POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group number	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day	Observatory
1937	h. m.		°	°	°				
July 23	11 12	5477	−64.0	359.3	+30.0		1309		U. S. Naval.
		5474	−19.0	44.3	−21.0	36			
		5476	−5.0	58.3	+10.5		97		
		5472	+1.0	64.3	−14.0		582		
		5471	+8.5	71.8	+7.5	24			
		5469	+39.0	102.3	−21.0	97			
		5467	+48.0	111.3	+14.0	36			
		5465	+59.0	122.3	−15.0		36		
		5463	+69.0	132.3	+13.0		533	2,750	
July 24	11 11	5477	−51.0	359.1	+30.5		1503		
		5476	+9.0	59.1	+10.0		121		Do.
		5472	+13.0	63.1	−14.5		485		
		5471	+21.0	71.1	+7.5	12			
		5469	+51.0	101.1	−21.0	97			
		5463	+85.0	135.1	+12.0		533	2,751	
July 25	13 32	5477	−37.5	358.1	+30.5		2182		Do.
		5479	−17.5	18.1	+15.5		24		
		5478	+21.0	56.6	−19.0	16			
		5476	+24.0	59.6	+9.5		242		
		5472	+28.0	63.6	−15.0		485		
		5469	+65.0	100.6	−21.0	97		3,046	
July 26	12 20	5481	−82.0	300.9	+29.5	242			Do.
		5477	−25.0	357.9	+31.0		2763		
		5479	−4.0	18.9	+15.0		48		
		5478	+35.0	57.9	−18.5	6			
		5476	+38.5	61.4	+9.5		194		
		5472	+41.0	63.9	−14.0		679		
		5469	+79.0	101.9	−21.0	97		4,029	
July 27	11 13	5483	−79.0	291.4	−12.0		291		Do.
		5481	−70.0	300.4	+29.0	194			
		5477	−13.0	357.4	+31.0		2763		
		5479	+9.0	19.4	+15.0		36		
		5476	+51.0	61.4	+9.0		242		
		5472	+55.0	65.4	−15.0		679	4,205	
July 28	11 7	5484	−68.0	289.2	+7.0	24			Do.
		5483	−65.0	292.2	−12.0		388		
		5481	−59.0	298.2	+29.0	194			
		5485	−54.0	303.2	−22.0		24		
		5477	−1.0	356.2	+33.0		2521		
		5479	+22.5	19.7	+15.0		36		
		5476	+65.0	62.2	+10.0		194		
		5472	+68.0	65.2	−15.0		533	3,914	
July 29	11 26	5486	−70.0	273.8	−17.0		145		Do.
		5484	−53.0	290.8	+7.0	6			
		5483	−52.0	291.8	−11.0		533		
		5481	−46.0	297.8	+29.0	242			
		5485	−39.0	304.8	−21.0		97		
		5477	+3.0	346.8	+34.0		1406		
		5477	+19.5	3.3	+29.0		1115		
		5479	+40.0	23.8	+14.0	12			
		5476	+74.0	57.8	+9.0	194			
		5472	+79.0	62.8	−15.0		485	4,235	
July 30	11 6	5489	−80.0	250.8	+24.0		970		Do.
		5487	−56.0	274.8	+15.0	16			
		5486	−55.5	275.3	−15.5		73		

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group number	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day	Observatory
1937	h. m.		°	°	°				
July 30	11 6	5484	−39.5	291.3	+8.5	24			
		5483	−38.0	292.8	−11.0		388		
		5481	−34.0	296.8	+30.0	194			
		5485	−28.0	302.8	−21.0		73		
		5477	+16.0	346.8	+33.5		1406		
		5477	+34.0	4.8	+29.5		1067		
		5479	+54.0	241.8	+14.0	16		4,227	
July 31	13 6	5489	−66.0	250.5	+23.0		1454		U. S. Naval.
		5488	−64.0	252.5	+30.0	194			
		5487	−42.0	274.5	+15.0		73		
		5486	−41.0	275.5	−14.0		85		
		5484	−25.0	291.5	+8.0	48			
		5483	−22.0	294.5	−11.0		388		
		5481	−20.0	296.5	+30.0	194			
		5485	−11.0	305.5	−21.0		73		
		5477	+29.5	346.0	+34.0		1309		
		5477	+48.0	4.5	+29.5		970	4,788	

Mean daily area for 31 days, 3,256.

