# DISPERSION AS A MEASURE OF RAINFALL VARIABILITY IN THE WET ZONE OF SRI LANKA

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## INTRODUCTION

The present study is focused on the variability of annual rainfall in the Wet Zone of Sri Lanka (hereafter referred to as Wet Zone) in the period 1941-2000. A comparative study of two averaging periods 1941-1970 (referred to as 1$^{st}$ 30-year period) and 1971-2000 (referred to as 2$^{nd}$ 30-year period) was carried out.
The Wet Zone of Sri Lanka occupies 23 percent of the land area in the country. The Wet Zone has a unique place in the wider geography of Sri Lanka in terms of its physical geography, as well as its human geography. Rainfall in particular, as reflected in landforms, drainage, natural vegetation, economic activities, settlement patterns, and general social fabric and life style of the people. The Wet Zone is the economic power-house and the main area of population concentration in the country and eighty three percent of the land area in the Wet Zone is available for use. With this brief farmable, it is important to analyze the rainfall variability in the Wet Zone. Therefore, dispersion technique has been applied for the analysis of variability of rainfall for the present study. Only 36 out of 182 rainfall-reporting stations in the Wet Zone have selected for the present study (See table. 1).

## METHODOLOGY

Graphical representation of rainfall variability through dispersion diagram is long-established technique of variability analysis, and has been applied to different areas worldwide (Monkhouse and Wilkinson, 1952 and Sirinanda, 1990) and Sri Lanka (Domroes, 1974 and Sirinanda, 1983). Through the identification of the centre-most point ( medians or the 50$^{th}$ percentiles) and the ranges within which annual rainfall over a period is distributed when arranged in ascending order (particularly the inter-quartile range between the lower quartile –the 25$^{th}$ percentile, and the upper quartile- the 75$^{th}$ percentile, within which 50% of the rainfall is dispersed about the median). It would be possible to arrive at preliminary generalizations about the inter-annual variability of rainfall which can, then, be refined with reference to more rigorous statistical technique such as the standard deviation and coefficient of variability.
The dispersion diagram can also be used in the identification of intra- annual variability of rainfall, delineation of different rainfall seasons and for the analysis of monthly variability of rainfall.

The information required for dispersion analysis are, the median or 2nd quartile, the 1st and 3rd quartile which define the Inter- Quartile Range and the minimum and maximum rainfall for each station.

The following 'rule of thumb' based on Sirinanda (1990) and Monkhouse and Wilkinson (1952) are used to analyze the intra- annual variability of rainfall in the wet zone during the two -30 year period. Variability is recognized in this instance by the identification of 'breaks' in the annual rainfall pattern. In order to identify' breaks' in regularity, the relative positions of medians and quartiles between adjacent or alternative year is compared.

(1) Major Breaks and Graded Major Breaks

If one period's lower quartile is higher than the upper quartile of an adjacent period, i. e. if the 'inter- quartile band' of the one period is clear of that for an adjacent period, a 'major break' (a sudden change) is evident in the incidence of rainfall. These major 'breaks' would signify a rapid transition from one period to another.

(2) Minor Breaks and Graded Minor Breaks

If the median rainfall of one period is higher than the upper quartile of an adjacent period, and the lower quartile of the former lies above the median of the latter, this would constitute a 'minor break', signifying a progressive or step-wise change. Sometimes a major graded break may consist of two minor breaks. If the conditions for a minor break are satisfied for alternate instead of the adjacent periods, a 'graded minor break' is said to exist.

(3) Any other differences in the spread of inter-quartile bands of adjacent or alternate periods would not represent any significant changes in rainfall regime.

Above mentioned rules would apply in the same way to the comparison of selected two 30-year periods (e.g . the first 30-year period and the second 30-year period as used in the study).

## 1. RESULTS

Table 2 indicates the inter quartile data of selected stations. Dispersion diagrams for the two periods at the 36 selected stations are shown in the Fig. 1 which depicts the two periods for each station by double-bar diagram.

## 2. DISCUSSION AND CONCLUSIONS

Two 30-year periods have been examined according to rainfall breaks in term of Quartile Values as described above, from one period to another. Most areas in the wet zone have had higher median rainfall (i.e. the Second Quartile) in the first 30-year period, with the exception of the following:

1. West of the flanks of the central massif, represented by No. 21, Kenilworth;
2. East central Up-country, represented by No. 15, Dunsinane, and No. 16 Nuwara Eliya,
3. Western slopes of the central massif, represented by No.27, Ratnapura,
4. Northern flanks of the Rakwana massif, represented by No. 32, Depedene and
5. Western slopes of the Rakwana massif, represented by No. 35, Pelewatta.

