NOTES, ABSTRACTS, AND REVIEWS

CLASSIFICATION OF MONTHLY CHARTS OF PRESSURE ANOMALY OVER THE NORTHERN HEMISPHERE [1]

By C. E. P. BROOKS, M. Sc., and WINNIFRED QUINNELL

For a long time I have had a very lively interest in the study of weather abnormalities in various parts of the world, not only by reason of the importance of such a study of weather phenomena, but also because eventually such studies may form the approach to the solution of the larger problem of seasonal weather forecasting. If, and when, weather abnormalities can be forecast the problem of seasonal forecasts will easily follow. I therefore, welcome the memoir here abstracted. The authors selected the period 1873 to 1900 and 114 stations, mostly in the Northern Hemisphere, as the groundwork for their study. They have used departures from normal pressure rather than charts of monthly isobars.—*Ed.*

The 336 charts for the years 1873 to 1900 were divided into two groups, according to whether pressure at Thorshavn was above or below the normal for the month. When the pressure at that station in any month was very nearly normal the chart for that month was allocated to the positive group if the oceanic region between Iceland and the British Isles was dominated by a positive anomaly of pressure (center of excess) and to the negative group if it was dominated by a negative anomaly (center of deficit).

These two groups were next divided into five types according to the position of the center of the anomaly as shown in the scheme below:

GROUP I. PRESSURE AT THORSHAVN ABOVE NORMAL	GROUP II. PRESSURE AT THORSHAVN BELOW NORMAL
IA. Center of excess over or near Scandinavia.	IIA. Center of deficit over or near Scandinavia.
IB. Belt of excess from British Isles across Europe.	IIB. Belt of deficit from British Isles across Europe.
IC. Center of excess over British Isles.	IIC. Center of deficit over British Isles.
ID. Center of excess over Iceland or southern Greenland.	IID. Center of deficit over Iceland or southern Greenland.
IE. Pressure above normal over the Arctic generally; belt of deficit across the Atlantic and southern Europe in 40–50 N.	IIE. Pressure below normal over the Arctic generally; belt of excess across the Atlantic and Mediterranean in about 40 N.

The sequence of types in successive months which, parenthetically is the most important part of the discussion, is given in Table 4, and this table also gives in italics the frequency which would be expected if the distribution were due purely to chance, the actual occurrences being in roman. The figures are further divided into seasons, winter, October to March, and summer, April to September. The authors comment on these figures as follows:

> A comparison of the roman and italic figures shows very little indication of any ordered sequence. There is a slight tendency for the persistence of types from one month to the next, the same type occurring in two successive months in 44 cases in winter and 41 in summer, compared with an expectancy of 35 and 36, respectively; type IC (center of excess over British Isles) is especially persistent in winter. Type ID in summer tends to be followed by either ID or IC. Type IIC (center of deficit over British Isles) in winter tends to be followed by Group I (pressure above normal at Thorshavn), this sequence occurring on 25 occasions out of 31.

The tendency of certain weather types to persist as mentioned in the above paragraph is in all probability a world-wide phenomenon and is more highly developed in high than in low latitudes. The British Isles and Scandinavia are examples of a maximum development of this tendency. In the United States a single type of cyclonic movement occasionally dominates the weather for a period as long as two months in the cold season. Marked abnormalities in temperature in the same sense may be experienced over a period as long as three to four months.

The 10 types as above outlined were next divided into a number of subtypes. This process was initially empirical, the charts of each type being sorted and arranged until a number of sets were obtained, the members of each set being characterized by a certain family likeness. When this was done each set was examined to find points in common that could be used as a basis of classification, and the final allocation was made on the basis of classification thus obtained.

The number of charts that was allocated to each subtype naturally varied somewhat. Types IID, ID, and IC occur most frequently, these types accounting for half of the months.

Subtype IID, as already shown, consists of a center of pressure deficit over Iceland or south Greenland, and subtype ID the reverse, that is, a center of pressure excess instead of deficit; subtype IC has the excess of pressure anomaly over the British Isles.

The authors remark: "In view of the great variability of pressure in the Icelandic region, the frequency of subtypes IID and ID deficit or excess of pressure centered near Iceland is to be expected, the frequency of subtype IC (excess centered over British Isles) is more surprising."

The type of pressure anomaly for each month of the period 1873 to 1918 is given in tabular form with the months of uncertain classification given in parentheses and the months with an anomaly exceeding 10 millibars in bold faced type. Concerning the latter it is rather surprising to find that the pressure anomaly is greater than 10 millibars in the Icelandic region 77 per cent of the time in February, 65 in January, 63 in March, and 56 in December.

