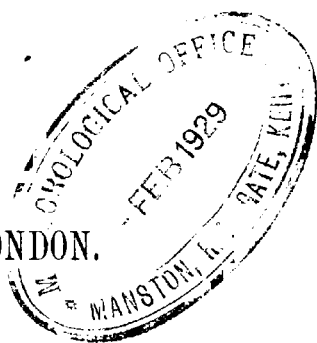


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THE CLIMATE OF NORTH-WEST
RUSSIA.

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THE CLIMATE OF NORTH-WEST RUSSIA.

The area dealt with in the following pages extends from the Arctic Ocean on the north to Petrograd and the Gulf of Finland on the south, and from the Swedish Frontier on the west to Longitude 45° E. on the east.

A considerable portion of this area is within the Arctic Circle; its southern boundary, on the other hand, is in the latitude of the Shetland Islands.

The fundamental circumstance in determining the climate of such a part of the world is the great difference between the amount of sunshine received in summer and winter. Within the Arctic Circle there is the extreme contrast between 24 hours of daylight at midsummer and none at all at midwinter. At noon at midsummer the elevation of the sun above the horizon at Archangel is 49° , which is the same as the elevation at London noon on April 18th. The freezing point of water comes about the middle of the annual temperature-range, so that during the winter half-year the country is frost-bound, agricultural operations are suspended and sledges are generally used for locomotion. In summer, on the other hand, the growth of plants is rapid and the canals and numerous rivers and lakes are open to navigation. A large proportion of the area considered is covered with forests; to the south barley and oats are cultivated successfully; in some places, for example, near Vologda, flax is an important crop.

Sources of Information.—The organisation of meteorological observations throughout the Russian Empire was on a satisfactory basis, so that even in the less densely inhabited regions reports from fairly numerous stations are available. The best general impressions of Russian climatology can be gained by a study of the series of maps in the Atlas published to celebrate the Jubilee of the Central Observatory. The following stations have been selected as representative of North-West Russia :—

TABLE I.

No.	Station.	Position.	Latitude N.	Longitude E.	Height ft.
1	Kola	Near Murmansk ...	$68^{\circ}53'$	$33^{\circ}1'$	22
2	Orlov	Mouth of White Sea	$67^{\circ}12'$	$41^{\circ}22'$	236
3	Kem	White Sea S.E.. Coast	$64^{\circ}57'$	$34^{\circ}39'$	30
4	Archangelsk	White Sea, S.W. ...	$64^{\circ}33'$	$40^{\circ}32'$	22
5	Petrozavodsk	Murman Railway...	$61^{\circ}47'$	$34^{\circ}23'$	206
6	Petrograd	Gulf of Finland ...	$59^{\circ}56'$	$30^{\circ}16'$	16
7	Vologda	Junction for Archangelsk	$59^{\circ}14'$	$39^{\circ}53'$	390

Temperature Scales.—This memorandum is designed in the first instance for readers who are accustomed to the use of the Fahrenheit scale of temperature. The scale in popular use in Russia is Réaumur's, but it has been superseded in native science literature by the Centigrade. With any of these scales there is the inconvenience of illogical "negative" temperatures. By adopting the "Absolute" scale on which temperature is measured from the "Absolute Zero" this disadvantage is avoided. The degrees of the Absolute scale are equal to those of the Centigrade.*

The Fahrenheit scale has been used below in the text; in the tables Fahrenheit and Absolute values are given in parallel columns. It may be mentioned here that thermometers graduated on the Absolute scale are obtainable from the Meteorological Office.

Temperature.—The normal variation of mean temperature throughout the year at seven stations is shown in Tables IV. to X. At Archangel the range is from 7° F. in January to 60° F. in July. Petrograd is not so cold as Archangel in winter, the mean January temperature being 15° F., but the July temperature is practically the same, 64° F.

Both the towns mentioned have their climate moderated by the presence of the neighbouring waters, the White Sea at Archangel and the Gulf of Finland at Petrograd. The range of temperature is greater at places further from the coast line. The comparative warmth of the coast of the Arctic Ocean in winter is of great importance, as it makes navigation possible throughout the year and justified the construction of the railway to Murmansk. There is a continual drift of warm water from the Atlantic keeping the temperature of the sea and of the air over it comparatively high throughout the winter.

The January temperature at Alexandrovsk, near the mouth of the Kola River, is about equal to that at Petrograd, and lighthouse stations to the north-west of that inlet are still warmer. In the interior of Lapland the mean temperature for January is as low as 7° F., but considering the latitude this may be regarded as moderately warm. In comparing North-West Russia with Central Siberia in the same latitude, it must be remembered that the prevailing winds in winter—from the west and south-west—have made but a short passage across Scandinavia since leaving the warm waters of the Atlantic.

Variability of Temperature.—The range of possible temperatures in the cold season is remarkable. Thus on the average, January temperature at Archangel fluctuates between the maximum 33° F and the minimum -25° F., a range of 58° F. This great range is due to alterations in the general meteorological conditions, such as

* To convert Centigrade readings to Absolute add 273. To convert Centigrade to Fahrenheit multiply by 9, divide by 5, add 32.

the direction and strength of the wind and the presence or absence of cloud. The insignificant difference, about 1.5° F., between the mean temperature at dawn and in the early afternoon in the same month indicates the small effect of the winter sun. In July, on the other hand, the normal range for the month is much smaller, from 39° F. on the coldest night to 80° F. on the hottest day, though the July sun is responsible for a mean diurnal variation of 14° F. between 55° F., the temperature at sunrise, and 69° F., the temperature at 3 p.m., the hottest hour of the day.

The "Record" temperatures for Archangel (from 1813) are said to be -53° F. and 94° F. The extremes for the period 1871 to 1908 which has been adopted for Table V. are -49° F. and 85° F.

Like data for other stations will be found in the Tables IV.—X. on pages 94 to 107.

Thawing and Freezing.—The principal events in the meteorological year, the thawing and freezing of the rivers, occur shortly after the passages of mean air temperature through 32° F.

The dates of these phenomena vary considerably from year to year, but the thawing is the more punctual of the two. On the average the date at which the rivers are free in the latitude of Petrograd is April 21st. At Archangel it is about May 8th, and at Kola May 21st. Freezing occurs at the same places in the reverse order, the date being November 2nd at Kola, November 5th at Archangel, and November 24th at Petrograd. Approximate average dates for other places are given in Table II. The way in which this table is to be read may be illustrated by the case of the Northern Dvina at Archangel.

On the average the freezing of the Dvina occurs on November 5th. It is an even chance that it will occur between October 28th and November 13th. One year in ten it occurs before October 21st, the earliest being October 16th; one year in ten it occurs on or after November 21st; in one year (actually 1877) the river remained open until December 16th.

It will be seen from the table that the date of freezing is considerably more variable than the date of thawing.

From the point of view of international communication the freezing of the seas is of more significance than that of the rivers. It is the great advantage of Murmansk as compared with Archangel that the harbour can be kept ice-free during the winter. On the Murman coast there is often pack-ice, but navigation can be kept open even without the use of ice-breakers.

Ice usually begins to form in the White Sea by the end of October; the earliest ice observed was on October 13th, 1892, in Archangel Bay. The ice remains all through the winter, as a rule only as drift ice, at the mercy of the winds and of the current which normally sets outwards carrying the water of the rivers to the ocean. The fixed ice stretches two or three miles from the

TABLE II.—Dates of Forming and Breaking up of Ice.

Station.	Record.	1st Decile.	1st Quartile.	Median.	3rd Quartile.	Last Decile.	Record.
NOVA AT PETROGRAD—							
Forming	Oct. 12	Nov. 9	Nov. 17	Nov. 24	Dec. 2	Dec. 12	Jan. 8
Breaking up	Mar. 18	Apr. 10	Apr. 15	Apr. 21	Apr. 26	May 1	May 12
DVINA AT ARKHANGELSK—							
Forming	Oct. 16	Oct. 21	Oct. 28	Nov. 5	Nov. 13	Nov. 20	Dec. 16
Breaking up	Apr. 21	May 1	May 8	May 13	May 19	May 23	June 7
ONEGA AT ONEGA—							
Forming	Oct. 27	Nov. 6	Nov. 11	Nov. 23	Nov. 30	Dec. 8	Jan. 6
Breaking up	Apr. 17	Apr. 29	May 4	May 9	May 14	May 19	June 2
LAKE ONEGA AT PETROZAVODSK—							
Forming	Nov. 13	Nov. 19	Nov. 27	Dec. 4	Dec. 13	Dec. 19	Dec. 26
Breaking up	Apr. 28	May 2	May 11	May 17	May 23	May 27	June 14

The information on which this table is based is derived mainly from Rykatcheff, Repertorium für Meteorologie, 2, 1887. Über der Auf- und Zungung der Gewässer des Russischen Reiches. For years subsequent to 1889 the dates of thawing and freezing are published in the official Yearbook.

coast. Usually the mouth of the sea is closed, and in some few winters the fixed ice may stretch all over the sea.

Navigation to Archangel is occasionally open by the beginning of May, but the usual date is about the 21st. In certain years, *e.g.*, in 1916, the port is not declared open until the middle of June. Under natural conditions it was usually closed by the end of October, but with the aid of ice-breakers it has been kept open as late as the middle of February.

Precipitation.—Precipitation in the forms of rain and snow may be considered together, the amount of snow being estimated in terms of the water it yields on melting.

The total fall for the year averages rather over 500 mm. in the south of the area; this is about equal to the normal fall on the Essex coast, the driest part of England. Further north there is less precipitation; the amount in the interior of the Kola peninsula is less than 200 mm. The heaviest falls are everywhere in the summer, the lightest towards the end of the winter. A large proportion of the rainfall is associated with cyclonic depressions which have reached Russia from the Atlantic, after crossing Scandinavia or Germany. Summer thunderstorms occur even in the far north. In Lapland there are on the average less than five thunderstorms a year. The number increases to the south. At Archangel and Petrograd it is about ten and at Vologda twenty. In some places nearly half of the rainfall of the summer is recorded on the days of thunderstorms.

