Government and the support of the Great Northern Telegraph Company (Grande Compagnie des Télégraphes du Nord). This company undertakes, for an annual payment of only 337,500 francs (about $68,000), during twenty-five years, to establish and work a cable starting from the Shetland Islands, touching at the Faroe Islands, and ending in Iceland. The Danish Government, on its part, will defray the expenses of the establishment and maintenance of the necessary meteorological stations and of the daily meteorological cablegrams; it will undertake to complete the hydrographic work that is a necessary preliminary to laying the cable, and, finally, it will pay an annual subvention of 125,000 francs for twenty years.

It therefore only remains to obtain a further annual sum of 212,500 francs in order to definitely assure telegraphic communication with Iceland, and this would be equally as important to the interests of commerce as it would to the needs of meteorology. It is believed that the states of northern Europe and America, which are especially interested in the realization of this project, will certainly guarantee the money that is still needed.

According to Paulsen's proposition these various states should, in order that this project may be carried out, subscribe for ten years to the meteorological cablegrams that will be sent.

The committee can only confirm the opinion that it has already expressed on several occasions, as to the great importance of the daily telegraphic communication of information relative to the atmospheric conditions in Iceland. It also expresses a hope for the success of the efforts made in this matter by the Danish Government.

A proposition was then made by Neumayer and von Bezold relative to the publication, by the Deutsche Seewarte in Hamburg, of a periodical international bulletin of the weather. According to the authors it should appear as an appendix to the Hamburg daily Wetterbericht, and contain a table of 10-year means of the daily international a. m. observations for about 100 stations. These means of temperature, barometric pressure; and rainfall should appear in columns alongside of the normal values for these three elements.

The Committee was of opinion that it would be useful to have a model of the proposed publication, in order that each meteorological service might appreciate its scope and form an idea as to the extent to which it could cooperate in it.

A committee was appointed, composed of Messrs. Pernter, Billwiller, Neumayer, Rykatcheff, Mohn, and Tacchini, under the presidency of Pernter, to consider the extension and improvement of the international service of meteorological telegrams for use in the prediction of the weather.

Finally, it was decided that the International Committee and the various commissions or subcommittees appointed at the Conference at Paris in 1896, and now present in St. Petersburg (i. e., the commissions on aeronautics, magnetics, solar radiation, weather telegraphy, etc.), should meet in 1900 in Paris immediately after the Congress on Meteorology, which will be held on the occasion of the Exposition. This Congress will probably assemble during the first half of September.

The meetings of the Committee were agreeably diversified by excursions and instructive visits to the principal scientific establishments in St. Petersburg.

On the day of the opening there was at 9 p. m. a reception at the Central Physical Observatory Nicolas.

The following day (Sunday) an excursion to Cronstadt and Peterhof on a naval vessel.

On Monday, a visit to the Winter Palace and to the Gallery of the Hermitage.

On Tuesday, an excursion to the Aeronautic Park, and thence to the Magnetic and Meteorological Observatory at Pavlosk.

On Wednesday, a visit to the Astronomical Observatory at Poulkova.

On Thursday, an inspection in detail of the Central Physical Observatory. In the evening, a conference given by General Tillo to the Geographical Society.

On Friday, a visit to the Imperial Library and to the Bureau of Weights and Measures.

This program shows that the time was well filled during the whole week of the meeting of the Committee. The Russian Government, according to its traditions, always receives with great magnificence the scientists who hold their meetings in Russia, and on this occasion it extended a grand welcome to the meteorologists. The delegates have carried away with them a most agreeable remembrance of their visit to St. Petersburg.

NOTES BY THE EDITOR.

RESULTS OF WORK WITH BALLOONS AND KITES AT TRAPPES, FRANCE.

