place. It is generally admitted that temperature would rise in some areas and fall in others, and even this varies with the season. The general circulation of the atmosphere would no doubt be intensified, but what changes in the distribution of pressure and rainfall this would involve can not be stated. It is also not certain that an increase in solar radiation results in more radiation reaching the earth's surface, for the upper atmosphere may at the same time become more opaque to solar radiation.

All these problems require investigation but nothing can be done without absolutely reliable information about the solar radiation. There are plenty of meteorological data for most problems, it is the solar data which are lacking.

In order to obtain the information required, there should be more stations in different parts of the world repeating the work done at Washington, Mount Wilson (Calif.), Montezuma (Chile), and Harqua Hala (Ariz.), so that errors due to the earth's atmosphere may be detected and eliminated. This would give satisfactory information regarding the energy received on the confines of the atmosphere. We need, in addition, measurements of the radiation received at the earth's surface. This is a much more difficult problem. Instruments and methods are available, but the practical difficulties of making the measurements and interpreting the results are very serious. So far as I know, there does not exist at present a single series of measurements from which it is possible to determine the periodic and secular variations, over any extended period, of the solar energy received at the earth's surface.

With regard to the former—the measurement of the solar radiation outside the atmosphere—the work requires a special observatory with expensive instruments and specialized staff. It is, therefore, primarily work to be undertaken by governments. In the present financial state of the world it will be difficult, but probably not impossible, to get governments to undertake the expense; the committee might do something in this direction.

The measurement of the radiation received at the earth's surface is not such an expensive matter. What is required is an agreement on the instruments and methods which will give the best results and provision made for the comparison of different instruments. Then instruments must be installed where they will be kept in constant and careful use, so that homogeneous series of data may, in the course of a few years, be available for statistical investigations.

Solar Relations with Weather

By Sir GILBERT T. WALKER

Apart from the effects of variations in the solar constant from day to day upon meteorological conditions, upon which H. H. Clayton is working, there are relationships between monthy and seasonal data of the solar constant or sunspot numbers on the one hand and of rainfall, pressure, or temperature on the other; thus the correlation coefficient between sunspots and the annual temperature of India, as given by the data of 47 years, is as high as -0.5. These relationships strongly suggest that at times of increased solar activity there is increased opacity to heat radiation both within the earth's atmosphere and outside it in regions where the ordinary extrapolation is ineffective; such questions clearly deserve study.

An extension of determinations of the solar constant to new countries is highly desirable; and it would be of great value if an independent method, such as that of photometry, could be applied. The measures of Jupiter's brightness from 1878 to 1890 by Müller, of Potsdam, were promising, as was the suggestion by Evershed of studying the brightness of the moon.

LATE ICE IN LAKE ERIE

Mr. J. H. Spencer, of the Buffalo Weather Bureau Office, has sent us information on the extraordinary ice conditions in Lake Erie before and during the very late opening of navigation this year. The following notes and excerpts are of interest:

At the end of April ice fields approximately 35 miles long occupied the eastern end of the lake except for small patches of open water along the Canadian side. The first attempt to break through the ice was made on April 30 by three freighters, which got only 5 miles out of Buffalo before being stuck fast for a week. On May 6, 18 ships attempted the passage and on the 7th 18 more, and on the following days yet more.

It was not until May 9, at 1:25 p. m., that navigation was finally opened by the arrival of the freighter *W. A. Reiss* from Chicago, followed by 13 others, which laboriously had broken their way through the heavy ice fields. Ten of the west-bound fleet of 55 vessels reached open water on May 10.

The almost unprecedented coldness of this spring was responsible for this historic battle with the ice. The mean temperature for March was 4.3° F. below normal, and for April 7.8° F. below. April's monthly mean temperature of 35.0° F. was the lowest for this month at Buffalo since 1874; hence the ice did not disintegrate in April as usual. Moreover, strong NE. winds were almost absent in April and May, and consequently were of no help in breaking up the ice in the eastern end of the lake.

This note appears in our Daily Local Record of May 26: "There are still great fields of soft ice in this end of Lake Erie. Inbound and outbound vessels plow through it with great difficulty. Accidents are frequent, and numerous vessels have been damaged by ice, the damage being confined chiefly to wheels and rudders."

"There were great quantities of ice in the lake on May 31. * * * On June 1, however, it had almost disappeared as though by magic. After two postponements, the lake passenger season between Detroit and Buffalo was opened on June 2 * * *. These unprecedented conditions caused great money loss to the port of Buffalo and to the commerce of the Great Lakes, due in part to the damage of vessels, but chiefly to the late opening of navigation."

WEATHER BUREAU STAFF MEETINGS, 1925–26

By EDGAR W. WOOLARD, Secretary

The regular biweekly meetings of the scientific and technical staff of the Central Office of the United States Weather Bureau, initiated in the autumn of 1923, have been continued on the same plan as heretofore, during the winter of 1925–26. Following is a list of the discussions (asterisks denote speakers from outside the Weather Bureau); meetings during previous seasons have been reported in the MONTHLY WEATHER REVIEW, 1924, **52,** 35–36, 166, and 1925, **53,** 264.

September 30, 1925

W. J. Humphreys. Report on proceedings of the Babson conference on long-range weather forecasting.

October 7, 1925

A. J. Henry. Monthly pressure variations in the northern hemisphere, and their bearing on seasonal weather forecasting.

C. L. Mitchell. The accuracy of forecasts made from variations in solar radiation.

October 21, 1925

Discussion of G. C. Simpson's paper on "The New Ideas in Meteorology."

