

POSITIONS AND AREAS OF SUNSPOTS—Continued

Date	East-ern stand-ard time	Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Dif-ference in longi-tude	Lon-gi-tude	Lat-i-tude	Dis-tance from center of disk				
1939 June 29..	A m 8 35	6507 (*) 6518 6516	+7 +8 +25 +67	114 115 132 174	-3 +25 -14 +8	9 25 29 68	121 8 18 121	20 2 7 11		
			(107)	(+3)		1,863	170			
June 30..	11 57	6522 6517 6514 6514 6509 6519 (*) 6519 6508 6507 6518 6516	-50 -22 -19 -10 +4 +7 +7 +15 +10 +20 +38 +81	42 70 73 82 96 99 99 107 111 112 130 173	-9 -22 -23 -23 -7 +9 +9 -12 +5 -3 -12 +9	51 32 32 26 10 20 10 20 19 21 40 82	242 242 24 61 170 194 36 291 170 73 6 12	6 2 3 2 21 12 8 3 2 11 2 1	F U. S. Naval.	
			(92)	(+3)		1,521	73			

Mean daily area for 30 days, 1,430.

* = Not numbered.
Plate quality: P, poor; F, fair; G, good, VG, very good.

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR JUNE 1939

[Dependent alone on observations at Zurich]

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

June 1939	Relative numbers	June 1939	Relative numbers	June 1939	Relative numbers
1.....	129	11	Ec 119	21	68
2.....	a 120	12	-----	22	74
3.....	ad 113	13	d ---	23	dd 65
4.....	a 97	14	a ---	24	74
5.....	d 104	15	a 101	25	61
6.....	124	16	97	26	c 84
7.....	127	17	-----	27	Ec 109
8.....	d 113	18	MWcc 91	28	d 137
9.....	ad 116	19	89	29	aa 134
10.....	a 104	20	aa ---	30	a 118

Mean, 25 days = 102.7

a = Passage of an average-sized group through the central meridian.
b = Passage of a large group 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 B. FRANCIS DASHIELL

The 646 upper-air observations of atmospheric pressure, temperature, and humidity made by airplanes and radiosondes in the United States, Canada, Bermuda, the north Atlantic, Canal Zone, and Hawaii, during the month of June 1939, are shown in tables 1 and 1a. The pressures and temperatures, as well as resultant-wind directions and forces, are indicated on charts VIII, IX, X, and XI. Isentropic data for June are shown on chart XII. Tables 2 and 3 present certain upper-air wind observations, and table 4 shows the mean height of the tropopause during the month. A complete description of these charts and tables will be found in the January 1939 issue of the MONTHLY WEATHER REVIEW.

In the lower levels of the atmosphere (up to 5 kilometers) where observations are obtained both by airplanes and radiosonde, all stations but one computed monthly means at 5 kilometers. Of all radiosonde observations launched at the surface 40 percent reached 19 kilometers and 5 stations were able to compute means for 21 kilometers. Individual ascents to 23 kilometers were made at all stations, and one flight over the north Atlantic reached 24 kilometers.

A great area of low mean atmospheric pressure prevailed during June north of the United States across southern Canada and stretched indefinitely northeast of the Hudson Bay region. This pressure distribution is shown on charts VIII, IX, X, and XI. In the United States, however, the lowest mean pressure at the 5,000-foot level (1,524 meters—chart VIII) was recorded on Mount Washington, N. H., while relatively low mean pressures prevailed over the northern Rocky Mountain region. At 3, 4, and 5 kilometers, lowest mean pressures were noted over Spokane, Wash., and highest pressures over the Southeast, particularly Pensacola, Fla., and Norfolk, Va. This distribution varied somewhat from that noted during the preceding spring and winter months when Sault Ste. Marie, Mich., recorded the lowest pressures in the United States.

Above 5 kilometers, where only radiosonde observations are made, lowest mean pressure occurred over Fargo, N. Dak., and highest pressure over Nashville, Tenn., at all levels from 6 to 19 kilometers. Mean pressures at Washington, D. C., and St. George's, Bermuda, were nearly the same for all levels. The latter, however, averaged slightly lower. Over the north Atlantic ocean, between 40° and 43° N. and 47° and 53° W., mean pressures at all levels were slightly higher than those recorded over Halifax, Nova Scotia, but considerably lower than the pressures noted at St. George's, Bermuda.

