POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group number	Heliographic			Area		Total area for each day	Observatory
			Diff. in longitude	Longitude	Latitude	Spot	Group		
1937	*h. m.*		°	°	°				
Aug. 29	9 9	5539	−57.0	238.3	+12.0		170		Mt. Wilson.
		5538	−57.0	238.3	+28.0		485		
		5536	−11.0	284.3	−12.0		36		
		5537	+24.0	319.3	+32.0		48		
		5527	+27.0	322.3	+15.0		36		
		5533	+37.0	332.3	+12.0		6		
		5522	+50.0	345.3	+33.0		970		
		5525	+65.0	0.3	−13.0	194			
		5521	+70.0	5.3	+23.0		24		
		5523	+71.0	6.3	+30.5	16			
		5524	+78.0	13.3	−11.0	194			
		5534	+88.0	23.3	+14.0	242		2,421	
Aug. 30	9 9	5540	−88.0	194.1	+20.0	145			Do.
		5539	−44.0	238.1	+12.0		121		
		5538	−44.0	238.1	+29.0		582		
		5536	+3.0	285.1	−13.0		48		
		5533	+37.5	319.6	+13.0		73		
		5527	+40.0	322.1	+15.0	12			
		5522	+63.0	345.1	+33.0		291		
		5525	+79.0	1.1	−14.5		145	1,417	
Aug. 31	10 50	5543	−78.0	190.0	−13.0	12			U. S. Naval.
		5540	−75.0	193.0	+18.5		170		
		5542	−49.0	219.0	+6.0		48		
		5538	−31.0	237.0	+29.0		436		
		5539	−27.5	240.5	+11.5		48		
		5536	+19.5	287.5	−12.0		48		
		5541	+58.0	326.0	−12.5	6			
		5533	+63.0	331.0	+12.5		121		
		5522	+75.0	343.0	+33.0		582	1,471	

Mean daily area for 31 days, 2,233.

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR AUGUST 1937

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

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

August 1937	Relative numbers	August 1937	Relative numbers	August 1937	Realtive numbers
1		11	140	21	80
2	*a* 180	12	*Mc* 144	22	103
3	*Mc* 207	13	114	23	*Eac* 139
4	*d* 197	14	*ab* 124	24	*Mca* 150
5	*ab* 205	15	128	25	*ab* 137
6	176	16	119	26	144
7	135	17		27	*d* 143
8	*d* 154	18	*dd* 82	28	130
9	173	19	*Ec* 88	29	110
10	*a* 183	20	*Ec* 96	30	*d* 109
				31	128

Mean, 29 days=138.6.

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 L. P. HARRISON

Mean free-air data based on airplane weather observations during the month of August 1937 are given in tables 1 to 3. A description of the methods by which the various monthly means and normals therein are computed may be found in this section of the MONTHLY WEATHER REVIEW for January and March 1937.

It will be noted that many of the "normals" are based on only 3 years of observations. Conclusions based on departures from such short-period "normals" must be used with caution.

The mean surface temperatures for August (see chart I) were above normal over practically the entire country. The largest positive departures at the surface were largely concentrated in the north-central part of the country, with values ranging from about +2° C. to +5.6° C. Elsewhere the positive departures generally averaged from +1° C. to +3° C. Slight negative departures occurred over small areas in the extreme northwest, the central California coast, northern Florida, and southeastern Georgia.

The mean free-air temperatures for the month up to 5 kilometers above sea level (table 1) were generally above normal, except over the extreme northwestern and the southeastern sectors of the country where they were largely below the normal by slight amounts The greatest positive departures prevailed over the north-central portion in harmony with the conditions observed at the surface; however, the (available) values here ranged only from +1° C. to +3.7° C. in the free air. The northeast coastal area was characterized by similar departures with a slightly lower extreme. The departures of positive sign were elsewhere of inconsequential magnitude. It is of interest to note the pronounced horizontal gradient of temperature over the Western Plateau Region at 2 kilometers. This is best exemplified by the data for Salt Lake City and Cheyenne which had a monthly mean temperature of 22.7° C. and 17.9° C., respectively.

