

## Statistical Analysis of Thunder-Days to Assist Forecasting Natural disasters

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### ABSTRACT

Lightning is a natural disaster causing more than 50 human deaths every year, injuring many and damaging significant amount of property. As thunder is caused by lightning, hearing thunder is the best audible proof of occurrence of lightning. A thunder-day is defined as an observational day during which thunder is heard at a given location.

Eleven meteorological regions, Colombo, Badulla, Kurunegala, Nuwara-Eliya, Hambanthota, Trincomalee, Anuradhapura, Katunayake, Ratmalana, Ratnapura and Galle were selected for their reliability of thunder-day data for the 30 year period 1961 to 1990. Mann-Kendall rank statistic, Spearman's rank statistic and the least-square regression method were used to detect the trend of thunder-days and their significance. The chi-squared test was used to compare the proportion of thunder-days among the regions for a year and for all monsoon periods and significant differences have been found among them. Further, pair-wise comparison of proportions of thunder-days among the regions was also carried out. Normal approximation to the binomial distribution was used to compute the probabilities of occurrence of thunder-days for each region in all monsoons. Percentages of proportion of thunder-days were calculated and bar charts were drawn for each region. Contour maps were drawn which demonstrate frequencies of lightning activity in all eleven regions of Sri Lanka for the period 1961–1990 on yearly and seasonal basis.

Annual lightning activity shows considerable variation from year to year. It is at a maximum in Ratmalana and at a minimum in Hambanthota. Maximum lightning activity is in Ratmalana and the minimum is in Badulla in NE monsoon and first inter monsoon. During the SW monsoon period, the maximum lightning activity is confined to Badulla and the minimum is in Hambanthota and Galle. In the first inter-monsoon period, the maximum lightning activity has been confined to Ratmalana and the minimum to Galle.

The annual trend of thunder-days in Colombo and Badulla is significant ( $p < 0.05$ ) and upward and is significant ( $p < 0.05$ ) and downward in Katunayake and Ratmalana. In NE monsoon, there is downward trend in Hambanthota and Katunayake ( $p < 0.05$ ), but in SW monsoon there is an upward trend in Colombo and Badulla ( $p < 0.05$ ) but a downward trend in Ratmalana ( $p < 0.05$ ). In first inter-monsoon there is downward trend in Kurunegala, Katunayake, Ratmalana and Nuwara-Eliya ( $p < 0.05$ ) but an upward trend in Badulla ( $p < 0.05$ ). Significant ( $p < 0.05$ ) upward trend in thunder-days was found in Badulla in second inter monsoon. A number of groups of regions experiencing similar lightning activity were seen. Anuradhapura-Nuwara Eliya, Hambanthota-Badulla, Trincomalee-Ratnapura were three pairs of such regions.

Proportion of thunder-day occurrence is higher in first and second inter-monsoon seasons, the highest being in the month of April. The probability of getting a given number of thunder-days in a year is high in Colombo, Katunayake, Ratmalana, Badulla, Ratnapura and Galle and low in Hambanthota. The probability of getting thunder-days is highest in Ratmalana in NE monsoon and is lowest in Hambanthota and Galle in SW monsoon, Trincomalee and Badulla in first inter monsoon and Galle, Trincomalee and Nuwara Eliya in second inter monsoon season.

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