

1. WIND ROSE AND MEAN SPEED BY WIND DIRECTION
 2. MONTHLY NUMBER OF DAYS WITH STRONG WINDS
 REPRESENTATIVE WEATHER MAPS
 3. TRACKS OF SEVERE TYPHOONS

1. Wind Rose and Mean Speed by Wind Direction.

Wind generally moves horizontal to the ground surface and is represented by its direction (wind direction) and velocity (wind speed).

Wind direction and speed of surface wind are measured at a height of 10 m and mean values calculated from values observed during the 10 minutes before measurements are made.

The wind direction is constant at gale force and variable when the wind is weak. Daily change in wind speed reaches a maximum at around 1300 and a minimum at dawn.

Wind with a speed of less than 0.2 m/s is referred to as calm and the wind direction is not indicated. A quiet day is one on which the daily mean wind speed is calm.

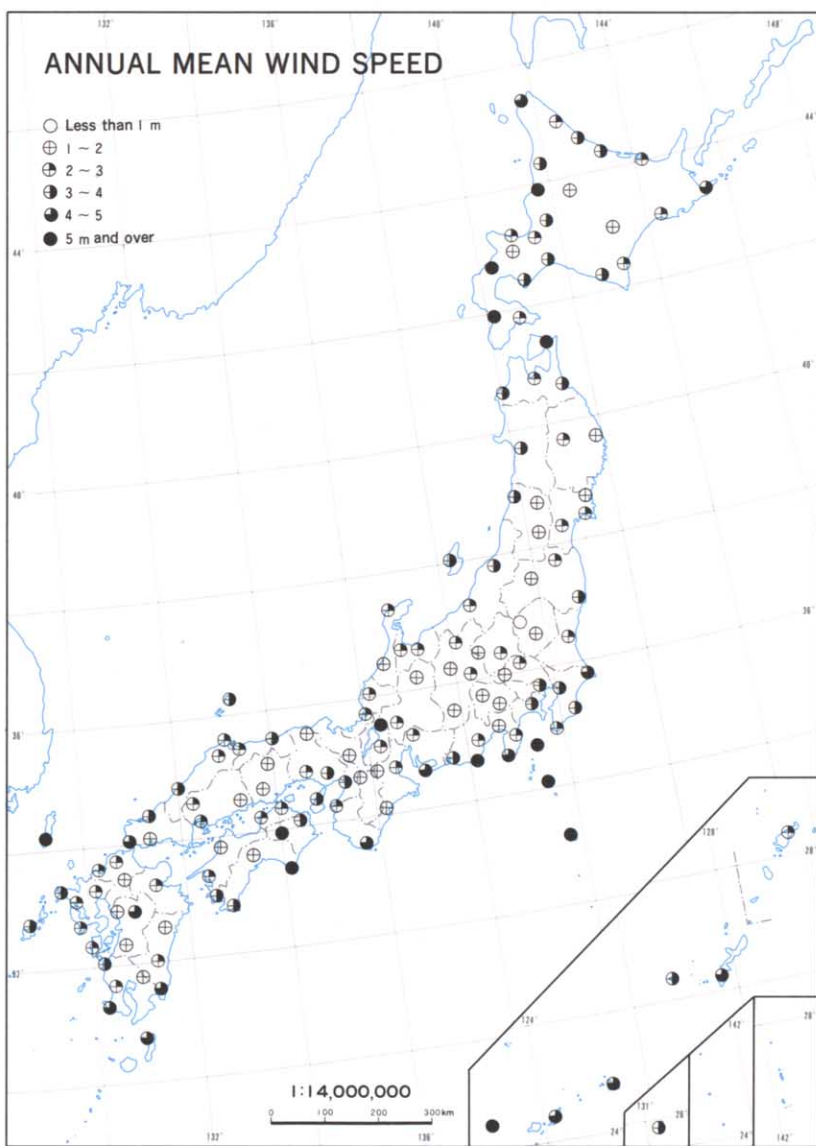
Daily mean wind speed is calculated over 24 hours of wind run from 0000 to 2400, and is represented in meters per second. The run of wind means the distance a body of air moved in a given time. The value obtained by dividing the run of wind by the time required to cover it is the wind speed.

The frequency of wind direction is the ratio of the number of measurements for each wind direction and calm periods to the total number of measurements per month (8 × number of days in a month). The wind direction is usually shown for 16 directions in Japan.

