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Multivariate time series models for temperature data in Nuwara Eliya, Sri Lanka

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Sri Lanka is located north of the equator. Hence, its climate is regarded as a tropical climate and the average mean temperature in Sri Lanka is 27.0 °C (81 °F). However, the temperature in some parts of the island deviates from the typical temperature pattern. Especially the cities in the central parts of Sri Lanka are situated far above the sea level, and hence temperature in these regions is low and experience seasonal behaviour. Nuwara Eliya district is one of the tourism hotspots of Sri Lanka, which is located in the central province. The lowest annual regional temperature in Sri Lanka is recorded in weather stations at Nuwara Eliya, which is about 15.0 °C (59 °F). Nuwara Eliya district is long known for its high-quality agricultural products including tea, vegetables, and fruits. The behaviour of temperature heavily influences these two industries (tourism and agriculture). Therefore, it is very significant to analyze the temperature in Nuwara Eliya. Thus, in this study, we expect to analyze the monthly atmospheric temperature of Nuwara Eliya. For that, monthly maximum, and minimum temperature series in Nuwara Eliya from 1997 to 2018 were collected from the Department of Meteorology, Sri Lanka. This study focused on seeking the joint behaviour of monthly maximum and minimum temperature series while analyzing the correlation structure of both series. Using regression analysis, the seasonal components and trend components of both series were estimated. However, according to the trend analysis, both series did not experience a significant trend during the considered time period. Then, using the whitening technique, a significant cross-correlation between the seasonally adjusted two series was investigated. A VAR (Vector Autoregression) model was fitted to represent the joint behaviour of the two deseasonalized temperature series. VAR (3) model was selected as the best multivariate model for the two series. In addition, the forecasting accuracy using the multivariate model was assessed. The resulted mean absolute percentage error values (MAPE) are 6.29% and 2.43% for minimum and maximum series respectively. These MAPE values confirm that the model can be utilized for better predictions with higher accuracy.

Keywords: Cross correlation, Prewhitening, Time Series