

NOTES ON THE METEOROLOGY OF JAPAN.

BY

E. KNIPPING.

[READ JUNE 19th 1884.]

The following notes are based upon data obtained from twenty-three meteorological stations in Japan during the year 1883, the extreme positions being Kagoshima and Nagasaki in the south and Sapporo and Nemuro in the north. For three stations, namely, Hiroshima, Miyako and Nemuro, the records extend only over part of the year.

The mean temperature for the year 1883 ranged from 16.7° C. (62.6 Fahr.) at Kagoshima to 6.5° C. (43.7 F.) at Sapporo. The decrease with the latitude amounted to about 0.9° C. for each degree of latitude. The rate is one of the largest known, being exceeded in Europe only by the rate in the meridian of the Sea of Azow 1.0° C., while in central Europe and Britain it is 0.4° C. only. Nobiru, in 38 degrees latitude, has the same mean temperature as Cork and Valencia, in 52 deg. latitude, the advantage on the side of a great part of Britain amounting to 14 degs. of latitude, being equivalent to the difference of the north cape of Yezo and the South cape of Kiushu.

At Miyasaki in Kiushu the coldest month in 1883 was December; elsewhere in Kiushu, Shikoku, the Inland Sea, and the country round Owari bay, January; in the rest of Nippon and Yezo, February: the hottest month being August. The difference of mean temperature in February and August ranged from 19° C. (34.2 F.) at Miyasaki, 20° C. (36.0 F.) on the south coast to 28° C. (46.4 F.) at Sapporo; increasing with the latitude and distance from the sea. At Shanghai the corresponding average range of temperature is 25° C. (45.0 F.), at Peking 31° (55.8 F.), at Irkutsk 39° (70.2 F.), while in the Shetlands and in south Ireland it is only 8° C. (14.4 F.) 11° (19.8 F.) at Glasgow, 14° C. (25.2 F.) at Camden. The

annual variation in 1883 in Japan was thus more than double the amount for Britain.

The daily variation of temperature (mean monthly maximum less minimum temperature) was in February lowest along the west coast from Shimonoseki 5° C. (9.0 F.) to Niigata 6° C. (10.8 F.), increasing with the latitude and distance from the sea, reaching the greatest amount 12° C. (21.6 F.) at Akita and Sapporo. In August the figures varied from 7° C. (12.6 F.) at Kochi, Shimonoseki and Niigata to more than 12° C. (21.6 F.) at Kyoto and Sapporo, the increase depending more on the distance from the sea than the latitude. The highest temperature recorded in 1883 at any station was 36.6° C. (97.88 F.) at Wakayama; the lowest— 22.2° C. (-7.96 F.) at Sapporo. The difference between the highest and lowest record at one and the same station was 36° at Kochi, (64.8 F.) 56° C. (100.8 F.) for Sapporo. Changes of 14 and 15° C. at one station in 24 hours are not unfrequent in the spring and autumn.

All stations, regarding temperature for the latitude, show for January a large deficit, from to 4° to 7° C., (7.2 to 12.6 F.) Numazu the smallest; most stations for July 1883 a slight excess, Wakayama 2° C. (3.6 F.); however Miyasaki, the east coast and Tsugaru strait show in July also a deficit, amounting to 2° (3.6 F.) at Miyako and Hakodate.

In winter the differences of pressure in Japan were exceedingly great, decreasing from S. W. to N. E. If we take December 1883, for instance, we have 767 millimetres (inches 30.197) pressure in Kiushiu and Shikoku, 755 mm. (29.724) at Nemuro, or a rate of 0.9 mm. (0.035) for each 60 nautical miles, one of the greatest rates known. Accordingly we have in winter generally strong west winds, much snow and clouded sky on the weather shore, north-west and west coast; clear weather and little snow on the lee shore, south and east coast. In summer the pressure over Japan shows only slight differences, 1 to 3 mm. (0.039 to 0.107); decreasing towards the west, and mostly light southerly and easterly winds.

Least rain fell in 1883 in Yezo, at Awomori, Nobiru and in the Inland Sea, less than 1 metre (39.37 inches); most in

Kanazawa, 2.4 m. (94.49 inches), and in Kiushu and Shikoku. In January, February, November and December the north-west and west coast show the greatest fall; in March; the distribution, is, however, more equal. In April, May and June Kiushu and Shikoku show the highest record; July and August were dry, except heavy downpours during typhoons; 171 mm. (6.73 inches) on August 18th at Nagasaki, 162 mm. (6.38 inches) at Kochi on the 20th. September and October show a more equal distribution over all stations.

The geographical position of Japan between the two greatest areas of land and water in the world makes its climate dependent on these two great factors. The connection between temperature and pressure is such, that where the temperature is comparatively too high the pressure is low, and where the temperature is too low, the pressure is high. In Siberia in January temperature is 20° C. (36.0 F.) too low for the latitude, the pressure as high as 778 mm. (30.630), while at the same time near Alaska in the North Pacific temperature is 14° (25.2 F.) too high, pressure as low as 752 mm. (29.606.) The flow of air being from high to low, and the powerful upper currents being always from the W. our winds in winter are W., strong; all depressions march with the wind towards the east without interruption, and easterly gales are rare. In July the position is almost reversed but not so marked as in January. Temperature in Central Asia is then 8° C. (14.4 F.) too high, pressure at 750 mm. (29.527); in the North Pacific 6° C. (10.8 F.) too low, pressure at 766 mm. (30.157). Thus in winter differences of 34° C. (61.2 F.) and 26 mm. (1.023) are at work, in summer 14° C. (25.2 F.) only and 16 mm. (0.629). Thus the prevailing winds in summer should be south and east, light, the depressions march to the north and west, but their progress is comparatively slow, as they are not carried on by the upper currents. The march and progress of the depressions, on which the weather depends, is connected with the gradual formation, disappearance and reversal of these areas of high and low temperature and pressure.

The law connecting both invites an application with

regard to February 1883, in which, judging by January and March, an abnormal distribution of pressure appears to have taken place. Pressure was too high in the whole east and north of Japan, the line from highest to lowest pointing about south-east; temperature should have been thus also too low, and a comparison shows actually that February 1883 was the coldest out of a period of 7 years in Tokio, 8 in Sapporo, 7 in Hakodate and, 3 years for several other stations.