TOPO-CLIMATE OF SRI LANKA: A STUDY OF THE DUMBARA HILLS

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Abstract

In comparison with other countries, with so many Meteorological Stations and Rain Gauging Stations, many of which have functioned for well over 100 years, no significant studies have been conducted about the topo-climate in Sri Lanka. The main purpose of this study is to understand it along with the climate of Dumbara Hills.

The approach of the study consists of an analysis of available data and field measurements. It was carried out through a profile study, an observational study and a model study. The profile study includes compilation of data available at the Department of Meteorology and analysis of such data along two profiles namely AA_1 and BB_1 parallel to NE-SW direction and CC_1 profile along the main axis of the Dumbara Hills which is perpendicular to other cross sections.

The observational studies include an analysis of monthly rainfall and other climatic parameters for the period 1991-95 of inland stations within the central highlands on a seasonal basis. Interrelationships among climatic parameters and altitudes are determined using correlation analyses. Field studies were based on an analysis of data from secondary sources and field investigations were based on the eastern and western aspects of the Dumbara Hills. In addition, climatic parameters such as air temperature, relative humidity wind speed were measured at field sites by using instruments. Apart from the above measurements, visual observations of cloud cover, the height of cloud base and wind shaped trees were made at field level. Field experiments were conducted at Bambarella, Kirimetiyakanda, Narangamuwa, Kobonella and at Corbet's Gap in the Dumbara Hills. The first one is on the west facing a slope, the second is a peak and the next three are on the east facing a slope.

The development of a series of statistical models to understand the intrinsic relationship between the monthly rainfall of selected stations along the Colombo - Katugastota profile (AA_1) with location specific data and upper atmospheric data of Colombo was the ultimate objective. This model simulates some observed meso-scale features over Sri Lanka. An equation is formulated on the terrain following co-ordinates, which facilitate the incorporation of the effect of topography.

Some of the findings of the study are given below:

1. During the southwest monsoon, the maximum belt of rainfall is at 1000m as well as between 150m and 250m range are on the western slope. The belt of minimum rainfall indicated is between 90m and 1300m on the eastern slope.
2. The variation of temperature change between 0830 and 1730LST shows peak values in Badulla (670m) on the eastern slope for all months and on another peak in Ratnapura for January and July.
3. The values of the mean relative humidity as well as relative humidity at 0830 LST are highest on the eastern stations during January. During July, the mean relative humidity at 0830 LST, 1730 LST shows the lowest value along the western slope and a very high value at the peak of the profile. The seasonal variation of the mean relative humidity at the western low altitude stations is lower than at eastern stations.
4. The highest rainfall during the first inter monsoon is in Talawakele and the lower values at a lower elevation are in Nuwara Eliya. From January to February, the mean wind speeds are high at Peradeniya and low at Girandurukotte.
5. A decrease of the maximum temperature, with an increasing altitude is clearly indicated at both slopes. The wind speed during the month of January at Peradeniya is higher than at Talawakele and it made a considerable decrease of the lapse rate. Within these altitudes (492-1382m) are high lapse rates in 357 to 492m range.
6. The variation of the height of the cloud base at Bambarella during six days of July 1991 indicated that two peaks were at 1130 and 1530LST respectively. The lowest height of the cloud base was at 0730LST. All over, during the time from 0630 to 1830LST the height of the cloud base was less than1900m.
7. The average cloud cover at Bambarella is minimum at 1630LST, and maximum at 0630LST during the southwest monsoon. There is a gradual decrease in cloud cover from 0630 to 1630 LST and followed by an increase.
8. Peak wind speeds prevail at 1130 and 1430LST. Also the wind direction changes mid day. Generally after 1230LST, the wind speed fluctuation takes place.

9. The daytime values of relative humidity in the field were close to that of Sita Eliya. After 1530 LST the *RH* value at field exceeded the Sita Eliya value due to a high amount of cloud cover (8 Octas). At the end of the day, RH was high like that of Katugastota.
10. The analysis of radar wind data in Colombo with the rainfall at Katugastota and Kobonella shows for both, northeast and southwest monsoons, the 300mb pressure levels of the highest correlation coefficient for all seasons except NEM & SWM at Kobonella.
11. Among the pressure levels, 500mb level shows a high correlation coefficient during the southwest monsoon. Hence, this is a more influential level for rainfall at Katugastota as well as at Kobonella.
12. The southwest monsoon predicted monthly rainfall ($\overline{RF_P}$) of a point **P** along the profile AA_1 is to be able to calculated with the following equations;

$$ln\,\overline{RF}_P = -44.8337 + (9.01E\text{-}05)\,D^2 - 0.02939\,d - 8.17803/H + 2.86377\sqrt{Td_{500}} + 0.096482\,U_{300m} + 0.03434\sqrt{H} \qquad \textbf{(7.2)}$$

$$ln\,\overline{RF}_P = 9.552614 + 0.000763\,D^2 - 0.04397\,d - 0.13009D - 0.00064\,d^2 - 8.95362/H + 0.002938\,RF_{Ka.} \qquad \textbf{(7.4)}$$

Where U_{300} - wind speed at 300mb pressure level in knots

Td_{500} - dew point temperature at 500mb pressure level in ^{0}C

D - horizontal distance from western sea coast along NE direction

H - height above average sea level (m)

d - distance from the peak of Dumbara hills along the NE direction (km)

$RF_{Ka.}$ - rainfall of Katugastota