The mean free-air relative humidities and specific humidities are given in table 2. The distribution of the positive and negative departures of relative humidity from the normals in the eastern part of the country during this month was not very regular over extensive areas (i. e. spotted). Near the northeastern coastal region slight to moderate positive departures (2 to 13 percent) were prevalent. The middle-Atlantic coastal area had practically normal humidities up to 4 kilometers. The data in the table for Lakehurst, N. J., indicates a departure of −21 percent at 5 kilometers. This subnormal value, presumably resulting from fewness of observations, is open to some doubt especially since the data for Norfolk, Va., portrayed departures decreasing from +9 percent at the surface to +3 percent at 2 and 2.5 kilometers then increasing to +12 percent at 5 kilometers. The region immediately south of the Great Lakes was generally characterized by slight positive departures at low elevations and moderate negative departures at the high elevations (−10 to −14 percent at 5 kilometers). Elsewhere in the east slight to low moderate departures of either sign occurred over various localities. On the other hand, the western half of the country judging from available data largely had humidities which were below normal by slight to moderate extents, except in the extreme northwest. There, small positive departures prevailed. Humidity conditions in the Dakotas were apparently similar to those occurring in connection with the western regime of deficient values.

Table 3 shows the monthly mean free-air barometric pressures and equivalent potential temperatures. The

isobaric charts constructed on the basis of the former data disclosed very "flat" pressure conditions over the entire country on the average, with but slightly higher pressures in the East than the West and in the South than the North. At elevations from 3 to 5 kilometers an appreciable average pressure gradient existed from the central Western Plateau Region northwestward (e. g., 5 kilometers, mean sea level, Salt Lake City mean pressure 560 mb; Spokane, 554 mb). A high-level Plateau anti-cyclone of limited extent and slight intensity presumably was connected with this phenomenon and with the above-normal transport of air from the Southwest and West over the extreme Northwest sector as indicated by the resultant winds for the levels in question.

Table 4 shows the free-air resultant winds based on pilot-balloon observations made near 5 a. m. (75th meridian time) during August. Generally speaking, the resultant winds were practically normal in direction over the entire country with a few notable exceptions: Georgia, northern Florida, and Washington, as exemplified by Atlanta, Pensacola, and Seattle, respectively. Over the former two stations, the resultants for the month were oriented at various levels, excluding the surface stratum, perhaps 30° to about 110° counterclockwise from the corresponding normals, i. e., from a more southwesterly or southerly direction. Over the latter station at elevation 0.5 to 1 kilometer, the resultants were oriented from 80° to 160° clockwise from normal, while at elevations 1.5 to 2 kilometers, they were oriented 120° to 25° counterclockwise, i. e., from more southerly directions.

The resultant velocities were largely below normal in the eastern half of the country and above normal in the western half. The departures in this respect were mostly slight, i. e., less than 3 meters per second. Positive departures in excess of the latter value were found at a few stations; viz, Spokane, 3.5 to 5.7 meters per second from 2 to 4 kilometers; Omaha, between 3.0 and 4.1 meters per second from 0.5 to 1.5 kilometers. Similar excessive negative departures were found over several stations, viz, Chicago, 3.3 to 3.7 meters per second at 2 and 2.5 kilometers; Detroit, about 3.1 at 3 and 4 kilometers; St. Louis, 3.8 at 5 kilometers.

Table 5 shows maximum free-air wind velocities and directions for various sections of the United States during August as determined by pilot balloon observations. The extreme maximum was 42.0 meters per second from the southwest at 10,935 meters above sea level over Modena, Utah.

The mean monthly specific humidities and equivalent potential temperatures are shown in tables 2 and 3, respectively. The mean maximum free-air values of these data were found to be centralized over the southeastern portion of the Western Plateau Region and contiguous areas to the east. Study of the patterns shown by the monthly resultant winds, and the lines of constant value of these two elements constructed on charts for the various levels discloses striking evidence of the probable existence, statistically at least, of a high-level anticyclone over the territory specified above. The three types of data referred to appear most consistent with this conclusion for levels from 3 to 5 kilometers above sea level, especially if it is assumed that the equivalent potential temperatures and the specific humidities undergo little change on the average in air masses transported along anticyclonic trajectories over the regions in question. The weather which prevailed during the month was such as to lead one to expect that the latter assumption is justifiable.

