METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JULY 1940

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

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The mean surface temperatures during July were above normal over a large part of the country. Mean temperatures below normal occurred in parts of Texas and Oklahoma, over the Gulf States, the South Central States and in a narrow strip of the Central Atlantic region. Nebraska and South Dakota, together with eastern North Dakota and northwestern Minnesota, had mean temperatures from 6° to 8° F. above normal for the month, while a small area in northeastern Texas recorded a mean temperature 4° below normal.

At the 1,500 m. level the direction of the resultant winds was south of the normal resultant direction (counterclockwise turning) over most of the country. At this level the opposite turning of the resultant wind, indicating the total mass transport of air from more northerly latitudes than usual during the month, was noted over a portion of the South Central States and the west Gulf States and at separate localities in the northwestern mountain region and along the upper Atlantic coast. The same shift in the direction of the resultant winds occurred at 3,000 meters. No well-defined tendencies were noted when the direction of the 5 p. m. (E. S. T.) resultant winds at the 5,000 m. level were compared with the corresponding 5 a. m. normals for the month.

The 5 a. m. resultant velocity for July at the 1,500 m. level was higher than normal along the Pacific coast, over the Southwest and over the West Central States and below normal over the rest of the country. At 3,000 meters the 5 a. m. resultant velocities for the month were below normal over most of the northern half of the country and were above normal to the southward. Except at scattered stations the 5 p. m. resultant velocities were higher than the corresponding 5 a. m. normals at the 5,000 m. level.

It is interesting to note that again in July most of the country which recorded above normal surface temperatures also showed resultant winds at the 1,500 m. level from directions more southerly than is normal for the month. This tendency is also shown clearly at the 3,000 m. level. In the 2 previous months this relation between the mean surface temperature and the direction of the resultant winds for the month was not in evidence at this higher level.

At the 1,500 m. level during July the directions of the resultant winds at 5 p. m. were in general considerably south of their direction at 5 a. m. (counterclockwise turning). At the 3,000 m. level the resultant winds shifted to the southward during the day over the northwestern and north-central parts of the country, but showed a shift to northward generally over the rest of the country.

At the 1,500 m. level the resultant velocity for the month of July was lower at 5 p. m. than at 5 a. m. over most of the country, this velocity having increased during the day only over the Great Lakes and over the Northwest. At the 3,000 m. level the same changes in resultant velocity were noted except that the increase in velocity extended over Montana and over the North Central States.

At the levels from 4,000 meters up to at least 17,000 meters the highest mean monthly pressures occurred over Phoenix, Ariz., and the lowest over Sault Ste. Marie, Mich. However, at the 6,000 m. level, Buffalo and Sault Ste. Marie both had the same mean monthly pressure, 483 mb. At the 1,000, 2,000, and 3,000 m. levels, Atlantic Station No. 2 had higher mean monthly pressure than any station in the United States. At the 1,000 m. level, for example, the mean pressure at Atlantic Station No. 2 was 914 mb., while the highest for the United States at this level was 910 mb., at Miami and at Norfolk, and the lowest was 901 mb. at Boise, Idaho. At Phoenix, Ariz., where the pressure was maximum at higher levels, a low mean pressure of 902 mb., was recorded at 1,000 meters and a relatively low pressure of 806 mb. at 2,000 meters. Mean pressures were in general lower for all upper levels at more northerly latitudes. At the 10,000 m. level, for example, mean pressures were 291 mb. at Phoenix, 273 mb. at Sault Ste. Marie, 270 mb. at Fairbanks, and 266 mb. at Juneau.

Mean monthly pressures were generally higher during July than during June at all levels from the surface to at least the 14,000 m. level. With only occasional isolated exceptions this was true over all of the United States, over Fairbanks and Juneau and over both Atlantic stations. This increase in mean pressure over that of the preceding month was considerable, amounting, for example, to an average of 7 mb. over the Great Lakes at the 1,000 m. level.

The greatest difference in mean pressure occurred at the 8,000, 9,000, and 10,000 m. levels, at each of which there was a difference of 18 mb. between the pressure at Phoenix and that at Sault Ste. Marie. The steepest mean pressure gradients during the month were found between Sault Ste. Marie and Washington, D. C., and between Sault Ste. Marie and Omaha. In the latter case there was an average difference of 13 mb. in pressure along the 9,000 m. level within a horizontal distance of about 700 miles.

