The Thermal Factor in Ceylon's Climate

"THE average state of weather as determined in terms of time and space" may be accepted as a satisfactory definition of climate. [1] Of the atmospheric elements that produce weather, temperature and precipitation form the two basic constituents. Pressure, wind, humidity etc., make up the remaining weather bases.

It is an accepted maxim [2] that the Solar Constant is the fundament of weather and climate. The incoming solar radiation, acting directly as well as indirectly through terrestrial radiation, is responsible eventually for the 'mechanics' of the atmosphere which produce weather. The direct expression of this Solar Constant is of course insolation measured in terms of heat units called temperature ; the temperature in turn reacts upon the atmosphere, especially in the lower atmosphere, in warming the air. This warmed air, conforming to the principles of thermo-dynamics, begins to ascend. In its process of ascent the air cools adiabatically ; when the satisfactory atmospheric conditions are realized, the ascending air in its cooling process reaches saturation point (dew point) condenses into clouds which eventually may precipitate, either as rain or as snow (in its manifold varieties).[3] This sequence is but an expression of meteorologic processes on a small scale. The same sequence when considered on a grand scale is of tremendous atmospheric importance. The temperature—the direct expression of insolation—is also responsible for the creation of atmospheric conditions such as pressure patterns over the earth on a gigantic scale ; the result would be the generation of large scale movements of air called wind systems. And in turn are created other atmospheric phenomena which in combination produce the weather. The geographical factor of land-sea distribution with its contrasting responses to temperature reacts to the meteorologic overlay, to evolve the *cellular* pattern of atmospheric circulation of the world. And finally on a time-space basis the atmospheric superstructure acting upon the geographical basement leads to the development of the climatic pattern on earth.

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1. For a fuller definition of Climate see, George Thambyahpillay, " Climatic Controls in Ceylon." *Ceylon University Review*, XI, 3 and 4 July-October 1953, 171.

2. Glen T. Trewartha, *An Introduction to Weather and Climate* (New York McGraw Hill, 1943, 6.

3. Detailed analysis of this process has been considered in, Grorge Thambyahpillay, " Thunderstorm Phenomena in Ceylon," *Ceylon University Review*, XII, 3, (July, 1954), 164—176.

Based upon these above considerations, man has from time immemorial attempted to speak of the 'climate of a place'—meaning an area of similar weather averaged over a long period. A further stage was the recognition of climatic 'homologues' and the consideration of climatic types. There is thus available to us today the many attempts of man to group climatic 'homologues' and attempts at climatic classifications. The present mosaic of climatic classifications are based upon varying 'bases' such as temperature, precipitation, wind, humidity, drought periods etc., However the two basic criteria used are temperature and precipitation and considered in terms of 'thermal efficiency' and 'precipitation effectiveness.' In these macro-climatic patterns so far suggested the island of Ceylon because of its small size, has naturally fitted in rather insignificantly. Usually Ceylon falls under one climatic type on this world basis and at most under two types. [4] The significant fact, however, is that only rainfall has been considered in the demarcation of climatic regions of Ceylon. Even the attempts made by geographers in Ceylon reflect this rainfall 'base' for the demarcation of climatic regions in Ceylon. The commonplace division of the island into three 'climatic zones' is of course well known ; the Wet, Dry and Arid Zones. [5] These are obviously rainfall regions and not climatic regions. Thus temperature as a climatic base has been neglected ; this relegation of the thermal factor to an insignificant position is unwarranted climatologically. Probably the island's latitudinal limits[6] being not more than five degrees of extent and within ten degrees of the equator, are considerations that have resulted in the neglect of the temperature factor. However the geographical features of the island such as proximity to the Indian sub-continent and the elevation (up to 8300 feet) do play their role in producing significant thermal differences over the island. The thermal factor therefore, has to be taken into account in analysing the climate of the island. The climatic zone again being the integrated expression of the weather elements (temperature and rainfall, being the significant ones in the island) their combined interaction upon the geographical basement of Ceylon must needs be considered in demarcating the island into climatic regions. [7]

4. George Thambyahpillay, "Ceylon and the World Climatic Mosaic," *Ceylon University Review*, XII, No. 1 (January, 1954), 24—29.

5. The following criteria have been used in the demarcation of these "climatic zones' :—
Wet Zone : average annual rainfall of over 75 inches.
Dry Zone : average rainfall of 50—75 inches.
Arid Zone : average annual rainfall of less than 50 inches (but more than 35 inches).

6. 5.55' to 9.50' N.L.

7. In the next two papers, attempts will be made to suggest 'thermal' and 'hyetal' regions for Ceylon. Based on these two papers, a third paper will follow with eventual suggestion of 'climatic regions' for the Island.

Thermal Characteristics

The island of Ceylon in terms of its latitudinal position would be expected to exhibit high temperatures. However, it is also true that high relative humidity [8] is typical of these latitudes. No part of the island has an annual average of less than 84 per cent. [9] About two-thirds of the island has a high relative humidity of over 88 per cent. with Ratnapura reaching a very high of 94.5 per cent.

The highland averages over 92 per cent, the only exception here, being the Uva Plateau, an area lying immediately to the east of the Central Ridge, with Diyatalawa experiencing a low average of 85 per cent. The lowland has over 90 per cent, except the northern part where the amount gradually decreases to 85 per cent (Mannar). Anuradhapura, however, stands out with a 90 per cent content. A line running from the west coast (midway between Puttalam and Mannar), making a northward bend about Anuradhapura and then southeastwards to reach the east coast south of Trincomalee, forms the southward boundary of the area with less than an 86 per cent average. Jaffna has an 87 per cent average.

The effect of coast-proximity locations, with no mountain ranges along any part of the coast, is clearly evident. The high relative humidity content is at once the expression of the constant convectional circulation, replaced in periods by the monsoonal movements. The significance of geographical *aspect* is revealed by the lower amounts in the northern third of the island ; this is a reflection of the continental influence of the Indian subcontinent. As a contrast, the southern two-thirds of the island reflect the strong marine influence from the vast Indian Ocean. That the highest amounts are confined to the highland and not the coastal belt is explained by the higher elevations exposed to the sea-breezes and the monsoonal winds. Same absolute humidity would give higher relative humidity as the air cools in the ascent from sea level to the mountains. The Uva Plateau in the highland, which alone has low amounts (85 per cent) relative to the environment, is seasonally shut out from the effects of the convectional and monsoonal winds ; from the west by the lofty Central Ridge and from the east by the Lunugala Ridge. Badulla, which is only 18 miles northeast of Diyatalawa, because of its geographical position has a high average or

8. The average humidity per cent data are obtained by computing the means from the dry and wet-bulb temperature readings for the day and night. The day readings are the mean of observations at 0930 and 1530 hours. The night readings are obtained from the minimum readings of the dry and wet bulb temperatures and represent approximately the maximum relative humidity in the 24 hours.

9. The immediate environs of Trincomalee alone exhibit a low humidity per cent of 84.

over 94 per cent.[10] This high degree of humidity is due to the character of the rainfall incidence in the island.[11]

Thus these two meteorological aspects—high intensity of insolation (due to high angle of incidence of the incoming solar rays) and the high per cent of relative humidity, tend to be counteracting processes. The result, therefore, is the amelioration of temperatures. No station in the island records a mean temperature of over 85°F (Plate II) during any month, while the annual mean is everywhere less than 82°F (Table II). Two other factors serve to ameliorate temperatures over the island : the insular character (no place is more than 65 miles from the ocean) and the small areal extent.[12] This would therefore mean, insignificant temperature differences over the island (horizontally) ; the maximum observed range is not more than 7.6°F, while in the Southwestern quadrant it is only about 3.0°F. As a contrast, the adjoining subcontinent of India reflects the effects of continentality by virtue of its size. Thus temperatures are higher during summer and lower during winter ; this is in marked contrast to the cooler ' summers' and relatively warmer ' winters ' in Ceylon. However since the island is not insulated from the Indian subcontinent, the effect of continentality is felt very slightly in the form of increased annual temperature ranges towards the north of the island.

The latitudinal position again pays a vital role in the temperature characteristics of the island. The high solar intensity and the high temperatures during the late afternoons induce high incidence of convective circulation. The high humidity content (referred to earlier) helps in the formation of low cumulus clouds and thus the hottest part of the day, paradoxically is very cloudy.[13] The cloudy (overcast) sky serves to impede the incoming solar rays reaching the lower surface of the atmosphere. Thus, here again is reflected the effects of the counteracting processes. The periods of the Southwest and the Northeast Monsoonal rainfall with high incidence[14] of overcast sky are therefore also periods of lower temperatures. All these meteorologic processes create atmospheric conditions which are responsible for relatively cooler temperatures for the island than its latitude warrants it. In other words the island reflects negative temperature anomalies.

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10. For detailed considerations, especially in connection with the seasonal variation and the physiological effects of relative humidity in the island reference may be made to, George Thambyahpillay, *Climates of Ceylon*, (University of California, 1952), 47—57.

11. The significance of rainfall incidence in Ceylon has been dealt with in great detail in, George Thambyahpillay. *The Rainfall Rhythm in Ceylon.* (Colombo : Apothecaries, 1955), P1. VIII, 52 p.

12. 25,532 square miles.

13. For a detailed analysis of the sequence resulting in the cloudy sky see, Thambyahpillay .. "Thunderstorm Phenomena.........." op. cit., 165—168.

