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Monthly Distribution of Precipitation in Peninsular Malaysia

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ABSTRAK

Manuskrip ini membincangkan kajian taburan hujan bulanan di Semenanjung Malaysia. Dapat dibuktikan bahawa peranan utama dimainkan oleh laluan ITCZ, sementara peranan sekundar dimainkan oleh kesan kedua-dua monson timur laut dan barat daya.

ABSTRACT

A study was made of the monthly distribution of rainfall in Peninsular Malaysia. It is shown that the principal influence is given by the passage of the Intertropical Convergence Zone (ITCZ), while the secondary influence is the effects of both the NE and the SW monsoons.

Keywords: ITCZ, NE and SW monsoons, precipitation

INTRODUCTION

Peninsular Malaysia is located in equatorial latitudes. Within these latitudes the climate is greatly influenced by the monsoon winds as well as by the passage of the Intertropical Convergence Zone (ITCZ) (Necco 1980).

Due to the semi-annual reversal of the wind system, a north-east (NE) and a south-west (SW) monsoon season may be clearly defined in Peninsular Malaysia (Camerlengo *et al.* 1996). The NE monsoon season ranges from November to February, while the SW monsoon season ranges from May to September (Nasir and Marghany 1996). Two transitional periods are usually detected among these two monsoon seasons of 4-6 weeks (Nasir and Camerlengo 1996).

The trade winds of both the southern and the northern hemispheres converge on a latitudinal band of highly convective clouds (cumulonimbus), sometimes referred to as the Intertropical Convergence Zone (ITCZ) (Petterssen, 1956). The ITCZ follows the motion of the sun (Hess, 1956).

The ITCZ represents convergence of the trade winds of both hemispheres at surface levels and a consequent divergence of air mass at the upper levels of the atmosphere. Convergence of air mass in the lower layers of the atmosphere is a clear indication of precipitation. Because the monthly maximum precipitation is recorded at the same latitude during similar months all across Peninsular Malaysia, we strongly feel that the double monthly maximum of precipitation accurately represents the location of the ITCZ.

To better understand the behaviour of the ITCZ, it is convenient to consider the earth to be in a fixed position. The passage of the ITCZ at the equator is registered, roughly, in September/October and in March/April, respectively. The sun reaches the earths' northernmost (southernmost) position in June (December).

The aim of this investigation was to better understand the monthly distribution of precipitation in Peninsular Malaysia as no such study has ever been carried out. For this purpose, monthly records of precipitation of 22 meteorological stations were analysed.

DATA

The monthly precipitation of Ipoh, Cameron Highlands, Kuala Lumpur, Malacca, Temerloh, Batu Embun, Penang, Alor Setar, Chuping, Kuala Terengganu, Kota Bharu, Mersing, Kuantan, Langkawi, Setiawan, Petaling Jaya, Universiti Malaya, Kluang, Johor Bahru, Muadzam Shah, Pusat Kaji Ikli (KT), and Kuala Krai were obtained from the *Monthly Summary of Meteorological Observations,* published by the Malaysian Meteorological Service. The location of the rainfall stations as well as the years of monthly records of rainfall are given in *Fig 1.*

RESULTS AND DISCUSSION

Considering a fixed earth, the sun is in the southern hemisphere during January and thus the ITCZ is in its southernmost position. As a consequence of this, maximum rainfall is recorded in the southern half of Peninsular Malaysia. Conversely, minimum precipitation is registered in the northern half of Peninsular Malaysia (*Fig. 2*).

Due to the influence of the NE monsoon winds, higher values of precipitation are recorded on the east coast of Peninsular Malaysia, than at similar stations on the west coast (*Fig. 2*). Air mass, at the east coast, discharges its humidity as it moves further inland.

Air mass in central Peninsular Malaysia is relatively dry because the air mass discharges its humidity in the windward side of the Titiwangsa mountain range.

The salient feature of February is that rainfall, in the southern half of Peninsular Malaysia is lower than during January (*Fig. 3*) Therefore, the passage of the ITCZ does not represent a significant factor during February. Furthermore, a relatively dry air mass is registered in the northern half of Peninsular Malaysia. As in January, higher values of precipitation are registered on the winward side of the Titiwangsa mountain range (facing the Malacca Strait).