At the levels below 10,000 meters the mean temperatures in July were higher than in June at Fairbanks and Juneau and at both Atlantic stations. This increase in temperature was also generally true over the United States except in the Great Lakes region and in part of the East Central States, where temperatures at these levels were somewhat lower than in June. At most of the levels above 10,000 meters the changes in mean temperature were well distributed. However, at the three levels, 15,000, 16,000, and 17,000 m., the mean temperature was lower than in June over the Rocky Mountain and Plateau region, the average temperature for these levels being about 4° C. lower at Albuquerque than in the preceding month.

At the 1,000 and 2,000 m. levels, lower mean temperatures were recorded over most of the country than were observed during the corresponding month in 1939. At these levels temperatures were warmer for July this year than last only at El Paso and at Miami, over the Northwest and extreme west and along the central Atlantic coast. Only Spokane and El Paso were warmer than last year at all of the next three higher levels, all other stations being in general cooler at these levels.

The altitude of the level of mean freezing temperature in July was higher in general over the western half of the country than over the eastern half. This level of 0° C. was lowest over Sault Ste. Marie, about 2,900 meters, and was highest over Phoenix, 5,300 m. The level of freezing rose rapidly to the southward over the eastern part of the country, being 3,900 m. at Joliet, 4,300 m. at Nashville, and 4,700 m. at Pensacola. Over most of the country the level of freezing was several hundred meters higher than

in June; however, the level of freezing was about 300 m. lower than in June over the eastern Great Lakes.

The lowest free-air temperature at standard levels in July was −76.9° C. (−106.4° F.) recorded at El Paso at the 17,000-meter level. Minimum temperatures lower than −70.0° C. (−94.0° F.) occurred in the free air during the month over all of the United States south of 35° N.; while all free-air minimum temperatures in the area north of 45°, except at Lakehurst, were higher than −69° C. (−92.2° F.). At Juneau, Alaska, the lowest temperature recorded in July was −58.4° C. (−73.1° F.) at 11,000 meters above sea level.

Table 3 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 65.2 meters per second (145.8 miles per hour) observed on July 4 at Washington, D. C. This high-velocity wind was blowing from the WSW at an altitude of 9,860 meters (over 6 miles) above sea level. This velocity, however, was 18.8 meters per second (42 miles per hour) lower than the extreme velocity observed in July 1939.

Tropopause data for July showing the mean altitude and temperature of the tropopause at various stations are shown in table 4 and on chart XIII.

MEAN MONTHLY ISENTROPIC CHART [1]

The dominant features on the mean monthly isentropic chart (Θ=314° A.) for July 1940, are the typical summertime anticyclonic eddy over the South Central States, and the moist tongue over the Gulf coast. Assuming that the chart, although based only on data for the first half of the month, was representative in its broad aspects of conditions for the entire month, the large excess of precipitation over the Gulf coast may be related to the moist tongue which prevailed there, and perhaps the deficiencies which lie southwest of the lakes were caused by the dry tongue associated with the anticyclonic eddy. The above normal precipitation in the northwest was probably not caused by motion in the 314° A. surface during the first half of July.

NOTE.—During the month of July radiosonde observations were made only during the first 13 days of the month at all Weather Bureau stations. Similar observations were made during the full month at the six Navy stations and at the two Atlantic stations. Data shown on tables 1 and 4, and data used in the above discussion of aerological observations, are based on all observations. Temperature and pressure data for the six Navy stations used in the preparation of all charts (VIII to XIII) have, however, been recomputed to include only the first 13 days of July.

[1] Prepared by the Research Division.

TABLE 1.—*Mean free-air barometric pressure (P.) in millibars, temperature (T.) in degrees Centigrade, and relative humidities (R. H.) in percent, obtained by airplanes and radiosondes during July 1940*