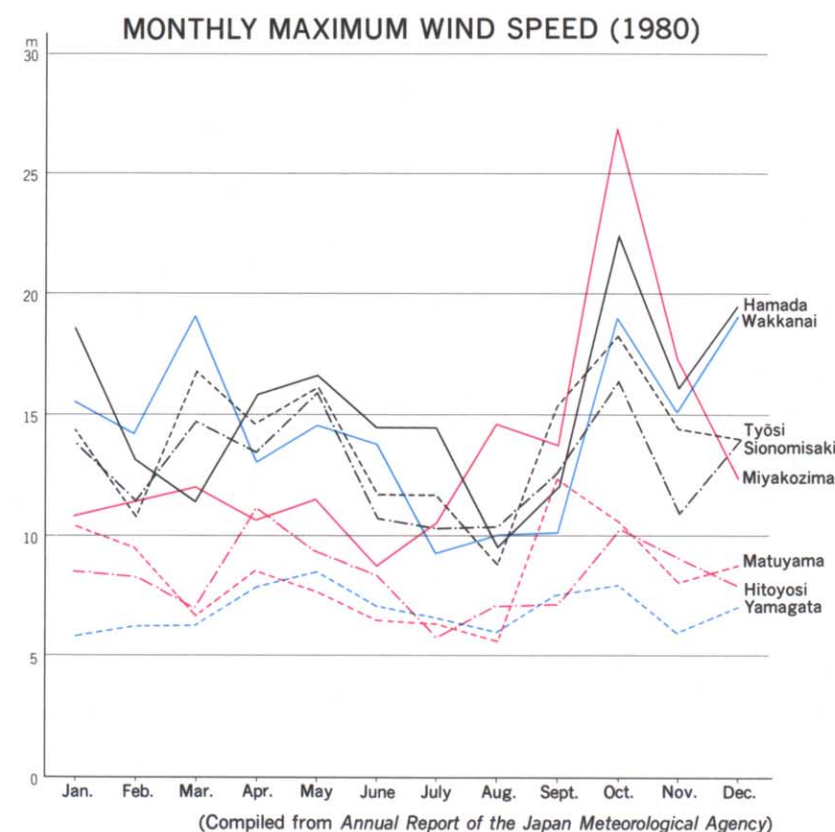
The frequency of wind direction in Japan shows characteristics in winter, with northwest winds blowing frequently. In summer, south to southwest winds are relatively frequent. Quiet days are common in inland areas.

[Salient Points of the Legend and Map Compilation]

The frequency of wind direction (wind rose) and the mean speed by wind direction are indicated by normals calculated from values observed at meteorological offices throughout the country from 1975 to 1980. The normals for frequency of wind direction are obtained from the daily mean value which is calculated from values recorded at eight observation time a day (0300, 0600, 0900, 1200, 1500, 1800, 2100, 2400). The anemometer for recording daily mean wind speed was changed from a four-cup to a three-cup anemometer in 1961, and was further modified to a recording wind vane and propeller type anemometer in 1975.



(Compiled from Climatic Table of Japan)



(Compiled from Annual Report of the Japan Meteorological Agency)

2. Monthly Number of Days with Strong Winds

Velocity of wind is not constant but alters continuously. In addition to mean wind speed, instantaneous wind speed and maximum instantaneous wind speed, etc., are used to express wind speed. Instantaneous wind speed is based on recorded values which are not averaged, while the maximum instantaneous wind speed is the maximum value of instantaneous wind speed.

Days with strong winds are days when a daily maximum wind speed of more than 10 m/s is recorded.

Days with strong winds are common on the Japan Sea side, capes and solitary islands during the winter when strong monsoons blow. They are common on the Pacific side during the spring when extratropical cyclones pass by, and in the typhoon season. They are usually scarce in inland basins.

[Salient Points of the Legend and Map Compilation]

The number of days with strong winds is shown by normals calculated from the values observed at meteorological offices throughout the country from 1975 to 1980. Normals are obtained from the monthly number of days with strong winds.

2. Representative Weather Maps

Weather is divided into 15 types such as fine, thunder storm (with lightning and thunder) and so on by the total amounts of clouds and each meteorological factor. The weather map indicates wind direction and velocity, isobars and fronts for each area.

The weather varies daily and momentarily, with a typical arrangement of atmospheric pressure appearing in each season.

Winter Type (west high, east low): This is the winter type in which a high pressure area lies on the continent of Asia and a low pressure area over the Pacific. Northwesterlies blow across the sky of Japan, thick clouds cover the sky on the Japan Sea side and sometimes bring snow and thunder, whereas it is continuously fine and dry on the Pacific side. When this type appears in the early spring, it is generally known as 'a return of midwinter.'

