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# Climate of South and Southeast Asia according to Thornthwaite's Classification Scheme

by

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## Introduction

In the course of the study of the paddy soils in South and Southeast Asia (Project Leader: Prof. K. Kawaguchi, Faculty of Agriculture, Kyoto University) there are many instances where soil distribution is governed primarily by climate. The occurrence of Grumusols in a region that has a distinctly dry season is an oft-quoted examples of this sort. One of the most striking examples of differing soil distribution governed by climate is seen in Ceylon. Irrespective of the similarity of parent rocks underlying a greater part of the island, Reddish Brown Earths are the dominant soils in the dry zone as against associations of Red-Yellow Podzolic Soils and Red-Yellow Latosols in the wet zone. Thus, in attempting to acquire a better understanding of soil forming conditions over the entire paddy-growing area of tropical and subtropical Asia, climate must first be made the subject of a detailed study.

There are several schemes for classifying world climates, the one proposed by Köppen being the most well known. A method proposed by Thornthwaite (1) in 1948 is also widely used and has unique features in that 1) water need is computed from mean monthly temperature as "potential evapotranspiration", and 2) soil moisture retention is taken into consideration in assessing water surplus and deficiency. As "soil-forming processes are related to water surpluses and deficiencies" (estimated with due consideration for soil moisture), Thornthwaite's method has been preferred to other classification schemes by many soil scientists. For this reason, we apply the same method to the present study, in spite of the intrinsic questions as to method which are discussed below.

## Data and Methods

The regions studied in this paper are restricted to those in which rice is an important agricultural crop. Thus, a part of India, i. e., Kashmir, Rajasthan and Gujarat, as well as a wide area extending beyond the Indus Plain in West Pakistan are deliberately

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omitted from the study area.*

The necessary data for making the classifications, i. e., mean monthly temperature and rainfall, were obtained from different sources as listed below for each country or region.

| | |
|---|---|
| Pakistan (West and East) | Reference (2) |
| India | Ditto |
| Ceylon | Ditto |
| Burma | Ditto |
| Laos | Ditto |
| Cambodia | Ditto |
| Vietnam (North and South) | Ditto |
| Philippines | Ditto |
| East Malaysia | Ditto |
| West Malaysia | Reference (2) & (3) |
| Indonesia | Reference (2), (4), (5) & (6) |
| Thailand | Reference (7) |

For Thailand, not only the data but also various indices according to Thornthwaite's method were cited from Ogino (7), who had adopted the same method to classify the climate of Thailand.

The accuracy of the data cited from the above sources is quite variable. The length of time over which these meteorological data were accumulated varies from periods as short as one or two years to greater than fifty years. The density of distribution of the meteorological stations, as seen in Figs. 1–7, is also quite variable from one region to another. This affects accuracy in the mapping of results.

The range of longitude, latitude, and altitude of the two hundred seventy-eight stations for which data are available have the following spreads :

| | | |
|---|---|---|
| Longitude | 66°59′E | 128°10′E |
| Latitude | 10°10′S | 32°30′N |
| Altitude | 0 m | 3,023 m |

The basic parameter in Thornthwaite's method is "potential evapotranspiration (PE)". According to Thornthwaite the value of PE ($e$ cm) is related to a mean monthly temperature ($\theta$°C) by the following formula :

$$e = c\theta^a$$

where $c$ and $a$ are functions of $\theta$. Empirically $a$ is expressed by a formula,

$$a = 675 \times 10^{-9} I^3 - 771 \times 10^{-7} I^2 + 1792 \times 10^{-5} I + 0.49239$$

* Even the Indus Plain is not a rice-growing area in its natural climatic condition. But with its developed irrigation system, the area under rice cultivation is presently about 1.3 million hectares (3.25 million acres), which exceeds the sum of all rice growing areas in West Malaysia and Ceylon.

