

AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures during February were considerably above normal at all levels at Ellendale, the northernmost station. (See Table 1.) Positive departures of appreciable magnitude occurred also at Royal Center and Broken Arrow. Negative departures occurred at all levels at Due West and in the higher levels at Groesbeck.

Free-air relative humidities were considerably above normal at Broken Arrow, especially in the higher levels. This fact together with the positive temperature and vapor pressure departures at this station are of special significance in view of the appreciable excess over normal of the total precipitation for the month. Free-air vapor pressures averaged mostly above normal at the other stations excepting Due West.

The resultant free-air wind directions at the 1,000-meter level were mostly northwesterly east of the Rocky Mountains except in the extreme south where they were southerly. Along the North Pacific coast they were variable with a southerly component predominating at the more northerly stations.

At 3,000 meters the resultant direction was strikingly uniform from the west-northwest at practically all stations in the country with a marked northerly component at San Francisco and Modena.

Free-air resultant velocities decreased from the northern to southern stations with lowest values in the Rocky Mountain region.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during February, 1931—Continued

Altitude m. s. l. (meters)	RELATIVE HUMIDITY (%)															
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)							
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal						
Surface	75	+6	76	+7	82	+1	80	+6	78	0						
500	68	+2	68	+4	81	+1	76	+8	73	-2						
1,000	62	+5	64	+4	63	-7	71	+13	76	+3						
1,500	63	+12	60	+4	53	-9	65	+14	57	-5						
2,000	62	+16	50	-3	50	-9	56	+10	54	-2						
2,500	59	+15	44	-7	49	-10	53	+9	53	-1						
3,000	56	+13	46	-3	49	-9	49	+7	55	0						
4,000	57	+16	46	0	36	-19	42	+5	57	0						
5,000	55	+16			34	-24			58							

VAPOR PRESSURE (mb.)															
Surface	7.51	+1.27	7.28	-0.62	4.14	+1.55	11.29	+1.80	5.34	+0.82					
500	6.73	+1.25	6.85	-0.19	4.01	+1.47	9.99	+1.85	4.70	+0.77					
1,000	5.81	+1.42	5.79	-0.23	3.37	+1.05	8.08	+1.48	3.88	+0.66					
1,500	5.05	+1.47	4.64	-0.22	2.63	+0.56	6.49	+1.34	2.94	+0.40					
2,000	4.13	+1.31	3.29	-0.50	2.18	+0.45	4.95	+0.94	2.53	+0.52					
2,500	3.36	+1.04	2.36	-0.57	1.78	+0.36	4.14	+0.90	2.14	+0.48					
3,000	2.90	+1.01	2.05	-0.21	1.40	+0.29	3.56	+0.88	1.87	+0.53					
4,000	1.92	+0.61	1.67	+0.43	0.60	-0.17	2.92	+1.16	1.50	+0.67					
5,000	1.14	+0.34			0.16	-0.22			1.24						

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during February, 1931

Altitude m. s. l. (meters)	TEMPERATURE (°C.)									
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	6.6	+1.7	5.8	-2.0	-3.1	+6.6	12.0	+2.2	1.5	+3.0
500	6.3	+2.5	6.3	-0.8	-3.2	+6.5	10.8	+2.2	0.0	+3.5
1,000	5.6	+2.6	4.9	-0.6	-1.8	+6.3	8.5	+0.2	-1.8	+2.7
1,500	3.4	+1.3	2.8	-0.8	-2.7	+5.4	6.5	-0.6	-2.3	+3.1
2,000	1.1	+0.6	0.9	-0.8	-4.5	+5.0	4.8	-3.8	-3.0	+3.0
2,500	-1.2	+0.6	-1.5	-0.8	-6.9	+4.9	2.0	-0.7	-5.7	+3.0
3,000	-3.4	+1.0	-4.1	-0.9	-9.8	+4.7	-4.4	-4.7	-7.8	+3.4
4,000	-10.2	-0.6	-10.7	-1.7	-15.4	+4.4	-9.9	-5.4	-12.9	+4.3
5,000	-16.4	-1.1			-21.7	+3.9			-19.4	

TABLE 2.—Free-air data obtained by airplanes at naval air stations during February, 1931