14. Thambyahpillay. *Rainfall Rhythm in Ceylon. op cit.*

A major control of temperature in the island is however that of altitude. The hypsometry map (Plate II) of the island reveals a mountainous core of 1000 to 8300 feet occupying the south-central part. Hence it is natural that conforming to the principle of environmental lapse rate, temperatures would range in this highland zone on the basis of 3.5°F per 1000 feet. At 6000 feet for example the temperatures average 60°F. Hence within this highland would occur ' isothermal levels.' Unfortunately in Ceylon only sixteen (16) Meteorological stations have observed temperatures for a satisfactory period. A method was therefore adopted in computing temperatures for a larger number of stations and landmarks (such as peaks etc). in order to spread the thermal network.

Since the sixteen stations that have recorded temperatures are of known elevation, these were located on a graph (Plate I) using temperature and elevation as the cordinates. A ' line of slope ' drawn through these points would indicate the averaged temperature-elevation ratio. On this graph stations with known elevations but without observed temperatures were plotted to obtain potential temperatures. By this process the temperatures for a large number of stations were obtained and used in the preparation of a mean annual temperature map [15] (Plate II) for the island. The map reveals a circular isothermal pattern relative to the contours. The following contour-isotherm relationships are remarkable :—

Elevation in feet :	1000	3000	5000	6000
Interpolated Temperatures in °F :	77	70	65	60

A critical study of this ' coincidence ' of the interpolated isotherms with the contours shows that this is not a mere coincidence. The theoretically computable isotherms on the lapse rate (temperature-altitude) ratio of 3.5° per 1000 feet seem to accord well with the interpolated isotherms. The interpolated mean annual isotherm map is however generalized ; it is but natural that wide modifications from this simple isothermal pattern would occur within the highland in terms of localized relief, [16] such as deep valleys, exposure (both to insolation and monsoonal circulation during the respective periods), etc. In other words a micro-thermal

15. The interpolated isotherms were determined on an altitudinal basis in relationship to the environmental lapse rate ratio.

16. Thambyahpillay. " Climatic Controls......." *op. cit.*, 173.

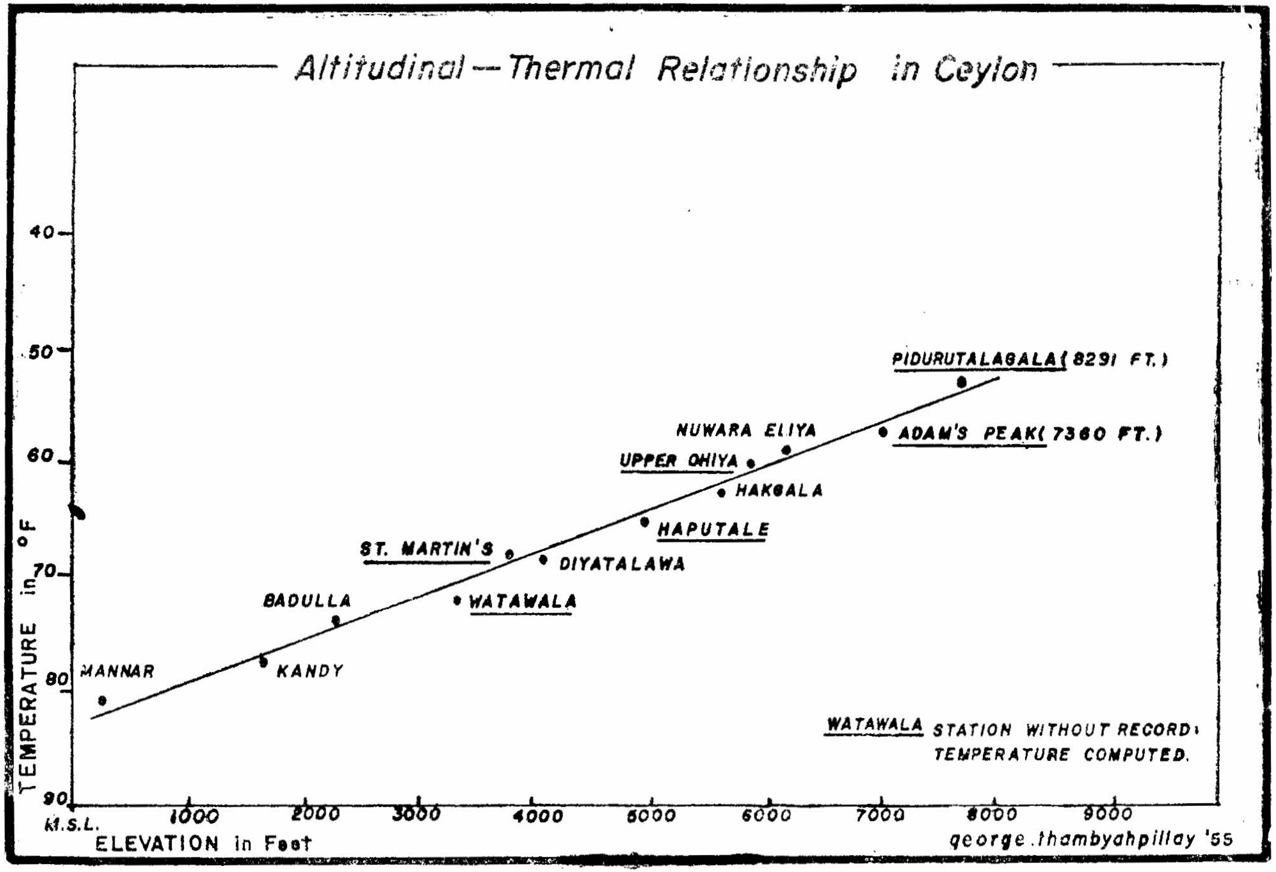
Altitudinal — Thermal Relationship in Ceylon
TEMPERATURE in °F
40
50
60
70
80
90
M.S.L.
1000
2000
3000
4000
5000
6000
7000
8000
9000
ELEVATION in Feet
PIDURUTALAGALA (8291 FT.)
ADAM'S PEAK (7360 FT.)
NUWARA ELIYA
UPPER OHIYA
HAKGALA
HAPUTALE
ST. MARTIN'S
DIYATALAWA
WATAWALA
BADULLA
KANDY
MANNAR
WATAWALA STATION WITHOUT RECORD: TEMPERATURE COMPUTED.
george. thambyahpillay '55

PLATE I

mosaic would interpose within the general macro-thermal pattern.[17] The table below illustrates the relationship between actual temperatures and computed temperatures, in terms of sea level and lapse ratio.

Station	Height in feet.	Mean temperature in °F.	Computed temperature assuming 82.0°F. at sea level.
Colombo	24	80·5	—
Kandy	1611	77·5	76·7
Badulla	2225	73·5	74·3
Diyatalawa	4104	68·2	67·7
Hakgala	5581	63·1	62·2
Nuwara Eliya	6170	59·5	60·3
Other 'stations'			
Pidurutalagala	8292	—	53·0
Adam's Peak	7360	—	56·5

Temperatures in the island never fall below freezing level (32°F) long enough to induce the formation of snow ; snow has never been observed in any part. However temperatures below freezing level do occur, especially at nights within deep valleys in the Highland above 6000 feet.[18] There are no large expanses of water bodies to appreciably affect temperatures over the island. However the water surfaces of the numerous large irrigation reservoirs (*tanks*, *wewas* and *kulams*) in the northern lowland (Dry zone) and the Gal Oya Reservoir would induce perceptible local temperature variations. The *tanks* in the southern lowland (Dry zone) being few and with small water surfaces would not have much effect (even perceptibly) on temperatures. Evaporation from these water surfaces and the thermal conservative capacity of water are two forms in which temperatures are affected. Humidity in these areas are therefore increased. The heavily forested areas with their high degree of transpiration potential would also affect vicinity temperatures[19] ; this would mainly be in the form of

17. In this paper it is the macro-thermal aspects that would be considered. A micro-thermal consideration would require initial detailed pioneer investigation. An attempt at a micro-climatic study will be made of the University Campus with the data collected by the University Meteorological Station ; the results would appear as a research paper.

18. The Ambawela valley is a perfect example of this effect. Other such valleys occur in the Nuwara Eliya region. In 1949 during field investigations in the Nuwara Eliya region, freezing temperatures were experienced in the Ambawela Valley.

19. C. H. Holmes, " The Climate and Vegetation of the Dry Zone of Ceylon," *Bull. Ceylon Geog. Soc.*, V. 4 and V. 1 (March—June 1951), 145—153.

high humidity in the air just above the canopy layers and thus negative micro-thermal anomalies would result. However, these being purely micro-thermal in character, will not be considered in the present paper where the macro-thermal aspect alone will be analysed.

