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THE CLIMATIC REGIONS OF JAPAN*)

With 1 figure, 1 supplement (II)**) and 2 tables

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Zusammenfassung: Die Klimaregionen Japans

In der vorliegenden Arbeit wurde versucht, Japan empirisch nach makro-, makro-meso-, meso-, meso-regional, und mikro-regional-klimatischen Gesichtspunkten zu untergliedern. Dabei ergeben sich für die makroklimatische Gliederung 5, für die makro-mesoklimatische 13 und für die mesoklimatische Gliederung 39 Regionen. Diese Zahl entspricht in etwa der Zahl der von anderen Klimatologen in vorangegangenen Untersuchungen gewonnenen Regionen. Die Zahl der Regionen für die meso-regional-klimatische Gliederung beläuft sich auf 186 und die für die mikro-regional-klimatische Gliederung auf 323 Regionen. Die durchschnittliche Ausdehnung der nach mikro-regional-klimatischen Gesichtspunkten gegliederten Regionen beträgt ca. 1150 km². Dieser Wert entspricht den üblichen mikro-, lokal- oder geländeklimatischen Werten. Typische Beispiele für Regionen mit Stadtklima, Gebirgsklima usw. werden im einzelnen vorgestellt. Die erarbeiteten Klimaregionen sind in einer beigefügten Karte (II) in Farbe dargestellt.

I. Introduction:

The climate of Japan has been studied under regional aspects since the end of the last century, mainly, on a macro or meso-scale basis. In order both to characterize regions from the point of view of pure climatology and to contribute to the detailed planning of agriculture, industry etc. from the point of view of applied geography, local or micro-climatic subdivisions of the regions are needed.

In the course of preparing the 26 volumes of the "Regional Geography of Japan" edited by AONO et al. (1968–1979) the author has studied the climatic subdivisions of Japan on a local or micro-climatic scale. These studies were taken up in the late nineteenfifties, but first results for the Kanto district were not published until 1967 (YOSHINO, 1967). This paper summarizes the studies on the climatic regions of Japan.

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II. Problems in climatic subdivision:

Climatic subdivisions are regional divisions based on a climatological system of classification. In general, classification means arranging objects into groups or sets on the basis of their similarities or relationships (SOKAL, 1974). Many scholars have contributed to climatic classification and division since the last century, and KNOCH and SCHULZE (1954) have summarized their work.

There are two methods in climatic division: one is empirical or inductive, the other genetic or deductive. In this study on local or micro-scale subdivision, in addition to macro- and meso-scale subdivisions, an empirical method is used, as the genetics or causes of climatic phenomena are mostly of global scale. This is larger than meso-scale and, accordingly, a subdivision of local scale must be carried out empirically mainly based on local climatic factors such as micro-topography, local distribution of land and sea etc. The horizontal scales of the regions used in this paper are as follows (YOSHINO, 1975): macro-scale from 200 to 50 000 km., meso-scale from 10 to 200 km. and local or micro-scale from 100 m. to 10 km.

Examples of climatic subdivisions in local or micro-scale are found in the climatic atlasses published by the German Weather Service (Deutscher Wetterdienst). They include a map showing "Klimabezirke" (climatic districts), which are subdivided into areas of 2600–3 500 sq. km. The horizontal scale of 50–60 sq. km. corresponds with the local or micro-scale mentioned above.

III. Previous studies on climatic subdivisions of Japan:

The oldest description of climatic subdivisions of Japan for the purpose of weather forecasting was made by NAKAGAWA in 1899. In a textbook on geography by YAZU (1912) which was broadly used from about 1910 until about 1930, it was shown that Japan has to be divided into four climatic regions, if the Supan classification method of world climates is applied (SUPAN, 1911). A climatography by SANDERS (1920) contains a simple division which refers to a study by the Japanese Agricultural Bureau published in 1910.

Fukui (1933) presented a detailed climatic division of Japan based on his previous work by empirical methods (Fukui, 1928). He divided Japan into three main parts:

1. South Japan and the southern parts of the Amami-Oshima Islands having a mean annual temperature >20 °C.
2. Middle Japan consisting of Kyushu, Shikoku, Honshu and the Ōshima Peninsula of Hokkaido, where the mean annual temperature is <20 °C and the monthly mean temperature during at least three months <0 °C.
3. North Japan, the remaining part of Hokkaido, where the monthly mean temperature is <0 °C during 4 months or more.