These six stations have received a higher median rainfall in the second 30-year period, whereas other stations representing these same areas show according with the general pattern with a higher median rainfall (Second Quartile) in the first 30-year period.

The relative positioning of quartile shows that no area with a 'major break' between the three periods. Three areas with 'minor breaks' , namely, No. 9 Elkaduwa (Northeastern mid country), No. 18, Norwood (East central up country) and No. 31, Wellandura (East central low country). Therefore, it can be said that significant differences in selected rainfall regime have been very few.

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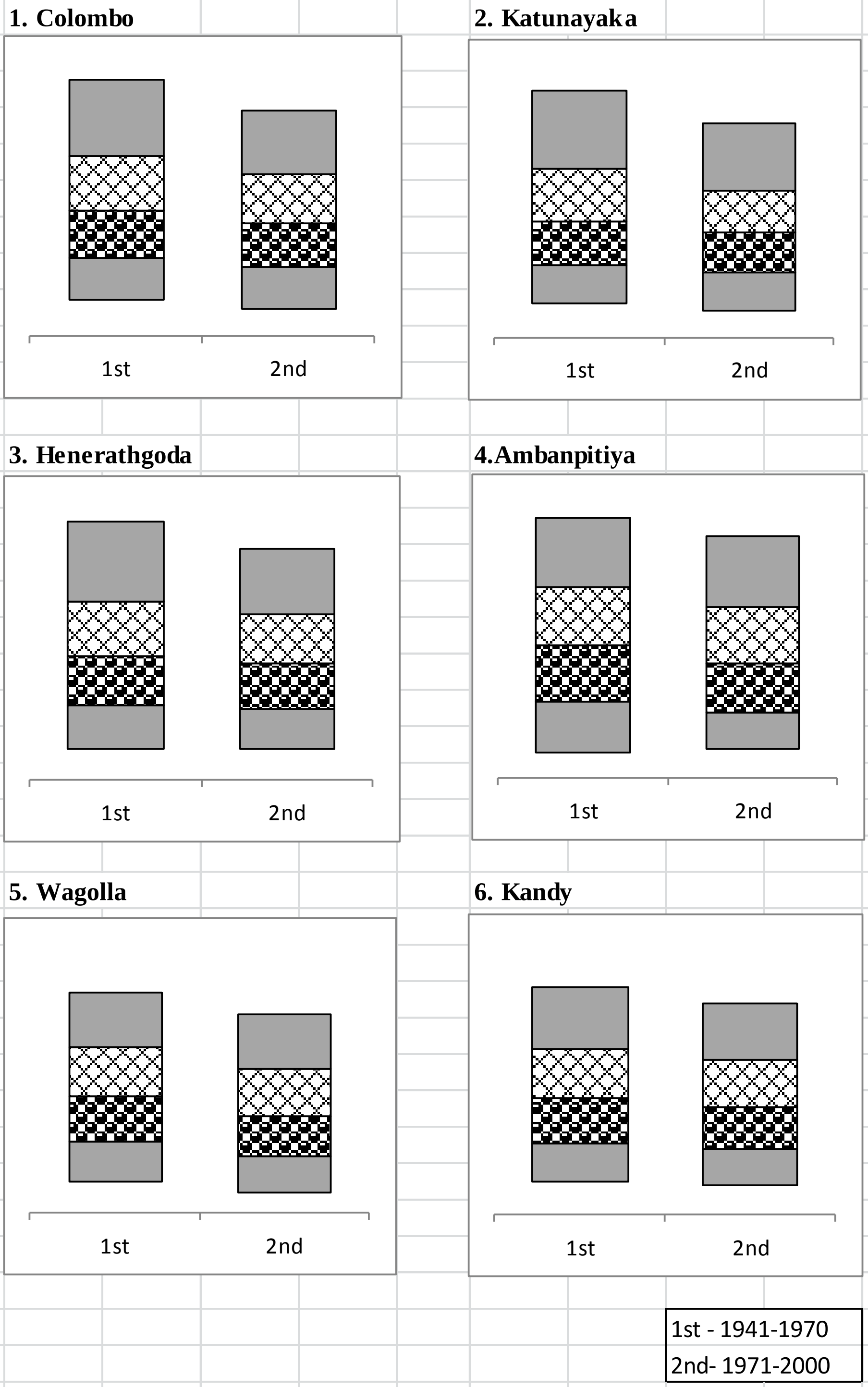
**Table 1-Selected Rainfall Reporting Stations**

