

Spatial and temporal variations of thunderstorm activities over Sri Lanka

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Received: 5 September 2014 / Accepted: 30 March 2015
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Abstract Spatial and temporal variation of frequencies of thunderstorms over Sri Lanka using thunder day data is presented. A thunder day is simply a calendar day in which thunder is heard at least once at a given location. Two sets of data were collected and analyzed: annual totals for 10 climatological stations for a period of 50 years and monthly totals for 20 climatological stations for a period of 20 years. The average annual thunder days over Sri Lanka was found to be 76. Among the climatological stations considered, a high number of annual thunder days was recorded in Ratnapura (150 days/year), followed by Colombo (108 days/year) and Bandarawela (106 days/year). It appears that there are no widespread long-term increasing or decreasing trends in thunderstorm frequencies. However, Colombo, the capital of Sri Lanka which has over two million people shows an increasing trend of 0.8 thunder days per year. Although there is a high variability between stations reporting the number of thunder days, the overall pattern within a year is clear. Thunderstorm frequencies are high during two periods: March–May and September–November, which coincide with the first inter-monsoon and second inter-monsoon periods. Compared to the dry zone, the wet zone, especially the southwestern region, has high thunderstorm activity. There is a clear spatial difference in thunderstorm activities during the southwest and northeast monsoon seasons. During both these seasons, enhanced thunderstorm activities are reported on the leeward side of the mountain range. A slight reduction in the thunderstorm activities was found in the high elevation areas of the hill country compared to the surrounding

areas. A lightning ground flash density map derived using annual thunder days is also presented.

1 Introduction

Thunder days or thunder events recorded from very early days in climatological stations have been used to study the characteristics of thunderstorms worldwide. For example, Changnon (1988a; 1988b) described the temporal and spatial aspects of thunderstorms in the USA using thunder events recorded in 152 first-order stations during the period 1948–1977. In a subsequent study, thunder day occurrences during a 100-year period based on data from 86 first-order stations were used to investigate the long-term fluctuations in thunderstorm activities in the USA (Changnon and Changnon 2001). In Japan, the long-term variations of thunder day frequencies in various regions have been investigated by using 100-year thunder day records (Kitagawa 1989). The long-term variability of thunderstorm occurrence in Poland was investigated by using thunder day observations from 56 stations in the period 1951–2000 representing all geographical regions (Bielec-Bakowska 2003). Kuleshov et al. (2002) studied the distribution and frequency of thunderstorms in Australia using thunder day data from 300 sites over a period of 10 years. Although improved techniques to monitor activities in thunderstorms over large regions such as lightning locating systems (Orville et al. 2002) and more recently satellite-based optical sensors (Christian et al. 2003) are now available, long-term variations of thunderstorm activities (20 years or more) related to change in climate are still derived through the thunder day observations.

Sri Lanka has a warm and tropical climate with frequent thunder activities due to its position between 5° and 10° North latitudes. However, studies are not yet available in literature

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