The mean annual temperature map (Plate II) indicates a general increase of temperatures from the mountainous centre towards the lowlands, in all directions. This is seen markedly towards the northwest, where temperatures over 82°F form the mean and occur within a zone aligned NW/SE ; to the north of this belt the Jaffna Peninsula has slightly lower readings. The southern limit of this zone is a southeast-trending line from the south of Aruvi Aru on the west coast to a point on the east coast about the Koddiyar Bay. The northern half and the southeastern coastal plain of the island, experience higher temperatures than the rest of Ceylon. The 76°F isotherm encloses the highland and is related to the 1500 contour. The Hatton and the Uva Plateaus reflect higher temperatures than the Central Ridge (over 6000 feet) which has temperatures less than 60°F. The two depressional Basins the 4000–foot–level Hatton and Uva Plateaus on either side of the Central Ridge exhibit tmperatures ranging between 60°F and 72°F. A similar temperature range is reflected in the Southern Platform (south of the east-west trending limb of the Central Ridge). The Kandy Plateau about the 1500–foot–level naturally exhibits still higher temperatures, namely up to about 76°F on the mean. This generalized picture of the character of the thermal features of the island would be of value only in the light of more detailed considerations, such as the maxima-minima temperature distributions, the diurnal ranges and the seasonal rhythm.

The Maxima temperature distribution would naturally reflect the geographical aspect. Thus the mean maxima temperatures would be in the lowlands and towards the northern part of the island because of the proximity to the Indian subcontinent. Despite the fact that the northern lowland is farther from the Equator than the southern lowland this latitudinal factor (though of a small extent, namely about four degrees) is ineffective. The geographical factor of proximity to the Indian ' landmass ' and therefore the climatic effect of continentality is the dominant feature. The 85° zone is bound in its southern limits by a line trending southeasterly joining Kudremalai Point on the west coast to a location about Kalkudah (north of Batticaloa). From this line there is a general decrease southwards with the 82° isotherm dominating the western and southern lowlands. The altitudinal effect is reflected once again by the concentric character of the isothermal zone where the maxima temperatures range between 80°F and 65°F. The Minima temperatures also reflect the same areal pattern as that exhibited by the maxima temperatures ; but the effect of continentality is minimised with no ' belt-concentration ' in the northern lowland. The altitudinal control of creating concentric isothermal patterns however is still reflected : thus, the central mountainous core has a minima range between 75°F and below 60°F. Once again it is noticeable that the temperatures in the island reflect negative maxima and positive minima anomalies.

The mean diurnal temperature ranges on the other hand do not reflect a simple pattern because the effect of humidity and rainfall [20] is of great significance. A general overall pattern may however be discerned, namely coastal minima and highland maxima. The former is obviously due to the marine influence where the constant high humidity keeps the diurnal ranges (day-night temperature differences) very low. The general range here is about 9°F ; again the southwestern and the northeastern parts of the island exhibit the lowest,—an effect of the alternating convectional and monsoonal rainfall and therefore high humidity incidence. The range naturally increases away from the coastal belt and reaches a high maximum of over 17°F at Nuwara Eliya and Badulla (Table III and Plate III). A north-south trending zone exhibits a 15°F range, including the Highland and part of the northern lowland (up to Anuradhapura). This high-range zone areally located between the southwestern and northeastern coastal belt is easily explained by the distance of this zone from the areas of Monsoonal rainfall concentration. On the other hand because of the dominant influence of the rainfall from convection this zone naturally has a high diurnal range. The afternoons and the clear cloudless skies at night create radiational conditions which facilitate the high ranges. [21] The cloudy forenoon and early afternoons (when the land is yet in the process of acquiring the cumulative thermal effect) with high temperatures contrast with the cloudless, starry nights when nocturnal terrestrial radiation is greatly facilitated, to create low temperatures. The high temperatures during the day and low temperatures during the night would form the sequence of areas especially away from the coast. In the Highland this diurnal sequence of alternating high and low temperatures is still more characteristic ; this is in fact, accentuated in the highland because of relief (i.e., the elevational differences locally). A high degree of micro-mosaic thermal ranges are reflected in the Highland because of the pattern of the ' relief mosaic.'

20. For detailed considerations on this aspect see Thambyahpillay. *Rainfall Rhythm in Ceylon op. cit.*

21. The diurnal weather sequence of the Convectional period has been dealt with in detail in Thambyahpillay, " Thunderstorm Phenomena..........," *op. cit.* 165—167.

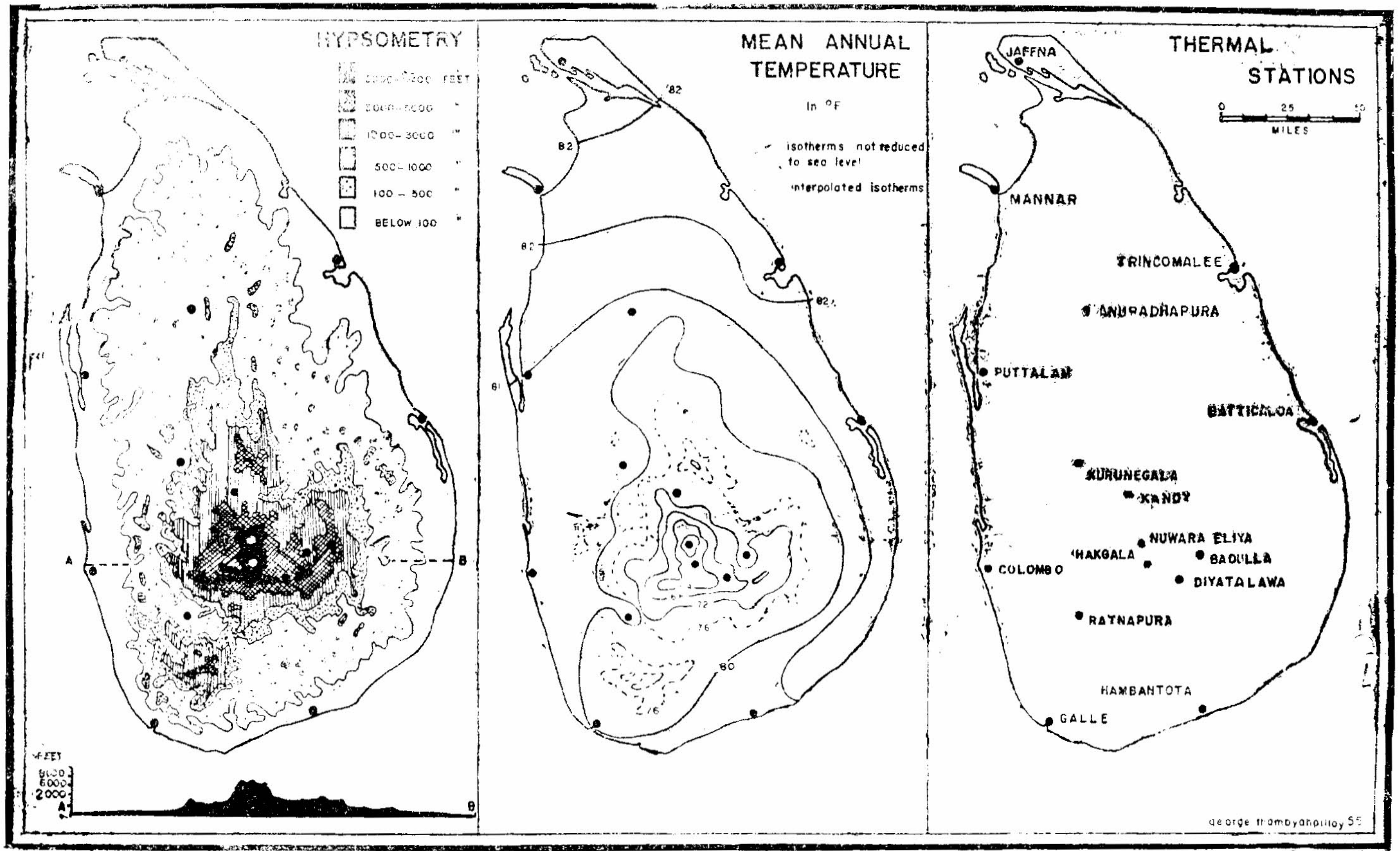
HYPSOMETRY
1000-3000
500-1000
100 - 500
BELOW 100
FEET
A
B
MEAN ANNUAL TEMPERATURE
In °F
isotherms not reduced to sea level
interpolated isotherms
82
80
76
72
THERMAL STATIONS
0
25
50
MILES
JAFFNA
MANNAR
TRINCOMALEE
ANURADHAPURA
PUTTALAM
BATTICALOA
KURUNEGALA
KANDY
NUWARA ELIYA
HAKGALA
BADULLA
COLOMBO
DIYATALAWA
RATNAPURA
HAMBANTOTA
GALLE
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PLATE - II

Detailed observations within the University Park has revealed this pattern.[22] Thus accentuation is the product not purely of thermal conditions *in situ* but often the product of the resulting dynamical process. The drainage of cold air (on a *katabatic* form) into the valleys and depressions is a thermo-dynamical process.[23] The piling-up of cold air within the confines of small depressions and valleys resulting in very low temperatures (even to freezing level in December and January) is characteristic of the Highland region. Even in March-April and October when temperatures are high in Ceylon, these features are noticeable in the Highland ; in fact because of the basic convectional circulation in the island, the high diurnal ranges are more the normal than being anomalous.

Seasonal incidence of Temperature

The above analysis of the annual mean thermal conditions needs however to be substantiated by a study of the seasonal pattern. Since the island's latitudinal position does not warrant it the traditional four-seasonal incidence of weather, the monthly analysis of temperature is being attempted.

