# *Climatic Controls in Ceylon*[1]

CLIMATE has been defined as, ' the average state of the atmosphere at a given place within a specified period of time '.[2] The state of the atmosphere at any time or place, termed the weather, is the result of the interaction of various atmospheric phenomena, such as temperature, moisture, wind movements, etc., and is of a specific nature. Climate, on the other hand, involves a composite idea and has an abstractness about its concept; the former is directly sensible to the human being, the latter is not. Weather, being phenomena associated in terms of specific moments of occurrence, is easily understandable; climate, on the other hand being a generalization—the averaging of weather phenomena over specified times and over a particular place—is not easily understood; the latter assumes a sense of unreality as weather conditions do not accord with the average state. Weather is a time variability, while climate is a place variability.

However, in the understanding of the climate of any place, the atmospheric phenomena play a vital role, because it is their interactions that produce the weather phenomena. But these atmospheric phenomena, in turn, are the result of certain primary features, both geographical and meteorological. These features are termed climatic factors or more correctly, controls.[3] Thus, climate differs from place to place, because controls are different. They may be planetary and local.

### Planetary Controls

Climate is relative to a place and thus the geographical location is fundamental (Plate I). Ceylon is situated within ten degrees north of the Equator and is therefore influenced fundamentally by equatorial atmospheric phenomena. The immediate influences are the thermal features, which in turn affect pressure, winds, precipitation, humidity and other aspects of weather. The latitudinal position of the island hence warrants it high temperatures. The high solar intensity is produced by the high angle of incidence of the solar rays all times of the year.[4] However, despite this high solar intensity, a process—the direct result of the heat intensity and indirectly that of the latitudinal position—

1. For a fuller understanding of the implications of this paper, reference may be made to *Climates of Ceylon*, by George Thambyahpillay, (M.A. Thesis; University of California, Los Angeles, 1952), 258 pp.

2. Helmut Lansberg, *Physical Climatology* (Pennsylvania : State College, 1941), x.

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

4. Elsie K. Cook, *Ceylon—Its Geography, Its Resources, and Its Peoples.* Rev. by K. Kularatnam (2nd Ed., London : Macmillan, 1951), 103.

serves to counterbalance the high temperature effect. The processes of convection, adiabatic cooling and resulting condensation are responsible for both the high per cent. of humidity (average 80 to 90 per cent.) in the lower atmosphere and the ever present cumulus clouds.[5] These features help in the absorption and reflection of the incoming solar radiation. They also lead to the marked development of the land-sea breeze characteristic weather phenomena of the island.

The small areal extent of the island is also a factor responsible for the absence of features of continentality. It is therefore no surprise that except under extraordinary circumstances, no part of the island exhibits average temperatures exceeding 85°F. The distribution of land and sea areas also tends to modify the latitudinal effect. The island, slightly over 25,000 square miles, does exhibit marine influences (lower temperatures, land and sea breezes[6]) as is to be expected. However, despite its insularity, Ceylon is not insulated from continental influences. Since the island is merely the southern appendage of the Indian sub-continent of one and a half million square miles, and separated from it by the narrow Palk Strait, from the climatic standpoint, Ceylon is affected by continental influences.[7]

Another result of its latitudinal position is the lack of the characteristic four-seasonal features of the mid-latitudes. The only seasonal effect is that produced by the apparent migration of the sun and the thermal Equator with the accompanying wind-belt shift, causing the wet and the dry seasons. Planetary control is also reflected in the pressure conditions. The solar movement is reflected in the northward and southward shift of the Equatorial Low Pressure systems (Doldrums). Thus, the effect of the moisture-laden Trade Wind systems is felt in the island in the form of winds and rainfall. From the above considerations, one would except the island to experience an equatorial type of climate ; uniform high temperatures, heavy precipitation from convection and Trades and a vegetation of the Rain Forest type. This is not the case due to the operation of other controls of a non-planetary type.

## Local Controls

Certain local climatic controls are able to exercise dominancy over the planetary controls, in some aspects ; thus an otherwise hot, wet 'steaming' tropical island has been rendered favourable climatically for human habitation by civilized groups at least since 500 B.C.