In the Comptes Rendus, Paris, July 10 and August 21, 1899, Monsieur L. Teisserenc de Bort, the proprietor of the Meteorological Observatory of Trappes near Paris, gives some account of recent work at that place. In his first article he says:

The use of kites for carrying self-registers up into the free air has for several years been practised successfully by the meteorologists of the United States. During the past four years, Mr. A. Lawrence Rotch has accumulated very interesting data at the Blue Hill Observatory near Boston.

Since the autumn of 1897 we have been carrying on analogous researches at the Observatory for Dynamic Meteorology at Trappes[1] and in the course of the year 1898 our self-registers have often attained an altitude of 2,000 meters (6,562 feet).

During the present year, thanks to the improved construction of our kites, according to the Hargrave cellular system, which is also employed in America, we were able to raise our apparatus to 3,940 meters (12,927 feet) on June 14; to 3,950 meters (11,778 feet) on the 15th; and more than 3,300 meters (10,827 feet) on July 3.

The atmospheric soundings made at Trappes on more than a hundred days clearly show the different characters of the rate of diminution of temperature with altitude within the areas of high pressure and within the areas of low pressure, respectively. Within the high areas, as soon as one rises a few hundred meters above the soil, he perceives the rate of decrease of temperature to be diminishing and indeed often observes an inversion of the rate; in the low areas, on the contrary, the rate of diminution is rapid and attains the value indicated by the adiabatic rate for air that has more or less moisture.

With respect to the winds our ascensions show: (1) That during clear weather and high barometric pressure the velocity of the wind generally diminishes in proportion as we ascend above the ground up to an altitude that varies between 1,500 and 3,000 meters; (2) on the other hand, for cloudy weather and areas of low temperature the wind increases appreciably with the altitude, particularly in the neighborhood of the stratum of lower cloud.

In his second article on the temperature of the free air, as shown by 90 ascensions of the sounding balloon, M. Teisserence de Bort says:

The knowledge of the distribution of temperature with altitude at different seasons of the year and under different meteorological conditions is a fundamental datum for the physics of the globe and for meteorology.

Hitherto our information as to the temperature of the free air has been very limited because of the small number of scientific balloon ascensions carrying observers to great heights, and also because these

[1] Trappes is 7 miles from Versailles and about 36 kilometers, or 16 miles, west-southwest from the office of the Central Meteorological Bureau of Paris.

ascensions could not be made in bad weather, so that a large class of interesting atmospheric conditions have escaped our investigation.

The employment of the sounding balloon, on the other hand, inaugurated in 1894 by French aeronauts, has permitted us to carry out repeated explorations of the atmosphere under all circumstances.

We have, during the past two years, at the Observatory for Dynamic Meteorology, studied the lower strata of the atmosphere by means of the kite, and have added thereto systematic explorations of the upper regions by means of the sounding balloon.

After some preliminary trials our useful work began at Trappes in April, 1898, and has been executed at different intervals each month since that date. The ascensions followed each other very closely at certain times in order to follow the changes that were then going on in the atmosphere. We have thus accumulated a mass of scientific documents which is without doubt by far the most important of all that exists relative to this subject, for it contains more than 100 ascensions of sounding balloons, of which 7 surpassed 14,000 meters (8.70 miles); 24 surpassed 13,000 meters (8.08 miles), and 53 attained an altitude of at least 9,000 meters (5.59 miles).

As the value of the records given by the self-registers depends above all upon the precautions taken to assure their accuracy, we have taken great care, as I have stated to the Academy of Sciences in my note of July 11, 1898, to thoroughly protect the thermometer from all sources of error. Various improvements have been made in our apparatus, but the instruments used by us in our first ascensions have been quite recently also used simultaneously with those recently constructed, and have given comparable results.

The series of observations is, therefore, homogeneous throughout.

