# MODELLING DROUGHT CONDITION IN HAMBANTOTA DISTRICT: A TIME SERIES APPROACH

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J.A.N.C.K.DAMAYANTHA

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**J.A.N.C.K. Damayantha**
**District Planning Secretariat**
**Ministry of North West Region Development**
**Kurunegala**
**Sri Lanka**

## ABSTRACT

According to the Department of Meteorology sources, Sri Lanka has experienced with eight prolonged drought periods during the period 1940-2001. Some areas in Hambantota, Puttlam, Monaragala, Ampara and Ratnapura districts were subjected to severe droughts in recent past and mostly affected areas were belonged to Hambantota district.

During 2001, severe drought conditions were reported in Hambantota, Lunugamwehera, Suriyawewa and Tissamaharamaya divisional secretariat divisions in Hambantota district. In some areas, there were no rains for the past 21 months. According to the government sources, three hundred thousand of people had become victims of the drought. Four cultivating seasons had disrupted and people lost their income and occupations. They had been felt with various diseases and children had to suspend their education activities. Therefore, it is vital to have comprehensive studies on drought in Hambantota to get a thorough understanding of the drought situation.

With this background, a study was carried out to model the dry period in Hambantota based on 100 years data. This was done by fitting suitable time series models to the absolute drought days (consecutive non rainy days $\geq 15$, is called absolute drought days) with the following objectives.

- Plot the time series to absolute drought days belong to First Intermonsoonal Season(FIM), South West Monson(SWM), Second Intermonsoonal Season (SIM) and North East Monsoon(NEM) seasons individually and examine whether there are trend, seasonal component, cyclical variation, irregular variation and outlier observations.

- Fit time series models such as AR(p), MA(q) and ARMA(p,q) to stationary residuals for four seasons.
- Predict missing and future absolute drought days.

For this analysis, Tissamaharamaya irrigation station was selected and daily rainfall data for hundred years was used at the beginning. The data set was converted into binary data, based on daily rainfall data ≥ 0.3mm as "1" (rainy day), otherwise "0" (non-rainy day)(Appendix A.1). Thereafter, it was converted from monthly format to standard week format and it was also divided into seasons such as FIM, SWM, SIM and NEM and calculated consecutive non rainy days ≥ 15 (Absolute drought days) using the Excel Macro Programme (Appendix A.2) for the above seasons seperately. Thereafter time series graphs were plotted for four seasons by using ITSM 2000 software package.

Original series for four seasons were examined whether there are trend, seasonal component, cyclical variation, irregular variation and outlier observations. Original non-stationary series were transformed into stationary series by using suitable method. Differencing method was used in this project. The ACF and PACF graphs were used to find the order of the models. Minimum FPE, AICC, BIC and Likelihood statistic values were used to fit several models such as AR, MA and ARMA. By the aid of diagnostic checking and tests of randomness on residuals, best models were selected

For the FIM season, ARMA(1,13) was selected as suitable model which had minimum AICC, BIC and –2log(LH) values. For the SWM season, ARMA(2,3) was selected as suitable model. For the SIM season, MA(2) was selected as suitable model. For the NEM season, MA(1) was selected as suitable model. There were no data during the period 1995-1997. Therefore, based on the selected models, absolute drought days have been predicted for these three years individually for four seasons. Future values have also been forecasted by using suitable models from 2002 to 2010 with sqrt(MSE) and approximate 95 percent prediction bounds.