

Prediction of monthly mean minimum temperature at Nuwara Eliya

T.K.Hewapathirana

Department of Statistics & Computer Science, University of Kelaniya.

ABSTRACT

Global warming has been identified as a major environmental issue today. Analysis of temperature data in a particular region is useful to determine the trend in the temperature variation and estimate the future values. The present study was carried out to fit a suitable model to temperature data to determine the seasonal variation and trend in the monthly mean minimum temperature at Nuwara Eliya in order to forecast the future values. A discrete time series on monthly mean minimum temperature from 1995-2002 was considered for this study.

When the time plot of the data was examined, it was found that the monthly mean minimum temperature values follow a periodic pattern. As the variation in the time series was dominated by a regular seasonal effect, an additive seasonal model in the form

$$x_t = m_t + s_t + \varepsilon_t$$

where x_t = observation at time t
 m_t = smoothed component
 s_t = seasonal component
 ε_t = random error

was considered to forecast the future temperature values.

As the observations were recorded monthly, a linear filter with weights $(1/24)[1,2,2,\dots,2,2,1]$ was considered in order to obtain the smoothed values. Estimated seasonal factors (\hat{s}_t) were calculated by normalizing the averaged residuals obtained from the smoothing procedure.

A linear trend (\hat{Y}_t) was fitted to the depersonalized data. After estimating the model parameters by the method of least squares the linear trend was found to be

$$\hat{Y}_t = 12.1959 + 1.99E-03*t; \quad \text{where } Y_t = x_t - \hat{s}_t,$$

Adequacy of the fitted additive model was checked by examining the residuals and the model obtained was found to be satisfactory in forecasting the future monthly mean minimum temperature values at Nuwara Eliya. Forecasts could be generated successfully using trend and seasonal factors only for a lead time up to three years and eight months.

According to the present study, it was revealed that the seasonal factors for December, January, February and March were comparatively very low and there is a slight tendency for the mean minimum temperature at Nuwara Eliya to increase over time and the rate was estimated to be approximately 0.024C° per year.