The memoir contains a series of 36 greatly reduced Northern Hemisphere charts showing typical cases of pressure anomalies.

The impression that one gets from these charts is that the large fluctuations of pressure are confined, in the main, to high latitudes and that there is need of much more data both from continental and oceanic areas before the delimitation of regions of pressure abnormalities can be accurately fixed.—*A. J. H.*

[1] Meteorological Office, Geophysical Memoirs No. 31 (first number of Volume IV).

SHORT-WAVE ECHOES AND THE AURORA BOREALIS [1]

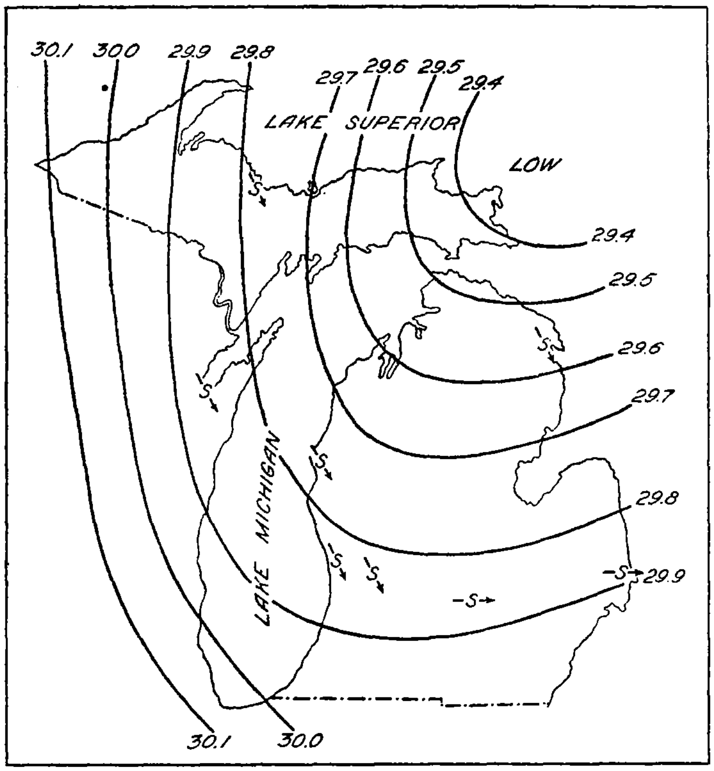
By CARL STORMER

On February 29 of this year I received a letter from Engineer Jørgen Hals, Bygdø, Oslo, in which he says:

> I herewith have the honor to advise you that at the end of the summer 1927, I repeatedly heard signals from the Dutch short-wave transmitter station PCJJ (Eindhoven). At the same time as I heard the telegraph signals I also heard echoes. I heard the usual echo, which goes round the earth with an interval of about one-seventh second, as well as a weaker echo about 3 seconds after the principal signal had gone. When the principal signal was especially strong, I suppose that the amplitude for the last echo 3 seconds after, lay between one-tenth and one-twentieth of the principal signal in strength. From where this echo comes I can not say for the present. I will only herewith confirm that I really heard this echo.

[1] Reprinted from Nature, London, November 3, 1928, p. 681.

Immediately I heard of this remarkable observation, it struck me that the wireless waves were reflected from those streams and surfaces of electrons to which I was led by theoretical investigations on the aurora borealis in my paper published in 1904 in Videnskabsselskabets Skrifter, Christiania ("Sur le mouvement d'un point matériel portant une charge d'électricité sous l'action d'un aimant élémentaire"). In reference to that paper, and the subsequent more complete one in Archives des Sciences physiques et naturelles, Geneva, 1907, one of the most striking features of the theory was that streams of electrons coming from without toward the earth were deviated by the earth's magnetic field in such a way that an immense space was formed free from electric particles, and having the shape of a torus described by revolution of an oval tangent to the magnetic axis of the earth at the center. These results were also in full agreement with



Typical pressure condition favorable for snow squalls over Michigan

Kr. Birkeland's remarkable experiments with cathode rays directed toward a magnetic sphere, described in 1901 in Videnskabsselskabets Skrifter ("Expédition norvégienne de 1899–1900 pour l'étude des aurores boréales"). If now the wireless signals could penetrate the Heaviside layer, they would pass into this empty space, and might be reflected by the walls of the electrons forming its outer boundary. The long time interval between the principal signal and the echo agrees well with the immense dimensions of these toroidal spaces.