In general, marked contrasts occurred in the respective weather conditions over the western and eastern halves of the country. The Western Plateau Region to the Pacific coast and the central and southwestern Great Plains were dominated by outbreaks of polar and transitional polar air masses from the Canadian Northwest and from the North Pacific anticyclone which was rather strongly developed during the month. This situation led to the prevalence of warm and dry, subsiding (S) air masses near the surface over much of this area. However, at times, owing to the relatively high pressure to the south and east, partly as a consequence of the well-developed North Atlantic anticyclone which frequently lay off the east coast, considerable warm, moist, tropical Atlantic (T_A) air moved in two streams from the Gulf of Mexico: northwestward over the Plateau region and the southwestern Great Plains, as well as north and northeastward over the Mississippi Valley and the southeastern part of the country. Over the first of these localities the T_A air frequently overlay and mixed with the S air. The elevated terrain here caused the air masses to be relatively warm as compared with those in the free air over the surrounding lower terrain. The isentropic surfaces were thus depressed over the Plateau region and contiguous areas immediately to the east which thus became a sort of stagnant reservoir of moisture-laden air at moderate and high levels that may be identified with the high-level Plateau anticyclone previously mentioned. The result of these conditions was great deficiency in precipitation (10 to 50 percent of normal) from the Pacific coast to the Mississippi except in the extreme northwestern, north-central and south-central parts of the country where precipitation was copious (100 to 200 percent of normal).

The precipitation over the extreme northwest was associated with several cyclones from the Pacific formed by the interaction of T_P and P_P air.

The rainfall over the north-central region mostly had its genesis on many occasions by the motion of T_A air from the southwestern reservoir anticyclonically northeast and eastward upward along the slopes of the dome shaped isentropic surfaces within the polar and transitional polar air masses passing over the north-central locality in question.

On some occasions weakly-developed cyclones associated with occluded fronts formed by action of N_P and T_A air were effective in producting the rather plentiful precipitation observed over much of the eastern third of the country. In these cases, troughs of T_A air above the cyclones were the immediate sources of the rain which was frequently of the shower type. The ascent of T_A air up the inverted-saucer-like slopes of the isentropic surfaces within the North Atlantic anticyclone lying along the east coast was also important for the precipitation in that area.