Practically the whole of the precipitation from the beginning of November to the middle of April is in the form of snow. Heavy falls exceeding a few inches in the day are very rare, however. The first fall of the season, which may be only an inch deep, suffices to make the sledge routes available, and it is only occasionally that a thaw follows the first considerable fall. During the winter the snow accumulates, but the greatest depth—about the end of March—does not exceed 3 ft. This represents about 9 inches of water, the density of old untrodden snow being about one-fourth of that of water, whereas that of new snow may be as small as one-tenth. The surface of the ground beneath the snow being frozen hard at the time of the spring thaw, the greater part of the melted snow runs off the land to the lakes and rivers, so that floods are frequent at this time.

Underground Temperature.—It is a general rule that the temperature of the soil a few feet below the surface varies but slightly throughout the year; it follows that a sharp distinction must be made between localities where this underground temperature is above and below the freezing point. In the latter class, the sub-soil is frozen throughout the year, and a thin layer near the surface being badly drained, is frequently water-logged. Such ground is known as tundra; it may bear good herbage but it cannot support trees. There is a small area of tundra near the eastern end of the

Murman Coast, but in other parts of the region under consideration the subsoil is not permanently frozen.

In countries where the ground is not covered with snow the mean temperature of the ground at a few feet below the surface approximates closely to the mean air-temperature. On the other hand, a covering of snow protects the ground from intense cold, and it follows that in countries such as North Russia, where there is this protection from cold but no corresponding protection from the heat of summer, the mean temperature underground is considerably higher than on the surface, the difference amounting to some 10° F. It will be seen that the presence of snow during winter is in this way of great service to agriculture, and especially to the forester. The roots of the larger trees reach to depths where the temperature is above the freezing point throughout the year. The insulating effect of the snow may be regarded also from another point of view. The upper surface of the snow cools by radiation, and as it receives little heat from below it reaches very low temperatures and thereby is able to cool the air. It is for this reason that the range of air-temperature is so much greater in winter than in summer.

Cloudiness.—The percentage* of cloudy skies in North Russia is high. On the average nearly 80 per cent. of the sky is covered with cloud. During the winter months completely overcast skies have been reported at every observation for weeks together. On the occasions when the clouds disappear, even for a few hours, there is an immediate fall in temperature unless, as rarely happens, a strong wind is blowing at the time. The most cloudy month is usually November; clear skies are most frequent in June.

Fog.—Fog and mist are rare in winter. In the latitude of Petrograd mists at night are frequently reported during the summer and autumn months, but further north they are not so common.

At Archangel and at other places near the coast fogs occur three or four times a month during the winter, with very low temperatures and winds from the northerly quarter. Evidence with regard to fog on the Murman Coast is rather conflicting. According to the table on page 96, prepared from official Russian reports, there are on the average 15 days on which fog is reported at Orlov Lighthouse, at the mouth of the White Sea, in July, and 16 in August. On the other hand, in the meteorological logs preserved at the Meteorological Office only 8 per cent. of the observations referring to the neighbourhood give fog and 7 per cent. mist, so that the conditions at Orlov would appear to be exceptional.

At Teriberka, near the mouth of the Kola River, "mists" are frequently reported in summer with northerly winds, but "fogs" appear to be rare.

General Circulation of the Atmosphere.—Except during the height of summer, the general movement of the air across Northern

* See below, Appendix II.

Russia is from west or south-west to east or north-east; the highest pressure is to the south-east and the lowest to the north-west. In January the pressure is on the average 1,019 mb. at Vologda and 1,009 mb. at Kola. According to a well-known law the average drift of the air is therefore about 5 metres per second or 11 miles per hour, from south-west. The calculation of this average is made on the assumption that equal winds from opposite quarters cut out so that the result indicates a preponderance of rather strong south-west winds above those from other quarters.* The actual winds on individual days are associated with the passage of cyclones and anticyclones, as in Western Europe, and are, therefore, very irregular. The general tendency of the cyclones is to move from west to east, but there is a great variety in their tracks.

In summer the average pressure gradient over Russia is very slight, the normal pressure being within 1 mb. of 1,012 mb. from the Arctic Ocean to the Caucasus. There is a slight tendency on the whole for northerly winds to predominate, but along the Gulf of Finland westerly breezes are most frequent.

Gales.—On the great plains of Russia gales are rare. The number reported at Vologda averages less than two per annum, and these are distributed sporadically throughout the year. At Petrozavodsk the annual total rises to 15, the greater number occurring in winter. Similar figures are given for Archangel and for Kem.

On parts of the coasts of the Arctic Ocean the gales are almost continuous for long periods in winter. At Orlov, situated at the mouth of the White Sea, the number of days of gale in November is actually 16 on the average. At this time of the year the difference in temperature between the cold land and the comparatively warm water is considerable, so that when the wind is blowing off the land, as it usually does, the atmosphere is in a very unstable state. The conditions which have earned for parts of the Antarctic Coast the title "The Home of the Blizzard" are therefore reproduced on a small scale and gales result. The great excess of wind strength at North Cape and Vardö over that at Pechenga and Murmansk is noteworthy. It is quite common to have a wind of Force 7 or 8 at North Cape and a calm at Murmansk.

The Upper Air.—Measurements of the temperature of the Upper Air in the neighbourhood of Petrograd are sufficiently numerous for safe generalisations. The average difference between the temperatures at the surface in the South of England and at Petrograd is about 13° F., and this difference persists up to 12,000 ft. Beyond that height the difference falls off. At 30,000 ft. there is equality between the two regions. The greatest interest attaches to observations in the winter and spring, when very low temperatures may occur near the ground. On such occasions there are always "inversions." In the course of an ascent the air gets warmer, perhaps for the first 6,000 ft. and it may be that the

* See below, Appendix II.

surface temperature is not observed again until 12,000 ft. is reached. In general the variation from day to day is much less at considerable elevations than near the ground. It must not be assumed, however, the "inversions" are the general rule. On the average at Petrograd, even in January, there is a slight drop of temperature in the first 1,000 ft. In the hot season in the daytime the drop frequently approximates to 6° F. per 1,000 ft., which implies complete stirring of the air, the condition favourable to thunderstorms and causing "bumpy" flying.

For latitudes such as that of the Murman Coasts, the observations made by H. Maurice who conducted* a Franco-Swedish expedition to Kiruna in Swedish Lapland, just within the Arctic Circle, are fundamental. Maurice found that the conditions prevailing in this region were not essentially different from those in central Europe. In particular the height and temperature of the stratosphere were associated more closely with the pressure prevailing at the earth's surface than with the season of the year or with latitude. Maurice's observations made in 1907 and 1908 refer to the end of winter; his latest series was in August, 1909. The means of the temperatures found at various heights are shown in Table IIIA. Far greater cold was encountered at ground level in 1908 than in 1907, but the difference was almost eliminated at 3,000 metres. In the 1908 series "inversions" near the ground were general though usually the highest temperature recorded in an ascent was not more than two or three degrees above that at the surface. Much larger differences occurred on a few occasions: for example, on March 11th, the temperature at the surface was -20° F. and at 950 metres above sea level (450 m. above ground) the trace indicated $+3^{\circ}$ F.

The results† of a cruise of the Duke of Monaco's yacht to Spitzbergen in the summer of 1906 are of interest. The average rate at which temperature decreased with increase of height was found to be rather low. This was due to an alternation in the course of ascents between rises and falls of temperature, and suggested that successive layers of air had probably come from different regions.

The relation between the distribution of temperature and wind strength is mutual. A necessary condition for the production of low temperatures by radiation from the ground is the absence of strong winds. On the other hand, when inversions do occur, the air being much heavier below than above is in a very stable condition, there is little interchange of air by means of eddies, and any wind blowing up above is unable to communicate its motion to the lower layers. Accordingly it may be taken as a general rule that very low temperatures at the surface will be accompanied by only the lightest of breezes, but that they are consistent with much stronger winds at moderate heights. According to the

* L'expédition Franco-Suédoise de Sondages Aériens, N.A.R.S., S.U. Ser. IV. Vol. 3. No. 7. Upsala, 1913.

† Hergesell, Beiträge der Physik der Freien Atmosphäre, Vol. 2, p. 96, 1907: some of the data obtained during a similar cruise in 1907 are given in "Observations des ascensions internationales . . . pendant l'année 1907."

Petrograd figures (Table III.) the difference between the average summer and winter temperatures is greatest at the surface of the earth, 24a or 44° F. At 6,000 ft. the difference is reduced to 15a

TABLE III.—Upper Air Temperatures at Petrograd.*

Height	Winter.	Spring.	Summer.	Autumn.	Height.	Winter.	Spring.	Summer.	Autumn.
km.	a	a	a	a	ft.	°F.	°F.	°F.	°F.
12.0	217	223	225	222	40,000	-68	-58	-54	-59
9.0	219	224	230	226	30,000	-65	-56	-45	-52
6.0	236	240	250	244	19,700	-34	-28	-9	-20
3.0	254	258	269	262	9,850	-1	5	26	12
1.0	263	269	281	271	3,300	15	25	46	29
0.5	264	271	285	274	1,650	16	29	53	34
0.0	264	274	288	274	0,000	15	33	59	34

TABLE IIIA.—Upper Air Temperatures at Kiruna.†

67° 50' N. 20° 14' E.

Height above M.S.L.	Height above Station.	March, 1907, 15 ascents.	Feb., Mar., 1908, 16 ascents.	August, 1903, 8 ascents.	Height above M.S.L.	Height above Station.	March, 1907, 15 ascents.	Feb., Mar., 1908, 16 ascents.	August, 1903, 8 ascents.
km.	km.	a	a	a	ft.	ft.	°F	°F	
0.5	0.0	270	259	283	1,650	0	27	7	51
1.0	0.5	268	262	282	3,300	1,650	22	11	49
3.0	2.5	258	256	272	9,850	8,200	5	1	30
6.0	5.5	242	237	256	19,700	18,050	-24	-33	1
9.0	8.5	225	217	234	30,000	28,000	-55	-68	-38
12.0	11.5	219	213	223	40,000	38,000	-64	-75	-58

or 27° F. It remains about the same up to 25,000 ft. The "tropopause" (above which temperature is nearly uniform) occurs at about 30,000 ft. in winter, at 34,000 ft. in summer, and at these great heights the difference between winter and summer temperature is only 8a or 14° F., so that the range is reduced to one-third of its value at the surface.

