

TABLE 2.—Free-air resultant winds (m. p. a.) during December, 1922.

Altitude, m. s. l. (m.)	Broken Arrow, Okla. (233m.)				Drexel, Nebr. (396m.)				Due West, S. C. (217m.)				Ellendale, N. Dak. (444m.)				Groesbeck, Tex. (141m.)				Royal Center, Ind. (225m.)			
	Mean.		5-year mean.		Mean.		5-year mean.		Mean.		2-year mean.		Mean.		5-year mean.		Mean.		5-year mean.		Mean.		5-year mean.	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface.....	N. 49° W.	1.7	S. 60° W.	1.2	S. 48° W.	1.5	W.	1.1	N. 37° E.	0.6	S. 62° W.	0.9	N. 71° W.	3.7	N. 54° W.	3.4	S. 55° W.	2.2	S. 86° W.	1.2	S. 34° W.	1.2	S. 50° W.	2.1
250.....	N. 46° W.	1.7	S. 52° W.	1.3	.....	.....	.....	.....	N. 88° E.	0.6	S. 60° W.	1.1	.....	.....	.....	.....	S. 51° W.	2.7	S. 82° W.	1.6	S. 26° W.	1.9	S. 50° W.	2.4
500.....	S. 43° W.	1.3	S. 43° W.	3.4	N. 66° W.	2.4	N. 88° W.	1.8	S. 34° W.	1.1	S. 67° W.	3.3	N. 70° W.	4.4	N. 61° W.	3.7	S. 50° W.	4.2	S. 50° W.	3.2	S. 59° W.	4.5	S. 57° W.	5.0
750.....	S. 53° W.	2.0	S. 43° W.	4.3	N. 89° W.	4.1	N. 74° W.	3.5	S. 64° W.	2.5	S. 76° W.	5.0	N. 75° W.	6.4	N. 60° W.	5.7	S. 55° W.	5.4	S. 52° W.	4.8	S. 72° W.	7.0	S. 66° W.	6.6
1,000.....	S. 64° W.	2.5	S. 60° W.	4.5	S. 85° W.	5.5	N. 75° W.	5.2	S. 61° W.	3.9	S. 82° W.	6.1	N. 69° W.	8.9	N. 58° W.	6.8	S. 56° W.	5.9	S. 52° W.	5.8	W.	7.9	S. 79° W.	7.8
1,250.....	S. 72° W.	3.2	S. 77° W.	4.8	N. 89° W.	7.2	N. 76° W.	5.4	S. 61° W.	4.9	S. 81° W.	6.7	N. 66° W.	10.0	N. 56° W.	7.6	S. 59° W.	6.6	S. 60° W.	6.6	S. 86° W.	10.6	S. 83° W.	9.8
1,500.....	S. 77° W.	4.0	S. 82° W.	5.2	N. 87° W.	9.2	N. 78° W.	6.9	S. 63° W.	6.2	W.	8.3	N. 65° W.	11.2	N. 58° W.	8.9	S. 63° W.	8.3	S. 64° W.	7.4	W.	13.1	S. 88° W.	11.0
2,000.....	S. 76° W.	6.1	S. 86° W.	6.9	N. 87° W.	11.8	N. 79° W.	8.9	S. 66° W.	8.3	N. 88° W.	8.9	N. 66° W.	13.6	N. 60° W.	10.1	S. 67° W.	8.2	S. 70° W.	8.6	N. 89° W.	14.7	N. 89° W.	12.3
2,500.....	S. 84° W.	8.1	N. 89° W.	9.6	N. 84° W.	13.8	N. 79° W.	11.4	S. 81° W.	9.8	N. 82° W.	12.6	N. 69° W.	15.9	N. 65° W.	12.2	S. 70° W.	9.7	S. 75° W.	10.0	N. 80° W.	16.9	N. 87° W.	13.3
3,000.....	S. 86° W.	9.9	N. 86° W.	11.6	N. 82° W.	15.6	N. 80° W.	13.4	S. 86° W.	14.8	N. 85° W.	15.0	N. 72° W.	16.9	N. 70° W.	13.7	S. 70° W.	12.2	S. 72° W.	11.6	N. 86° W.	16.8	S. 87° W.	13.8
3,500.....	N. 84° W.	9.9	N. 84° W.	12.8	N. 76° W.	17.3	N. 84° W.	15.2	S. 80° W.	14.4	N. 88° W.	13.7	N. 77° W.	19.2	N. 79° W.	15.0	S. 73° W.	12.2	S. 74° W.	11.9	N. 72° W.	14.0	S. 84° W.	11.2
4,000.....	N. 88° W.	7.1	N. 82° W.	10.9	N. 76° W.	18.8	N. 86° W.	17.0	N. 82° W.	12.5	N. 78° W.	12.5	N. 80° W.	20.0	N. 79° W.	14.8	S. 68° W.	12.8	S. 73° W.	11.4	S. 68° W.	18.6	S. 74° W.	12.7
4,500.....	N. 78° W.	10.5	N. 79° W.	13.1	N. 68° W.	19.9	N. 72° W.	18.4	.....	.....	N. 70° W.	13.2	.....	.....	S. 73° W.	16.2	S. 74° W.	11.2	N. 89° W.	11.2	.....	.....	.....	.....
5,000.....	S. 68° W.	14.9	N. 88° W.	14.7	N. 68° W.	20.8	N. 78° W.	17.7	N. 68° W.	12.6	S. 77° W.	15.3	S. 78° W.	13.4	N. 84° W.	13.6