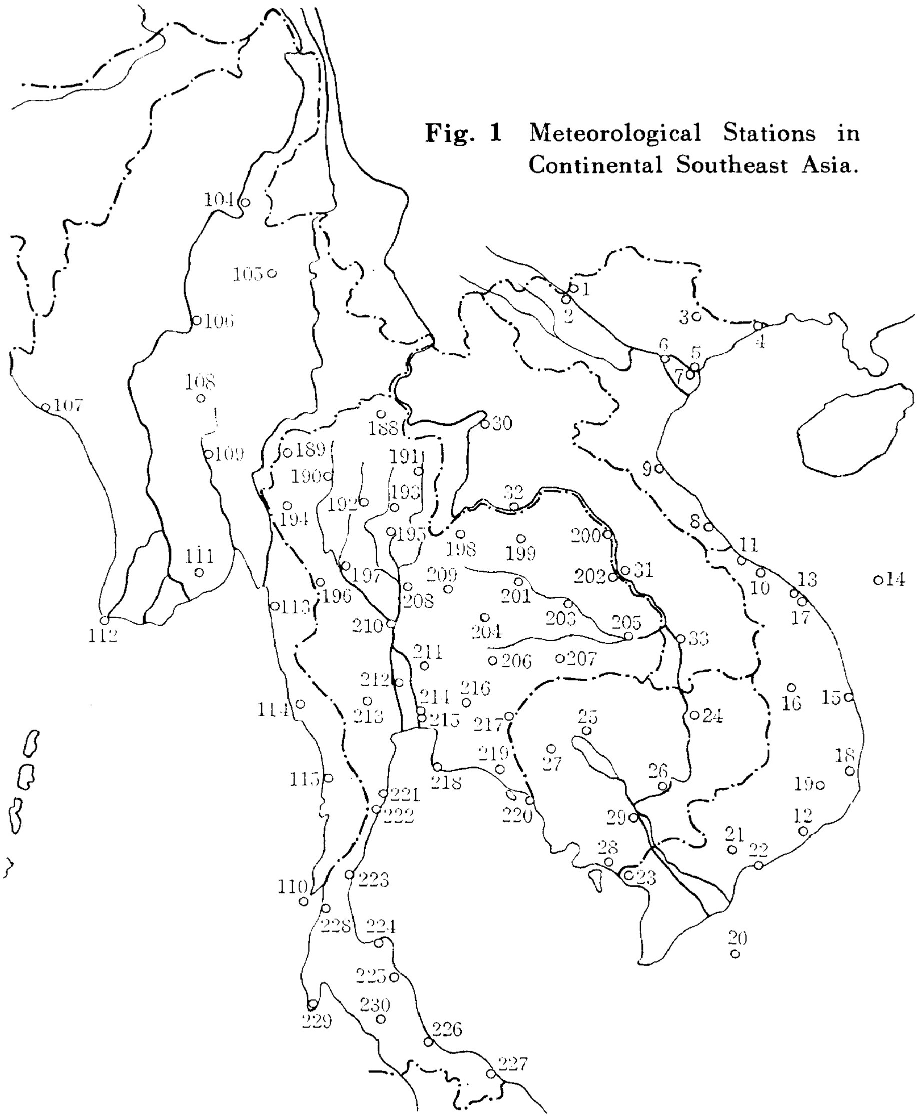


**Fig. 1** Meteorological Stations in Continental Southeast Asia.

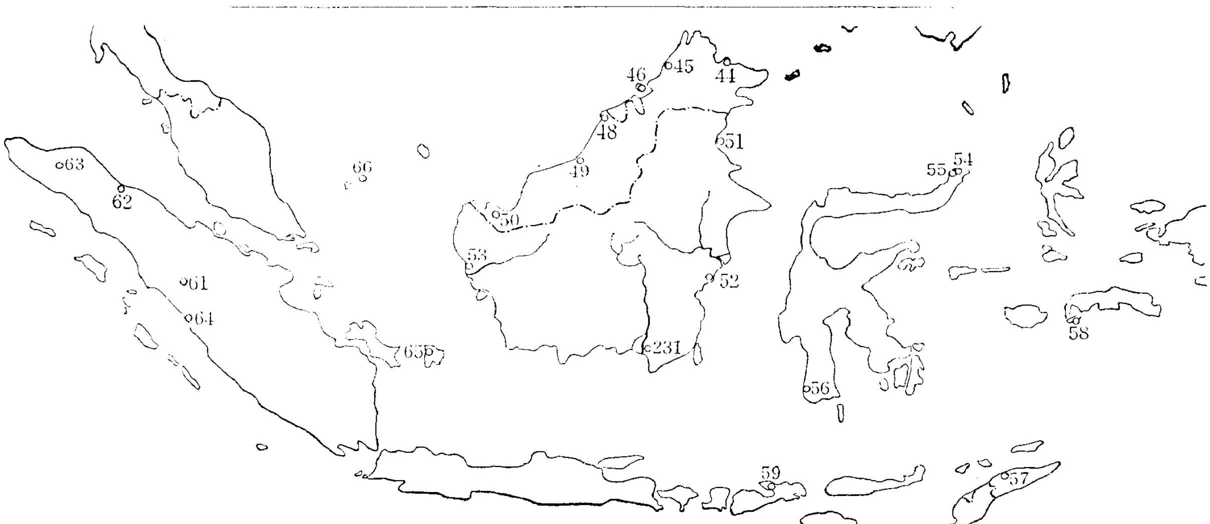


**Fig. 2** Meteorological Stations in Insular Southeast Asia.

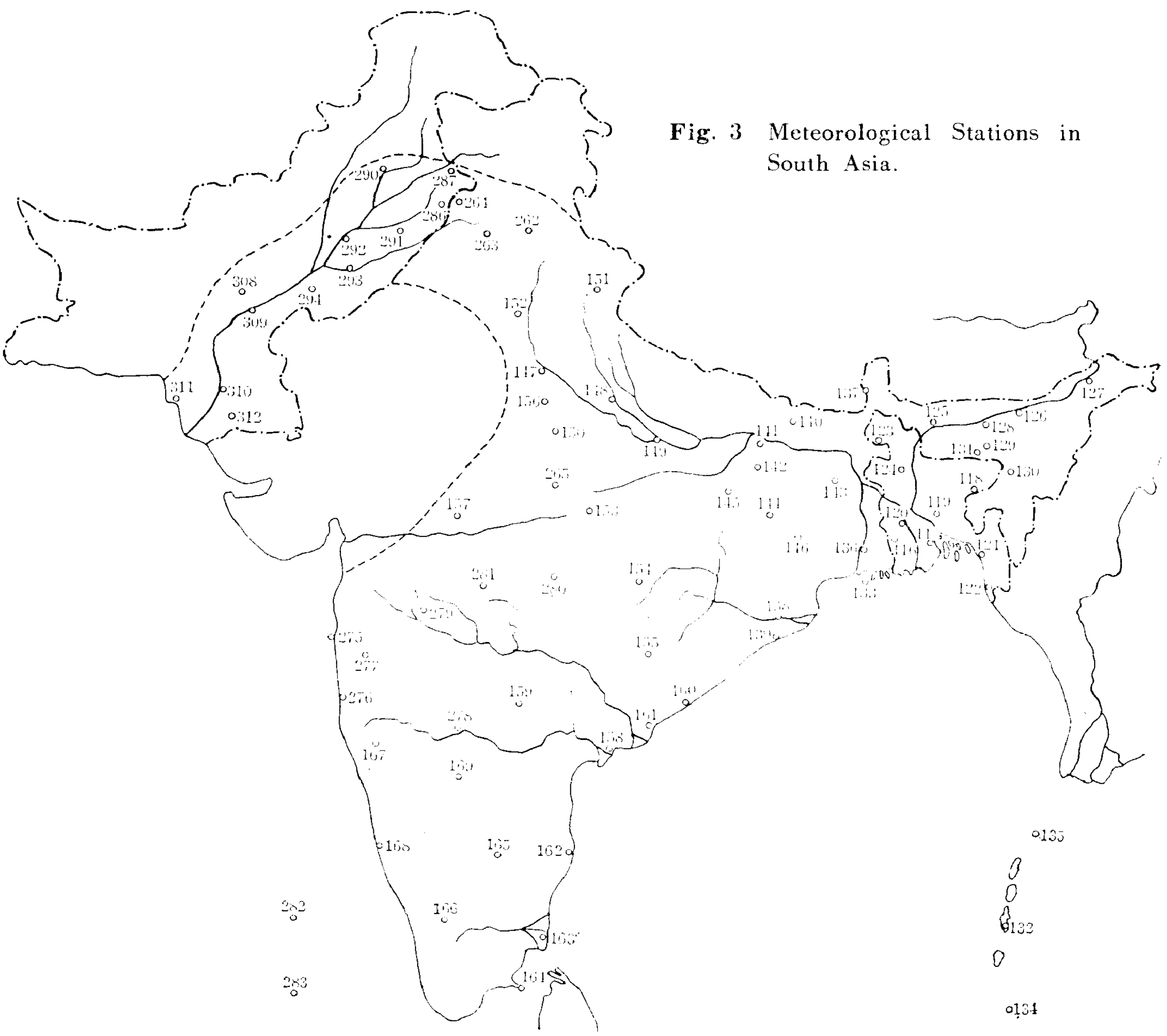

**Fig. 3** Meteorological Stations in South Asia.

where

$$I=\sum_{1}^{12} i, \text{ and } i=(\theta/5)^{1.514}$$

In effect, $e$ is expressed as follows,

$$e=1.6(10\theta/I)^{a}$$

Thornthwaite prepared a table of $i$ values for different $\theta$ to save the labor of calculation. Computation of $e$ from the values of $I$ and $\theta$ according to the formula is also facilitated by the use of a nomogram, a basic assumption for which is that a straight line relationship between $\log\theta$ and $\log e$ always passes a point corresponding to $\theta=26.5°C$ and $e=13.5$ cm in a $\log\theta$ vs. $\log e$ coordinate. For temperatures higher than 26.5°C, values of $e$ cannot be computed with the Thornthwaite formula, but are given in a separate table. Since $e$ values thus obtained are standard values for a day length of 12 hours and for a 30-day month, corrections for actual day lengths and actual total monthly days are necessary. Correction factors are also given in another table for different

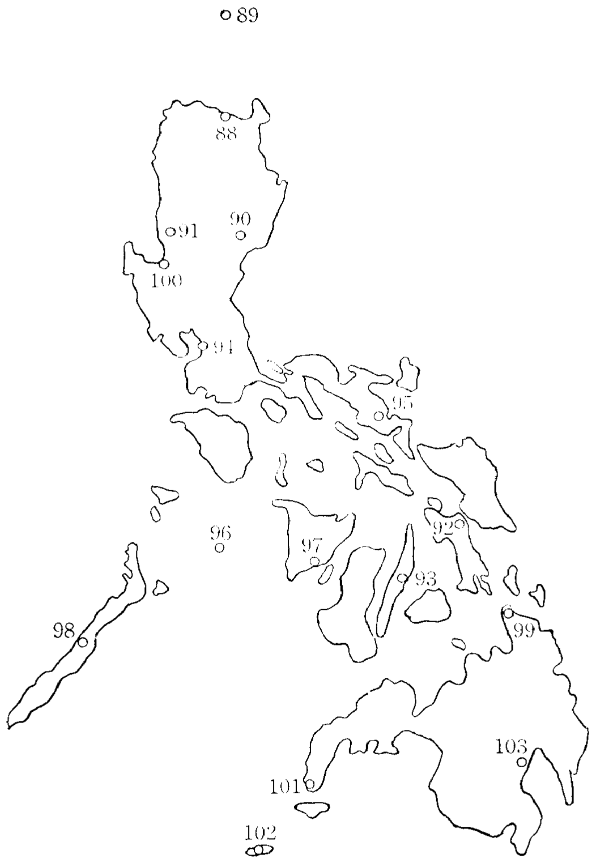


**Fig. 4** Meteorological Stations in the Philippines.

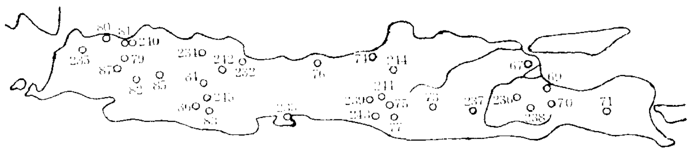

**Fig. 5** Meteorological Stations in Java, Indonesia.

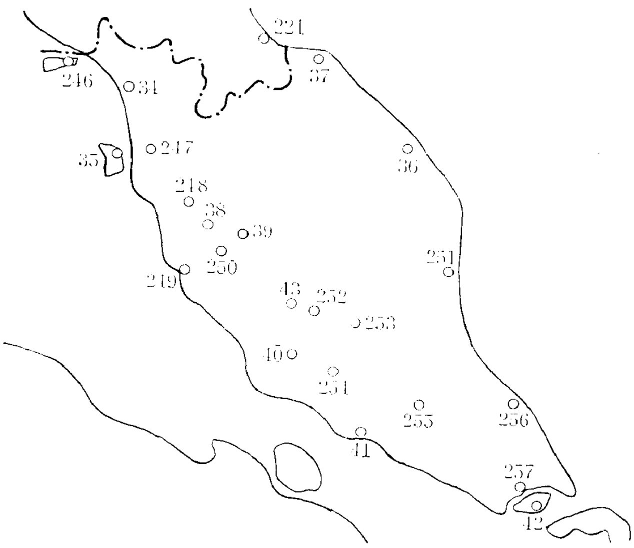


**Fig. 6** Meteorological Stations in West Malaysia and Singapore.

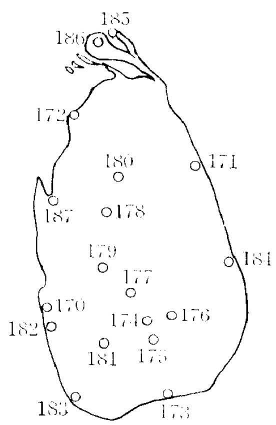


**Fig. 7** Meteorological Stations in Ceylon.

latitudes and months.

