

DECEMBER

Despite the general deficiency in precipitation only a few duststorms, mostly local in character, should be classified as dense, although there were occasional reports of zero visibility during the first half of the month from scattered stations in Wyoming, Nebraska, Kansas, and Oklahoma, and of 200 yards at Holly, Colo., on the late afternoon and early evening of the 27th.

Light dust was again reported from Texas northward to the Canadian border, but the number of days with dusty conditions, ranging from 1 to as many as 5 in drier portions of the area, was much less than in months just preceding.

The only heavy duststorm in Oklahoma occurred at Goodwell, Texas County, on the 26th-27th. Days with light to moderate dust were the 5th, 7th, 13th, 15th, 17th, 26th, and 27th; nearly all the dust was confined to the Panhandle. In Kansas duststorms of moderate intensity occurred in a few western counties on the 7th and in many parts of the western third of the State on the 12th; at Dodge City the duststorm on November 12 was sufficiently heavy to stop the automatic sunshine recorder.

On the 12th visibility in Colorado was reduced to one-fourth mile at times over the greater portion of the South Platte Valley and the Arkansas-Platte Divide, and to 1 mile in the Arkansas Valley east of the 104th meridian. Baca County had numerous days with light dust but no serious damage or discomfort resulted; the only dense duststorm in Colorado was the one at Holly mentioned above.

Western Nebraska reported locally dense dust on the 12th and 27th; local dust blowing occurred at scattered places in the eastern two-thirds of South Dakota on the 1st, 4th, 11th-15th, and duststorms were general throughout south-central North Dakota on the first day of the month.

At Rock Springs, Wyo., dusty conditions prevailed on the 11th with visibility reduced to zero occasionally between 7:30 and 8 p. m.

Only 8 States west of the 90th meridian received subnormal precipitation during the last month of the year. These were Minnesota, Wisconsin, Louisiana, New Mexico, and the Plains States from South Dakota southward to and including Oklahoma. Percentages of normal in these States varied from only 42 in Nebraska to 98 in South Dakota. All States, except Ohio, to the east of the Mississippi River had subnormal falls.

No dense dust was reported during December and light dust was noted only in Montana, Wyoming, South Dakota, Nebraska, Kansas, and Oklahoma. Montana had light dust on 3 days, the 16th, 18th, and 30th, and all these storms were local in character. Dusty conditions were noted in Wyoming on the 5th and 6th, in South Dakota on the 7th and 31st, and considerable dust was reported in western Kansas on the 2d, with light, local storms on the 21st, 23d, 27th, and 31st. At Dodge City, Kans., the wind movement for December was the lowest for many years, which probably explains why dust occurred on so few dates. Goodwell, Okla., had light dust on the 2d and 30th, but no heavy dust was noted at that, or any other Oklahoma station, during the month.

The year closed with precipitation much below normal over a large central and northern area and duststorms, occasionally severe and resulting in considerable damage to winter grains, were reported in early January.

This paper has been compiled from the numerous reports collected and sent in by the various officials in charge and section directors of the States referred to from time to time. The reports from S. D. Flora, Topeka, Kans.; A. E. Osborn, Dodge City, Kans.; W. H. Wahlgren, Oklahoma City, Okla.; W. E. Maughan, Helena, Mont.; O. R. Roberts, Bismarck, N. Dak.; Thomas A. Blair, Lincoln, Nebr.; and H. F. Choun, Denver, Colo., have been extremely helpful and in some cases have been quoted verbatim.

WEATHER OF 1937 IN THE UNITED STATES

By J. P. KOHLER

[Weather Bureau, Washington, D. C., February 1938]

