AEROLOGICAL OBSERVATIONS

By W. R. STEVENS

Free-air temperature departures for November were mostly positive except at Ellendale, where subnormal temperatures prevailed at all levels observed.

Relative humidity departures were small but mostly positive; vapor pressures were above normal at all stations except Ellendale.

Resultant wind directions were near normal, but there was a tendency toward greater resultant velocities than usual. The latter averaged twice as great as in the preceding month, yet exceptionally strong winds aloft were but infrequently observed, only one station reporting a velocity as high as 40 meters per second. Below 2,000 meters the winds were largely of southerly component except in the northern Plains States where they were northerly at all altitudes. Above 2,000 meters the winds were mostly W. to WNW. Easterly components prevailed over Jacksonville to 750 meters, New Orleans to 750 meters, San Juan to 2,500 meters, and Key West to 4,000 meters.

The kite flight made at Due West on the 3d is of special interest since it was obtained within a rather well-developed low pressure area, Greenville, S. C., 29.60 inches. The ascent shows a WSW. wind at practically all levels from the surface to 4,553 meters and a shift to W. on the descent. The lapse rate increased from less than adiabatic for moist air to slightly superadiabatic. The temperature record for the ascent shows no inversions while the descent shows three. The origin of these inversions seems to be due to advection of slightly colder air at various levels which leaves an inversion above.

The flight of the 15th at Groesbeck was made during the passage of a cold front. During the ascent the wind was from a southerly direction at nearly all levels. Before the kites were landed the wind at lower levels had shifted to northerly with a sharp decrease in temperature from the surface to 500 meters, and a smaller decrease to 2,000 meters. The latter was due to lifting of the air by the underrunning cold wedge which resulted in adiabatic cooling and saturation. We find the characteristic inversion present above the surface layer of coldair. Light rain began shortly after the arrival of the cold front.

The kite ascent of the 27th at Royal Center was made in a trough which extended from southern Quebec to Oklahoma and was followed by a heavy rain that afternoon and night. The overrunning of a warm southerly wind by a WNW. wind producing an adiabatic to superadiabatic lapse rate for moist air, as shown by this flight, is quite typical of trough conditions in this country. The free-air conditions on this date are shown in the following table:

Time	Altitude	Temperature	$\frac{\Delta T}{100}$	Relative humidity	Wind	
					Direction	Velocity
	Meters	*°C.*		*Per cent*		*m. p. s.*
7:56 a. m.	225	16.0		81	SW	5.8
8:03 a. m.	571	12.9	0.90	89	WSW	18.4
8:28 a. m.	1,723	5.0	0.61	100	W	21.6
8:30 a. m.	1,873	7.6	−1.73	43	W	20.8
8:54 a. m.	2,919	−1.0	0.82	100	WNW	22.2
9:12 a. m.	3,502	−4.4	0.58	99	WNW	22.7

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during November, 1927*

TEMPERATURE (°C.)

Altitude, m. s. l. (meters)	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)		Washington, D. C.* (7 meters)	
	Mean	Departure from 10-year mean	Mean	Departure from 7-year mean	Mean	Departure from 10-year mean	Mean	Departure from 10-year mean	Mean	Departure from 10-year mean	Mean	Departure from 8-year mean
Surface	11.2	+1.5	12.1	+1.2	−4.8	−2.3	18.6	+5.2	6.7	+2.1	12.7	+5.4
250	11.1	+1.5	11.8	+1.1			18.0	+4.8	6.5	+2.1	11.7	+5.2
500	9.9	+1.2	11.3	+1.5	−4.8	−2.3	17.0	+4.4	4.9	+1.9	11.5	+5.1
750	9.6	+1.6	10.7	+1.8	−5.0	−2.6	15.9	+4.0	3.8	+1.7	11.5	+5.5
1,000	9.6	+2.1	9.7	+1.7	−4.7	−2.5	15.0	+3.7	3.3	+1.8	10.8	+5.8
1,250	9.6	+2.6	8.6	+1.3	−4.8	−2.6	13.8	+3.3	2.1	+1.2	9.7	+5.9
1,500	9.3	+2.9	7.3	+0.9	−5.3	−2.9	12.6	+2.9	1.2	+0.9	8.8	+5.5
2,000	7.3	+2.7	4.7	+0.1	−7.6	−3.7	10.4	+2.7	−1.0	+0.5	7.1	+4.4
2,500	4.9	+2.5	2.7	−0.1	−10.1	−4.0	8.0	+2.3	−3.4	0.	4.4	+4.0
3,000	1.9	+1.9	0.7	+0.1	−13.1	−4.4	5.7	+2.4	−5.8	−0.1	1.7	+3.7
3,500	0.3	+2.8	−1.9	+0.2	−15.8	−4.3	3.2	+2.7	−7.4	+0.3	−1.0	+3.6
4,000			−3.7	+1.0	−18.3	−3.9	−1.3	+1.0	−9.3	+1.1	−3.8	+3.8
4,500			−6.1	+2.0	−22.1	−4.7			−12.3	+0.8	−4.8	+3.8
5,000											−8.6	+3.8

