TABLE 14.

Place.	Soil.	0.0—0.3	0.3—1.2	1.2—3.0	3.0—5.0
Osaka ...	Sand...........	0.00853	0.00693	0.00642	0.00465
Tokyo ...	Loam...........	0.00320	....	0.00301	0.00200
Nagoya..	Sand and loam..	0.00338	0.00512	0.00696	0.00658

At Osaka and Tokyo the diffusivity seemingly diminishes as we go into the deeper strata, while at Nagoya it increases with depth down to a certain stratum. The diffusivity of the upper layer at Nagoya is equal to that at Tokyo, while the diffusivity of the deeper stratum rather resembles that at Osaka. The reason for this, according Doctor Okada, is that the soil at Osaka is composed of granitic sand, and that at Tokyo of loam, while at Nagoya it is not uniform, the upper stratum being composed of loam and the deeper of sand with some loam. The conductivity of the Osaka soil decreases with depth, the mean conductivity being 0.00265 in C. G. S. units. Thus, the conductivity of sandy soil is one hundredth part of that of zinc, and is nearly equal to that of glass, while it is as much as ten times the conductivity of snow that has a density 0.18.

Applying Schubert's formula,[8] Doctor Okada computed the total amount of annual heat exchange to be 2163 gram-calories per unit area at the stratum of 4.0 meters below the surface. According to Angot the total annual amount of insolation at the latitude of 35° is 220018 gram-calories per square centimeter assuming the coefficient of transparency as 0.7 and the solar constant at 3 gram-calories per square centimeter per minute. Hence, the author concludes that the quantity of solar energy consumed in heating the soil is one-hundredth part of the total insolation which is received by the surface of the soil.

AN ACCOUNT OF RECENT METEOROLOGICAL AND GEO-PHYSICAL RESEARCHES IN JAPAN.

By Dr. S. TETSU TAMURA, Washington, D. C. Dated August 30, 1905.

The important scientific papers published in Japan are usually found in the Journal of the College of Science of the Tokyo Imperial University, in the Proceedings of the Tokyo Physico-Mathematical Society, or in the Journal of the Meteorological Society of Japan. I find, however, that neither of these publications are easily accessible in America, except in large Government bureaus or in prosperous university libraries. Moreover, those papers published elsewhere in Japanese are in no way accessible or intelligible to the western scientists. Perhaps this may be one of the reasons why Japanese scientific works are not duly known to American laymen as well as to scientists, though very brief references are given in "Science Abstracts". In the preceding article I have given an account of earth temperature investigations in Japan, and I am now induced to give some reviews, with occasional notes, of other memoirs by Japanese scientists on meteorology and its allied sciences.

1. PROF. F. OMORI ON THE ANNUAL VARIATION OF THE HEIGHT OF SEA LEVEL.

Professor Omori, of the Tokyo Imperial University, has published two papers on this subject in the Proceedings of the Tokyo Physico-Mathematical Society, Vol. II, Nos. 13 [1904], and 20 [1905]. The interesting feature of these papers is the comparison of the variation of the height of sea level with that of barometric pressure. In the first paper the author discussed their annual variations at Ayukawa, in the Province of Rikuzen, and Misaki, in the Province of Sagami, which two places are situated on the Pacific coast.

The following table gives the mean monthly relative heights of the sea level at Ayukawa and Misaki, deduced from the tide-gage observations during the year 1902, and also the mean barometric pressure in the vicinities of these places.

TABLE 1.

Month.	Monthly mean height of sea level.		Barometric pressure, reduced to sea level.
	Ayukawa.	Misaki.	
	mm.	*mm.*	*mm.*
I	121	129	761.3
II	0	0	764.5
III	23	69	762.2
IV	45	103	760.2
V	96	188	759.4
VI	171	171	756.1
VII	197	175	766.2
VIII	184	226	758.8
IX	219	276	758.7
X	172	246	764.1
XI	117	164	765.5
XII	157	257	761.0

From Table 1 it will be seen that the monthly variations of sea-level heights at Misaki and Ayukawa are quite similar, but just the reverse of the variations of barometric pressure. The range of the barometric variation is 9.3 mm., which corresponds to $9.3 \times 13.6 = 126$ mm., height of water. On the other hand, the range of the mean monthly variation of height of sea level is 276 mm. at Misaki and 219 mm., at Ayukawa, or twice as large as the range of the barometric variation. Hence, Professor Omori concludes that the sea bottom is subjected to a greater total pressure in the summer months than in February, March, and April. The cause of this elevation of the sea level in the summer the author attributes partly to the decrease of barometric pressure in Japan and its vicinities, and partly to the existence of the high pressure over the North Pacific Ocean, which causes the depression of the sea level in that region. In the winter the phenomena are just the reverse. From these facts Professor Omori explains why there are at the bottom of the west Pacific Ocean more earthquakes in the summer than in the winter.