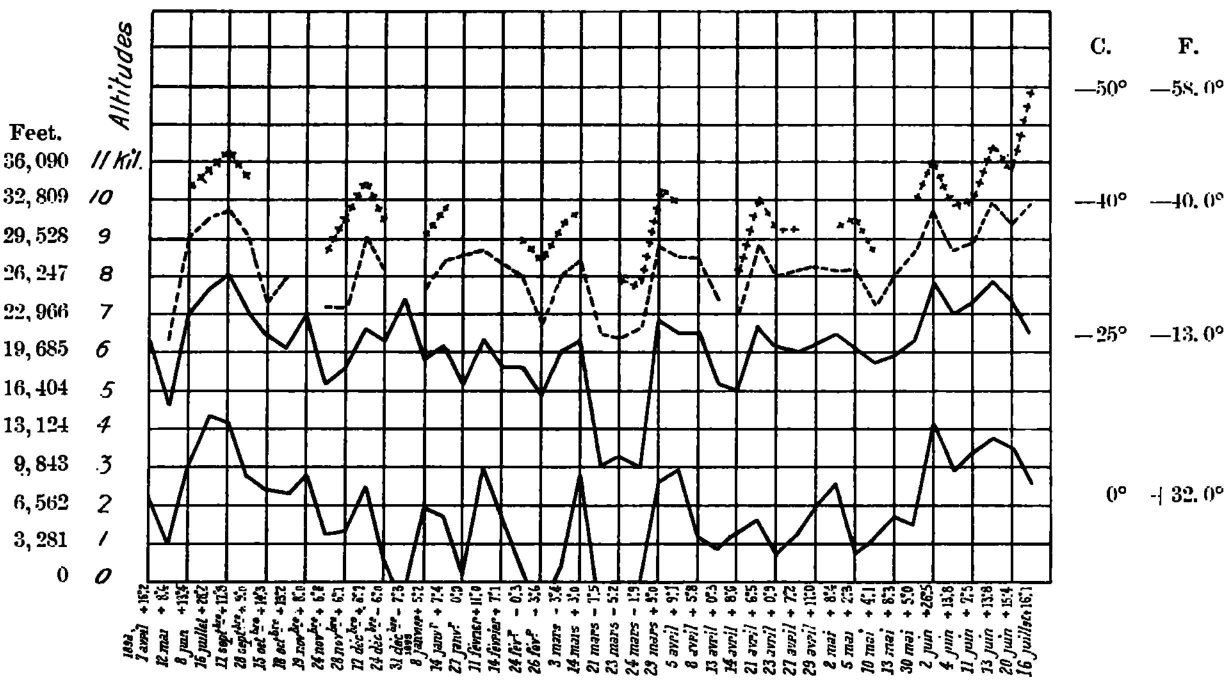

FIG. 1.—Isotherms in free air above Trappes, France.

This diagram shows the height at which the isotherms of 0°, —25°, —40°, —50° C, were encountered on the respective dates. Below the zero line are given both the dates and the temperatures of the air observed at the ground when the balloon started on each ascension. The isotherms of —40° and —50° are not given for certain ascensions; these gaps are due to the fact that the balloon did not rise high enough to encounter those temperatures.

The readings of the curves recorded by the sounding balloons have enabled us to prepare the diagram herewith, which for the first time gives us an idea of the temperature of the free air and its variations in the course of a year, at an altitude of 11,000 meters (36,090 feet or 6.84 miles). In order not to complicate this diagram we have restricted ourselves to showing therein only the altitudes at which the balloons have recorded certain characteristic temperatures: 0°, —25°, —40°, —50° C. (32°, —13.0°, —40.0°, —58.0° F.).

From the discussion of all these documents the following generalizations result:

1. The temperatures at various heights present important variations in the course of a year, and rather larger than have hitherto been admitted according to previous observations made in ordinary balloons.

The temperature 0° C. occurs at very different altitudes, which explains the variations of temperature at the ground, which latter often falls to this temperature in the winter, although it is strongly heated in summer. Thus the isotherm of 0° C., which sometimes touches the ground, or does not exist at all within the atmosphere proper (of course, when the temperatures are negative below), is at other times high above and in the warm season may even be found at 4,000 meters.