PROVISIONAL SUNSPOT RELATIVE NUMBERS, JULY 1937

[Dependent along on observations at Zurich and its station at Arosa]

[Furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

July 1937	Relative numbers	July 1937	Relative numbers	July 1937	Relative numbers
1	*a* 69	11	*Wac* 202	21	150
2	*Ec* 91	12	*ad* 223	22	*d* 145
3	74	13	*a* 188	23	*a* 139
4	*Mcd* 65	14	*aad* 215	24	126
5	91	15	*a* 204	25	124
6	*Ecd* 108	16		26	*d* 115
7	*a* 143	17	*d* 152	27	*d* 143
8	*Wcd* 185	18	*b* 167	28	*b* 124
9	*bd* 181	19	*a* 155	29	*Ebc* 128
10	192	20	*Ec* 149	30	*d* 139
				31	131

Mean, 30 days=143.9.

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity; *E*: on the eastern part of the sun's disk, *W*: on the western part, *M*: in the central circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, *In Charge*]

By LOYD A. STEVENS

Mean free-air data, based on airplane weather observations made during the month of July 1937, are given in tables 1 to 3.

The mean free-air temperatures were generally below normal at all levels over the region east of the Rocky Mountains and near normal or slightly above elsewhere. The greatest negative departures occurred over Wright Field in the lower levels (−3.9° C. at 2 kilometers) and over Norfolk in the higher levels (−3.7° C. at 5 kilometers). The greatest positive departure (+2.0° C.) occurred over Spokane at 1 kilometer. The highest temperatures occurred over Oklahoma City at 0.5 and 1 kilometer, and over El Paso from 1.5 to 5 kilometers. At 5 kilometers, however, the temperature over El Paso was only 0.1° C. higher than over San Diego. There was, therefore, a gradual shifting of the statistical center of highest temperatures, toward the west, with altitude. There were two statistical centers of low temperatures located over Seattle and Sault Ste. Marie, respectively; the former having the lower temperatures at all levels except at 5 kilometers where they were equal in value. In general the mean free-air temperatures for July were higher at all levels than in June by 3° to 6° C. over the northern part of the country and by 1° C. over the extreme southern part. The greatest increase occurred at Oakland at 1 kilometer where the temperature for July (24.7° C.) was 8.2° C. higher than that for June (16.5° C.). At Kelly Field, however, the temperatures for July were slightly lower than for June at all levels above 1 kilometer. The same was true at Barksdale Field above 2 kilometers.

The mean free-air relative humidities at all levels were, in general, above normal over the northern part of the country east of the Rocky Mountains and below normal over the western Rocky Mountains and Pacific coast regions and in portions of the southeastern part of the country. The greatest negative departures (−10 percent) occurred over El Paso from 1.5 to 2.5 kilometers and the greatest positive departure (+12 percent) occurred over Norfolk at 3 kilometers.

The mean free-air barometric pressures and equivalent potential temperatures for the month are shown in table 3. In general there was an increase in the average pressure

of July over June at all stations and levels except over Kelly Field and Pensacola at 5 kilometers, where there was a decrease. The greatest increase occurred over the northern and western portions of the country, being greatest over Salt Lake City at 5 kilometers, where it amounted to 7 mb. Due to the greater increase in pressure over the northern part of the country, there was a resultant decrease in the south to north pressure gradient across the country in July as compared with June. The mean isobaric charts, as drawn from the values in table 3, were characterized by a statistical center of high pressure over Kelly Field at all levels and by relatively low pressure over the northern border with the low centers at Sault Ste. Marie and Seattle in the higher levels.

Free-air resultant winds, based on pilot balloon observations made near 5 a. m. (75th meridian time), are shown in table 4. For the most part, the resultant wind directions were remarkably close to the normal at nearly all stations and at all levels. The most outstanding exceptions occurred at Sault Ste. Marie at 0.5 kilometer where the direction for the current month was 187° (S.) and the normal 277° (W.). At Pensacola, also, the current resultant directions varied from the normal in a clockwise direction by amounts of 35° to 94° between 2 and 3 kilometers. At 4 kilometers the current resultant at Pensacola was 272° (W.) 2.0 m. p. s. while the normal is 44° (NE.) 0.7 m. p. s. At Oklahoma City the current resultant directions varied in a clockwise direction by amounts of 50° and 87°, respectively, at 2.5 and 3 kilometers and at 4 kilometers the current resultant was 349° (N.) 3.9 m. p. s. and the normal 103° (ESE) 0.7 m. p. s. Resultant velocities were, in general, below normal at all levels over the northeast and southwest portions of the country and above normal elsewhere. The greatest negative departure from the normal (−5.3 m. p. s.) occurred at Detroit at 5 kilometers and the greatest positive departure (+4.1 m. p. s.) occurred at Nashville at 3 kilometers.