5. Thambyahpillay, op. cit., 47-53.

6. Land and Sea breezes are the typical features of Ceylon's weather phenomena and are less operative only when the Monsoonal circulation attains full intensity.

7. Thambyahpillay, op. cit., 59-65.





One of the most significant controls is that of altitude, especially upon temperature.[8] The central mountainous area of the island, with a maximum elevation of little over 8,000 feet (Plate II), experiences average annual temperatures about 28°F lower than those in the coastal lowland areas.[9] A map of isotherms (of actual temperatures) drawn for the island reveals the close altitude-temperature relationship (Plate III). This has an important bearing both upon vegetation-agriculture and human habitation. The varied surface configuration of the highlands, with deep valleys and high peaks, produces pronounced micro-climatic characteristics,[10] which modify considerably the macro-climatic aspects of the island and of the highland in particular. Anabatic (up-valley) and katabatic (down-valley) wind movements, temperature inversions, exposure (i.e., aspect) of slopes to wind and rainfall, are some of the micro-climatic features that greatly alter the concept of the 'normal' climate of highland tracts.

Another effect of altitude is reflected in the 'barrier-role'; the highlands in general exhibit a north-south trending axial 'ridge' extending from about the Knuckles, through Pidurutalagala, the High Plains (Moon, Elk and Horton Plains) and Kirigalpotta to the edge of the Southern Escarpment. From this 'ridge' the slopes descend fairly steeply in all directions except in the north. This ridge acts not only as a physical divide but also as an effective climatic 'divide'.[11] It demarcates the drier from the wetter parts of the highlands during the respective Monsoons. The most noteworthy are the sheltered positions of the mountain slopes contrasting with those on the exposed sides (i.e., the leeward and the windward sides respectively). This is reflected in the rainfall distribution during the respective Monsoons (Plate IV). During the period of the Southwest Monsoon the wet-dry divide clearly demarcates the wetter Hatton Plateau from the drier Welimada Plateau. During the period of the North-east Monsoon, however the contrast is not so distinct, because of the direction of the Monsoonal 'streamlines'. Nevertheless this physical divide acts as an effective divide of seasonal precipitation.[12] The demarcating isohyet of 20 inches (Southwest Monsoon) coincides almost perfectly with the 'highland divide'. This relief feature plays a still further dominant climatic role. The Southwest Monsoonal moisture-laden winds are compelled to deposit their content west of the highland divide, because of exposure ; orographic ascent results

8. Thomas Blair, *Climatology* (New York : Prentice Hall, 1943), 76-78.

9. Lowland coastal average temperatures 85°F ; highland average temperatures 57°F. Thambyahpillay, op. cit., 25-39.

10. When the Ceylon University Meteorological Station is established with the co-operation of the Colombo Observatory and the Department of Geography, the writer proposes to undertake micro-climatic investigations in the University Park.

11. Blair, op. cit., 81.

12. Thambyahpillay, op. cit., 92-98.

in cooling and condensation of water vapour. The same winds as they cross the highland divide are bereft of their moisture content and are thus dry winds. But as they descend the eastern slopes of the highland divide (Plate V), they are adiabatically warmed which only induce further ' drying '. It is these *katabatic* winds[13] that are responsible for some of the extremely dry and scorching winds in the Batticaloa area in August,[14] during the dominance of the Southwest Monsoon.

Of major importance as a climatic control is the Monsoonal feature, (Plate I) the direct result of the proximity of the island to the sub-continent of India. In terms of the nature of the distribution[15] as well as intensity, the rainfall on the southwest side of the island during the months of May and June[16] contrasts markedly with the early morning and late afternoon showers produced by the convectional currents during the inter-Monsoonal months of March-April and October. The former rainfall is continuous and heavy, hardly abating for hours. The Southwest Monsoon dominates the scene from about May to August-September.[17] The climatic control of the distribution of land and sea surfaces and the consequent disproportionate heat coefficients of the two bodies is clearly reflected. ' The Monsoon climates manifest a dominance of geographical influences over those of the planetary '.[18] During the months of November, December and January, the Northeast Monsoon prevails to exercise control. The heavier rainfall along the eastern littoral of the island is significant evidence. The continuing northeast persistency of the Upper air currents over the island[19] further helps to determine the onset of the Northeast Monsoonal ' streamlines '. Tropical Revolving Storms[20] and shallow depressions with their accompanying sudden, short period, highly regionalised distribution of

13. W. G. Kendrew, *Climatology*, (Oxford ; Clarendon, 1949), 306-312. These occur in different geographical areas and are thus regionally named ; e.g., *Foehn* (in the Rhone Valley, Mediterranean), *Chinook* (east of the Rockies; in Alberta, Montana and Wyoming), *Sirocco* (Sahara), Berg (South Africa), *Bohorok* (Sumatara).