TABLE 1.—*Mean free-air temperatures (t), °C obtained by airplanes during August 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	24.1	−0.2	25.4	−0.7	23.0	−0.5	19.7	−0.3	16.4	−0.4	13.2	−0.5	10.2	−0.7	4.5	−0.5	−1.2	−0.4
Billings, Mont.[2] (1,090 m)	12	18.8						21.7		19.0		15.8		12.1		4.7		−2.5	
Boston, Mass.[1] (5 m)	28	20.8	+1.4	22.0	+1.8	19.7	+2.0	16.9	+2.2	14.1	+2.1	11.4	+1.9	8.7	+1.6	3.5	+1.8	−2.3	+1.6
Cheyenne, Wyo.[2] (1,873 m)	29	16.6	+1.4							17.9	+1.3	19.2	+1.6	16.1	+1.3	8.3	+1.2	−0.2	+0.9
Chicago, Ill.[2] (187 m)	31	20.3	+1.5	22.8	+2.0	20.1	+0.9	17.0	+1.0	13.9	+1.1	10.7	+0.7	7.5	+0.4	1.8	+0.5	−3.5	+1.0
Coco Solo, Canal Zone [2] (15 m)	23	25.5		23.6		21.1		18.4		15.6		13.6		11.1		4.7		−1.4	
El Paso, Tex.[2] (1,194 m)	30	23.7	+0.6					25.6	+1.1	22.6	+0.6	19.0	+0.6	15.1	+0.5	7.3	+0.5	0.2	+0.5
Fargo, N. Dak.[2] (274 m)	30	18.9	+2.4	21.7	+2.4	22.2	+3.4	20.2	+3.6	17.5	+3.7	14.1	+3.1	10.8	+3.0	4.1	+2.7	−3.1	+2.2
Kelly Field (San Antonio), Tex.[1] (206 m)	31	25.2	+1.4	24.8	+0.6	23.7	+0.9	20.8	+0.4	16.9	−0.3	13.4	−0.8	10.3	−1.0	4.2	−1.0	−1.0	−0.1
Lakehurst, N. J.[2] (39 m)	22	20.5	+1.0	21.5	+1.2	18.5	+0.7	15.7	+0.6	13.0	+0.5	10.4	+0.2	7.5	−0.3	2.1	−0.4	−2.2	+0.2
Maxwell Field (Montgomery), Ala.[1] (52 m)	30	24.5	+0.2	24.2	−0.5	21.2	−1.0	17.8	−1.2	14.7	−1.3	11.7	−1.5	8.9	−1.5	3.3	−1.4	−1.7	−0.9
Mitchell Field (Hempstead, L. I.), N. Y.[1] (29 m)	22	20.8	+1.6	22.1	+1.9	20.0	+1.9	17.2	+2.0	14.8	+2.2	11.9	+2.0	9.1	+1.7	3.6	+1.6		
Nashville, Tenn.[2] (180 m)	31	22.8	+0.4	24.5	+0.5	21.9	0.0	18.6	0.0	15.5	0.0	12.3	−0.1	9.3	−0.1	3.9	+0.4	−1.6	+0.8
Norfolk, Va.[2] (10 m)	25	22.9	−0.9	22.4	−0.1	19.6	−0.5	16.9	−0.2	13.9	−0.1	11.1	−0.2	8.0	−0.6	1.8	−1.2	−4.0	−1.6
Oakland, Calif.[2] (2 m)	31	13.8		18.4		23.9		21.8		19.0		15.8		12.5		5.5		−1.5	
Oklahoma City, Okla.[2] (391 m)	31	24.6	−0.2	25.6	−0.6	26.3	+0.2	23.2	+0.4	19.6	+0.3	15.9	+0.1	11.9	−0.4	5.0	−0.5	−1.8	−0.7
Omaha, Nebr.[2] (300 m)	31	23.1	+2.9	24.7	+2.9	24.7	+2.2	22.2	+1.9	19.5	+2.0	16.1	+1.8	12.6	+1.6	6.0	+1.8	−0.7	+1.8
Pearl Harbor, Territory of Hawaii [3] (6 m)	31	23.7	−1.3	21.9	0.0	18.7	+0.5	16.0	+0.5	14.2	+0.7	12.9	+1.2	11.0	+1.5	5.6	+0.8	0.1	+1.7
Pensacola, Fla.[3] (13 m)	28	23.8	−0.9	23.8	+0.2	20.8	0.0	17.9	+0.2	15.1	+0.3	12.2	+0.3	9.4	+0.4	3.8	+0.6	−1.4	+0.7
St. Thomas, Virgin Islands [3] (8 m)	31	28.8		24.6		21.2		18.5		15.9		13.5		11.0		5.4		0.0	
Salt Lake City, Utah [3] (1,288 m)	30	19.7						24.7		22.7		19.1		15.5		7.4		−0.5	
San Diego, Calif.[3] (10 m)	29	19.2	−1.7	17.4	−1.7	23.7	+0.5	24.0	+1.6	21.4	+1.0	18.2	+1.2	14.8	+1.2	7.4	+0.8	−0.1	0.0
Sault Ste. Marie, Mich.[2] (221 m)	31	16.1		18.9		18.2		15.9		13.5		10.8		8.1		2.2		−4.1	
Scott Field (Belleville), Ill.[1] (135 m)	26	20.6	−0.2	24.9	+0.3	22.4	−0.4	19.0	−0.8	15.8	−0.9	12.6	−0.9	9.9	−0.6	4.0	−0.1	−1.6	+0.4
Seattle, Wash.[3] (10 m)	16	16.3		13.8		11.7		9.3		7.1		4.8		2.6		−2.4		−8.2	
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	26	19.6	+1.5	22.1	+1.7	19.5	+1.2	16.7	+1.1	13.6	+0.8	10.8	+0.8	8.3	+1.0	2.6	+1.1	−3.2	+1.5
Spokane, Wash.[3] (596 m)	31	13.6	−0.8			18.9	−0.7	16.6	−1.2	13.3	−0.6	9.3	−0.5	5.9	−0.3	−0.7	−0.6	−7.3	−0.4
Washington, D. C.[3] (13 m)	25	23.1	+1.0	23.4	+2.1	20.7	+1.4	17.8	+1.3	14.3	+0.7	11.4	+0.6	8.3	+0.3	2.8	0.0	−2.7	+0.2
Wright Field (Dayton), Ohio [1] (244 m)	27	19.2	−0.1	21.4	+0.1	21.5	+0.8	18.4	+0.7	15.3	+0.3	12.7	+0.5	10.2	+0.6	4.4	+0.6	−1.4	+0.6

[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); Boston, 74 (3); Cheyenne, 122 (4); Chicago, 92 (3); El Paso, 92 (3); Fargo, 123 (4); Kelly Field, 124 (4); Lakehurst, 76 (3); Maxwell Field, 117 (4); Mitchel Field, 109 (4); Nashville, 124 (4); Norfolk, 170 (8); Oklahoma City, 123 (4); Omaha, 208 (7); Pearl Harbor, 164 (6); Pensacola, 235 (9); San Diego, 232 (9); Scott Field, 114 (4); Selfridge Field, 119 (4); Spokane, 124 (4); Washington, 216 (9); 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 August 1937. (Dep. represents departure from "normal" relative humidity)*