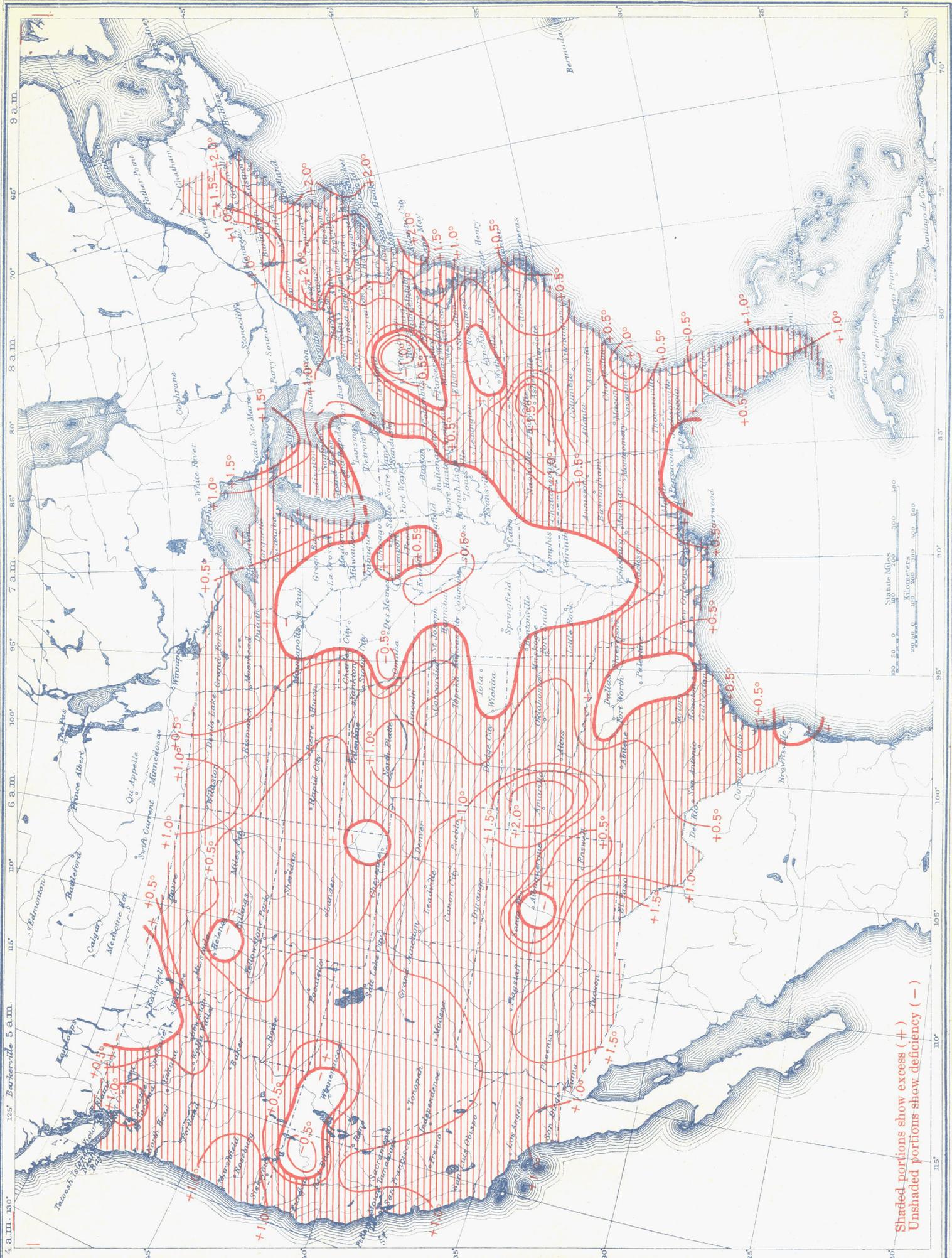
The outstanding event associated with the weather of the year was the great flood in the lower Ohio and Mississippi Valleys brought about by excessive rains in January over the drainage areas of the Ohio River and its tributaries, including the Wabash, the Cumberland, and the Tennessee. The monthly rainfall over the middle and southern portions of Ohio ranged consistently from above 9 inches to more than 14 inches. Over southern Indiana rainfall averaged 16.22 inches (12.20 inches above the average), in southern Illinois 11.74 inches or more than 8 inches in excess of normal. Over central Tennessee monthly falls averaged more than 16 inches and in the western division about 18.50 inches. McKenzie, Tenn., reported 23.90 inches for the month, Earlington, Ky., 22.97, Hickory, Miss., 21.48, and Evans Landing, Ind., 21.39 inches; also monthly totals for Jeffersonville, Ind., and Leavenworth, Ind., were in excess 20 inches. Many stations in southeastern Missouri and eastern Arkansas reported monthly totals in the neighborhood of 20 inches. Statistics covering the area of overflow and the damage of all kinds are not yet available, but probably will surpass all other previous great floods in the United States. A detailed discussion of rainfall over the various watersheds, river stages, and meteorological phenomena responsible for the heavy rains in the Ohio Valley during January

appears in Supplement No. 37 of the MONTHLY WEATHER REVIEW.