Table 5 shows the maximum free-air wind velocities and their directions for various sections of the United States during July, as determined by pilot balloon observations. The extreme maximum for the month was 42.0 m. p. s. from the WSW. at 15,400 meters above sea level over Portland, Oreg.

The mean monthly equivalent potential temperatures and specific humidities are shown in tables 2 and 3, respectively. There was an increase in the mean equivalent potential temperature of July over June at nearly all stations and levels. The maximum increase (+17° A.) occurred at Salt Lake City at 1.5 kilometers. At Pensacola, however there was a decrease of 1° A. at 1.5, 2, and 2.5 kilometers, respectively, and of 2° A. at 3 kilometers. In general, there was an increase in the average specific humidities of July over June at most stations and levels, the maximum (+3.2 grams) occurring at Salt Lake City at 2 kilometers. At some stations and at certain levels, however, there were small decreases of 0.1 to 0.7 grams in the averages for July as compared with those for June. The decrease was most consistent at Pensacola where it occurred at all levels from 1.5 to 4 kilometers. The locations of the statistical centers of high and low specific humidities and equivalent potential temperatures agreed closely with those of high and low pressure except that the lowest mean specific humidities occurred at Oakland between 1 and 4 kilometers with no corresponding low pressure center over that region.

The outstanding features of the weather for the month included the unusual strength and the frequent far westward movement of the Atlantic HIGH and the frequent outbreaks of N_{PP} and P_P air from the Pacific HIGH. These latter air masses usually entered the country over the States of Washington and Oregon and caused unusually heavy rains over most of the Rocky Mountain regions where they were met by warm moist T_A and T_M air circulating around the western edge of the Atlantic HIGH. The latter air mass frequently dominated the entire southern portion of the country east of the Rocky Mountains, which probably accounted for the fact that the precipitation over this area was, in general, only 25 to 50 percent of normal. Relatively few well-defined LOWS developed within or entered the country during the month.

TABLE 1.—*Mean free-air temperatures (t), °C obtained by airplanes during July 1937. (Dep. represents departure from "normal" temperature.)*