Beginning the analysis in March—the beginning of the *Climatic Year*[24] in Ceylon—when weather conditions most typical of the island prevail, except for the Highland with its characteristic lower temperatures (of less than 80°F generally and a very small zone of less than 70°F[25]) the rest of the island exhibit high temperatures of over 80°F (Plate IV ; Table II). This thermal pattern is a reflection of the early equinoctial conditions that prevail over the island during March-April. The resulting thermally induced convectional rainfall in some sense ameliorates the temperatures by providing a high incidence of cloud cover especially in the late afternoons and evenings : the high temperatures and the lower, night temperatures on the average prevent mean high temperatures during the month. In the northwest however, the temperatures are between 82°F and 84°F, —an expression, of continentality to a slight degree. A narrow zone extending north-south of over 82°F occupies the region west of the high

22. Even within this small area, the minor depressions and valleys are often ' foggy ' and the very lowest slopes with *down-slope stratus*.Because of their elevated positions, Peiris, Marrs and Fernando Halls, provide ideal sites from which to observe these *katabatic* phenomena. The piling-up of the cold air descending into the depressions causes these valley-fogs. Sometimes the stratus is formed *in situ* in the valleys ; this is the direct result of *ground radiation*. This effect produces the anomaly of higher temperatures on the higher elevations and the lowest temperatures in the valley bottoms and depressions; the slopes would then reflect decreasing temperatures from their ' shoulders ' to their ' bottoms.' Thus the thermal anomaly of *temperature inversions* are characteristic within the Highland.

23. While the thermal aspect (cold air) is produced by direct terrestrial (nocturnal) radiation, the descent of the cold air and subsequent piling-up in the valley bottoms is caused by the dynamic process.

24. Thambyahpillay, *Rainfall Rhythm in Ceylon* op.cit 18

25. Kandy 3.4°F; Badulla 73.4°F; Diyatalawa 67.6°F; Hakgala 62.0°F and Nuwara Eliya 59.1°F.

Ridge, and includes Ratnapura and Kurunegala (82.4°F and 82.3°F, respectively). This might be explained by the non-effectiveness of the sea-breeze in extending its ameliorating character far inland. On the other hand along the coastal belt (west and east coast) the marine effect is noticeable.[26] By April, however with equinoctial conditions fully established[27] certain changes are noticeable in the thermal character of the island ; The 82°F isotherm has now a southerly extension so that almost the northern two-thirds of the island exhibit temperatures over 82°F. (Plate IV). The other remarkable features are the establishment of a thermal zone of over 84°F in the north[28] and the diminution of the below-80°F zone, so as to be more confined to the higher elevations of the Highland. This month along with March, forms the ideal convectional circulation period : the hot forenoons and the early afternoons with their high temperatures and the cloudless nights with their cooler temperatures explain the high degree of the diurnal temperature ranges (Table III). It is also seen that temperatures all over the island have increased as compared to March ; this is illustrated in the table below :—

Station	Height above M.S.L. (feet)	Mean temperatures (in°F)		Diurnal temperatures ranges (in°F)	
		March	April	March	April
Anuradhapura	295	81.2	82.9	19.3	16.8
Badulla	2225	73.2	75.2	17.9	17.8
Batticaloa	26	80.2	82.2	10.3	11.1
Colombo	24	80.9	82.0	13.8	11.9
Diyatalawa	4104	67.6	69.1	19.1	17.4
Galle	13	80.6	81.5	11.1	9.4
Hakgala	5581	62.0	64.6	21.3	19.0
Hambantota	61	80.4	82.0	12.5	11.3
Jaffna	14	82.2	84.7	12.7	9.4
Kandy	1611	78.4	79.1	19.9	18.2
Kurunegala	381	82.3	82.8	20.6	16.5
Mannar	12	82.2	84.2	14.3	12.5
Nuwara Eliya	6170	59.1	60.6	24.6	21.6
Puttalam	27	81.3	82.7	16.8	13.2
Ratnapura	113	82.2	82.4	19.1	17.1
Trincomalee	24	80.9	83.3	9.0	11.4

26. The constant onset of the sea breeze during the hottest periods of the day explains the negative thermal features along the coast thus : Batticaloa 80.2°F, Colombo 80.9°F, Galle 80.6°F, Hambantota 80.4°F and Trincomalee 80.9°F.

27. The Sun is overhead Colombo on April 8th and at slightly later dates over Mannar and Jaffna.

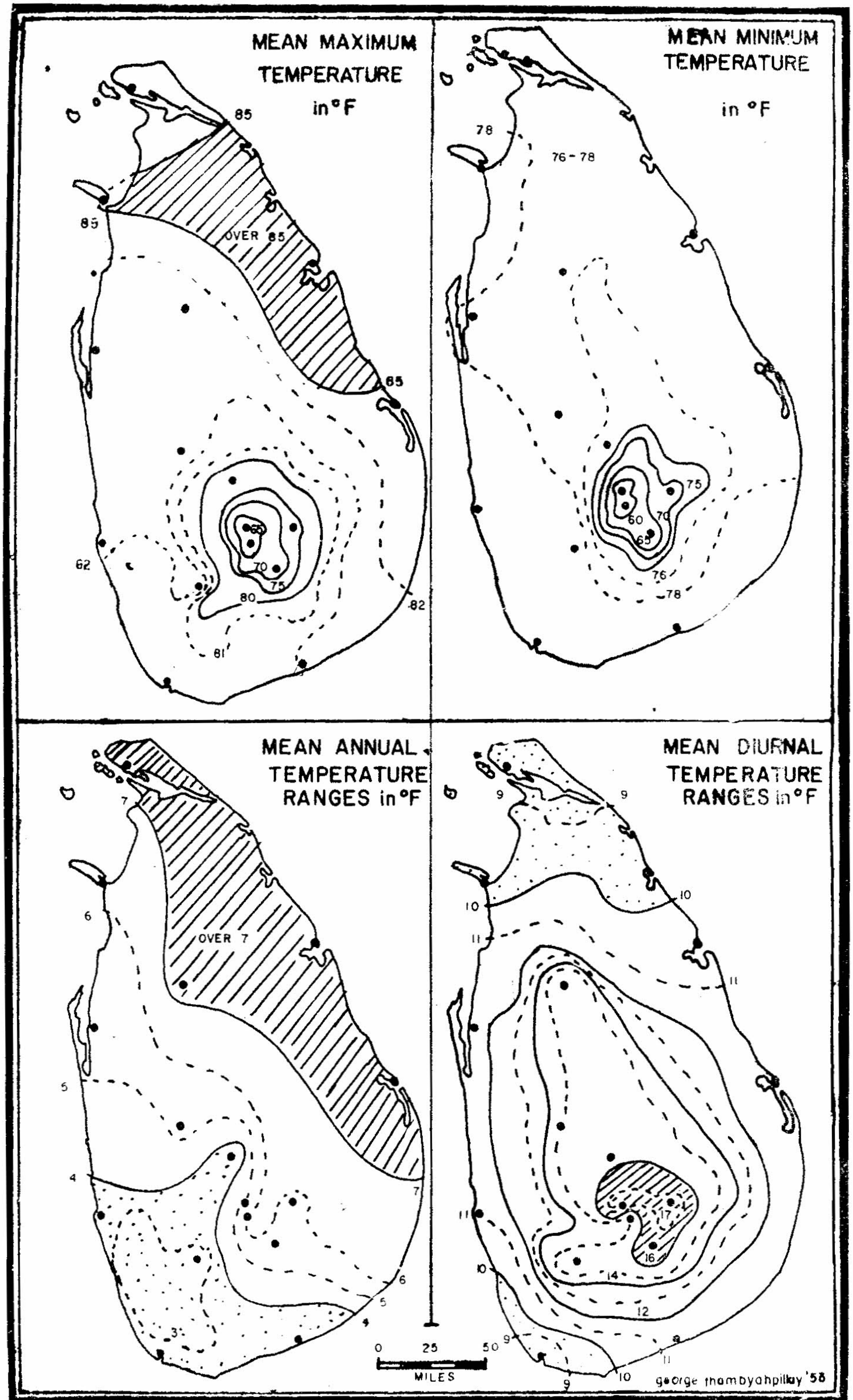
28. Jaffna 84.7°F and Mannar 84.2°F.

While the mean temperatures show a positive change, the diurnal ranges on the other hand show a general decrease. This is as to be expected ; the increasing incidence of the conventional circulation and its accompanying rainfall create a higher incidence of humidity as well as the cumulative effect of humidity in the atmosphere and explains the negative character of the change in the diurnal ranges. However the ranges are still high, especially in the highland as well as in inland locations. (See Plate II for location of these stations). The higher ranges reflected by the Highland stations (Nuwara Eliya, Hakgala, Diyatalawa, Badulla and Kandy) are an expression of relief while the inland stations (Anuradhapura and Kurunegala) reflect the distance from the sea ; the sea breeze therefore becoming less effective, in ameliorating temperatures.