The second paper by F. Omori contains the discussions of similar data obtained for four different places on the coast of the Japan Sea. The places are:

1. Hamada, in the Province of Iwami.
2. Wajima, on the northern coast of the Peninsula of Noto.
3. Iwasaki, on the western coast of the Province of Mutsu.
4. Otaru, in the Province of Shiribeshi, Hokkaido.

The mean monthly relative heights of the sea level at the four different places during 1902, and the monthly means of barometric pressure at the same places are given in Table 2.

TABLE 2.

Month.	Mean height of sea level at the four places.	Mean height of barometer at same places.
		mm.
I	112	761.38
II	0	764.20
III	48	761.61
IV	88	758.85
V	191	757.70
VI	206	757.21
VII	236	755.44
VIII	276	757.49
IX	312	757.55
X	257	763.64
XI	176	764.42
XII	181	761.37

From this table the annual variation of the barometric pressure will be seen, as in the case of the places on the Pacific coast, to be nearly the reverse of that of the height of sea level. Now the range of the former was 8.98 mm. which corresponds to $8.98 \times 13.6 = 122$ of water. The range of the variation of sea-level heights was 312 mm. Along the coast of the Japan Sea the variation of the sea-level height is opposite

[8] Zur Theorie der Wärmeleitung im Erdboden. Phys. Zeitschr, 1901. I Jahrgang, No. 41, p. 444.

to and nearly 2.6 times larger than the corresponding variation of the barometric pressure. Thus, the author reaches the same conclusion that the sea bottom is subjected to a greater total pressure in the summer months than in February, March, and April, just as it was found in Misaki and Ayukawa on the Pacific coast.

Finally, Professor Omori gives his computations of the monthly values of the relative total pressure at the sea bottom, i. e., the sum of the mean monthly values of the height of sea level and that of the barometer as in Table 3.

TABLE 3.

Month.	Presssre at sea bottom.
	mm.
I	193
II	119
III	132
IV	134
V	222
VI	230
VII	238
VIII	304
IX	341
X	368
XI	298
XII	262

According to this table the total pressure at the sea bottom was greatest in October and smallest in February, March, and April. The annual variation of sea-level height on the coast of the Japan Sea is perfectly similar to that on the Pacific coast.

2. DR. T. OKADA'S PAPER ON THE THERMAL CONDUCTIVITY OF SNOW.

The hourly observations of temperature at three depths, 10, 20, and 30 centimeters of accumulated snow, the surface of which was freely exposed to direct sunshine, were undertaken by Doctor Okada (now chief of the service of prediction of the Central Meteorological Observatory) in February, 1904, at Sapporo, which is situated in the western part of the northern island called Hokkaido. The means of the temperatures observed with long-stem mercurial thermometers at the specified depths for thirteen days, from the 5th to the 17th of the month, are given in Table 4.

TABLE 4.—*Temperature under the snow.*

Hour.	10 cm.	20 cm.	30 cm.	Hour.	10 cm.	20 cm.	30 cm.
1 a. m.	−4.68	−2.25	−1.71	1 p. m.	−3.44	−2.56	−2.00
2 a. m.	−4.90	−2.31	−1.77	2 p. m.	−2.98	−2.20	−1.99
3 a. m.	−5.04	−2.45	−1.80	3 p. m.	−2.66	−2.02	−1.96
4 a. m.	−5.08	−2.44	−1.84	4 p. m.	−2.62	−1.82	−1.68
5 a. m.	−5.24	−2.51	−1.87	5 p. m.	−2.72	−1.84	−1.72
6 a. m.	−5.40	−2.63	−1.92	6 p. m.	−2.82	−1.75	−1.66
7 a. m.	−5.44	−2.69	−1.94	7 p. m.	−2.82	−1.75	−1.65
8 a. m.	−5.42	−2.77	−1.97	8 p. m.	−2.96	−1.77	−1.67
9 a. m.	−5.40	−2.82	−1.94	9 p. m.	−3.02	−1.90	−1.63
10 a. m.	−5.08	−2.85	−1.96	10 p. m.	−3.10	−1.96	−1.60
11 a. m.	−4.62	−2.83	−1.95	11 p. m.	−3.10	−2.03	−1.64
Noon	−4.02	−2.75	−2.01	Midnight	−3.16	−2.13	−1.70
				Mean	−4.01	−2.29	−1.77