14. H. Jameson, ' The Batticaloa Kachchan', *Royal Met. Soc.*, 67 (Jan., 1941), 55.

15. Thambyahpillay, op. cit., 92-115.

16. A. J. Bamford, ' On the Intensity of Rainfall in Ceylon' *Memoirs, Colombo Observatory*, I (1941), 22-27.

17. However in reality the picture is not as simple as here envisaged. The onset of the Southwest Monsoon is preceeded by the pre-Monsoonal showers. For detailed considerations refer Thambyahpillay, op. cit., 76-83.

18. Emmanuel de Martonne, *Traite de Geographyie Physique* (Paris: Colin, 1925), 245.

19. *Weather in the Indian Ocean*, II, 6 B., M.O. 492 (Gt. Bt.: Met. Office), 134.

20. These are distinct from the ' cyclones' of the mid-latitudes. This term is adopted from the accepted usage by the British Meteorological Service. The interactions of ' Convergences ' and the Intertropical Fronts are related to the formation of these Depressions and Cyclones. The Jaffna Cyclone of November 30th, 1952 is a striking example of one of these cyclonic ' inroads '.





rainfall exercise their climatic control notably during the period of the Northeast Monsoon as well as during the inter-Monsoonal periods.[21] Out of a total of forty-eight cyclonic ' inroads ' observed over the island between 1925 and 1944, thirty-seven occurred between October and January !

Thus the climatic controls, planetary and local, acting severally or in combination, contribute their share to produce those weather elements that interact over the island. The weather phenomena so produced eventually determine the island's climatic characteristics.

*The names of the Meteorological Stations (indicated by dots) on Plates II, III and IV have not been inserted because of cartographic problems. They may, however, be easily located from among the following :—

| | |
|---|---|
| Anuradhapura | Jaffna |
| Badulla | Kandy |
| Bandarawela | Kurunegala |
| Batticaloa | Mannar |
| Colombo | Nuwara Eliya |
| Galle | Puttalam |
| Hakgala | Ratnapura |
| Hambantota | Trincomalee. |