By May thermal characteristics exhibit remarkable changes which are a reflection of the new atmospheric conditions that are being established ; this is the pre-S. W. Monsoonal period. While the southern third of the island shows little change (the temperatures are still below 82°F) the northern and eastern parts, on the other hand, exhibit higher temperatures, amounting to over 85°F in certain localities.[29] The map for May (Plate IV) shows the north-eastern quadrant of the island has temperatures over 84°F : a southeast-trending line joining a point on the west coast (just above Kudremalai Point) to a point below Kalkudah on the east coast forms the southern boundary of the over 84°F isothermal zone. The Mannar environs and a coastal zone extending from Mullaitivu to about Panichchankeni (on the east coast) exhibit temperatures over 85°F. The concentric lower-temperature zone is still more diminished with only Nuwara Eliya and Hakgala showing temperatures below 70°F (Table II). The decrease of temperatures along the southwestern coastal belt is the direct expression of the early Southwest Monsoonal effect.[30] The fall of temperature in Kandy is because of the currents reaching this station through the Kadugannawa Gap. Ratnapura too exhibits a ' fall ' because of its physical location, namely a valley into which the air currents surge.

	Mean Temperatures in °F	
	April	May
Galle	81·5	81·3
Hambantota	82·0	81·8
Kandy	79·1	78·9
Ratnapura	82·4	81·6

29. Mannar : 85.0°F and Trincomalee : 85.2°F.
30. In fact it is not until early June that the Southwest Monsoon is established. The southwesterly ' surges ' that are experienced in May are, in effect, the southeast Trades which have acquired a southwesterly component in conformity with Ferrel's Law. Detailed considerations have however been made in, Thambyahpillay. *Rainfall Rhythm........op.cit.*, 24—26.


MEAN MAXIMUM TEMPERATURE in °F
85
85
OVER 85
85
82
80
75
70
65
81
82
MEAN MINIMUM TEMPERATURE in °F
78
76 - 78
75
70
60
65
76
78
MEAN ANNUAL TEMPERATURE RANGES in °F
7
6
OVER 7
5
4
7
6
5
4
3
MEAN DIURNAL TEMPERATURE RANGES in °F
9
9
10
10
11
11
17
16
14
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9
0 25 50
MILES
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PLATE III

The increasing temperatures in the eastern sector of the island is of significance and reflects the beginning of atmospheric conditions that are to accentuate this positive thermal characteristics during the following months of the fully established Southwest Monsoon. The June map (Plate IV) clearly illustrates this contention. This feature has a climatological *raison d'etre* ; the Monsoon is the main cause. The Monsoon is fully established only by early June [31] and everywhere in the western part of the island, lower temperatures (due to higher humidity and greater cloud incidence) form the characteristic thermal features. Even Mannar which exhibited a positive thermal feature in May, now shows a decrease of 0.6°F. On the other hand all stations on the eastern coast show increased temperatures ; this positive thermal incidence is not due to the absence of the Monsoonal effect. Contrary to common opinion and paradoxical though it may seem, yet it is the Monsoon that is responsible : the Monsoonal currents do reach the eastern part of the island. But they arrive as moisture-bereft winds and therefore are " drying " in their characteristics. This is true of locations in the northern and northeastern coasts (for example, Jaffna and Trincomalee). On the eastern coast (for example, Batticaloa) on the other hand, a new phenomenon is active ; the Monsoonal currents that ' spill-over ' the Central Ridge are not only bereft of their moisture-content and therefore in themselves ' drying,' but they are also adiabatically warmed in their descent. They thus arrive as scorching, strong winds in the eastern and northern parts of the island.

In the months of July and August the same thermal characteristics that prevailed in June on the regional pattern are continued and still more emphasized. It is not until October that thermal conditions are wont to change, consequent upon the changing atmospheric environment. The S. W. Monsoonal months therefore exemplify a dual regional character in their thermal features : in other words, a positive expression in the east and a negative expression in the west. This characteristic while being generally true, slight variations may be noticed in an analysis of the individual stations,—this being due to the effect of local controls such as exposure and altitude of the site of the meteorological stations. The increasing temperature of Hambantota, during the S. W. Monsoonal period may be cited here. Due to its local physiographic situation, without an effective

31. *ibid.*, 27. The onset of the Southwest Monsoon is derermined by the analysis of the anemometer recordings at Colombo, Galle, Hambantota, Trincomalee and most especially from the Little Basses. The time of occurence of the "deep surges" of the Monsoonal stream indicates the onset: mean readings reveal that the true Monsoon sets in, not earlier than the 26th of May and the not later than the 6th of June. This 'deep surge' is always preceded by two distinct groups of southwesterly air currents termed the ' shallow phase ' about April 20th and the ' intermediate phase ' about the first or second week of May.

' lifting agency ' to induce the Monsoonal winds to precipitate their moisture, [32] this station exhibits lower rainfall, lower humidity per per cent and hence the consequent positive temperature anomalies. This is still more paradoxical because Hambantota lies athwart the path of the Monsoonal surge. [33] The following two stations may be compared as illustrative of the regional contrasts of the positive and negative thermal trends :—

Mean Temperatures (in °F.)

	April	*May*	*June*	*July*	*August*
Galle	81·5	81·3	80·4	79·8	79·6
Trincomalee	83·3	85·2	85·4	85·2	84·6

In Batticaloa this is the period of the *Kachchan*, [34]—a characteristic *fohn*-effect wind that is most dominant especially in August. The decending moisture-bereft Monsoon warms adiabatically and blows as a strong gust, first felt at Diyatalawa and subsequently at Batticaloa. [35] In the Jaffna Peninsula the positive thermal features usher-in the Kodaikalam, [36] while the *chologam* [37] forms the characteristic wind. The former is of significance in an agro-climatological sense and the latter on a physiological climatic sense.

32. The Monsoonal currents inspite of their moisture-laden characteristics often require a ' lifting agency ' to induce the currents to precipitate ; such ' agencies ' may be an air mass, high vegetation canopy, physiographic features etc. The latter seems to be of great significance in Ceylon and very often micro-hyetal regions of intense rainfall correspond to the micro-relief pattern. The Southern Mountain Wall unfortunately is too distant from Hambantota to provide the ' lifting agency ' for Monsoonal currents over the Hambantota environs to precipitate their ' heavy burden.'

33. A comparison of the rainfall figures of two stations facing the S.W. Monsoonal currents may be used as elucidation of this ' lifting agency ' control of precipitation :—

Average rainfall (in inches)

	April	*May*	*June*	*July*	*August*
Galle	8.7	12.6	8.4	6.3	6.2
Hambantota	3.9	4.3	2.1	2.1	1.5

For further considerations refer, Thambyahpillay, *Rainfall* Rhythm........*op.cit.* 30.

34. The *Kachchan* is a dry, scorching wind, comparable to the *Bohorok* in Sumatra, the *Sirocco* in the Sahara and the *Chinook* in the Alberta, Montana and Wyoming Provinces (east of the Rockies) in North America. This wind is a *katabatic* wind and is therefore adiabatically warmed. For details refer Thambyahpillay, " Climatic Controls........", *op.cit.*, 173—175 and 180.

35. The anemometers at Diyatalawa and Batticaloa unmistakeably record these winds because of their velocity. However the thermometers indicate sudden increase of temperatures.

36. This term strictly translates as the ' dry season ' and is rainless except for the convectional rainfall. This period also therefore inaugurates the ' irrigation activity ' in the Jaffna Penninsula with the *well-sweep* still forming the method of raising water to the surface.

37. This term is the Tamil-equivalent of ' S.W. Monsoon ' and is characterised by the strong winds that mark the onset of the Monsoon.

In September (Plate IV) conditions are least Monsoonal, with the 'retreat stage' of the Monsoon in dominance : on the other hand the convectional circulation tries to re-assert itself. These two phenomena therefore explain the thermal features of this month. The over 84°F isothermal zone is confined to the immediate environs of Trincomalee only. The regional pattern has changed very little from the August pattern, but the true character is masked by late-Monsoonal activity re-asserting itself very often. However there seems to be a very generalized feature of increased temperatures in the western part of the island and decreasing temperatures in the eastern part.

The period, May to September, that has been analysed in terms of the thermal characteristics, reveal very interesting features when the diurnal temperature ranges are considered. Here again the features seem to reflect the Monsoonal-Convectional significance. Thus while the stations located in the S.W. Monsoonal-dominant zone reflect lower ranges and remarkable decrease with the setting-in of the Monsoon, the stations that do not benefit from the Monsoonal rainfall show high diurnal ranges,—at once the reflection of the Convectional dominance. Jaffna and Mannar however also show decreased ranges because of their immediate coastal locations : it is also due to their proximity to the Monsoonal trajectory across India. Because of the decrease in rainfall in these stations, the temperatures are still high with cloud incidence also being high (in path of the Monsoonal *streamlines*) ; the ranges have been minimised. During this period even within the Monsoonal-dominant areas, the months of high and low diurnal ranges are a reflection of the 'monthly incidence of Monsoonal dominancy.' Thus for example, while the coastal station Colombo shows a marked low range in July, in August the same station shows a slight increase of 0.3°F and in September a still further increase of 0·6°F (since August). Hambantota on the other hand shows a sudden decrease in May (9·1°F) this being a fall of 2·1°F from the April range. In the case of Colombo, it is clearly seen that June-July was the dominant Monsoonal-incidence period ; this is clearly the reflection of the exposure aspect, namely, its location on the west coast. The diurnal ranges of Hambantota reveal, that with the onset of the Monsoon it felt the effect remarkably to cause the decrease and subsequently in the next month of June the increase in ranges was initiated, because of the non-effectiveness of the Monsoon to precipitate. Anuradhapura, Diyatalawa and Kurunegala, because of their inland locations, not only show high ranges but also a general increase of temperatures with the progressive dominance of the Monsoon : the dual features of course, are an expression of the convectional dominance. All these three stations however show relatively lower ranges