The isotherm of —25, which ordinarily remains far above the ground, is also subject to great variations in altitude. In the winter time we find it at about 3,000 meters, and in the summer time above 7,000. In September we have even found it above 8,000 meters; there may be a variation of 5,000 meters in altitude in the course of sixteen months of observations and, probably, we have not yet observed the extremes.

The isotherm of —40° falls many times to near 6,000 meters, and is ordinarily found in the neighborhood of 9,000, sometimes exceeding this altitude, especially toward the end of summer.

The temperature of —50° C., has never been found below 8,000 meters; its greatest altitude has been 12,000 in September, 1898, and July, 1899. It therefore varies at least 4,000 meters.

We see that even at this altitude, where we have passed upward through two-thirds of the whole mass of the atmosphere, the variations of temperature are still very considerable.

2. According to these observations it would seem that even up to 10,000 meters there may be a quite marked tendency to an annual variation of temperature, the maximum taking place toward the end of summer and the minimum at the end of winter; but this phenomenon varies very decidedly from day to day, depending on the changes in the atmospheric situation; thus in the same season, for example, we find the isotherm of —40° at 8,500 meters on March 14, 1899, but at 6,600 meters on March 24.

If we calculate the variability of the temperature at various heights by determining the positive or negative departures of temperature for each ascension, from the general mean for that altitude, we see that beginning a short distance from the ground up to an altitude of 9,000 meters the departures do not vary much with altitude.

The following table, based in general on the results of 80 ascensions, gives the mean departures for two groups of temperature observations of very nearly equal importance. It shows, contrary to that which has hitherto been accepted, that there is no rapid diminution of thermal variability with altitude. It is, however, probable that the distribution of these departures in a vertical direction varies with the type of weather.

The rate of vertical diminution of temperature varies appreciably from day to day, and these variations, like those of the temperatures themselves, have some connection with the different atmospheric conditions.

Altitude above ground.		Mean departures.				Mean of *a* and *b* by weight.	
		a		*b*			
Meters.	*Feet.*	° *C.*	° *F.*	° *C.*	° *F.*	° *C.*	° *F.*
171	561	5.36	9.6	5.75	10.3	5.53	10.0
1,000	3,281	5.48	9.8	5.14	9.8	5.20	9.4
2,000	6,562	5.54	10.0	5.74	10.3	5.63	10.1
3,000	9,843	5.97	10.7	6.30	11.3	6.11	11.0
4,000	13,124	6.17	11.1	6.50	11.8	6.36	11.4
5,000	16,404	5.91	10.6	6.32	12.3	6.34	11.4
6,000	19,685	6.53	11.8	6.63	11.9	6.59	11.9
7,000	22,966	6.81	12.3	6.15	11.0	6.45	11.6
8,000	26,247	6.45	11.6	5.70	10.4	6.05	10.8
9,000	29,528	6.61	11.9	4.81	8.7	5.55	10.0

a Balloon ascensions between April, 1898, and the middle of February, 1899.
b Balloon ascensions between February and July, 1899.

PRELIMINARY RESULTS OF WEATHER BUREAU KITE OBSERVATIONS IN 1898.

We have already stated in the MONTHLY WEATHER REVIEW that after the preparatory work in the construction of kites and meteorographs had been brought up to a favorable condition by Prof. C. F. Marvin, it was ordered by the Chief of the Weather Bureau that a number of stations should be equipped with this apparatus and observers drilled in its use, so that the determination of atmospheric conditions over a considerable extent of country, at the height of a mile above sea level, might be carried out in a systematic manner, day by day, subject only to the omissions that necessarily occur when rain or calm prevented a kite ascension. In addition to the experimental station at Washington, sixteen others were provided for early in the year 1898, and regular observations began during the latter part of the month of April. The records for the six warmer months, May to October, inclusive, have now been partially reduced by H. C. Frankenfield, Forecast Official, and published under the title of Weather Bureau Bulletin F. Vertical Gradients of Temperature, Humidity, and Wind Direction. A Preliminary Report on the Kite Observations of 1898.