THE WEATHER ELEMENTS.

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PRESSURE AND WINDS.

The distribution of the average sea-level pressure during December, 1922, presented some features not frequently observed on charts of similar character for that month in other years, notably the extensive displacement of the high area normal to the Southeastern States in winter which, during the present month, had an unusual extension into the New England States, due to the southward movement of high-pressure areas from the Hudson Bay territory, a condition infrequently experienced so early in the winter. Also the Plateau high pressure, which usually persists with much strength, was materially weakened, and occupied a position well south of that usual to the period of the year. This weakening and displacement were due mainly to the persistence of high pressure over southeastern Alaska, forcing the winter cyclones of that region inland at points farther south than usual, particularly during the early portion of the month. Finally, the lowering of the average pressure, normally only feebly apparent, along the eastern slope of the Rocky Mountains was much more fully developed than usual.

The changes in atmospheric pressure during December, 1922, as compared with the preceding month, likewise exhibited distinct departures from those usually prevailing. Under normal conditions pressure in December increases over that for November in all portions of the United States save in New England and the far Northwest, where, due to more stormy conditions, it is usually distinctly less. During the current month this was reversed as to eastern districts, where the pressure was distinctly higher than in November, while in the Northwest the area of decreased pressure was greatly extended and the decreases far greater than normal.

Due to the rapid movement of cyclones and anticyclones across the country, the atmospheric circulation was much complicated, the prevailing wind directions frequently differed greatly at near-by points, and no extensive areas had winds closely conforming to the indications of the pressure gradients.

Some high winds occurred over the north Pacific coast districts during the early part of the month and again near the end, and the cyclonic storm that moved northeasterly from the middle Mississippi Valley to southern New England from the 27th to 29th was attended by gales and high winds over the middle and north Atlantic coasts.

A tabular statement of the main facts concerning the damaging storms of the month follows at the end of this section.

TEMPERATURE.

December as a whole experienced marked variations of temperature for different periods of the month and for the various portions of the country.

The first few days were decidedly warm in most sections of the South from Texas eastward, and warmth to a somewhat less degree was experienced over the entire country east of the Rocky Mountains, save over Montana and portions of North Dakota. Here, particularly in northern Montana, severe cold was experienced and the period was moderately cold over most of the country to westward of the Rocky Mountains.

During the period from the 5th to 12th severe cold continued in Montana and adjacent States and to the westward of the Rocky Mountains, and extended over the northern and portions of the central districts to New England. In portions of Montana this week was from 25 to 30 degrees colder than is usually observed in December. This period continued moderately warm in most southern, and portions of the central, districts.

The week ending the 19th continued cold over all northern districts, the temperatures along or near the northern border ranging from 20 to 30 degrees below normal; in western Montana some of the lowest temperatures ever observed in December were reported. The cold weather extended southward over the Great Plains to the Rio Grande and into most of the eastern districts, the weather continuing moderately warm, however, over the East Gulf and South Atlantic States; the week was moderately warm in the far Southwest.

The period from the 19th to 26th experienced a remarkable rise in temperature over the Northwestern States. There was a very general warming up over nearly all parts of the country, except that severe cold continued during the first few days in the Northeastern States. The last few days were notably warm, particularly about Christmas, and that day was the warmest ever known in many portions of the central valleys and Great Plains.

