri Lanka, an island surrounded by the ocean. Further improvements by incorporating other parameters such as solar flares and sea surface temperature of the Indian Ocean may increase the accuracy in predicting future weather patterns.

Keywords: Sun, solar activity, weather, neural network

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