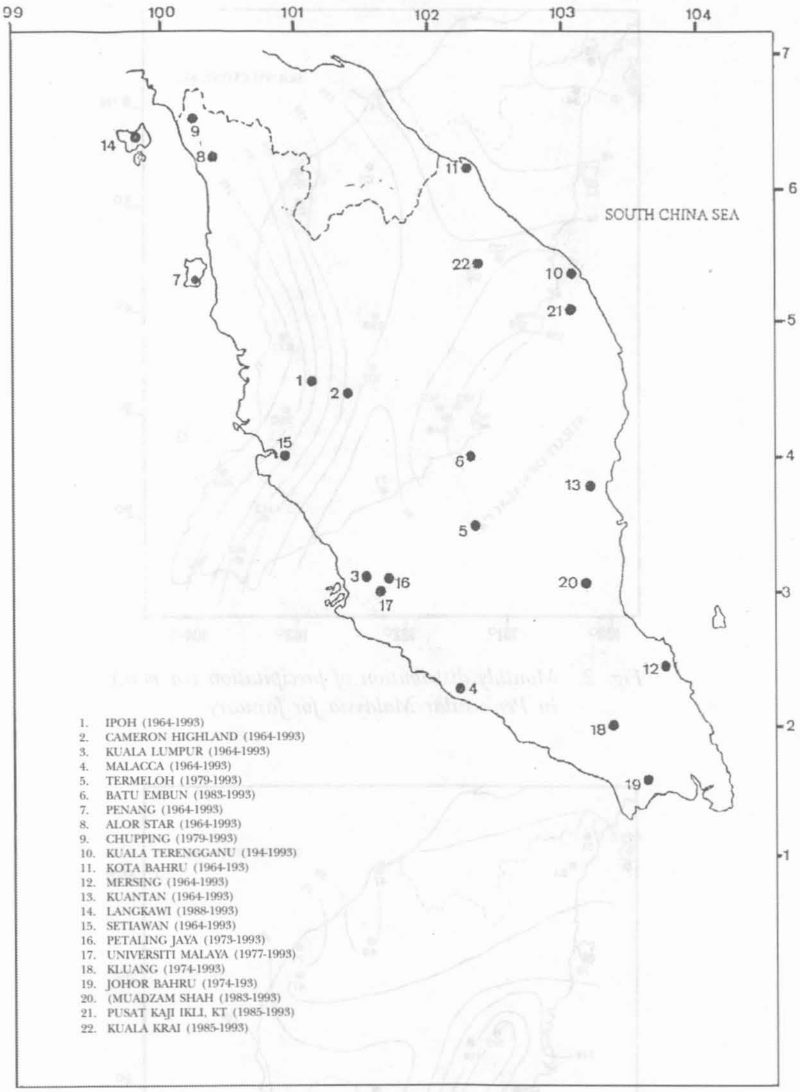

Figure 1. Location of precipitation stations being analyzed. The years of records of rainfall are indicated in parenthesis

Considering a fixed Earth, the Sun crosses the equator towards the northern hemisphere during March. As a consequence of this, the passage of the ITCZ has a greater effect in the southern half of Peninsular Malaysia (*Fig. 4*). Consequently, lower values of precipitation are registered in the northern half of Peninsular Malaysia than in the southern half.

All stations on the west coast of Peninsular Malaysia register higher values of precipitation during April than the stations on the east coast (*Fig. 5*). This may be explained by the effect of the SW monsoon, which usually starts in the

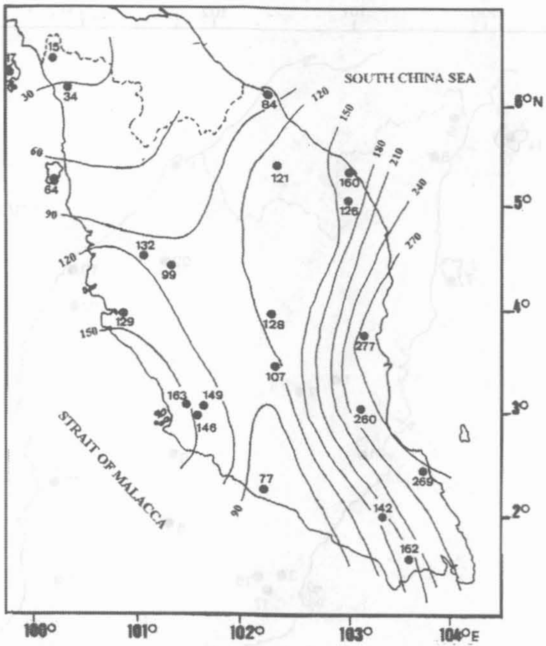

Fig. 2. Monthly distribution of precipitation (in mm.) in Peninsular Malaysia for January

