

STUDY OF SOLAR RADIATION VARIATION IN SRI LANKA

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Solar radiation is the electromagnetic radiation emitted by the Sun which can be captured and turned into useful forms of energy, such as heat and electricity. It has been increasingly valued due to its application for useful purposes. However, clinical studies have shown that there are negative effects of solar radiation on the human skin. Therefore, the knowledge of the variation of solar radiation in Sri Lanka is crucial for industries as well as policymakers. The study aims to identify the type and behaviour of surface net solar radiation (SSR) and other relevant factors such as convective precipitation (CP), instantaneous moisture flux (IE), surface pressure (SP), sea surface temperature (SST), sunshine duration (SD), 10 m U wind component (U10) and 10 m V wind component (V10). Daily data on above parameters for 39 years were obtained from the European Centre for Medium-Range Weather Forecasts website. The geographical area (4.50° to 10.50° latitude and 78.00° to 83.25° longitude) which covers Sri Lanka was considered in the study. The behaviour of each variable, when moving across the land area, was studied and it is found that the median values and variations of SST, CP, SP, and IE are comparatively very low in the central region of the country than in the coastal area. The median values of SSR are higher in the East than in the West of the country. Median values and variation of SD are significantly higher in the East than in the West. The area was divided into 72 small grids and a regression model was fitted for each grid. All models were significant at 5% level with an adjusted-R² greater than 85%. The relative importance of independent variables on SSR for each grid area was obtained. The SD was the highest contributing factor to solar radiation in the region while CP had the least relative importance on the West coast and the central region of the country. The wind components have the least relative importance in the southwest area while the SP have higher relative importance in the northwest region. Moreover, the highest relative importance of the IE on SSR was found in the land area. Overall, the analysis revealed that there is a variability of the relative importance of the independent variables studied on solar radiation in the region. Furthermore, multiple time series analysis was conducted to predict the SSR of 6 grids representing different locations in the country. Augment Dicky Fuller Test revealed that all variables were stationary at 5% level of significance. As the Johansen cointegration test indicated the existence of eight cointegration relationships, the Vector Error Correction model was fitted. The adequacy of each model was evaluated using cross-validation. Findings revealed that the forecasted SSR values are decreasing gradually along with its variability.

Keywords: Regression, Relative importance, Solar radiation, Vector Error Correction Model