Even using the nomogram and the tables, the computation of a corrected PE value requires considerable time and labor. In the present paper this process is left to a computer (FACOM 230-60 of the Computer Center of Kyoto University) by feeding the tables into its memory core and by transforming the nomogram into formulae. Direct computation using the Thornthwaite formula has also been attempted, but the deviation of the result from that of the tables-and-nomogram method is especially large when temperatures are higher than 26.5°C.

Given the data for water requirement (i. e., potential evapotranspiration) and water supply (i. e., rainfall), the water balance for each month can be estimated. In this process a moisture retention maximum of 100 mm is postulated for every soil regardless of its texture. Though this assumption is often criticized, for the purposes of climatic classification no better alternative can be proposed in view of the wide variability of soil texture even within a similar climatic region. By summing up monthly surpluses and deficiencies, yearly values $s$ and $d$, respectively, are obtained. Using $e$(PE), $s$, and $d$ values the following three indices are calculated :

Humidity index $Ih=\frac{100s}{e}$

Aridity index $Id=\frac{100d}{e}$

Moisture index $Im=\frac{100s-60d}{e}$

The following climatic types are distinguished according to their moisture index values :

| Climatic Type | Moisture Index |
|---|---|
| A Perhumid | 100 and above |
| $B_4$ Humid | 80 to 100 |
| $B_3$ Humid | 60 to 80 |
| $B_2$ Humid | 40 to 60 |
| $B_1$ Humid | 20 to 40 |
| $C_2$ Moist Subhumid | 0 to 20 |
| $C_1$ Dry Subhumid | −20 to 0 |
| D Semiarid | −40 to −20 |
| E Arid | −60 to −40 |

Furthermore, moist climates (A, B, $C_2$) and dry climates ($C_1$, D, E) are subdivided as follows according to their aridity and humidity indices :

| Moist Climates (A, B, $C_2$) | Aridity Index |
|---|---|
| r little or no water deficiency | 0−16.7 |
| s moderate summer water deficiency | 16.7−33.3 |
| w moderate winter water deficiency | 16.7−33.3 |

| | |
|---|---|
| $s_2$ large summer water deficiency | 33.3+ |
| $w_2$ large winter water deficiency | 33.3+ |

| Dry Climates ($C_1$, D, E) | Humidity Index |
|---|---|
| d little or no water surplus | 0−10 |
| s moderate winter water surplus | 10−20 |
| w moderate summer water surplus | 10−20 |
| $s_2$ large winter water surplus | 20+ |
| $w_2$ large summer water surplus | 20+ |

As for the thermal regime, PE itself is used as an index of thermal efficiency. Different climatic types are separated as follows:

| Climatic Type | TE Index (or PE) |
|---|---|
| E′ Frost | 14.2 (cm) and below |
| D′ Tundra | 28.5−14.2 |
| $C_1'$ Microthermal | 42.7−28.5 |
| $C_2'$ Microthermal | 57.0−42.7 |
| $B_1'$ Mesothermal | 71.2−57.0 |
| $B_2'$ Mesothermal | 85.5−71.2 |
| $B_3'$ Mesothermal | 99.7−85.5 |
| $B_4'$ Mesothermal | 114.0−99.7 |
| A′ Megathermal | 114.0 and above |

In addition to this, summer concentration of thermal efficiency (S) is taken as another differentiating characteristic. S is a measure of the concentration of potential evapotranspiration over the three-month summer period expressed as a percentage of total PE. Summer concentration types are separated as follows:

| Summer Concentration Types | Summer Concentration % |
|---|---|
| a′ | 48.0 and below |
| $b_4'$ | 51.9−48.0 |
| $b_3'$ | 56.3−51.9 |
| $b_2'$ | 61.6−56.3 |
| $b_1'$ | 68.0−61.6 |
| $c_2'$ | 76.3−68.0 |
| $c_1'$ | 88.0−76.3 |
| d′ | 88.0 and above |

The method of computation and the criteria for classification for this study having been outlined above, before stating the result of their application, we have to admit one fundamental drawback to the method when applied to a tropical climate. Though Thornthwaite's method is apparently intended to cover the tropics, there is no guarantee for its validity when actually applied there. As Thornthwaite himself noted, "the computed values of potential evapotranspiration are of the right order of magnitude throughout most of the United States, but whether or not the formula can be used without modification to determine PE in equatorial regions is uncertain."

In this study the fourth differentia, i. e., summer concentration of thermal efficiency, is not taken into account, because the regions here studied are mostly tropical and such summer concentration is not very much in evidence. Thus, the first three criteria, that is, the moisture index, the thermal efficiency index, and the aridity or humidity index, are used for making the climatic classification.

In subdividing moist and dry climates according to their aridity or humidity indices, the six months from May to October are taken as summer and the remaining six months as winter. This division coincides with the customary division of rainy and dry seasons for most of the area studied.

## Results and Discussions

The results of computations and classification are given in Tables 1 to 11 for each country or region. The location of meteorological stations is plotted in Figures 1 to 7. To summarize the study, an approximate distribution of different climatic types in terms of moisture index values and the seasonal distribution of water surplus and deficiency is shown in Figure 8.

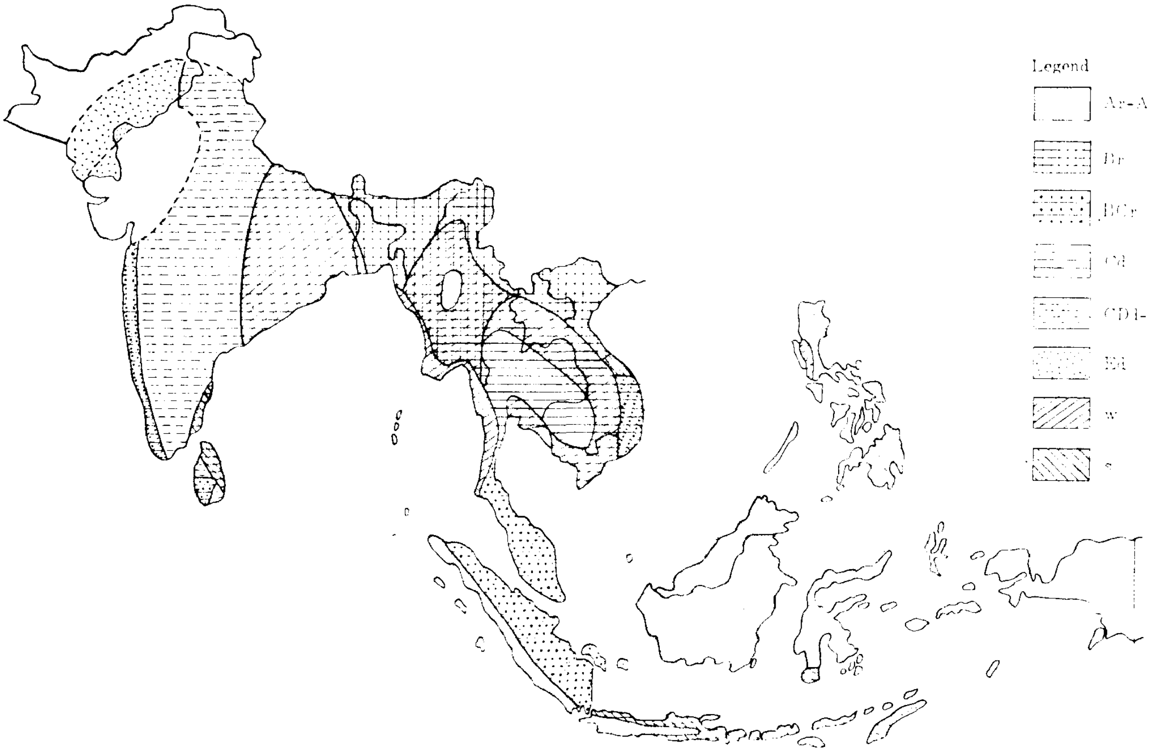


**Fig. 8** Climatic Regions in South and Southeast Asia with Respect to Humidity and Seasonal Distribution of Water Surplus or Deficiency.

According to their thermal efficiency indices, most of the stations within the area belong to the megathermal class or A′. Only those stations situated at high altitudes belong to mesothermal classes, $B_4'-B_1'$. The following generalization can be made as to the relationship between thermal efficiency class and altitude:

| Thermal Efficiency Class | Altitude | No. of Stations |
|---|---|---|
| A′ | Below 500 m | — |
| $B_4'$ | 500–900 | 5 |
| $B_3'$ | 900–1300 | 8 |
| $B_2'$ | 1300–2000 | 11 |
| $B_1'$ | Above 2000 | 4 |

Notable exceptions to the rule are as follows:

| Class | Station No. | Altitude |
|---|---|---|
| A′ | 144 | 655 |
| | 155 | 553 |
| | 157 | 556 |
| | 159 | 545 |
| | 165 | 921 |
| | 167 | 753 |
| | 176 | 667 |
| | 265 | 551 |
| | 277 | 559 |
| | 279 | 581 |
| $B_4'$ | 3 | 265 |
| $B_2'$ | 19 | 962 |

All but one (No. 176) of the exceptions to class A′ are from the inland part of India, where summer concentration of thermal efficiency is relatively high and a continental climate prevails. Station No. 3 is located along the China-Vietnam border and the irregularity may be related to a high latitude. For Station No. 19 in South Vietnam no reasonable explanation is available.