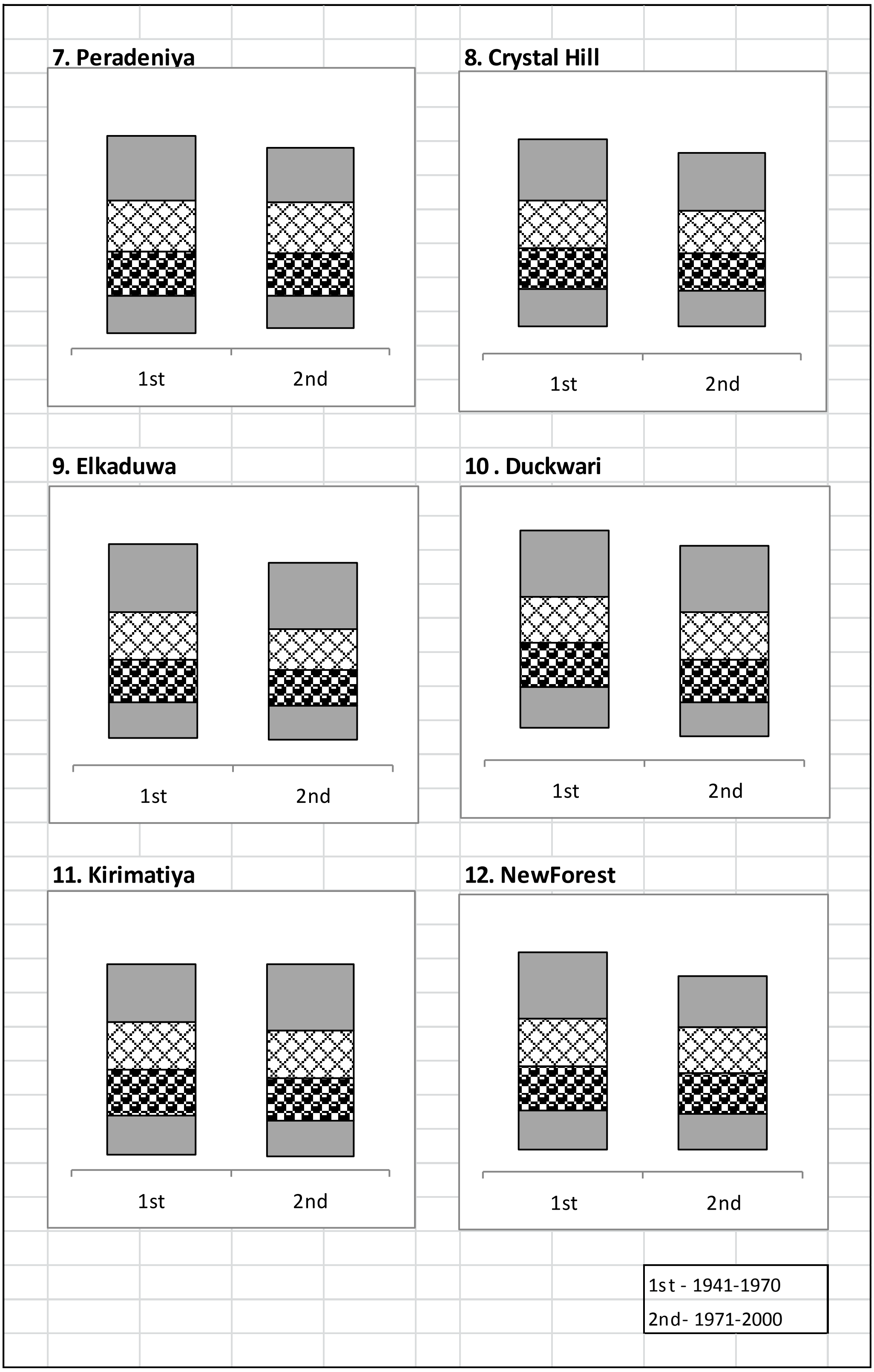
1. Colombo
2. Katunayake
3. Heneratgoda
4. Ambanpitiya
5. Wagolla
6. Kandy
7. Peradeniya
8. Crystal Hill
9. Elkaduwa
10. Duckwari
11. Kirimetiya
12. New Forest
13. Sogama
14. Hope
15. Dunsinane
16. Nuwara Eliya
17. Sandringham
18. Norwood
19. Maskeliya
20. Watawala
21. Kenilworth
22. Weweltalawa
23. Avissawella
24. Horana
25. Kaluthara
26. Sirinkadura
27. Ratnapura
28. Hapugastenna
29. Balangoda
30. Godakawela
31. Deepdene
32. Wellandura
33. Mawarala
34. Kekanadura
35. Pelawatta
36. Galle

