

TABLE 2.—Free air data determined at naval air stations during February 1930

Altitude (meters) m. s. l.	Temperature (° C.)			Relative humidity (%)		
	Pensa- cola, Fla.	San Diego, Calif.	Wash- ington, D. C.	Pensa- cola, Fla.	San Diego, Calif.	Wash- ington, D. C.
Surface.....	11.8	14.8	3.3	84	72	73
500.....	12.5	14.1	3.4	64	61	66
1,000.....	10.4	13.8	2.3	64	50	60
2,000.....	5.6	9.3	-1.5	58	35	55
3,000.....	0.9	5.2	-5.8	44	24	47
4,000.....			-13.1			53

TABLE 4.—Observations by means of kites, captive and limited-height sounding balloons during February, 1930

	Broken Arrow, Okla.	Due West, S. C.	Ellen- dale, N. Dak.	Gros- beck, Tex.	Royal Center, Ind.
Mean altitudes (meters) m. s. l., reached during month.....	2,808	2,617	2,957	2,418	2,611
Maximum altitude (meters) m. s. l., reached and date.....	4,439	4,359	5,107	4,172	4,531
Number of flights made.....	32	30	28	26	29
Number of days on which flights were made..	27	28	28	22	27

¹ 17th. ² 22d. ³ 3d. ⁴ 8th. ⁵ 21st.
In addition to the above there were approximately 125 pilot balloon observations made daily at 53 Weather Bureau stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By P. C. DAY

GENERAL SUMMARY

The outstanding feature of the weather of the month was the remarkable warmth that prevailed over most portions of the country from about the 18th to 25th. Springlike weather prevailed to an unusual extent on a number of days during this period, and temperatures above any previously recorded in February were reported by some stations on several successive dates, a most unusual occurrence; also the extremes were in many cases a number of degrees higher than previously recorded.

Aside from the temperature abnormalities referred to, the weather elements were mainly not unusual.

PRESSURE AND WINDS

At the beginning of February high pressure existed in the central Plateau region, but without attendant cold; in fact warmer weather prevailed over most districts, a condition that may be expected with the entrance of an anticyclone into the United States at such a low latitude, and moderate temperatures continued for several days, save that a movement of high pressure southward from Hudson Bay toward New England brought sharp changes to cooler by the 4th in New England and the adjoining Maritime Provinces of Canada. At the same time low barometric pressure prevailed along the northern border with local precipitation at many points. By the 4th low barometric pressure had moved to the lower Mississippi Valley, and heavy rains had overspread near-by areas. This storm moved off the southern New England coast by the following morning, and was quickly followed by another low-pressure area moving into the Lake region, with attending light snow in the northern Plains and to the eastward. In the meantime the high pressure over the Plateau had remained nearly stationary, attended by generally fair conditions, and much colder weather had overspread New England and near-by areas in both the United States and Canada, temperatures of 50° or more below zero being reported from the interior of the Province of Quebec, though this cold was quickly followed by decided warmth over the same area.

By the morning of the 9th the anticyclone that had remained over the Plateau had been reinforced by an area of high pressure from the Pacific Northwest and was central over the northern Rocky Mountain region, attended by sharp changes to lower temperatures in that region, but there was considerable warming to the eastward with falling pressure and some snow over the Lake region, the cyclonic conditions moving into the St. Law-

rence Valley by the 10th; and light snow continued over portions of the Great Lakes, turning to light rain over small areas to the southward.

On the 11th there was considerable warming up from the central Rocky Mountains northeastward over the Dakotas and near-by areas in Canada, but lower temperatures prevailed in most northern districts from the Great Lakes eastward. By the following day there were three important temperature changes progressing along the northern border; the warm area of the 11th had moved eastward to the Great Lakes, extending southward to the northern part of the Gulf States, while the cold area to the eastward had moved to New England, and a new cold wave had developed in the upper Missouri Valley and to the northward, where changes from 20° to 40° colder were noted. Similar conditions existed during the 13th, the several areas having moved eastward in their respective orders, though the cold in the Northwest extended its area materially, while the similar area of cold over the Northeast had practically passed into the North Atlantic. During this period considerable precipitation occurred along the northern border from the Pacific eastward to near the Atlantic coast, with some snow at scattered points in the northern portions. On the 14th precipitation continued at scattered points somewhat further south than on the previous day, and it became rather general over the eastern section from the Gulf States northeastward to New England, with more or less snow, particularly from the Dakotas eastward into New England, where, near the coast, the precipitation became comparatively heavy.