His division of the second order, based on the mean annual and monthly precipitation and its seasonal changes, shows ten meso-climatic regions. The third order division considered again the seasonal changes of precipitation and furthermore the number of days with frost, snow, and ice, their duration, local wind, duration of sea fog, sea ice and frozen ice in the coastal regions or mountain fog in the mountainous regions. This division of the third order resulted in 26 regions and 36 subregions.

Later, Fukui (1934, 1938) applied Köppen's classification method (Köppen, 1931) and Isozaki (1933) the old method of Thornthwaite (1931) to Japan, using the observed data of about 100 stations. Trewartha himself developed an empirical climatic division of Japan in the first of his regional geography (Trewartha, 1945), but applied Köppen's classification method in his second edition (Trewartha, 1965).

Based on the data observed at about 2000 climatological stations, Sekiguti (1949) presented a climatic classification of Japan in a detailed colour map using Köppen's method. Unfortunately, however, Hokkaido and the Nansei Islands (Ryukyu) are not shown in this map. It was made clear that

1. Cfa climate prevails in Japan generally,
2. with increasing altitude two types of changes occur, i.e. Cfa, Cfb, Dfb, and Cfa, Dfa, Dfb,
3. Cw climate does occur sporadically in Japan,
4. Dfc climate is found in the regions above 2 000 m in Central Japan and 1 500 m in the Tohoku District,
5. EH climate occurs at an altitude of more than 2 500–2 900 m in the North and Central Japanese Alps and of more than 2 300–2 400 m in the South Japanese Alps and in the mountains of the Kanto District.

Sekiguti (1952, 1959) developed a new classification method based on the monthly changes as well as on the annual means of air temperature, precipitation, sunshine and water surplus. In order to arrive at an objective division of regions he calculated correlation coefficients by forming pairs of all monthly values of two neighbouring stations and drew a boundary line between them, if the correlation coefficient was of no statistical significance.

A genetic classification was attempted by Suzuki (1962, 1966) on the basis of prevailing airmasses for a division of the first order and of distribution areas of winter precipitation for a division of the second order. These were subdivided further by considering rainfall totals of frontal and cyclonic activities. In a later study Suzuki (1974) pointed out that these climatic regions correspond quite well with the distribution of some plants and anthropogeographical phenomena. Other genetic classifications of climate took into account precipitation maxima during the bai-u, shurin-typhoon, or winter monsoon seasons (Maejima, 1967).

According to the new classification method by Thornthwaite (1948) Japan can be divided into 25 regions (Fukui, 1957, 1958). Similar to the radiation-aridity index of Budyko (1956), R/LP, where R is net radiation, L sensible heat of evaporation and P annual precipitation, Uchijima (1962) proposed an agroclimatic classification of paddy field environments of Japan by developing an index $Sw^*/L \cdot P^*$, where Sw^* is the net radiation on the water surface and P^* the precipitation on the water surface. He divided Japan at first into four regions by accumulated water temperatures of less than 3 000 °C, 3 000–4 000 °C, 4 000–5 000 °C and of more than 5 000 °C and then by the index. This latter division resulted in 15 regions.

Schwind (1967) in his physical regional geography of Japan developed a division of his own which is based on Köppen's classification and on the classification of Fukui. The subdivided regions are 6 regions ("Regionen") of the first order, 22 provinces ("Provinzen") of the second order and 56 districts ("Distrikte") of the third order. Mizukoshi (1977) in his climatographical description presented a first order climatic division of 7 regions.

The Japan Meteorological Agency established agricultural meteorological regions to establish their observation network about ten years ago. Their map shows approximately 690 micro-scale subdivisions, the most detailed subdivision so far, but which, unfortunately, provides no climatic boundaries of macro- or meso-scale.

Table 1 summarizes the results and shows the regional divisions of the first, second and third order by the different researchers. From this the following general statements may be derived.

1. There are 2–8 subdivisions of the first order. When ommitting Trewartha's division combining regions of the first and second order, however, then there are only 2–6 subdivisions of the first order.
2. The number of subdivisions of the second order is relatively large, when the empirical method is employed (15–23), but relatively small, when the genetic method is employed (5–7).