Altitude, m. s. l. (meters)	Temperature (°C.)				Relative humidity (%)			
	Hampton Roads, Va.	Pensacola, Fla.	San Diego, Calif.	Washington, D. C.	Hampton Roads, Va.	Pensacola, Fla.	San Diego, Calif.	Washington, D. C.
Surface	2.2	9.8	15.0	-0.5	68	82	65	79
500	2.4	10.3	13.5	1.4	67	73	65	60
1,000	0.9	7.7	11.2	-0.3	47	76	62	54
2,000	-0.9	4.0	5.2	-3.5	28	59	55	45
3,000	-4.4	-0.6	0.7	-7.5	18	46	38	55

TABLE 3.—Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during February, 1931

Altitude, m. s. l. (meters)	Broken Arrow, Okla. (233 meters)		Brownsville, Tex. (12 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,873 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (139 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (14 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (127 meters)		Medford, Oreg. (410 meters)		
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	
Surface	S 31 E	1.0	S 40 E	0.7	S 16 W	0.7	N 78 W	2.6	N 33 E	0.8	N 67 W	1.3	N 7 E	0.6	S 60 W	2.5	N 34 W	0.9	N 52 E	2.0	N 51 E	2.3	N 5 E	0.3	
500	S 16 E	3.7	S 51 E	4.3	S 85 W	4.4			N 22 W	0.8	N 83 W	1.9	S 34 W	1.9	S 69 W	6.4	S 53 W	0.7	N 74 E	3.5	S 78 E	3.6	N 5 E	0.2	
1,000	S 43 W	3.6	S 9 E	4.8	S 80 W	7.7			N 78 W	3.0	N 82 W	4.4	S 80 W	1.2	S 69 W	6.4	S 68 W	2.6	N 54 E	2.6	S 63 E	2.9	N 5 W	1.4	
1,500	S 86 W	3.1	S 28 W	4.9	N 44 W	4.4			N 75 W	4.4	N 67 W	6.0	N 71 W	1.2	S 86 W	7.8	N 87 W	1.8	S 53 W	1.8	S 49 E	2.0	S 5 W	2.6	
2,000	S 89 W	3.9	N 89 W	2.5	N 36 W	10.7	N 76 W	4.1	N 68 W	6.3	N 67 W	6.0	N 64 W	2.9	N 84 W	7.7	N 80 W	3.6	S 85 W	3.6	S 73 E	2.0	S 52 W	2.6	
2,500	N 86 W	4.0	N 64 W	7.2	N 38 W	11.5	N 73 W	5.8	N 65 W	7.7	N 61 W	9.4	N 64 W	4.2	N 77 W	6.8	N 80 W	5.1	N 81 W	5.1	N	3.6	S 62 W	4.1	
3,000	N 61 W	3.5	N 77 W	6.8	N 43 W	13.6	N 71 W	5.8	N 71 W	9.7	N 51 W	9.9	N 76 W	7.7	N 82 W	5.4	N 73 W	13.0	N 76 W	5.2			S 75 W	3.1	
4,000							N 70 W	6.1	N 72 W	14.6	N 80 W	10.1	N 88 W	9.9						N 85 W	10.0			S 81 W	2.5
5,000							N 47 W	2.9	N 82 W	18.5									N 89 W	13.6					

TABLE 3.—Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during February, 1931—Continued.

Altitude (meters) m. s. l.	Memphis, Tenn. (145 meters)		Modena, Utah (1,665 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (299 meters)		Phoenix, Ariz. (356 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,294 meters)		San Francisco, Calif. (8 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Spokane, Wash. (606 meters)		Washington, D. C. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Surface	N 63 E	0.4	N 69 W	0.2	N 65 E	0.9	S 51 E	1.1	S 76 E	2.2	S 88 W	0.4	S 55 E	0.5	N 80 E	1.2	N 61 W	0.5	S 33 E	0.9	S 12 E	1.0	N 24 W	1.0
500	N 36 W	1.4	-----	-----	S 19 W	1.6	S 73 E	2.0	S 63 W	3.3	N 11 E	1.6	S 2 W	4.7	S 38 E	1.6	N 9 W	1.6	S 2 W	4.7	S 2 E	2.5	N 46 W	5.9
1,000	N 45 W	4.0	-----	-----	N 34 W	2.2	S 78 W	3.6	S 48 E	0.7	N 48 W	5.3	S 3 E	1.0	N 3 E	1.1	N 34 W	5.0	S 20 W	4.4	S 2 E	2.5	N 52 W	8.3
1,500	N 41 W	5.8	-----	-----	N 88 W	3.5	S 76 W	5.1	S 19 E	1.5	N 60 W	7.4	S 37 E	1.0	N 33 W	6.0	N 33 W	6.0	S 35 W	4.8	S 36 W	3.4	N 56 W	11.0
2,000	N 51 W	5.8	-----	-----	N 73 W	4.2	N 62 W	5.7	11 W	2.2	N 62 W	8.9	S 3 E	2.1	N 16 W	8.4	N 32 W	8.4	S 22 W	4.4	S 49 W	3.4	N 50 W	10.9
2,500	N 38 W	5.6	-----	-----	N 58 W	4.4	N 68 W	6.2	S 40 W	2.5	N 64 W	8.9	S 31 W	1.8	N 18 W	11.7	N 39 W	11.7	S 22 W	3.4	S 54 W	4.4	N 51 W	12.2
3,000	-----	-----	-----	-----	N 8 W	1.4	N 82 W	6.2	N 70 W	7.8	N 74 W	8.2	S 77 W	1.4	N 34 W	5.4	N 41 W	11.2	-----	-----	S 72 W	4.4	N 59 W	11.0
4,000	-----	-----	-----	-----	N 59 W	4.7	-----	-----	N 76 W	8.8	-----	-----	S 53 W	3.8	-----	-----	-----	-----	-----	-----	S 23 W	4.0	-----	-----
5,000	-----	-----	-----	-----	N 34 W	7.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TABLE 4.—Observations by means of kites, captive and limited height sounding balloons during February, 1931