November 4, 1925

**G. Breit.* The Kennelly-Heaviside layer.

November 18, 1925

**H. U. Sverdrup.* Meteorological observations off the coast of Siberia during the *Maud* expedition.

December 2, 1925

W. R. Gregg. Atmospheric discontinuities, permanent and temporary.

December 16, 1925

A. J. Henry. The North Pacific statistical anticyclone.

January 13, 1926

O. L. Fassig.—Rainfall of the Caribbean region.

January 27, 1926

O. L. Fassig. Upper air work at San Juan.
C. F. Marvin. A proposed international temperature scale.

February 10, 1926

C. F. Marvin. Recently published investigations of meteorological periodicities.

February 24, 1926

Messrs. Weightman, Mitchell, and *Henry.* Analysis and discussion of Clayton's weather forecasts from solar radiation data.

March 10, 1926

**C. F. Brooks.* The Gulf Stream and the Weather: Project and Progress.

March 24, 1926

H. H. Kimball. Possible thermal effects of fluctuations in the solar constant, of fluctuations in insolation, and of fluctuations in ultraviolet solar radiation.
W. J. Humphreys. Measurements of ultraviolet solar radiation, and of ozone in the atmosphere.

April 7, 1926

H. C. Frankenfield. The Weather Bureau's river work in the Ohio Valley.

April 21, 1926

**C. G. Rossby.* The work of the Swedish meteorological service.

May 5, 1926

**Capt. A. H. Thiessen.* The meteorological work of the United States Signal Corps.

May 13, 1926

**C. F. Brooks.* The general problem of scientific long-range forecasting.

May 19, 1926

C. F. Marvin and *E. B. Calvert.* The Weather Bureau Service on the Pacific coast, with especial reference to fire-weather warnings.

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HAILSTORM AT DALLAS, TEX., MAY 8, 1926

By JOSEPH L. CLINE

[Weather Bureau Office, Dallas, May 10, 1926

On the morning of May 8, 1926, the northern portion of eastern Texas was in the southeast quadrant of a fairly well marked depression with a trough formation extending northward from the lower Rio Grande Valley. A warning of local thunderstorms was issued at Dallas on this morning.

The sky on the 8th was generally clear to partly cloudy, and the temperature rose from 65° F., at 4 a. m. to 85° at 5 p. m. The sun shone brightly in the afternoon, with no local indications of any disturbance except a slowly falling barometer, until 4:10 p. m., when a heavy bank of clouds came from the north and northwest, covering the sky by 4:40 p. m. Rain began at 6:59 p. m., and hail fell with the rain from 7:04 p. m. to 7:25 p. m., the barometer having reached its lowest point, 29.59 inches, at about 7:10 p. m., after which a sharp rise of 0.08 inch occurred. Vivid lightning attended the storm, but there were no unusual meteorological conditions except the unprecedented hailstorm. The storm moved toward the southeast, its center passing slightly east of the station.

Hail fell over an area 1 to 15 miles wide, from about 25 miles north of Dallas to more than 25 miles southeast of Dallas, the region of heaviest hail and greatest damage extending from about 10 miles north of the city southward over the central and eastern portions of it to about 15 miles southeast of the Weather Bureau station. No rain or hail fell 10 miles southwest of the station and none in the southwest portion of Oak Cliff.

Hailstones of various sizes and shapes were reported. Some were compared in size to hen's eggs and others to baseballs, while on the outer edge of the storm they were as small or smaller than common moth balls. Near White Rock Lake some of them measured 7 inches in circumference the long way and 5 inches round the body. Hailstones which fell in Highland Park, 5 miles north of the Weather Bureau station, measured 2 to 4 inches in diameter, some being as large as and having the shape of good-sized cooking squash. Reliable reports indicate that the largest hailstones were 8 to 12 inches in circumference, having 5 to 8 layers, some of the stones weighing 22 ounces. Mr. P. S. Cook, observer, who was in the storm near the Weather Bureau office, measured one hailstone 4.2 inches in diameter.

Damage by hail and wind to structures in Dallas and Dallas County was estimated at more than three-quarters of a million dollars. In buildings in the business section of the city plate-glass windows, glass in windows on northern exposures and in most skylights were broken. Many residences will have to be supplied with new roof coverings, especially in the southeastern part of the city, where roofs of composition, tile, and old shingles were demolished. Tops of automobiles and street cars were punctured by the hailstones. The damage at its worst was so great that the scene in the streets resembled destruction by machine-gun fire.

Scores of people were injured, none fatally. A few horses and other animals were reported to have been killed. Crops and much fruit were destroyed, though the area of total loss of these was small. The sunshine recorder was the only instrument broken by hail at the Weather Bureau office.

METEOROLOGICAL SUMMARY FOR SOUTHERN SOUTH AMERICA, APRIL, 1926

By Señor J. B. NAVARRETE

[El Salto Observatory, Santiago, Chile]

(Translated by B. M. V.)

The atmospheric régime over Chile during April was relatively stable, and it was somewhat rainy in the southern zone.

High pressure in the south during the 2d–4th caused generally fine weather in southern South America.

Between the 5th and 7th an important depression crossed the far southern region, causing rain over the southern part of the continent as far north as Arauco Province. At Valdivia 15 mm. fell on the 6th.

During the 8th–14th high pressure occupied the southern area, causing generally fine weather and low temperature, with cold waves in the southern Provinces and minima below freezing in Lonquimay.

On the 15th a new depression crossed the far south, giving bad weather and rains as far as Valdivia; 15 mm. fell at this farthest point where rain occurred.