In connection with upper air temperatures it may be useful to note that the system‡ generally adopted for the graduation of altimeters involves large errors in cold climates, all heights being over-estimated. Under average conditions at Petrograd in January the correction required approaches 10 per cent. At 10,000 ft. above ground the altimeter readings would be 10,800, and at 20,000 ft. it would be 22,000. On the other hand, in July the corresponding corrections are negligible up to 12,000 ft., and only amount to 500 ft. at 20,000 ft.

* Mean Values (Rykatcheff).

† Mean Values (computed at the M.O.)

‡ The Estimation of Height from Readings of an Altimeter. M.O. Publication, 228.

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‡ The Estimation of Height from Readings of an Altimeter. M.O. Publication, 228.

Aurora.—The presence of the Aurora or Northern Lights is frequently mentioned as providing some compensation for the absence of the sun during the long nights of winter in the north. The reported observations indicate that the Aurora is visible on most clear nights and in fact on practically every night when the sky is clear or half-covered. Moreover, Aurora behind thin clouds may make a considerable difference to the amount of general illumination, just as it is never dark at the time of full moon, even when the sky is completely overcast.

APPENDIX I.

Weather in Murmansk, Kola Creek and District in late Winter.

The following notes are based on experience in February and March, 1919.

(1) The best, almost the only, condition for fine weather is a High Pressure over the White Sea and a Low over Bodo or Haparanda. This gives light or moderate south-easterly surface winds with clear cold nights and cloudless days. These periods of fine weather are of quite long duration; the low centre over the Bodo area remains fixed there for two, three and sometimes more days at a time.

(2) The really dangerous matter here is any North in the wind. In almost every case a wind between East and West going through North brings low cloud and snow.

The map condition for bad weather is either:—

- (a) A High over Bodo area, or
- (b) A Low over the White Sea.

(3) Bad weather comes here, too, by reason of the frequency (comparatively) of small depressions coming down from the North along the Eastern edge of a High Pressure to the West. These small depressions move rapidly and pass fairly rapidly, but bring high winds, driving snow and generally very bad weather. The absence of stations to the North or North-East makes their forecasting difficult; it is necessary to be continually on the alert for them even when conditions otherwise seem fair.

(4) During the months in question there was a good percentage of blue skies and they continued during fairly long periods. There was only one fog, though morning mists and valley cloud-banks up the Kola creek were frequent under fine weather conditions. On occasions the air was remarkably clear and pilot balloons could be followed to exceptional heights.

APPENDIX II.

Diagrams illustrating the amount of cloud during Summer and Winter with winds from different directions, at Kola and Archangel.

The analysis on which these diagrams are based is similar to that carried out by D. Brunt, for Kew Observatory, Richmond.* All the observations made at Kola and Archangel during the ten years 1899-1908 were classified according to the direction of the wind and the cloud amount. For example, all observations of North winds at 7h. with sky one quarter covered were grouped together, all such observations in the six summer or six winter months being pooled. Precipitation (rain or snow) and fog were treated as sub-classes of "overcast sky."

The proportion of winds from each direction is shown at the top of the diagrams. The lengths of the lines in these figures give the frequencies of the directions; they do not indicate the strength of the wind.

The winds from each direction are then taken together and the percentages of observations of clear sky, $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ covered and overcast sky and of rain and of fog are shown by appropriate shading.

It will be seen that, on the whole, at both Kola and Archangel, there is a large amount of cloud, while in summer the best chance for a clear sky is when calms prevail during the afternoon and evening; calms in the morning are likely to bring fog. At Kola a wind from the south brings the least amount of cloud, while at Archangel it is a wind from the north-east that brings clear sky and one from the north-west and west that brings the least proportion of overcast sky.

In winter at Archangel calms are associated with clear skies, but also there is a large percentage of fogs with calms in the morning. Kola also has fogs with calms, but the proportion of fogs there is very small compared with that of Archangel. At Kola in winter the winds between north-west and south-east (through east) are so infrequent and so alike in character that they have been pooled and one diagram for them all has been given. These winds give the greatest proportion of overcast skies while clear skies are fairly evenly divided between south, south-west and west. At Archangel clear skies are given with a north and north-east wind and overcast skies by a wind between south and west.

At Kola the frequency of precipitation shows a decided variation with wind direction in both summer and winter. Rain comes with a north and north-east wind, and is rarer with winds from the south and south-west, *i.e.*, a wind blowing down the river valley is dry, while one blowing up the long and wide mouth of the river from the Arctic Ocean brings rain or snow with it. At Archangel the variation is not so marked, but an east wind brings the greatest amount of precipitation in both summer and winter. Calms in summer have very little precipitation, the most being in the morning.

Diurnal variation of precipitation is fairly well marked at Kola, especially in summer, when the afternoon observation shows the least proportion of rain or snow, but the variation of cloudiness throughout the day is not very obvious even in summer. At Archangel there is little diurnal variation in either cloudiness or precipitation, but as a rule the evening observation gives the least percentage of overcast skies.

The wind diagram for Kola in winter is noticeable for the persistence of south-west winds. At Archangel the winds are more evenly distributed and in summer at both stations the diagrams are very regular.

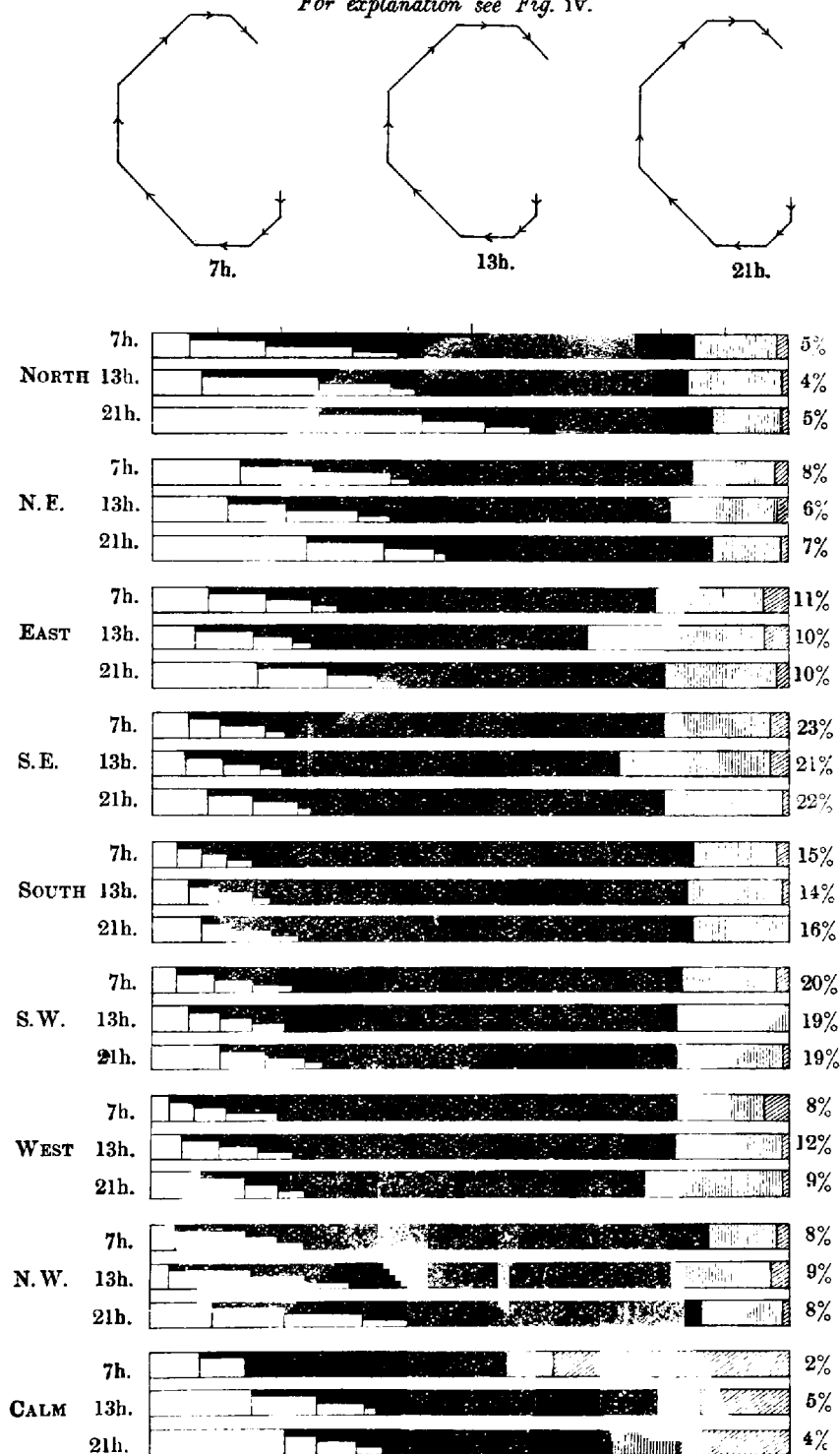
* Professional Notes No. 1.

ARCHANGEL.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS

WINTER:—OCTOBER TO MARCH, 1899–1908.

For explanation see Fig. iv.



ARCHANGEL.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS

WINTER:—OCTOBER TO MARCH, 1899-1908.

For explanation see Fig. iv.

