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Numerical Classification of the Climate of South and Southeast Asia

by

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Introduction

In a preceding paper[1] the climate of South and Southeast Asia was dealt with using Thornthwaite's classification method. The result indicated that the number of climatic types classified on the basis of thermal efficiency, humidity, and seasonal distribution of water surplus or deficiency amounted to 42 for the regions concerned, so that a delineation of climatic regions corresponding to each type was highly difficult. Only a small-scale map with many inclusions could be produced with respect to humidity climatic types, taking seasonal distribution of water surplus or deficiency somewhat into consideration. Besides the difficulty in mapping, problems inherent to the method were also discussed; use of a parameter, i. e., potential evapotranspiration, is the essential feature of Thornthwaite's method, but there is no guarantee for the validity of the parameter when calculated for the tropical climate, as Thornthwaite himself admitted.

Recently we examined the applicability of a numerical taxonomic method to the climatic classification of Japan,[2] with an intention to establish climatic regions of the country as a basis of classification of alluvial soils. As noted in this study the numerical method gave readily mappable climatic regions with a fairly good internal coherence, while Thornthwaite's method adopted for the purpose of comparison presented the same difficulty as stated above.

In the present paper applicability of the numerical taxonomic method to a classification of the climate of South and Southeast Asia is tested. Here our intention is again to set up climatic regions as a basis for considering classification of alluvial soils in the rice-growing South and Southeast Asia.

I Materials and Methods

Based on the previous study with Thornthwaite's method and on preliminary trials

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with the numerical method, the stations were selected so that the major variations of the climate of South and Southeast Asia may be represented. In practice, one hundred and twenty-five stations out of some 300 stations, for which mean monthly temperature and rainfall data are available (cf., Kyuma[1]), were chosen taking density of distribution of stations as well as variability of climate in an area into consideration. The fundamental limitation to this selection of sample stations is that there are many areas for which meteorological data are very scarce, e. g., Laos, Burma, and the Indonesian Islands other than Java.

Another consideration in selecting the stations is to exclude the stations on highlands; those stations having thermal efficiency types other than A′ in Thornthwaite's classification are deliberately excluded. This is because the major alluvial lands extend on the lowlands. One exception to this rule is a station at Bandung (B4′), which was taken as a representative of highland plains in Java.

A map showing distribution of the sample stations is given in Fig. 1. Thornthwaite's climatic types and other data for the sample stations are given in Table 1 together with those for other stations.

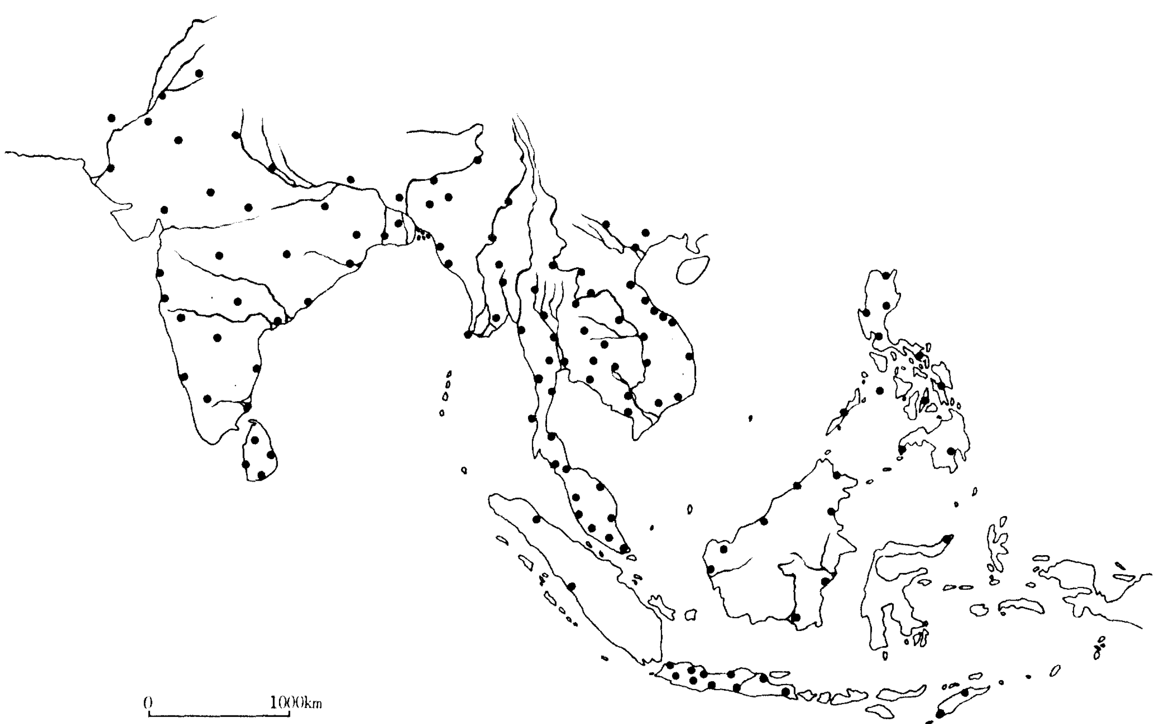

Fig. 1 A Map showing Distribution of the Sample Stations

As in the previous paper[2], the numerical taxonomic procedures used here are after Sokal and Sneath.[3] Taxonomic distances were calculated after standardization of the original climatic data (mean monthly temperatures and mean monthly rainfalls from

Table 1 List of Stations, Their Location and Climatic Types

Station No.	Station Name	Latitude	Climatic Grouping: Thornthwaite's Method	Climatic Grouping: Numer. Taxon. & Disc. Func.
		VIETNAM (North Vietnam)		
1*	Laokay	22°30′N	$B_2A'r$	VIII
3	Langson	21°51′N	$B_1B_4'r$	VIII
4	Moncay	21°31′N	$AA'r$	VIII
5	Haiphong	20°49′N	$B_1A'r$	VIII
6	Hanoi	21°30′N	$B_1A'r$	VIII
7	Phulien	20°40′N	$B_2A'r$	VIII
8	Dong Hoi	17°29′N	$B_3A's$	VI
9	Vinh	18°39′N	$B_2A'r$	VIII
		(South Vietnam)		
10	Hue	16°24′N	$AA's$	VI
11	Quang Tri	16°44′N	$B_1A's$	VI
12	Phanthiet	10°56′N	$C_1A'd$	V
13	Tourane	16°　N	$B_2A's_2$	VI
14	Hoang-Sa	16°33′N	$C_1A's$	V
15	Qui Nhou	13°45′N	$B_1A's_2$	VI
17	Da Nang	16°02′N	$B_2A's$	VI
18	Nha-Trang	12°15′N	$C_1A's$	V
20	Poulo Condore	8°40′N	$C_2A'w$	V
21	Saigon	10°47′N	$C_2A'w$	V
22	Cape Saint Jacoues	10°20′N	$C_1A'w$	V
23	Hatien	10°10′N	$B_1A'w$	V
		CAMBODIA		
24	Stung Treng	13°31′N	$C_2A'w$	V
25	Siemreap	13°22′N	$C_1A'w$	V
26	Kompong Cham	12°00′N	$C_2A'w$	V
27	Battambang	13°06′N	$C_1A'd$	V
28	Kampot	10°37′N	$B_1A'r$	V
29	Phnom Penh	11°33′N	$C_1A'd$	V
		LAOS		
30	Luang Prabang	19°53′N	$C_1A'd$	VII
31	Seno Savannakhet	16°33′N	$C_2A'w$	V
32	Vientiane	17°57′N	$B_1A'w$	VII
33	Pakse	15°07′N	$C_2A'w_2$	V

Note: * Station numbers printed in Gothic are those used for numerical taxonomy.
** Roman numerals put in parentheses are the group number according to discriminant functions.