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes, meters m. s. l., reached during month	2,822	2,636	3,193	2,492	2,852
Maximum altitude, meters m. s. l., reached	5,416	4,149	5,197	4,500	5,352
Number of flights made	28	30	26	19	27
Number of days on which flights were made	26	28	25	19	26

In addition to the above, there were approximately 176 scheduled pilot balloon observations made daily at 60 Weather Bureau stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By M. C. BENNETT

GENERAL SUMMARY

February was much warmer than normal in nearly all sections of the country. Along the Atlantic and Gulf coasts temperatures were near the average, but in Florida they were slightly below. In the Ohio Valley the month averaged from 4° to 8° warmer than normal, the central Mississippi Valley from 8° to 11° warmer, and from Iowa and Nebraska northward and northwestward, the plus departures were from 12° to more than 20°.

The precipitation during the month was very unevenly distributed. A large portion of the Southeast received less than half the normal. Light amounts fell also over a belt from the western lake region westward to South Dakota, and in much of the northern Rocky Mountain and the Pacific regions, while the northern portion of the Ohio Valley received from 60 to 75 per cent of normal. Generous amounts were received from southern Missouri, Oklahoma, and the central Rocky Mountain region southward, while the far Southwest received abnormally heavy rains.

TEMPERATURE

The temperature conditions were much like those of January just preceding, but usually February was still warmer than January had been. The first six days of February greatly resembled the last few of January, temperatures being below normal in parts of the Northeast, and about normal in Florida, while some cool weather occurred in the far Northwest; but for most of the country the warmth was noteworthy and very unseasonable, two stations in North Dakota averaging 34° warmer than normal for the week ending February 3.

A cold spell, not severe, appeared about the 8th in the far Northwest, yet was mainly of brief duration, save

that after it had spread southward and eastward the southeastern portion of the country was mainly cooler than normal until about the 20th. Meantime, moderately cool weather had set in over the southern Plateau region. The last week was generally cooler than normal in southern sections from New Mexico to the south Atlantic coast, particularly in Texas; but central and northern sections had mild weather for the season all the second half of February, especially the districts between the Lakes and the northern Rocky Mountains.

While February as a whole was decidedly mild in most States, the temperatures were comparatively steady from day to day, with few new records established. The highest marks were generally noted about the 8th in the lower Mississippi Valley and in central sections east of that river, but on the 23th from Michigan and Ohio eastward; while west of the Mississippi River they occurred mainly during the first five days or about the 19th. The lowest readings occurred usually from the 7th in the Pacific Northwest to the 11th in the Atlantic and Gulf States; but in the middle and southern Rocky Mountain region and to westward at various dates.

Of the 37 States from the Plains eastward only 15 recorded temperatures below zero at any time during February, 1931.

Chart No. 1 shows the distribution of mean temperature with respect to the normal.

Much of the upper Missouri Valley found this the warmest February in the whole period of records, which at a few points exceeded 50 years in length.

For most of the central and north-central portions of the country the 3-month winter period, December, 1930, to February, 1931, averaged warmer than, or about equal to, the warmest other like period of record. At St. Paul, Minn., in a record covering 111 consecutive winters, only that of 1877-78 surpassed the mildness of the winter just ended.