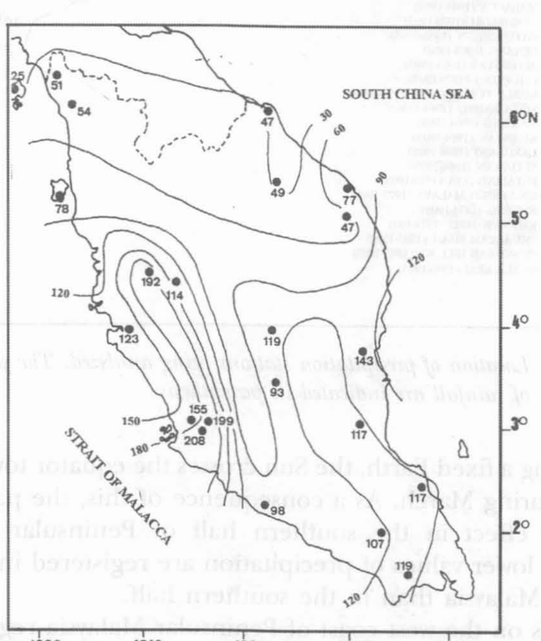

Figure 3. Same as Figure 2, but for February

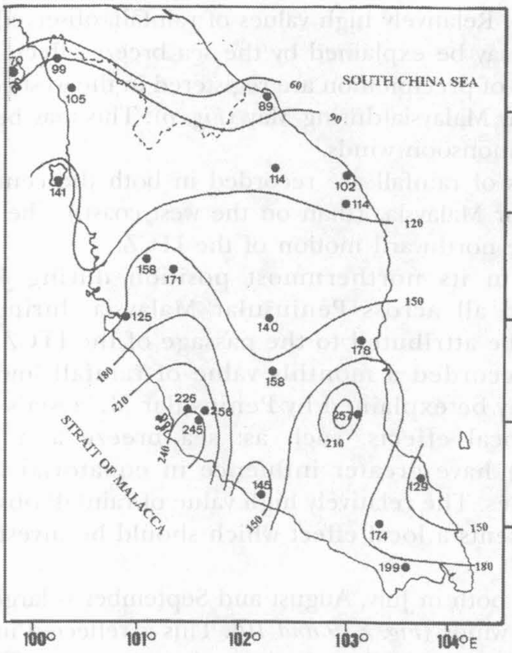

Fig. 4. Same as Figure 2, but for March

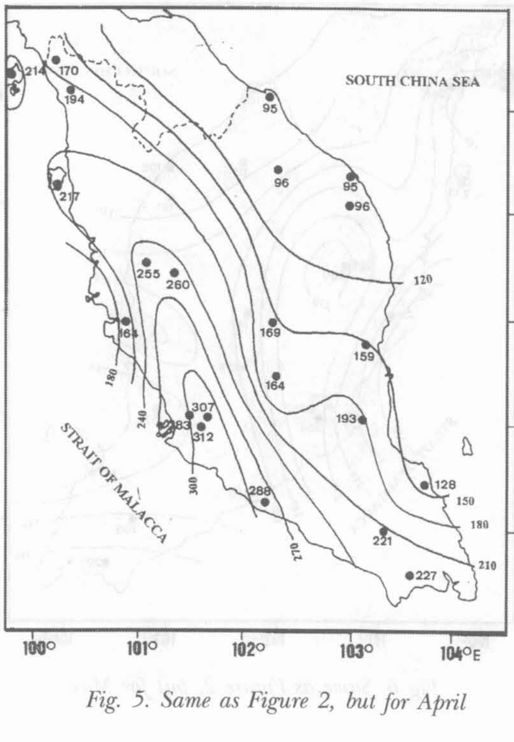

Fig. 5. Same as Figure 2, but for April

last week of April. Relatively high values of rainfall, observed on both the east and west coasts, may be explained by the sea breeze effect.

Higher values of precipitation are registered in the west coast, than the east coast of Peninsular Malaysia during May (*Fig. 6*). This may be attributed to the effect of the SW monsoon winds.

Higher values of rainfall are recorded in both the central and northern parts of Peninsular Malaysia. (than on the west coast.) The higher values are largely due to the northward motion of the ITCZ.