Station		Latitude	Climatic Grouping	
No.	Name		Thornthwaite's Method	Numer. Taxon. & Disc. Func.
		MALAYSIA (West Malaysia)		
34	Alor Star Aerodrome	6°12′N	$B_1A'r$	V
35	Penang	5°25′N	$B_2A'r$	II
36	Kuala Trengganu	5°20′N	$B_3A'r$	II
37	Kota Bharu	6°08′N	$B_3A'r$	II
38	Ipoh	4°34′N	$B_1A'r$	II
40	Kuala Lumpur	3°07′N	$B_2A'r$	II(I)**
41	Malacca	2°12′N	$B_1A'r$	I
42	Singapore	1°18′N	$B_1A'r$	I
246	P. Langkawi	6°19′N	$B_2A'r$	II
247	Kulim	5°23′N	$B_4A'r$	II
248	Kualakangsar	4°46′N	$C_2A'r$	I
249	Sitiawan	4°13′N	$C_2A'r$	I
250	Kampar	4°18′N	AA′r	III
251	Kuantan	3°46′N	$B_4A'r$	II
252	Bentong	3°31′N	$B_1A'r$	II
253	Kepong	3°14′N	$B_3A'r$	II
254	Jelebu	2°57′N	$C_2A'r$	I
255	Segamat	2°30′N	$C_2A'r$	I
256	Mersing	2°27′N	$B_4A'r$	II
257	Johore Bahru	1°28′N	$B_3A'r$	II
		(East Malaysia)		
44	Sandakan	5°50′N	$B_3A'r$	II
45	Jesselton	5°51′N	$B_3A'r$	V
46	Labuan	5°17′N	AA′r	II
48	Miri	4°23′N	$B_3A'r$	II
49	Bintula	3°11′N	AA′r	II
50	Kuching	1°29′N	AA′r	III
		INDONESIA		
51	Tarakan	3°19′N	AA′r	III(II)
52	Balikpapan	1°17′N	$B_2A'r$	I
53	Pontianak	0°01′N	$B_4A'r$	II
54	Mapanget	1°32′N	AA′r	III
55	Menado	1°30′N	$B_3A'r$	III
56	Makassar	5°08′S	$B_4A's$	III
57	Dili	8°35′S	DA′d	I
58	Amboina	3°42′N	AA′r	IV
60	Koepang	10°10′S	$C_2A's_2$	I
62	Medan	3°35′N	$B_1A'r$	I
64	Padang	0°56′S	AA′r	III

Station		Latitude	Climatic Grouping	
No.	Name		Thornthwaite's Method	Numer. Taxon. & Disc. Func.
65	Tandjueng Pandan	2°45′S	$B_3A'r$	II
66	Terempa	3°12′N	$B_2A'r$	II
67	Soerabaya	7°16′S	$C_2A's$	I
69	Pasuruan	7°38′S	$C_1A's$	I
71	Djember	8°09′S	$B_1A'r$	I
74	Semarang	7°00′S	$B_1A'r$	I
75	Klaten	7°42′S	$C_2A's$	I
76	Pekalongan	6°53′S	$B_2A'r$	I
77	Wedi-Birit	7°45′S	$B_1A's$	I
79	Tjitajam	6°27′S	AA′r	III
80	Kuyper	6°02′S	$C_1A's$	I
81	Djakarta	6°11′N	$C_2A'r$	I
87	Buitenzorg (Bogor)	6°35′S	AA′r	III
231	Bandjarmasin	3°19′S	$B_3A'r$	I
232	Tjirebon	6°42′S	$B_1A's$	I
233	Tjilatjap	7°44′S	AA′r	III
234	Subang	6°35′S	AA′r	III
235	Serang	6°07′S	$C_2A'r$	I
237	Modjopanggung	8°03′S	$B_1A'r$	I
238	Malang	7°58′S	$B_4A'r$	III
239	Magelang	7°29′S	AA′r	III
240	Kemajoran	6°08′S	$C_2A'r$	I
242	Kadhipaten	6°46′S	$B_4A'r$	III
243	Djokjakarta	7°49′S	$B_1A'r$	I
244	Dadapajam	7°17′S	$B_3A'r$	III
245	Bandung	6°55′S	$(B_2B'_4r)$	III
	THE PHILIPPINES			
88	Aparri	18°22′N	$B_2A'r$	VI
89	Basco	20°27′N	$B_4A'r$	II
90	Echague	16°42′N	$C_2A's$	V
92	Tacloban	11°15′N	$B_1A'r$	I
93	Cebu City	10°20′N	$C_2A'r$	V
94	Manila Airport	14°31′N	$C_2A'w$	IV(V)
95	Legaspi City	13°08′N	AA′r	II
96	Cuyo	10°51′N	$B_1A'w$	IV
97	Iloilo City	10°42′N	$B_1A'w$	V
98	Iwahig	9°44′N	$B_1A'r$	I(V)
99	Surigao	9°48′N	AA′r	III
100	Dagupan City	16°03′N	$B_1A'w$	IV
101	Zamboanga City	6°58′N	$C_1A'd$	V
102	Jolo	6°03′N	$C_2A'r$	I
103	Davao	7°04′N	$C_2A'r$	I

Station		Latitude	Climatic Grouping	
No.	Name		Thornthwaite's Method	Numer. Taxon. & Disc. Func.
		BURMA		
104	Bhamo	24°16′N	$B_2A'r$	VII
106	Mandalay	21°59′N	DA′d	V
107	Akyab	20°08′N	AA′w	IV
108	Yamethin	20°25′N	DA′d	V
109	Toungoo	18°55′N	$B_2A'w$	IV
110	Victoria Point	9°58′N	AA′w	IV
111	Rangoon	16°46′N	$B_3A'w_2$	IV
112	Diamond Island	15°51′N	B A′w	IV
113	Amherst	16°05′N	AA′w	IV
114	Tavoy	14°07′N	AA′w	IV
115	Mergui	12°26′N	AA′w	IV
		PAKISTAN (East Pakistan)		
116	Satkhira	22°43′N	$C_2A'w$	VII
117	Barisal	22°42′N	$B_2A'r$	VII
118	Srimangai	24°19′N	$B_3A'r$	VIII
119	Narayanganji	23°37′N	$B_1A'r$	VII
120	Jessore	23°10′N	$C_2A'r$	VII
121	Chittagong	22°21′N	B A′r	IV
122	Cox's Bazar	21°26′N	AA′r	IV
123	Dinajipur	25°38′N	$B_1A'r$	VII
124	Bogra	24°51′N	$B_1A'r$	VII
		(West Pakistan)		
286	Lahore	31°33′N	DA′d	IX
287	Sialkot	32°30′N	DA′d	IX
290	Khushab	32°18′N	EA′d	IX
291	Montgomery	30°40′N	EA′d	IX
292	Multan	30°12′N	EA′d	IX
293	Bahawalpur	29°23′N	EA′d	IX
294	Khanpur	28°39′N	EA′d	IX
308	Jacobabad	28°18′N	EA′d	IX
309	Sukkur	27°42′N	EA′d	IX
310	Hyderabad	25°23′N	EA′d	IX
311	Karachi (Manora)	24°48′N	EA′d	VII
312	Badin	24°38′N	EA′d	VII
		INDIA (Assam)		
125	Dhubri	26°01′N	B A′r	VIII
126	Tezpur	26°37′N	$B_2A'r$	VIII
127	Mohanbari	27°29′N	AA′r	VIII

Station		Latitude	Climatic Grouping	
No.	Name		Thornthwaite's Method	Numer. Taxon. & Disc. Func.
128	Gauhati	26°05′N	$B_1A'r$	VIII
130	Silchar	24°49′N	$AA'r$	VIII
(West Bengal)				
132	Port Blair	11°40′N	$B_4A'w$	IV
133	Saugor (Sagar) Island	21°39′N	$B_1A'w$	VII
134	Car Nicobar	9°10′N	$B_2A'r$	V
135	Table Island	14°11′N	$B_1A'w$	IV
136	Calcutta	22°32′N	$C_2A'w$	V(VII)
(Orissa)				
138	Cuttack	20°48′N	$C_2A'w$	V
139	Puri	19°48′N	$C_1A'w$	V
(Bihar)				
140	Darbhanga	26°10′N	$C_1A'w$	VII
141	Patna	25°37′N	$C_1A'w$	VII
142	Gaya	24°45′N	$C_1A'w$	VII
143	Dumka	24°16′N	$C_2A'w$	VII
144	Ranchi	23°23′N	$B_1A'w$	VII
145	Daltonganj	24°03′N	$C_2A'w_2$	VII
146	Jamshedpur	22°49′N	$C_2A'w$	VII
(Uttar Pradesh)				
147	Agra	27°10′N	$DA'd$	IX
148	Kanpur	26°26′N	$DA'd$	VII
149	Allahabad	25°27′N	$C_1A'w$	VII
150	Jhansi	25°27′N	$DA'd$	VII
(Madhya Pradesh)				
153	Jabalpur	23°10′N	$B_1A'w_2$	VII
154	Raipur	21°14′N	$C_2A'w_2$	VII
155	Jagdalpur	19°05′N	$B_1A'w$	VII
156	Gwalior	26°14′N	$C_1A'd$	VII
157	Indore	22°43′N	$C_1A'w_2$	VII
265	Sagar	23°51′N	$C_2A'w_2$	VII
(Andhra Pradesh)				
158	Masulipatnam	16°11′N	$DA'd$	V
159	Hyderabad	17°27′N	$DA'd$	VII
160	Visakhapatnam	17°43′N	$DA'd$	V
161	Kakinada	16°57′N	$DA'd$	VII