The last few days of the month continued moderately warm over most districts, although there were sharp falls in temperature over the Northeastern States on the 26th and 27th, and the weather was cold along the Atlantic coast on the 29th and 30th.

The month as a whole was colder than normal over all northern portions of the country and in Canada as well,

save for a small area in Ontario, just eastward of Lake Huron; there the monthly averages were slightly higher than normal. In portions of Montana, Idaho, and adjacent States, the month was among the coldest of record, and in certain localities severe cold persisted for an unusually long period.

In the southern districts the average temperatures were mainly warmer than normal and in portions of the Gulf States it was a particularly warm and delightful month.

The maximum temperatures of the month were observed during the first decade over all districts from the Mississippi Valley eastward and in portions of Texas and adjoining States, and the far Northwest. Over the middle and northern Great Plains and most of the western Mountain States they were observed mainly during the last decade, at which time some of the highest temperatures ever observed in December were reported.

The lowest temperatures of the month were observed mainly during the last two decades, although the coldest weather of the month in Oregon and California occurred on the 8th. While record-breaking low temperatures were confined only to portions of western Montana, minimum temperatures nearly as low as ever before observed were reported from several localities in the northern Rocky Mountains.

PRECIPITATION.

Rains were frequent and generous in amount over the States from the middle and lower Mississippi Valley eastward to the coast where the monthly amounts were usually well above the normal. Over the Atlantic States to the northward of Maryland precipitation was mostly less than normal, but usually sufficient to relieve to a considerable extent the severe water shortage that had resulted from the semidroughts that had persisted for considerable periods in many parts of those States. In some sections of eastern Pennsylvania the water supply at the close of the month was still insufficient for present needs, due to the long period of deficient precipitation which for the year as a whole was the greatest in a hundred years or more.

Precipitation was mostly light, and materially less than normal over a wide area extending from the upper Lakes southwesterly to the Rio Grande Valley and Arizona. In portions of this area, particularly in Iowa, and locally in adjacent States, the total precipitation for the month was the least or nearly the least ever reported in December.

From the central and northern Rocky Mountains westward to the Pacific precipitation was mainly above normal, and markedly so over most of California where precipitation was frequent and at times heavy. Farther

north over Oregon and Washington precipitation was frequent, particularly during the first half of the month, but the totals were usually not greatly in excess of the normal.

The principal periods with heavy precipitation over considerable areas in the districts from the Mississippi Valley eastward were: The 7th to 9th, over most States from the Mississippi Valley eastward, covering a wide area with either rain or snow, but the amounts were usually not heavy; 14th to 15th, heavy precipitation in the lower Ohio Valley and Tennessee; 16th and 17th, in the Middle Gulf States and lower Ohio Valley; 19th in the East Gulf States; 21st in the South Atlantic States; 27th to 29th over the Gulf States, Ohio Valley, and Atlantic Coast States; 27th to 28th from central California northward; and on the 31st in the far Northwest.

SNOWFALL.

During the first 10 days of December considerable snow fell in the northern portions of the country from the Cascade Mountains eastward to Minnesota, especially in Montana and the high districts to the westward.

From the 13th to 17th considerable snow fell from the middle Plateau eastward to the western Plains region, and moderate amounts from Iowa eastward. On the 28th and 29th snow occurred from the Great Lakes eastward, with heavy falls in New York and New England.

At the end of the month the appreciable snow-covered area was confined mainly to New York and New England, the upper Lakes and thence westward to Montana, and at the higher elevations of the central and northern mountain States. In the high Sierra of California deep snow had accumulated, the depth approximating 100 inches at elevations of 7,000 feet, and there were greater depths at higher elevations. Deep snow had also accumulated in some of the high mountains of Colorado, Idaho, and Wyoming.

The distribution of the total snowfall of the month is shown on Chart VII of this issue.

RELATIVE HUMIDITY.

The relative humidity of the atmosphere showed some marked departures from the normal over small areas, particularly in Arizona and other portions of the Plateau region and southern California, where the percentages ranged from 10 to 25 per cent above the normal. In the Atlantic and Gulf States the percentages were likewise well above the normal, and also in the Dakotas. Elsewhere the relative humidity was usually below the normal though the departures were mainly small.