Among other notable features of the year's weather were: The severe cold of January throughout the Rocky Mountains, north-central Great Plains and upper Mississippi Valley when mean State temperatures were the lowest of record in Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, Colorado, and New Mexico, and the lowest of January record in the Dakotas and Nebraska, and the exceptionally warm January weather in the southeastern States, particularly in Alabama, which advanced vegetation, especially fruit, to premature stages only to be severely damaged by cold weather during March. Other features were low January temperatures in California which resulted in two destructive freezes, the backward spring weather in the northern Rockies and northern Plains States, the unusually dry spring in Montana and in the north and central Plains which was followed by the most devastating drought ever known in the extreme northeastern counties of Montana.

Drought conditions that were record breaking prevailed over Kansas almost throughout 1937; the year's moisture was deficient in every county, except those in the southeastern quarter. Near the close of the year the lack of normal rainfall in late summer and early fall months

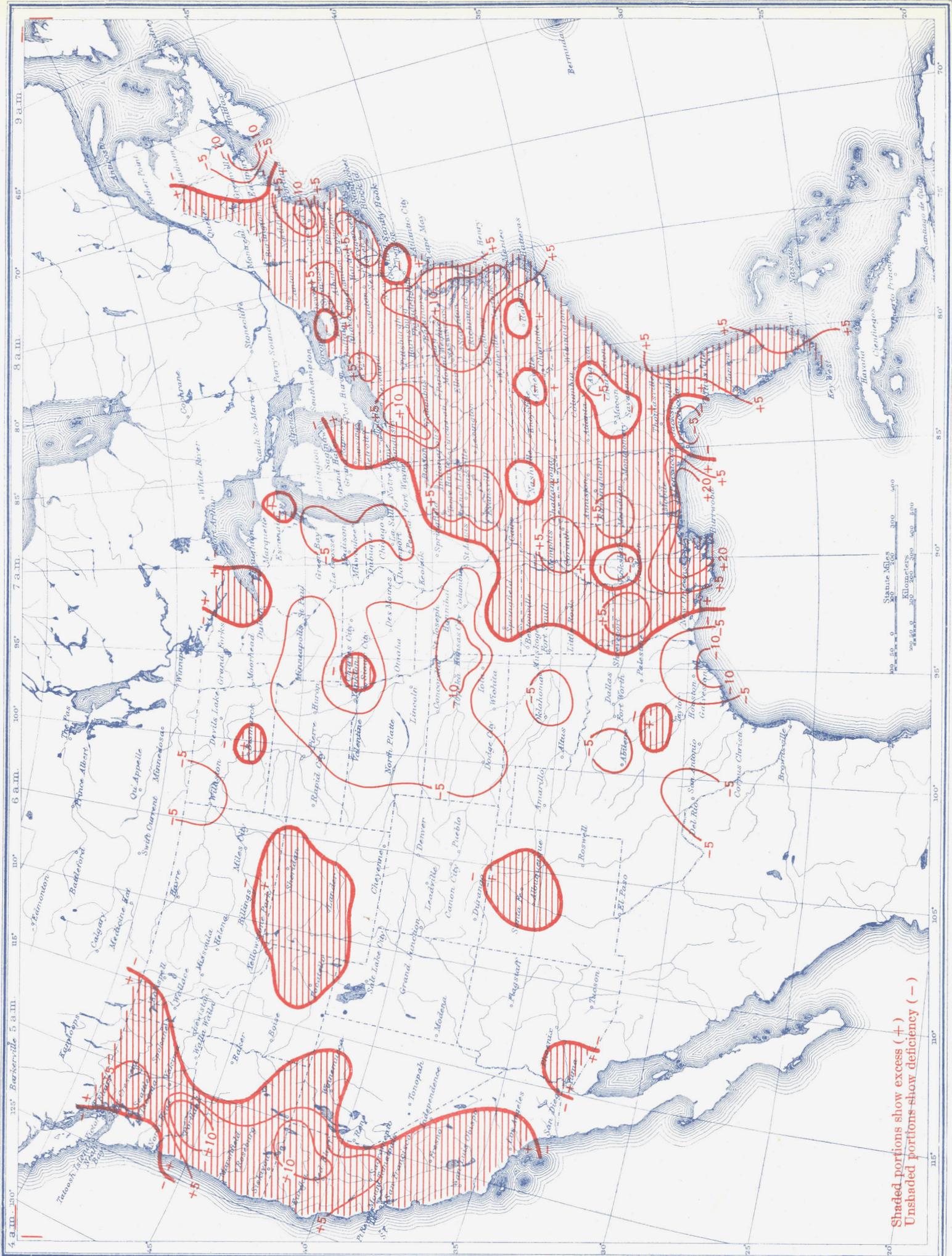
Annual Temperature Departures (°F) in the United States, 1937
(Plotted by J. P. Kohler)