Stations	Number of observations	Altitude (meters) m. s. l. Surface q	Surface R. H. Mean	Surface R. H. Dep.	500 q	500 R. H. Mean	500 R. H. Dep.	1,000 q	1,000 R. H. Mean	1,000 R. H. Dep.	1,500 q	1,500 R. H. Mean	1,500 R. H. Dep.	2,000 q	2,000 R. H. Mean	2,000 R. H. Dep.	2,500 q	2,500 R. H. Mean	2,500 R. H. Dep.	3,000 q	3,000 R. H. Mean	3,000 R. H. Dep.	4,000 q	4,000 R. H. Mean	4,000 R. H. Dep.	5,000 q	5,000 R. H. Mean	5,000 R. H. Dep.
Barksdale Field, La.	31	16.8	90	+6	13.8	65	+2	12.5	64	+1	11.2	66	0	9.6	66	0	8.0	64	+1	7.0	64	+4	4.9	59	+4	3.3	53	+2
Billings, Mont.	12	6.4	42								6.9	36		6.2	36		5.8	39		5.2	42		4.1	48		2.6	45	
Boston, Mass.	28	13.3	87	+4	12.5	72	+6	11.2	70	+4	10.2	72	+5	8.7	70	+7	7.5	67	+10	6.1	62	+7	4.4	57	+8	3.3	56	+13
Cheyenne, Wyo.	29	8.6	59	−4										8.5	53	−5	7.6	41	−6	6.4	40	−5	4.8	45	−4	3.9	56	−1
Chicago, Ill.	31	13.1	87	+2	12.6	69	0	11.1	68	+5	9.1	64	0	7.7	62	−2	6.5	61	+3	5.1	57	+5	3.5	50	+5	2.2	41	+3
Coco Solo, Canal Zone	23	18.9	94		17.0	89		14.6	84		12.8	82		11.5	83		8.8	68		6.9	60		5.4	64		3.9	61	
El Paso, Tex.	30	11.0	53	−5							10.2	42	−7	9.2	43	−6	8.7	48	−6	7.9	52	−7	6.6	66	−5	5.1	74	+1
Fargo, N. Dak.	30	11.3	81	+3	10.8	63	+1	9.3	50	−4	7.7	45	−7	6.7	43	−8	5.4	41	−7	4.7	41	−8	3.5	44	−3	2.7	48	+2
Kelly Field, Tex.	31	15.7	77	−10	15.6	76	−9	12.2	60	−9	10.7	59	−4	9.6	64	0	7.9	62	+2	6.1	56	+1	4.0	49	−2	2.7	41	−9
Lakehurst, N. J.	22	14.1	94	+3	11.3	67	−2	10.0	68	+1	8.6	65	−1	7.2	61	−2	6.0	57	−2	4.8	53	−2	3.8	53	−3	1.1	22	−21
Maxwell Field, Ala.	30	16.7	87	−1	14.9	75	+2	12.8	73	+1	11.4	76	+3	9.5	73	+3	8.1	72	+5	7.0	70	+5	5.3	69	+8	3.7	59	+6
Mitchel Field, N. Y.	22	14.3	94	+2	13.4	77	+3	12.4	77	+6	11.2	78	+6	9.8	74	+4	8.0	70	+6	7.0	69	+9	4.5	58	+4			
Nashville, Tenn.	31	14.6	83	−4	13.7	68	−2	13.0	71	+1	11.5	73	+1	9.4	69	−1	7.8	66	0	6.4	62	0	4.1	51	−5	2.6	42	−6
Norfolk, Va.	25	15.8	91	+9	13.8	78	+6	12.0	76	+8	10.1	72	+6	8.5	69	+3	7.2	66	+3	6.0	64	+5	4.2	61	+11	2.8	56	+12
Oakland, Calif.	31	8.6	88		8.9	64		6.4	31		5.2	27		3.7	22		3.0	20		2.3	19		1.6	19		1.0	18	
Oklahoma City, Okla.	31	14.7	73	+7	14.7	68	+6	12.8	54	0	11.6	55	+1	10.7	60	+4	9.2	62	+6	8.1	66	+9	5.4	63	+7	3.1	53	+1
Omaha, Nebr.	31	14.4	79	0	14.1	69	+1	12.4	57	+3	10.8	55	+3	9.2	52	+1	8.2	54	+3	7.2	56	+5	4.8	52	+2	3.2	50	+1
Pearl Harbor, Hawaii	31	14.2	78	+4	13.5	78	0	12.6	84	+1	10.7	80	+1	8.8	70	+1	6.1	50	−4	4.7	41	−4	3.2	35	+3	2.7	40	+8
Pensacola, Fla.	28	17.2	94	+6	16.1	83	+4	13.6	80	+4	11.6	77	+3	9.7	73	+2	8.1	70	+2	6.9	67	+2	5.2	65	+2	3.7	61	+4
St. Thomas, Virgin Islands	31	18.7	76		18.2	90		15.1	87		12.7	81		10.6	75		8.1	64		6.6	57		4.8	55		3.4	49	
Salt Lake City, Utah	30	8.3	50								9.4	41		8.0	37		6.8	37		5.8	38		4.5	45		3.6	54	
San Diego, Calif.	29	11.6	83	+3	11.1	85	+6	9.2	45	−2	6.3	29	−9	5.5	28	−8	5.0	29	−9	4.7	31	−10	3.6	35	−10	2.9	41	−4
Sault Ste. Marie, Mich.	31	10.4	90		9.6	67		9.2	63		7.9	60		7.0	58		5.6	52		4.5	47		3.0	42		2.0	39	
Scott Field, Ill.	26	13.5	89	+3	12.6	61	+1	11.6	62	+2	10.6	66	+6	8.7	62	+5	6.8	57	+3	5.5	52	+2	3.5	44	−2	1.5	24	−14
Seattle, Wash.	16	8.3	73		7.7	74		6.7	70		6.0	70		5.0	62		4.0	56		3.3	51		2.2	43		1.3	36	
Selfridge Field, Mich.	26	12.8	89	+4	11.0	63	−2	9.4	60	−2	8.5	60	+2	7.0	57	+2	5.7	53	+1	4.6	48	−1	3.2	44	−2	2.3	42	0
Spokane, Wash.	31	6.8	66	+6				6.3	41	−2	5.7	41	+1	5.4	46	+3	5.1	52	+5	4.3	53	+5	2.7	46	+2	1.8	45	+3
Washington, D. C.	25	15.0	86	+8	12.6	67	0	11.0	65	+2	9.4	63	−1	8.5	67	+2	7.0	62	0	5.7	59	0	3.7	49	−2	2.7	45	−2
Wright Field, Ohio	27	13.0	92	+5	12.8	77	+3	12.1	68	0	10.5	68	−1	8.7	64	0	6.7	55	−5	5.0	47	−8	3.3	40	−10	2.2	36	−10