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Billings, Mont. (1,089 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Buffalo, N. Y. (220 m.)				Charleston, S. C. (14 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	13	842	23.0	43	12	984	19.8	88	14	893	21.6	51	13	959	18.6	64	13	915	22.8	37	12	994	14.0	87	13	1,018	22.2	91
500					12	962	19.7	83													12	962	15.4	70	13	963	21.2	73
1,000					12	908	18.2	76					13	906	21.5	48	13	901	25.7	33	12	906	12.8	69	13	909	19.3	68
1,500					12	856	16.1	75	14	852	20.7	49	13	855	18.1	49	13	852	24.8	28	12	853	9.3	73	13	857	16.8	63
2,000	13	806	22.3	40	12	807	13.3	77	14	803	18.3	47	13	806	14.5	54	13	803	21.4	27	12	803	6.1	78	13	808	14.4	66
2,500	13	760	18.8	39	12	760	10.2	78	14	758	15.0	49	13	759	11.5	56	13	758	17.2	28	12	755	3.1	71	13	762	11.6	75
3,000	13	717	15.2	42	11	716	7.3	79	14	714	11.4	53	13	715	8.5	54	13	714	13.3	29	12	710	0.9	60	13	717	8.3	74
4,000	13	636	7.3	51	10	634	1.8	80	14	633	3.9	60	13	633	2.2	54	13	634	5.6	36	12	626	−4.8	52	13	635	2.8	71
5,000	13	563	−0.7	60	10	559	−3.7	78	14	559	−3.7	67	13	558	−4.3	50	13	560	−2.8	43	12	551	−11.0	43	13	561	−2.6	67
6,000	13	496	−8.3	66	10	492	−9.5	76	14	491	−11.0	66	13	491	−10.4	42	13	493	−9.9	43	12	483	−17.6	33	13	494	−8.1	67
7,000	13	435	−14.8	64	10	432	−15.7	71	14	431	−18.0	63	13	431	−17.6	41	12	432	−16.9	40	12	422	−25.2	33	13	434	−14.1	67
8,000	13	381	−22.0	64	9	378	−22.7	73	14	376	−25.5	60	13	376	−25.2	43	12	377	−24.9	40	12	367	−32.5	31	13	379	−20.8	67
9,000	13	331	−29.4	62	9	329	−30.3	69	14	327	−33.6	58	13	326	−32.9	39	12	328	−33.1	39	12	318	−39.0	34	13	330	−28.4	67
10,000	13	288	−37.0	60	9	285	−38.4	64	14	283	−42.2		13	282	−41.2		12	284	−41.0		12	274	−44.5		13	286	−36.4	65
11,000	13	248	−44.6		9	246	−46.8		14	244	−50.8		13	243	−49.1		12	244	−49.2		12	236	−48.9		13	247	−44.8	
12,000	12	213	−52.3		9	211	−54.6		14	208	−58.3		12	208	−56.7		12	210	−56.3		12	202	−52.3		13	213	−53.0	
13,000	12	182	−58.7		10	180	−61.5		14	177	−61.7		12	177	−60.4		12	179	−60.3		12	173	−54.3		13	182	−60.5	
14,000	12	155	−63.3		11	153	−64.6		14	151	−61.8		11	151	−58.2		12	152	−59.4		12	148	−54.8		12	154	−64.9	
15,000	12	132	−66.8		11	130	−66.9		14	128	−61.5		11	129	−58.6		12	130	−60.0		11	126	−54.9		12	131	−66.7	
16,000	10	112	−68.7		11	110	−68.8		13	110	−62.2		11	110	−59.1		11	111	−60.8		9	108	−55.7		12	111	−68.7	
17,000	10	95	−68.3		11	93	−68.2		12	93	−62.4		10	94	−57.7		11	94	−59.9		7	92	−55.2		11	94	−67.8	
18,000	9	80	−64.9		9	79	−66.5		10	79	−60.7		8	80	−56.5		8	80	−58.0		5	79	−54.5		11	79	−65.5	
19,000	8	68	−61.3		7	67	−63.1		7	67	−57.8						6	68	−56.4		5	67	−53.1		9	67	−63.1	
20,000					5	57	−59.4		5	57	−55.8														7	58	−60.3	
21,000																									6	49	−58.5	