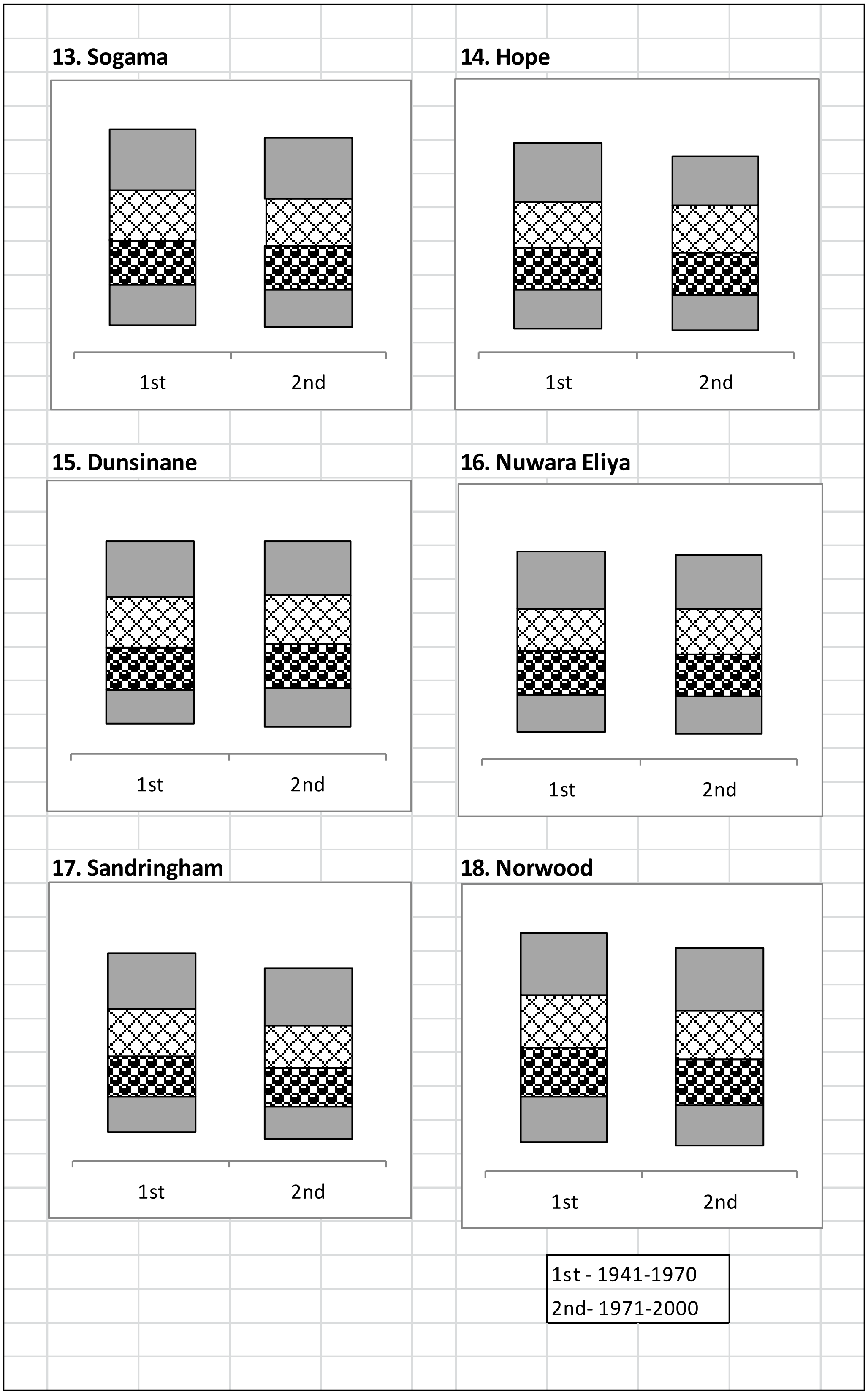
## Table No.2 - Quatile Values for Selected Rainfall Reporting Stations