Station	Number of obs.	Altitude (meters) m. s. l. Surface t	Surface Dep.	500 t	500 Dep.	1,000 t	1,000 Dep.	1,500 t	1,500 Dep.	2,000 t	2,000 Dep.	2,500 t	2,500 Dep.	3,000 t	3,000 Dep.	4,000 t	4,000 Dep.	5,000 t	5,000 Dep.
Barksdale Field [1] (Shreveport), La. (52 m)	31	24.0	−0.2	24.1	−0.9	22.2	−0.4	19.2	−0.3	15.9	−0.7	12.7	−0.9	9.7	−0.9	4.1	−0.6		
Billings, Mont.[2] (1,089 m)	31	19.6	0.0					21.9	0.0	19.6	−0.2	16.1	−0.3	12.4	−0.5	4.7	−0.5	−2.8	−0.2
Boston, Mass.[1] (5 m)	31	18.9		20.2		18.0		15.3		12.3		9.8		7.5		2.1		−4.2	
Cheyenne, Wyo.[2] (1,873 m)	23	14.8	−0.8							16.2	−1.5	17.7	−1.1	14.8	−0.6	7.4	+0.2	−0.6	+0.7
Chicago, Ill. [2] (187 m)	22	19.3		21.3		18.6		15.1		11.7		8.7		6.3		1.0		−4.9	
Coco Solo, Canal Zone [3] (15 m)	25	25.6		23.8		21.1		18.4		15.9		13.5		10.7		4.5		−1.5	
El Paso, Tex.[2] (1,194 m)	31	23.9	−0.2					26.0	+1.1	23.0	+1.0	19.4	+1.0	15.6	+1.0	7.5	+0.9	0.0	+0.8
Fargo, N. Dak.[2] (274 m)	31	17.5	−0.9	20.6	−1.0	20.2	−1.2	17.3	−1.6	14.3	−1.8	11.5	−1.5	8.9	−0.9	3.0	0.0	−3.3	+0.6
Kelly Field (San Antonio), Tex.[1] (206 m)	30	24.3	+0.6	23.7	−0.1	22.3	+0.1	19.7	−0.1	16.3	−0.5	13.4	−0.4	10.4	−0.5	4.4	−0.3	−1.9	−0.2
Lakehurst, N. J.[2] (39 m)	28	19.1	−0.7	20.7	−0.2	18.1	−0.4	14.7	−0.9	12.0	−0.9	9.2	−1.0	6.4	−1.3	1.1	−1.3	−5.4	−2.5
Maxwell Field (Montgomery), Ala.[1] (52 m)	31	23.4	−0.7	24.5	−0.2	21.8	−0.4	18.4	−0.5	15.0	−0.8	12.1	−0.8	9.1	−0.9	3.4	−0.5	−1.9	0.0
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	25	19.5	−0.1	21.0	+0.1	18.9	−0.1	16.2	0.0	13.1	0.0	10.9	+0.2	8.3	+0.2	3.1	+0.6		
Nashville, Tenn.[2] (180 m)	30	20.9	−1.2	23.0	0.0	20.2	−0.8	16.3	−1.5	13.3	−1.7	10.6	−1.5	7.8	−1.2	1.9	−1.1	−3.4	−0.4
Norfolk, Va.[2] (10 m)	26	23.5	−1.2	22.8	−1.2	19.7	−2.0	16.4	−2.3	13.0	−2.6	10.0	−2.8	6.9	−3.1	1.0	−2.9	−4.3	−3.7
Oakland, Calif.[2] (2 m)	31	14.6		18.0		24.7		23.0		20.0		16.6		13.0		5.7		−1.7	
Oklahoma City, Okla.[2] (391 m)	31	24.1	−0.1	25.4	−0.3	25.3	−0.4	22.4	−0.2	19.3	+0.2	15.7	+0.1	11.7	−0.2	4.2	−0.6	−2.9	−1.3
Omaha, Nebr.[2] (300 m)	11	21.4		23.5		23.6		20.7		17.0		13.4		10.4		4.1		−2.1	
Pearl Harbor, T. H.[2] (6 m)	30	23.5	−0.1	21.2	−0.2	17.9	0.0	15.2	+0.2	12.9	+0.1	10.8	−0.2	8.6	−0.2	5.1	+0.9	−0.5	+0.6
Pensacola, Fla.[2] (13 m)	27	23.3	−2.2	23.9	−0.1	20.9	−0.6	17.7	−0.6	14.8	−0.5	11.9	−0.5	8.9	−0.5	3.5	+0.1	−1.8	+0.4
St. Thomas, Virgin Islands [3] (8 m)	31	28.8		24.5		20.7		18.1		16.0		14.0		10.9		4.2		−1.5	
Salt Lake City, Utah [2] (1,288 m)	27	19.7						22.9		21.3		18.0		14.2		6.4		−0.9	
San Diego, Calif.[2] (10 m)	31	19.4	−1.2	17.3	−1.1	21.8	−0.5	22.8	+0.5	20.6	−0.4	17.5	0.0	13.8	+0.1	6.7	0.0	−0.1	+0.3
Sault Ste. Marie, Mich.[2] (221 m)	31	14.6		17.5		16.3		13.6		11.0		8.5		5.8		0.1		−6.3	
Scott Field (Belleville), Ill.[1] (135 m)	30	20.1	−1.7	23.4	−2.1	20.8	−2.9	17.6	−3.0	14.1	−3.1	11.3	−2.7	9.1	−1.7	3.2	−0.8	−3.3	−0.9
Seattle, Wash.[2] (10 m)	27	13.2		13.3		12.6		11.1		9.4		7.4		5.2		0.2		−6.3	
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	10	17.1		20.2		17.8		14.6		11.1		8.5		5.9		0.7		−5.4	
Spokane, Wash.[2] (596 m)	31	16.7	+1.1			22.4	+2.0	20.5	+1.6	16.9	+1.5	13.0	+1.4	9.6	+1.4	2.9	+1.5	−4.5	+1.2
Washington, D. C.[2] (13 m)	27	21.8	−1.7	21.9	−0.8	19.2	−1.5	16.0	−2.0	12.9	−2.2	9.7	−2.4	6.6	−2.7	1.2	−2.7	−4.0	−2.4
Wright Field (Dayton), Ohio [1] (244 m)	28	17.9	−2.1	21.3	−1.1	18.3	−3.2	14.6	−3.7	11.2	−3.9	8.7	−3.5	6.2	−3.1	0.5	−2.8	−5.4	−2.8

[1] Army. [2] Weather Bureau. [3] Navy.