Table 1: The number of climatic regions of Japan in the 1st, 2nd and 3rd order in the previous studies

Researchers and year of publication	Number of the regions			Remarks
	1st order	2nd order	3rd order	
Fukui, 1933	3	13	34	Counted for the Japanese territory at present by the writer.
Trewartha, 1945	8	–	–	Except Nansei Isl.
Sekiguti, 1949	3	8	–	By Köppen's method. Except Hokkaido and Nansei Isl.
Fukui, 1957	–	23	–	Counted transitional climate region as one respectively. Except Nansei Isl.
Suzuki, 1962, 1966	2	5	8	Except Nansei Isl.
Uchijima, 1962	4	15	–	Except Nansei Isl.
Maejima, 1967	3	7	10	Except Nansei Isl.
Schwind, 1967	6	22	56	For the Japanese territory at present.
Mizukoshi, 1977	7	–	–	For the territory roughly at present.

3. The same tendency can be observed when dealing with the third order: There are 34 subdivisions according to FUKUI and 56 according to SCHWIND by the empirical division, but 8 according to SUZUKI and 10 according to MAEJIMA by the genetic division.
4. In the case of empirical division, the number of regions in the second order is roughly four times as large as that of the first order, and the number of divisions of the third order is about three times as large as that of the second order.
5. The actual area of the subdivisions comprises 60 000–70 000 sq. km in the first order, 15 000–25 000 sq. km in the second order and 6 600–11 000 sq. km in the third order.

IV. Method of climatic subdivision:

In this study an attempt is being made to divide the climatic regions from the first to the fifth order. In reference to the standard scale of climates (YOSHINO, 1975), the scales of the five orders are as follows: The first order is of macro-scale, the second order between macro- and meso-scale, the third order is of meso-scale, the fourth between meso- and local scale and the fifth order of local or micro-scale. The letters for each order used in this study as well as the numbers of the regions thus obtained are shown in Table 2 and Supplement II.

The boundaries are established as follows: The boundary between I and II considers the 180 °C warmth index line by KIRA (1977), or approximately the 20 °C isotherm of the annual mean air temperature. The boundary between II and III coincides in most parts with the 0 °C isotherm of the mean daily minimum temperature in January which is an indicator for frequent frost occurrence. This boundary roughly corresponds with the 16 °C isotherm of the annual mean temperature on the Pacific coast of Honshu, Shikoku and Kyushu. The boundary between III and IV which is the most important and most significant boundary in Japan reflects the divide between the Pacific-side climate and the Japan-Sea climate. The boundary is drawn in accordance with the 50 cm-isoline of mean maximum snow depth which plays a definite role as a delimiting factor for the distribution of vegetation (YOSHINO, 1978), human activity (ARISUE, 1955) and social life (SUZUKI, 1974). The boundary between IV and V is drawn by taking into account the regions where the monthly mean temperature is 0 °C in four months or more.

Table 2: Scales and letters of the respective orders and numbers of regions obtained in this study

Order	Scale of subdivision	Examples of letters used	Number of regions
1st	Macro	I, II, III, IV and V	5
2nd	Macro-meso	II_1, II_2, IV_1, V_2 ———	13
3rd	Meso	A, B, C, ———	39
4th	Meso-local	a, b, d, g, ———	186
5th	Local-micro	a_1, b_2, c_1, g_4, ———	323

The subdivision of the second order has been carried out in such a way that the regions obtained have a horizontal range of 300–600 km. The regions of the 2nd order are mostly of longish shape coinciding with the geographical regions or districts generally recognized. For instance, Region IV_1 corresponds to "Sanin" District, Region IV_2 to "Hokuriku" District and Region III_3 to the "Chubu" and "Kanto" Districts.

The regions of the 3rd, 4th and 5th order are divided in the following way: At first distribution maps were drawn up using the long-term annual mean value of the climatic stations (Japan Met. Agency, 1958, 1959, 1972). The scale of the original working maps has been

1:1 000 000 and the number of climatological stations is about 1 900 for the whole of Japan. The basic maps produced for the present study are concerned with:

Air temperature:

a Climatic extremes:

1. the monthly mean minimum temperature observed in January
2. the monthly mean maximum temperature in August
3. the absolute minimum temperature observed
4. the absolute maximum temperature observed

b Climatic means:

1. the monthly mean temperature in January
2. the monthly mean temperature in August
3. the annual mean temperature