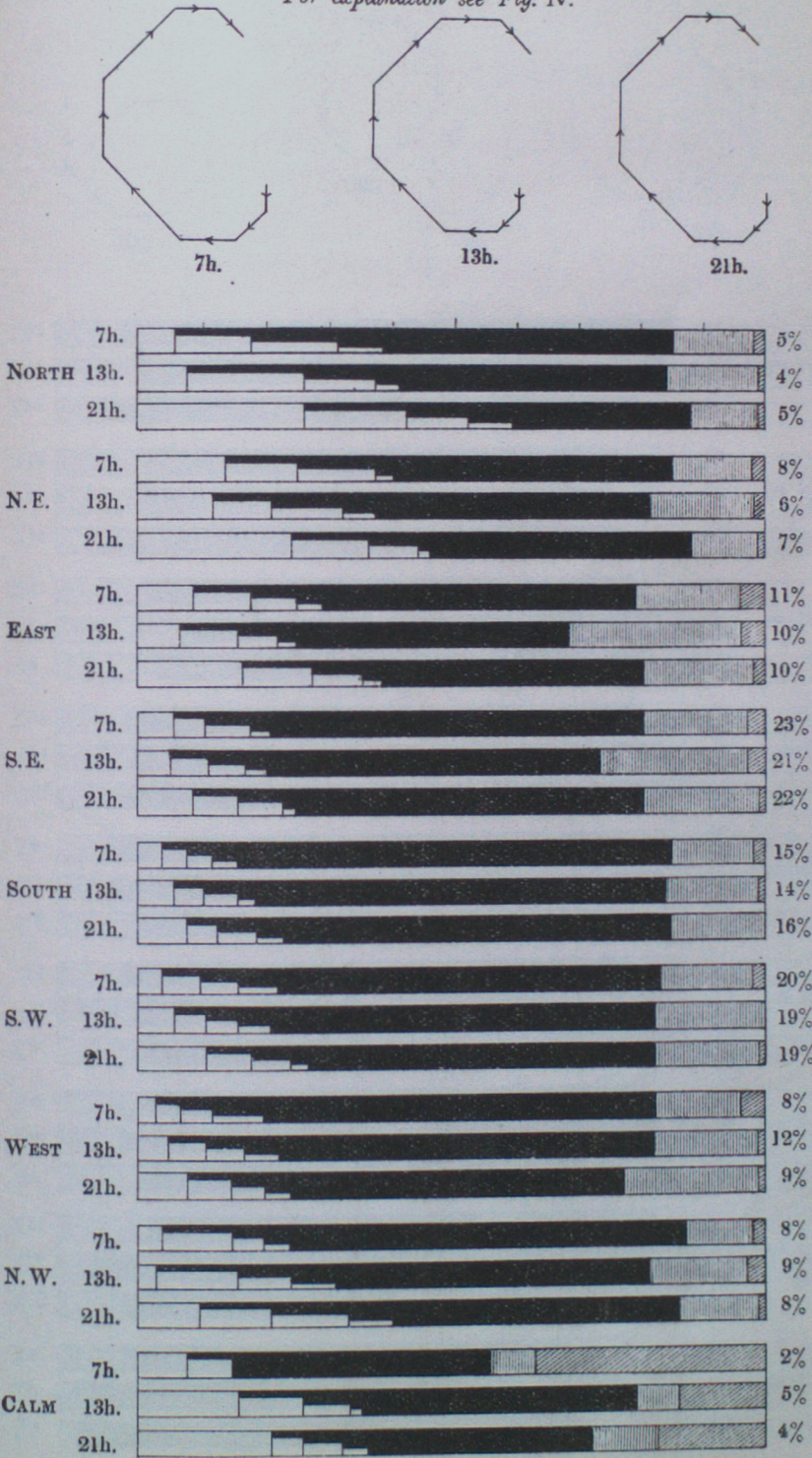


Figure II.

ARCHANGEL.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS
SUMMER:—APRIL TO SEPTEMBER, 1899–1908.

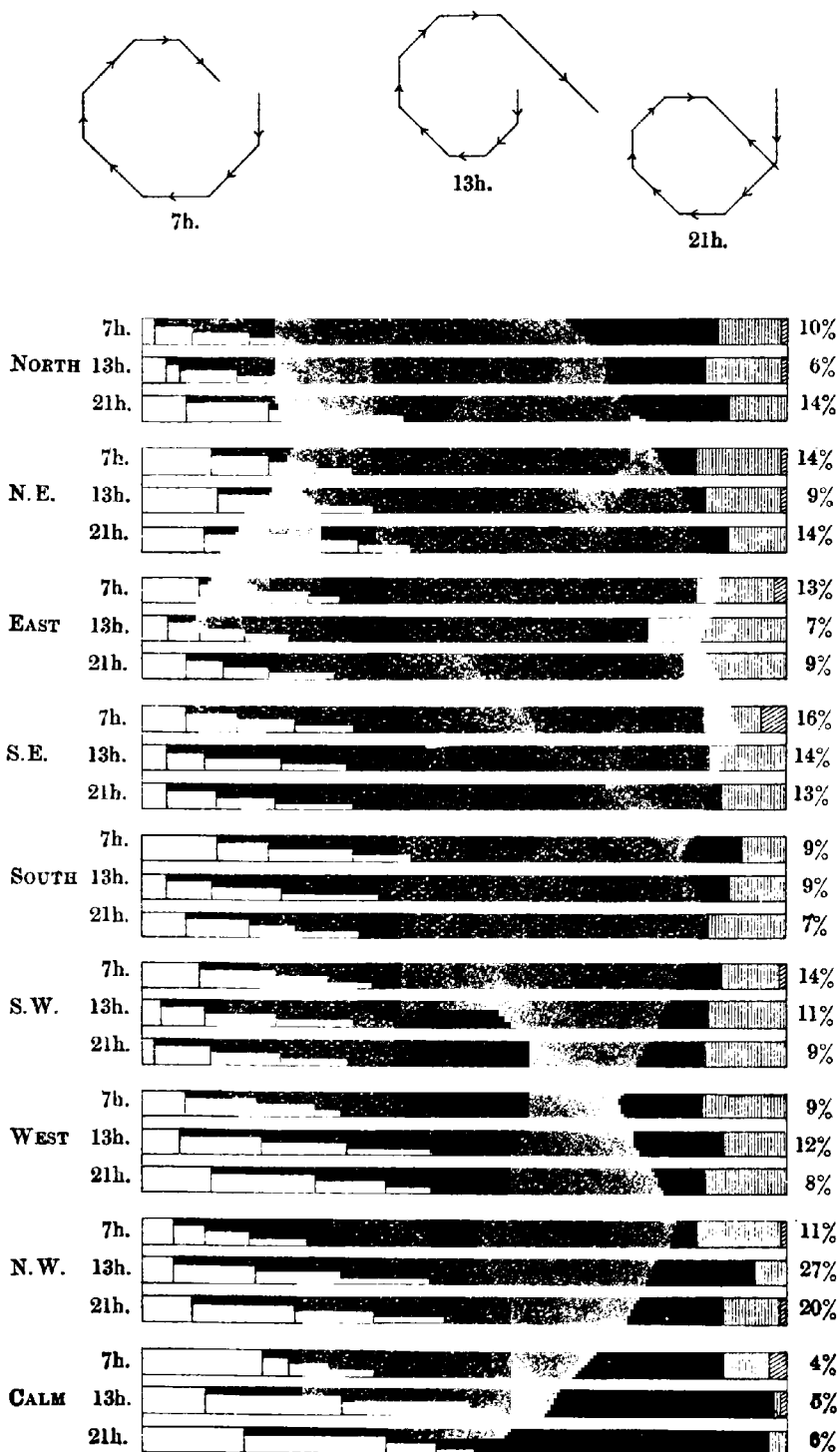


Figure II.

ARCHANGEL.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS
SUMMER:—APRIL TO SEPTEMBER, 1899–1908.

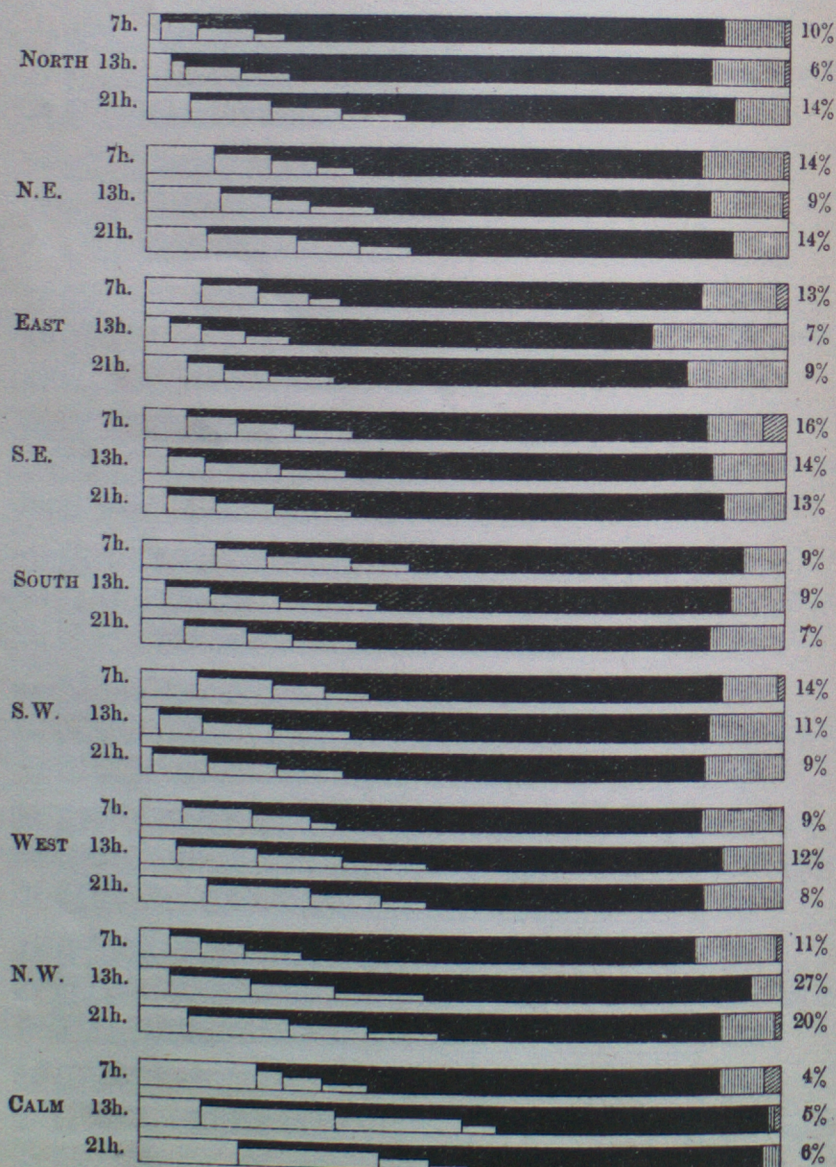
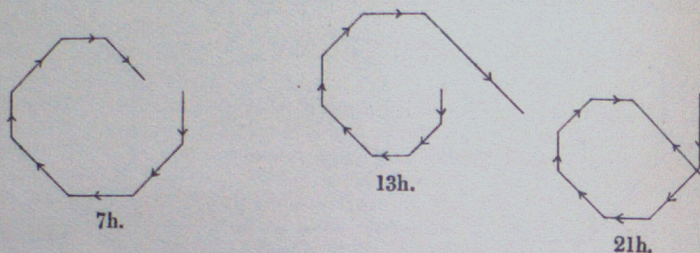


Figure III.