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

Stations	Altitude (meters) m. s. l.																	
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
	Number of observations	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	1,009	343	959	342	906	341	854	340	806	337	759	334	715	334	634	332	560	332
Billings, Mont	12	893	321					851	330	803	330	757	331	714	331	632	331	558	328
Boston, Mass	28	1,017	329	960	334	907	333	856	333	807	331	759	331	716	329	635	329	560	331
Cheyenne, Wyo	29	815	332							803	336	757	340	714	339	633	336	561	335
Chicago, Ill	31	995	330	960	336	906	334	855	330	806	328	758	327	714	325	631	325	558	326
Coco Solo, Canal Zone	23	1,009	351	955	349	902	345	851	342	803	342	756	337	713	335	631	334	559	334
El Paso, Tex	30	882	340					852	344	804	343	758	344	715	342	634	341	561	340
Fargo, N. Dak	30	980	326	955	330	902	332	851	331	803	330	756	328	712	328	630	328	557	329
Kelly Field, Tex	31	994	344	961	346	908	341	856	339	808	337	761	334	717	331	635	329	562	330
Lakehurst, N. J	22	1,013	332	959	330	905	329	854	328	804	326	758	325	713	324	631	327	559	324
Maxwell Field, Ala	30	1,011	344	960	343	907	340	856	337	807	334	760	333	716	331	633	332	560	333
Mitchel Field, N. Y	22	1,015	332	962	336	907	337	856	336	807	335	760	332	715	332	634	330		
Nashville, Tenn	31	995	337	960	341	906	341	855	339	806	335	759	333	715	331	633	329	560	329
Norfolk, Va	25	1,017	339	961	339	908	336	856	333	807	330	760	329	716	328	633	327	559	327
Oakland, Calif	31	1,014	310	957	321	903	325	853	324	804	323	758	322	714	322	632	323	559	324
Oklahoma City, Okla	31	969	343	957	345	905	346	854	345	806	344	760	341	716	338	634	334	561	330
Omaha, Nebr	31	979	339	957	342	905	343	854	341	806	339	760	338	716	337	634	333	562	332
Pearl Harbor, Territory of Hawaii	31	1,015	336	960	337	906	337	855	334	806	332	760	328	717	327	636	328	563	331
Pensacola, Fla	28	1,017	344	962	347	908	341	857	338	808	335	761	333	717	332	634	332	561	333
St. Thomas, Virgin Islands	31	1,017	354	962	353	908	347	856	343	808	339	761	334	717	333	635	333	562	334
Salt Lake City, Utah	30	871	329					850	341	803	340	757	338	714	337	633	334	560	334
San Diego, Calif	29	1,012	324	957	326	904	333	852	331	805	331	758	331	715	332	634	332	562	332
Sault Ste. Marie, Mich	31	991	318	959	323	905	327	853	326	804	326	756	325	713	324	630	324	557	325
Scott Field, Ill	26	1,001	331	960	338	907	338	855	337	807	333	758	330	716	329	633	327	561	326
Seattle, Wash	16	1,019	311	961	312	906	312	852	313	803	313	754	314	709	315	626	317	552	318
Selfridge Field, Mich	26	996	328	960	330	906	329	854	328	805	326	758	325	714	324	631	325	558	327
Spokane, Wash	31	946	310			902	319	850	321	802	322	754	322	710	321	627	321	554	321
Washington, D. C	25	1,017	337	962	336	908	334	857	331	808	331	761	329	716	327	634	326	560	329
Wright Field, Ohio	27	989	330	960	334	906	338	855	336	806	333	760	330	716	327	633	327	560	328