There was scattered precipitation in east-central districts on the 15th, mostly snow, which continued over the coast districts on the following day, the snow turning to rain in the central and southern sections. This precipitation area was followed on the 16th by much warmer weather over the northern districts between the Mississippi River and the Rocky Mountains, and this warmth gradually moved toward the Atlantic coast during the following two days.

By the 19th anticyclonic conditions had become established over most southern districts, and high temperatures prevailed in practically all of the country, continuing with some local interruptions into the middle of the third decade, when precipitation set in over many central districts followed by changes to cooler over the interior portions, the lower temperatures moving eastward in the wake of the precipitation area that was advancing from the central valleys on the 26th and 27th. By the morning of the 27th low barometric pressure had moved into the central Plateau region attended by local snows at the higher elevations, and during the following day advanced

slowly into the lower Missouri Valley, where snow changed to rain locally, and at the end of the month the storm was advancing toward the upper Lakes, snow again falling in the districts to northward of the center, and rain continuing in the middle Mississippi and portions of the Ohio Valleys. At the same time precipitation had set in over the Middle Gulf States.

The average pressure for the month was usually less than normal over the central and northern districts from the Lake region and Mississippi Valley westward, save in the far Southwest, and was above normal from the Gulf States northeastward to New England and eastern Canada. Compared with the averages for the preceding month, pressures were lower over practically all portions, and decidedly lower over the central and northern districts and in the adjacent portions of the Canadian Northwest.

The winds of the month were unimportant in the matter of damage, and occurred at infrequent intervals; and as a rule they were confined to limited areas.

The distribution of the averages of pressure for the month as a whole, the departures from the normal, and the changes in pressure from January to February are shown on the usual charts, while the important facts in connection with wind and other storms appear, as is customary, at the end of this section.

TEMPERATURE

Unlike the preceding January, which was extremely cold over many of the western parts, February experienced much warm and springlike weather, particularly during the last day or two of the second decade and the early part of the last decade. Temperatures in excess of any that had previously been recorded in February were reported at numerous points in the central-western area.

The first two days of February were mainly warmer than normal, while the 3d was moderately cool over the far West, and the 4th was cool over the Northeastern States, and in portions of the Great Plains and Rocky Mountain regions.

For the week ended February 11, the mean temperatures were above normal over all parts of the country, save a small area in Colorado, and in parts of the Northeast. The week ended February 18 was likewise warmer than normal in all midwestern and far western districts, but it was moderately cool over the eastern third. The week ended February 25 was one of abnormal warmth, the weather partaking more of that associated with mid spring than of midwinter. In some of the northern and central sections this period was the warmest ever associated with February, the weekly averages ranging up to nearly 30° above the normal for that period of the month; the individual daily values were in a number of instances decidedly higher than had ever before been registered in February, while in some cases the monthly means, as a result of these unusual temperatures, were the highest ever observed in the month. The last three days of the month were cooler than normal, save in some few localities.

The maximum temperatures occurred mainly during the heated period of the first half of the last decade, principally from the 23d to 25th, though in the more western districts they occurred mainly a few days earlier.

The lowest temperatures were reported from a few of the more southern districts on the 1st, but in most other districts the lowest temperatures were recorded about the 15th or 16th, though in a few western localities they were delayed until toward the end of the month.

As stated elsewhere, only one small area in western Colorado had averages of temperature below the normal. In all other districts the average temperatures for the month were above the normal, and in numerous large areas over the central and northwestern parts they ranged from 10° to 15° or more above.