KOLA.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS
SUMMER:—APRIL TO SEPTEMBER, 1899–1908.

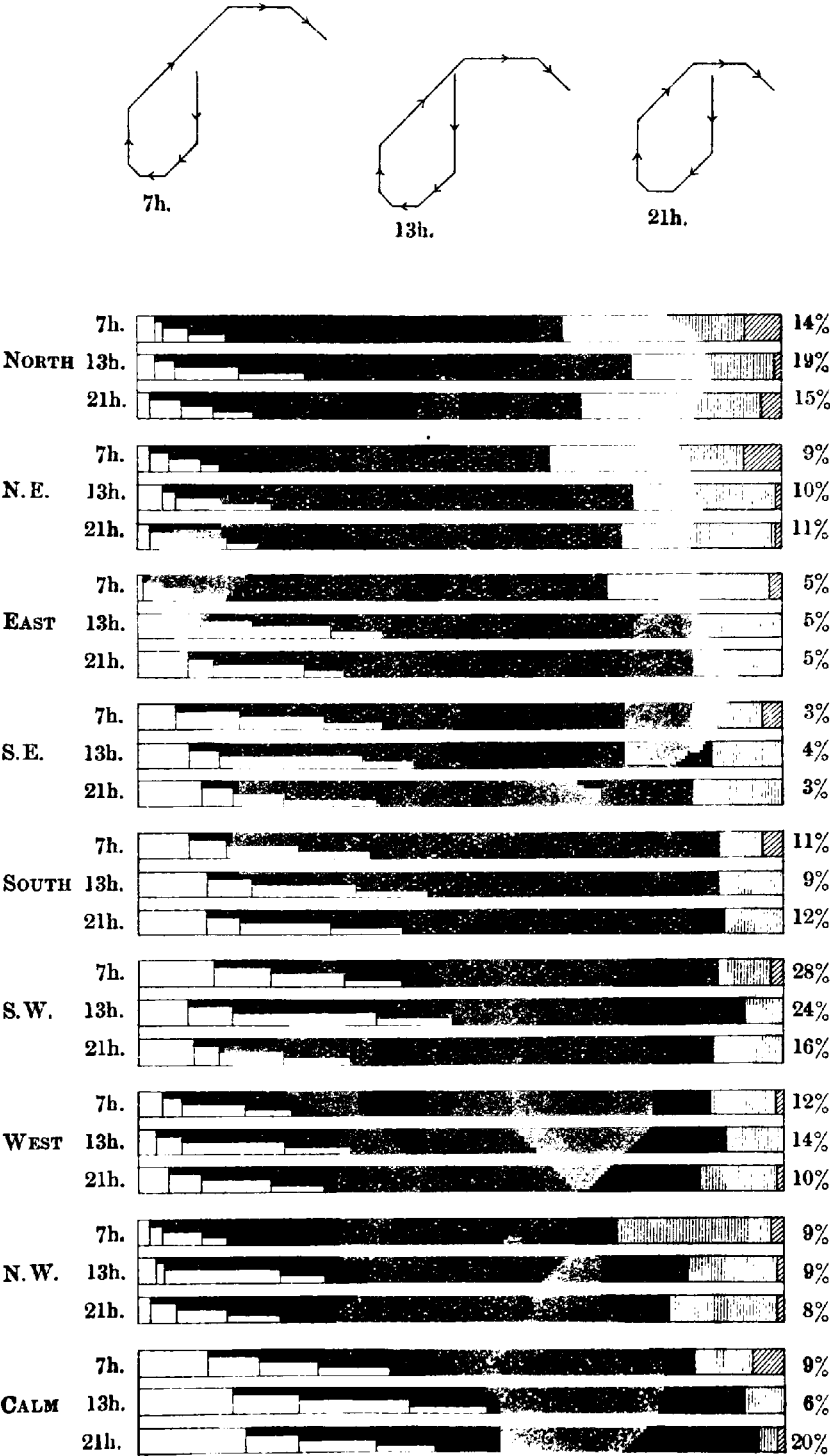


Figure III.

KOLA.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS
SUMMER:--APRIL TO SEPTEMBER, 1899-1908.

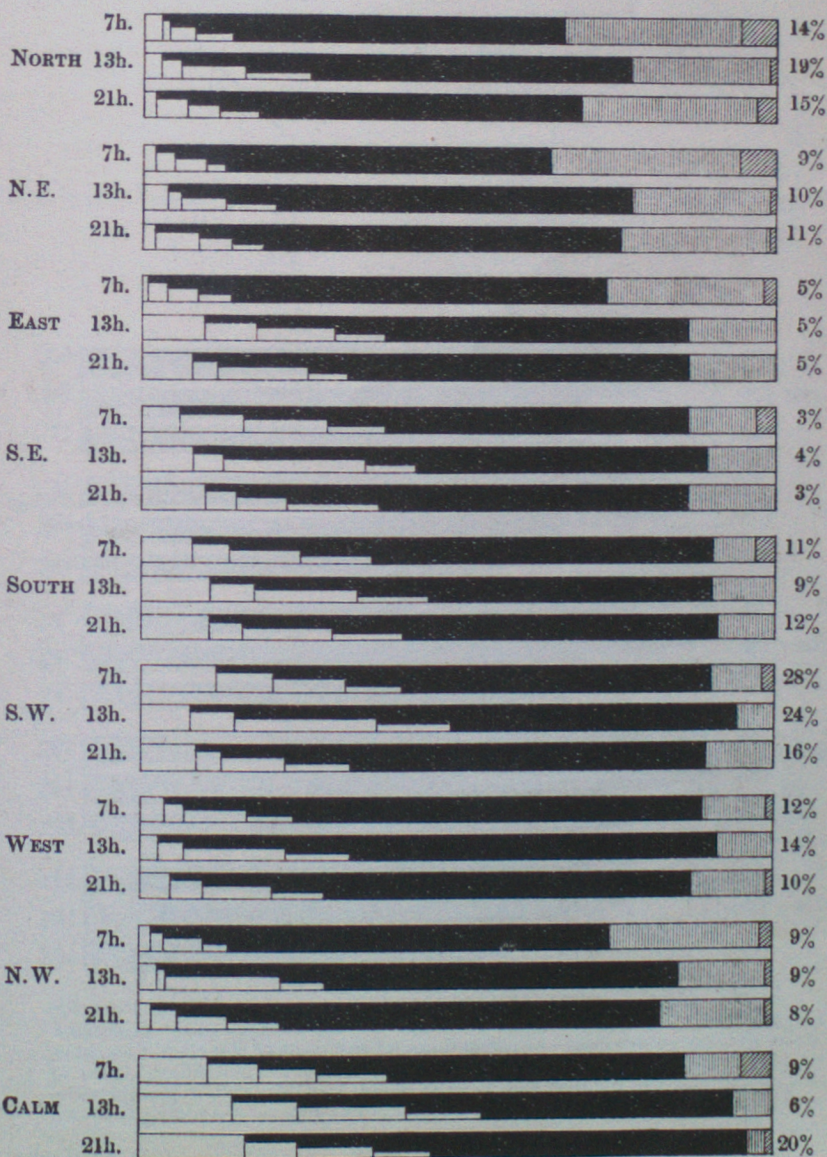
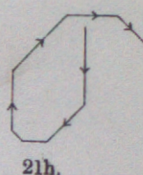
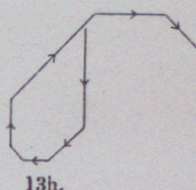
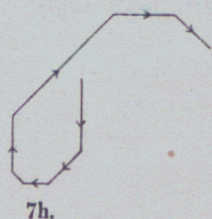
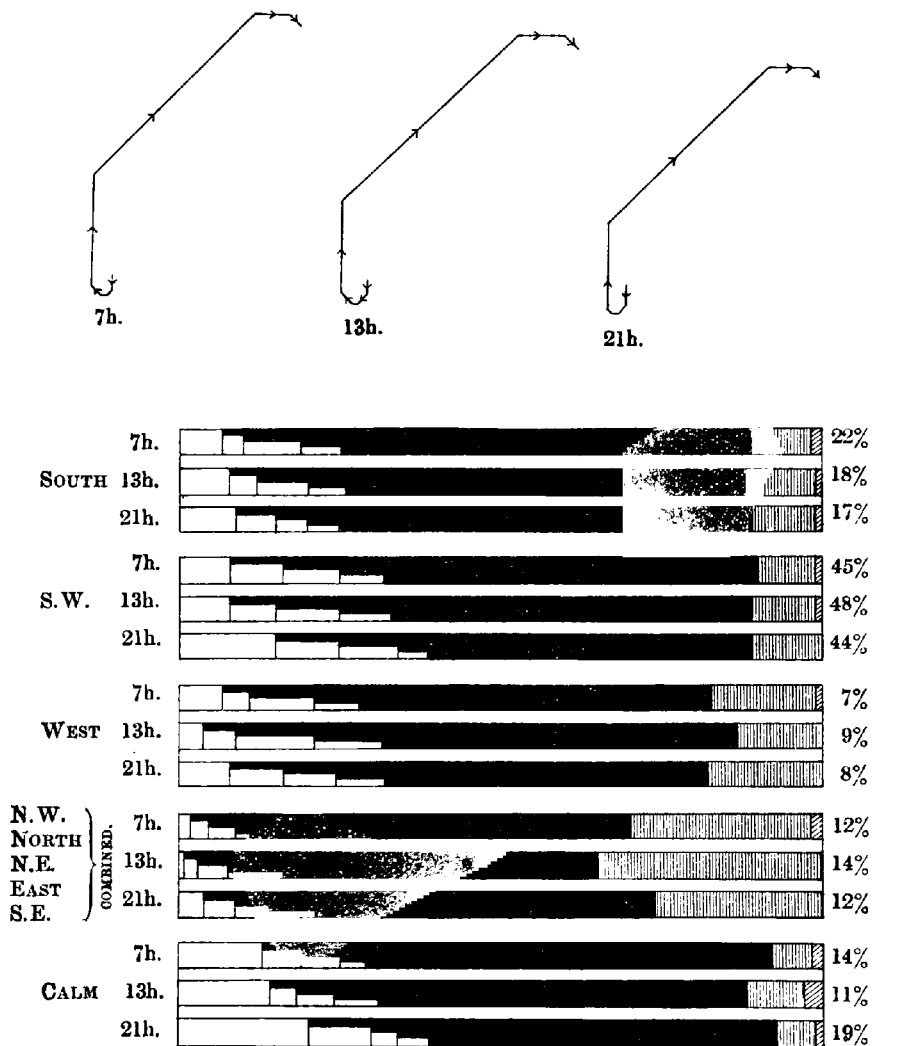


Figure IV.