TABLE 4.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during August 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	337	1.1	119	0.2	326	1.8	287	0.9	279	2.7	195	0.7	43	0.7	270	0.8	144	2.6	30	0.3	102	2.6	209	0.2	174	1.0
500			225	2.2			290	4.0			203	3.4	168	1.3	259	1.6	172	5.0	198	5.1	110	5.3	239	0.6	204	3.3
1,000			253	2.5			279	4.7			234	2.7	241	3.2	251	2.8	213	6.4	180	4.7	120	5.2	303	1.9	221	3.2
1,500			249	1.2	95	1.1	273	4.8			268	2.4	258	3.1	259	2.9	252	6.8	163	3.7	115	4.2	326	0.6	230	2.9
2,000	177	1.5	223	0.6	208	1.0	256	5.2	258	4.5	302	1.5	268	3.2	281	3.0	274	6.9	130	2.7	117	3.7	238	0.9	235	2.8
2,500	197	2.4	196	1.0	239	4.0	263	4.9	232	5.1	334	1.9	272	3.0	283	2.5	281	8.0	103	2.7	123	3.3	242	3.4	241	3.0
3,000	219	2.3	179	1.3	251	6.6	267	5.5	234	4.4	345	3.5	287	3.0	313	2.5	291	9.4	78	2.6	123	2.8	236	6.2	269	2.4
4,000	245	1.2	176	1.1	253	11.0	266	9.0	250	5.0					320	3.1	290	10.0	82	2.7	200	1.2	238	8.3	360	3.4
5,000	227	0.5							247	5.4					297	5.1			54	4.0			250	10.6		

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	213	0.5	282	1.1	171	3.4	149	2.4			359	0.8	153	1.0	147	4.5			128	0.5	132	0.8	138	1.0	268	0.6
500	301	3.6	246	2.7	185	7.1	174	6.7			103	1.0	180	4.5					227	2.1	113	0.2			237	3.6
1,000	291	3.7	300	4.5	208	11.5	200	9.4			154	1.1	213	3.1					262	5.8	166	0.6	216	3.4	261	2.6
1,500	274	4.0	287	2.5	213	7.0	222	8.4			135	1.8	202	2.3	160	6.4			275	5.6	220	1.8	238	5.2	257	3.1
2,000	270	5.4	248	2.8	222	3.2	240	5.6			114	2.5	196	1.9	180	5.5			273	5.4	262	2.6	237	6.8	273	2.9
2,500	276	5.6	217	3.4	252	0.7	256	3.9			102	3.0	320	1.8	206	4.3			278	5.7	278	4.1	240	8.5	276	4.2
3,000	290	6.7	210	2.9	351	1.1	288	2.9			107	3.2	298	1.6	224	5.4			286	6.8	263	5.3	245	10.2	260	5.2
4,000	266	8.4			49	1.2	307	3.3					295	2.4	250	6.4			298	7.2	262	7.2	239	12.3	264	4.4
5,000							261	3.3					347	0.9												

[1] Navy stations.