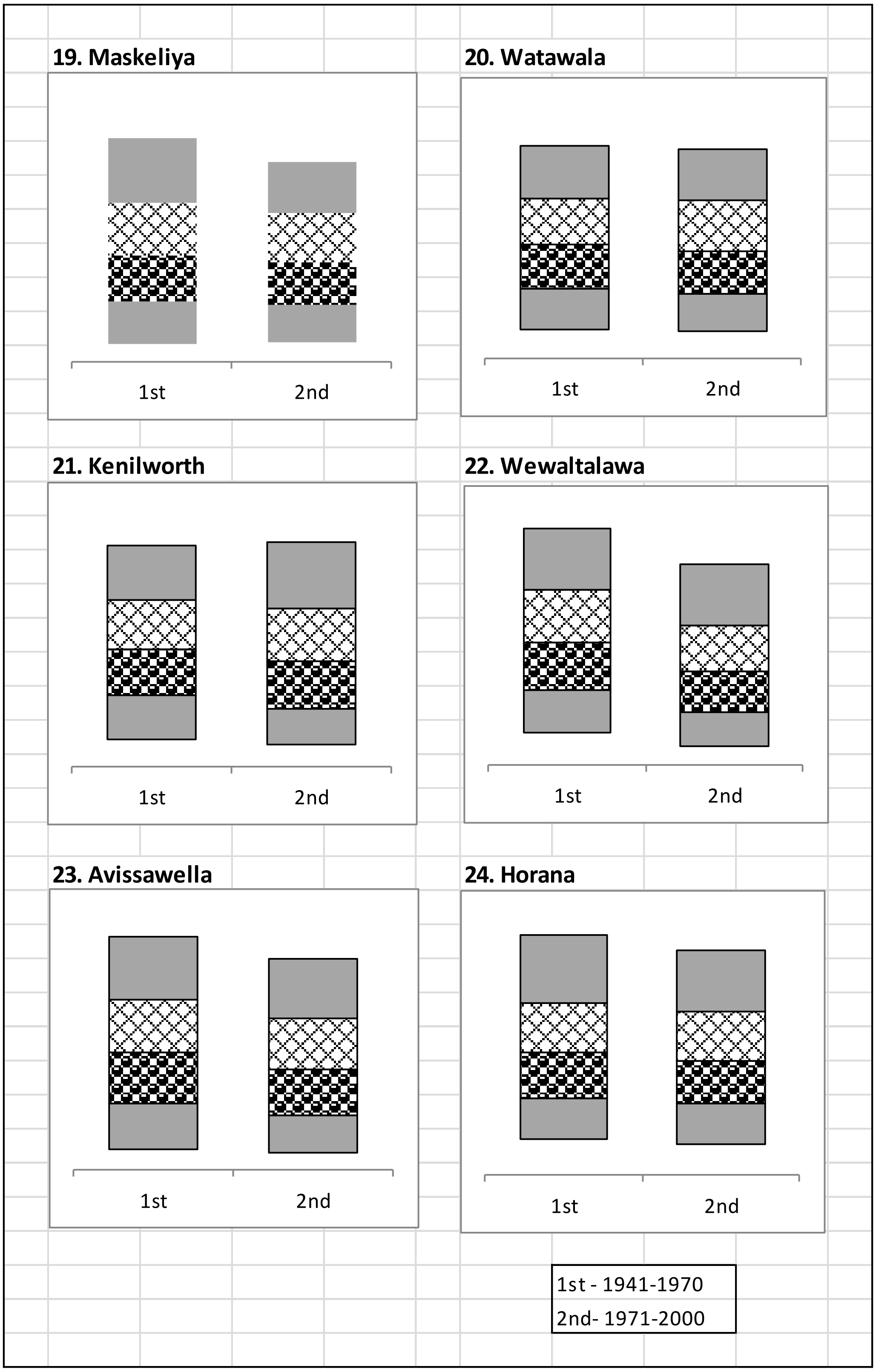
| Station | Quaritile | 1st 30-year | 2nd 30-year | | Station | Quaritile | 1st 30-year | 2nd 30-year |
|---|---|---|---|---|---|---|---|---|
| 1 | Q3 | 2759.4 | 2493.1 | | 19 | Q3 | 3138.4 | 2982.7 |
| | Q2 | 2462.4 | 2256.4 | | | Q2 | 2799.8 | 2583.8 |
| | Q1 | 2132.5 | 2078.5 | | | Q1 | 2523.1 | 2225.6 |
| 2 | Q3 | 2710.8 | 2169.8 | | 20 | Q3 | 5543.6 | 5981.8 |
| | Q2 | 2171.6 | 2033.1 | | | Q2 | 5141.3 | 5004.3 |
| | Q1 | 1968.8 | 1949.7 | | | Q1 | 4624.7 | 4371.9 |
| 3 | Q3 | 2755.2 | 2498 | | 21 | Q3 | 5720.1 | 6200 |
| | Q2 | 2434.4 | 2316.7 | | | Q2 | 5318 | 5398.8 |
| | Q1 | 2195.1 | 1983 | | | Q1 | 5020.3 | 4161.1 |
| 4 | Q3 | 2957.5 | 2874.1 | | 22 | Q3 | 6270.1 | 5478.1 |
| | Q2 | 2822.4 | 2413.8 | | | Q2 | 5420 | 4901.4 |
| | Q1 | 2551.4 | 1852.8 | | | Q1 | 5136.3 | 3918 |
| 5 | Q3 | 2557.3 | 2462.5 | | 23 | Q3 | 4146.7 | 4069.3 |
| | Q2 | 2387.5 | 2165.4 | | | Q2 | 3930.7 | 3506.9 |
| | Q1 | 2052.4 | 1878.2 | | | Q1 | 3700.1 | 2998.7 |
| 6 | Q3 | 2104.1 | 2055.6 | | 24 | Q3 | 3745 | 3745.1 |
| | Q2 | 1985.8 | 1800.1 | | | Q2 | 3510.1 | 3279.5 |
| | Q1 | 1713.5 | 1580.4 | | | Q1 | 3245.7 | 3203.8 |
| 7 | Q3 | 2355.5 | 2362.9 | | 25 | Q3 | 2780.2 | 2583.8 |
| | Q2 | 2111.5 | 2010.4 | | | Q2 | 2546.2 | 2363.2 |
| | Q1 | 1727.4 | 1530.3 | | | Q1 | 2258.3 | 2245.1 |
| 8 | Q3 | 2228.4 | 1963.3 | | 26 | Q3 | 4521.2 | 4312.5 |
| | Q2 | 1883.6 | 1794.4 | | | Q2 | 4213.2 | 3947 |
| | Q1 | 1716.2 | 1627.1 | | | Q1 | 3916.3 | 3414.7 |
| 9 | Q3 | 2582.9 | 2241.8 | | 27 | Q3 | 3924.7 | 4115.9 |