Precipitation:

c Climatological precipitation intensities:

1. the absolute daily maximum precipitation observed
2. the number of days with precipitation 1 mm/day or more
3. the number of days with drizzle (0.1–1.0 mm/day)

d Climatological means:

1. the monthly precipitation in January representing the winter monsoon season
2. the monthly precipitation in June representing the bai-u season
3. the monthly precipitation in August representing the summer monsoon season
4. the monthly precipitation in September representing the typhoon season

In a first step every isotherm, isohyetal or isoline map is subdivided in accordance with the following phenomena:

1. Significant values are considered in particular. For example, the 0 °C, −3 °C, −6 °C isotherms on the maps of the monthly mean minimum temperature are applied in the case of Kanto District. The criteria of significance vary from district to district.
2. Special attention is given to the areas, where the isotherms, isohyetes or isolines run closely, in other words, where their gradient is steep. Here again the criteria of what constitutes steep gradients vary from district to district. In this study the criteria have been determined subjectively.

In a second step these subdivisions are projected on each other in the following manner: The map of subdivision I is obtained by projecting the maps No. 1–4 of the climatological extremes of air temperature on each other, the map of subdivision II by projecting maps No. 1–3 of the climatological means of air temperature on each other and the map of subdivision III by projecting map I onto map II.

In the same way the map subdivision VI relating to precipitation has been drawn up by merging the map of subdivision IV showing climatological precipitation intensities with the map of subdivision V containing the climatological means. Finally, the map of subdivision VII has been prepared according to the prevailing wind conditions studied by KAWAMURA (1977). In a last step the maps of subdivision III, VI and VII have been merged into one map, the map of climatological subdivision. In this case the lines on the three maps were treated equally in general which means that air temperature, precipitation and wind conditions are regarded as having the same values in the subdivision of climate in a small scale.

V. Results:

a) Macro- and meso-scale subdivisions

The results of subdivisions into those of the first, second and third order are dealt with first. The subdivision shows 5 regions of the first order, 13 regions of the second order and 39 regions of the third order, all of them shown in Fig. 1. The number of the subdivisions of the third order is almost the same as that by FUKUI (1933) and two thirds of that by SCHWIND (1967). Their names are as follows:

Region I_1 — Nansei Islands and others.

A: Iriomote, and Ishigaki Isls., B: Miyako, Okinawa and Yoron Isls., C: Oki-no-erabu, Amami-ōshima, and Kikai Isls., and D: Oki-no-daito, Minamidaito, and Kitadaito Isls.

Region I_2 — Ogasawara Islands and others.

A: Iwo Isl., B: Ogasawara Isls., and C: Torishima Isl.

Region II_1 — The Pacific coast of South Kyushu and Shikoku.

A: Yaku Isl., Tanegashima Isl., and the Pacific coast of South Kyushu, and B: The Pacific coast of Shikoku.

Region II_2 — Part of the Pacific coast from Kii Peninsula to Bōsō Peninsula.

A: The Pacific coast of Kii and Atsumi Peninsulas, and B: The Pacific coast of the Izu and Bōsō Peninsulas.

Region III_1 — Kyushu and a part of Yamaguchi Prefecture.

A: The lowlands of western Kyushu, B: The central mountain areas of Kyushu, and C: Northern Kyushu, Gotō Rettō, Tsushima and other islands.