RELATIVE HUMIDITY (%)

Altitude, m. s. l. (meters)	Broken Arrow Mean	Departure	Due West Mean	Departure	Ellendale Mean	Departure	Groesbeck Mean	Departure	Royal Center Mean	Departure	Washington Mean	Departure
Surface	72	+5	75	+5	74	−4	77	+3	76	+3	68	−8
250	72	+5	74	+5			78	+6	76	+3	69	−5
500	72	+9	71	+6	73	−4	80	+13	77	+5	67	−2
750	70	+9	70	+7	69	−3	81	+18	78	+8	64	−2
1,000	65	+7	69	+7	63	−4	76	+17	76	+9	64	−2
1,250	61	+7	68	+8	60	−3	72	+16	73	+10	66	−1
1,500	57	+6	66	+9	61	+1	65	+12	69	+10	64	−1
2,000	48	+2	65	+14	67	+10	52	+5	58	+4	56	+1
2,500	40	−2	53	+10	66	+9	44	+3	50	0	54	+3
3,000	42	0	44	+4	67	+10	31	−6	60	+10	46	+1
3,500	43	+3	35	−3	58	0	21	−15	58	+10	42	−1
4,000			1	−30	55	−5	45	+11	49	+4	32	−5
4,500			13	−24	80	+17			49	+4	22	−5
5,000											14	−5

VAPOR PRESSURE (mb.)

Altitude, m. s. l. (meters)	Broken Arrow Mean	Departure	Due West Mean	Departure	Ellendale Mean	Departure	Groesbeck Mean	Departure	Royal Center Mean	Departure	Washington Mean	Departure
Surface	10.39	+2.21	11.00	+1.54	3.22	−0.99	16.85	+4.74	8.32	+1.77	10.41	+2.20
250	10.33	+2.21	10.90	+1.60			16.52	+4.89	8.25	+1.77	10.02	+2.37
500	9.57	+2.20	10.38	+2.02	3.15	−0.98	16.05	+5.48	7.62	+1.80	9.64	+2.41
750	9.24	+2.47	9.82	+2.13	2.89	−0.94	15.06	+5.58	7.22	+1.90	9.12	+2.44
1,000	8.51	+2.30	9.06	+1.97	2.65	−0.90	13.40	+4.84	6.92	+2.11	8.69	+2.53
1,250	7.94	+2.29	8.08	+1.75	2.51	−0.80	11.63	+4.06	6.17	+1.90	8.38	+2.62
1,500	6.89	+1.86	7.08	+1.51	2.42	−0.67	9.74	+3.10	5.42	+1.63	7.79	+2.43
2,000	4.59	+0.69	5.44	+1.26	2.26	−0.37	6.55	+1.64	3.78	+0.79	6.02	+1.86
2,500	2.99	−0.02	3.35	+0.42	1.86	−0.37	4.55	+0.74	2.83	+0.48	4.71	+1.55
3,000	2.46	+0.01	1.95	−0.23	1.49	−0.34	2.61	−0.13	2.79	+0.72	3.39	+1.27
3,500	1.90	+0.05	0.82	−0.83	0.90	−0.59	0.91	−1.15	2.20	+0.53	2.32	+1.03
4,000					0.74	−0.49	1.02	−0.46	1.63	+0.50	1.38	+0.87
4,500					0.81	−0.26			1.33	+0.51	0.74	
5,000											0.16	

*Naval Air Station, Washington, D. C.