TABLE 5.—*Maximum free air wind velocities (meters per second), for different sections of the United States based on pilot balloon observations during August 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]	25.0	SW	1,184	11	Newark	24.5	WSW	4,263	20	Pittsburgh	34.0	WNW	9,000	18	Albany.
East-Central [2]	19.0	SSE	1,184	31	Nashville	18.0	WSW	3,340	13	Washington	32.4	NE	10,360	16	Washington.
Southeast [3]	25.7	SSE	620	30	Jacksonville	20.5	SW	4,440	7	Charleston	21.5	NE	12,360	20	Charleston.
North-Central [4]	33.2	SW	1,080	23	Fargo	26.7	W	4,568	18	Bismark	38.0	N	10,190	25	Detroit.
Central [5]	25.6	SW	124	7	Wichita	24.8	WSW	4,445	11	Davenport	36.0	N	8,980	1	Indianapolis.
South-Central [6]	29.8	SSE	2,020	21	Del Rio	17.2	NNE	4,270	11	Amarillo	32.0	N	18,670	24	Amarillo.
Northwest [7]	30.6	WSW	2,133	18	Spokane	39.0	SW	4,460	22	Medford	36.0	WSW	7,533	15	Spokane.
West-Central [8]	32.9	SW	2,500	22	Winnemucca	34.8	WSW	3,760	13	Winnemucca	42.0	SW	10,935	24	Modena.
Southwest [9]	24.0	SSW	984	28	Las Vegas	31.1	SW	4,100	27	Havre	28.4	SW	10,200	3	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.

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD, in Charge]

By BENNETT SWENSON

During August 1937 floods occurred principally in the Susquehanna River Basin, in portions of the South Atlantic drainage area, and in the Arkansas River Basin.

Rains on August 26–27, heavy over portions of the Susquehanna watershed, resulted in local flooding in some of the tributaries of the Susquehanna River. The damage was especially heavy in the vicinity of Wellsboro, Pa., as the result of excessive rainfall over a small area between Wellsboro and Corning, N. Y. At the former place 7.39 inches were recorded between 4 and 9 a. m. of the 27th, and 6.01 inches were reported at the latter point between 9 a. m. and 10:30 p. m. of the same date. All of the small mountain streams draining into Pine Creek were within the area of the overflow. The total damage in the vicinity of Wellsboro as a result of the storm and flood has been estimated at $645,000.

Moderate floods were in progress in the rivers of eastern North Carolina at the close of the month and full information on flood damage will be included in the next issue of the REVIEW.

Overflows in the Saluda and Santee Rivers in South Carolina during the latter part of August and the first few days of September were light and no damage of consequence occurred.

Local floods occurred in the Ninnescah and North Canadian Rivers, tributaries of the Arkansas River. The overflow in the Ninnescah River in Kansas was greatest between Kingman and Oxford and resulted in damage estimated at $115,000 in this area. The flooding in the North Canadian River in Oklahoma was slight and no damage of consequence was reported.

Table of flood stages during August 1937

[All dates in August unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Tioughnioga: Whitney Point, N. Y.	12	27	27	12.2	27
James: Columbia, Va.	10	26	[1] 28	11.3	28
Dan: Danville, Va.	11	26	26	13.4	26
Roanoke:					
Weldon, N. C.	31	25	30	37.5	28
Scotland Neck, N. C.	23	25	[2]	28.9	30
Williamston, N. C.	10	30	[2]	10.4	31
Tar:					
Rocky Mount, N. C.	8	26	[2]	11.1	27, 29, 30
Tarboro, N. C.	18	30	[2]	21.9	Sept. 1
Greenville, N. C.	13	31	[2]	16.2	Sept. 3
Little: Kenly, N. C.	8	26	31	10.0	27
Neuse:					
Neuse, N. C.	14	25	31	18.2	26
Smithfield, N. C.	13	25	[2]	18.1	29
Goldsboro, N. C.	14	29	[2]	18.6	Sept. 3
Saluda: Pelzer, S. C.	6	13	16	7.1	14
Santee:					
Rimini, S. C.	12	July 28	1	12.5	July 30
		27	[2]	13.0	30
				13.4	Sept. 3
Ferguson, S. C.	12	29	[2]	12.9	Sept. 6
MISSISSIPPI SYSTEM					
Ohio Basin					
West Fork of White: Anderson, Ind.	8	9	16	10.5	13
		21	23	8.1	21
Arkansas Basin					
North Canadian:					
Canton, Okla.	6	22	22	6.0	22
Yukon, Okla.	8	23	25	9.1	24

[1] Fell 0.6 below flood stage on 27th.
[2] Above flood stage at end of month.