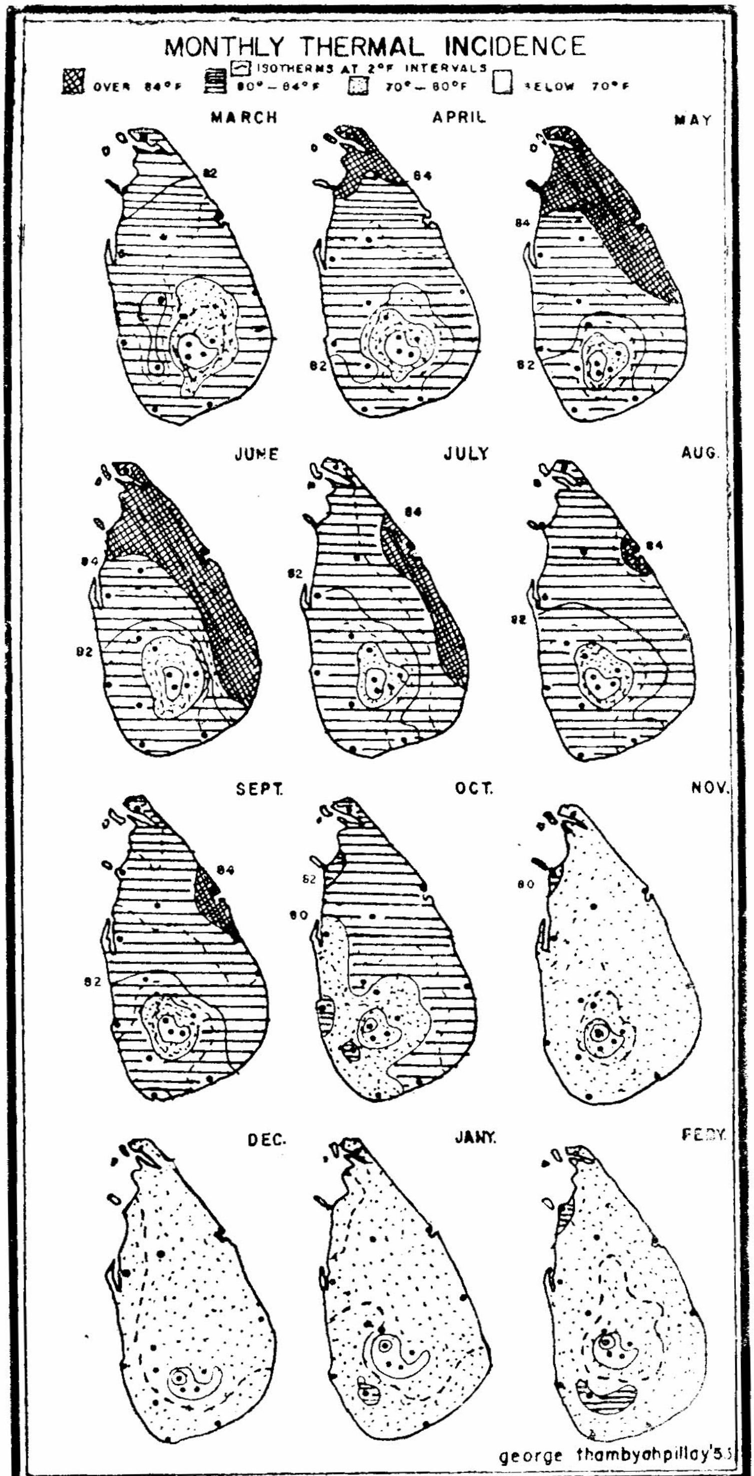
MONTHLY THERMAL INCIDENCE
ISOTHERMS AT 2°F INTERVALS
OVER 84°F
80° – 84°F
70° – 80°F
BELOW 70°F
MARCH
APRIL
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
JANY.
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PLATE IV

as compared to those that prevailed during the convectional period *par excellence*,—March and April. Badulla, Batticaloa and Trincomalee on the other hand exhibit their highest ranges for the year during these months because of the marked convectional dominance. Here again exposure (east coast and easterly aspect) is of significance. The table below illustrates the above mentioned features :—

Mean Diurnal Temperature Ranges (in °F) [38]

	April	*May*	*June*	*July*	*Aug.*	*Sep.*	*Year*
a. Westerly coastal exposure							
Colombo	11·9	9·4	8·0	7·7	8·0	8·6	11·0
b. Non-effective ' lifting agency ' of Monsoon							
Hambantota	11·3	9·1	9·6	11·3	11·8	10·4	11·2
c. Proximity to Monsoonal Indian trajectory							
Jaffna	9·4	6·5	5·7	6·2	6·7	7·1	8·8
Mannar	12·5	8·9	7·7	8·4	8·9	9·1	9·9
d. Eastern Coast and easterly exposure							
(Highlands) Badulla	17·8	18·6	20·0	22·3	21·8	21	17·6
(Lowlands) Batticaloa	11·1	12·3	14·6	15·4	14·0	13·7	11·5
Trincomalee	11·4	12·9	13·1	14·3	14·9	14·9	10·8
e. Western Highland and Monsoonal exposure							
Nuwara Eliya	21·6	16·9	10·2	10·5	11·2	13·8	17·3
f. Inland locations.							
Anuradhapura	16·8	14·2	13·3	15·0	16·0	16·5	15·4
Kurunegala	16·5	13·1	11·0	11·2	12·3	13·3	15·0

In October, new atmospheric conditions—contrasting from those that prevailed during the Monsoonal period—come into effect to dominate the weather scene in the island. The map (Plate IV) clearly exhibits the thermal features that are the result thereof. Except for the Mannar environs [39] no area experiences mean temperatures of over 82°F and only the north-eastern half of the island has temperatures over 80°F. This period has

38. The relatively high readings for the Highland stations are of course the reflection of the relief effect.
39. Mannar : 82.2°F.

certain comparisons with those that prevailed in March-April. The convectional circulation is the dominant 'weather generator': but the March-April maps are not in fact similar to the October map because of certain other circumstances. The Convectional weather phenomenon is rightly prevalent at this time over the island in view of the autumnal equinoctial period.[40] But since this is the pre-winter period of the Northern Hemisphere and also because the Northeast Trades blowing from cooler latitudes have their incidence on the island at this time, temperatures generally are lower. After the slight increase in temperatures in September in certain localities, an overall slight decrease in temperatures in October is noticeable in all the observing stations (Table II). The area of less than 70°F thermal incidence has increased to include Diyatalawa, Hakgala and Nuwara Eliya.[41] The diurnal temperature ranges show once again an interesting picture with regional contrasts. Colombo with convectional dominance show a slight increase of 1·5°F from the observation of the previous month, while the corresponding increases at other stations are Galle (1·6°F), Nuwara Eliya (almost 2·0°F), Puttalam (1·7°F) and Kurunegala (almost 1·0°F). Apart from these notable increases, other stations such as Badulla, Diyatalawa, Batticaloa and Trincomalee exhibit slight increases. The four stations that show decrease, do so because of their easterly aspect. The table below clearly elucidates this feature :—

Mean Diurnal Temperature Ranges (in °F).

	September	*October*	*Change* (+/–)
a. *Westerly exposure*			
Colombo	8·6	10·1	+1·5
Galle	5·9	7·5	+1·6
Puttalam	8·9	10·6	+1·7
Nuwara Eliya	13·8	15·7	+1·9
b. *Inland*			
Kurunegala	13·3	14·2	+0·9
Kandy	15·1	15·6	+0·5
c. *Easterly exposure*			
Badulla	21·5	17·4	–4·1
Diyatalawa	17·1	15·6	–1·5
Batticaloa	13·7	11·8	–2·9
Trincomalee	14·9	12·2	–2·7

40. The Sun is overhead Colombo on September 5th ; but in view of the time-lag, true equinoctial conditions are not established until late-September and early October. The Monsoonal incidence however, is also responsible for the masking of the equinoctial conditions that may prevail in September.

41. Diyatalawa : 68.5°F, Hakgala : 63.0°F, and Nuwara Eliya : 59.8°F.

The months of November, December, January and February exhibit thermal features almost similar, except for very minor differences. In November the island begins to clearly reflect its latitudinal effect of being in the northern Hemisphere, which now has its winter. However because of the island's proximity to the Equator, the winter effect is not marked. Nevertheless thermally, the onset of the Northern Winter is of significance. The immediately adjacent landmass of India begins to acquire its High Pressure ' cells ' from which cetrifugal winds stream along the Ganges Valley gradient to merge with the now prevalent Northeast Trades that dominate the island's atmospheric environs. The temperatures therefore, are low all over the island in November and the decrease of temperature is continued into the months of December and January. Except for Mannar (80·0°F in December) and Ratnapura (80·2°F in January : an expression of local controls) no other station in Ceylon has temperatures over 80·0°F in December and January. This remarkable overall pattern of low thermal incidence is unmistakeably seen in the corresponding maps (Plate IV). That the centrifugally streaming polar air currents of Siberian origin have their repercussions on the thermal scene in the island at this time is not quite certain. According to acknowledged climatologists, like Kendrew[42], Byers [43] and Trewartha [44], the Siberian *Polar Streamlines* do not affect the weather of India, because of the impenetrable Himalayan-Arakan Yoma-Yunnan Plateau mountain barrier. It is then least probable that they would seriously affect the island. However, it is possible though, that a few ' interlopers ' may stream-in through the Brahmaputra Gap or even reach the island from the Pacific (by way of the Northeast Trades). [45] There is no doubt that the local ' high ' that develops over the Punjab-Kashmir-Jammu environs generates ' cold *streamlines* ' that would follow the Ganges gradient, to merge with the Northeast Trades.[46] These latter with their quasi-Monsoonal characteristics would naturally affect the island and will find expression in the thermal pattern. The extremely ' cold blasts ' that one experiences in the Jaffna Peninsula, Trincomalee and even in the Kandy environs, are unmistakeable, evidences of the occasional

42. W. G. Kendrew. *Climatology* (Oxford : Clarendon Press, 1949), 145 and........ *Climate of the Continents* (Oxford : Clarendon, 1937), 113—114. During Kendrew's recent stay in the University Campus, the writer had occasion for personal discussions with him on this aspect.