Charts VIII, IX, X, and XI show the mean temperatures for June at 1.5, 3, 4, and 5 kilometers, respectively. Mean low temperatures occurred over the same areas where lowest mean pressures were noted within the United States. Mean temperatures were highest over El Paso, Tex., at 1.5, 3, and 4 kilometers, and over Pensacola, Fla., at 5 kilometers. San Diego, Calif., was warmer than Pensacola, Fla., at 1.5 and 3 kilometers. At 5 kilometers the lowest mean free-air temperature was -14.4° C. over Spokane, Wash. This was slightly colder than in the preceding month and decidedly lower than in the corresponding month of 1938.

The lowest free-air temperatures for June were recorded over Sault Ste. Marie, Mich., at the surface; over Seattle, Wash., from 0.5 to 2.5 kilometers; Spokane, Wash., at 3, 4, and 5 kilometers; Fargo, N. Dak., from 6 to 12 kilometers; Washington, D. C., at 13 and 14 kilometers; Oklahoma City, Okla., from 15 to 18 kilometers; and over Washington, D. C., at 19 kilometers. The lowest mean temperatures for June were recorded over St. George's, Bermuda, at 12, 13, 14, 15, and 16 kilometers.

While all stations (tables 1 and 1a) were warmer in June than during the preceding month of May in the lower levels, the current month was colder in the higher levels. This was particularly noticeable above the 13-kilometer level over all stations except Fargo, N. Dak.

Above 5 kilometers the lowest mean temperature recorded in the United States during the current month was -67.2° C. over Oklahoma City, Okla., at 16 and 17 kilometers. This was exceeded, however, over St. George's, Bermuda (-68.1° C.) at the same level. Mean temperatures for June were lower at all radiosonde stations than in the preceding months of March, April, and May. The mean of -66.9° C. over Washington, D. C., at 17 kilometers was the lowest recorded since November 1938, and that at Sault Ste. Marie, Mich. (-60.7° C.), has been exceeded but twice—in August 1938 (-61.8° C.) and March 1939 (-60.8° C.). The lowest mean temperature for the current month over Oklahoma City, Okla. (-67.2° C.), was the lowest recorded there since December 1938 (-68.4° C.).

The mean relative humidity in the free air for June was high at most levels, particularly from the surface up to 2.5 kilometers. Pensacola, Fla., and Seattle, Wash., had the highest mean humidity at all levels up to 1.5 kilometers; Norfolk, Va., at 2 and 2.5 kilometers; Billings, Mont., at 3, 4, and 5 kilometers; and Washington, D. C., from 6 to 9 kilometers, inclusive. Humidity was low, however, over San Diego and Oakland, Calif., above 2 kilometers, and over El Paso, Tex., at all levels.

June resultant-wind directions and velocities, computed for 114 stations in the United States, Canada, Mexico, and Cuba, are given on charts VIII, IX, X, and XI (1.5, 3, 4, and 5 kilometers, respectively). Included in the above are data from two new stations—Camden, N. J., and Elkins, W. Va. At the close of the fiscal year the Weather Bureau was conducting regular pilot-balloon observations at 94 stations within the United States (shown on the charts), 1 in Puerto Rico, and 4 in Alaska. A selected list of stations for which resultants have been computed, based on 5 p. m. (E. S. T.) observations, is given in table 2.

Maximum altitudes reached by pilot balloons in the United States during June showed little variation from the previous month. At 33 percent of the stations the maximum altitudes failed to exceed 10 kilometers; 48 percent reached from 10 to 15 kilometers; and only 3 percent passed 20 kilometers. The highest altitude reached was 21,040 meters over Wichita, Kans., but this was exceeded by a flight of 21,186 meters at San Juan, Puerto Rico. During June, however, maximum altitudes obtained at Rapid City, S. Dak., Wichita, Kans., Houston, Tex., Ely, Nev., and Havre, Mont., were considerably greater than those reached in May.

Conditions favorable for long balloon observations at high altitudes existed on June 3d along the Middle Atlantic coast; on the 5th over the Great Lakes and thence southward to Tennessee; on the 8th in Florida; and during the last week of June almost generally elsewhere. An example of the progressive movement of such favorable conditions as noted in the Pacific northwest shows that maximum altitudes were reached on the 27th at Seattle, Wash.; on the 28th at Spokane, Wash.; on the 29th at Missoula, Mont.; and at Billings, Mont., on the 30th. Similar situations elsewhere in the country have been noticed during June and preceding months of this year.