The author next undertook the observations of the density of snow at different depths, and found the following values from three observations at each depth:

Depth in centimeters	5	25	34	45
Density in C. G. S. units	0.13	0.24	0.29	0.35

As is pointed out by the author, the density of the accumulated snow regularly increases with the depth. The following linear equation, connecting the observed density and the depth, was obtained by Okada:

$$\rho = 0.101 + 0.0055\,x$$

where ρ denotes the density and x the depth in centimeters. Then, applying the amplitude equations[1]

$$\log_e a = \log_e a_0 - x\sqrt{\frac{\pi}{a^2 T}}$$

or

$$\log_e a = \log_e a_0 - px$$

where a is the amplitude at any depth x of snow, a_0 that at the surface, a^2 the diffusivity of the snow, and T the period, Doctor Okada computed the values of p and a^2, which are given as follows:

Depth.	10–20 cm.	20–30 cm.
p	0.1089	0.0982
a^2	0.0031	0.0038

Now $a^2 = \frac{k}{\rho c}$, where c is the specific heat of snow.

According to Okada's formula representing the relation between the density and the depth of snow, the mean density of snow for the stratum from 10 to 20 cm. is found to be 0.18 and that for the stratum 20 to 30 cm. to be 0.24. Hence, assuming the specific heat of snow to be 0.508, the author obtained 0.00028 for the conductivity of snow for the stratum from 10 to 20 cm. and 0.00045 for that from 20 to 30 cm.

The conductivity of snow is found to vary with its density. H. Abels deduced from his hourly observations at Katharineburg the formula

$$k = 0.00068\,\rho^2$$

and M. Janssen obtained from his laboratory experiments the formula

$$k = 0.00005 + 0.0019\,\rho + 0.006\,\rho^4.$$

With these formulæ, Doctor Okada computed the values of the conductivity of snow for $\rho = 0.18$ and $\rho = 0.24$, and compared his own values:

Density.	Abels's formula.	Janssen's formula.	Okada's values.
0.18	0.00022	0.00039	0.00028
0.24	0.00039	0.00051	0.00045

Here the author points out that his values are equal to the means of the values calculated by Abels's and Janssen's formulæ.

The following memoirs are referred to by Doctor Okada:

(1) Hjelström: Ueber die Wärmeleitung des Schnees. Met. Zeit., Bd. VII, 226.

(2) H. Abels: Beobachtungen der täglichen Periode der Temperatur in Schnee und Bestimmung des Wärmeleitungsvermögen des Schnees als Function seiner Dichtigkeit. Rep. für Meteor. Bd. XVI, No. 1, 1892.

(3) M. Janssen: Ueber die Wärmeleitungs fähigheit des Schnee. Öfversigt af Kongl. Vetenskaps-Akademiens Förhardlingar, 1901, No. 3.

3. DR. K. HONDA'S PAPER ON DAILY PERIODIC CHANGES IN THE LEVEL OF ARTESIAN WELLS IN JAPAN.

Doctor Honda's present discussion of this problem was published in the Proceedings of the Tokyo Physico-Mathematical Society, Vol. II, No. 6, 1903, and Vol. II, No. 9, 1904, and in the publications of the Earthquake Investigation Committee, No. 18, 1904. It is based upon his observations of level in an artesian well at the Tokyo Imperial University, which is 5.7 kilometers distant from the sea and 15 meters above sea level. The well is 380 meters deep and lined with iron tubes 14 centimeters in diameter. From the observations the author reaches the following conclusions:

1. The water level has two maxima and minima in 24 hours, with a range of from one to three centimeters.

2. The fluctuations are markedly regular about new and full moon, resembling the ocean tide, the range being considerably greater than at the half moon.

3. The phases of maxima and minima of the water level in the well correspond to those of the tides in the Tokyo Bay; high-water level corresponds to high tide.