| | Q2 | 2334.2 | 2003.6 | | | Q2 | 3663.7 | 3703.9 |
| | Q1 | 2038.3 | 1853.8 | | | Q1 | 3490.4 | 3355.1 |
| 10 | Q3 | 2612.7 | 2660.9 | | 28 | Q3 | 5095.9 | 5151.3 |
| | Q2 | 2453.9 | 2343 | | | Q2 | 4792.2 | 4657.8 |
| | Q1 | 2307.2 | 1990 | | | Q1 | 4140.3 | 4159.4 |
| 11 | Q3 | 2235.6 | 2224.2 | | 29 | Q3 | 2566.6 | 2509.5 |
| | Q2 | 2130.3 | 2028.3 | | | Q2 | 2220.4 | 2163.7 |
| | Q1 | 1820.9 | 1680 | | | Q1 | 1945.5 | 1717.4 |
| 12 | Q3 | 2993.6 | 2824.9 | | 30 | Q3 | 2193.7 | 1728.8 |
| | Q2 | 2734.5 | 2578.7 | | | Q2 | 2022 | 1453.1 |
| | Q1 | 2490.9 | 2283.3 | | | Q1 | 1823.9 | 1417.3 |
| 13 | Q3 | 3215.7 | 3051.2 | | 31 | Q3 | 2526.5 | 2308.5 |
| | Q2 | 2915.8 | 2829.9 | | | Q2 | 2415.9 | 2044.8 |
| | Q1 | 2581.9 | 2425.8 | | | Q1 | 2075.5 | 1755.4 |
| 14 | Q3 | 2917.5 | 3112.2 | | 32 | Q3 | 3226.7 | 3417.9 |
| | Q2 | 2721.4 | 2626.7 | | | Q2 | 2965.7 | 3005.8 |
| | Q1 | 2433.6 | 2255.9 | | | Q1 | 2792.4 | 3417.9 |
| 15 | Q3 | 3245.2 | 3112.2 | | 33 | Q3 | 3323.7 | 3510.5 |
| | Q2 | 2687.5 | 2831 | | | Q2 | 3165 | 3134.2 |
| | Q1 | 2224 | 2505 | | | Q1 | 2872.5 | 2532.8 |
| 16 | Q3 | 2058 | 2157.1 | | 34 | Q3 | 1933.9 | 1784.9 |
| | Q2 | 2026.9 | 2037.6 | | | Q2 | 1764.8 | 1745.8 |
| | Q1 | 1841.5 | 1758.5 | | | Q1 | 1577.1 | 1217.1 |
| 17 | Q3 | 2642 | 2350.1 | | 35 | Q3 | 5258.8 | 5349 |
| | Q2 | 2201.8 | 2104.3 | | | Q2 | 4761.8 | 4895 |
| | Q1 | 1909.8 | 1773.7 | | | Q1 | 4167.8 | 4555 |
| 18 | Q3 | 3199.4 | 2976.9 | | 36 | Q3 | 2680.9 | 2472.5 |
| | Q2 | 2976.9 | 2755.6 | | | Q2 | 2423.3 | 2323.3 |
| | Q1 | 2788 | 2456.7 | | | Q1 | 2226.4 | 2188.9 |