GEORGE THAMBYAHPILLAY

21. Thambyahpillay, op. cit., 87-90.

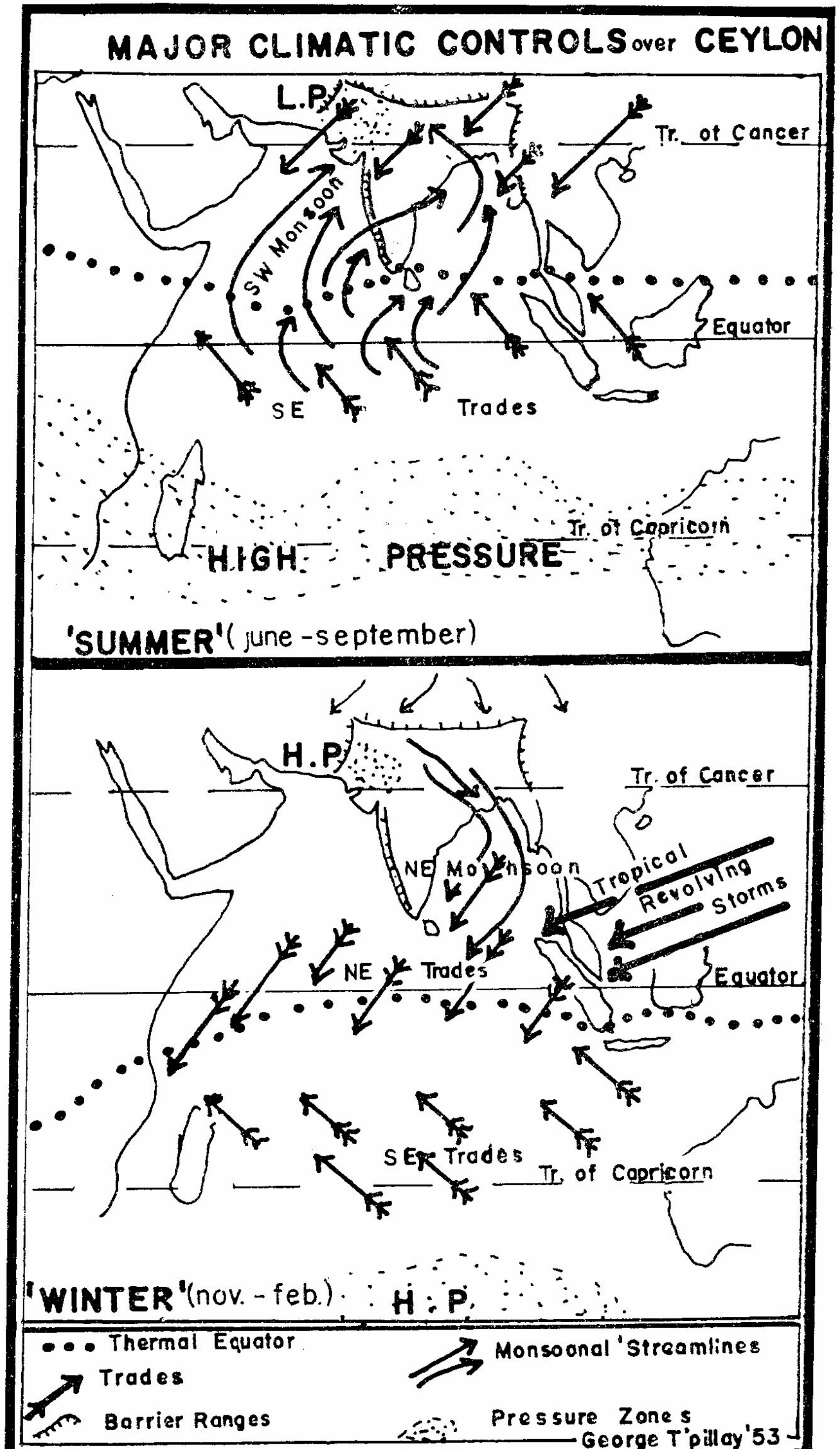



Plate I