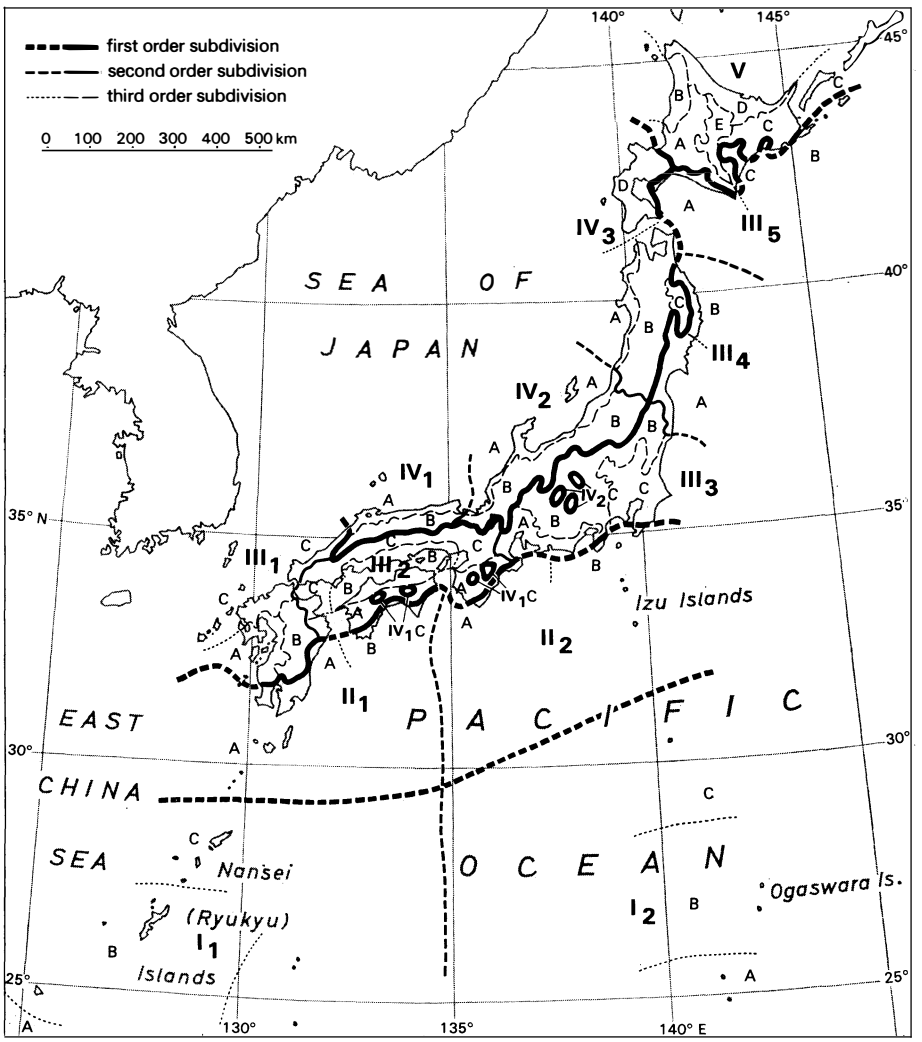


Fig. 1: The climatic regions of Japan

Region III_2—Setouchi (Inland Sea region) and its surrounding region.

A: A part of Kyushu, and most parts of the mountain areas of Shikoku and Kii, B: The lowlands of Shikoku and Chugoku and Setouchi area in a narrow sense, and C: A zonal area extending from a part of Kyushu to Kii mountainous area via Chugoku Mountains.

Region III_3—Chubu and Kanto Districts, except the Pacific coast areas, and the mountain regions exposed to the Japan Sea climate.

A: The region surrounding Ise Bay and Tokai area, B: The mountainous regions of Chubu, northern Kanto and southern Tohoku, and C: The main part of the Kanto District.

Region III_4—The Pacific coast of Tohoku District.

A: The Pacific coast, Sendai Plain, and the lowland of the river Kitagami, and B: The Sanriku coastal area.

Region III_5—The Pacific coast of Hokkaido.

A: The eastern edge of Ōshima Peninsula and the Pacific coast from Muroran to Cape Erimo, and B: The plains of the river Tokachi and of the lower course of the river Kushiro, the Nemuro Peninsula, the Habomai and the Shikotan Islands.

Region IV_1—The greater part of the Japan Sea side of the Chugoku District.

A: The coastal area and Oki Islands, B: The mountain area, and C: The detached areas of the alpine or subalpine zones in Shikoku and Kii Peninsula.

Region IV_2—The Japan Sea side region of the Chubu District.

A: The Hokuriku coastal area and the islands of Sado and Awashima, B: The mountainous areas of Hokuriku, Chubu, northern Kanto, and Fukushima Prefecture, and C: alpine or subalpine zones of the Chubu District.

Region IV_3 — The Japan Sea side of the Tohoku District and the southern peninsula of Hokkaido.

A: The Japan Sea coast of the Tohoku District, B: The central mountainous areas of the Tohoku District, C: The central and northern parts of Kitagami Mountains, and D: Ōshima Peninsula, Okushiri Island, the Iburi Mountains and Shikotan Peninsula.

Region V — The main part of Hokkaido.