Generalizations in terms of humidity climatic types are more difficult to draw and the delineation of climatic classes on even a small-scale map requires some boldness. Some of the noteworthy points that the author has found are as follows:

(1) The distribution of perhumid to fourth humid climates (A or $B_4$) is relatively narrow on lowlands. This is in contrast to a wide area of Tropical Rainforest climate in Köppen's classification. For example, a greater part of the west coast lowland of West Malaysia belongs to the Tropical Rainforest climate area in Köppen's scheme, whereas here the same area is shown to have mainly subhumid to first humid climate ($C_2$ or $B_1$).

(2) The continental part of Thailand and Cambodia is the driest area of considerable extension in Southeast Asia, almost as dry as the Ganges basin of India or the dry zone of Ceylon in South Asia. There is a general impression that Southeast Asia is a humid region as contrasted to South Asia where climate is much drier. But this is not necessarily the case. The occurrence of Grumusols in Thailand and Cambodia can now be readily explained on a climatic basis.

(3) Fairly obviously, orographic influence on the distribution of humidity climatic types is great. A typical example of this is seen in the spotty occurrence of perhumid to fourth humid areas in the southeastern coastal part of Thailand, where mountain ranges over 1500 meters high act as a barrier to the moist air coming from the Gulf of Thailand.

(4) With respect to the seasonal distribution of water surplus or deficiency, the study area can be grouped into the following four categories :

Moist throughout (r)…North Vietnam, Assam (India), West Malaysia, Sumatra, Borneo (Kalimantan and East Malaysia), the inland part of Java, East Pakistan, the Ceylon wet zone, and the greater part of the Philippines.

Summer rain (w)…Marginal parts of Thailand and Cambodia, Laos, South Vietnam, Burma, the east coast of the Bay of Bengal, the Arabian Sea coast of India, and northeastern India.

Winter rain (s)…Middle Vietnam, the Java Sea coast, the Ceylon dry zone, and the southeastern coast of India.

Dry throughout (d)…The central areas of Thailand, Cambodia, and Burma, central and northwestern India, and West Pakistan.

By way of summary, a map (Fig. 8) was prepared showing humidity climatic types and the seasonal distribution of water surplus and deficiency over the study area (lowland). Although we have to admit numerous inclusions for each of the climatic types delineated on the map, we are able to assess the degree of dessiccation or moistening that a soil undergoes during its formation process in different regions of South and Southeast Asia.

## Summary

As a first step towards clarifying the soil-forming conditions of rice-growing tropical and subtropical Asia, a climatic classification according to Thornthwaite's method was carried out. Data on the mean monthly temperature and rainfall for some 280 meteorological stations throughout most of the South and Southeast Asian regions were collected from various sources. Computation of the potential evapotranspiration was facilitated by the use of a computer. Classification results are expressed by a combination of 3 symbols representing humidity, thermal efficiency, and the seasonal distribution of water

surplus or deficiency. Thus, forty-two climatic types are distinguished in the study area. A generalization as to the relationship between altitude and climatic type was deduced with respect to thermal efficiency. Distribution of the humidity climatic types was so complex that only a small-scale map with many inclusions could be prepared (cf. Fig. 8).

## References


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**Table 1** Moisture Data for VIETNAM (in mm)

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipitation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| | | | | (North Vietnam) | | | | | |
| 1 | Laokay | 22°30′N | 103 | 1231 | 1750 | 519 | 0 | 42.2 | $B_2A'r$ |
| 2 | Chapa | 22°21′N | 1640 | 750 | 2768 | 2019 | 0 | 269.1 | $(AB_2'r)$ |
| 3 | Langson | 21°51′N | 265 | 1116 | 1428 | 312 | 0 | 28.0 | $B_1B_4'r$ |
| 4 | Moncay | 21°31′N | 10 | 1216 | 3085 | 1869 | 0 | 153.7 | $AA'r$ |
| 5 | Haiphong | 20°49′N | 5 | 1296 | 1774 | 521 | 43 | 38.2 | $B_1A'r$ |
| 6 | Hanoi | 21°30′N | 8 | 1256 | 1673 | 423 | 5 | 33.4 | $B_1A'r$ |
| 7 | Phulien | 20°40′N | 113 | 1232 | 1781 | 551 | 0 | 44.7 | $B_2A'r$ |
| 8 | Dong Hoi | 17°29′N | 20 | 1388 | 2118 | 1059 | 331 | 62.0 | $B_3A's$ |
| 9 | Vinh | 18°39′N | 6 | 1286 | 1828 | 630 | 88 | 44.9 | $B_2A'r$ |
| | | | | (South Vietnam) | | | | | |
| 10 | Hue | 16°24′N | 16 | 1351 | 2904 | 1790 | 237 | 122.0 | $AA's$ |
| 11 | Quang Tri | 16°44′N | 7 | 1423 | 2541 | 1445 | 326 | 87.8 | $B_4A's$ |
| 12 | Phanthiet | 10°56′N | 6 | 1623 | 1216 | 130 | 537 | − 11.8 | $C_1A'd$ |
| 13 | Tourane | 16° N | 8 | 1435 | 1974 | 1027 | 487 | 51.2 | $B_2A's_2$ |
| 14 | Hoang-Sa | 16°33′N | 6 | 1638 | 1348 | 189 | 478 | − 6.0 | $C_1A's$ |
| 15 | Qui Nhou | 13°45′N | 6 | 1567 | 1653 | 711 | 625 | 21.4 | $B_1A's_2$ |
| 16 | Pleiku | 13°59′N | 779 | 1021 | 2684 | 1847 | 182 | 170.2 | $(AB_4'w)$ |
| 17 | Da Nang | 16°02′N | 7 | 1470 | 1969 | 949 | 450 | 46.2 | $B_2A's$ |
| 18 | Nha-Trang | 12°15′N | 6 | 1590 | 1096 | 231 | 727 | − 12.9 | $C_1A's$ |
| 19 | Dalat | 11°45′N | 962 | 837 | 1804 | 975 | 9 | 115.9 | $(AB_2'r)$ |
| 20 | Poulo Condore | 8°40′N | 6 | 1686 | 1834 | 567 | 418 | 18.8 | $C_2A'w$ |
| 21 | Saigon | 10°47′N | 11 | 1685 | 1806 | 560 | 440 | 17.57 | $C_2A'w$ |
| 22 | Cape Saint Jacoues | 10°20′N | 18 | 1579 | 1300 | 204 | 484 | − 5.5 | $C_1A'w$ |
| 23 | Hatien | 10°10′N | 3 | 1689 | 1958 | 572 | 302 | 23.1 | $B_1A'w$ |

**Table 2** Moisture Data for CAMBODIA

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 24 | Stung Treng | 13°31′N | 54 | 1625 | 1729 | 565 | 460 | 17.8 | $C_2A'w$ |
| 25 | Siemreap | 13°22′N | 15 | 1616 | 1281 | 202 | 537 | − 7.4 | $C_1A'w$ |
| 26 | Kompong Cham | 12°00′N | 16 | 1690 | 1698 | 472 | 463 | 11.5 | $C_2A'w$ |
| 27 | Battambang | 13°06′N | 18 | 1665 | 1350 | 104 | 419 | − 8.9 | $C_1A'd$ |
| 28 | Kampot | 10°37′N | 5 | 1703 | 2066 | 624 | 258 | 27.5 | $B_1A'r$ |
| 29 | Phnom Penh | 11°33′N | 12 | 1750 | 1320 | 92 | 523 | − 12.7 | $C_1A'd$ |

**Table 3** Moisture Data for LAOS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 30 | Luang Prabang | 19°53′N | 304 | 1453 | 1203 | 50 | 300 | − 8.9 | $C_1A'd$ |
| 31 | Seno Savannakhet | 16°33′N | 155 | 1532 | 1460 | 383 | 457 | 7.1 | $C_2A'w$ |
| 32 | Vientiane | 17°57′N | 170 | 1535 | 1714 | 578 | 400 | 22.0 | $B_1A'w$ |
| 33 | Pakse | 15°07′N | 96 | 1673 | 1564 | 526 | 635 | 8.7 | $C_2A'w_2$ |