Resultant winds for June, based on 5 a. m. (E. S. T.) observations (charts VIII and IX) showed that the directions at 1.5 and 3 kilometers were from the southwest quadrant in 58 percent of all cases. The 5 p. m. (E. S. T.) resultant directions (charts X and XI) at 4 and 5 kilometers had southwesterly components in 53 percent of all observations. Southwesterly resultants prevailed almost generally at 1.5 kilometers except over New England, New York, Pennsylvania, California, and Canada, where the

winds were from the northwest quadrant. In Cuba, southern Florida, Mexico, and on the Gulf coast, the winds were southeasterly. At 3, 4, and 5 kilometers the same situation prevailed except that winds with northwesterly components were noted at points as far south as North Carolina over the extreme East. Winds with northeasterly components occurred over San Antonio, Tex., at 3, 4, and 5 kilometers, and at Jacksonville and Miami, Fla., at 5 kilometers.

Wind directions for June were more southerly in most cases than during the preceding month of May, except in California and a few northern Rocky Mountain stations where the winds were more northerly. Resultant wind velocities during the current month were generally higher than in May. Large increases in velocity over the previous month were noted at Cheyenne, Wyo., Huron, S. Dak., Las Vegas, Nev., Medford, Oreg., Oklahoma City, Okla., Omaha, Nebr., Reno, Nev., and Salt Lake City, Utah. Highest velocities were confined to the northern and eastern sections of the country, as well as to the Rocky Mountain region at 5 kilometers.

Comparing the 5 a. m. (E. S. T.) resultant winds with normals for a limited number of selected stations, it was found that the wind directions at the 1.5- and 3-kilometer levels departed but little from normal. However, large departures in a counterclockwise rotation from normal were noted at Cincinnati, Ohio, Fargo, N. Dak., Key West, Fla., Nashville, Tenn., St. Louis, Mo., Sault Ste. Marie, Mich., and Seattle, Wash. At Key West, Fla., the June directions were 119° and 114° , as compared to the normals of 148° and 170° at 1.5 and 3 kilometers, respectively.

Sault Ste. Marie, Mich., showed the greatest velocity departures from normal—3 meters per second at 1.5 and 3 kilometers. Elsewhere velocity departures from normal were not so pronounced, but in practically all cases the June resultant velocities were slightly higher than the normal at these two levels.

Also comparing the 5 p. m. (E. S. T.) observations at 4 and 5 kilometers (charts X and XI), as well as those at all levels (table 2), with the established 5 a. m. normals, little variation from normal for June was noted. All, however, were more southerly by counterclockwise orientations away from the normal directions. However, at Atlanta, Ga., Cincinnati, O., Houston, Tex., Nashville, Tenn., Omaha, Nebr., and Oklahoma City, Okla., large departures occurred. These also were by counterclockwise rotations away from the normal direction.

Individual maximum velocities for June are shown in table 3. Between the surface and 2.5 kilometers a wind speed of 45.3 meters per second was recorded at Modena, Utah, on the 15th. Between 2.5 and 5 kilometers a velocity of 67.4 m. p. s. occurred on the 3d over Reno, Nev., at 3.9 kilometers. But, above 5 kilometers, at Miami, Fla., a maximum wind speed of 73 meters per second from the North was recorded at 20.6 kilometers on the 8th. This appears to be the first time such a high velocity has been recorded in Florida in the upper air.

MEAN MONTHLY ISENTROPIC CHART ¹

The mean isentropic chart (chart XII) for June 1939, $\theta=310$, is typical of summer charts, with a large anticyclonic tongue extending from the plateau eastward to Toronto, and another tongue extending northeastward along the coast. A third, smaller tongue extends through the central Mississippi Valley.

¹ This chart and the following discussion have been prepared by the Air Mass Section of the Meteorological Research Division.

The departure of precipitation from normal shows only a rough correlation with the moist tongues. Over the western plateau and for some distance eastward there is a general deficit in rainfall which seems to have no relation to the large moist area prevailing over the plateau in summer. The large excesses in precipitation over Okla-

homa, Iowa and Minnesota seem to correspond roughly to large up-slope wind components in these regions. The same is true of the excess rainfall in Indiana and Ohio, and on the central Gulf coast. The two large areas of deficient rainfall in the Mississippi Valley and New England correspond to downslope winds.