4. The phases of the maxima and minima of the well water level are directly opposite to those of the diurnal maxima and and minima of the atmospheric pressure about new and full moon; but as we approach the half moon the difference of the phases becomes smaller and smaller.

[1] See the note on the "Mathematical theory of the linear flow of heat," in the current number of the MONTHLY WEATHER REVIEW, by S. T. Tamura.

5. High atmospheric pressure lowers the water level and low atmospheric pressure causes high water level.

6. Rains appear to have no effect on water level.

Next the author shows, that as the curve of variation of water level is simple and regular, there must be one principal cause of the change, the others, if there be any, must be subordinate and not essential. Now the author shows that this main cause may be the existence of a porous layer containing gas underneath the well, so that high barometric pressure in the surface air forces the water from the well into the cavities, but low pressure lets it flow back again. The tides have a similar, but opposite effect. A closed jar was fitted over the mouth of the well. The change of the air pressure in this jar caused artificially by a change of 1 mm. of mercury produced a change of 13.5 mm. in the water level. But as the natural air pressure acts both on the water and the ground about the well, the observed change of 4.35 mm. in the water level, corresponding to 1 mm. change of the air pressure, is a differential effect, representing 32 per cent of the barometric fluctuation. Thus, the earth's crust would transmit 68 per cent of air pressure on the surface to a depth of 380 m. Hence, the author concludes that the daily fluctuations in the water level are essentially due to tides. The observations of the wells in Yokohama, 2 kilometers from the sea coast, Yoshiwara (3.3 kilometers), Okubo (6.4 kilometers) confirm the existence of a porous layer or air space in the ground. Finally, the author explains why Professor Omori finds that the maximum earthquake activity which generally coincides with high barometers is at some stations accompanied by low barometers.

4. PROF. Y. WADA'S TEMPERATURE MOYENNE ANNUELLE DE LA SURFACE DE LA MER DANS L'OCEAN PACIFIQUE OCCIDENTAL.

This paper by Prof. Y. Wada, who was then the chief of the service of prediction in the Central Meteorological Observatory of Japan, and is now the director of the Japanese Weather Service in Korea, was published in 1904 in Bulletin No. 1 of the Central Meteorological Observatory. The tracing of the isotherms of surface water and the discussion of the distribution of the temperature in the sea surrounding the Japanese Islands are based upon the observations of twenty years (1882–1901) on ships by the members of the Central Meteorological Observatory. The number of vessels amounted to 1086, of which 848 belonged to Japan and the rest to foreign countries. The region of observation comprises the area between longitudes 114° and 146° east of Greenwich and latitudes 22° and 46° north. This vast area was divided into squares of two degrees on each side. The number of observations, however, differs accordingly to the month and the location of the squares. The total number of observations is 133,255, eight-tenths of which belong to the region between the longitudes 128° and 140° east, and the latitudes 30° and 42° north.

The thermometer which is ordinarily used on Japanese ships, in order to measure the temperature of the sea water, is of the same form as that used on foreign ships. It is a mercury thermometer whose scale is not directly engraved on the stem, but on a metallic plate which is fastened to the stem. The stem and scale are placed in a metallic case which carries at the lower part a reservoir of water in which the bulb of the thermometer is plunged. In order to observe the surface water, a linen bag (sac toile) is thrown into the sea. After dipping it until its temperature becomes the same as that of the water, the bag is pulled up and the temperature of the water in it is measured. The hours of the observations on Japanese ships were 2^h, 6^h, 10^h both in the morning and evening, but older observations were generally taken at 4^h and 8^h in the morning, at noon, and at 4^h and 3^h in the evening and at midnight.

In the period of twenty years and in the regions above mentioned, the highest mean temperature of the surface sea water was 30° C., observed in August at the Formosan Strait, and the lowest, —3° C., in the Gulf of Pechili and also in the Japan Sea (in the vicinity of Vladivostok), the former occurring in the months of January and February, and the latter in December. The annual range is 33° C., taking the whole region into consideration. If we consider the annual range of variation in each region, we observe that it generally increases with the latitude. While the annual range is only 6° or 7° at low latitudes, it goes beyond 20° at the latitudes higher than 30° north. The range, however, diminishes gradually as we go farther from continents. The region which has the greatest annual range is the Gulf of Pechili (China), where the mean temperature of the month of August attains 24° C., and that of February, —3° C., so that the annual range is 27° C. The smallest annual range of 6° is found in the vicinity of Cape South (Formosa), where the temperature of August is 28° and that of February is about 22°.