**Table 4** Moisture Data for MALAYSIA
(West Malaysia)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 34 | Alor Star Aevodrone | 6°12′N | 3 | 1714 | 2128 | 615 | 201 | 28.8 | $B_1A'r$ |
| 35 | Penang | 5°25′N | 5 | 1772 | 2733 | 987 | 26 | 54.8 | $B_2A'r$ |
| 36 | Kuala Trenggann | 5°20′N | 31 | 1735 | 2912 | 1177 | 0 | 67.8 | $B_3A'r$ |
| 37 | Kota Bharu | 6°08′N | 6 | 1688 | 2755 | 1138 | 72 | 63.4 | $B_3A'r$ |
| 38 | Ipoh | 4°34′N | 39 | 1687 | 2348 | 663 | 0 | 39.3 | $B_1A'r$ |
| 39 | Comeron Highlands | 4°28′N | 1448 | 810 | 2642 | 1833 | 0 | 226.3 | $(AB_2'r)$ |
| 40 | Kuala Lumpur | 3°07′N | 39 | 1720 | 2499 | 779 | 0 | 45.3 | $B_2A'r$ |
| 41 | Malacca | 2°12′N | 45 | 1692 | 2207 | 516 | 0 | 30.5 | $B_1A'r$ |
| 42 | Singapore | 1°18′N | 10 | 1716 | 2232 | 516 | 0 | 30.1 | $B_1A'r$ |
| 43 | Frasers Hill | 3°43′N | 1301 | 886 | 2719 | 1835 | 0 | 207.2 | $(AB_3'r)$ |
| 246 | P. Langkawi | 6°19′N | 4 | 1660 | 2462 | 978 | 175 | 52.6 | $B_2A'r$ |
| 247 | Kulim | 5°23′N | 32 | 1730 | 3128 | 1399 | 0 | 80.9 | $B_4A'r$ |

| No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 248 | Kualakangsar | 4°46′N | 39 | 1740 | 2043 | 324 | 21 | 17.9 | $C_2A'r$ |
| 249 | Sitiawan | 4°13′N | 7 | 1710 | 1902 | 296 | 106 | 13.6 | $C_2A'r$ |
| 250 | Kampar | 4°18′N | 39 | 1724 | 3686 | 1961 | 0 | 113.7 | AA′r |
| 251 | Kuantan | 3°46′N | 19 | 1589 | 3003 | 1414 | 0 | 89.0 | $B_4A'r$ |
| 252 | Bentong | 3°31′N | 97 | 1746 | 2354 | 610 | 0 | 34.9 | $B_1A'r$ |
| 253 | Kepong | 3°14′N | 97 | 1665 | 2693 | 1027 | 0 | 61.7 | $B_3A'r$ |
| 254 | Jelebu | 2°57′N | 137 | 1633 | 1661 | 107 | 80 | 3.6 | $C_2A'r$ |
| 255 | Segamat | 2°30′N | 29 | 1742 | 1991 | 258 | 10 | 14.5 | $C_2A'r$ |
| 256 | Mersing | 2°27′N | 45 | 1547 | 2822 | 1276 | 0 | 82.5 | $B_4A'r$ |
| 257 | Johore Bahru | 1°28′N | 15 | 1694 | 2815 | 1123 | 0 | 66.3 | $B_3A'r$ |
| | (East Malaysia) | | | | | | | | |
| 44 | Sandakan | 5°50′N | 46 | 1773 | 3137 | 1364 | 0 | 76.9 | $B_3A'r$ |
| 45 | Jesselton | 5°51′N | 3 | 1627 | 2591 | 1197 | 234 | 64.9 | $B_3A'r$ |
| 46 | Labuan | 5°17′N | 18 | 1772 | 3573 | 1803 | 0 | 101.8 | AA′r |
| 48 | Mirl | 4°23′N | 3 | 1680 | 2834 | 1153 | 0 | 68.6 | $B_3A'r$ |
| 49 | Bintula | 3°11′N | 3 | 1587 | 3499 | 1914 | 0 | 120.6 | AA′r |
| 50 | Kuching | 1°29′N | 26 | 1693 | 3905 | 2214 | 0 | 130.8 | AA′r |

**Table 5** Moisture Data for INDONESIA

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 51 | Tarakan | 3°19′N | 12 | 1613 | 3869 | 2257 | 0 | 140.0 | AA′r |
| 52 | Balikpapan | 1°17′N | 7 | 1579 | 2228 | 649 | 0 | 41.1 | $B_2A'r$ |
| 53 | Pontianak | 0°01′N | 3 | 1698 | 3178 | 1481 | 0 | 87.2 | $B_4A'r$ |
| 54 | Mapanget | 1°32′N | 86 | 1395 | 3398 | 2002 | 0 | 143.5 | AA′r |
| 55 | Menado | 1°30′N | 2 | 1582 | 2663 | 1116 | 36 | 69.2 | $B_3A'r$ |
| 56 | Makassar | 5°08′S | 2 | 1600 | 2851 | 1685 | 435 | 89.0 | $B_4A's$ |
| 57 | Dili | 8°35′S | 0 | 1785 | 848 | 0 | − 938 | − 31.5 | DA′d |
| 58 | Amboina | 3°42′N | 4 | 1567 | 3459 | 1892 | 0 | 120.7 | AA′r |
| 59 | Tambora | 8°12′S | 500 | 1053 | 3752 | 2698 | 0 | 256.2 | $(AB_4'r)$ |

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 60 | Koepang | 10°10′S | 45 | 1647 | 1440 | 542 | 749 | 5.6 | $C_2A's_2$ |
| 61 | Fort de kock | 0°18′N | 920 | 994 | 2105 | 1113 | 0 | 111.9 | $(AB_3'r)$ |
| 62 | Medan | 3°35′N | 23 | 1516 | 2029 | 512 | 0 | 33.8 | $B_1A'r$ |
| 63 | Takengon | 4°40′N | 1205 | 964 | 1738 | 775 | 0 | 80.4 | $(B_4B_3'r)$ |
| 64 | Padang | 0°56′S | 7 | 1626 | 4172 | 2547 | 0 | 156.6 | $AA'r$ |
| 65 | Tandjueng Pandan | 2°45′S | 3 | 1637 | 2874 | 1238 | 0 | 75.6 | $B_3A'r$ |
| 66 | Terempa | 3°12′N | 3 | 1639 | 2403 | 764 | 0 | 46.6 | $B_2A'r$ |
| 67 | Soerabaya | 7°16′S | 7 | 1670 | 1674 | 439 | 436 | 10.6 | $C_2A's$ |
| 69 | Pasuruan | 7°38′S | 5 | 1684 | 1284 | 191 | 591 | − 9.7 | $C_1A's$ |
| 70 | Tosari | 7°58′S | 1735 | 744 | 2018 | 1292 | 18 | 172.1 | $(AB_2'r)$ |
| 71 | Djember | 8°09′S | 83 | 1461 | 1868 | 595 | 187 | 33.0 | $B_1A'r$ |
| 73 | Tawang Mangoe | 7°37′S | 952 | 896 | 3369 | 2523 | 48 | 278.4 | $(AB_3'r)$ |
| 74 | Semarang | 7°00′S | 10 | 1643 | 2033 | 519 | 129 | 26.6 | $B_1A'r$ |
| 75 | Klaten | 7°42′S | 200 | 1537 | 1639 | 502 | 400 | 17.1 | $C_2A's$ |
| 76 | Pekalongan | 6°53′S | 9 | 1637 | 2213 | 788 | 211 | 40.4 | $B_2A'r$ |
| 77 | Wedi-Birit | 7°45′S | 150 | 1519 | 1846 | 582 | 254 | 28.3 | $B_1A's$ |
| 79 | Tjitajam | 6°27′S | 110 | 1546 | 3466 | 1920 | 0 | 124.2 | $AA'r$ |
| 80 | Kuyper | 6°02′S | 2 | 1791 | 1603 | 276 | 464 | − 0.1 | $C_1A's$ |
| 81 | Jakarta | 6°11′N | 8 | 1638 | 1799 | 424 | 263 | 16.3 | $C_2A'r$ |
| 82 | Pangerango | 6°45′S | 3023 | 585 | 3286 | 2701 | 0 | 461.9 | $(AB_1'r)$ |
| 83 | Kertasari | 7°14′S | 1620 | 746 | 2663 | 1917 | 0 | 257.0 | $(AB_2'r)$ |
| 84 | Lembang | 6°50′S | 1300 | 849 | 1946 | 1098 | 0 | 129.3 | $(AB_2'r)$ |
| 85 | Patjet | 6°45′S | | 872 | 2736 | 1865 | 0 | 214.0 | $(AB_3'r)$ |
| 86 | Tjiwidej Bosch keet | 7°10′S | 1780 | 736 | 3445 | 2709 | 0 | 368.3 | $(AB_2'r)$ |
| 87 | Buitenzorg (Bogor) | 6°35′S | 250 | 1385 | 3934 | 2550 | 0 | 184.1 | $AA'r$ |
| 231 | Bandjarmasin | 3°19′S | 2 | 1678 | 2755 | 1077 | 0 | 64.2 | $B_3A'r$ |
| 232 | Tjirebon | 6°42′S | 4 | 1809 | 2209 | 723 | 324 | 29.2 | $B_1A's$ |
| 233 | Tjilatjap | 7°44′S | 6 | 1614 | 4274 | 2659 | 0 | 164.8 | $AA'r$ |

