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Periodic time series modeling for temperature data in Nuwara Eliya

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Many climatological time series display interesting properties such as trend, seasonality and autocorrelation. In addition to the autocorrelation, some time series display periodic autocorrelation, which is not readily visible. Time series, which depict periodic correlation are called as periodic time series and they can be modeled using autoregressive moving average models with periodically varying parameters. The key objective of this study was to model monthly temperature data using a periodic autoregressive model and to predict under the periodic correlation. In this research monthly mean minimum temperature series and monthly mean maximum temperature series in Nuwara Eliya district were considered. Since considered data were monthly data, the period of the data sets was twelve. In this research Fisher's g-test was used to detect periodic correlation. Fisher's g-test showed that only monthly mean minimum temperature series has a significant periodic correlation structure. Seasonally adjusted mean minimum temperature series was modeled using periodic autoregression (PAR) model. Using the Akaike information criterion, PAR model of order 1 with zero mean was chosen as the best fitted model for representing the seasonally adjusted data. The parameters of the model were estimated using periodic Yule-Walker estimation. Further, to check whether the periodic model was the best time series model for modeling and forecasting monthly mean minimum temperature data in Nuwara Eliya, different seasonal autoregressive integrated moving average models (SARIMA) were fitted. Finally, using forecast accuracy measurements such as Mean Error (ME), Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE), all models were compared and the best model was identified as the PAR(1) model that showed a ME value of -0.0861, RMSE value of 0.613 and MAPE value of 4.664%. According to comparison, periodic auto regression model of order 1 has the best forecasting accuracy among all fitted time series models.

Keywords: Periodic correlation, Temperature, PAR models, Forecasting