Shaded portions show excess (+)
Unshaded portions show deficiency (-)

Annual Precipitation Departures (inches) in the United States, 1937

(Plotted by J. P. Kohler)



Shaded portions show excess (+)
Unshaded portions show deficiency (-)

seriously hampered plowing and seeding of late grains in the northern portions of the Missouri and Mississippi Valleys.

Another notable, but desirable, feature of the year's weather was the marked freedom from destructive storms such as tornadoes which entailed great loss of life and property in the spring months of 1936, especially in the Southeastern States.

Notwithstanding the extremely low temperatures in the western half of the country during January, the year 1937 averaged 0.7° above normal. Table 1 shows, indirectly, that the mean temperatures in practically all districts

averaged close to normal. Only one district, the upper Mississippi Valley, averaged below normal warmth. The Ohio Valley and Tennessee district was exactly normal while in all other sections the annual mean temperature was above normal, but generally not more than 1°, except that in the Atlantic coast regions, and sections bordering on the Pacific Ocean, departures ranged from 1° to 2° above normal. In 1936, the upper Lake region was the only section with below-normal warmth while in the remaining districts departures were positive and generally considerably greater as compared to 1937.

TABLE 1.—Monthly and annual mean temperature departures, 1937

[Compiled from "Table 2.—Climatological Data for Weather Bureau Stations" contained in the 12 issues of the REVIEW during 1937]