TABLE 1.—Mean free-air barometric pressures (P.) in mb., temperatures (T.) in °C., and relative humidities (R. H.) in percent obtained by airplanes during June 1939

Stations and elevations in meters above sea level	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.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.						
Billings Mont. (1,090 m.)	30	890	11.9	77	---	---	---	---	---	---	847	11.4	66	798	8.5	64	751	5.1	68	706	1.9	70	623	-4.7	70	548	-11.4	63			
Cheyenne, Wyo. (1,873 m.)	30	811	11.1	61	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
Chicago, Ill. (187 m.)	30	992	18.5	85	955	19.8	71	902	17.7	68	851	14.9	68	802	12.4	62	755	9.9	60	710	7.2	54	628	1.3	48	554	-4.9	42			
Coco Solo, C. Z. (15 m.)	29	1,011	25.8	92	957	24.1	91	905	21.9	85	854	19.7	84	806	17.5	80	760	15.7	68	716	13.4	65	635	8.0	65	558	-2.8	46			
El Paso, Tex. (1,193 m.)	30	879	24.0	82	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
Lakehurst, N. J. (39 m.)	26	1,012	17.9	81	957	19.5	67	903	17.4	65	852	15.2	69	803	12.7	72	756	10.7	68	712	8.6	59	630	3.2	52	556	-3.0	49			
Norfolk, Va. (10 m.)	21	1,016	23.3	91	961	23.4	74	908	21.1	72	856	18.0	79	808	15.1	80	761	12.3	75	717	9.6	65	635	4.4	56	561	-2.1	50			
Pearl Harbor, T. H. (6 m.)	30	1,016	22.4	79	960	19.4	80	906	15.6	84	854	12.5	81	804	10.1	74	757	8.9	63	713	6.9	58	630	2.0	24	---	---	---			
Pensacola, Fla. (13 m.)	28	1,015	24.2	94	960	23.9	75	906	21.5	72	856	18.9	67	807	16.4	63	761	13.5	64	717	10.9	60	636	5.6	57	562	0.1	59			
St. Thomas, V. I. (8 m.)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
Salt Lake City, Utah (1,288 m.)	30	868	14.1	58	---	---	---	---	---	---	847	17.3	48	799	15.3	43	753	11.9	44	709	8.1	47	627	0.2	52	553	-7.5	53			
San Diego, Calif. (10 m.)	29	1,012	18.0	78	956	14.6	84	902	17.6	63	851	19.1	43	802	17.5	34	756	14.8	31	712	11.5	29	631	5.6	25	558	-1.6	23			
Seattle, Wash. (10 m.)	22	1,017	14.8	70	960	10.1	82	904	7.5	82	850	5.4	76	800	2.9	73	751	0.8	65	706	-1.5	56	622	-6.5	46	---	---	---			
Spokane, Wash. (597 m.)	29	944	11.9	71	---	---	---	---	---	---	900	13.3	58	847	10.6	57	798	6.4	62	750	2.3	67	705	-1.6	69	621	-8.2	65	545	-14.4	60

¹ Navy.
² Temporarily discontinued.

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.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

TABLE 1a.—Mean free-air barometric pressures (P) in mb., temperatures (T) in °C., and relative humidities (R H) in percent obtained by radiosondes during June 1939