PRECIPITATION

As is apt to be the case in a month so unexpectedly mild, precipitation was mainly less than normal. This was especially true of the eastern, southern, and central sections. The largest area with precipitation greater than normal included most northern counties of Michigan and Wisconsin, and practically all of Minnesota and the Dakotas. Much of Washington likewise had more than normal precipitation, which was fortunate in view of the shortage there during January.

The southern part of the Florida Peninsula and an area including much of Oklahoma and Arkansas with parts of eastern Texas and northern Louisiana were other districts where amounts moderately greater than normal were received.

Altogether, 13 States of the 48 had more precipitation than their February averages, but of these only Minnesota, North Dakota, and Washington received more than 120 per cent of the normal.

The largest amount reported from any single station was slightly more than 30 inches, measured at a point in northwestern Washington.

Precipitation was wholly absent or was negligible over large portions of New Mexico and Texas. Most parts of the Southwest, including California and Nevada, received much less than normal, likewise nearly all the lower Missouri Valley. In the eastern half of the country the shortage was marked from Mississippi and Alabama northeastward through the Appalachian region to Maryland, also to eastward from the mountains to the coast in districts from Georgia to southern New Jersey. Likewise in northeastern New York and central and northern New England, there was nearly everywhere a considerable shortage.

SNOWFALL

In almost every portion of the country the snowfall was less than the averages found from previous Februaries. Particularly marked was the shortage from the middle Plains eastward over the central valleys to the Middle Atlantic coast, where much snow is looked for and scarcely any occurred. To southward, the entire area of the important cotton States had no snow, save a few had small amounts, mainly in mountainous portions. The southern limit of February's snowfall is thus found considerably farther north than usual, in marked contrast with the location of the January limit, which was far to the southward of the average position.

In the States near the middle of the Canadian boundary the month's snowfall was usually somewhat greater than normal. Here, and in most of the far West besides, the chief snowfalls came during the last decade of the month. The only important snowfall from the middle Plains eastward, however, occurred about the middle of the month, just before the chief cold period.

The stored snow in the elevated portions of the far West was usually of disappointing quantity when February ended. In New Mexico and the extreme Northwest this was especially true, remarkably little remaining at that time. However, the middle and northern Rocky

Mountain region and the eastern parts of the middle Plateau were indicated in some districts to have sufficient snow to promise an average water supply, though the outlook as a whole for a good late water flow was discouraging.

RELATIVE HUMIDITY

The relative amount of moisture in the atmosphere was well below the normal as deduced from previous records

over important areas, the deficiencies being large in many southern districts, where they ranged up to as much as 25 per cent. They were also less than normal, but to a slightly less degree, in portions of the Great Plains, Rocky Mountain, and Plateau districts, though in these areas there were small localities having values somewhat above normal, and similar conditions existed over the Pacific Coast States, along the middle Gulf coast, over portions of New England and in the upper Lake region.

SEVERE LOCAL STORMS, FEBRUARY, 1930

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Berrien County, Ga.....	4					Wind.....	Trees blown down; old barns unroofed.....	Official, U. S. Weather Bureau.
Mint Hill, N. C.....	4	7.30 p. m.	200		\$2,000	Tornadoic wind.....	Damage mainly to small houses, barns, and timber. Path 4 miles long.	Do.
Toole County, Mont.....	10					High wind.....	Character of damage not reported.....	Do.
Central City, Ind. (near).....	12				10,000	Electrical and wind.....	Considerable damage to power plant at coal mine. Power lines to towns in vicinity damaged.	Do.
Cascade County, Mont.....	18					Destructive wind.....	Many thousands of dollars damage in and near Browning.	Do.
Springfield, Ill., and vicinity.....	23-24					Severe thunder-storm.....	Basements flooded; street light affected; 3 barns burned.	Do.
Indianapolis and Richmond, Ind.....	24					Hail and thunder-storm.....	Much glass in greenhouses broken; some roofs damaged.	Do.
Roseville, Ohio (near).....	24	5.30 p. m.	100-200		150,000	Severe thunder-storm and tornadoic wind.....	Heavy property loss; 4 persons injured; 300 people suffered temporary loss of work. Path about 1 mile long.	Do.
San Francisco, Calif.....	24					Thunderstorm and wind.....	Some damage by lightning.....	Do.
Calro, Ill.....	25	P. m.			1,300	do.....	Pumping plant damaged.....	Do.
San Jose, Calif.....	26	4 p. m.				Hail and wind.....	Street car service interrupted, some roofs damaged and trees broken.	Do.