It was now very interesting to me to obtain more evidence of these remarkable echoes, and last spring and summer I organized a long series of observations, for which I am very much indebted to Dr. van der Pol, at Philips Radio, Eindhoven, for his very efficient work in sending signals, and further to Elektrisk Bureau, Oslo, to the Norwegian Telegraph Administration, and to Engineer Hals, for aid in arranging the reception of the signals. The observations were continued during October but no certain evidence was obtained before October 11. Eindhoven emitted during the afternoon very strong signals of undamped waves of wave-length 31.4 meters, and Hals and I heard very distinct echoes several times, the interval between signal and echo varying between 3 and 15 seconds, most of them coming about 8 seconds after the principal signal. Sometimes two echoes were heard with an interval of about 4 seconds. I immediately telegraphed the success to Dr. van der Pol at Eindhoven, and asked him to control and verify the effect. Next day I received the following telegram:

> Last night special emission gave echoes here varying between 3 and 15 seconds stop 50 per cent of echoes heard after 8 seconds stop van der Pol.

After this it seems that we have here a new and remarkable phenomenon, the study of which may throw much new light on the electric currents in space outside the earth and on their connection with the aurora borealis and magnetic storms. The variability of the phenomenon indicated by the observations agrees well with the corresponding variability of aurora and the magnetic registrations.

Snow squalls of the Lake region (by R. M. Dole, Weather Bureau, Lansing, Mich.)—Cold air flowing over warm water creates clouds, and as a result the land to the leeward of the wind is cloudy as long as the contrast in temperature is marked. Michigan, for instance, is covered with a cloud sheet from November to May, and the sunshine is markedly deficient during these months.

In spring and fall and often in winter snow squalls occur when high pressure brings in cold air, which blows over the warm lake waters. The difference in temperature must be somewhat marked, and there must be a rather steep barometric gradient. This often occurs when a low pressure system with circular isobars crosses the Great Lakes, and when the barometric lines run north-south or even northwest-southeast. The cold air crossing the warm Lake Michigan builds up enormous clouds, which are very similar to thunderstorms in appearance and sometimes are electrical. The tops rise to a considerable height with false cirrus and blue-black curtain clouds, out of which drifts snow, and if it is cold enough this snow reaches the surface in the form of snow squalls. These snow squalls are quite the regular thing in the spring, fall, and often in the winter.

The snow squall condition is of the utmost importance to flying, because the visibility is very low—often only 10 feet—and the wind is strong and often dangerous. The squalls are of short duration and after passing, the sun comes out for a few moments until the next squall arrives. The pilot, of course, with any weather sense can readily see these squalls coming 15 miles away because of their great heads and silver crests, but it is practically impossible to dodge them; the pilot can only dodge the strong squally portion by flying to the left of the curtain cloud.

The snow squall condition obtains after the storm proper is just east of Lake Michigan and often when the storm has passed down the St. Lawrence Valley. The conditions which are ripe for squalls are a marked contrast in temperature and the lines running nearly north-south, so that the wind is anywhere between west-northwest to north-northeast. Very often the sky is clear at sunrise but by 9 to 11 a. m. cumulus clouds are noted on the northern horizon, and under the influence of a strong sun in a clear sky they build up enormously.

The influence of the sun is necessary, and the squalls disappear as soon as the sun has set as a rule. Squalls do not obtain when a uniform sheet of stratus covers the sky.

The charts given show typical instances when snow squalls were general over Michigan, and a marked similarity will be noticed in the trend of the isobaric lines, and squalls will occur whenever there is a similar distribution of pressure with lines running north-south. In looking over the old records of Michigan weather these squalls were noted all through the history of past conditions, and in many instances the winds were termed dangerously strong and the snow as very thick.

Not only does the rather round low pressure area with lines running roughly north-south produce snow squalls in the fall, winter and spring, but it causes clearing weather to be delayed from 12 hours to several days after the pressure has begun to rise. Precipitation, either as a steady fall or in the form of sun showers, is the usual thing, and it is most exasperating to forecasters as well as to the public. Rising pressure which would be certain fair weather anywhere away from the water is just the opposite in the Lake Region.

The anticyclones of December, 1928.—Two of the anticyclones of this month call for special note, the first was centered over the Lander (Wyo.) station, from the 4th to the 10th, both inclusive. It was doubtless formed originally by a flow of polar air on the 3d and 4th. Thereafter it was maintained largely by intense terrestrial radiation and the drainage of cold air into the depression in which the Lander station is situated. Two secondary anticyclones were discharged from this anticyclone, the first on the 5th, and this one was doubtless a result of the eastward flow of a part of the original mass of polar air. The second one was pinched off on the 7th when a ridge of cold air over western Nebraska and Kansas became separated from the original mass.