The sun is in its northernmost position during June. Therefore, rainfall observed all across Peninsular Malaysia during this particular month may not be attributed to the passage of the ITCZ. In spite of this, no station has recorded a monthly value of rainfall lower than 100 mm (*Fig. 7*). This may be explained by Peninsular Malaysia's location close to the Equator. Local effects, such as: sea breeze and mountain winds (anabatic winds) have greater influence in equatorial latitudes than in any other latitudes. The relatively high value of rainfall observed in Kuantan (203 mm) represents a local effect which should be investigated in greater detail.

. Precipitation, both in July, August and September is largely determined by the SW monsoon winds (*Fig. 8, 9 and 10*). This is reflected in the recording of maximum precipitation at all stations on the west coast. The high values of precipitation registered at the east coast may be attributed to the sea breeze

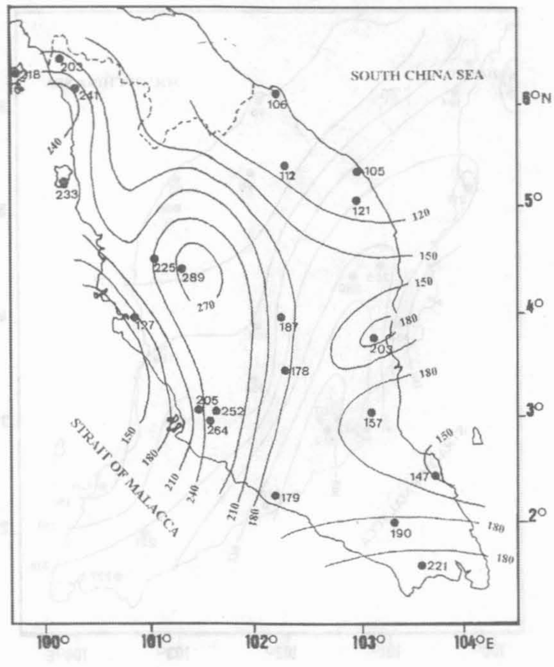

Fig 6. Same as Figure 2, but for May

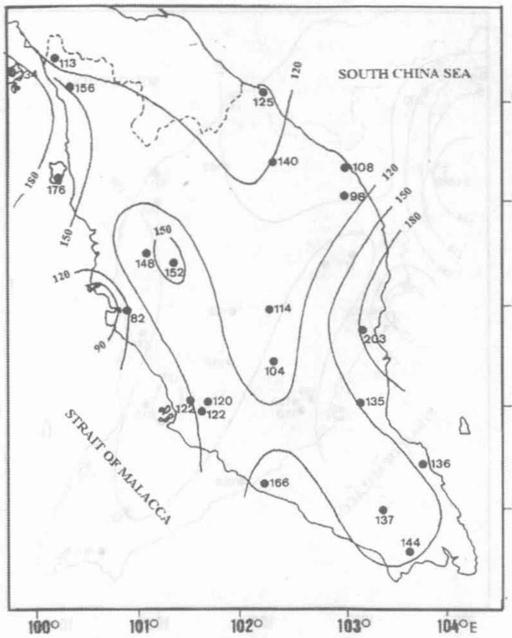

Fig 7. Same as Figure 2, but for June

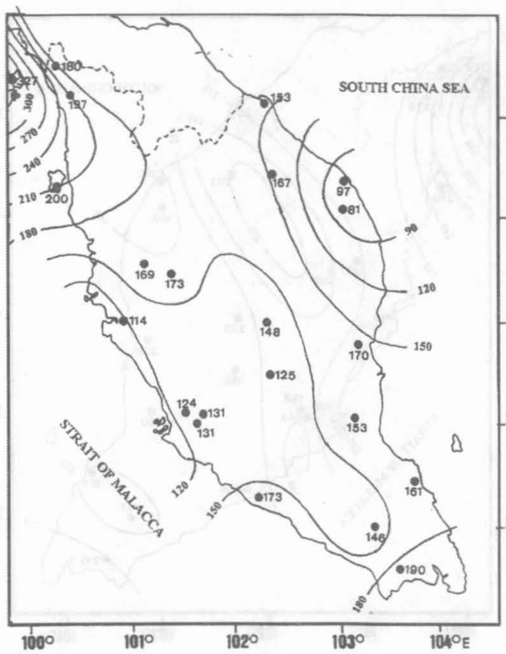

Fig 8. Same as Figure 2, but for July

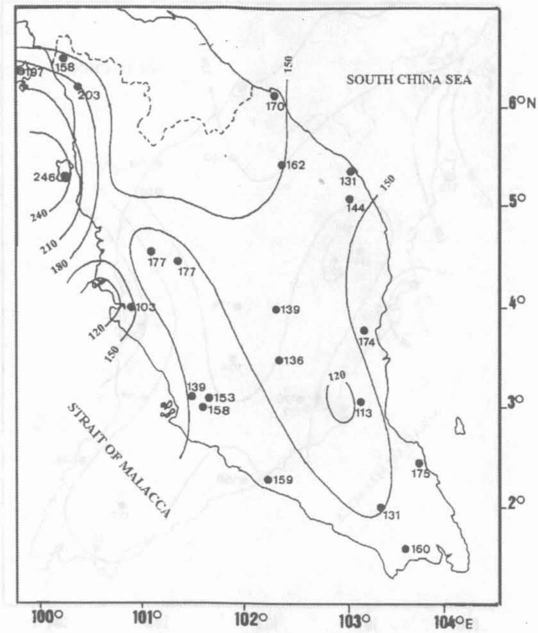

Fig 9. Same as Figure 2, but for August

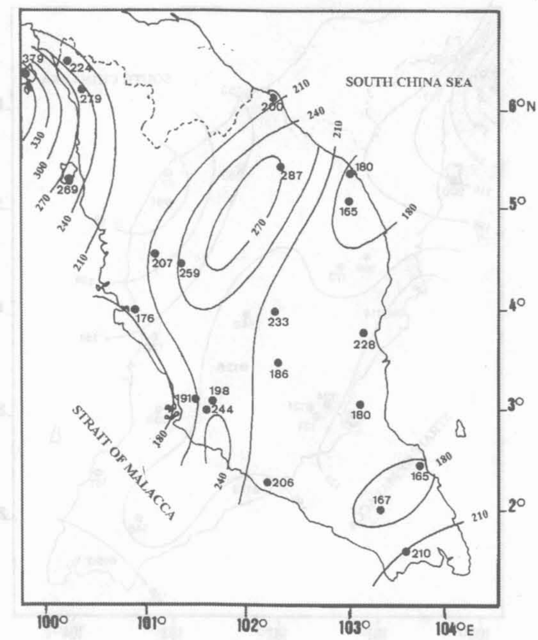

Fig. 10. Same as Figure 2, but for September

effect. High values of precipitation observed in the northern half of Peninsular Malaysia during September may be attributed to the equatorward motion of the ITCZ (*Fig. 10*).

As October is a transitional month between monsoons, the higher values of rainfall recorded at all stations of Peninsular Malaysia may be solely attributed to the southward motion of the ITCZ (*Fig. 11*).

Higher values of precipitation are recorded in November on the east coast of Peninsular Malaysia (*Fig. 12*). This effect may be explained by the NE monsoon winds. However, maximum values observed in both Kuala Terengganu and Kota Bharu (as compared; for example, with Kuantan and Mersing) may be explained by the southward passage of the ITCZ. Therefore, on the east coast a clear distinction between both the effects of the NE monsoon winds and the passage of the ITCZ is possible.

Maximum values of rainfall on the east coast are registered in the southern half of Peninsular Malaysia during December (*Fig. 13*). Both Mersing and Kuantan have higher values of precipitation than either Kuala Terengganu or Kota Bharu. Again, this may be explained by the southward motion of the ITCZ. Conversely, minimum values of precipitation are registered in the northern part of the west coast.

On an annual basis, relatively high values of rainfall are registered all across Peninsular Malaysia (*Fig. 14*).