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																				
	Bermuda (50 m.)			Fargo, N. Dak. (274 m.)			Nashville, Tenn. (180 m.)			Oakland, Calif. (2 m.)			Oklahoma City, Okla. (391 m.)								
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity					
Surface	29	1,012	22.8	85	30	978	13.8	85	30	994	20.8	91	30	1,014	12.1	85	30	966	21.1	84	
500	29	961	19.9	82	30	952	16.0	74	30	958	21.4	81	30	956	12.8	76	30	955	21.4	79	
1,000	29	907	16.8	82	30	898	14.9	68	30	904	19.5	79	30	901	16.8	50	30	901	21.0	68	
1,500	29	855	14.3	82	30	846	12.4	67	30	853	16.5	79	30	849	15.0	41	30	851	18.8	63	
2,000	29	806	11.8	78	30	797	9.5	64	30	804	13.8	73	30	800	12.4	36	30	802	16.0	60	
2,500	29	759	9.9	73	29	750	6.6	63	30	758	11.1	70	30	754	9.8	33	30	756	13.2	58	
3,000	29	714	7.5	67	29	706	3.5	65	30	714	8.8	66	30	709	7.2	30	30	712	9.8	57	
4,000	29	632	2.7	61	27	624	-2.3	60	30	632	3.7	62	30	628	1.8	27	29	631	3.3	57	
5,000	29	558	-3.0	53	27	549	-8.7	55	29	558	-2.0	59	30	554	-4.5	27	29	557	-3.5	55	
6,000	28	491	-9.2	53	27	482	-15.5	52	29	492	-7.4	52	30	487	-11.2	27	29	490	-9.9	51	
7,000	28	431	-15.6	47	27	422	-22.5	49	29	432	-13.8	48	30	426	-18.4	27	29	430	-16.1	46	
8,000	28	376	-23.0	46	27	367	-30.3	48	29	378	-20.5	45	30	373	-25.4	27	28	376	-23.0	44	
9,000	28	327	-31.0	45	26	317	-38.1	48	29	329	-27.9	45	29	324	-32.6	26	28	327	-30.2	42	
10,000	28	284	-38.7	45	26	274	-45.3	48	29	286	-35.6	44	29	280	-39.8	26	28	284	-37.6	42	
11,000	28	244	-46.7	45	25	236	-50.9	48	29	247	-43.4	44	29	242	-46.6	26	28	244	-45.4	42	
12,000	28	210	-54.8	45	24	202	-54.4	48	29	212	-51.2	44	29	207	-53.0	26	28	210	-52.7	42	
13,000	28	179	-62.1	45	24	172	-66.9	48	29	182	-58.0	44	29	177	-67.1	26	27	180	-59.0	42	
14,000	25	152	-65.5	45	23	147	-68.3	48	29	155	-62.8	44	29	151	-60.0	26	26	153	-63.8	42	
15,000	24	129	-67.5	45	20	125	-69.0	48	29	131	-65.2	44	29	129	-61.5	26	25	130	-65.7	42	
16,000	23	109	-68.1	45	14	107	-68.8	48	29	112	-66.1	44	28	110	-62.6	26	22	110	-67.2	42	
17,000	23	93	-66.5	45	12	91	-69.4	48	27	94	-66.0	44	26	93	-63.1	26	20	93	-67.2	42	
18,000	17	79	-64.0	45	9	77	-68.8	48	24	80	-63.7	44	25	79	-62.1	26	17	79	-66.3	42	
19,000	13	67	-60.8	45	6	66	-68.4	48	20	68	-61.1	44	17	67	-60.6	26	10	67	-64.4	42	
20,000	7	57	-57.2	45	5	57	-62.8	48	16	58	-57.9	44	14	57	-58.7	26	5	57	-62.8	42	
21,000	5	48	-53.9	45	---	---	---	48	11	49	-53.7	44	7	48	-56.6	26	---	---	---	---	---

¹ Operated by Massachusetts Institute of Technology.

TABLE 1a.—Mean free-air barometric pressures (P) in mb., temperatures (T) in °C., and relative humidities (RH) in percent obtained by radiosondes during June 1939—Continued

(Altitude (meters) m. s. l.)	Stations and elevations in meters above sea level																	
	Omaha, Nebr. (300 m.)			Sault Ste. Marie, Mich. (221 m.)			Washington, D. C. ¹ (13 m.)			Halifax, N. S. ¹ (5 m.)			At Sea ² (5 m.)					
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity		
Surface	30	976	19.2	85	30	987	11.0	89	27	1,015	19.5	86	20	1,015	10.8	26	1,015	13.5
500	30	954	19.9	78	30	955	13.1	80	27	960	19.0	74	20	956	10.9	26	956	13.5
1,000	30	900	18.4	69	30	900	12.3	78	27	906	17.6	69	20	900	9.6	26	901	11.9
1,500	30	849	16.3	63	30	847	10.3	77	27	854	15.0	70	20	847	7.7	26	849	9.9
2,000	30	800	13.4	60	30	798	8.2	73	27	805	12.6	63	20	797	5.7	26	799	7.9
2,500	30	754	10.5	59	30	751	5.6	72	27	758	9.5	65	20	750	3.8	26	752	5.7
3,000	30	710	7.7	55	30	706	3.3	69	27	713	7.1	60	20	705	1.5	26	707	3.4
4,000	28	628	1.9	51	29	624	-2.1	60	27	631	2.1	60	20	622	-3.1	25	624	-1.4
5,000	28	554	-4.2	48	28	549	-8.0	58	27	556	-3.8	62	20	548	-8.5	25	550	-7.2
6,000	28	488	-10.2	46	28	482	-14.4	55	27	490	-9.5	61	20	480	-13.9	25	483	-13.0
7,000	28	428	-17.5	44	28	422	-21.1	52	27	430	-15.1	56	20	420	-19.5	25	423	-19.5
8,000	28	374	-24.7	42	27	368	-28.0	51	27	376	-21.5	57	20	366	-26.0	25	369	-26.7
9,000	28	325	-32.2	40	27	319	-35.7	52	27	327	-29.2	57	20	318	-32.7	24	320	-34.2
10,000	27	282	-39.1	38	27	276	-43.0	52	27	284	-37.0	57	19	275	-39.7	24	277	-41.3
11,000	24	243	-46.5	38	27	233	-49.1	52	26	246	-44.9	57	19	237	-46.4	24	239	-47.7
12,000	23	208	-52.5	38	26	203	-53.5	52	25	211	-52.7	57	17	203	-51.3	24	205	-52.8
13,000	22	178	-58.4	38	25	174	-56.4	52	25	180	-59.5	57	16	174	-53.2	24	176	-56.2
14,000	20	152	-61.4	38	24	149	-57.9	52	23	153	-64.2	57	14	149	-55.8	21	150	-57.4
15,000	20	129	-62.6	38	22	126	-59.4	52	21	130	-65.6	57	14	127	-57.6	20	128	-58.6
16,000	20	110	-64.2	38	19	108	-60.7	52	17	110	-66.5	57	12	108	-58.7	16	109	-59.5
17,000	19	93	-65.2	38	14	92	-59.6	52	14	93	-66.9	57	10	91	-58.9	15	92	-59.6
18,000	17	79	-64.3	38	11	78	-58.0	52	9	79	-66.0	57	8	78	-57.6	13	78	-58.4
19,000	14	67	-62.3	38	5	67	-56.6	52	8	67	-64.5	57	6	66	-56.2	12	67	-57.1
20,000	12	56	-60.7	38	5	56	-56.6	52	6	57	-62.9	57	6	56	-55.5	11	57	-55.8
21,000	8	48	-58.9	38	5	48	-58.9	52	6	48	-58.9	57	6	48	-55.5	6	48	-54.2
22,000	8	48	-58.9	38	5	48	-58.9	52	6	48	-58.9	57	6	48	-55.5	6	48	-52.7