Low Pressure Appeared Over the East China Sea: This is the type in which an extratropical cyclone develops near Taiwan and advances east-northeast along the Japanese Islands. This may be as strong as a small typhoon and brings stormy weather and even snow to the Pacific side. This type is frequent from late winter to early spring. A similar type is the Japan Sea Cyclone Type. This is generated on the Japan Sea side and moves in a north-easterly direction, bringing winds first from the southwest and then northwest and rain or snow, while a foehn effect occurs on the Japan Sea side. This type is apt to bring disasters such as avalanches, shipwrecks or great fires.

Northeast Pattern: This is the type in which an anticyclone covers only the north part of Honsyū from the continent of Asia and a cyclone moves east along the south coast of Honsyū. This type is frequent in the autumn and the winter, causing cloud or light rain throughout the country.

Moving High Type (spring, autumn): This is the type in which an anticyclone moves over the sky of Japan from west to east and is a typical weather pattern in spring and autumn, but may occur at times in the winter. It brings fine weather all over the country but does not last long as it is migratory.

Belted Type High (spring, autumn): This is the type in which migratory anticyclones pass off the south coast of Honsyū or over Honsyū itself continuously like a belt. These are frequent from spring to early summer and in the autumn. Long periods of fine weather are experienced from west Japan to the Kantō area, whereas the weather is changeable in north Japan owing to the passage of pressure troughs.

Baiu Pattern: This is the type in which anticyclones are located in the direction of the Sea of Okhotsk and southeast off Japan; a front occurs on the boundary between them across the islands of Japan from east to west. This type develops from late May to late July. The front is near Okinawa in late May when the anticyclone in the north is strong; however, it gradually moves northward according to the development of the anticyclone in the south, approaching Hokkaidō in late July. When it is stagnant, a long Baiu season results, and if a cyclone moves along the front, localized torrential rains will occur.

Summer Type (south high, north low): This is the summer type in which a predominant anticyclone lies southeast off Japan and a cyclone is located on the continent of Asia or the Sea of Okhotsk. This type is common from July to August when a Pacific anticyclone develops, during which hot and fine weather results and thunder repeatedly occurs.

Typhoon: This is the type in which a typhoon developing over southern part of the North Pacific Ocean comes close to the islands of Japan and is common from summer to autumn.

Autumn Type (autumn rain front): This is the type in which a front develops over the islands of Japan where there is a boundary between a northerly sub-zero air mass and a weak Pacific anticyclone. This type is common from September to October. When it is stationary, unsettled weather continues, which is known as Syūrin.

[Salient Points of the Legend and Map Compilation]

The representative weather map shows the typical distribution of atmospheric pressure in each season from 1976 to 1980.

There are climatic recording methods based on the international system of the World Meteorological Organization (WMO), and also systems unique to each country. The weather symbols on these maps are based principally on the Japanese system.

3. Tracks of Severe Typhoons

A typhoon is a tropical cyclone which develops on the North Pacific near the equator; its force of wind must exceed 8 (wind velocity of 17.2 m/s or 34 knots). The development and course of a typhoon are complex and determined by the distribution of atmospheric pressure and the condition of the wind surrounding it.

The standard course of a typhoon follows a radial pattern along the margin of a Pacific anticyclone. The typhoon first moves west-northwest carried by easterly winds, gradually develops to its maximum size near 20°N to 30°N, then decreases in velocity. Afterward, carried by westerly winds, it turns northeast and increases in velocity. Its energy then gradually decreases until it becomes an extratropical cyclone and finally disappears.

The isobars of typhoons are concentric circles with winds blowing stronger near the center of the typhoon.

The eye of a typhoon is 20 to 30 km in diameter, where there are breezes, high temperatures and some blue sky. About 30 typhoons develop per year and about 10 of them strike the islands of Japan or approach the surrounding sea.

Many of the severe typhoons which influence Japan occur from June to October, with strong typhoons often bringing great damage to Japan in September. All strong typhoons such as the Muroto Typhoon (1934), Makurazaki Typhoon (1945), Tōyamaru Typhoon (1954), Kanogawa Typhoon (1958), Isewan Typhoon (1959), and the Second Muroto Typhoon (1961) occurred in September.