A: The river basin of the Ishikari, the southern Yubari Mountains and the Hidaka area, B: The area surrounding the Teshio Mountains and Mount Shokanbetsu, and the Rishiri and Rebun Island, C: Mountainous areas of Tokachi and Kushiro and Kunashiri and Etorofu Isls., D: Okhotsuk coastal area of Soya and Abashiri, and E: Central high mountainous areas of Hokkaido composed of Ishikari, Hidaka and the Yubari Mountains.

b) Local and micro-scale subdivisions

The results of the local and micro-scale subdivisions are shown in the colored map. The number of the subdivisions of the fifth order amount to 323 as shown in Table 2. The average size of a region is 1 150 sq. km, an area of approximately 34 by 34 km. One can say that this figure agrees with the standard scales for local or micro-scale climatic regions of the order of 10 km.

In this study the author refrains from describing each region due to lack of space. However, several examples of the typical local and micro-climatic regions such as the regions with urban climate, mountain climate, basin climate, cape climate and plain climate are given.

Typical regions of urban climate

Tokyo is a region of core urban (III_3, Cc_2) and of surrounding suburban climate (III_3, Cc_1). In Region Cc_2 air temperature is higher, vapour pressure lower, relative humidity much lower, the number of fog days much smaller, and the amount of dust fall decreasing (Yoshino, 1975). In Region Cc_1 these tendencies are less marked but still clearly to be noticed. In contrast, country wind components develop more in Region Cc_1, than in Region Cc_2.

Other regions of typical urban climates are found in Nagoya (III_3, Cd_2) and in Osaka (III_2, Cf_2). The climatic differences between the centers of these regions and their surrounding areas are smaller than in the core of Tokyo, due to the difference both in area and in population.

Regions of typical mountain climates

In Kyushu the most typical mountain climate is found in Yakushima Island (II_1, Aa_2). In the valleys of Mount Miyanoura (1 935 m) of this island 2–3 m of snow accumulation is not infrequent in winter, although it is located at 30° 30′ N. In Shikoku, the Japan Sea side climate can be found in the region of Mount Ishizuchi (1 982 m) with its surrounding area (IV_1, Ca), and in the region of Mount Tsurugi (1 955 m) and its surrounding area (IV_1, Cb), despite their location on the Pacific side. In these regions winter snow is characteristic in particular. The same applies to the Regions IV_1, Cc and IV_1, Cd of the Kii Peninsula. Heavy rain fall can be observed in these regions during the bai-u and typhoon seasons, but maximum precipitation is found in winter, despite the fact that these regions are located on the Pacific side. Mount Odaigahara (1 695 m) in Region IV_1, Cd shows the highest mean annual precipitation in Honshu, i.e. 5 186 mm at the Odaigahara climatological station (1 566 m). Regions IV_2, Bd_4, Ca, Cb and Cc are the so-called Japanese Alps of central Japan. The peaks are generally higher than 3 000 m. The climate is marked by strong westerly winds, low temperature and heavy snow fall.

Regions of typical basin climates

In Japan there are many regions with typical basin climates characterized by high diurnal ranges of temperature, a large number of days with frost, frequent fog, low wind speed, mountain and valley breezes and a relatively large number of days with thunderstorms. An example is the Hita basin of Region III_1, Be_3 in Kyushu. Region III_3, Bj_2 in central Japan might be a further good example. The basin climate in Hokkaido is characterized by a very low minimum temperature. The absolut minima are −41,5 °C at Bifuka (Region V, Ad_3) recorded on January 27, 1931, −41,3 °C at Kamiotoineppu (Region V, Ad_3) recorded on the same day, −41,0 °C at Asahikawa (Region V, Ad_2) recorded on January 29, 1902, and −40,8 °C at Moshiri (Region V, Bd) recorded on January 29, 1977. These stations are located at the bottom of the basins. The monthly mean minimum temperature here is also low, mostly < −19 °C. It is worth noting that these values are observed at stations located in areas between 43–45° N.

Regions of typical cape climate

The cape climate is one of the outstanding local and micro-climatic features in Japan. This climate is characterized by high wind speed, salty wind effect, high minimum temperature and relatively low maximum temperature. For instance, cape Ashizuri in Region II_1, Ba_2 has a monthly mean minimum temperature of 7,3 °C in January as against 1,6 °C at Tosashimizu located about 12 km away from the coast. The horizontal gradient reaches about 0,48 °C/1 km. This may be attributable to the fact that the warm current flows near the cape and the strong monsoon winds do not form strong ground inversions, which are effective partic-

ularly in winter. Region II_1, Bc_2, Region II_2, Bb_2, Region III_3, Ce_2 and Region III_5, Ad_2 may also be good examples of cape climate in our country.