**Figure No. 1- Dispersion diagrams of the annual rainfall in the Wet Zone of Sri Lanka for the periods 1941-1970 and 1971-2000**

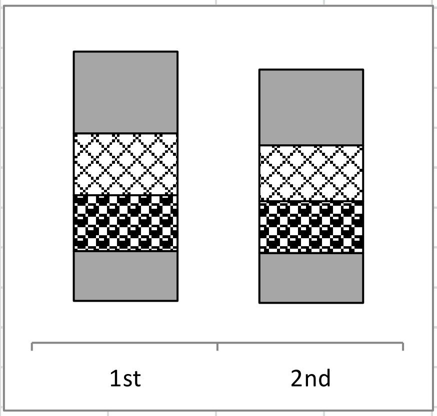



7. Peradeniya
1st
2nd
8. Crystal Hill
1st
2nd
9. Elkaduwa
1st
2nd
10 . Duckwari
1st
2nd
11. Kirimatiya
1st
2nd
12. NewForest
1st
2nd
1st - 1941-1970
2nd- 1971-2000

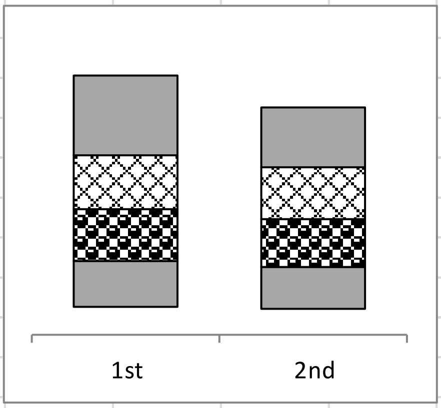

13. Sogama
1st
2nd
14. Hope
1st
2nd
15. Dunsinane
1st
2nd
16. Nuwara Eliya
1st
2nd
17. Sandringham
1st
2nd
18. Norwood
1st
2nd
1st - 1941-1970
2nd- 1971-2000


19. Maskeliya
1st
2nd
20. Watawala
1st
2nd
21. Kenilworth
1st
2nd
22. Wewaltalawa
1st
2nd
23. Avissawella
1st
2nd
24. Horana
1st
2nd
1st - 1941-1970
2nd- 1971-2000