TABLE 2.—*Free-air resultant winds (m. p. s.) during November, 1927*

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)			
	Mean		10-year mean		Mean		7-year mean		Mean		10-year mean	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface	S. 33° W.	1.5	S. 42° W.	1.5	S. 53° W.	0.5	W.	0.6	N. 40° W.	3.5	N. 50° W.	2.5
250	S. 33° W.	1.5	S. 41° W.	1.6	S. 42° W.	0.6	W.	0.6				
500	S. 29° W.	2.2	S. 39° W.	2.3	S. 73° W.	2.7	S. 82° W.	1.5	N. 46° W.	3.9	N. 58° W.	2.6
750	S. 36° W.	3.5	S. 42° W.	3.3	S. 77° W.	3.9	S. 88° W.	2.3	N. 40° W.	5.4	N. 59° W.	4.1
1,000	S. 42° W.	4.7	S. 53° W.	4.0	S. 80° W.	4.6	S. 84° W.	3.1	N. 48° W.	6.2	N. 61° W.	5.0
1,250	S. 54° W.	6.3	S. 62° W.	5.0	S. 79° W.	6.5	S. 89° W.	4.5	N. 56° W.	6.6	N. 64° W.	5.9
1,500	S. 66° W.	8.4	S. 72° W.	5.8	S. 85° W.	7.0	S. 88° W.	5.7	N. 60° W.	7.4	N. 62° W.	7.0
2,000	S. 75° W.	10.0	S. 79° W.	7.1	N. 88° W.	7.9	S. 86° W.	7.5	N. 63° W.	11.0	N. 64° W.	8.9
2,500	S. 77° W.	10.4	S. 84° W.	7.9	S. 83° W.	8.9	S. 86° W.	9.1	N. 62° W.	14.5	N. 64° W.	11.1
3,000	S. 89° W.	10.4	S. 87° W.	8.9	S. 46° W.	9.1	S. 78° W.	10.0	N. 66° W.	18.0	N. 67° W.	13.2
3,500	S. 85° W.	12.3	S. 86° W.	9.6	S. 50° W.	13.7	S. 79° W.	11.8	N. 74° W.	18.2	N. 67° W.	14.2
4,000	S. 84° W.	14.1	S. 84° W.	10.9	S. 69° W.	17.0	S. 81° W.	14.0	W.	21.0	N. 68° W.	13.8
4,500					S. 68° W.	21.0	S. 81° W.	15.1	W.	28.0	N. 64° W.	16.1
5,000												

Altitude m. s. l. (meters)	Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)				Washington, D. C. (34 meters)			
	Mean		10-year mean		Mean		10-year mean		Mean		7-year mean	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface	S. 9° W.	3.1	S.	0.3	S. 48° W.	3.6	S. 46° W.	2.4	N. 87° W.	0.7	N. 55° W.	1.4
250	S. 7° W.	4.9	S. 24° W.	1.0	S. 46° W.	3.9	S. 50° W.	3.0	S. 72° W.	3.7	N. 68° W.	3.6
500	S. 10° W.	7.7	S. 5° W.	2.2	S. 52° W.	7.0	S. 55° W.	5.4	S. 74° W.	5.1	N. 67° W.	5.3
750	S. 15° W.	9.3	S. 21° W.	3.0	S. 58° W.	9.9	S. 60° W.	7.0	N. 84° W.	7.1	N. 65° W.	6.6
1,000	S. 23° W.	9.9	S. 37° W.	3.6	S. 64° W.	10.8	S. 69° W.	7.6	N. 83° W.	8.3	N. 65° W.	7.1
1,250	S. 32° W.	9.8	S. 51° W.	4.1	S. 68° W.	11.5	S. 72° W.	7.9				
1,500	S. 34° W.	9.3	S. 61° W.	4.6	S. 74° W.	11.6	S. 77° W.	9.0	N. 67° W.	10.1	N. 63° W.	7.8
2,000	S. 45° W.	7.8	S. 75° W.	5.6	S. 88° W.	12.1	S. 84° W.	10.2	N. 79° W.	10.3	N. 71° W.	10.0
2,500	S. 53° W.	6.9	S. 80° W.	7.0	S. 82° W.	15.1	S. 86° W.	12.0	N. 88° W.	9.9	N. 86° W.	11.0
3,000	S. 63° W.	9.2	S. 83° W.	8.9	N. 81° W.	15.0	N. 86° W.	13.3	N. 87° W.	12.2	N. 80° W.	13.5
3,500	S. 71° W.	14.1	S. 75° W.	10.8	N. 86° W.	14.4	N. 85° W.	13.4	N. 84° W.	13.1	N. 81° W.	13.8
4,000	S. 70° W.	15.0	S. 72° W.	9.1	S. 88° W.	15.8	N. 88° W.	13.5	N. 80° W.	14.6	N. 75° W.	14.8
4,500	W.	19.0	S. 70° W.	11.0	N. 85° W.	17.3	S. 88° W.	13.9	N. 85° W.	14.9	N. 76° W.	15.5
5,000									N. 78° W.	14.7	N. 72° W.	16.4