RIVERS AND FLOODS

By R. E. SPENCER

Details of overflow and damage caused by the flood in the Wabash system in January, 1930, which had not been received in time for inclusion in the REVIEW for that month, are given below. The quotation, taken from the report of Mr. J. H. Armington, official in charge of the Indianapolis, Ind., office of the Weather Bureau, includes also some further comment on precipitation and stages, with particular reference to comparative features of the 1913 and 1930 floods:

The stages reached in the great flood of March, 1913, except at Vincennes on the Wabash and at Decker on the White, considerably exceeded those of January, 1930. At most points on the White the crests of the January flood were exceeded also by those of February, 1916; and the same was the case at a few points on the middle Wabash, particularly at Terre Haute, although the difference at Terre Haute was but 0.4 foot. Therefore, as the severity of flooding was not so great above the junction of the forks of the White and above the middle-upper Wabash, estimates on areas inundated are confined to the Wabash Valley from Tippecanoe County downstream to the mouth.

Along that stretch of the river a total of approximately 684 square miles were overflowed, 293 square miles being in Illinois and 391 square miles in Indiana. The most extensive and most severe flooding, however, was from Knox County southward on the Indiana side and from Lawrence County southward on the Illinois side of the river. Lawrence County heads the list with 121 square miles of flooded territory, while Gibson and Knox Counties are second and third, with 91 and 87 square miles, respectively, and Posey County is fourth, with 86 square miles.

Had it not been for the breaking of levees from Vincennes upstream past Terre Haute and for the further stage diminution caused by the opening of levee gates above Terre Haute and by the severe cold which overspread the entire region just as the water was approaching its highest points, the stages reached above Vincennes would undoubtedly have been considerably higher than they were. As it was, the crests were not only reduced, but their

occurrence was considerably hastened in point of time; so that, from source to mouth, they occurred within a period of about three days, whereas ordinarily the flood wave requires somewhat more than a week to run its course.

Even without the reduction thus produced, however, it is practically certain that the crests of the January flood would not have been as high as those of the flood of March, 1913, unless the building and changing of levees since that time has materially altered flood heights. This conclusion is based on the fact that the average rainfall over the entire Wabash Valley in the flood of March, 1913, was more than 1 inch greater in its period of five days than was the average rainfall over the same region in the flood of January, 1930, over its period of eight days. Even the somewhat higher initial stages which at most places preceded the period of rainfall in 1930 would not balance the greater amount of rainfall and shorter period in 1913. It may be noted in passing that careful study of the 1913 situation at Vincennes has placed the crest of the flood in that year at 28 feet at least had it not been for wide breaks in the levees of both Wabash and tributary streams. The same statements are applicable to the main stream of White River from the junction of the forks to its mouth.

Damage and loss caused by flooding.—Data on damage and loss by flooding are given below for the Wabash and the White Valleys separately:

Losses and damage in the Wabash Valley proper:

Item No. 1, tangible property—	
Levees.....	\$75,930
Public utilities.....	4,000
Industries.....	111,463
Railroads.....	240,301
Cities and communities.....	34,600
Fences.....	510,850
Roads and bridges.....	113,000
Total.....	1,090,144

Item No. 2, farm property—

(a) Matured crops.....	3,818,550
(b) Prospective crops.....	463,530
(c) Equipment, livestock, etc.....	601,110

Total..... 4,883,190