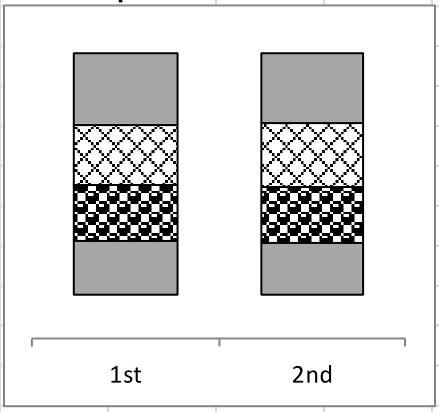
**25. Kalutara**



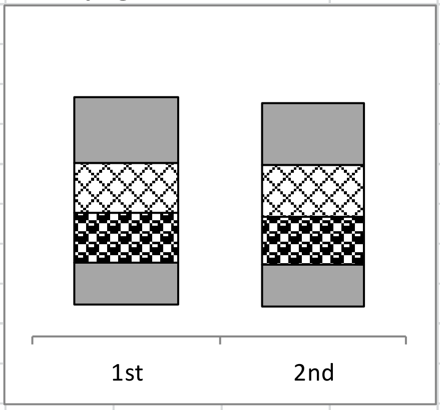

**26. Sirinkandura**



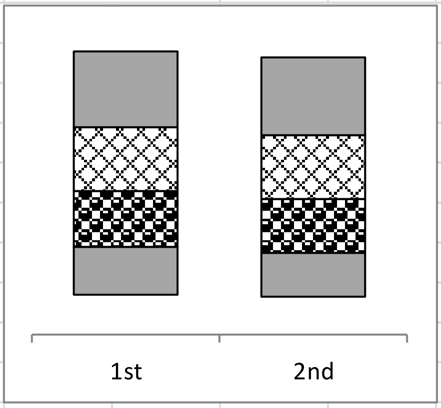

**27. Ratnapura**



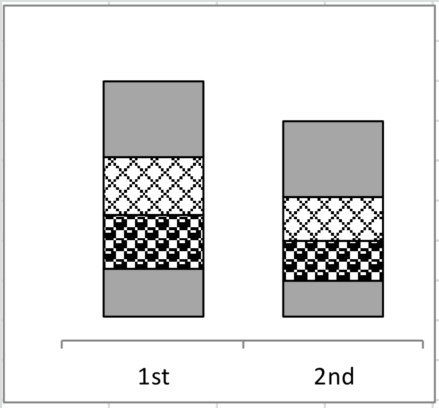

**28. Hapugastanna**




**29. Balangoda**

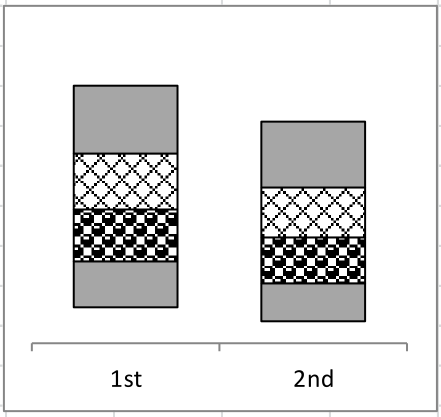



**30. Godakewala**

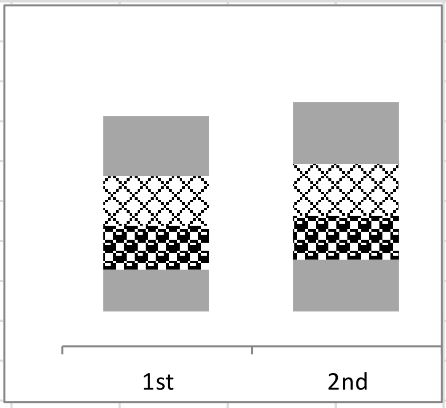



1st - 1941-1970
2nd- 1971-2000

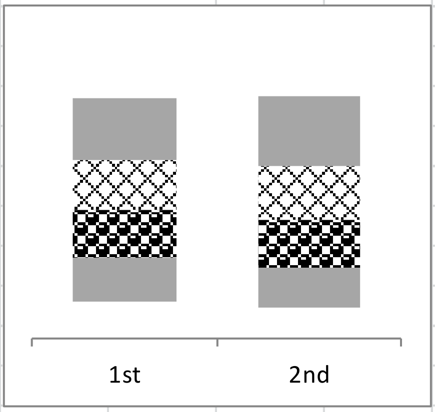
**31. Wellandura**



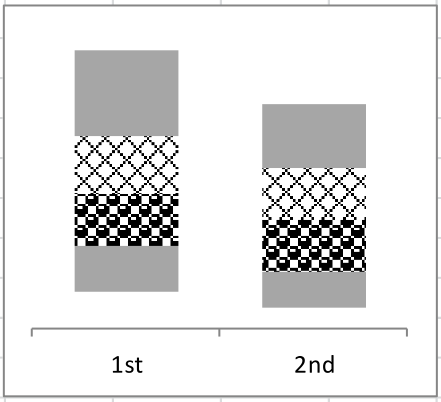

**32. Deepdene**



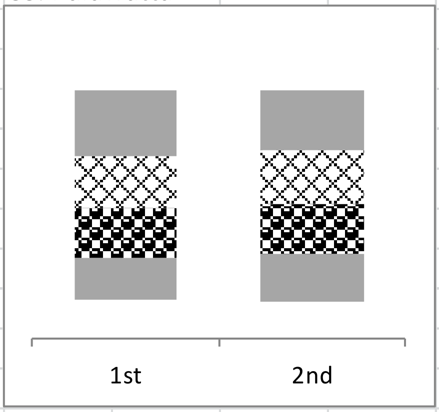

**33. Mawaralla**




**34. Kekannadura**




**35. Palawatta**




**36. Galle**