Regions of typical plain climate

In the Kanto Plain there is a typical plain climate: Region III_3, Cb_2, where dry and cold northwesterly fall winds prevail in the winter monsoon period (YOSHINO, 1970) and south or southeasterly warm winds are predominant in the summer monsoon period. The centre of this region has a relatively dry climate. In summer, low pressure systems are produced locally. Southerly winds bring the polluted air from the Tokyo area to this region.

The other example becomes evident in the Tokachi Plain (III_5, Bb). In this region, the strong local wind, "tokachi-harukaze", prevails in spring, while the winter is very cold, because of the strong ground inversion, and precipitation is relatively scarce through the seasons.

References

AONO, H. et al.: Nihon chishi (Regional geography of Japan). 26 vols., Ninomiya-shoten, Tokyo (1968–1979).*)

ARISUE, T.: Snow accumulation and bus communication. Tenki (1955), *2*, 32–35.*)

BUDYKO, M. I.: Teplovoi balans zemnoi poverkhnosti. Gidromet. Izdat., Leningrad (1956), 1–254.

FUKUI, E.: On the climatic classification of Japan. Geog. Rev. of Japan, *4* (1928), 841–853.*)

– : The climatic provinces of Japan. Geog. Rev. of Japan, *9* (1933), (1) 1–17, (2) 109–127, (3) 195–219, (4) 271–300.**)

– : Köppen's climatic classification and its application to Japan. Rissho-Daigaku Chirigakkaishi (1934), (1), 40.*)

– : Climatology. Kokinshoin, Tokyo (1938), 1–566.**)

– : The second Thornthwaite climatic classification of Japan. Tokyo Geog. Papers (1957), (1), 103–112.*)

– : The second Thornthwaite climatic classification of Asia. Tokyo Geog. Papers (1958), (2), 47–64.*)

ISOZAKI, M.: The new Thornthwaite climatic classification and its adaptation to Japanese region. Jour. Geog., Tokyo, *45* (1934), 234–245.*)

Japan Meteorological Agency: The temperature of Japan; Monthly averages, Kansoku-gijutsu-shiryo (1958), (10), 1–178.

– : The precipitation of Japan; Monthly averages, ibid (1959), (13), 1–185.

– : The monthly normals of temperature and precipitation at climatological stations in Japan (1941–1970), ibid (1972), (36), 1–209.

KAWAMURA, T.: Areal distribution of surface winds in Japan. Tech. Rep. Japan Meteorological Agency (1977), (91), 1–76.**)

KIRA, T.: A climatological interpretation of Japanese vegetation zones. In: Vegetation science and environmental protection, ed. by A. Miyawaki and R. Tüxen, Maruzen, Tokyo (1977), 21–30.

KNOCH, K. und SCHULZE, A.: Methoden der Klimaklassifikation. Pet. Geog. Mitt. (1954), Ergänzungsheft, (249), 1–79.

KÖPPEN, W.: Grundriß der Klimakunde. Berlin (1931), 1–388.

MAEJIMA, I.: A climatic division of Japan. In: Chirigaku zusetsu, ed. by M. Ichikawa et al., Kokinshoin, Tokyo (1967), 31.*)

MIZUKOSHI, M.: Climatic division and climatography. In: Climate of Japan, ed. by E. Fukui, Elsevier, Amsterdam, and Kodansha, Tokyo (1977), 225–270.

NAKAGAWA, G.: On the climatic division of Japan. Jour. Geog., Tokyo (1899), *11*, 347–354.*)

SANDERS, E. M.: Climatic zones of Japan and Formosa. Mon. Wea. Rev. (1920), *48*, 404–408.

SCHWIND, M.: Das japanische Inselreich. Walter de Gruyter, Berlin (1967), 1–581.

SEKIGUTI, T.: The Köppen climatic classification of Japan. Shakaichiri, Tokyo (1949), (15), 12–16.*)

– : Some problems of climatic classification: A new classification of climates of Japan. Proc. 8th General Assembly, 18th Congr. of IGU (1952), 285–290.