Owing to the unexpected demands suddenly precipitated upon the Bureau by the war with Spain, and the consequent immediate extension of the Weather Bureau Service over the West Indies, kite work was temporarily relinquished in November, 1898; but three stations still continue making ascensions, one daily, and two whenever possible.

As the kite undoubtedly offers the best possible method of getting at the true temperature of the atmosphere in perfectly free air, at considerable altitudes, it was especially important that the temperature observations should be promptly reduced and published. Dr. Frankenfield's report probably gives us the most extensive information available as yet as to the conditions of the atmosphere up to the height of a mile above the surface of the ground. The details of the observations and computations are given in full for the use of special students in Bulletin F, but the following general results will be of universal interest.

The Marvin kite-meteorograph keeps a continuous record of pressure, temperature, moisture, and wind velocity, but the adopted plan of observation included frequent additional special observations of the apparent angular elevation of the kite and the length of wire paid out from the reel, whence the true altitude can be computed without depending upon the barograph record. Observations of this kind were made as nearly as practicable at each 500 feet of altitude, while at the same time the rate of ascent or descent of the kite was temporarily checked, so that the thermometer might certainly come to the temperature of the wind at that elevation. These special observations are the only ones discussed in Bulletin F; they usually began early in the morning, but in the case of high ascensions they necessarily lasted over until the afternoon; very rarely were two ascensions made in one day. The mean of the morning and afternoon series generally corresponded to about 10 or 11 a. m., and it is these means that are now reprinted from Dr. Frankenfield's work, to which we must refer for the separate results. The total number of ascensions discussed by him amount to 1217, and the total number of observations of each element, not including those at the ground, amounted to 3,835. The distribution of the ascensions and altitudes is shown in Tables 1 and 2.

TABLE 1.—*Summary of stations and observations.*

Stations.	Elevation above sea level.	No. of months observations.	No. of kite ascensions.	Number of observations at the respective altitudes above ground. 1,000 feet.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	Total.
Washington	115	5.0	87	51	52	53	28	19	9	7	3	1	223
Cairo	315	5.5	39	6	33	31	23	19	4	....	.....	.....	116
Cincinnati	940	5.0	38	3	7	24	19	16	9	3	.....	.....	81
Fort Smith	527	5.0	19	12	18	18	8	2	.....	.....	.....	.....	58
Knoxville	990	5.0	19	8	8	8	8	2	.....	.....	.....	.....	34
Memphis	319	4.3	37	16	22	27	26	21	5	.....	.....	.....	117
Springfield, Ill.	684	5.0	46	15	52	53	28	15	9	2	.....	.....	174
Cleveland	705	5.0	93	29	62	55	48	21	11	1	.....	.....	227
Duluth	1,197	5.5	96	61	71	83	60	32	13	5	.....	.....	325
Lansing	869	5.0	58	23	23	22	34	22	10	.....	.....	.....	134
Sault Ste. Marie	722	5.3	74	7	42	46	39	31	15	.....	.....	.....	180
Dodge	2,473	6.0	138	119	123	118	106	66	28	10	2	1	573
Dubuque	894	5.7	65	19	32	40	35	15	7	.....	.....	.....	148
North Platte	2,811	6.0	132	70	162	133	102	44	13	1	.....	.....	525
Omaha	1,241	4.5	61	0	29	50	45	34	19	6	2	.....	185
Pierre	1,595	5.5	134	96	105	91	65	38	19	2	.....	.....	416
Topeka	972	6.0	81	68	65	76	72	26	11	1	.....	.....	319
Total	....	.....	1,217	603	906	928	746	423	182	38	7	2	3,835