Station No.	Station Name	Latitude	Climatic Grouping: Thornthwaite's Method	Climatic Grouping: Numer. Taxon. & Disc. Func.
		(Madras)		
162	Madras	13°00′N	$C_1A's$	V
163	Nagapatlinam	10°46′N	$C_1A's_2$	V
164	Pamban	9°16′N	DA′d	V
166	Coimbatore	11°00′N	DA′d	V
		(Mysore)		
165	Bangalore	12°58′N	$C_1A'd$	V
167	Belgaum	15°51′N	$B_1A'w_2$	VII
168	Mangalore	12°52′N	$AA'w_2$	IV
169	Bellary	15°09′N	$B_3A'r$	V
		(Delhi & Punjab)		
152	New Delhi	28°35′N	DA′d	VII(IX)
263	Ludhiana	30°56′N	DA′d	IX
264	Amritsar	31°38′N	DA′d	IX
		(Rajasthan)		
266	Jaipur	26°55′N	DA′d	VII
267	Kotah	25°11′N	DA′d	VII
268	Bikaner	28°00′N	EA′d	IX
269	Jadhpur	16°18′N	EA′d	VII
		(Gujarat)		
270	Ahmedabad	23°04′N	DA′d	VII
271	Dwarka	22°22′N	EA′d	VII
272	Surat	21°12′N	$C_1A'w$	V
273	Bhuji	23°15′N	EA′d	VII
274	Veraval	20°54′N	DA′d	VII
		(Maharastra)		
275	Bombay (Calaba)	18°54′N	$B_2A'w_2$	IV
276	Ratnagiri	16°59′N	$B_3A'w_2$	IV
277	Poona	18°32′N	DA′d	VII
278	Sholapur	17°40′N	DA′d	V
279	Aurangabad	19°53′N	DA′d	VII
280	Nagpur	21°06′N	$C_1A'w_2$	VII
281	Akola	20°42′N	DA′d	VII
		(Kerala)		
284	Fort Cochin	9°58′N	$B_4A'w$	IV
285	Trivandrum	8°29′N	$C_2A'w$	V

Station		Latitude	Climatic Grouping	
No.	Name		Thornthwaite's Method	Numer. Taxon. & Disc. Func.
		CEYLON		
170	Colombo	6°54′N	$B_2A'r$	II
171	Trincomalee	8°35′N	$C_2A's_2$	II
172	Mannar	8°59′N	DA′d	V
173	Hambantota	6°07′N	DA′d	V
176	Badulla	6°59′N	$B_3A'r$	I
177	Kandy	7°20′N	$B_3A'r$	I
178	Maha Illuppallama	8°07′N	$C_1A's$	V
179	Kurunegala	7°28′N	$B_1A'r$	II
180	Anuradhapura	8°21′N	$C_1A's$	V
181	Ratnapura	6°41′N	AA′r	II
182	Ratmalana	6°49′N	$B_2A'r$	II
183	Galle	6°02′N	$B_2A'r$	II
184	Batticaloa	7°43′N	$C_2A's_2$	II
185	Kankesanturai	9°48′N	$C_1A's_2$	V
186	Jaffna	9°39′N	$C_1A's_2$	V
187	Puttalam	8°02′N	$C_1A'd$	V
		THAILAND		
188	Chiang Rai	19°55′N	$B_1A'w$	VII
189	Mae Hong Son	19°18′N	$C_1A'w$	V
190	Chiang Mai	18°47′N	$C_1A'd$	VII
191	Nan	18°47′N	$C_1A'd$	VII
192	Lampang	18°12′N	$C_1A'd$	V
193	Phrae	18°10′N	$C_1A'd$	V
194	Mae Sariang	18°10′N	$C_1A'w$	V
195	Uttaradit	17°37′N	$C_1A'w$	V
196	Mae Sot	16°40′N	$C_2A'w_2$	V
197	Tak	16°50′N	DA′d	V
198	Loei	17°32′N	$C_1A'd$	VII
199	Udon Thani	17°26′N	$C_1A'w$	V
200	Nakhon Phanom	17°30′N	$B_2A'w$	IV
201	Khon Kaen	16°20′N	$C_1A'd$	V
202	Mukdahan	16°33′N	$C_2A'w$	VII
203	Roi Et	16°03′N	$C_1A'w$	V
204	Chaiyaphum	15°45′N	$C_1A'd$	V
205	Ubon Ratchathani	15°15′N	$C_2A'w$	V
206	Nakhon Ratchasima	14°58′N	$C_1A'd$	V
207	Surin	14°53′N	$C_1A'd$	V
208	Phitsanulok	16°50′N	$C_1A'd$	V
209	Phetchabun	16°25′N	$C_1A'd$	V
210	Nakhon Sawan	15°48′N	$C_1A'd$	V

Station		Latitude	Climatic Grouping	
No.	Name		Thornthwaite's Method	Numer. Taxon. & Disc. Func.
211	Lop Buri	14°48′N	$C_1A'd$	V
212	Suphan Buri	14°30′N	$C_1A'd$	V
213	Kanchanaburi	14°01′N	$DA'd$	V
214	Don Muang	13°55′N	$C_1A'w$	V
215	Bangkok	13°44′N	$C_1A'w$	V
216	Prachin Buri	14°10′N	$B_1A'w$	IV
217	Aranyaprathet	13°42′N	$C_1A'w$	V
218	Sattahip	12°39′N	$C_1A'd$	V
219	Chanthaburi	12°37′N	$B_4A'w$	IV
220	Khlong Yai	11°47′N	$AA'r$	IV
221	Hua Hin	12°34′N	$DA'd$	V
222	Prachuap Khiri Khan	11°48′N	$C_1A'd$	V
223	Chumphon	10°27′N	$B_1A'r$	V
224	Ban Dan	9°08′N	$C_2A'r$	V
225	Nakhon Si Thammarat	8°25′N	$B_2A'r$	II
226	Songkhla	7°13′N	$B_1A's$	II
227	Narathiwat	6°26′N	$B_3A'r$	II
228	Ranong	9°58′N	$AA'r$	IV
229	Phuket	7°58′N	$B_2A'r$	V
230	Trang	7°30′N	$B_1A'r$	V

January to December) for all the possible pairs of stations. The weighted pair-group method was used for sorting (or clustering) and a dendrogram was prepared (cf., Fig. 2).

All the necessary computations were carried out with a FACOM 230-60 at the Computer Center of Kyoto University, using the same programs as in the previous paper.[2)]

II Results and Discussions

Figure 2 shows a dendrogram based on the taxonomic distance-weighted pair-group sorting method for the 125 stations. As the taxonomic distances were calculated from the 24 characters, the values equal to or greater than 0.98 are not significant at 5% level.[3)] With this consideration in mind a straight line is drawn on the dendrogram to intersect the distance coordinate at a value of 0.95, so that the smallest number of groups may be separated. In this way, 9 groups are separated, if we neglect those having less than 5 member stations. These 9 groups comprise 5 to 32 member stations, and a total of 115 stations are classified into either of the groups, leaving 10 stations unclassified. Among the latter, there is the one from the highlands of Java, i. e., the station at Bandung (No. 245).