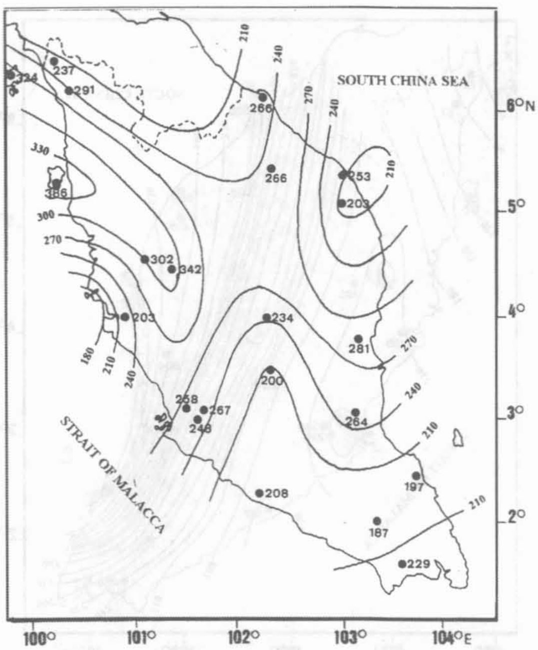

Fig 11. Same as Figure 2, but for October

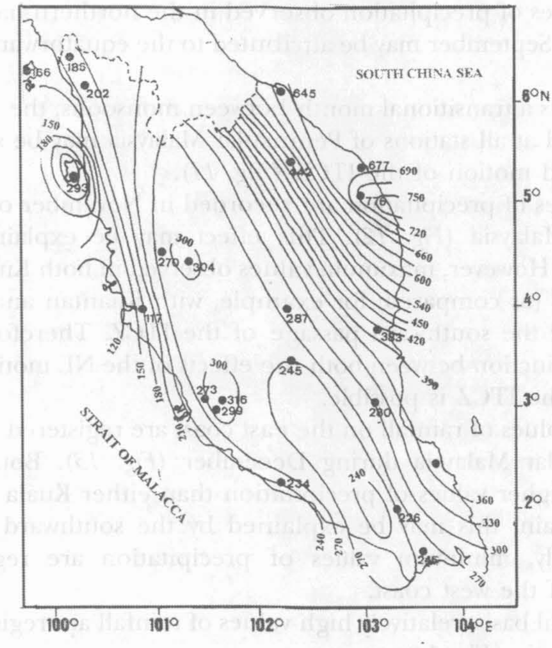

Fig 12. Same as Figure 2, but for November

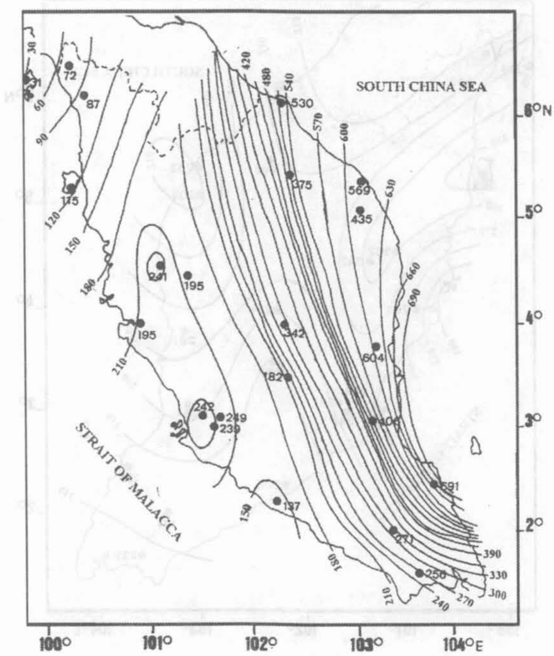

Fig 13. Same as Figure 2, but for December

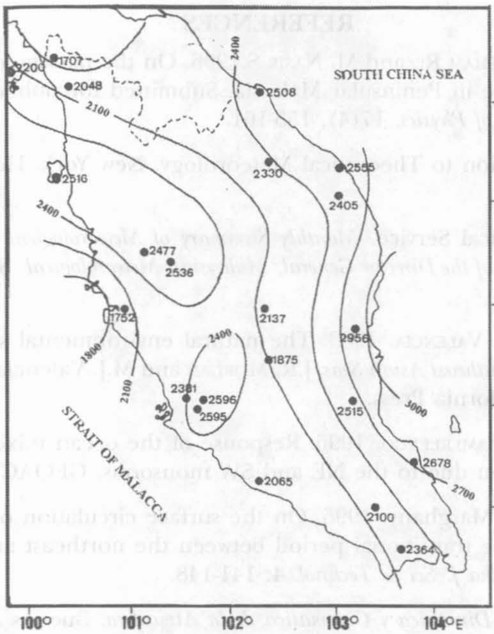

Fig 14. Annual distribution of precipitation (in mm.) along Peninsular Malaysia

CONCLUSION

The primary influence (in the total amount of precipitation) is given by the double passage of the ITCZ. The secondary influence is given by the effects of both the NE and the SW monsoons. The fact that the influence of the NE monsoon is greater than the SW monsoon may be attributed to:

a. NE monsoon winds are stronger than SW monsoon winds (Morgan and Valencia 1983: Taira *et al.* 1996).
b. The South China Sea is deeper than the Strait of Malacca. Therefore, the humidity of the air mass moving further inland is greater on the east coast than on the west coast of Peninsular Malaysia.
c. SW monsoon winds play no significant role in the rainfall distribution of Peninsular Malaysia's east coast.

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