TABLE 2.—*Mean temperature gradients from the ground up to the respective altitudes and the number of observations.*

Stations.	1,000 feet.	1,500 feet.	2,000 feet.	3,000 feet.	4,000 feet.	5,000 feet.	6,000 feet.	7,000 feet.	8,000 feet.	Total No. of observations.
	°	°	°	°	°	°	°	°	°	
Washington, D. C.	5.6	4.4	4.0	3.5	3.2	3.0	3.1	3.0	3.0	
	51	52	53	28	19	9	7	3	1	223
Cairo, Ill.	9.7	6.6	6.0	4.9	4.7	4.3	......	......	......	
	6	33	31	23	19	4	......	......	......	116
Cincinnati, Ohio	13.0	6.3	6.9	5.8	5.6	4.7	4.2	......	......	
	3	7	24	19	16	9	3	......	......	81
Fort Smith, Ark	7.2	7.0	6.7	5.8	3.8	......	......	......	......	
	12	18	18	8	2	......	......	......	......	58
Knoxville, Tenn	8.4	6.2	6.6	5.4	5.0	......	......	......	......	
	8	8	8	8	2	......	......	......	......	34
Memphis, Tenn	7.8	6.8	5.0	3.8	3.7	3.5	......	......	......	
	16	22	27	26	21	5	......	......	......	117
Springfield, Ill	7.6	5.7	5.1	4.4	4.0	3.7	3.6	......	......	
	15	52	53	28	15	9	2	......	......	174
Cleveland, Ohio	5.7	4.1	3.6	3.5	4.1	4.1	4.3	......	......	
	29	62	55	48	21	11	1	......	......	227
Duluth, Minn	5.2	4.8	4.6	4.6	4.3	3.8	4.6	......	......	
	61	71	83	60	32	13	5	......	......	325
Lansing, Mich	7.5	6.0	4.7	4.1	3.9	3.8	......	......	......	
	23	23	22	34	22	10	......	......	......	134
Sault Ste. Marie, Mich	6.6	6.2	5.2	4.5	3.9	3.0	......	......	......	
	7	42	46	39	31	15	......	......	......	180
Dodge, Kans	6.3	5.2	4.8	3.7	3.1	3.2	3.2	3.2	4.9	
	119	123	118	106	66	28	10	2	1	573
Dubuque, Iowa	6.9	5.9	4.6	3.5	3.2	3.3	......	......	......	
	19	32	40	35	15	7	......	......	......	148
North Platte, Nebr	6.8	6.5	5.9	5.2	4.4	4.7	5.4	......	......	
	70	162	133	102	44	13	1	......	......	525
Omaha, Nebr	......	5.4	4.9	3.6	3.2	3.5	3.8	4.1	......	
	......	29	50	45	34	19	6	2	......	185
Pierre, S. Dak	5.9	5.1	4.8	4.3	3.7	4.4	4.0	......	......	
	96	105	91	65	38	19	2	......	......	416
Topeka, Kans	7.4	6.2	4.9	4.0	3.8	3.9	4.5	......	......	
	68	65	76	72	26	11	1	......	......	319
Mean	7.4	5.8	5.2	4.4	4.0	3.8	4.1	3.4	4.0	
	603	906	928	746	423	182	38	7	2	3,835

TABLE 3.—*Mean decrease of temperature from the ground up to the respective altitudes.*

	1,000 ft.	1,500 ft.	2,000 ft.	3,000 ft.	4,000 ft.	5,000 ft.	6,000 ft.	7,000 ft.	8,000 ft.
	°	°	°	°	°	°	°	°	°
Morning	7.2	5.5	4.8	4.0	3.7	3.7	3.9	3.4	3.0
Afternoon	7.5	6.4	6.0	5.5	4.9	4.3	4.5	3.5	4.9
Mean	7.4	5.8	5.2	4.4	4.0	3.8	4.1	3.4	4.0