The Great Basin anticylone discharged but a single secondary; the latter took a course to the southeastward over New Mexico and moved thence to the Atlantic. Pressure in all of the secondaries diminished as they crossed the Mississippi Valley and again increased where they crossed the Appalachians, although in no case could they be considered as being composed of polar air.—*A. J. H.*

BIBLIOGRAPHY

C. FITZHUGH TALMAN, in Charge of Library

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Ångström, Anders.
Recording solar radiation. A study of the radiation climate of the surroundings of Stockholm. Stockholm. 1928. 36 p. illus. plates. 31½ cm.

Barros Paiva, Tancredo de.
Bibliographia do clima Brasilico. Notas recolhidas. Rio de Janeiro. 1928. 34 p. 24½ cm.

Ecuador. Oficina de informacion y propaganda.
El departamento de agricultura del Ecuador. Quito. 1928. unp. illus. 29 cm. [No pagination. Contains article: Servicio nacional de meteorologia agricola.]

Ficker, H. v.
Meteorologie. 170 p. illus. 24 cm. (Sonderdr.: Müller-Pouillet, Lehrbuch der Physik, Bd. 5, 1. 11 Aufl.)

Great Britain. [Ministry of health.]
Report of a committee appointed at a conference of public authorities to consider the question of floods from the River Thames in the county of London. London. 1928. 27 p. 24½ cm.

Hunter, John.
Belper, Derbyshire. Summary of observations of rainfall and temperature during the 50 years 1877–1926. n. p. n. d. 13 p. 35 cm.

Kalitin, N. N.
Solar radiation during the solar eclipse of June 29, 1927, according to the observations made at Malmberget (Sweden). p. 113–128. illus. 26 cm. [Author, title, and text in Russian, summary in English.]

McAdie, Alexander.
Hazard of lightning in aviation. unp. illus. 30½ cm. (Bull. Daniel Guggenheim fund for promotion of aeronautics, inc. no. 10, Sept. 26, 1928. New York.)

Morandi, Luis.
La temperatura y la lluvia en el período 1924–1927. Observaciones de la estación meteorológíca anexa a la cátedra de meteorología. p. 141–170. figs. 24½ cm. [Revista de la fac. de agron. no. 1. Agosto 1928. Montevideo.]

Morris, Clyde T.
Practical design of wind bracing. New York. n. d. 12 p. illus. 28 cm.

Murphy, E. W. M.
Rainfall of Ireland. Clonmel. 1926. 11 p. 20½ cm. (Irish rainfall assoc.)

Sampaio Ferraz, J. de.
A previsão de tempo a longo prazo. Methodo racional. Correlações. Periodicidades. Notas sobre formulas recentes para a previsão das seccas do Ceará, e das chuvas da bacia do Prata, interessando o Estado de S. Paulo. Rio de Janeiro. 1928. 19 p. 23½ cm.
A previsão do tempo baseada em observações locaes (indicações aceitaveis e abusões condemnaveis). Rio de Janeiro. 1928. 25 p. 23½ cm.

Sarasola, Simón.
Los huracanes en las Antillas . . . Segunda edición, aumentada con el apéndice Génesis y evolución del huracán de 20 de Octubre de 1926 y catálogo de ciclones en la Isla de Cuba de 1865 a 1926, por M. Gutiérrez Lanza. Madrid. 1928. xv, 254 p. illus. 26 cm.

Sasaki, T., *& others.*
On the effect of temperature changes upon an altimeter. p. 461–496. figs. 26½ cm. (Report of the Aeron. res. inst., Tôkyô imp. univ., no. 41. Sept., 1928. v. 3, 2.)

Sherman, E. A.
Protection forests of the Mississippi River watershed and their part in flood prevention. Washington. 1928. 50 p. figs. plate. 23 cm. (U. S. Dept. agric., circ. no. 37.)

Wittenburg, P.
Problèmes géophysiques de la Iakoutie . . . Leningrad. 1928. ix, 258 p. illus. plates (fold.) 23 cm. (Acad. des sci. de l'Union des Rép. Soviet. soc. Matériaux de la comm. pour l'étude de la Rep. autonome Sov. soc. Iakoute. Liv. 2.) [In Russian, with English table of contents and abstracts.]