Observations taken about 4 a. m. 75th Meridian time, except by Navy stations along the Pacific coast and Hawaii, where they are taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Barksdale, 93 (3); Billings, 124 (4); Cheyenne, 115 (4); El Paso, 92 (3); Fargo, 124 (4); Kelly Field, 120 (4); Lakehurst, 85 (3); Maxwell Field, 116 (4); Mitchel Field, 83 (3); Nashville, 122 (4); Norfolk, 185 (8); Oklahoma City, 123 (4); Pearl Harbor, 122 (4); Pensacola, 237 (10); San Diego, 227 (9); Scott Field, 119 (4); Spokane, 123 (4); Washington, 231 (10); Wright Field, 120 (4).

TABLE 2.—*Mean free-air relative humidities (R. H.), in percent, and specific humidities (q), in grams/kilogram, obtained by airplanes during July 1937. (Dep. represents departure from "normal" relative humidity)*

Stations	Number of observations	Altitude (meters) m. s. l.																										
		Surface			500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.	
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.
Barksdale Field, La	31	10.0	86	−1	13.6	69	+1	11.3	61	−4	10.3	63	−2	9.0	64	+1	7.8	65	+5	6.4	61	+3	4.6	58	+1	----	----	----
Billings, Mont	31	9.0	56	+3	----	----	----	----	----	----	8.7	45	+3	7.8	44	+3	7.3	48	+4	6.8	54	+8	5.1	61	+11	3.4	60	+5
Boston, Mass	31	11.5	84	----	10.2	66	----	8.9	62	----	8.1	63	----	7.2	64	----	6.2	62	----	5.2	57	----	3.4	48	----	2.5	49	----
Cheyenne, Wyo	23	9.3	71	+8	----	----	----	----	----	----	----	----	----	8.9	62	+6	7.3	43	0	6.5	44	+1	5.1	51	+3	4.1	61	+4
Chicago, Ill	22	11.4	81	----	10.8	65	----	9.4	63	----	8.4	67	----	7.6	71	----	6.2	68	----	5.1	61	----	3.8	58	----	2.6	51	----
Coco Solo, Canal Zone	25	19.6	95	----	17.2	88	----	14.9	85	----	13.2	84	----	11.4	80	----	9.3	72	----	7.2	64	----	5.5	67	----	4.0	64	----
El Paso, Tex	31	9.5	45	−3	----	----	----	----	----	----	8.9	36	−10	8.1	37	−10	7.3	39	−10	6.5	42	−9	5.7	55	−8	4.3	62	−4
Fargo, N. Dak	31	10.5	82	+4	10.2	64	+2	8.8	54	+2	8.3	57	+7	7.3	57	+10	6.2	55	+9	5.2	52	+6	3.6	48	+2	2.4	44	−2
Kelly Field, Tex	30	16.0	83	−7	15.5	81	−4	12.1	65	−6	10.4	62	−4	9.0	63	0	7.2	57	−1	6.0	55	+1	4.2	51	+1	3.0	50	0
Lakehurst, N. J	28	12.6	92	+2	10.4	65	−2	9.1	63	−1	8.4	68	0	6.8	62	−3	5.7	59	−2	4.9	57	+1	3.4	51	−1	3.0	63	+13