Location.	Mean maximum temperature.		Mean minimum temperature.		Annual range.
	° C.	Mo.	° C.	Mo.	° C
Strait of Formosa	30	August	15	January	15
Strait of Pescadores	28	August	15	January	13
East side of Formosa	28	August	15	February	13
Loo Choo Archipelago	29	August	14	January	15
West side of Kinshu	28	August	16	February	12
East side of Kinshu	29	August	10	January	13
South side of Shikoku	27	August	13	March	14
Interior sea	27	August	9	February	18
South side of main island	26	August	14	February	12
Southeast side of main island	26	August	11	January	15
East side of main island	25	August	7	February	18
Strait of Tsugaru	22	August	6	February	16
South of Hokkaido	22	August	2	March	20
East of Hokkaido	19	August	—1	February	20
Okhotsk Sea	19	August	—3	March	22
West of Hokkaido	22	August	3	February	19
Northwest of main island	26	August	7	February	19
West of main island	27	August	10	February	17
Siberian coast	23	August	—2	December	25
East of Korea	25	August	3	February	22
Korean Strait	27	August	11	February	16
West of Korea	25	August	1	February	24
Gulf of Pechili	24	August	—3	February	27
Yellow Sea	27	August	0	February	27
Chinese coast	27	August	0	February	27
East China Sea	28	August	11	February	17

Professor Wada further points out that, with some exceptions, the march of the temperature of the sea follows very nearly the direction of the ocean currents. It is known that the seas surrounding Japan are under the direct influence of two contrary currents, one being the equatorial and the other the polar. The former, which is called Kuroshiwo, runs along Formosa, Loo Choo, and then divides itself into two currents. The principal current runs along Kinshu and Shikoku islands and then along the main island as far as the latitude of 36°, at which it quits the Japanese coast. The other branch passes into the Japan Sea from the west of the Japanese Islands, and then runs toward northeast along the coast of Japan, finally entering the Sea of Okhotsk.

The polar current which comes down along the Kurile Islands, passes the eastern extremity of Hokkaido, and then runs meridionally to the east of the main island as far as latitude 36°. Besides, another branch of the polar current appears to run down along the Siberian coast, touching Korea. In the regions where the currents run the annual changes of the temperature are relatively small, while they are very large in those regions where there are no currents. For instance, in the Gulf of Pechili, which is surrounded by the continent, the features of the isotherms for each month show convincingly the existence of those currents and also the changes of their directions in the course of the year.

Finally, Professor Wada discusses in detail the distribution of the temperature on the surface of the sea in each month of the year, and gives tables of the variations of temperature within each square (2° × 2°) from month to month, and thirteen charts of isotherms which were traced from the above data. These charts comprise the twelve charts of isotherms for the twelve months, and one chart of annual isotherms. They are most noteworthy and interesting, and will throw much light on meteorological and climatological conditions in eastern Asia.

THE VARIATION IN MINIMUM TEMPERATURES ON STILL, CLEAR NIGHTS WITHIN THE CONFINES OF A VILLAGE.

By Prof. WILLIS I. MILHAM, Ph. D., Williamstown, Mass. Dated August 4, 1905.

The present investigation was suggested by the reports of extremely low temperatures from different parts of a village, while a registering minimum thermometer, exposed in a regular thermometer shelter, gave much higher readings. The purpose of the investigation was to determine, among other things, the amount of the total variation, the influences that determine the amount of the variation, and the regularity with which a certain station is either colder or warmer than other stations. The observations were made in the village of Williamstown, the seat of Williams College, which is located among the Berkshire Hills of western Massachusetts. The village is situated in the middle of a saucer-like depression about three miles in diameter, surrounded by fairly high mountains, the highest peaks of which range from about 1200 feet to 3505 feet (Greylock Mountain). There are two main valleys leading into this depression, one from the east and one from the south. The outlet through which the Hoosic River flows is to the northwest. The village proper is about one and one half miles long and three quarters of a mile wide, and is situated on three small knolls in the middle of this depression; it consists of detached houses, surrounded by ample lawns and gardens, and the streets are wide. The accompanying map, fig. 1, shows the streets and water courses; the contour lines, drawn every ten feet, give the elevation above mean sea level.