¹ Navy. ² Soundings made by U. S. Coast Guard Cutters *Champlain* and *Chelan* of International Ice Patrol. The observations at sea were made in an area extending from latitudes 40° to 43° N. and from longitudes 47° to 53° W. Humidity data will be published at a later date. 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—None of the means included in this table are based on less than 15 surface or 5 standard-level observations. Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels, also, the humidity data are not used in daily observations when the temperature is below -40° C.

TABLE 2.—Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (E. S. T.) during June 1939

[Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second (superior figures indicate number of observations)]

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)		Albuquerque, N. Mex. (1,554 m.)		Atlanta, Ga. (302 m.)		Billings, Mont. (1,095 m.)		Boise, Idaho (850 m.)		Brooklyn, N. Y. (15 m.)		Brownsville, Tex. (7 m.)		Buffalo, N. Y. (220 m.)		Burlington, Vt. (132 m.)		Charleston, S. C. (18 m.)		Cheyenne, Wyo. (1,873 m.)		Chicago, Ill. (192 m.)		Cincinnati, Ohio (167 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	154	4.0 ³⁰	230	3.3 ³⁰	253	1.0 ³⁰	5	1.9 ³⁰	297	2.8 ³⁰	154	1.3 ³⁰	148	6.5 ³⁰	232	2.3 ³⁰	233	1.0 ³⁰	173	3.0 ³⁰	277	2.1 ³⁰	221	2.2 ³⁰	211	1.2 ³⁰
500	158	5.6 ³⁰	237	2.1 ³⁰	240	1.2 ³⁰	7	1.5 ³⁰	300	4.1 ³⁰	222	3.2 ³⁰	151	8.0 ³⁰	235	4.2 ³⁰	246	2.0 ³⁰	182	5.5 ³⁰	221	4.3 ³⁰	221	4.3 ³⁰	223	2.9 ³⁰
1,000	168	5.5 ³⁰	243	2.5 ³⁰	237	2.1 ³⁰	7	1.5 ³⁰	297	4.1 ³⁰	274	5.5 ³⁰	158	7.1 ³⁰	247	5.4 ³⁰	252	3.5 ³⁰	191	4.4 ³⁰	229	4.3 ³⁰	226	4.0 ³⁰	244	5.0 ³⁰
1,500	183	5.3 ³⁰	235	3.7 ³⁰	242	3.3 ³⁰	262	1.3 ³⁰	302	3.3 ³⁰	285	5.9 ³⁰	164	5.4 ³⁰	270	6.6 ³⁰	247	3.9 ³⁰	211	3.7 ³⁰	239	4.2 ³⁰	240	4.2 ³⁰	244	5.0 ³⁰
2,000	201	3.6 ³⁰	243	3.9 ³⁰	239	3.9 ³⁰	249	4.2 ³⁰	286	3.6 ³⁰	303	9.2 ³⁰	156	5.1 ³⁰	288	9.7 ³⁰	309	7.1 ³⁰	253	3.0 ³⁰	279	2.7 ³⁰	258	6.3 ³⁰	260	6.3 ³⁰
2,500	223	2.8 ³⁰	246	5.4 ³⁰	253	4.4 ³⁰	254	6.7 ³⁰	269	5.3 ³⁰	301	9.9 ³⁰	148	3.8 ³⁰	286	9.9 ³⁰	322	8.1 ³⁰	259	3.2 ³⁰	263	4.9 ³⁰	250	4.4 ³⁰	257	6.8 ³⁰
3,000	301	3.1 ³⁰	253	8.7 ³⁰	257	4.7 ³⁰	254	9.6 ³⁰	262	9.7 ³⁰	300	11.9 ³⁰	145	3.8 ³⁰	302	13.3 ³⁰	273	3.2 ³⁰	273	3.2 ³⁰	258	7.2 ³⁰	269	7.0 ³⁰	269	7.0 ³⁰
4,000	309	3.1 ³⁰	259	10.2 ³⁰	251	5.5 ³⁰	262	13.0 ³⁰	253	12.8 ³⁰	319	12.5 ³⁰	145	3.8 ³⁰	289	12.2 ³⁰	276	2.3 ³⁰	276	2.3 ³⁰	264	12.4 ³⁰	278	6.0 ³⁰	278	6.0 ³⁰