Maxwell Field, Ala	31	15.5	86	−2	12.6	64	−7	11.6	64	−5	10.5	67	−5	9.0	67	−2	7.2	61	−2	6.0	59	−3	4.3	56	−4	2.9	48	−6
Mitchel Field, N. Y	25	12.6	90	−1	12.4	76	0	11.1	73	+2	9.8	73	+1	8.9	76	+2	7.5	69	0	6.4	67	+2	4.3	57	−1	----	----	----
Nashville, Tenn	30	13.2	84	−4	12.7	69	−1	11.7	71	+2	10.0	74	+4	8.0	68	+3	6.0	57	−1	5.0	55	−2	3.4	48	−3	2.1	38	−8
Norfolk, Va	26	15.0	84	+4	12.5	70	0	10.8	68	+3	9.6	70	+6	8.4	72	+9	7.1	70	+10	6.0	69	+12	4.1	63	+8	2.1	42	−3
Oakland, Calif	31	8.9	87	----	9.3	69	----	6.7	31	----	5.1	25	----	4.1	22	----	3.5	22	----	3.0	23	----	2.2	25	----	1.8	29	----
Oklahoma City, Okla	31	14.0	72	+1	14.7	69	+3	12.8	57	+2	11.6	58	+4	10.0	57	+3	8.5	58	+4	7.7	63	+6	5.5	68	+10	3.4	61	+7
Omaha, Nebr	11	12.8	78	----	11.7	62	----	9.9	48	----	9.2	50	----	8.6	56	----	7.5	59	----	6.0	54	----	3.6	44	----	2.0	35	----
Pearl Harbor, T. H	30	14.0	78	−2	13.2	80	0	12.3	87	+3	10.4	82	+2	8.5	73	+4	6.1	57	+5	5.0	52	+10	2.5	29	+2	1.5	24	0
Pensacola, Fla	27	16.3	92	+5	14.6	75	−4	12.2	71	−4	10.3	69	−4	8.4	64	−5	7.0	61	−5	5.8	58	−5	4.4	56	−4	3.0	51	−4
St. Thomas, Virgin Islands	31	17.6	72	----	17.3	86	----	15.5	92	----	12.6	83	----	9.6	68	----	6.8	51	----	5.5	49	----	3.9	47	----	2.7	42	----
Salt Lake City, Utah	27	10.4	63	----	----	----	----	----	----	----	10.9	53	----	9.3	47	----	8.0	47	----	6.9	49	----	5.6	59	----	4.4	67	----
San Diego, Calif	31	11.4	81	+2	10.7	83	+2	8.3	46	−4	6.8	33	−6	5.7	30	−3	5.0	30	−5	4.9	34	−5	3.8	39	−5	2.9	41	−5
Sault Ste. Marie, Mich	31	9.5	90	----	9.4	72	----	9.2	71	----	8.2	71	----	7.2	69	----	5.8	63	----	4.8	59	----	3.4	56	----	2.3	52	----
Scott Field, Ill	30	13.3	89	+5	11.7	62	+1	10.7	63	+4	9.8	66	+6	8.5	68	+8	6.8	61	+4	5.6	55	+1	4.0	52	−1	2.7	50	−1
Seattle, Wash	27	8.1	87	----	7.9	79	----	6.9	68	----	6.0	63	----	5.5	60	----	4.5	52	----	3.6	46	----	2.3	37	----	1.5	34	----
Selfridge Field, Mich	10	11.1	88	----	9.6	62	----	9.1	62	----	8.2	64	----	7.3	69	----	5.8	63	----	4.3	54	----	2.6	39	----	1.4	27	----
Spokane, Wash	31	9.2	72	+8	----	----	----	7.7	41	−6	6.6	37	−6	6.1	41	−5	5.7	46	−3	5.1	49	−1	3.5	46	−4	2.0	40	−8
Washington, D. C	27	13.7	85	+8	10.9	64	−1	10.0	65	+4	8.6	65	+3	7.4	64	+2	6.5	66	+6	5.3	63	+5	3.5	53	+4	2.4	47	+3
Wright Field, Ohio	28	12.0	92	+7	11.1	67	−1	10.0	69	+6	8.9	72	+7	7.3	71	+8	5.4	58	+1	4.7	56	+1	3.2	50	+1	2.2	46	+1