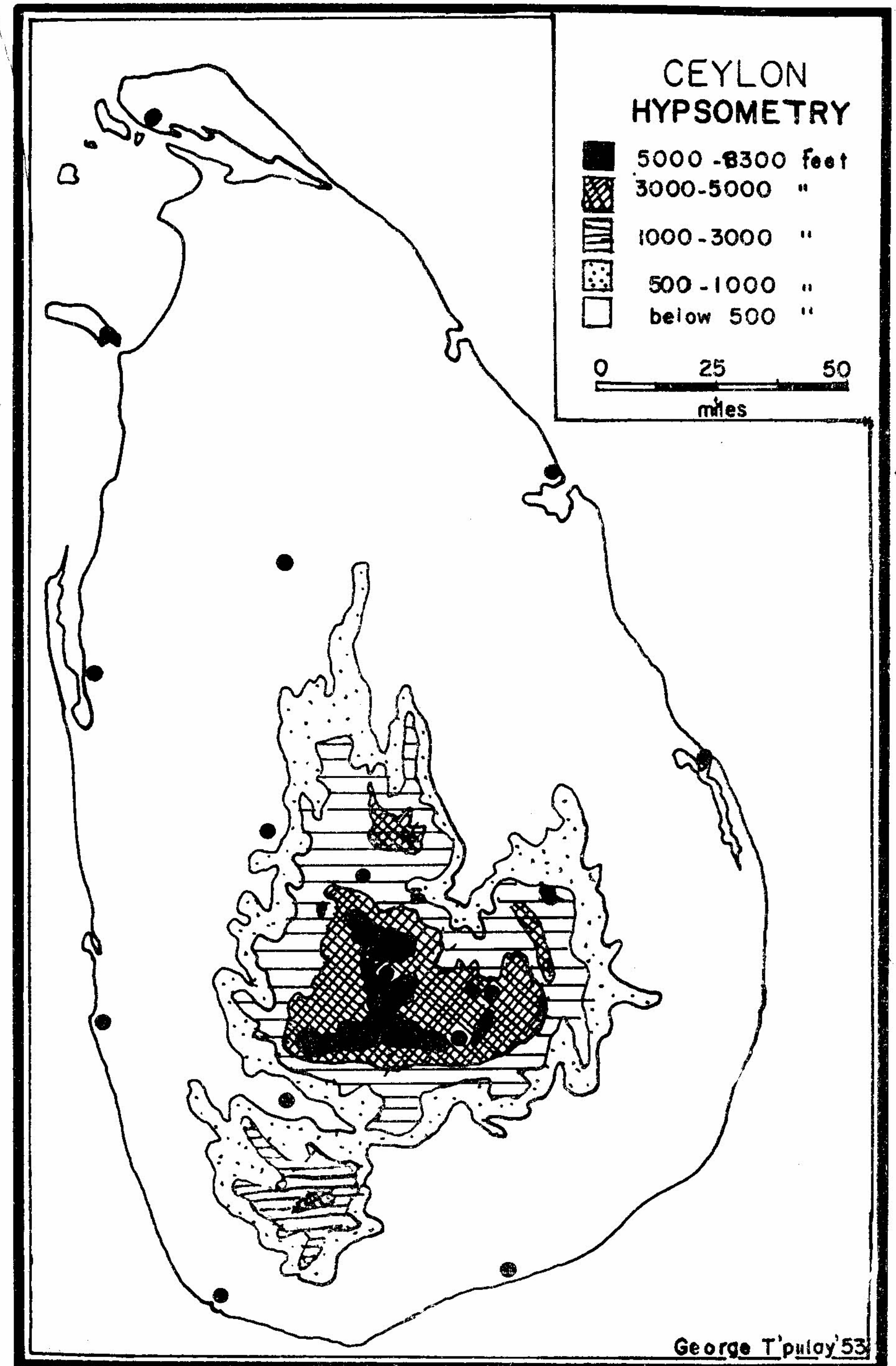
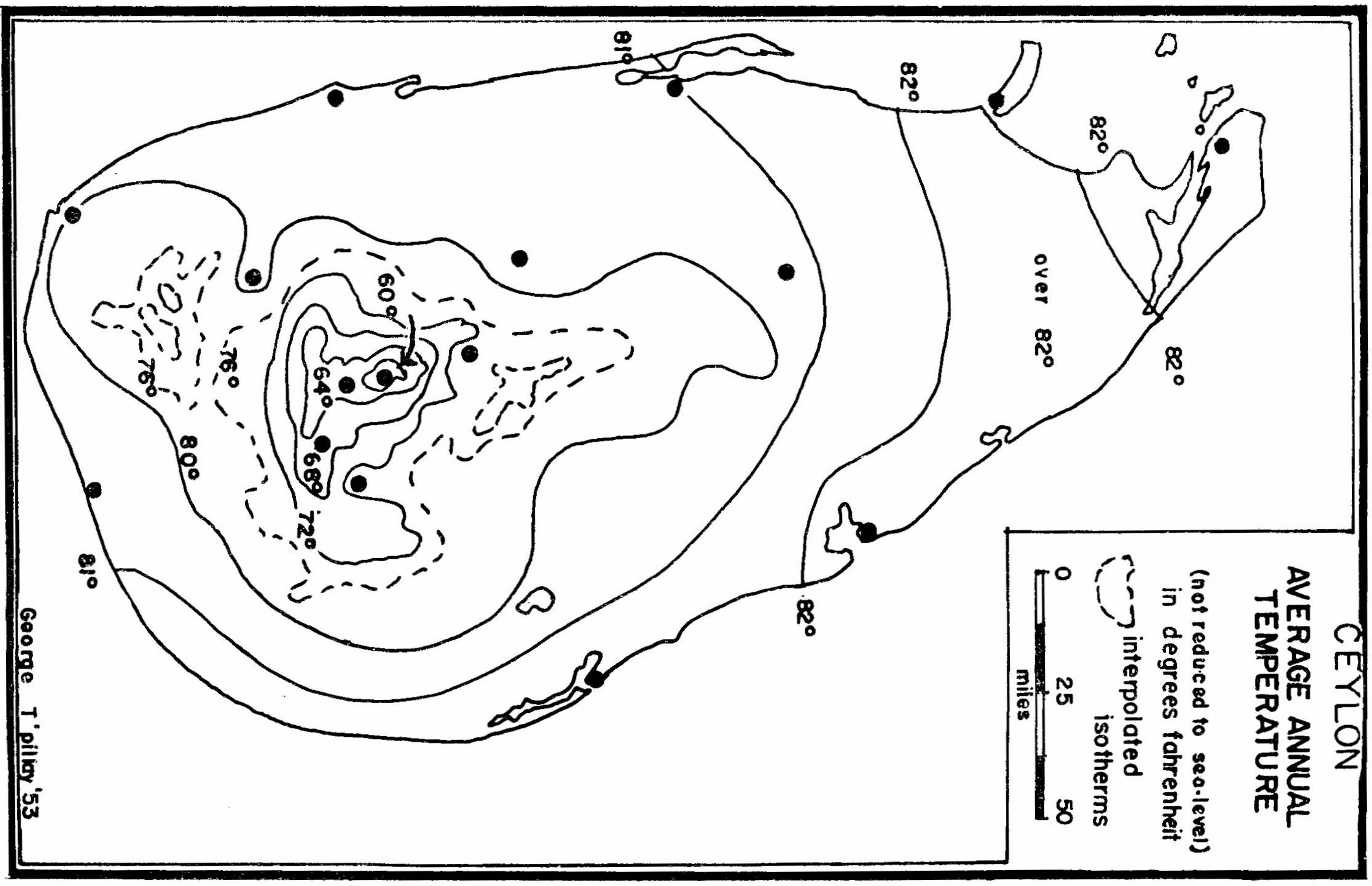