– : Climatic regions in Japan. Tokyo Geog. Papers (1959), (3), 65–78.**)

SOKAL,R. R.: Classification: purposes, principles, progress, prospects. Science (1974), (185), 1115–1123.

SUPAN, A.: Grundzüge der physischen Erdkunde. Leipzig (1911), 1–230.

SUZUKI, H.: The classification of Japanese climates. Geog. Rev. Japan (1962), *35*, 205–211.**)

– : Japanese climate and climatic regions. In: Nippon, ed. by R. Ishida et al., Kokinshoin, Tokyo (1966), 41–62.*)

– : Climatic regions and related phenomena in Japan. Bull. Dept. Geogr. Univ. Tokyo (1974), (6), 15–39.

THORNTHWAITE, C. W.: The climates of North America according to a new classification. Geog. Rev. (1931), *21*, 633–655.

– : An approach toward a rational classification of climate. Geog. Rev. (1948), *38*, 55–94.

TREWARTHA, G. T.: Japan: A physical, cultural, and regional geography. Univ. of Wisconsin Press, Madison (1945), 1–607.

– : Japan. A geography. Univ. of Wisconsin Press, Madison and Milwaukee (1965), 1–652.

UCHIJIMA, Z.: Agroclimatological classification of Japan in relation to paddy rice cultivation. Bull. National Inst. Agr. Sci., Japan (1962); Ser. A (9), 1–28.**)

YAZU, M.: A textbook on climatography of Japan. Maruzen, Tokyo (1912), 1–353.*)

YOSHINO, M. M.: Climatic division of Kanto district, Japan. Ann. Tohoku Geog. Ass. (1967), *19*, 165–171.**)

– : Oroshi, ein starker Lokalwind in der Kanto-Ebene, Japan. Colloquium Geographicum, Bonn (1970), *12*, 43–57.

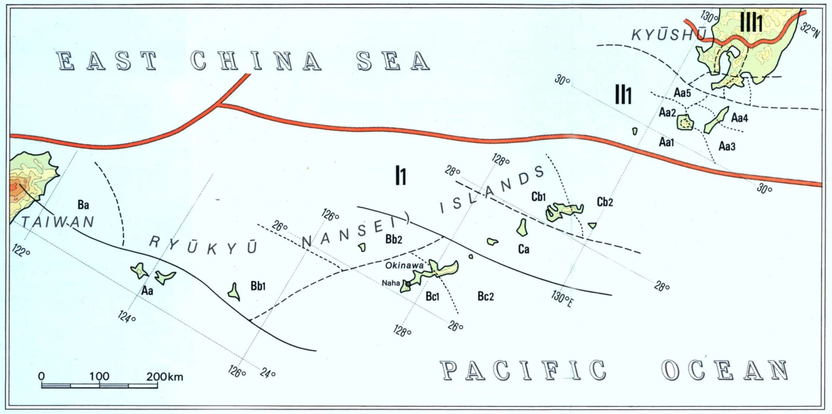
– : Climate in a small area. University of Tokyo Press, Tokyo (1975), 1–549.

– : Altitudinal vegetation belts of Japan with special reference to climatic conditions. Arctic and Alpine Res. (1978), *10* (2), 449–456.

*) in Japanese. **) in Japanese with English abstract.

M. M. Yoshino:

CLIMATIC DIVISION OF JAPAN



SEA OF JAPAN

SEA OF OKHOTSK

PACIFIC OCEAN

HONSHŪ

HOKKAIDŌ

KYŪSHŪ

SHIKOKU

V

IV3

IV2

IV1

III5

III4

III3

III2

III1

II2

II1

I1

Sapporo

Hakodate

Niigata

Sendai

Kyōto

Osaka

Kōbe

Nagoya

Tōkyō

Yokohama

Hiroshima

Fukuoka

Kitakyūshū

Kumamoto

Nagasaki

Fuji-san 3776 m

2702 m

3016 m

3190 m

3120 m

2678 m

3025 m

3068 m

Order of division	Examples of letters	Scale of division
1st	I, II, III,	Macro–
2nd	I1, II2,	Macro–/Meso–
3rd	A, B, C,	Meso–
4th	a, b, c,	Meso–/Local–
5th	a1, b2, d3,	Local–/Micro–

3000 m
2000
1000
500
200
0

0 100 200 300 km

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