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 234 | Subang | 6°35′S | 95 | 1539 | 3369 | 1855 | 26 | 119.5 | AA′r |
| 235 | Serang | 6°07′S | 40 | 1666 | 1739 | 225 | 152 | 8.0 | $C_2A'r$ |
| 236 | Punteu (Batu) | 7°50′S | 1000 | 942 | 1847 | 962 | 56 | 98.6 | $(B_4B_3'r)$ |
| 237 | Modjopanggung | 8°03′S | 90 | 1644 | 1893 | 489 | 241 | 21.0 | $B_1A'r$ |
| 238 | Malang | 7°58′S | 445 | 1192 | 2193 | 1073 | 71 | 86.5 | $B_4A'r$ |
| 239 | Magelang | 7°29′S | 380 | 1324 | 2804 | 1479 | 0 | 111.7 | AA′r |
| 240 | Kemajoran | 6°08′S | 3 | 1601 | 1719 | 362 | 244 | 13.5 | $C_2A'r$ |
| 241 | Kaliurang | 7°36′S | 925 | 962 | 4875 | 3913 | 0 | 406.8 | $(AB_3'r)$ |
| 242 | Kadhipaten | 6°46′S | 45 | 1713 | 3114 | 1581 | 181 | 86.0 | $B_4A'r$ |
| 243 | Djokjakarta | 7°49′S | — | 1507 | 2002 | 643 | 147 | 36.8 | $B_1A'r$ |
| 244 | Dadapajam | 7°17′S | 172 | 1657 | 2896 | 1297 | 57 | 76.2 | $B_3A'r$ |
| 245 | Baudung | 6°55′S | 768 | 1100 | 2159 | 1060 | 0 | 96.4 | $(B_4B'_4r)$ |

**Table 6** Moisture Data for THE PHILIPPINES

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 88 | Aparri | 18°22′N | 4 | 1657 | 2307 | 916 | 266 | 45.6 | $B_2A'r$ |
| 89 | Basco | 20°27′N | 11 | 1557 | 3003 | 1446 | 0 | 92.9 | $B_4A'r$ |
| 90 | Echague | 16°42′N | 78 | 1667 | 1583 | 279 | 365 | 3.6 | $C_2A's$ |
| 91 | Baguio | 16°25′N | 1510 | 811 | 4615 | 3804 | 0 | 468.9 | $(AB_2'r)$ |
| 92 | Tacloban | 11°15′N | 21 | 1737 | 2210 | 472 | 0 | 27.2 | $B_1A'r$ |
| 93 | Cebu City | 10°20′N | 42 | 1771 | 1789 | 213 | 194 | 5.5 | $C_2A'r$ |
| 94 | Manila Airport | 14°31′N | 15 | 1715 | 1791 | 572 | 497 | 16.0 | $C_2A'w$ |
| 95 | Legaspi City | 13°08′N | 19 | 1693 | 3407 | 1713 | 0 | 101.2 | AA′r |
| 96 | Cuyo | 10°51′N | 4 | 1778 | 2228 | 939 | 491 | 36.2 | $B_1A'w$ |
| 97 | Iloilo City | 10°42′N | 14 | 1709 | 1933 | 536 | 311 | 20.4 | $B_1A'w$ |
| 98 | Iwahig | 9°44′N | 14 | 1652 | 1963 | 556 | 244 | 24.8 | $B_1A'r$ |
| 99 | Surigao | 9°48′N | 22 | 1672 | 3856 | 2185 | 0 | 130.7 | AA′r |
| 100 | Dagupan City | 16°03′N | 2 | 1821 | 2002 | 731 | 552 | 22.0 | $B_1A'w$ |
| 101 | Zamboanga City | 6°58′N | 6 | 1703 | 1302 | 0 | 401 | − 14.1 | $C_1A'd$ |

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 102 | Jolo | 6°03′N | 13 | 1671 | 1987 | 315 | 0 | 18.8 | C₂A′r |
| 103 | Davao | 7°04′N | 20 | 1689 | 1971 | 282 | 0 | 16.7 | C₂A′r |

**Table 7** Moisture Data for BURMA

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 104 | Bhamo | 24°16′N | 118 | 1363 | 1857 | 692 | 199 | 42.0 | B₂A′r |
| 105 | Lashio | 22°58′N | 854 | 1087 | 1574 | 588 | 99 | 48.6 | (B₂B₄′r) |
| 106 | Mandalay | 21°59′N | 76 | 1626 | 776 | 0 | 850 | − 31.4 | DA′d |
| 107 | Akyab | 20°08′N | 5 | 1491 | 4778 | 3606 | 318 | 229.1 | AA′w |
| 108 | Yamethin | 20°25′N | 119 | 1581 | 966 | 0 | 616 | − 23.4 | DA′d |
| 109 | Toungoo | 18°55′N | 48 | 1564 | 2105 | 947 | 406 | 45.0 | B₂A′w |
| 110 | Victoria Point | 9°58′N | 47 | 1720 | 3964 | 2653 | 408 | 140.0 | AA′w |
| 111 | Rangoon | 16°46′N | 23 | 1693 | 2529 | 1409 | 572 | 62.9 | B₃A′w₂ |
| 112 | Diamond Island | 15°51′N | 12 | 1686 | 3117 | 1915 | 483 | 96.4 | B₄A′w |
| 113 | Amherst | 16°05′N | 22 | 1655 | 5156 | 3983 | 483 | 223.2 | AA′w |
| 114 | Tavoy | 14°07′N | 6 | 1618 | 5856 | 4714 | 477 | 273.7 | AA′w |
| 115 | Mergui | 12°26′N | 20 | 1596 | 4123 | 2796 | 270 | 165.0 | AA′w |

**Table 8** Moisture Data for PAKISTAN
(East Pakistan)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 116 | Satkhira | 22°43′N | 5 | 1541 | 1639 | 389 | 292 | 13.9 | C₂A′w |
| 117 | Barisal | 22°42′N | 3 | 1513 | 2065 | 732 | 180 | 41.2 | B₂A′r |
| 118 | Srimangai | 24°19′N | 21 | 1408 | 2509 | 1116 | 13 | 78.7 | B₃A′r |
| 119 | Narayangani | 23°37′N | 8 | 1566 | 2012 | 601 | 154 | 32.5 | B₁A′r |
| 120 | Jessore | 23°10′N | 7 | 1500 | 1608 | 309 | 200 | 12.6 | C₂A′r |
| 121 | Chittagong | 22°21′N | 14 | 1496 | 2858 | 1531 | 168 | 95.6 | B₄A′r |
| 122 | Cox's Bazar | 21°26′N | 4 | 1440 | 3560 | 2261 | 142 | 151.1 | AA′r |
| 123 | Dinaj pur | 25°38′N | 37 | 1423 | 1836 | 646 | 235 | 35.5 | B₁A′r |
| 124 | Bogra | 24°51′N | 20 | 1484 | 1776 | 539 | 247 | 26.3 | B₁A′r |

(West Pakistan)

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 286 | Lahore | 31°33′N | 214 | 1396 | 492 | 0 | − 9036 | − 38.8 | DA′d |
| 287 | Sialkot | 32°30′N | 253 | 1355 | 807 | 0 | − 5480 | − 24.3 | DA′d |
| 290 | Khushab | 32°18′N | 188 | 1417 | 385 | 0 | −10318 | − 43.7 | EA′d |
| 291 | Montgomery | 30°40′N | 170 | 1432 | 257 | 0 | −11753 | − 49.2 | EA′d |
| 292 | Multan | 30°12′N | 123 | 1479 | 167 | 0 | −13117 | − 53.2 | EA′d |
| 293 | Bahawalpur | 29°23′N | 117 | 1439 | 148 | 0 | −12912 | − 53.8 | EA′d |
| 294 | Khanpur | 28°39′N | 91 | 1468 | 165 | 0 | −13025 | − 53.3 | EA′d |
| 308 | Jacobabad | 28°18′N | 56 | 1537 | 990 | 0 | −14379 | − 56.1 | EA′d |
| 309 | Sukkur | 27°42′N | 67 | 1522 | 980 | 0 | −14241 | − 56.1 | EA′d |
| 310 | Hyderabad | 25°23′N | 29 | 1616 | 157 | 0 | −14589 | − 54.2 | EA′d |
| 311 | Karachi (Manora) | 24°48′N | 4 | 1503 | 204 | 0 | −12994 | − 51.9 | EA′d |
| 312 | Badin | 24°38′N | 9 | 1554 | 234 | 0 | −13197 | − 51.0 | EA′d |