Plate II

Plate III



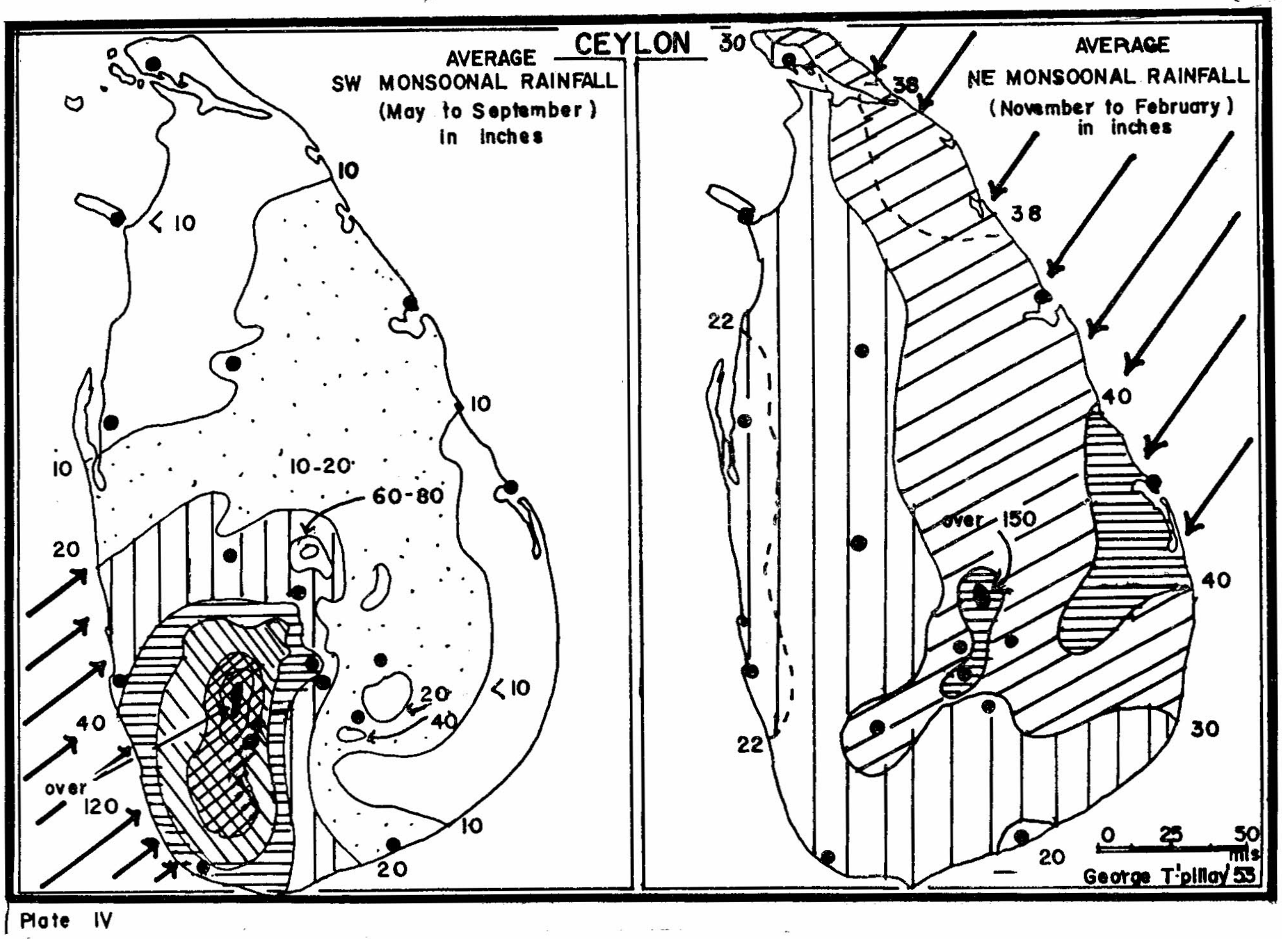




Plate IV

# SOUTHWEST MONSOONAL PERIOD

(may — september)

**ALTITUDE-EXPOSURE-WIND-RAINFALL**

**RELATIONSHIP**

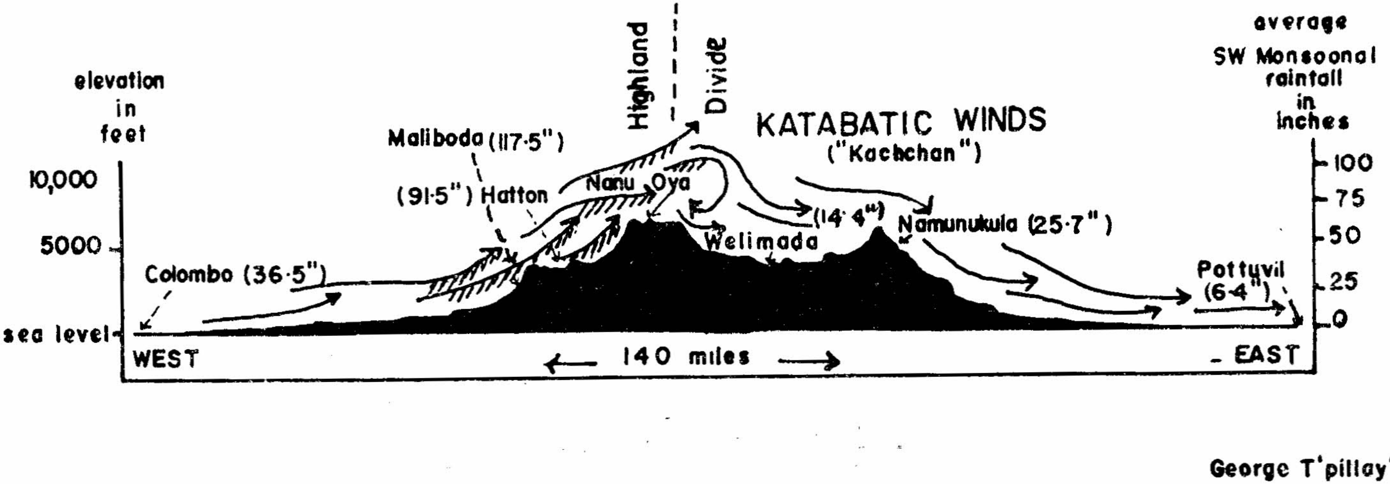



Plate V.