Districts	January	February	March	April	May	June	July	August	September	October	November	December	Annual
New England.....	+9.3	+5.5	-1.5	-0.1	+2.5	+1.0	+1.7	+4.8	+0.1	-0.8	+2.1	-0.6	+2.0
Middle Atlantic.....	+9.6	+2.1	-1.8	-0.3	+1.7	+1.9	+7	+2.7	-1.9	-2.0	+4	0	+1.1
South Atlantic.....	+11.3	-4	-7	-2	+6	+2.4	+3	+1.2	-7	-2.4	-2.1	-1.6	+6
Florida Peninsula.....	+9.5	+1.6	-1.0	+2	+2	+8	+1	+4	+3	-7	-1.7	-1.7	+7
East Gulf.....	+11.3	-8	-3.0	-2	+1.5	+1.8	0	+1.0	-9	-2.3	-3.5	-9	+3
West Gulf.....	-2	+4	-1.5	0	+1.4	+1.8	+4	+2.5	+1.2	+6	-2.5	-3	+1
Ohio Valley and Tennessee.....	+8.2	-4	-2.3	-4	+2	+1.4	-4	+3.6	-1.6	-3.0	-2.5	-1.8	0
Lower Lakes.....	+7.8	+3.6	-3.2	-2	+8	+2	+1.2	+1.0	-1.2	-2.7	+1	-1.8	+8
Upper Lakes.....	+1.9	+3.1	-1.3	-2	+1.9	+6	+2.3	+3.7	+3	-2.7	-4	-2.9	+8
North Dakota.....	-12.6	-1.4	+1.7	-1	+3.4	+1.1	+3.7	+7.4	+1.6	+9	-1.1	-7	+3
Upper Mississippi Valley.....	-2.3	-9	-1.7	-1.0	+1.5	+1	+1.9	+3.7	+9	-1.7	-2.1	-1.9	-2
Missouri Valley.....	-8.2	-7	-1.4	-8	+2.9	+1.1	+3.6	+7.0	+2.6	-3	-2.1	-5	+3
Northern Slope.....	-16.6	-9	+3	0	+3.6	+4	+3.9	+3.6	+3.8	+4.5	+1.1	+1.3	+4
Middle Slope.....	-8.2	+3	-2.0	+1	+3.1	+0.0	+3.3	+6.2	+2.5	+1.1	-1.2	-4	+4
Southern Slope.....	-3.0	+1.6	-4.2	+1.3	+1.8	+1.5	+1.7	+1.5	+3.1	+2.8	-3	+1	+9
Southern Plateau.....	-6.7	-1.6	-1.8	+6	+2.9	+4	+1.5	+3.6	+3.8	+2.9	+3.0	+4.2	+1.1
Middle Plateau.....	-15.8	-3.1	+7	-1.9	+7.8	+6	+2.6	+3.4	+3.8	+2.9	+1.1	+1.7	+5
Northern Plateau.....	-15.1	-2.9	+1.6	-2.2	+2.5	+5	+3.3	-3	+4.0	+5.1	+4.0	+4.9	+5
North Pacific.....	-7.9	-3	+2.6	-1.2	+1.4	+2.6	+1.4	+2	+1.8	+4.6	+2.4	+2.8	+1.0
Middle Pacific.....	-10.3	-2.8	+4	-1.3	+1.7	+1.8	+1.9	+1.6	+1.2	+2.4	+1.8	+3.9	+2
South Pacific.....	-5.8	-3	+7	+1.4	+2.2	+7	+1.2	+7	+2.5	+2.4	+1.3	+4.7	+1.0
United States.....	-2.1	+8	-1.2	-3	+2.6	+1.1	+1.8	+3.3	+1.3	+6	+1	+6	+7

† Mean of the monthly values.

The relatively warmest section for the year was the New England district which averaged 2° above normal. The relatively warmest month was August with a departure of 3.3°. May, June, July, and September were also considerably warmer than normal and February, October, November, and December averaged slightly above normal. Only three months, January, March, and April for the country as a whole, averaged subnormal warmth; January was the relatively coldest month with a negative departure from normal of 2.1°. Close examination of table 1 shows that January was characterized by marked contrasting temperature conditions in different portions of the country. Decidedly above-normal warmth prevailed in the Northeast and Ohio Valley and Tennessee while west of the Mississippi River and the Lake region temperatures, especially the Plateau and Rocky Mountain districts, were markedly below normal. Deviations from the normal by districts during the remaining months of the year were much less marked, except that during August excessive warmth prevailed in North Dakota, the upper Mississippi Valley and middle Slope districts.

Chart I, based on data furnished by 170 first- and second-order stations, as compared to table 1, offers a less generalized summation of temperature conditions for the year. It shows a large interior area of subnormal warmth while the remainder of the country, except small local areas, averaged above normal.

During the past year, although precipitation was not normal over a large interior section and July and August were comparatively hot, it was a decided improvement over conditions which existed in 1936. On a State average basis only 5 States west of the Mississippi River, viz, Texas, Arizona, Colorado, Utah, and Nevada, had less annual rainfall than in 1936. All States which suffered severely from the lack of rainfall in 1936 received in 1937 substantial increases apart from small gains, 10 percent or less, in Iowa, Kansas, and Montana. East of the Mississippi River and the Lake region the annual rainfall, without exception, averaged above normal, as well as in the Pacific Coast States.

Table 2 shows that for the United States as a whole precipitation averaged 0.4 inch in excess of normal or about 2.1 inches above the corresponding 1936 figure. In 10 of the 21 climatological districts, comprising the area westward from the upper Lakes to the northern slope and southward to the Mexican border and west Gulf district, there was a decided shortage in rainfall. The relatively driest sections were the Missouri Valley and middle and southern slope districts (in 1936, 14 sections received less-than-normal precipitation). Annual averages were decidedly in excess of normal in the Atlantic coast and east Gulf sections and also in the north and middle Pacific districts, the middle Pacific district (principally northern California) being the relatively wettest with an excess of 8.8 inches.