TABLE 3.—*Mean free-air barometric pressures (P), in mb, and equivalent potential temperatures (Θ_E), in °A. obtained by airplanes during July 1937*

Station	Number of observations	Altitude (meters) m. s. l.																	
		Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
		P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E
Barksdale Field, La	31	1,010	341	960	340	906	337	855	335	807	334	760	333	716	331	634	331	----	----
Billings, Mont	31	892	329	----	----	----	----	852	335	804	336	758	336	714	335	633	333	560	331
Boston, Mass	31	1,014	323	957	326	903	326	852	326	803	325	755	325	711	325	629	325	556	326
Cheyenne, Wyo	23	815	333	----	----	----	----	----	----	804	335	757	338	715	338	633	336	560	336
Chicago, Ill	22	993	325	957	329	904	327	852	327	804	326	756	324	710	324	629	326	555	326
Coco Solo, Canal Zone	25	1,008	353	951	350	899	347	848	344	800	342	753	339	710	335	628	335	556	334
El Paso, Tex	31	882	336	----	----	----	----	851	340	804	340	758	340	115	339	635	338	562	337
Fargo, N. Dak	31	980	321	955	327	902	328	850	329	802	328	756	328	711	327	629	327	555	328
Kelly Field, Tex	30	994	343	962	344	909	339	858	336	810	334	763	332	719	330	638	330	564	330
Lakehurst, N. J	28	1,010	326	958	328	904	326	853	326	804	324	756	323	712	323	630	324	556	326
Maxwell Field, Ala	31	1,010	339	960	337	907	337	856	336	808	333	760	330	716	329	634	329	561	330
Mitchel Field, N. Y	25	1,013	326	960	332	906	332	854	331	805	331	758	330	713	330	632	329	----	----
Nashville, Tenn	30	995	331	960	336	906	336	855	332	806	329	759	325	715	325	633	325	560	326
Norfolk, Va	26	1,015	338	958	335	905	332	853	331	804	330	757	328	713	327	630	326	556	325
Oakland, Calif	31	1,014	311	956	321	903	327	853	326	805	325	759	325	716	324	634	325	561	327
Oklahoma City, Okla	31	969	340	957	345	904	345	854	344	806	342	760	339	716	337	635	334	562	330
Omaha, Nebr	11	980	332	957	334	904	334	854	335	805	335	759	333	715	331	633	328	560	327
Pearl Harbor, T. H	30	1,016	335	959	335	906	335	854	332	806	330	759	326	715	326	634	325	560	327
Pensacola, Fla	27	1,017	340	961	342	907	338	854	334	805	332	758	330	714	329	632	330	558	331
St. Thomas, Virgin Island	31	1,018	350	964	350	910	347	858	341	810	336	762	331	719	330	637	328	563	329
Salt Lake City, Utah	27	872	335	----	----	----	----	851	343	803	342	757	340	714	338	633	337	561	336
San Diego, Calif	31	1,012	323	957	324	903	329	852	331	804	331	758	331	715	331	634	331	562	332
Sault Ste. Marie, Mich	31	988	315	956	321	902	324	850	324	801	324	754	323	710	323	627	324	553	324
Scott Field, Ill	30	1,000	330	960	334	906	333	855	333	806	331	759	328	715	328	633	328	560	328
Seattle, Wash	27	1,018	307	961	312	905	314	852	315	802	318	754	318	710	318	628	320	554	321
Selfridge Field, Mich	10	994	322	958	324	905	326	853	325	804	324	756	322	712	321	629	321	556	321
Spokane, Wash	31	945	321	----	----	902	327	850	328	804	327	757	327	714	327	632	326	558	325
Washington, D. C	27	1,016	332	959	330	905	330	853	328	804	326	757	326	713	324	630	325	556	327
Wright Field, Ohio	28	987	325	958	336	904	328	853	327	804	324	756	322	712	322	629	323	555	324

TABLE 4.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during July, 1937*

[Wind from N=360°, E=90°, etc.]

Altitude (m.) m. s. l.	Albuquerque, N. Mex. (1,554 m.)		Atlanta, Ga. (309 m.)		Billings, Mont. (1,088 m.)		Boston, Mass. (15 m.)		Cheyenne, Wyo. (1,873 m.)		Chicago, Ill. (192 m.)		Cincinnati, Ohio (153 m.)		Detroit, Mich. (204 m.)		Fargo, N. Dak. (274 m.)		Houston, Tex. (21 m.)		Key West, Fla. (11 m.)		Medford, Oreg. (410 m.)		Nashville, Tenn. (194 m.)	
	Direction	Velocity	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	2	1.8	289	1.0	307	2.3	260	1.5	281	2.6	238	1.8	140	0.2	270	1.7	92	0.3	167	1.0	119	2.9	196	0.5	237	0.9
500	-----	-----	291	3.7	-----	-----	292	4.4	-----	-----	250	5.2	259	3.1	277	4.1	142	2.5	196	7.9	122	5.8	237	0.9	243	2.1
1,000	-----	-----	286	4.6	-----	-----	290	3.9	-----	-----	268	5.2	271	4.2	289	5.5	224	2.4	195	7.3	132	5.0	288	1.6	249	3.3
1,500	-----	-----	270	4.4	312	0.9	287	4.7	-----	-----	281	4.7	271	4.5	286	5.8	258	2.9	184	5.7	129	3.8	358	0.4	250	4.6
2,000	112	0.9	270	4.3	252	1.9	288	5.3	260	2.9	270	5.1	267	4.0	287	5.9	278	4.8	174	4.9	132	2.7	35	1.6	248	4.5
2,500	216	1.5	255	4.6	244	3.2	286	6.5	235	3.4	266	4.4	265	4.0	280	6.8	278	6.1	159	3.8	151	2.3	195	1.4	247	4.0
3,000	257	2.2	261	5.0	260	4.6	282	6.9	248	4.4	280	1.9	282	3.1	274	6.4	301	4.2	150	3.2	152	3.2	207	4.4	251	5.7
4,000	240	2.3	252	5.2	268	8.5	298	5.9	284	5.2	262	2.4	-----	-----	298	4.0	300	6.9	107	1.5	-----	-----	219	7.2	-----	-----
5,000	280	0.3	-----	-----	-----	-----	-----	-----	291	5.4	-----	-----	-----	-----	293	3.7	-----	-----	97	0.6	-----	-----	231	10.7	-----	-----