KOLA.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS
WINTER:—OCTOBER TO MARCH, 1899-1908.



EXPLANATION.

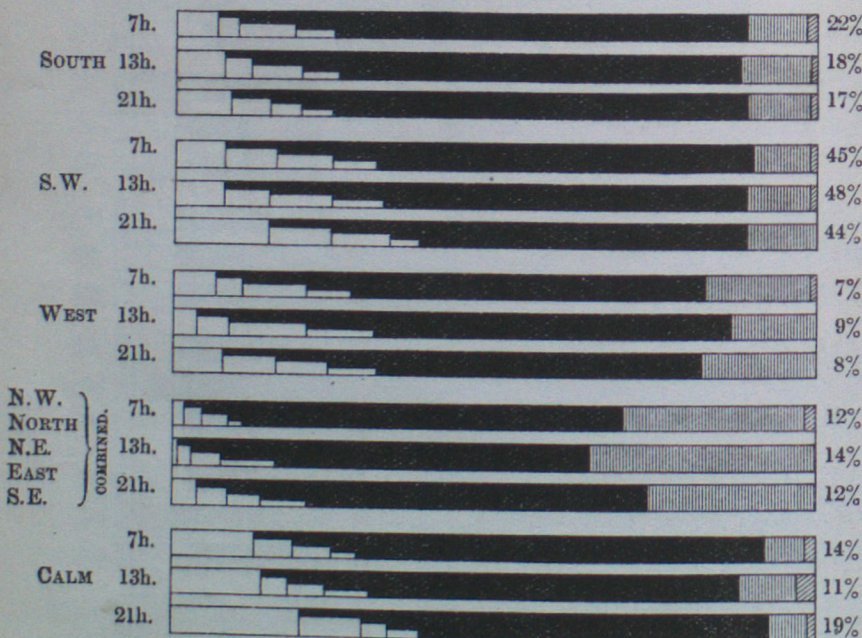
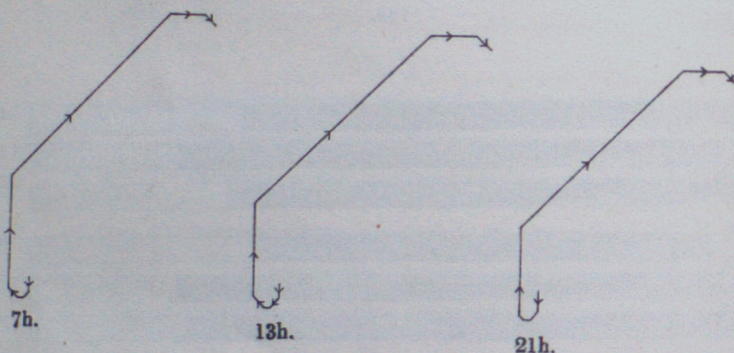
In the upper diagrams the lengths of the several straight lines are proportional to the frequencies of winds in the corresponding directions. These frequencies are stated as percentages on the right of the cloud diagrams, in which each horizontal strip gives for morning (7 h.), midday (13 h.) or evening (21 h.), the frequency of various cloud amounts and of precipitation or fog with the wind from a specified quarter. The scheme of shading is shown below:

☐ CLEAR SKY. ☐ 1/4 CLOUDED. ☐ 1/2 CLOUDED. ☐ 3/4 CLOUDED
☐ OVERCAST WITHOUT PRECIPITATION. ☐ PRECIPITATION (RAIN OR SNOW) ☐ FOG OR MIST.

Figure IV.

KOLA.

FREQUENCY OF CLOUD WITH VARIOUS WINDS AT THREE HOURS
WINTER:—OCTOBER TO MARCH, 1899-1908.



EXPLANATION.

In the upper diagrams the lengths of the several straight lines are proportional to the frequencies of winds in the corresponding directions. These frequencies are stated as percentages on the right of the cloud diagrams, in which each horizontal strip gives for morning (7 h.), midday (13 h.) or evening (21 h.), the frequency of various cloud amounts and of precipitation or fog with the wind from a specified quarter. The scheme of shading is shown below:

- CLEAR SKY.
- ▤ 1/4 CLOUDED.
- ▥ 1/2 CLOUDED.
- ▧ 3/4 CLOUDED.
- OVERCAST WITHOUT PRECIPITATION.
- ▨ PRECIPITATION (RAIN OR SNOW).
- ▩ FOG OR MIST.

TABLES IV. to X.

TABLE IV.—KOLA.—2 to 25 Years'

—	Sun above Horizon middle of Month.	Air Temperature (Fahrenheit Scale).						
		Mean.	Normal Daily. 2 Years.		Normal Range for Month.		Record.	
			Max.	Min.	Max.	Min.	Max.	Min.
	hrs.							
January ...	2.7	11	17	4	34	-22	40	-39
February ...	7.8	12	17	1	32	-26	38	-35
March ...	11.7	18	25	9	37	-16	44	-38
April ...	16.1	29	36	21	49	-2	55	-18
May ...	21.5	38	41	30	60	18	83	8
June ...	24	48	53	40	75	30	82	28
July ...	24	54	65	46	77	37	84	33
August ...	17.7	52	61	44	71	34	78	32
September ...	13.3	43	47	37	59	27	63	22
October ...	9.1	31	32	27	47	9	56	-7
November ...	4.4	20	27	14	39	-13	44	-23
December ...	0	13	21	6	34	-23	41	-35
Year ...	152.3	31	37	23	51	4	84	-39

—	Relative Humidity $\frac{1}{3}$ (7, 13, 21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	86	1	7	10	9	9
February ...	84	0	8	20	9	9
March ...	80	0	6	7	9	9
April ...	76	0	7	15	9	7
May ...	74	1	15	19	11	7
June ...	71	1	17	20	11	3
July ...	74	3	35	27	13	0
August ...	81	4	33	26	13	0
September ...	85	2	26	17	14	2
October ...	87	1	20	13	13	8
November ...	88	2	15	16	12	11
December ...	87	1	9	16	11	10
Year ...	81	16	198	27	125	75

TABLE IV.—KOLA.—2 to 25 Years'

	Sun above Horizon middle of Month.	Air Temperature (Fahrenheit Scale).						
		Mean.	Normal Daily. 2 Years.		Normal Range for Month.		Record.	
			Max.	Min.	Max.	Min.	Max.	Min.
	hrs.							
January ...	2.7	11	17	4	34	-22	40	-39
February ...	7.8	12	17	1	32	-26	38	-35
March ...	11.7	18	25	9	37	-16	44	-38
April ...	16.1	29	36	21	49	-2	55	-18
May ...	21.5	38	41	30	60	18	83	8
June ...	24	48	53	40	75	30	82	28
July ...	24	54	65	46	77	37	84	33
August ...	17.7	52	61	44	71	34	78	32
September ...	13.3	43	47	37	59	27	63	22
October ...	9.1	31	32	27	47	9	56	-7
November ...	4.4	20	27	14	39	-13	44	-23
December ...	0	13	21	6	34	-23	41	-35
Year ...	152.3	31	37	23	51	4	84	-39

	Relative Humidity $\frac{1}{3}$ (7, 13, 21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	86	1	7	10	9	9
February ...	84	0	8	20	9	9
March ...	80	0	6	7	9	9
April ...	76	0	7	15	9	7
May ...	74	1	15	19	11	7
June ...	71	1	17	20	11	3
July ...	74	3	35	27	13	0
August ...	81	4	33	26	13	0
September ...	85	2	26	17	14	2
October ...	87	1	20	13	13	8
November ...	88	2	15	16	12	11
December ...	87	1	9	16	11	10
Year ...	81	16	198	27	125	75

Observations, 1871-1908 ; 1912-1913.

Lat. 68° 53' N.
Long. 33° 1' E.
Height above M.S.L. { 6·7 m.
22 ft.

Air Temperature (Absolute Scale).							Cloud.		
Mean.	Normal Daily, 2 Years.		Normal Range for Month.		Record.		Mean Amount, 0-10.	Number of days, all 3 observations.	
	Max.	Min.	Max.	Min.	Max.	Min.		Clear Sky.	Over-cast.
261	264	258	274	243	277	234	7	2	10
262	265	256	273	241	276	236	6	2	7
265	269	260	276	246	280	234	6	3	8
271	275	267	282	254	286	245	7	2	9
277	278	272	289	265	301	260	7	1	9
282	285	277	297	272	301	270	6	2	9
285	291	281	298	276	302	274	7	1	9
284	289	279	294	274	299	273	7	1	11
279	282	276	288	270	290	267	7	1	10
272	273	270	281	260	286	251	7	0	12
266	270	263	277	248	280	242	7	1	11
262	267	258	274	242	278	236	7	2	11
272	275	268	284	258	302	234	7	18	116

Wind.										
Mean Force Beaufort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
3	1	1	1	1	6	10	5	2	4	4
3	1	0	1	2	6	10	3	1	4	3
3	2	1	1	1	4	10	5	2	5	3
3	3	2	2	2	5	6	3	2	5	1
3	4	3	3	2	3	5	4	2	5	2
3	6	4	3	1	3	4	3	2	4	2
3	7	4	3	2	3	4	2	2	4	2
3	5	3	2	2	4	4	3	3	5	1
3	3	2	1	1	5	8	3	2	5	2
3	1	1	1	1	7	10	4	2	4	2
3	1	1	1	1	6	11	4	1	4	3
3	1	0	1	2	6	11	5	1	4	2
3	35	22	20	18	58	93	44	22	53	27

TABLE V.—ORLOV.—9 to 23 Years'

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	4.0	14	6	33	—12	37	—23
February ...	8.2	14	5	29	—12	35	—18
March ...	11.8	16	9	33	— 5	41	—26
April ...	15.7	25	21	41	5	51	— 6
May ...	20.0	34	28	54	17	77	4
June ...	24	41	35	68	27	80	11
July ...	21.8	48	41	72	33	78	28
August ...	17.0	50	42	68	34	79	32
September ...	13.1	43	37	59	28	66	21
October ...	9.4	32	29	46	17	54	11
November ...	5.4	25	18	37	2	43	— 9
December ...	1.7	14	10	33	— 6	39	—18
Year ...	152.1	30	23	48	11	80	—26

—	Relative Humidity $\frac{1}{3}$ (7,13,21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	86	0	10	7	14	12
February ...	86	0	9	6	12	11
March ...	85	1	9	6	11	10
April ...	82	5	19	11	16	13
May ...	79	6	27	12	16	11
June ...	79	9	36	17	14	5
July ...	82	15	53	27	15	0
August ...	82	16	54	26	17	0
September ...	83	5	46	23	19	3
October ...	84	2	30	21	20	12
November ...	85	0	19	6	17	15
December ...	86	1	11	4	13	12
Year ...	83	60	323	27	184	104

Observations, 1843-1908.