The 9 groups are numbered as Group I to IX, from the top to the bottom of the

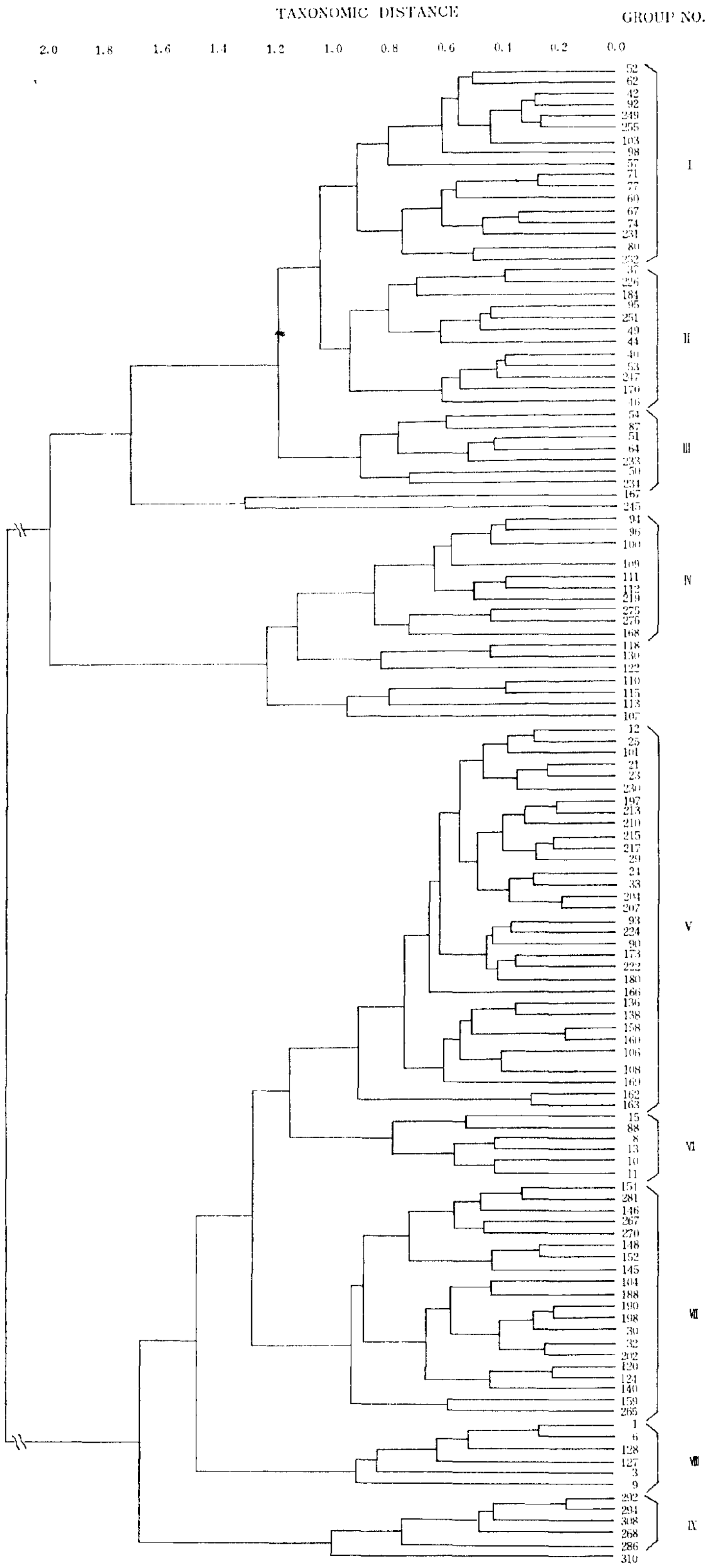

Fig. 2 A Dendrogram for 125 Sample Stations based on Taxonomic Distances and Weighted Pair-Group Method

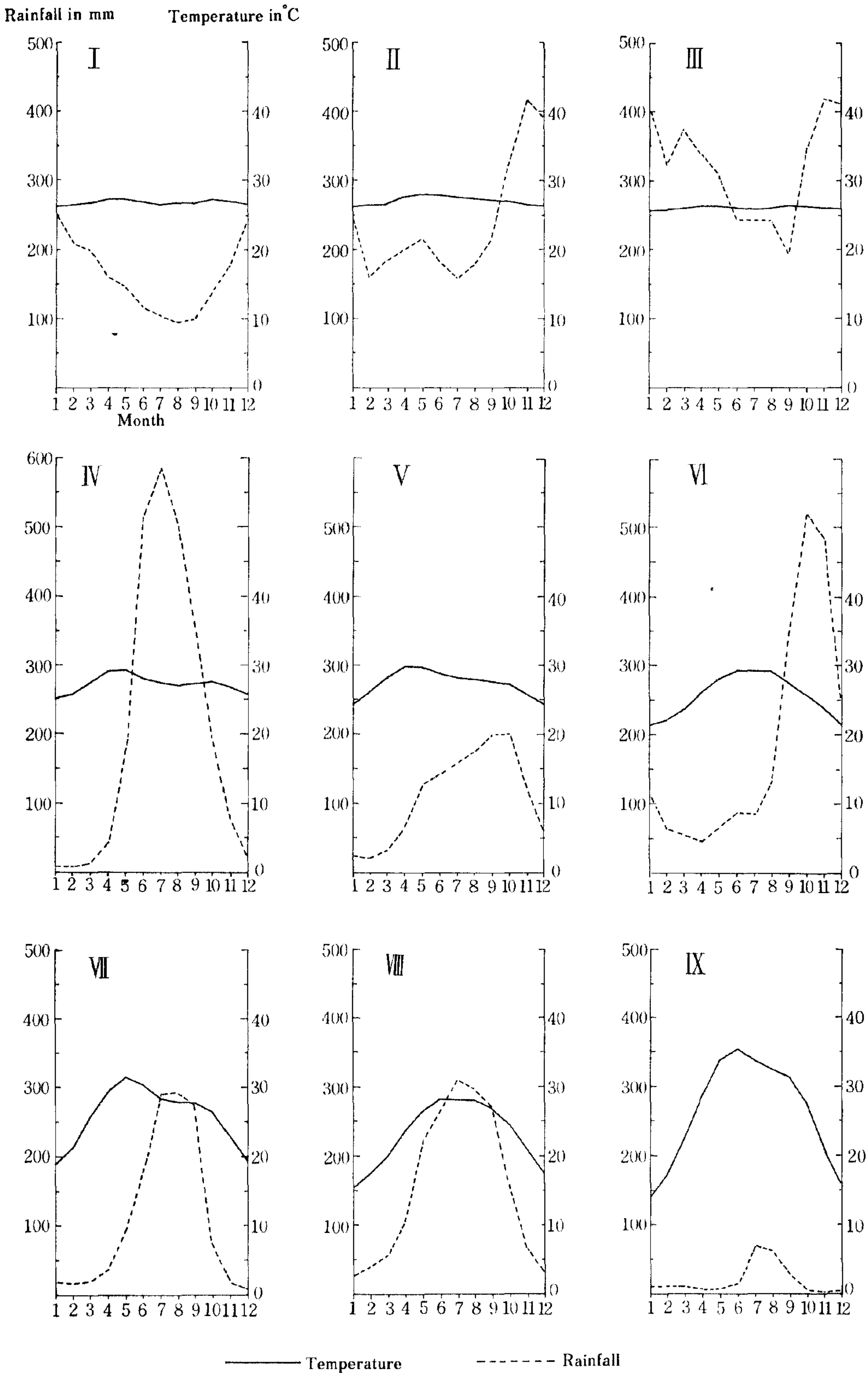

Fig. 3 Illustration of Sample Mean Vectors of the Nine Groups

dendrogram. The mean vectors of the 24 characters for each group are illustrated in Fig. 3. As these groups are believed to represent the major variations of the climate of South and Southeast Asia, the next step is to establish climatic regions as mappable equivalents of the groups. Although the distribution of stations belonging to each of the groups shows fairly good regionality, one difficulty in delineating climatic regions on a map is scarcity of the number of stations for each group relative to the area to be covered.

In order to overcome this difficulty, we introduced the method of discriminant function which has been proven useful in the previous paper which dealt with the Japanese climate.[2] An essential prerequisite for the method is the equality of variance-covariance matrices of the groups. But a method to test the equality can be applied only when the number of member stations of the group exceeds the number of characters, and in the present case only one out of the 9 groups has more than 24 stations. Therefore, as in the previous study on Japanese climate, we put forward an ***a priori*** assumption that the epuality of the covariance matrices is held, and proceed with obtaining discriminant functions.