Altitude (m.) m. s. l.	Newark, N. J. (14 m.)		Oakland, Calif. (8 m.)		Oklahoma City, Okla. (402 m.)		Omaha, Nebr. (306 m.)		Pearl Harbor, Territory of Hawaii [1] (68 m.)		Pensacola, Fla.[1] (24 m.)		St. Louis, Mo. (170 m.)		Salt Lake City, Utah (1,294 m.)		San Diego, Calif. (15 m.)		Sault Ste. Marie, Mich. (198 m.)		Seattle, Wash. (14 m.)		Spokane, Wash. (603 m.)		Washington, D. C. (10 m.)	
	Direction	Velocity	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	281	0.3	346	1.6	169	4.7	154	1.6	59	4.8	312	1.3	201	1.2	156	3.0	2	1.1	106	0.2	117	0.4	117	1.6	308	1.2
500	312	2.7	270	2.3	179	7.5	180	5.4	70	7.9	287	4.2	222	4.9	-----	-----	275	0.4	187	1.3	32	1.9	-----	-----	312	4.2
1,000	305	2.8	313	3.1	210	11.9	215	6.7	78	8.5	276	4.2	251	4.8	-----	-----	339	2.5	257	2.8	23	0.9	212	2.6	318	5.8
1,500	283	2.9	332	1.2	230	8.0	236	5.1	86	6.6	252	3.9	266	4.3	157	4.0	292	3.6	284	3.9	315	1.3	247	3.4	309	5.3
2,000	277	4.1	209	1.6	245	5.2	267	3.1	92	5.9	251	2.4	283	4.0	162	3.2	272	2.5	299	4.1	296	2.4	246	5.1	284	4.9
2,500	277	4.7	194	2.6	269	3.0	299	3.0	85	5.0	263	2.5	302	4.1	199	1.9	198	1.2	305	4.4	278	3.6	246	5.7	279	4.9
3,000	270	5.4	189	5.4	299	2.5	298	4.0	104	3.5	266	1.6	321	4.1	249	2.3	137	2.5	304	4.2	273	4.9	238	7.0	269	5.2
4,000	267	6.7	-----	-----	349	3.9	321	4.6	-----	-----	272	2.0	330	3.2	255	3.8	-----	-----	314	5.4	264	8.7	248	10.0	281	4.0
5,000	257	6.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	285	5.2	-----	-----	-----	-----	264	9.5	-----	-----	-----	-----

[1] Navy stations.

TABLE 5.—*Maximum free-air wind velocities (M. P. S.), for different sections of the United States based on pilot-balloon observations during July 1937*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station
Northeast [1]	35.5	SW	1,210	26	Buffalo	30.4	WSW	4,310	26	Columbus	36.8	SW	9,900	22	Albany.
East-Central [2]	22.6	WSW	860	26	Richmond	25.6	WNW	3,569	18	Richmond	38.8	ENE	7,920	1	Greensboro.
Southeast [3]	22.5	ENE	1,400	2	Tampa	23.5	W	4,660	1	Spartanburg	25.6	WSW	5,020	1	Spartanburg.
North-Central [4]	37.9	SW	1,508	9	Bismarck	30.0	WNW	2,990	16	Detroit	31.3	W	10,190	19	Detroit.
Central [5]	26.4	W	2,465	15	Davenport	30.0	NW	4,985	4	Davenport	40.4	W	11,140	27	Indianapolis.
South-Central [6]	27.4	SSE	2,110	9	Amarillo	23.5	NNW	3,590	1	Memphis	32.0	NNW	7,910	30	Memphis.
Northwest [7]	25.4	WSW	886	13	Pendleton	36.4	SSW	4,460	1	Medford	42.0	WSW	15,414	9	Portland.
West-Central [8]	26.0	SSW	2,500	31	Modena	35.6	WSW	2,860	14	Winnemucca	41.6	SSW	12,015	29	Modena.
Southwest [9]	19.3	WSW	2,400	16	Havre	28.6	WSW	5,000	21	Havre	37.2	WSW	11,820	13	Las Vegas.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and Northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and Western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, Northern Nevada, and Northern California.
[9] Southern California, Southern Nevada, Arizona, New Mexico, and extreme West Texas.