Lat. 67° 12' N.
Long. 41° 22' E.
Height above M.S.L. { 72 m.
236 ft.

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0-10	Clear sky.	Over cast.
263	258	274	248	276	242	8	1	18
263	258	271	248	275	245	8	1	16
264	260	274	252	278	241	7	2	13
269	267	278	258	283	252	8	1	17
274	271	285	264	298	257	8	1	19
278	274	293	270	300	263	8	1	16
282	278	295	274	299	271	8	1	20
283	278	293	274	299	273	8	0	21
279	276	288	271	292	267	8	0	21
273	271	281	265	285	261	8	0	20
269	265	276	256	279	250	8	0	20
263	261	274	252	277	245	8	0	20
272	268	282	261	300	241	8	8	221

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Ca'm.	Gales.
5	1	2	2	2	4	9	7	3	1	13
5	1	2	1	2	5	8	5	3	1	10
5	3	3	1	3	3	9	5	3	1	10
4	4	3	1	2	2	7	5	5	1	6
4	5	3	1	2	3	5	4	6	2	5
4	5	2	1	2	3	4	3	8	2	4
4	4	1	1	2	4	4	2	11	2	2
4	4	2	1	2	4	5	4	8	1	4
5	3	2	1	2	3	6	5	7	1	8
5	2	2	2	2	3	8	7	5	0	12
6	1	2	1	2	3	10	7	4	0	16
5	2	2	1	1	3	11	6	4	1	12
5	35	26	14	24	40	86	60	67	13	102

TABLE VI.—KEM.—10 to 31 Years'

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	5.1	11	5	33	—19	39	—41
February ...	8.6	11	2	32	—23	42	—41
March ...	11.8	19	9	40	—15	50	—31
April ...	15.4	30	23	52	2	64	—14
May ...	18.8	41	33	68	22	81	14
June ...	21.9	50	41	74	31	84	26
July ...	20.1	59	48	78	38	88	30
August ...	16.5	55	46	74	34	94	29
September ...	13.0	46	38	62	27	67	16
October ...	9.6	35	30	53	13	63	—5
November ...	6.2	23	18	40	—4	51	—16
December ...	3.7	14	10	35	—11	43	—26
Year ...	150.7	33	25	53	8	94	—41

—	Relative Humidity $\frac{1}{3}$ (7,13,21) Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	88	1	16	19	9	8
February ...	86	1	11	8	6	6
March ...	81	2	14	12	8	8
April ...	77	1	17	16	8	6
May ...	71	2	35	23	11	4
June ...	69	1	41	43	10	1
July ...	75	2	58	32	11	0
August ...	81	3	49	46	11	0
September ...	84	2	50	62	12	1
October ...	87	2	34	25	11	6
November ...	90	1	24	15	10	8
December ...	89	1	20	20	8	8
Year ...	82	19	369	62	115	56

TABLE VI.—KEM.—10 to 31 Years'

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	5.1	11	5	33	-19	39	-41
February ...	8.6	11	2	32	-23	42	-41
March ...	11.8	19	9	40	-15	50	-31
April ...	15.4	30	23	52	2	64	-14
May... ..	18.8	41	33	68	22	81	14
June ...	21.9	50	41	74	31	84	26
July ...	20.1	59	48	78	38	88	30
August ...	16.5	55	46	74	34	94	29
September ...	13.0	46	38	62	27	67	16
October ...	9.6	35	30	53	13	63	-5
November ...	6.2	23	18	40	-4	51	-16
December ...	3.7	14	10	35	-11	43	-26
Year ...	150.7	33	25	53	8	94	-41

—	Relative Humidity $\frac{1}{3}$ (7,13,21) Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	88	1	16	19	9	8
February ...	86	1	11	8	6	6
March ...	81	2	14	12	8	8
April ...	77	1	17	16	8	6
May... ..	71	2	35	23	11	4
June ...	69	1	41	43	10	1
July... ..	75	2	58	32	11	0
August ...	81	3	49	46	11	0
September ...	84	2	50	62	12	1
October ...	87	2	34	25	11	6
November ...	90	1	24	15	10	8
December ...	89	1	20	20	8	8
Year ...	82	19	369	62	115	56

Observations 1863-1908.

Lat. 64° 57' N.
Long. 34° 39' E.
Height above M.S.L. { 9·1 m.
30 ft.

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0—10	Clear sky.	Over cast.
261	258	274	245	277	232	7	2	15
261	256	273	243	279	232	7	3	13
266	260	278	247	283	238	7	4	12
272	268	284	256	291	248	7	2	12
278	274	293	267	300	263	8	1	15
283	278	297	272	302	269	7	3	11
288	282	298	276	304	272	6	2	10
286	281	297	274	308	271	7	1	13
281	276	290	270	292	264	8	1	15
275	272	285	262	290	252	8	1	17
268	265	277	253	283	246	8	1	19
263	261	275	249	279	241	8	2	17
274	269	285	260	308	232	7	23	169

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
4	1	1	1	3	4	5	7	2	7	2
3	1	1	1	2	5	5	5	2	6	1
4	2	1	1	2	4	7	5	2	7	2
3	3	2	2	2	4	5	3	1	8	1
3	4	4	3	3	2	3	3	2	7	2
3	4	4	3	2	2	4	2	2	7	2
3	6	3	3	3	2	3	2	2	7	1
3	4	4	3	3	2	2	3	2	8	2
3	2	1	1	2	3	5	5	3	8	3
4	2	1	2	2	4	6	5	3	6	2
4	1	1	1	2	4	6	7	3	5	2
4	1	2	2	2	3	6	7	3	5	2
3	31	25	23	28	39	57	54	27	81	22

Observations 1863-1908.

Lat. 64° 57' N.

Long. 34° 39' E.

Height above M.S.L. { 9.1 m.
30 ft.

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0—10	Clear sky.	Over cast.
261	258	274	245	277	232	7	2	15
261	256	273	243	279	232	7	3	13
266	260	278	247	283	238	7	4	12
272	268	284	256	291	248	7	2	12
278	274	293	267	300	263	8	1	15
283	278	297	272	302	269	7	3	11
288	282	298	276	304	272	6	2	10
286	281	297	274	308	271	7	1	13
281	276	290	270	292	264	8	1	15
275	272	285	262	290	252	8	1	17
268	265	277	253	283	246	8	1	19
263	261	275	249	279	241	8	2	17
274	269	285	260	308	232	7	23	169

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
4	1	1	1	3	4	5	7	2	7	2
3	1	1	1	2	5	5	5	2	6	1
4	2	1	1	2	4	7	5	2	7	2
3	3	2	2	2	4	5	3	1	8	1
3	4	4	3	3	2	3	3	2	7	2
3	4	4	3	2	2	4	2	2	7	2
3	6	3	3	3	2	3	2	2	7	1
3	4	4	3	3	2	2	3	2	8	2
3	2	1	1	2	3	5	5	3	8	3
4	2	1	2	2	4	6	5	3	6	2
4	1	1	1	2	4	6	7	3	5	2
4	1	2	2	2	3	6	7	3	5	2
3	31	25	23	28	39	57	54	27	84	22

TABLE VII.—ARCHANGELSK.—12 to 25

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	5.3	7	2	33	—25	34	—49
February ...	8.7	9	1	30	—24	34	—35
March ...	11.8	18	8	38	—16	46	—35
April ...	15.3	30	25	53	5	66	—11
May ...	18.7	41	36	64	24	78	13
June ...	21.3	54	45	75	32	83	26
July ...	19.9	60	52	80	39	85	34
August ...	16.4	57	49	75	37	82	33
September ...	13.0	47	41	62	31	69	23
October ...	9.7	35	30	48	17	61	—5
November ...	6.4	21	17	37	—5	44	—15
December ...	4.0	11	4	33	—22	37	—32
Year ...	150.5	33	26	52	8	85	—49

—	Relative Humidity † (7,13,21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	88	3	21	10	9	9
February ...	88	3	17	8	10	9
March ...	84	3	21	13	8	8
April ...	79	2	18	9	6	5
May ...	74	1	25	43	7	3
June ...	69	0	38	29	9	1
July ...	73	1	57	36	9	0
August ...	80	2	53	43	9	0
September ...	85	2	51	17	12	1
October ...	89	4	39	24	12	7
November ...	91	3	27	17	11	10
December ...	89	3	21	9	10	10
Year ...	82	27	388	43	112	63

Years' Observations, 1871-1908.