43. Horace R. Byers. *General Meteorology* (New York : McGraw-Hill, 1944), 231.

44. Vernor, C. Finch and G. T. Trewartha. *Elements of geography* (New York : McGraw-Hill, 1942), 84.

45. Thambyahpillay. *The Rainfall Rhythm......*, *op.cit.*, 13—14.

46. The Northeast Trades is in effect the main feature of this period in the island. The term ' Northeast Monsoon ' has been erroneously conferred on the Trades. However see, Thambyahpillay, *ibid.*, 13—15 and 42—45.

incursions of '*polar streamlines*' either from the Indian 'high' or from across the Malayan Isthmus (originating from the outblowing Siberian *streamlines* that reach the Pacific and blow with the Trades). Even in February when temperatures are slightly on the increase (portending the follow-on of equinoctial atmospheric conditions) occasional 'cold blasts' are characteristic.[47] The diurnal ranges of temperature are characteristically low in the areas with easterly exposure : the so-called Northeast Monsoon is in dominance and hence Batticaloa, Trincomalee, Diyatalawa and Hakgala exhibit these smaller ranges. Mostly all other stations show a small increase in the ranges—, an indication of the increasing incidence of convection. A comparative tabulation would be helpful :—

Mean Diurnal Temperature Ranges (in °F.)

	Nov.	*Dec.*	*Jan.*	*Feb.*	*Year*
a. *Easterly exposure (Monsoonal)*					
Highland :					
Badulla	13·4	12·4	12·8	15·7	17·6
Coastal :					
Batticaloa	9·7	8·4	8·0	9·1	11·5
Trincomalee	8·6	6·9	5·5	6·7	10·8
b. *Westerly exposure (Convectional)*					
Coastal :					
Colombo	11·5	13·2	17·4	14·9	11·0
Galle	9·0	10·3	11·0	11·5	8·4
Highland :					
Nuwara Eliya	16·1	19·5	21·5	24·7	17·3

The general increase of ranges in February (Plate III) is commensurate with the changing atmospheric conditions, namely the trend towards convectional establishment. The increase in relative humidity per cent is

47. The weather that prevailed in February of 1955 was however an unusual feature of the island's climatic scene. The wind directions were mainly northerly, northeasterly and easterly in the University Campus : the strong gale-force winds were really the continuation rather late into February of the 'cold blasts' streaming with the Northeast Trades. Some 'depressional' activity prevailing off the eastern coast and sometimes extending inland were responsible for some of the gales accompained by general drizzle with occasional thunder showers : these characteristics seem to accord with the general nature of wind components of 'depression' and cyclones. More detailed study would be necessary to fully explain the 'unusual weather' in February. The strong incidence of these winds in the Kandy environs was due to the Dumbara Valley which facilitated their 'streaming-in.'

naturally due to the lower temperatures ; but in February, there is a general decrease everywhere. In February, Mannar with 80·1°F and Ratnapura with 81·5°F are the notable examples of high thermal incidence. The peculiarity of the Ratnapura reading is because of its localized relief and explains the later development of the 'Sabaragamuwa Convectional source region.'[48]

In reviewing the seasonal pattern of thermal incidence in Ceylon the dominant characteristics may be briefly considered.

(*a*) Temperatures are generally lower than warranted for the island in terms of its latitudinal position. These negative thermal anomalies are paradoxically the indirect consequence of high insolation expressed in the form of high cloud and humidity incidence. The Monsoonal and Convectional rainfall play their role in providing these two (cloud and humidity) media of amelioration of temperatures. The small size and the insular character of Ceylon are other facts facilitating the eventual negative anomalies.

(*b*) The monthly variation of temperatures are remarkably small, the mean range varying from between a maximum of 8·0°F to a minimum of 3·0°F. However the diurnal thermal ranges are comparatively high.[49]

These ranges seem to reflect the cloud and humidity incidence created by the nature of the rainfall incidence.

Diurnal Temperature Characteristics

Station	*Highest range* °F	*Highest range* *Month*	*Lowest range* °F	*Lowest range* *Month*	*Average Annual range* °F
Colombo	15-17	January February	8-9	June to August	11·0
Galle	12	February March	6-7	June to September	8·4
Trincomalee	14-15	June to September	5-7	November to February	10·8
Batticaloa	14-16	June to September	8-9	November to February	11·5

48. The two zones of 'Convectional genesis' in the island are found in the Uva Plateau and the Sabaragamuwa environment. Other localized zones do occur. But, because of their particular physiographic and geographical features these two zones are the examples *par excellence*.

49. These range from a low of 8.4°F (Galle) to a high of 17.3°F (Nuwara Eliya).

Thus months of Monsoonal rainfall show lower diurnal ranges, while months of convectional rainfall show high ranges : this relative variation has a climatological *raison d'etre*. The regional incidence of diurnal ranges reflects the geographical factor of altitude and more important, that of ' relief.' An ideal detailed map showing these thermal features would present a micro-mosaic pattern.

(*c*) The regional incidence of temperatures reflect the control of geographical factors. Highest temperatures are the features in the north and east : this is an expression of ' continentality ' because of the proximity of the northern part of the island to the Indian landmass. High temperatures are characteristic of the months of February and March (in the Southwest), of April (in the northwest) of May and June (in the northern third of Ceylon) of July, August and September (in the northeastern coastal belt).[50] The lowest temperatures are regionally confined to a concentric zone in the southcentral part of the island : this is the direct expression of the altitudinal control—the mountainous core of the island with an altitudinal variation of from 1000 feet to 8300 feet.

The Thermal Rhythm

The foregoing analysis reveals, that the thermal incidence in Ceylon, far from being a negligible aspect of the climate of the island, is in fact, of real significance. As mentioned before it is unfortunate that advanced students of the geography of the island have neglected the thermal factor in their attempts to explain scientifically the climate of Ceylon. In the attempt made to demarcate the island into climatic regions, the rainfall factor has been overemphasized with a corresponding complete negligence of the thermal factors.[51] In an earlier effort[52] the writer had attempted to analyse the precipitation (rainfall) characteristics of the island and to discern a ' rhythm : ' this ' rhythm ' character was climatologically explained and presented in a simple tabulated form. A similar attempt is here made to demonstrate in tabulated form, a distinct ' thermal sequence ' prevailing in the island.

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50. Some comparable figures are (i.e., highest and lowest ever recorded) :

	Highest Temperature (°F)	*Lowest Temperature* (°F)
Colombo	97.0 (February)	62.0 (January)
Galle	92.0 (March)	66.0 (December)
Trincomalee	10.0 (May)	65.0 (January)

51. A solitary attempt or two have been made to use the thermal factor, but the basis has been without sufficient climatological imprint.

52. Thamyahpillay, *The Rainfall Rhythm in Ceylon, op.cit.* pp. 52.

A detailed analysis of the seasonal pattern of the thermal characteristics has already been attempted earlier in this paper. In tabulating the 'seasonal sequence' it will be realized that this 'thermal rhythm' in the island is closely bound up with the earlier analysed 'rainfall rhythm.' This is climatologically justified and natural, because the weather and climate of any area is the reflection of the interaction of the two major climatic attributes, namely temperature and precipitation.

Period	*Month*	*General Characteristics*
Vernal Equinoctial	March	Temperatures high (over 80.0°F) everywhere ; lower temperatures reflect altitudinal effect. Range 59.1°F (Nuwara Eliya) to over 82°F (northwest and Ratnapura-Kurunegala zone). Diurnal ranges high : 9.0°F (east coastal : Trincomalee) to 24.6°F (highland Nuwara Eliya) ; Convectional effect.
	April	Generally similar to March but positive thermal changes. Low thermal zone smaller, high thermal incidence concentration in north-over 84°F (Mannar and Jaffna). Diurnal ranges negative yet still high 9.4°F-(Galle, Jaffna) to 21.6°F (Nuwara Eliya). Convectional dominance.
Feeble Equinoctial Pre-SW Monsoonal	May	Generally positive change except *southwesterly* Monsoonal effect of decrease of diurnal ranges 1.0—5.0°F. Marked positive change in north and east (over 84°F with Mannar and Trincomalee-over 85°F) ; Corresponding slight positive diurnal ranges. Low isothermal zone diminishes.
"*Summer*" *Solsticial* Southwest Monsoonal (west) Convectional (east)	June	Similar as in May with continuing negative changes in southwest (Monsoonal) and positive changes in north and east (dry 'Monsoonal effect *Marikalam-Chologam*). Diurnal ranges positive in east and north (convectional) and negative southwest monsoonal, i.e., easterly versus westerly exposure.
	July	High thermal zone (over 85°F) diminishes areally, but note Trincomalee and Batticaloa). Diurnal ranges positive (east and north) and negative (west). Monsoonal and convectional effect.
	August	Still high temperatures in east and north, but changes negative. Only Trincomalee over 85°F. Diurnal still high in Convectional zone and low in Monsoonal zone.
Weak SW Monsoonal Convectional	September	Over 82°F thermal zone in northeast : only Trincomalee over 85°F; Southwest partly Convectional (positive diurnal-Galle and Colombo) Diurnal ranges still high (convectional) in northeast.
Autumnal Equinoctial. Convectional	October	Negative change everywhere : positive diurnal ranges everywhere, except Batticaloa and Trincomalee.
Early Monsoonal Convectional	November	Lower temperatures everywhere. Diurnal ranges generally lower-below 80°F. Diurnal ranges positive-highland.