Using the same computer program as before, discriminant functions were obtained for all the possible pairs of groups, i. e., $\binom{9}{2}=36$ pairs, the coefficients of which are given in Table 2. As the computation in this case was carried out with the standardized data, the same transformation must be applied to the data prior to using the discriminant functions for classification. The formula of transformation and the transformation vectors are as follows;

$$X_i=\frac{x_i-\bar{x}_i}{s_i}$$

where x_i and X_i (i : 1, 2,…………, 24) are original and transformed character values, respectively.

Transformation vectors:

Character No.	1	2	3	4	5	6	7	8	9	10
$\bar{x}$	22.8	24.2	26.3	28.3	29.1	28.6	27.8	27.7	27.4	26.7
s	4.00	3.23	2.34	2.00	2.42	2.47	1.94	1.67	1.41	1.11

Character No.	11	12	13	14	15	16	17	18	19	20
$\bar{x}$	25.0	23.2	101	79	89	104	161	216	250	244
s	2.26	3.54	138.2	106.3	109.2	96.3	117.0	200.3	225.5	193.7

Character No.	21	22	23	24
$\bar{x}$	223	198	160	126
s	138.2	134.0	167.3	155.3

In order to check the validity of the method the 115 stations that made up the 9 groups were reclassified using discriminant functions. The number of misplacement cases is the following 6, or about 5%, which is nearly the same as in the previous

1

Table 2 Coefficients of Discriminant Functions for 36 Pairs of the 9 Groups

Character No.	Coefficients of Discriminant Functions, for Pairs of Groups								
	I–II	I–III	I–IV	I–V	I–VI	I–VII	I–VIII	I–IX	II–III
1	0.287×10^{0}	0.128×10^{1}	0.198×10^{1}	0.327×10^{1}	0.823×10^{1}	0.119×10^{2}	0.179×10^{2}	0.210×10^{2}	0.992×10^{0}
2	-0.114×10^{-1}	0.146×10^{1}	0.128×10^{1}	0.743×10^{0}	0.799×10^{1}	0.900×10^{1}	0.160×10^{2}	0.174×10^{2}	0.147×10^{1}
3	-0.493×10^{0}	0.146×10^{1}	-0.126×10^{1}	-0.273×10^{1}	0.565×10^{1}	0.193×10^{1}	0.128×10^{2}	0.863×10^{1}	0.195×10^{1}
4	-0.567×10^{0}	0.129×10^{1}	-0.282×10^{1}	-0.377×10^{1}	0.144×10^{1}	-0.358×10^{1}	0.529×10^{1}	-0.162×10^{1}	0.185×10^{1}
5	-0.727×10^{0}	0.823×10^{0}	-0.189×10^{1}	-0.225×10^{1}	-0.918×10^{0}	-0.395×10^{1}	0.748×10^{0}	-0.597×10^{1}	0.155×10^{1}
6	-0.111×10^{1}	0.946×10^{0}	-0.108×10^{1}	-0.207×10^{1}	-0.269×10^{1}	-0.383×10^{1}	-0.140×10^{1}	-0.970×10^{1}	0.206×10^{1}
7	-0.166×10^{1}	0.106×10^{1}	-0.117×10^{1}	-0.260×10^{1}	-0.479×10^{1}	-0.291×10^{1}	-0.274×10^{1}	-0.127×10^{2}	0.272×10^{1}
8	-0.130×10^{1}	0.123×10^{1}	-0.475×10^{0}	-0.235×10^{1}	-0.461×10^{1}	-0.194×10^{1}	-0.261×10^{1}	-0.109×10^{2}	0.253×10^{1}
9	-0.791×10^{0}	0.673×10^{0}	-0.822×10^{0}	-0.169×10^{1}	-0.126×10^{1}	-0.151×10^{1}	-0.164×10^{0}	-0.736×10^{1}	0.146×10^{1}
10	0.508×10^{0}	0.163×10^{1}	-0.712×10^{0}	0.739×10^{-1}	0.273×10^{1}	0.171×10^{1}	0.549×10^{1}	0.553×10^{0}	0.113×10^{1}
11	0.126×10^{1}	0.218×10^{1}	0.178×10^{0}	0.292×10^{1}	0.784×10^{1}	0.103×10^{2}	0.150×10^{2}	0.159×10^{2}	0.921×10^{0}
12	0.517×10^{0}	0.129×10^{1}	0.179×10^{1}	0.421×10^{1}	0.926×10^{1}	0.131×10^{2}	0.168×10^{2}	0.206×10^{2}	0.774×10^{0}
13	-0.302×10^{-1}	-0.481×10^{1}	0.722×10^{1}	0.678×10^{1}	0.401×10^{1}	0.697×10^{1}	0.674×10^{1}	0.726×10^{1}	-0.478×10^{1}
14	0.184×10^{1}	-0.423×10^{1}	0.768×10^{1}	0.721×10^{1}	0.550×10^{1}	0.739×10^{1}	0.644×10^{1}	0.759×10^{1}	-0.608×10^{1}
15	0.710×10^{0}	-0.857×10^{1}	0.901×10^{1}	0.811×10^{1}	0.698×10^{1}	0.872×10^{1}	0.693×10^{1}	0.904×10^{1}	-0.928×10^{1}
16	-0.155×10^{1}	-0.672×10^{1}	0.443×10^{1}	0.351×10^{1}	0.425×10^{1}	0.448×10^{1}	0.178×10^{1}	0.551×10^{1}	-0.517×10^{1}
17	-0.151×10^{1}	-0.353×10^{1}	-0.828×10^{0}	0.360×10^{0}	0.172×10^{1}	0.108×10^{1}	-0.173×10^{1}	0.280×10^{1}	-0.202×10^{1}
18	-0.126×10^{1}	-0.244×10^{1}	-0.767×10^{1}	-0.477×10^{0}	0.563×10^{0}	-0.126×10^{1}	-0.289×10^{1}	0.178×10^{1}	-0.118×10^{1}
19	-0.107×10^{1}	-0.281×10^{1}	-0.970×10^{1}	-0.113×10^{1}	0.418×10^{0}	-0.373×10^{1}	-0.414×10^{1}	0.644×10^{0}	-0.174×10^{1}
20	-0.221×10^{1}	-0.394×10^{1}	-0.109×10^{2}	-0.212×10^{1}	-0.100×10^{1}	-0.525×10^{1}	-0.531×10^{1}	0.748×10^{0}	-0.173×10^{1}
21	-0.276×10^{1}	-0.216×10^{1}	-0.597×10^{1}	-0.240×10^{1}	-0.599×10^{1}	-0.297×10^{1}	-0.399×10^{1}	0.150×10^{1}	0.603×10^{0}
22	-0.501×10^{1}	-0.531×10^{1}	-0.122×10^{1}	-0.166×10^{1}	-0.989×10^{1}	0.168×10^{1}	-0.385×10^{0}	0.338×10^{1}	-0.296×10^{0}
23	-0.550×10^{1}	-0.561×10^{1}	0.234×10^{1}	0.131×10^{1}	-0.707×10^{1}	0.366×10^{1}	0.265×10^{1}	0.404×10^{1}	-0.113×10^{0}
24	-0.498×10^{1}	-0.570×10^{1}	0.694×10^{1}	0.585×10^{1}	-0.859×10^{-1}	0.744×10^{1}	0.675×10^{1}	0.756×10^{1}	-0.721×10^{0}
CONST.	0.290×10^{1}	0.525×10^{2}	0.834×10^{0}	-0.186×10^{2}	0.772×10^{1}	-0.473×10^{1}	0.486×10^{2}	0.116×10^{3}	0.496×10^{2}