Lat. 64° 33' N.
Long. 40° 32' E.
Height above M.S.L. $\left\{ \begin{array}{l} 6\cdot7 \text{ m.} \\ 22 \text{ ft.} \end{array} \right.$

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0—10	Clear sky.	Over cast.
259	256	273	242	275	228	8	3	16
260	256	272	242	274	236	7	2	15
265	259	276	247	281	236	7	2	15
272	269	285	258	292	249	7	3	13
278	275	291	268	299	262	7	2	14
285	280	297	273	301	270	6	4	10
289	284	300	277	303	274	6	4	10
287	282	297	276	301	274	7	2	14
281	278	289	272	294	268	8	2	16
274	272	282	265	289	253	8	1	20
267	265	276	253	280	247	9	1	21
261	257	273	243	276	237	8	2	19
273	269	284	260	303	228	7	28	183

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
3	2	1	4	5	6	5	3	2	3	2
3	1	1	3	4	4	5	4	3	3	1
3	2	2	3	4	5	5	4	4	2	2
3	3	2	3	3	4	3	4	5	3	1
3	4	3	4	3	3	2	3	6	3	2
3	5	3	3	2	2	2	3	7	3	2
3	5	3	3	3	3	2	3	5	4	1
3	5	3	3	3	3	3	3	5	3	1
3	4	2	2	4	5	3	3	4	3	2
3	2	2	2	4	6	5	5	3	2	2
3	2	2	4	5	6	5	3	1	2	3
3	1	2	4	6	6	4	2	2	4	1
3	36	26	38	46	53	44	40	47	35	20

TABLE VIII.—PETROZAVODSK.—

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	6·2	17	5	34	—18	40	—34
February ...	9·0	14	6	33	—14	40	—37
March ...	11·8	22	12	43	—11	55	—28
April ...	14·9	34	26	56	11	73	— 5
May ...	17·9	45	37	70	24	83	13
June ...	19·7	58	47	76	36	84	28
July ...	18·7	63	53	80	44	89	40
August ...	15·9	59	49	75	40	89	34
September ...	12·9	49	41	66	31	80	26
October ...	9·9	38	32	55	16	64	5
November ...	7·1	26	21	41	2	46	—17
December ...	5·2	17	11	35	—12	40	—31
Year ...	149·2	37	29	55	12	89	—37

—	Relative Humidity ‡ (7,13,21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	83	0	24	15	18	18
February ...	81	0	28	21	16	15
March ...	77	0	30	18	18	17
April ...	71	1	29	21	13	9
May ...	68	1	52	22	17	4
June ...	65	0	57	53	14	0
July ...	71	1	77	45	14	0
August ...	78	0	85	37	17	0
September ...	81	1	52	46	18	1
October ...	83	1	45	26	19	8
November ...	86	0	44	19	21	16
December ...	86	0	33	20	21	20
Year ...	78	5	566	53	206	108

4 to 21 Years' Observations, 1870-1908.

Lat. 61° 47' N.
Long. 34° 23' E.
Height above M.S.L. { 62·7 m.
206 ft.

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0—10	Clear sky.	Over cast.
265	258	274	245	277	236	7	3	16
263	259	274	247	278	235	7	3	14
267	262	279	249	286	240	6	5	12
274	269	286	261	296	252	6	5	9
280	276	294	268	301	262	6	3	9
287	281	297	275	302	271	5	6	6
290	284	299	280	305	277	6	4	8
288	283	297	277	304	274	6	3	9
282	278	292	272	300	269	6	3	10
276	273	286	264	291	258	7	2	16
270	267	278	256	281	246	8	1	21
265	261	275	248	278	238	8	3	19
276	271	286	262	305	235	7	41	149

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
4	1	1	2	3	1	6	6	6	5	3
3	1	1	2	3	1	5	6	5	4	2
3	1	2	2	4	2	6	6	5	3	2
3	2	2	2	5	1	5	4	6	3	1
3	2	4	4	4	1	4	4	5	3	1
3	1	3	3	5	1	5	5	4	3	1
3	1	4	4	4	1	5	4	4	4	0
3	2	3	3	4	2	4	5	5	3	0
3	2	2	2	3	2	6	6	5	2	1
4	1	2	1	2	2	7	8	6	2	1
4	1	2	1	4	1	6	5	6	4	1
4	1	1	1	3	2	6	7	6	4	2
3	16	27	27	44	17	65	66	63	40	15

TABLE IX.—PETROGRAD.—

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record. 1743-1875. 1886-1905.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	6·8	15	12	36	— 9	42	—38
February ...	9·3	17	12	35	— 8	43	—36
March ...	11·8	23	18	42	— 3	55	—28
April ...	14·7	36	30	59	18	72	—11
May ...	17·2	48	42	73	31	86	14
June ...	18·8	59	51	77	41	94	29
July ...	18·0	64	56	79	48	97	40
August ...	15·8	61	53	78	46	93	32
September ...	12·8	51	45	67	35	85	25
October ...	10·1	40	37	56	24	69	6
November ...	7·5	29	26	45	10	56	—15
December ...	5·9	20	17	37	— 6	46	—31
Year ...	148·7	39	33	57	19	97	—38

—	Relative Humidity $\frac{1}{3}$ (7,13,21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	87	3	24	16	15	13
February ...	86	4	22	20	12	12
March ...	79	4	23	29	11	11
April ...	71	4	24	24	10	6
May ...	64	2	42	30	12	2
June ...	63	1	47	52	11	0
July ...	69	1	69	56	13	0
August ...	74	3	72	59	14	0
September ...	79	7	52	33	13	0
October ...	82	7	45	28	15	4
November ...	86	5	38	20	16	10
December ...	88	5	30	29	16	14
Year ...	77	46	488	59	158	72

10 to 135 Years' Observations, 1743-1908.

Lat. 59° 56' N.

Long. 30° 16' E.

Height above M.S.L. } 4·8 m.
16 ft.

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record. 1743-1875. 1886-1905.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0-10	Clear sky.	Over cast.
264	262	275	250	279	234	8	2	20
265	262	274	251	279	235	7	3	14
268	265	278	254	286	240	6	4	12
275	272	288	265	295	249	6	5	10
282	278	296	272	303	263	6	4	8
288	283	298	278	307	271	5	6	6
291	286	299	282	309	277	6	4	7
289	285	298	281	307	273	6	3	8
284	280	293	275	302	269	6	3	9
278	276	287	269	294	259	8	2	17
272	270	280	261	286	247	8	1	21
266	264	276	252	281	238	8	2	20
277	274	287	266	309	234	7	39	152

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
3	1	2	2	6	6	4	5	4	1	0·2
3	1	3	2	5	4	3	5	4	1	0·2
3	2	3	3	5	5	4	5	4	0	0·3
3	2	5	3	4	4	3	4	4	1	0·0
3	2	5	3	3	3	2	6	6	1	0·0
3	3	5	3	3	2	2	5	6	1	0·0
3	3	4	3	3	3	3	6	6	0	0·1
3	3	3	2	4	4	4	6	5	0	0·2
3	3	2	2	4	4	5	5	5	0	0·1
3	2	2	2	5	6	5	4	5	0	0·2
3	2	1	2	5	5	5	4	5	1	0·2
3	2	2	2	6	6	5	4	4	0	0·3
3	26	37	29	53	52	45	59	58	6	1·8

TABLE X.—VOLOGDA.—

—	Sun above Horizon middle of month.	Air Temperature. Fahrenheit Scale.					
		—	Normal Daily.	Normal Range for month.		Record.	
		Mean.	Min.	Max.	Min.	Max.	Min.
	hrs.						
January ...	6·8	10	3	33	—25	40	—44
February ...	9·3	13	6	33	—19	38	—39
March ...	11·8	23	13	41	—11	48	—29
April ...	14·7	37	28	58	10	69	—5
May ...	17·3	51	42	77	27	84	19
June ...	18·8	61	49	81	35	88	29
July ...	18·0	66	54	84	44	93	40
August ...	15·6	62	51	81	39	89	33
September ...	12·8	50	42	68	30	76	24
October ...	10·1	37	32	57	18	72	5
November ...	7·5	25	19	40	—4	47	—26
December ...	5·9	14	7	34	—20	40	—36
Year ...	148·6	37	29	57	10	93	—44

—	Relative Humidity ‡ (7,13,21). Mean.	Number of Days Fog.	Precipitation.			
			Water Equivalent.		Number of Days	
			Normal Total.	Record, 24 Hours.	Precip.	Snow.
			mm.	mm.		
January ...	86	0·0	28	15	16	15
February ...	84	0·1	22	9	15	14
March ...	78	0·3	24	17	13	13
April ...	74	1·3	33	24	11	7
May ...	68	0·4	55	47	14	2
June ...	68	0·1	65	28	14	0
July ...	72	0·1	72	49	14	0
August ...	79	1·1	56	34	15	0
September ...	85	1·1	55	38	15	1
October ...	87	1·7	45	23	15	7
November ...	88	0·6	32	14	17	15
December ...	88	0·2	26	17	16	16
Year ...	80	7·0	513	49	175	90

15 to 27 Years' Observations, 1844-1908.

Lat. 59° 14' N.
Long. 39° 53' E.
Height above M.S.L. { 118·9 m.
 390 ft.

Air Temperature. Absolute Scale.						Cloud.		
—	Normal Daily.	Normal Range for month.		Record.		Mean amount.	No. of days all 3 observations.	
Mean.	Min.	Max.	Min.	Max.	Min.	0—10	Clear sky.	Over cast.
260	257	274	241	277	231	8	3	19
262	259	273	245	276	233	7	4	16
268	262	278	249	282	239	7	4	13
276	271	288	261	294	252	6	5	10
284	278	298	270	302	266	6	3	10
289	282	300	275	304	271	6	4	8
292	285	302	280	307	277	6	3	9
290	283	300	277	305	274	7	2	10
283	278	293	272	298	268	7	3	12
276	273	287	265	295	258	8	2	18
269	266	277	253	282	241	8	1	21
263	259	274	244	277	235	8	3	19
276	271	287	261	307	231	7	37	165

Wind.										
Mean Force Beau- fort Scale.	Number of Days from								Number of Days	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Gales.
2	3	2	1	4	5	5	4	5	2	0·1
3	2	2	2	5	4	4	3	5	1	0·1
3	3	2	2	6	5	4	4	4	1	0·3
2	4	3	2	4	4	3	3	5	2	0·1
2	5	3	2	3	3	3	4	7	1	0·3
2	5	4	2	2	2	3	3	7	2	0·1
2	5	3	2	2	2	3	4	7	3	0·1
2	4	2	2	2	2	4	4	8	3	0·1
2	5	1	1	2	3	4	4	7	3	0·3
3	3	2	2	3	4	6	4	6	1	0·1
3	3	2	1	3	4	6	5	5	1	0·1
2	3	2	2	4	4	5	4	5	2	0·1
2	45	28	21	40	42	50	46	71	22	1·8