" *Winter* " *Solsticial* Northeast Monsoonal	December	Increasingly negative Monsoonal thermal changes. Diurnal ranges negative in east coast but positive in west (convectional).
	January	Similar as in December : All thermal features accentuated. Temperatures still below 80°F.
Early Convectional	February	Positive thermal changes yet temperatures still below 80°F ; positive diurnal ranges (portend equinoctial effect). Occasional ' polar interlopers ' with low temperatures in highland and coast.

GEORGE THAMBYAHPILLAY

TABLE I

Main Meteorological Stations

Station	Latitude (North)	Height above Mean Sea Level (feet)	Years of Observation a	
			Rainfall	Temperature
Anuradhapura	8°21'	295	85	26
Badulla	6°59'	2197	82	28
Batticaloa	7°43'	20	86	27
Colombo	6°54'	24	86	27
Diyatalawa	6°49'	4093	54	28
Galle	6°02'	41	87	26
Hakgala	6°55'	5581	71	22
Hambantota	6°07'	61	87	26
Jaffna	9°39'	14	85	28
Kandy	7°17'	1611	86	27
Kurunegala	7°28'	381	76	26
Mannar	8°59'	12	86	30
Nuwara Eliya	6°58'	6170	87	26
Puttalam	8°02'	7	87	28
Ratnapura	6°41'	113	87	27
Trincomalee	8°35'	24	86	27

a Observations recorded up to 1954.

Source : *Reports of the Colombo Observatory.*

TABLE II

Mean Monthly Temperature

(in °F)

Station	Ht. above M.S.L. feet	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Anuradhapura	295	76.2	78.2	81.2	82.9	83.2	83.0	83.3	83.4	83.2	81.2	78.6	76.6	80.9
Badulla	2225	70.0	71.2	73.2	75.2	75.8	75.3	75.2	75.3	75.0	74.2	72.4	70.6	73.5
Batticaloa	26	77.5	78.4	80.2	82.2	84.0	84.9	84.7	83.5	83.0	81.2	79.2	77.7	81.4
Colombo	24	79.2	79.6	80.6	82.0	82.1	81.3	80.8	80.8	81.0	80.2	79.2	78.9	80.5
Diyatalawa	4104	64.6	65.8	67.6	69.1	70.4	70.4	70.4	69.8	69.4	68.5	67.2	65.8	68.2
Galle	13	78.4	79.4	80.6	81.5	81.3	80.4	79.8	79.6	79.8	79.2	78.8	78.4	80.0
Hakgala	5581	59.2	60.6	62.0	64.6	65.4	63.4	62.8	63.0	63.4	63.0	61.4	59.9	63.1
Hambantota	61	78.8	79.6	80.4	82.0	81.8	81.6	82.0	81.4	81.3	80.8	79.6	78.8	80.7
Jaffna	14	77.6	79.0	82.2	84.7	84.8	84.6	82.9	82.4	82.6	81.6	79.2	77.6	81.5
Kandy	1611	75.4	76.8	78.4	79.1	78.9	77.2	76.6	76.0	76.8	76.4	76.0	75.2	77.0
Kurunegala	381	78.2	79.8	82.3	82.8	82.1	81.0	80.8	80.8	81.0	80.3	79.4	77.3	80.6
Mannar	12	78.8	80.1	82.2	84.2	85.0	84.4	83.3	83.0	83.2	82.2	80.0	78.8	82.1
Nuwara Eliya	6170	57.2	57.4	59.1	60.6	61.8	60.7	60.0	60.2	60.0	59.8	59.6	58.2	59.5
Puttalam	27	77.8	79.4	81.3	82.7	83.4	82.7	82.0	82.1	82.2	79.5	79.4	78.0	81.0
Ratnapura	113	80.2	81.5	82.2	82.4	81.6	80.6	80.6	80.4	80.4	80.0	79.8	79.8	80.0
Trincomalee	24	77.8	79.2	80.9	83.3	85.2	85.4	85.2	84.6	84.4	81.7	79.1	77.9	82.1

Source : **Reports of the Colombo Observatory,** Ceylon.

TABLE III

Mean Diurnal Temperature Ranges

(in °F)

Station	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Range	Year
Anuradhapura	14.2	17.3	19.3	16.8	14.2	13.3	15.0	16.0	16.5	15.3	11.3	13.0	6.3	15.4
Badulla	12.8	15.7	17.9	17.8	18.6	20.0	22.3	21.8	21.5	17.4	13.4	12.4	9.9	17.6
Batticaloa	8.0	9.1	10.3	11.1	12.3	14.6	15.4	14.0	13.7	11.8	9.7	8.4	7.4	11.5
Colombo	17.4	14.9	13.8	11.9	9.4	8.0	7.7	8.0	8.6	10.1	11.5	13.2	9.7	11.0
Diyatalawa	14.7	18.0	19.1	17.4	16.5	14.5	15.7	16.4	17.1	15.6	13.9	13.8	5.3	16.1
Galle	11.0	11.5	11.1	9.4	7.0	6.2	5.9	5.8	5.9	7.5	9.0	10.3	5.7	8.4
Hakgala	15.9	19.3	21.3	19.0	15.1	10.5	10.7	12.3	13.4	14.2	13.8	14.8	10.8	15.0
Hambantota	12.4	12.9	12.5	11.3	9.1	9.6	11.3	11.8	10.4	10.9	11.2	11.7	3.8	11.2
Jaffna	11.0	13.2	12.7	9.4	6.5	5.7	6.2	6.7	7.1	8.2	9.0	9.5	7.5	8.8
Kandy	16.7	19.5	19.9	18.2	15.6	12.0	12.0	13.2	15.1	15.6	15.5	16.1	7.9	15.8
Kurunegala	16.9	20.2	20.6	16.5	13.1	11.0	11.2	12.3	13.3	14.2	14.8	15.7	9.6	15.0
Mannar	9.2	12.6	14.3	12.5	8.9	7.7	8.4	8.9	9.1	9.7	8.9	8.0	5.9	9.9
Nuwara Eliya	21.5	24.7	24.6	21.6	16.9	10.2	10.5	11.2	13.8	15.7	16.1	19.5	14.5	17.3
Puttalam	15.6	18.1	16.8	13.2	9.4	7.0	7.5	8.4	8.9	10.6	12.1	13.6	11.1	11.8
Ratnapura	18.5	20.2	19.1	17.1	13.6	11.8	11.9	12.5	13.5	14.3	14.9	16.3	8.4	15.3
Trincomalee	5.5	6.7	9.0	11.4	12.9	13.1	14.3	14.9	14.9	12.2	8.6	6.9	9.4	10.8

Source : **Reports of the Colombo Observatory,** Ceylon.

TABLE IV

Mean Monthly Relative Humidity

(expressed as a %)

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Range	Mean Annual
Anuradhapura	95	94	94	93	92	90	88	88	90	93	95	95	7	91
Badulla	95	94	94	95	95	93	93	94	94	95	96	95	3	94
Batticaloa	89	89	90	91	86	79	78	79	82	87	91	91	13	86
Colombo	90	92	93	92	89	87	87	87	88	92	93	91	6	90
Diyatalawa	92	86	86	89	85	78	76	77	81	88	91	92	14	85
Galle	91	90	90	89	87	87	88	88	87	90	91	92	5	89
Hakgala	91	87	88	91	87	87	86	88	85	88	91	91	6	88
Hambantota	90	90	90	90	90	88	88	88	88	90	92	91	4	90
Jaffna	89	90	87	85	84	84	85	86	85	88	90	90	6	87
Kandy	88	87	90	93	90	88	88	88	90	91	94	91	7	90
Kurunegala	92	92	93	93	90	89	88	88	89	92	94	93	6	91
Mannar	86	87	88	87	83	82	83	84	83	85	88	86	6	85
Nuwara Eliya	91	88	90	93	93	90	91	92	92	93	93	92	5	92
Puttalam	93	93	92	90	87	85	85	86	86	90	92	93	8	89
Ratnapura	95	94	94	95	94	94	93	93	94	95	95	95	2	94
Trincomalee	84	83	86	87	83	79	78	80	82	87	90	87	10	84

Source : **Reports of the Colombo Observatory,** Ceylon.