[Salient Points of Legend and Map Compilation]

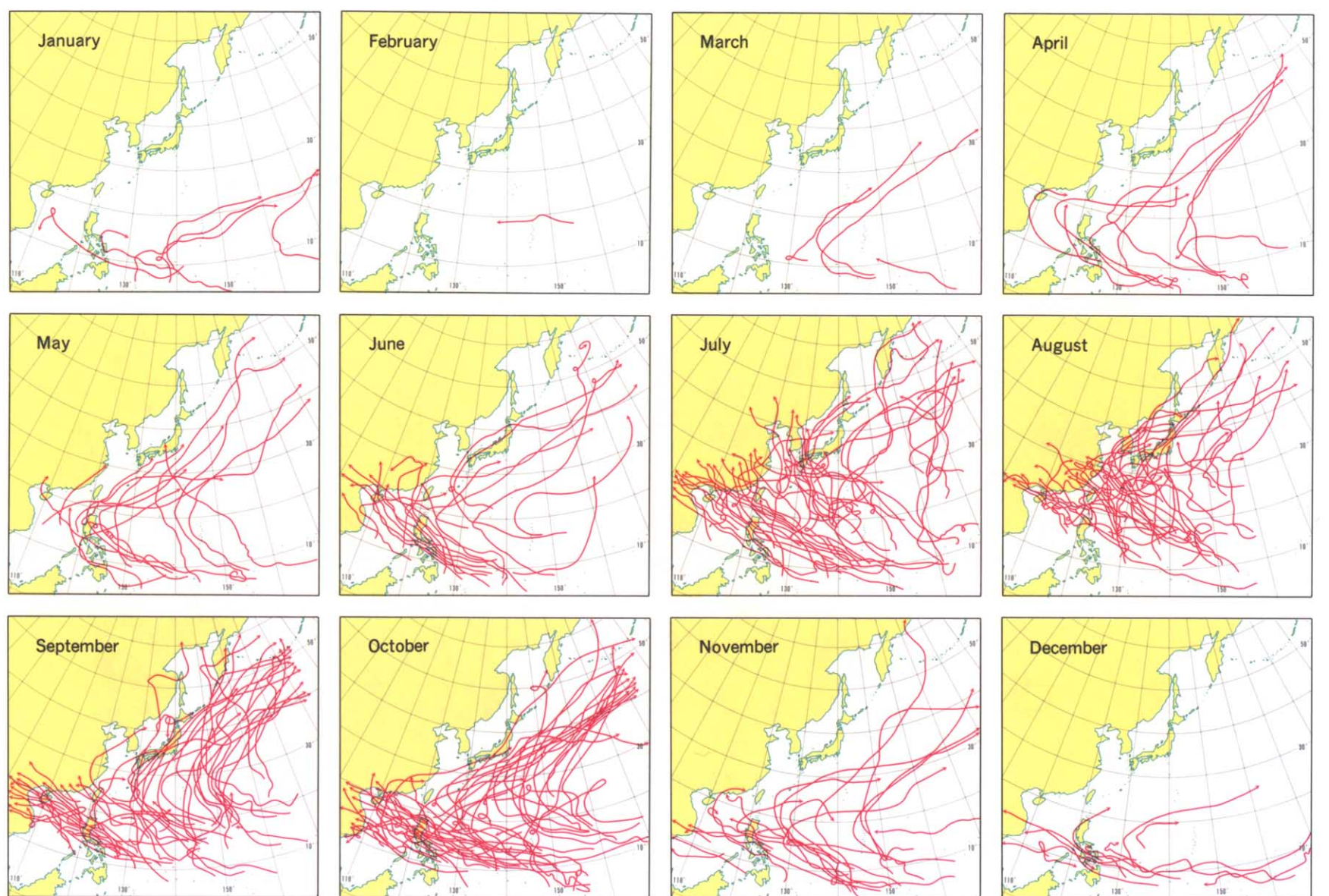
Severe typhoons refers to typhoons with less than 925 mb of minimum central pressure in areas within 300 km from the coastline of Japan, including its offshore islands, and those which inflicted great damage on Japan. Especially severe typhoon refers to those which caused particularly great damage and are called by special names.

Courses of typhoons indicate the areas where the center of each typhoon passed. The courses of especially severe typhoons are shown by different colors depending on the months of their passage, with the year of occurrence, number and name. The central pressure at 0900 (Japan standard time) every day is also indicated.

[Sources]

1. Japan Meteorological Agency, *Climatic Table of Japan, Part 2, Monthly Normals by Stations* (1951-1980), 1982
2. Japan Meteorological Agency, *Climatic Atlas of Japan*, 1980
3. Data from the Japan Meteorological Agency
4. Japan Weather Association, *Typhoon Summary of Japan* (1940-1970), 1973

COURSES OF TYPHOONS ACCORDING TO THE MONTH OF OCCURRENCE (1971~1980)



(Compiled from Typhoon Summary of Japan)