**Table 9** Moisture Data for INDIA

(Assam)

| No. | Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 125 | Dhubri | 26°01′N | 35 | 1379 | 2610 | 1345 | 113 | 92.6 | $B_4A'r$ |
| 126 | Tezpur | 26°37′N | 79 | 1327 | 1847 | 578 | 59 | 40.9 | $B_2A'r$ |
| 127 | Mohanbari | 27°29′N | 111 | 1229 | 2775 | 1548 | 0 | 126.0 | AA′r |
| 128 | Gauhati | 26°05′N | 54 | 1329 | 1634 | 395 | 91 | 25.6 | $B_1A'r$ |
| 129 | Shillong | 25°34′N | 1500 | 802 | 2252 | 1452 | 0 | 181.1 | $(AB_2'r)$ |
| 130 | Silchar | 24°49′N | 29 | 1423 | 3263 | 1849 | 8 | 129.6 | AA′r |
| 131 | Cherrapunji | 25°15′N | 1313 | 821 | 11439 | 10620 | 0 | 1294.3 | $(AB_2'r)$ |
| | (West Bengal) | | | | | | | | |
| 132 | Port Blair | 11°40′N | 79 | 1690 | 3176 | 1817 | 333 | 95.7 | $B_4A'w$ |
| 133 | Saugor (Sagar) Island | 21°39′N | 3 | 1544 | 1803 | 628 | 371 | 26.3 | $B_1A'w$ |
| 134 | Car Nicobar | 9°10′N | 10 | 1767 | 2424 | 874 | 217 | 42.1 | $B_2A'r$ |

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipitation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 135 | Table Island | 14°11′N | 27 | 1731 | 1941 | 683 | 473 | 23.1 | $B_1A'w$ |
| 136 | Calcutta | 22°32′N | 6 | 1609 | 1582 | 365 | 393 | 8.0 | $C_2A'w$ |
| 137 | Darjeeling | 27°03′N | 2127 | 691 | 2760 | 2069 | 0 | 299.2 | $(AB_1'r)$ |
| | (Orissa) | | | | | | | | |
| 138 | Cuttack | 20°48′N | 27 | 1675 | 1545 | 412 | 543 | 5.1 | $C_2A'w$ |
| 139 | Puri | 19°48′N | 6 | 1632 | 1373 | 226 | 486 | − 4.0 | $C_1A'w$ |
| | (Bihar) | | | | | | | | |
| 140 | Darbhanga | 26°10′N | 49 | 1458 | 1258 | 251 | 449 | − 1.3 | $C_1A'w$ |
| 141 | Patna | 25°37′N | 53 | 1505 | 1166 | 231 | 571 | − 7.4 | $C_1A'w$ |
| 142 | Gaya | 24°45′N | 116 | 1557 | 1187 | 267 | 637 | − 7.4 | $C_1A'w$ |
| 143 | Dumka | 24°16′N | 149 | 1502 | 1514 | 414 | 400 | 11.6 | $C_2A'w$ |
| 144 | Ranchi | 23°23′N | 655 | 1294 | 1513 | 534 | 316 | 26.6 | $B_1A'w$ |
| 145 | Daltonganj | 24°03′N | 221 | 1448 | 1237 | 325 | 537 | 0.2 | $C_2A'w_2$ |
| 146 | Jamshedpur | 22°′49N | 129 | 1545 | 1442 | 360 | 463 | 5.3 | $C_2A'w$ |
| | (Uttar Pradesh) | | | | | | | | |
| 147 | Agra | 27°10′N | 169 | 1463 | 767 | 0 | 696 | − 28.5 | $DA'd$ |
| 148 | Kanpur | 26°26′N | 126 | 1470 | 883 | 84 | 672 | − 21.7 | $DA'd$ |
| 149 | Allanabad | 25°27′N | 98 | 1496 | 1032 | 188 | 653 | − 13.6 | $C_1A'w$ |
| 150 | Jhansi | 25°27′N | 251 | 1526 | 917 | 133 | 742 | − 20.5 | $DA'd$ |
| 151 | Muktesar | 29°28′N | 2311 | 706 | 1308 | 602 | 0 | 85.2 | $(B_4B_1'r)$ |
| | (Madhya Pradesh) | | | | | | | | |
| 153 | Jabalpur | 23°10′N | 393 | 1357 | 1431 | 567 | 492 | 20.0 | $B_1A'w_2$ |
| 154 | Raipur | 21°14′N | 298 | 1548 | 1360 | 442 | 630 | 4.1 | $C_2A'w_2$ |
| 155 | Jagdalpur | 19°05′N | 553 | 1393 | 1530 | 587 | 451 | 22.7 | $B_1A'w$ |

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 156 | Gwalior | 26°14′N | 207 | 1455 | 903 | 115 | 669 | − 19.7 | $C_1A'd$ |
| 157 | Indore | 22°43′N | 556 | 1333 | 1127 | 309 | 518 | − 13.5 | $C_1A'w_2$ |
| 265 | Sagar | 23°51′N | 551 | 1401 | 1394 | 6033 | 6098 | 17.0 | $C_2A'w_2$ |
| | | | | (Andhra Pradesh) | | | | | |
| 158 | Masulipatnam | 16°11′N | 7 | 1697 | 1077 | 33 | 652 | − 21.1 | DA′d |
| 159 | Hyderabad | 17°27′N | 545 | 1455 | 761 | 0 | 695 | − 28.7 | DA′d |
| 160 | Visakhapatnam | 17°43′N | 3 | 1734 | 944 | 21 | 811 | − 26.9 | DA′d |
| 161 | Kakinada | 16°57′N | 8 | 1706 | 1096 | 26 | 638 | − 20.9 | DA′d |
| | | | | (Madras) | | | | | |
| 162 | Madras | 13°00′N | 16 | 1789 | 1233 | 275 | 829 | − 12.4 | $C_1A's$ |
| 163 | Nagapatlinam | 10°46′N | 9 | 1798 | 1367 | 450 | 881 | − 4.4 | $C_1A's_2$ |
| 164 | Pamban | 9°16′N | 11 | 1808 | 920 | 167 | 1056 | − 25.8 | DA′d |
| 166 | Coimbatore | 11°00′N | 409 | 1581 | 614 | 0 | 968 | − 36.7 | DA′d |
| | | | | (Mysore) | | | | | |
| 165 | Bangalore | 12°58′N | 921 | 1219 | 924 | 99 | 395 | − 11.3 | $C_1A'd$ |
| 167 | Belgaum | 15°51′N | 753 | 1257 | 1492 | 701 | 465 | 33.6 | $B_1A'w_2$ |
| 168 | Mangalore | 12°52′N | 22 | 1709 | 3479 | 2367 | 596 | 117.6 | $AA'w_2$ |
| 169 | Bellary | 15°09′N | 449 | 1705 | 520 | 1185 | 0 | 69.5 | $B_3A'r$ |
| | | | | (Delhi & Punjab) | | | | | |
| 152 | New Delhi | 28°35′N | 216 | 1446 | 715 | 0 | 730 | − 30.3 | DA′d |
| 262 | Simla | 31°06′N | 2202 | 710 | 1542 | 8320 | 0 | 117.2 | $(AB_1'r)$ |
| 263 | Ludhlana | 30°56′N | 247 | 1407 | 725 | 0 | − 682 | − 29.1 | DA′d |
| 264 | Amritsar | 31°38′N | 234 | 1316 | 646 | 0 | 670 | − 30.5 | DA′d |

(Maharastra)

| Station No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 275 | Bombay (Calaba) | 18°54′N | 11 | 1708 | 2078 | 12064 | 8368 | 41.2 | $B_2A'w_2$ |
| 276 | Ratnagiri | 16°59′N | 35 | 1642 | 2617 | 17517 | − 7769 | 78.3 | $B_3A'w_2$ |
| 277 | Poona | 18°32′N | 559 | 1398 | 715 | 0 | − 6831 | − 29.3 | DA′d |
| 278 | Sholapur | 17°40′N | 479 | 1593 | 679 | 0 | − 9138 | − 34.4 | DA′d |
| 279 | Aurangabad | 19°53′N | 581 | 1457 | 726 | 0 | − 7306 | − 30.1 | DA′d |
| 280 | Nagpur | 21°06′N | 310 | 1554 | 1251 | 3179 | − 6209 | − 3.5 | $C_1A'w_2$ |
| 281 | Akola | 20°42′N | 282 | 1602 | 877 | 426 | − 7674 | − 26.1 | DA′d |

(Kerala)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 284 | Fort Cochin | 9°58′ | 3 | 1705 | 3106 | 17460 | − 3447 | 90.3 | $B_4A'w$ |
| 285 | Trivandrum | 8°29′ | 64 | 1708 | 1835 | 4610 | − 3344 | 15.2 | $C_2A'w$ |

