

AEROLOGICAL OBSERVATIONS

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During July the Weather Bureau began daily airplane observation flights at Chicago, Cleveland, and Dallas and continued kite observations at Due West and Ellendale. The mean monthly free-air temperatures and relative humidities for these stations and those of the Navy are shown in Table 1. A comparison of these data with the normals based on nearby kite stations shows that the free-air temperatures were mostly above normal at all stations. Relative humidities were close to normal at all stations and vapor pressures were in general agreement with temperatures, i. e., above normal.

The resultant winds for the month were variable and light at the ground level. (Table 2.) At the 1,000-meter level the highest resultant velocities were found over the southern Plains States where they reached 8 meters per second with a strong southerly component. An easterly component persisted to 5,000 meters over Brownsville, Dallas, Key West, and Phoenix.

The superiority of airplanes over kites with respect to heights reached and regularity of flights is well brought out in Table 3 which shows the average and maximum heights reached and number of flights made.

TABLE 1.—Mean free-air temperatures and humidities obtained by airplanes (or kites) during July, 1931

Altitude (meters) m. s. l.	TEMPERATURE (°C)									
	Chicago, Ill. ¹ (190 meters)	Cleveland, Ohio ¹ (245 meters)	Dallas, Tex. ¹ (149 meters)	Due West, S. C. ² (217 meters)	Ellendale, N. Dak. ² (444 meters)	Hampton Roads, Va. ³ (3 meters)	Pensacola, Fla. ³ (2 meters)	San Diego, Calif. ³ (9 meters)	Washington, D. C. ³ (2 meters)	
Surface.....	20.0	19.3	24.8	27.2	21.4	26.9	26.3	24.0	25.0	
500.....	21.8	20.7	25.9	24.5	20.6	24.2	24.6	19.9	24.5	
1,000.....	21.4	20.8	24.7	22.1	19.2	21.8	22.0	23.0	22.8	
1,500.....	18.3	18.1	22.1	18.9	17.0					
2,000.....	15.1	15.1	19.2	15.5	14.3	15.3	16.0		16.7	
2,500.....	11.9	12.3	16.0	11.9	11.3					
3,000.....	8.8	9.8	12.8	8.8	8.7	10.1	9.7	13.0	10.6	
4,000.....	2.6	4.4	5.9	2.8	2.3		3.2		4.8	
5,000.....	-3.8	-1.1	0.3		5.5		-1.4		-1.4	
6,000.....		-6.6								

Altitude (meters) m. s. l.	RELATIVE HUMIDITY (%)									
	Chicago, Ill. ¹ (190 meters)	Cleveland, Ohio ¹ (245 meters)	Dallas, Tex. ¹ (149 meters)	Due West, S. C. ² (217 meters)	Ellendale, N. Dak. ² (444 meters)	Hampton Roads, Va. ³ (3 meters)	Pensacola, Fla. ³ (2 meters)	San Diego, Calif. ³ (9 meters)	Washington, D. C. ³ (2 meters)	
Surface.....	82	85	76	75	62	77	89	70	75	
500.....	64	73	70	75	62	71	83	62	66	
1,000.....	56	60	65	71	59	65	74	55	59	
1,500.....	60	63	65	71	57					
2,000.....	59	66	62	70	54	63	67	43	65	
2,500.....	53	62	58	70	53					
3,000.....	51	55	56	70	49	49	65	50	58	
4,000.....	44	46	58	50	49		54		54	
5,000.....	36	46	53		63		49		40	
6,000.....		45								

¹ Airplanes (Weather Bureau). ² Kites. ³ Airplanes (Navy).

TABLE 2.—Free-air resultant winds (meters per second) based on pilot-balloon observations made near 7 a. m. (E. S. T.) during July, 1931

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,528 meters)	Brownsville, Tex. (12 meters)	Burlington, Vt. (132 meters)	Cheyenne, Wyo. (1,873 meters)	Chicago, Ill. (198 meters)	Cleveland, Ohio (245 meters)	Dallas, Tex. (154 meters)	Due West, S. C. (217 meters)	Ellendale, N. Dak. (444 meters)	Havre, Mont. (762 meters)	Jacksonville, Fla. (14 meters)	Key West, Fla. (11 meters)
	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction
Surface.....	N 68 E 0.6	S 45 E 0.8	.....	N 68 W 2.4	N 76 W 0.3	S 17 W 1.7	S 5 E 1.0	S 45 E 0.2	N 47 W 0.7	S 88 W 0.6	S 73 W 0.7	S 65 E 2.3
500.....	.....	S 22 E 7.3	.....	.....	S 74 W 3.6	S 78 W 3.4	S 32 W 7.6	N 82 W 2.1	N 81 W 0.7	.....	S 74 W 4.9	S 61 E 5.3
1,000.....	.....	S 23 E 7.3	.....	.....	S 78 W 4.4	S 71 W 5.3	S 32 W 7.0	N 82 W 3.1	S 39 W 3.3	.....	S 71 W 4.1	S 57 E 6.0
1,500.....	.....	S 40 E 5.5	.....	.....	N 86 W 5.4	S 68 W 6.3	S 32 W 5.0	N 87 W 3.0	S 65 W 1.9	.....	S 76 W 2.8	S 60 E 5.6
2,000.....	S 18 E 2.7	S 40 E 5.5	.....	N 78 W 3.9	N 84 W 5.8	S 78 W 7.1	S 12 W 3.3	S 80 W 2.8	N 87 W 5.4	.....	S 80 W 1.9	S 65 E 4.7
2,500.....	S 11 W 2.6	S 49 E 5.4	.....	.....	N 84 W 3.4	N 82 W 7.0	S 9 E 2.0	S 77 W 2.6	N 78 W 7.5	.....	S 87 W 1.3	S 68 E 4.7
3,000.....	S 57 W 1.4	S 57 E 4.4	.....	N 84 W 3.5	N 71 W 5.9	S 80 W 6.4	S 46 E 1.2	N 89 W 3.0	N 77 W 9.5	.....	S 84 W 1.8	S 72 E 3.9
4,000.....	N 9 W 2.0	S 84 E 2.7	.....	N 76 W 4.0	S 56 W 6.9	S 83 W 6.7	S 83 E 1.6	S 83 W 2.8	N 74 W 9.6	.....	S 52 W 2.1	S 48 E 1.8
5,000.....	N 36 E 4.0	N 89 E 1.1	.....	N 61 W 7.7	.....	N 58 W 7.8	N 62 E 1.0	S 85 W 3.1	N 68 W 12.2	.....	S 85 W 16.1	N 45 E 2.8