2

Character No.	Coefficients of Discriminant Functions, for Pairs of Groups								
	II–IV	II–V	II–VI	II–VII	II–VIII	II–IX	III–IV	III–V	III–VI
1	0.170×10^{1}	0.299×10^{1}	0.794×10^{1}	0.116×10^{2}	0.176×10^{2}	0.207×10^{2}	0.704×10^{0}	0.200×10^{1}	0.695×10^{1}
2	0.129×10^{1}	0.754×10^{0}	0.800×10^{1}	0.901×10^{1}	0.160×10^{2}	0.174×10^{2}	-0.181×10^{0}	-0.721×10^{0}	0.652×10^{1}
3	-0.766×10^{0}	-0.224×10^{1}	0.615×10^{1}	0.242×10^{1}	0.133×10^{2}	0.913×10^{1}	-0.272×10^{1}	-0.419×10^{1}	0.420×10^{1}
4	-0.225×10^{1}	-0.321×10^{1}	0.201×10^{1}	-0.301×10^{1}	0.586×10^{1}	-0.106×10^{1}	-0.411×10^{1}	-0.506×10^{1}	0.153×10^{0}
5	-0.117×10^{1}	-0.152×10^{1}	-0.191×10^{0}	-0.322×10^{1}	0.147×10^{1}	-0.524×10^{1}	-0.272×10^{1}	-0.307×10^{1}	-0.174×10^{1}
6	0.326×10^{-1}	-0.958×10^{0}	-0.157×10^{1}	-0.272×10^{1}	-0.290×10^{0}	-0.858×10^{1}	-0.203×10^{1}	-0.302×10^{1}	-0.363×10^{1}
7	0.489×10^{0}	-0.938×10^{0}	-0.313×10^{1}	-0.125×10^{1}	-0.108×10^{1}	-0.110×10^{2}	-0.223×10^{1}	-0.366×10^{1}	-0.585×10^{1}
8	0.826×10^{0}	-0.105×10^{1}	-0.331×10^{1}	-0.641×10^{0}	-0.131×10^{1}	-0.956×10^{1}	-0.171×10^{1}	-0.358×10^{1}	-0.585×10^{1}
9	-0.307×10^{-1}	-0.898×10^{0}	-0.473×10^{0}	-0.714×10^{0}	0.627×10^{0}	-0.657×10^{1}	-0.149×10^{1}	-0.236×10^{1}	-0.194×10^{1}
10	-0.122×10^{1}	-0.433×10^{0}	0.222×10^{1}	0.120×10^{1}	0.498×10^{1}	0.462×10^{-1}	-0.235×10^{1}	-0.156×10^{1}	0.110×10^{1}
11	-0.108×10^{1}	0.166×10^{1}	0.657×10^{1}	0.906×10^{1}	0.137×10^{2}	0.147×10^{2}	-0.200×10^{1}	0.740×10^{0}	0.565×10^{1}
12	0.127×10^{1}	0.369×10^{1}	0.874×10^{1}	0.126×10^{2}	0.163×10^{2}	0.201×10^{2}	0.497×10^{0}	0.291×10^{1}	0.797×10^{1}
13	0.725×10^{1}	0.681×10^{1}	0.404×10^{1}	0.700×10^{1}	0.677×10^{1}	0.729×10^{1}	0.120×10^{2}	0.116×10^{2}	0.881×10^{1}
14	0.583×10^{1}	0.537×10^{1}	0.366×10^{1}	0.555×10^{1}	0.459×10^{1}	0.575×10^{1}	0.119×10^{2}	0.114×10^{2}	0.974×10^{1}
15	0.830×10^{1}	0.740×10^{1}	0.627×10^{1}	0.801×10^{1}	0.622×10^{1}	0.833×10^{1}	0.176×10^{2}	0.167×10^{2}	0.155×10^{2}
16	0.598×10^{1}	0.506×10^{1}	0.580×10^{1}	0.603×10^{1}	0.333×10^{1}	0.707×10^{1}	0.112×10^{2}	0.102×10^{2}	0.120×10^{2}
17	0.680×10^{0}	0.187×10^{1}	0.323×10^{1}	0.259×10^{1}	-0.220×10^{0}	0.431×10^{1}	0.270×10^{1}	0.389×10^{1}	0.525×10^{1}
18	-0.641×10^{1}	0.785×10^{0}	0.182×10^{1}	0.312×10^{-3}	-0.162×10^{1}	0.305×10^{1}	-0.523×10^{1}	0.196×10^{1}	0.300×10^{1}
19	-0.863×10^{1}	-0.535×10^{-1}	0.149×10^{1}	-0.266×10^{1}	-0.307×10^{1}	0.172×10^{1}	-0.689×10^{1}	0.168×10^{1}	0.323×10^{1}
20	-0.869×10^{1}	0.923×10^{-1}	0.121×10^{1}	-0.304×10^{1}	-0.310×10^{1}	0.296×10^{1}	-0.696×10^{1}	0.182×10^{1}	0.294×10^{1}
21	-0.322×10^{1}	0.363×10^{0}	-0.323×10^{1}	-0.213×10^{0}	-0.123×10^{1}	0.426×10^{1}	-0.382×10^{1}	-0.240×10^{0}	-0.383×10^{1}
22	0.379×10^{1}	0.335×10^{1}	-0.488×10^{1}	0.669×10^{1}	0.463×10^{1}	0.839×10^{1}	0.409×10^{1}	0.365×10^{1}	-0.458×10^{1}
23	0.784×10^{1}	0.680×10^{1}	-0.157×10^{1}	0.916×10^{1}	0.815×10^{1}	0.953×10^{1}	0.795×10^{1}	0.692×10^{1}	-0.146×10^{1}
24	0.119×10^{2}	0.108×10^{2}	0.489×10^{1}	0.124×10^{2}	0.117×10^{2}	0.125×10^{2}	0.126×10^{2}	0.116×10^{2}	0.562×10^{1}
CONST.	-0.207×10^{1}	-0.215×10^{2}	0.482×10^{1}	-0.764×10^{1}	0.457×10^{2}	0.113×10^{3}	-0.517×10^{2}	-0.711×10^{2}	-0.448×10^{2}