The thermometers used in this experiment were exposed at ten different stations in the village. These stations are numbered from one to ten, and each location is indicated on the accompanying map. A scale of distances and the true north and south direction have been added, so that in every case the elevation, the direction of the slope, the steepness of the slope, and the distance from running water can be determined from the map. It will be seen that Williamstown has a very diversified surface, consisting of fairly level areas, marked valleys, plenty of running water, and differences of elevation amounting to 120 feet. It is, therefore, well suited to the investigation of this problem.

The thermometers used were self-registering, minimum, alcohol thermometers of the regular Weather Bureau type, made by H. J. Green, of Brooklyn, N. Y. Each one was mounted on an unpainted pine board, about eighteen inches long and seven inches wide, exposed in the open, without a shelter of any kind, exactly five and one half feet from the surface of the ground, on the northwest side of a post or small tree at least fifteen feet from the nearest building, and always with a clear space of at least forty feet on the northwest side. The ground was covered with snow during the whole experiment, so that the surface under each thermometer was the same. Absolute uniformity in every particular was aimed at in exposing the thermometers.

The variations treated in this article are not due to inaccuracies in the thermometers, as the following precautions were taken:

(1) All the thermometers were wrapped up together in cloth and placed in a room where the temperature was nearly constant. At the end of several hours every thermometer indicated the same temperature within one or two tenths of a degree. This was done at the beginning and end of the investigation. (2) The thermometers were all read on several different occasions during high winds, while the temperature was changing slowly and the sky was covered with clouds. The readings always differed from the mean of all readings by less than one degree. (3) The thermometers were frequently changed from station to station during the investigation.

The observations were made during the winter of 1904–5 and are given in full for 36 nights in the accompanying Table 1. Observations were always taken when the temperature fell to zero or below at any point in Williamstown; also several additional sets when the temperature fell nearly to zero. The table thus contains observations for practically every night when there was a decidedly low temperature. A few observations are missing. Two thermometers were not put into commission at the beginning of the investigation and the other observations were lost for reasons which are of no interest here. These missing observations, however, in no way influence the conclusions which are drawn. Extreme care was used in setting the thermometers and making the readings and every effort was made to avoid all errors that might result from causes such as the jarring of the thermometer by the wind, careless setting or reading, tampering with instruments by unauthorized persons, etc. The first column of the table contains the date of observation. Even if the minimum occurred before midnight, the date given is always that of the following morning, when the readings of the thermometer were made.

Williams College is a cooperative station of the U. S. Weather Bureau and its shelter for the thermometers is of the form advocated by the Weather Bureau and is placed on the north side of an unheated building. There is an ample air space between the building and the shelter, and the instruments are five and one-half feet above the ground. The column under "Station" headed "A" contains the observations of minimum temperature made in this thermometer shelter. Station 1 was twenty feet north of this shelter and thus serves as a connecting link between observations made in a regular thermometer shelter and observations made in the open without a shelter as is the case with the ten stations. The columns under "Stations" and numbered 1 to 10 contain the observations made at ten stations whose positions are indicated on the map. The column headed "B" contains the observations made on a registering, minimum thermometer exposed on a small iron post of a piazza on the north side of a house. The thermometer was five and one-half feet above the floor of the piazza, six feet from the house and twenty feet southeast of station 8. These observations are added as this is a favorite way among people living in a village of exposing ordinary thermometers. The column headed "Total variation" gives the difference between the higher and lower temperatures observed at the ten stations on the night in question. The next column gives the characteristics of the night as regards the wind. The letters indicate the direction of the wind at 10:30 p. m. and it will be seen that it was from the northwest in every case. If the wind changed during the night this is indicated by a [*] and in every case it changed to either the east or southeast. The two numbers separated by a dash give the estimated wind velocity in miles per hour at 10:30 p. m. and at the time of the minimum. These are estimated velocities their absolute values may be somewhat erroneous, but they will nevertheless serve to designate the relative windiness of the different nights. The next column gives the character of the sky at the time of the minimum; the adjectives used are cloudless, thin haze, haze, thinly overcast, overcast. The next column gives the depth of the snow on the ground in inches; it will be seen that all the observations were taken over a snow surface, thus affording absolute uniformity as regards the radiating surface. The last column gives additional facts which may be of interest. Whenever