TABLE 2.—Precipitation departures, monthly and annual, 1937

[Compiled from "Table 2—Climatological data for Weather Bureau Stations" contained in the 12 issues of the REVIEW during 1937]

Districts	January	February	March	April	May	June	July	August	September	October	November	December	Sum
New England.....	+0.6	-1.3	-0.1	+1.0	+0.4	+1.2	-1.3	+0.7	+0.1	+1.1	+1.5	-0.5	+3.4
Middle Atlantic.....	+2.8	-0.7	-1.2	+1.6	-0.7	+1.1	-0.9	+1.8	-0.8	+2.7	+0.7	-1.9	+4.5
South Atlantic.....	+1.6	+0.3	-1.6	+2.7	-1.3	-0.3	+0.7	0	-1.2	+1.2	+0.4	-1.4	+1.1
Florida Peninsula.....	-1.1	+4.2	+1.7	-0.3	+0.6	-1.0	+0.6	-0.2	+1.1	-0.6	+0.7	-1.2	+4.5
East Gulf.....	+2.5	0	-0.8	+3.1	-0.4	0	-1.8	+1.1	-0.1	+4.8	-0.8	-2.3	+5.3
West Gulf.....	+1.7	-1.5	+0.6	-2.4	-1.8	-0.3	-0.8	-0.7	-0.7	+0.5	+0.5	+2.4	-2.5
Ohio Valley and Tennessee.....	+8.3	-1.2	-2.5	+0.5	-0.1	+0.3	-0.2	+0.4	-0.9	+2.1	-1.5	-0.2	+5.0
Lower Lakes.....	+2.1	-0.4	-0.7	+1.7	-0.4	+2.8	-0.2	+0.7	-1.2	+1.0	-0.8	-0.4	+4.2
Upper Lakes.....	+0.6	+0.1	-1.3	+1.1	-1.2	-0.2	-0.4	-0.5	+0.4	-0.1	-0.1	-0.6	-2.2
North Dakota.....	+0.3	0	-0.5	+1.0	-0.8	-0.6	+0.3	-0.2	-0.1	-0.5	-0.3	0	-1.4
Upper Mississippi Valley.....	+2.5	-0.2	-0.9	+0.8	-0.2	-0.2	-1.2	-1.1	-1.4	+0.2	-0.8	-0.1	-2.6
Missouri Valley.....	+1.4	-0.8	-0.2	-0.4	-1.1	-0.5	-0.6	-0.8	-2.0	-0.8	-0.5	-0.3	-6.6
Northern Slope.....	0	-0.1	+0.3	-0.4	-1.1	+0.2	+0.4	-0.6	-0.4	-0.3	-0.2	+0.3	-1.9
Middle Slope.....	+0.4	-0.4	+0.2	-1.2	-1.4	-0.2	-0.6	-0.9	-0.7	-0.6	-0.2	-0.2	-5.8
Southern Slope.....	-0.3	-0.6	+0.3	-1.0	+0.6	-0.8	-1.5	-1.2	-0.5	-0.6	-0.4	+1.0	-5.0
Southern Plateau.....	+0.1	+0.2	+0.4	-0.4	+0.5	+0.7	-0.7	-0.8	+0.4	-0.1	-0.6	-0.2	-0.5
Middle Plateau.....	+0.3	0	+0.2	-0.3	-0.3	-0.4	+0.5	-0.3	-0.2	-0.3	+0.1	+0.4	-0.3
Northern Plateau.....	-0.1	-0.2	+0.2	+0.7	-1.0	+0.5	-0.1	-0.2	-0.3	-0.2	+0.7	+0.2	+0.2
North Pacific.....	-2.9	+1.1	-1.1	+2.8	-0.7	+1.9	-0.4	+0.6	-0.2	-0.2	+3.4	+1.0	+5.3
Middle Pacific.....	-1.8	+1.2	+3.5	+0.5	-1.0	+0.8	0	0	-0.6	+0.9	+3.9	+0.4	+8.8
South Pacific.....	-0.5	+2.7	+1.0	-0.7	-0.2	-0.1	0	0	-0.2	-0.6	-0.9	+0.6	+1.1
United States.....	+0.9	+0.1	-0.2	+0.5	-0.6	+0.2	-0.4	-0.1	-0.5	+0.5	+0.2	-0.2	+0.4

¹ Sum of the 12 monthly values.