Altitude (meters) m. s. l.	Los Angeles, Calif. (127 meters)	Medford, Oreg. (410 meters)	Memphis, Tenn. (145 meters)	New Orleans, La. (25 meters)	Oakland, Calif. (8 meters)	Oklahoma City, Okla. (392 meters)	Omaha, Nebr. (299 meters)	Phoenix, Ariz. (356 meters)	Salt Lake City, Utah (1,294 meters)	Sault Ste. Marie, Mich. (198 meters)	Seattle, Wash. (14 meters)	Washington, D. C. (10 meters)
	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction	Direction
Surface.....	N 31 E 0.3	S 48 W 0.4	S 12 E 0.8	S 73 W 0.2	N 37 W 1.1	S 5 E 1.7	S 34 E 1.2	S 76 E 1.0	S 22 E 3.6	S 55 E 0.4	S 63 E 0.6	N 57 W 0.4
500.....	S 85 E 1.6	W 0.9	S 28 W 3.3	S 42 W 3.1	N 84 W 2.7	S 11 W 4.5	S 8 W 4.1	S 74 E 1.0	S 77 W 2.5	S 55 E 0.5	N 20 E 0.6	N 66 W 5.0
1,000.....	N 12 E 2.7	W 1.2	S 46 W 2.6	S 27 W 3.1	N 65 W 3.7	S 39 W 7.8	S 44 W 6.7	S 83 E 0.2	.....	N 86 W 6.1	N 15 E 0.6	N 48 W 6.1
1,500.....	N 22 W 0.0	E 0.8	S 55 W 2.0	S 1 W 2.9	S 86 W 2.3	S 49 W 8.4	S 60 W 5.6	N 73 W 0.8	S 25 E 3.3	N 83 W 6.7	N 3 W 1.8	N 57 W 5.9
2,000.....	N 55 W 1.4	S 82 E 1.3	S 33 W 2.0	S 12 E 2.1	S 46 W 2.3	S 54 W 3.6	S 83 W 4.5	N 18 W 1.5	S 13 E 2.3	N 78 W 7.5	N 35 W 1.0	N 61 W 5.5
2,500.....	S 51 E 0.9	S 34 W 3.5	S 24 E 3.1	S 6 W 1.9	S 30 W 2.2	S 52 W 2.5	N 87 W 4.2	N 15 W 1.6	S 49 W 9.3	N 77 W 9.0	N 63 W 2.0	N 70 W 7.0
3,000.....	S 71 E 2.1	S 34 W 5.5	S 24 W 3.5	S 9 E 2.0	S 16 W 2.1	S 76 W 1.1	N 85 W 2.6	N 14 E 1.4	S 81 W 2.1	N 73 W 9.7	N 69 W 3.3	N 76 W 7.0
4,000.....	.....	S 55 W 7.4	.....	S 7 W 0.6	.....	S 32 W 1.6	S 62 W 2.6	N 57 E 3.3	N 84 W 5.7	N 58 W 11.9	.....	N 72 W 7.9
5,000.....	.....	.....	.....	E 1.1	.....	N 12 W 0.9	.....	N 34 W 4.5	N 71 E 7.1	N 86 W 8.0	.....	.....

TABLE 3.—Observations by means of airplanes, kites, captive and limited height sounding balloons during July, 1931

	Dallas, Tex. ¹	Due West, S. C.	Ellendale, N. Dak.	Chicago, Ill. ¹	Cleveland, Ohio ¹
Mean altitudes (meters), m. s. l., reached during month.....	5,460	3,186	3,561	4,017	5,841
Maximum altitude (meters), m. s. l., reached.....	5,977	4,794	5,626	5,539	6,355
Number of flights made.....	31	26	31	31	31
Number of days on which flights were made.....	31	26	29	31	31

¹ Airplanes.

² Limited-height sounding balloon observation.