**Table 10** Moisture Data for CEYLON

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 170 | Colombo | 6°54′N | 6 | 1690 | 2397 | 706 | 0 | 41.8 | $B_2A'r$ |
| 171 | Trincomalee | 8°35′N | 7 | 1775 | 1727 | 569 | 617 | 11.2 | $C_2A's_2$ |
| 172 | Mannar | 8°59′N | 3 | 1781 | 951 | 106 | 937 | − 25.6 | DA′d |
| 173 | Hambantota | 6°07′N | 20 | 1709 | 1074 | 0 | 637 | − 22.4 | DA′d |
| 174 | Nuwara Eliya | 6°58′N | 1880 | 720 | 2328 | 1608 | 0 | 223.5 | $(AB_2'r)$ |
| 175 | Diyatalawa | 6°49′N | 1250 | 919 | 1671 | 752 | 0 | 81.9 | $(B_4B_3'r)$ |
| 176 | Badulla | 6°59′N | 667 | 1148 | 1826 | 731 | 52 | 61.0 | $B_3A'r$ |
| 177 | Kandy | 7°20′N | 480 | 1294 | 2084 | 792 | 0 | 61.2 | $B_3A'r$ |
| 178 | Maha Illuppallama | 8°07′N | 137 | 1674 | 1481 | 271 | 464 | − 0.4 | $C_1A's$ |
| 179 | Kurunegala | 7°28′N | 116 | 1687 | 2158 | 481 | 8 | 28.2 | $B_1A'r$ |
| 180 | Anuradnapura | 8°21′N | 89 | 1689 | 1446 | 289 | 531 | − 1.8 | $C_1A's$ |
| 181 | Ratnapura | 6°41′N | 46 | 1724 | 3904 | 2180 | 0 | 126.4 | AA′r |
| 182 | Ratmalana | 6°49′N | 5 | 1709 | 2479 | 769 | 0 | 45.0 | $B_2A'r$ |
| 183 | Galle | 6°02′N | 18 | 1636 | 2422 | 786 | 0 | 48.0 | $B_2A'r$ |

| No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 184 | Batticaloa | 7°43′N | 12 | 1716 | 1756 | 702 | 661 | 17.8 | $C_2A's_2$ |
| 185 | Kankesanturai | 9°48′N | 6 | 1809 | 1293 | 422 | 938 | −7.8 | $C_1A's_2$ |
| 186 | Jaffna | 9°39′N | 3 | 1738 | 1351 | 449 | 834 | −3.0 | $C_1A's_2$ |
| 187 | Puttalam | 8°02′N | 2 | 1728 | 1126 | 83 | 684 | −19.0 | $C_1A'd$ |

**Table 11** Moisture Data for THAILAND

| No. | Station Name | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| 188 | Chiang Rai | 19°55′N | 378 | 1393 | 1747 | 589 | 233 | 32.3 | $B_1A'w$ |
| 189 | Mae Hong Son | 19°18′N | 271 | 1548 | 1313 | 260 | 495 | −2.4 | $C_1A'w$ |
| 190 | Chieng Mai | 18°47′N | 314 | 1507 | 1249 | 141 | 399 | −6.5 | $C_1A'd$ |
| 191 | Nan | 18°47′N | 201 | 1565 | 1162 | 115 | 517 | −12.5 | $C_1A'd$ |
| 192 | Lampang | 18°12′N | 220 | 1568 | 1049 | 0 | 520 | −19.9 | $C_1A'd$ |
| 193 | Phrae | 18°10′N | — | 1579 | 1122 | 43 | 501 | −16.3 | $C_1A'd$ |
| 194 | Mae Sariang | 18°10′N | 314 | 1582 | 1289 | 221 | 513 | −5.5 | $C_1A'w$ |
| 195 | Uttaradit | 17°37′N | 63 | 1683 | 1496 | 273 | 459 | −0.1 | $C_1A'w$ |
| 196 | Mae Sot | 16°40′N | 210 | 1583 | 1500 | 496 | 580 | 9.3 | $C_2A'w_2$ |
| 197 | Tak | 16°50′N | — | 1678 | 951 | 0 | 727 | −26.0 | $DA'd$ |
| 198 | Loei | 17°32′N | — | 1487 | 1194 | 39 | 331 | −10.7 | $C_1A'd$ |
| 199 | Udon Thani | 17°26′N | 178 | 1610 | 1419 | 229 | 420 | −1.4 | $C_1A'w$ |
| 200 | Nakhon Phanom | 17°30′N | — | 1511 | 2162 | 1084 | 435 | 54.5 | $B_2A'w$ |
| 201 | Khon Kaen | 16°20′N | 157 | 1638 | 1210 | 60 | 487 | −14.2 | $C_1A'd$ |
| 202 | Mukdahan | 16°33′N | 138 | 1554 | 1447 | 338 | 445 | 4.6 | $C_2A'w$ |
| 203 | Roi Et | 16°03′N | 140 | 1644 | 1414 | 254 | 482 | −2.1 | $C_1A'w$ |
| 204 | Chaiyaphum | 15°45′N | — | 1634 | 1089 | 31 | 577 | −19.3 | $C_1A'd$ |
| 205 | Ubon Ratchathani | 15°15′N | 123 | 1657 | 1531 | 358 | 485 | 4.0 | $C_2A'w$ |
| 206 | Nakhon Ratchasima | 14°58′N | 181 | 1657 | 1156 | 20 | 521 | −17.7 | $C_1A'd$ |
| 207 | Surin | 14°53′N | 145 | 1654 | 1341 | 134 | 448 | −8.1 | $C_1A'd$ |
| 208 | Phitsanulok | 16°50′N | 50 | 1761 | 1356 | 127 | 533 | −10.9 | $C_1A'd$ |
| 209 | Phetchabun | 16°25′N | 114 | 1622 | 1288 | 137 | 470 | −8.9 | $C_1A'd$ |

| Station | | Latitude | Altitude m | Water need (PE or TE) | Precipi-tation | Water surplus | Water deficiency | Moisture index (Im) | Climatic type |
|---|---|---|---|---|---|---|---|---|---|
| No. | Name | | | | | | | | |
| 210 | Nakhon Sawan | 15°48′N | 28 | 1794 | 1182 | 33 | 644 | − 19.7 | $C_1A'd$ |
| 211 | Lop Buri | 14°48′N | 13 | 1797 | 1239 | 43 | 600 | − 17.6 | $C_1A'd$ |
| 212 | Suphan Buri | 14°30′N | — | 1785 | 1279 | 109 | 617 | − 14.6 | $C_1A'd$ |
| 213 | Kanchanaburi | 14°01′N | 28 | 1741 | 992 | 0 | 749 | − 25.8 | DA′d |
| 214 | Don Muang | 13°55′N | 3 | 1824 | 1544 | 224 | 504 | − 4.3 | $C_1A'w$ |
| 215 | Bangkok | 13°44′N | — | 1806 | 1409 | 184 | 522 | − 7.2 | $C_1A'w$ |
| 216 | Prachin Buri | 14°10′N | — | 1773 | 2112 | 802 | 465 | 29.5 | $B_1A'w$ |
| 217 | Aranyaprathet | 13°42′N | 44 | 1738 | 1522 | 177 | 394 | − 3.4 | $C_1A'w$ |
| 218 | Sattahip | 12°39′N | 55 | 1906 | 1313 | 100 | 691 | − 16.5 | $C_1A'd$ |
| 219 | Chanthaburi | 12°37′N | 5 | 1719 | 3027 | 1647 | 338 | 84.0 | $B_4A'w$ |
| 220 | Khlong Yai | 11°47′N | 4 | 1691 | 4456 | 2964 | 199 | 168.3 | AA′r |
| 221 | Hua Hin | 12°34′N | 3 | 1730 | 1019 | 31 | 742 | − 23.9 | DA′d |
| 222 | Prachuap Khiri Khan | 11°48′N | 5 | 1681 | 1163 | 54 | 572 | − 17.2 | $C_1A'd$ |
| 223 | Chumphon | 10°27′N | 3 | 1650 | 1964 | 400 | 84 | 21.2 | $B_1A'r$ |
| 224 | Ban Dan | 9°08′N | 3 | 1725 | 1858 | 384 | 251 | 13.5 | $C_2A'r$ |
| 225 | Nakhonsithammarat | 8°25′N | 5 | 1727 | 2569 | 941 | 99 | 51.0 | $B_2A'r$ |
| 226 | Songkhla | 7°13′N | 4 | 1789 | 2232 | 858 | 416 | 34.0 | $B_1A's$ |
| 227 | Narathiwat | 6°26′N | 4 | 1671 | 2690 | 1076 | 58 | 62.3 | $B_3A'r$ |
| 228 | Ranong | 9°58′N | 35 | 1631 | 5107 | 3695 | 218 | 218.5 | AA′r |
| 229 | Phuket | 7°′58N | 3 | 1775 | 2389 | 888 | 274 | 40.8 | $B_2A'r$ |
| 230 | Trang | 7°30′N | — | 1755 | 2178 | 661 | 238 | 29.5 | $B_1A'r$ |