3

Character No.	Coefficients of Discriminant Functions, for Pairs of Groups								
	III–VII	III–VIII	III–IX	IV–V	IV–VI	IV–VII	IV–VIII	IV–IX	V–VI
1	0.106×10^{2}	0.166×10^{2}	0.198×10^{2}	0.129×10^{1}	0.625×10^{1}	0.992×10^{1}	0.159×10^{2}	0.191×10^{2}	0.495×10^{1}
2	0.754×10^{1}	0.146×10^{2}	0.159×10^{2}	-0.540×10^{0}	0.670×10^{1}	0.772×10^{1}	0.148×10^{2}	0.161×10^{2}	0.724×10^{1}
3	0.471×10^{0}	0.114×10^{2}	0.718×10^{1}	-0.147×10^{1}	0.691×10^{1}	0.319×10^{1}	0.141×10^{2}	0.989×10^{1}	0.838×10^{1}
4	-0.486×10^{1}	0.400×10^{1}	-0.291×10^{1}	-0.956×10^{0}	0.426×10^{1}	-0.756×10^{0}	0.811×10^{1}	0.120×10^{1}	0.522×10^{1}
5	-0.477×10^{1}	-0.747×10^{-1}	-0.679×10^{1}	-0.354×10^{0}	0.976×10^{0}	-0.205×10^{1}	0.264×10^{1}	-0.407×10^{1}	0.133×10^{1}
6	-0.478×10^{1}	-0.235×10^{1}	-0.106×10^{2}	-0.990×10^{0}	-0.161×10^{1}	-0.275×10^{1}	-0.322×10^{0}	-0.862×10^{1}	-0.616×10^{0}
7	-0.397×10^{1}	-0.380×10^{1}	-0.137×10^{2}	-0.143×10^{1}	-0.362×10^{1}	-0.174×10^{1}	-0.157×10^{1}	-0.115×10^{2}	-0.219×10^{1}
8	-0.317×10^{1}	-0.384×10^{1}	-0.121×10^{2}	-0.187×10^{1}	-0.414×10^{1}	-0.147×10^{1}	-0.213×10^{1}	-0.104×10^{2}	-0.227×10^{1}
9	-0.218×10^{1}	-0.837×10^{0}	-0.803×10^{1}	-0.868×10^{0}	-0.443×10^{0}	-0.684×10^{0}	0.658×10^{0}	-0.654×10^{1}	0.425×10^{0}
10	0.720×10^{-1}	0.385×10^{1}	-0.108×10^{1}	0.786×10^{0}	0.344×10^{1}	0.242×10^{1}	0.620×10^{1}	0.127×10^{1}	0.266×10^{1}
11	0.814×10^{1}	0.128×10^{2}	0.137×10^{2}	0.274×10^{1}	0.766×10^{1}	0.101×10^{2}	0.148×10^{2}	0.157×10^{2}	0.491×10^{1}
12	0.118×10^{2}	0.155×10^{2}	0.193×10^{2}	0.242×10^{1}	0.747×10^{1}	0.113×10^{2}	0.150×10^{2}	0.188×10^{2}	0.505×10^{1}
13	0.118×10^{2}	0.116×10^{2}	0.121×10^{2}	-0.441×10^{0}	-0.322×10^{1}	-0.255×10^{0}	-0.480×10^{0}	0.377×10^{-1}	-0.278×10^{1}
14	0.116×10^{2}	0.107×10^{2}	0.118×10^{2}	-0.465×10^{0}	-0.218×10^{1}	-0.286×10^{0}	-0.124×10^{1}	-0.878×10^{-1}	-0.171×10^{1}
15	0.173×10^{2}	0.155×10^{2}	0.176×10^{2}	-0.897×10^{0}	-0.204×10^{1}	-0.292×10^{0}	-0.208×10^{1}	0.303×10^{-1}	-0.114×10^{1}
16	0.112×10^{2}	0.850×10^{1}	0.122×10^{2}	-0.925×10^{0}	-0.183×10^{0}	0.498×10^{-1}	-0.266×10^{1}	0.108×10^{1}	0.742×10^{0}
17	0.460×10^{1}	0.180×10^{1}	0.633×10^{1}	0.119×10^{1}	0.255×10^{1}	0.191×10^{1}	-0.900×10^{0}	0.363×10^{1}	0.136×10^{1}
18	0.118×10^{1}	-0.445×10^{0}	0.422×10^{1}	0.720×10^{1}	0.824×10^{1}	0.641×10^{1}	0.479×10^{1}	0.946×10^{1}	0.104×10^{1}
19	-0.919×10^{0}	-0.133×10^{1}	0.345×10^{1}	0.857×10^{1}	0.101×10^{2}	0.597×10^{1}	0.556×10^{1}	0.103×10^{2}	0.155×10^{1}
20	-0.131×10^{1}	-0.137×10^{1}	0.469×10^{1}	0.878×10^{1}	0.990×10^{1}	0.565×10^{1}	0.558×10^{1}	0.116×10^{2}	0.112×10^{1}
21	-0.816×10^{0}	-0.183×10^{1}	0.366×10^{1}	0.358×10^{1}	-0.150×10^{-1}	0.300×10^{1}	0.198×10^{1}	0.747×10^{1}	-0.359×10^{1}
22	0.699×10^{1}	0.492×10^{1}	0.868×10^{1}	-0.440×10^{0}	-0.867×10^{1}	0.290×10^{1}	0.834×10^{0}	0.460×10^{1}	-0.823×10^{1}
23	0.927×10^{1}	0.826×10^{1}	0.965×10^{1}	-0.103×10^{1}	-0.941×10^{1}	0.132×10^{1}	0.315×10^{0}	0.170×10^{1}	-0.837×10^{1}
24	0.131×10^{2}	0.125×10^{2}	0.133×10^{2}	-0.109×10^{1}	-0.702×10^{1}	0.499×10^{0}	-0.186×10^{0}	0.625×10^{0}	-0.594×10^{1}
CONST.	-0.572×10^{2}	-0.390×10^{1}	0.633×10^{2}	-0.194×10^{2}	0.689×10^{1}	-0.557×10^{1}	0.478×10^{2}	0.115×10^{3}	0.263×10^{2}

4

Character No.	Coefficients of Discriminant Functions, for Pairs of Groups								
	V–VII	V–VIII	V–IX	VI–VII	VI–VIII	VI–IX	VII–VIII	VII–IX	VIII–IX
1	0.863×10^{1}	0.146×10^{2}	0.178×10^{2}	0.368×10^{1}	0.963×10^{1}	0.128×10^{2}	0.596×10^{1}	0.913×10^{1}	0.317×10^{1}
2	0.826×10^{1}	0.153×10^{2}	0.166×10^{2}	0.101×10^{1}	0.805×10^{1}	0.938×10^{1}	0.704×10^{1}	0.837×10^{1}	0.133×10^{1}
3	0.466×10^{1}	0.156×10^{2}	0.114×10^{2}	-0.372×10^{1}	0.717×10^{1}	0.298×10^{1}	0.109×10^{2}	0.671×10^{1}	-0.419×10^{1}
4	0.200×10^{0}	0.907×10^{1}	0.215×10^{1}	-0.502×10^{1}	0.385×10^{1}	-0.307×10^{1}	0.887×10^{1}	0.195×10^{1}	-0.692×10^{1}
5	-0.170×10^{1}	0.300×10^{1}	-0.372×10^{1}	-0.303×10^{1}	0.167×10^{1}	-0.505×10^{1}	0.470×10^{1}	-0.202×10^{1}	-0.671×10^{1}
6	-0.177×10^{1}	0.669×10^{0}	-0.763×10^{1}	-0.115×10^{1}	0.128×10^{1}	-0.701×10^{1}	0.243×10^{1}	-0.586×10^{1}	-0.829×10^{1}
7	-0.313×10^{0}	-0.141×10^{0}	-0.101×10^{2}	0.188×10^{1}	0.205×10^{1}	-0.786×10^{1}	0.173×10^{0}	-0.974×10^{1}	-0.991×10^{1}
8	0.406×10^{0}	-0.259×10^{0}	-0.851×10^{1}	0.267×10^{1}	0.201×10^{1}	-0.624×10^{1}	-0.665×10^{0}	-0.892×10^{1}	-0.825×10^{1}
9	0.184×10^{0}	0.153×10^{1}	-0.567×10^{1}	-0.241×10^{0}	0.110×10^{1}	-0.609×10^{1}	0.134×10^{1}	-0.585×10^{1}	-0.719×10^{1}
10	0.163×10^{1}	0.541×10^{1}	0.479×10^{0}	-0.103×10^{1}	0.276×10^{1}	-0.218×10^{1}	0.378×10^{1}	-0.115×10^{1}	-0.493×10^{1}
11	0.740×10^{1}	0.121×10^{2}	0.130×10^{2}	0.249×10^{1}	0.714×10^{1}	0.806×10^{1}	0.465×10^{1}	0.557×10^{1}	0.920×10^{0}
12	0.886×10^{1}	0.126×10^{2}	0.164×10^{2}	0.381×10^{1}	0.753×10^{1}	0.114×10^{2}	0.372×10^{1}	0.757×10^{1}	0.385×10^{1}
13	0.186×10^{0}	-0.392×10^{-1}	0.479×10^{0}	0.296×10^{1}	0.274×10^{1}	0.325×10^{1}	-0.225×10^{0}	0.293×10^{0}	0.518×10^{0}
14	0.179×10^{0}	-0.777×10^{0}	0.377×10^{0}	0.189×10^{1}	0.933×10^{0}	0.209×10^{1}	-0.956×10^{0}	0.198×10^{0}	0.115×10^{1}
15	0.605×10^{0}	-0.119×10^{1}	0.927×10^{0}	0.174×10^{1}	-0.470×10^{-1}	0.207×10^{1}	-0.179×10^{1}	0.322×10^{0}	0.211×10^{1}
16	0.974×10^{0}	-0.173×10^{1}	0.201×10^{1}	0.233×10^{0}	-0.247×10^{1}	0.127×10^{1}	-0.271×10^{1}	0.103×10^{1}	0.374×10^{1}
17	0.719×10^{0}	-0.209×10^{1}	0.244×10^{1}	-0.641×10^{0}	-0.345×10^{1}	0.108×10^{1}	-0.281×10^{1}	0.172×10^{1}	0.453×10^{1}
18	-0.784×10^{0}	-0.241×10^{1}	0.226×10^{1}	-0.182×10^{1}	-0.345×10^{1}	0.122×10^{1}	-0.162×10^{1}	0.305×10^{1}	0.467×10^{1}
19	-0.260×10^{1}	-0.301×10^{1}	0.177×10^{1}	-0.415×10^{1}	-0.456×10^{1}	0.225×10^{0}	-0.412×10^{0}	0.437×10^{1}	0.478×10^{1}
20	-0.313×10^{1}	-0.319×10^{1}	0.287×10^{1}	-0.425×10^{1}	-0.431×10^{1}	0.175×10^{1}	-0.633×10^{-1}	0.600×10^{1}	0.606×10^{1}
21	-0.576×10^{0}	-0.159×10^{1}	0.390×10^{1}	0.302×10^{1}	0.200×10^{1}	0.749×10^{1}	-0.102×10^{1}	0.447×10^{1}	0.549×10^{1}
22	0.334×10^{1}	0.127×10^{1}	0.504×10^{1}	0.116×10^{2}	0.951×10^{1}	0.133×10^{2}	-0.206×10^{1}	0.170×10^{1}	0.376×10^{1}
23	0.235×10^{1}	0.135×10^{1}	0.273×10^{1}	0.107×10^{2}	0.972×10^{1}	0.111×10^{2}	-0.100×10^{1}	0.377×10^{0}	0.138×10^{1}
24	0.158×10^{1}	0.900×10^{0}	0.171×10^{1}	0.752×10^{1}	0.684×10^{1}	0.765×10^{1}	-0.685×10^{0}	0.126×10^{0}	0.811×10^{0}
CONST.	0.138×10^{2}	0.672×10^{2}	0.134×10^{3}	-0.125×10^{2}	0.409×10^{2}	0.108×10^{3}	0.533×10^{2}	0.121×10^{3}	0.672×10^{2}