5,000	290	4.5 ³⁰	260	11.6 ³⁰	255	5.1 ³⁰	261	14.4 ³⁰	261	14.4 ³⁰	319	12.5 ³⁰	145	3.8 ³⁰	289	12.2 ³⁰	276	2.3 ³⁰	276	2.3 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰
6,000	290	4.5 ³⁰	260	11.6 ³⁰	255	5.1 ³⁰	261	14.4 ³⁰	261	14.4 ³⁰	319	12.5 ³⁰	145	3.8 ³⁰	289	12.2 ³⁰	276	2.3 ³⁰	276	2.3 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰
8,000	289	4.1 ³⁰	263	16.9 ³⁰	276	5.4 ³⁰	261	14.4 ³⁰	261	14.4 ³⁰	319	12.5 ³⁰	145	3.8 ³⁰	289	12.2 ³⁰	276	2.3 ³⁰	276	2.3 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰
10,000	283	6.2 ³⁰	275	18.4 ³⁰	276	5.4 ³⁰	261	14.4 ³⁰	261	14.4 ³⁰	319	12.5 ³⁰	145	3.8 ³⁰	289	12.2 ³⁰	276	2.3 ³⁰	276	2.3 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰
12,000	283	6.2 ³⁰	275	18.4 ³⁰	276	5.4 ³⁰	261	14.4 ³⁰	261	14.4 ³⁰	319	12.5 ³⁰	145	3.8 ³⁰	289	12.2 ³⁰	276	2.3 ³⁰	276	2.3 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰	267	18.2 ³⁰

TABLE 4.—Mean altitudes and temperatures of significant points identifiable as tropopauses during June 1939, classified according to the potential temperatures (10-degree intervals between 310° and 409° A.) with which they are indentified (based on radiosonde observations)

Potential temperatures	Fargo, N. Dak.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Nebr.			Sault Ste. Marie, Mich.			St. Georges, Bermuda			Washington, D. C.		
	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.
310-319	3	8.9	-48.7				1	7.4	-35.0				1	8.7	-32.0	4	8.9	-46.5				1	8.7	-32.0
320-329	13	10.3	-52.0				3	9.1	-39.7				8	9.3	-43.0	1	11.1	-56.0				7	11.1	-50.6
330-339	13	12.7	-55.5	4	11.3	-51.5	12	10.6	-46.3	7	11.8	-56.7	10	10.4	-45.4	12	10.7	-50.3	11	12.7	-56.9	9	12.8	-63.1
340-349	9	12.3	-58.4	24	12.3	-54.4	21	12.3	-56.1	14	12.0	-53.6	15	12.3	-55.2	15	12.0	-55.3	16	12.9	-62.2	9	12.8	-63.1
350-359	3	13.8	-67.7	17	13.5	-61.0	15	13.5	-63.0	15	13.6	-63.1	10	13.2	-59.8	12	13.0	-58.8	13	13.9	-65.9	11	13.5	-62.6
360-369				10	14.5	-64.6	4	13.5	-55.8	8	15.0	-69.9	8	14.0	-59.9	2	13.6	-59.5	6	14.9	-69.3	4	14.4	-63.8
370-379				7	15.0	-64.3	4	14.5	-59.8	8	14.9	-63.8	5	14.5	-62.4	2	13.6	-53.5	5	17.7	-71.6	2	14.8	-63.0
380-389	1	13.9	-52.0	4	15.6	-67.2	4	15.5	-64.2	4	15.9	-67.0	5	15.5	-64.0	2	15.6	-65.5	1	16.0	-70.0			
390-399				6	16.5	-68.2	5	16.0	-65.0	3	16.1	-65.3	4	16.5	-67.8	2	15.4	-60.5	2	16.4	-69.0	3	16.5	-68.7
400-409				1	16.6	-62.0							1	17.1	-68.0						1	16.0	-65.0	
All (weighted means)		11.7	-55.3		13.6	-60.1		12.7	-56.2		13.6	-61.5		13.1	-56.8		11.7	-53.3		13.9	-63.9		13.2	-60.4
Mean potential temperature	334.5			354.8			347.8			352.7			350.9			332.4			366.5			354.8		