On a monthly basis variations from normal precipitation were equally divided. January, February, April, June, August, and November received above normal amounts. January was by far the wettest month with an excess of 0.9 inch and May the relatively driest with a deficiency of 0.6 inch.

Chart II, constructed from data furnished by 174 first- and second-order stations, shows the yearly distribution of precipitation with respect to normal. There appears a large area of decidedly deficient rainfall over northeastern Kansas, southeastern Nebraska, and northern Missouri with a smaller area of marked shortage of moisture in Oklahoma and along the West Gulf coast and immediate interior. Areas of markedly above-normal rainfall prevailed east of the Mississippi River and the Lake region and in the north and middle Pacific Coast States. The largest yearly excess reported from a first-order station was 29.73 inches at Pensacola, Fla.; New Orleans, La., had 21.94 inches in excess of the yearly normal. Similarly, the greatest shortage reported was 14.12 inches at Topeka,

Kans., and Kansas City, Mo., was close with 12.27 inches below annual normal rainfall.

Temperature extremes during the year were well within the limit of previous records. The highest maximum reported was 124° at Greenland Ranch, Calif., on August 11, 12, and 13 and at Cow Creek, Calif., on the 12th. The lowest temperature reported was -56° at West Yellowstone, Wyo., on January 21. Temperatures of freezing or below occurred in every State some time during the 12 months. July brought minima of freezing or below to 12 States and August brought similar minima to 10 States. The lowest for July was 20° at Austin, Oreg., on the 8th; and that for August was 13° at Seneca, Oreg., on the 28th.

The greatest annual precipitation recorded at any station in the United States during the year was 168.88 inches at Valsetz, Oreg., elevation, 1,150 feet; this station also reported the greatest monthly amount in the United States, 35.96 inches in December. During the year 1,204 stations experienced at least 1 month with no precipitation and 66 stations had months with totals of less than 0.01 inch.

NOTES AND REVIEWS

Note on Early Tornadoes in Georgia. By GEORGE W. MINDLING. In connection with the preparation of a summary of such data as could be found on tornadoes in Georgia during years preceding those covered by the Weather Bureau *Climatological Data*, the writer listed the tornadoes that are given as having occurred in Georgia in the well-known work of Finley, *Report on the Character of Six Hundred Tornadoes*, Professional Papers of the Signal Service, No. VII.

Correspondence was carried on with many newspaper offices in an effort to obtain some additional information about the early Georgia tornadoes listed in Finley's paper. There are only two instances in which this correspondence brought to light any errors or new information, which is a favorable indication of the general reliability of Finley's work: Two of the Georgia tornadoes listed in his report did not occur, viz, the one of April 3, 1880, at Toccoa, Ga., and one of April 4, 1880, in Washington County, both listed on page 16 of the Report.

Complete assurance has been obtained, through newspaper offices and others in Toccoa, that no tornado such as listed in Finley's work ever occurred at or near that place. The report indicates the destruction of 50 buildings and the loss of three lives. Toccoa was a very small place in 1880 and probably did not have 50 buildings at that time.

C. B. Chapman of the *Sandersville Progress* has furnished an account of a tornado that occurred in Davisboro, Washington County, at 6 p. m., February 18, 1884. This report was confirmed by Mamie S. Harris, whose brother lived in Davisboro when the town was wrecked by this tornado. Neither of these correspondents could find any one to confirm the occurrence of the tornado listed as occurring in the county on April 4, 1880.

E. W. HEWSON. A Survey of the Facts and the Theories of the Aurora. *Reviews of Modern Physics*, Vol. 9, pp. 403-431, 1937 October.

This paper provides a summary of present knowledge of the aurora, with bibliographic references to 81 papers.