study with the Japanese climate ;

Station No.	Grouping by N. T.	Grouping by D. F.
40	II	I
51	III	II
94	IV	V
98	I	V
136	V	VII
152	VII	IX

As can be seen from the result of computation, these are on the border between the two groups concerned ; thus, classification by means of discriminant functions appears to work satisfactorily. Accordingly, the method was applied to the rest of the stations, including the 10 stations that remain unclassified in the numerical taxonomy, and the result as shown in the last column of Table 1, was plotted on a map. Except for the Philippines, stations belonging to one group are so well clustered geographically that delineation of a climatic region as the mappable equivalent of the group is quite easy. Thus, the following 9 climatic regions, which correspond to the 9 groups, were delineated on a map, as shown in Fig. 4 ;

Group I Strait-Sunda Region

Group II Malay-Northern Borneo Region

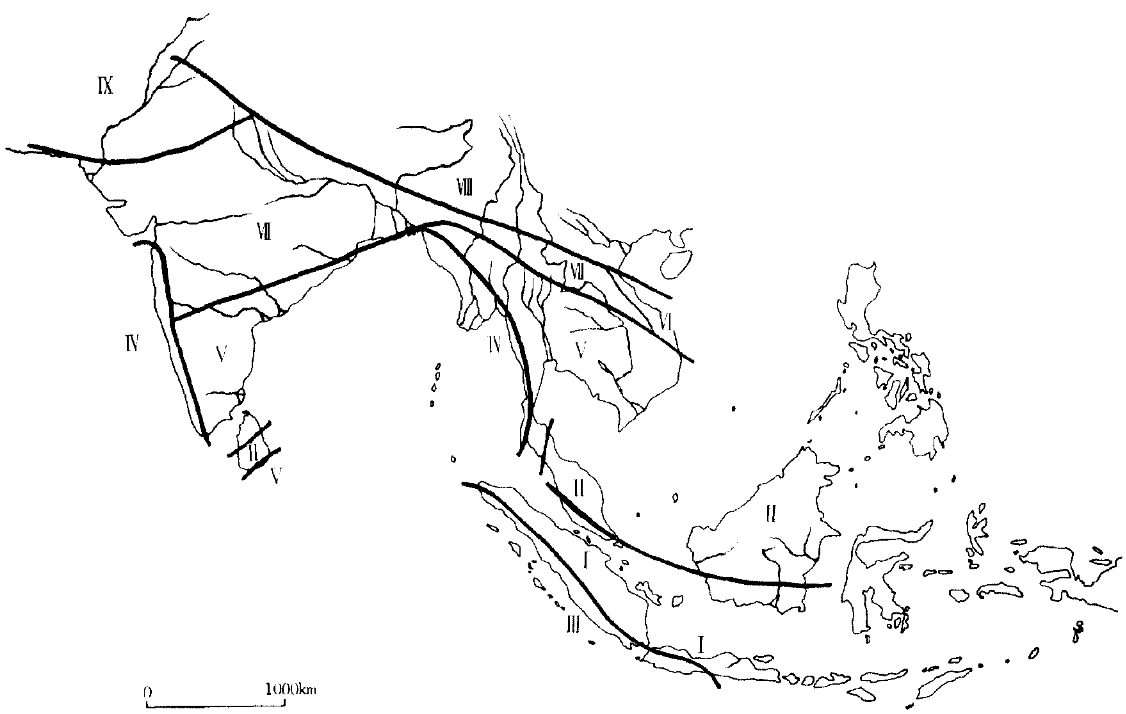

Fig. 4 A Map showing the Climatic Regional Division

Group III　Oceanic Sumatra-West Java Region
Group IV　Southwest-Facing Coastal Region
Group V　Southern Indochina-Southern India Region
Group VI　Middle Vietnam Region
Group VII　Central India-Northern Indochina Region
Group VIII　Tongking-Assam Region
Group IX　Lower Indus Region

The names of the regions are tentatively given so as to show the type region of the respective groups. The Philippines are climatically so complex that with a small number of stations used in this study it was impossible to delineate climatic regions.

A brief description of each group may be as follows (cf., Fig. 3);

Group I　Humid equatorial climate with very small temperature fluctuation; minimum rainfall of ca. 100 mm in Aug. and maximum rainfall of ca. 250 mm in Jan.

Group II　Humid to perhumid equatorial climate with very small temperature fluctuation; minimum rainfall of ca. 150 mm in July and maximum rainfall of ca. 400 mm in Nov.-Dec.

Group III　Perhumid equatorial climate with very small temperature fluctuation; minimum rainfall of ca. 200 mm in Sept. and maximum rainfall of over 400 mm in Nov.-Jan.

Group IV　Tropical monsoon climate with small temperature fluctuation; minimum rainfall of less than 10 mm in Jan.-Feb. and maximum rainfall of over 550 mm in July.

Group V　Tropical monsoon climate with small temperature fluctuation; minimum rainfall of ca. 20 mm in Feb. and maximum rainfall of ca. 200 mm in Sept.-Oct.

Group VI　Tropical monsoon climate with moderate temperature fluctuation; minimum rainfall of ca. 50 mm in March-April and maximum rainfall of ca. 500 mm in Oct.-Nov.

Group VII　Tropical to subtropical monsoon climate; minimum rainfall of less than 10 mm in Dec. and maximum rainfall of ca. 300 mm in July-Aug.

Group VIII　Subtropical monsoon climate; minimum rainfall of ca. 30 mm in Dec. and maximum rainfall of ca. 300 mm in July-Aug.

Group IX　Subtropical arid climate; slightly monsoonal with a rainfall maximum in July-Aug. (60–70 mm), but for the rest of the year rainfall does not exceed 30 mm.

A comparison with the result of the previous study using Thornthwaite's method reveals a considerable difference in the regional division. One of the main causes for the difference may be found in the use of taxonomic distances in the numerical taxonomy.

A slight difference in the pattern of rainfall in a year is neglected in the present result. The so-called summer rain and winter rain regions are not adequately expressed unless the difference in rainfall by seasons is prominent. Another cause may be found in insensitivity of Thornthwaite's method to temperature differences. As the lower threshold for the thermal efficiency class A′ has been set too low, all the lowland of the wide region is classified into one thermal efficiency class. The differences such as found between group V and VII and VII and VIII in the present study has been overlooked in Thornthwaite's method.

In order to utilize the climatic regions as the basis of classifying alluvial soils, they have to be characterized in relation to the soil processes, and the type and performance of vegetations. This task has not been undertaken in this present work and is left to a later study. The method of canonical analysis seems to be a useful tool for such a study.

Summary

The method of numerical taxonomy in combination with discriminant function has been proven useful in setting up readily mappable climatic regions. Nine regions have thus been established for the rice-growing South and Southeast Asia, as shown in Fig. 4. The mean monthly temperatures and rainfalls are illustrated in Fig. 3 for the sample stations belonging to each region. Climatic features of each region have been briefly described.

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