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

The report for June will be published in the July REVIEW.—*Editor.*

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL in Charge]

NORTH ATLANTIC OCEAN, JUNE 1939

By H. C. HUNTER

Atmospheric pressure.—Pressure during June averaged practically normal near the West Indies and the eastern coast of North America, but lower than normal over the central and northwestern portions of the North Atlantic, Bermuda having a deficiency of 0.06 inch. The southeastern portion showed a small excess, and the northeastern a large one, the average of Lerwick, Shetland Islands, being 0.15 inch greater than normal. However, over most of the eastern North Atlantic there was not so great an excess of pressure as during the preceding month.

Over the higher latitudes fluctuations of pressure were both rapid and wide for the time of year.

The extremes of pressure noted in available vessel reports were 30.70 and 29.38 inches. The high mark was recorded during the forenoon of the 21st, on an unidentified vessel near 55° N., 23° W. The low mark was noted within a very few miles of Cape Race, Newfoundland, early on the 1st, by the British liner *Caledonia*.

Table 1 shows that two far northern stations had lower pressure on the 14th than the *Caledonia's* extreme low, while on the 1st the Belle Isle station recorded a pressure of 28.64 inches.

Cyclones and gales.—There were about as many reports of gales along and near the chief routes to northwestern Europe as usual during June. There were several reports of strong gales (force 9), but none of winds of any greater energy. The northwestern portion of the much-traversed area furnished some strong-gale reports for the first week. The morning of the 1st found an intense low, which had come from the interior of Canada on an easterly course, centered near the northern tip of Newfoundland; thence it turned toward the north-northeast, so that its influence on transatlantic vessels did not last long. Later cyclones of somewhat less energy caused gales soon afterward in the vicinity of the Grand Banks.

TABLE 1.—Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, June 1939.

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	<i>Inches</i>	<i>Inch</i>	<i>Inches</i>		<i>Inches</i>	
Julianehaab, Greenland	29.82	-0.04	30.52	23	29.20	14
Reykjavik, Iceland	29.95	+0.07	30.71	21	29.26	14
Lerwick, Shetland Islands	29.95	+0.15	30.51	1	29.38	28
Valencia, Ireland	30.03	+0.03	30.42	9	29.50	28
Lisbon, Portugal	30.06	+0.03	30.37	9	29.89	12
Madaira	30.09	+0.02	30.21	7	29.94	25
Horta, Azores	30.20	-0.04	30.37	7	29.86	26
Belle Isle, Newfoundland	29.86	.00	30.36	26	28.64	1
Halifax, Nova Scotia	29.98	+0.01	30.28	3	29.56	6
Nantucket	29.99	+0.01	30.30	3	29.70	6
Hatteras	30.01	.00	30.21	27	29.52	23
Bermuda	30.07	-0.06	30.28	13	29.56	23
Turks Island	30.04	+0.01	30.12	16	29.91	23
Key West	30.00	+0.01	30.14	16	29.85	14
New Orleans	29.98	.00	30.19	21	29.77	14

¹ For 23 days.

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Near the fortieth parallel of latitude, about the 17th to 19th, rather stormy conditions prevailed between longitudes 65° and 35°, where such rough weather is seldom met during the early summer. A low of moderate energy, which had come from the Lake region, was central near northeastern Newfoundland on the 17th, with a trough extending far to the southward and southwestward, and this and the moderately high pressure in lower latitudes at the same time were the chief factors in causing the strong winds.

Tropical disturbance.—Elsewhere in this issue of the REVIEW is found an account of the disturbance which affected western Caribbean waters and the central and eastern parts of the Gulf of Mexico about the 12th to 16th. This low took in general a northward course and was never of great intensity.