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Denver, Colo. (1,616 m.)				El Paso, Tex. (1,193 m.)				Ely, Nev. (1,908 m.)				Fairbanks, Alaska (153 m.)				Joliet, Ill. (178 m.)				Juneau, Alaska (49 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	13	843	18.2	66	13	884	26.7	33	13	812	17.9	34	13	993	21.3	45	13	999	15.8	77	13	1012	13.5	80
500													13	956	18.8	43	13	962	19.3	56	13	959	11.0	79
1,000													13	901	14.8	45	13	907	17.0	59	13	902	7.8	82
1,500					13	853	26.4	31					13	849	10.6	49	13	855	13.4	64	13	850	4.6	85
2,000	13	806	19.4	58	13	806	23.6	32	13	804	20.4	30	13	799	6.5	53	13	805	10.1	67	13	798	2.3	84
2,500	13	760	16.6	54	13	761	20.0	33	13	758	20.1	25	13	751	2.5	57	13	758	7.5	65	12	750	−0.6	85
3,000	13	716	13.2	54	13	718	16.2	37	13	715	16.4	25	13	706	−1.3	59	13	713	4.7	59	12	704	−3.4	84
4,000	13	635	6.1	60	13	637	8.1	43	13	635	8.0	31	13	622	−6.7	56	13	631	−0.4	50	12	620	−9.2	72
5,000	13	562	−1.2	67	13	564	0.1	54	13	561	−0.7	38	13	547	−12.6	50	13	556	−5.7	39	12	545	−15.6	64
6,000	13	494	−8.5	71	13	497	−6.3	51	13	494	−8.7	39	13	479	−18.9	47	13	488	−12.5	35	12	476	−22.7	61
7,000	13	434	−15.5	71	13	437	−12.7	47	13	434	−15.8	35	13	418	−26.2	47	13	428	−19.7	31	10	415	−30.5	60
8,000	12	380	−22.2	66	13	382	−19.2	45	13	380	−23.4	31	13	363	−33.9	46	13	373	−27.1	30	9	360	−38.1	
9,000	13	330	−29.8	65	13	333	−26.6	41	13	330	−31.5	30	13	314	−41.3		12	324	−35.0		9	311	−46.1	
10,000	13	287	−38.1		13	290	−34.5	38	13	286	−39.4		13	270	−47.8		11	280	−42.4		9	266	−53.4	
11,000	11	247	−46.4		13	250	−42.4		13	246	−47.3		13	232	−52.7		11	241	−49.5		9	228	−56.2	
12,000	11	212	−53.6		13	216	−50.3		13	211	−54.2		13	199	−53.2		10	206	−55.3		9	195	−52.5	
13,000	11	181	−58.6		13	184	−57.4		13	180	−58.7		13	171	−50.5		9	176	−59.0		9	167	−50.0	
14,000	10	154	−62.4		13	157	−62.8		13	154	−61.7		13	146	−48.9		9	150	−60.3		6	144	−50.2	
15,000	9	132	−64.4		12	133	−67.8		13	131	−62.8		13	125	−47.5		8	127	−59.4		5	123	−50.5	
16,000	9	112	−65.5		11	113	−70.8		13	111	−64.3		12	108	−46.7		7	108	−60.0					
17,000	9	95	−65.0		11	95	−70.6		11	94	−63.1		10	93	−46.0		7	92	−59.3					
18,000	9	81	−63.1		10	80	−67.7		9	80	−60.6		10	80	−45.4		5	78	−57.2					
19,000	7	69	−60.0		8	68	−64.6		5	68	−57.7		10	69	−44.8									
20,000													10	59	−44.1									
21,000													7	51	−43.6									

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure (P.) in millibars, temperature (T.) in degrees Centigrade, and relative humidities (R. H.) in percent, obtained by airplanes and radisondes during July 1940*—Continued

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Lakehurst, N. J.[1] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Minneapolis, Minn. (263 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1 2] (10 m.)				Oakland, Calif. (2 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	H. R.
Surface	31	1,012	18.2	93	13	969	22.6	33	13	1,019	25.4	89	13	989	18.7	71	13	997	20.4	85	27	1,019	22.5	86	13	1,015	15.8	79
500	31	960	20.5	68	13	958	22.5	34	13	968	24.1	83	13	961	19.5	58	13	961	19.5	80	27	964	22.9	67	13	958	18.0	71
1,000	31	906	17.7	62	13	904	20.2	35	13	910	21.1	77	13	907	17.2	57	13	907	17.9	77	27	910	20.0	63	13	905	22.0	35
1,500	31	854	14.5	62	13	853	16.9	40	13	859	18.6	68	12	855	13.3	63	13	855	15.4	78	27	858	16.5	63	13	854	20.8	26
2,000	31	805	11.6	58	13	804	13.9	45	13	809	15.9	64	12	805	9.8	65	13	806	12.9	75	27	809	13.4	56	13	805	18.1	24
2,500	30	757	8.8	52	13	757	11.8	47	13	763	13.1	59	12	758	6.6	61	13	759	10.4	73	27	762	10.8	50	13	759	14.5	23
3,000	30	713	6.1	47	13	713	9.2	45	13	718	10.2	54	12	713	4.2	53	13	715	7.7	73	27	717	7.8	48	13	715	11.2	22
4,000	29	630	1.0	42	13	631	2.7	44	13	637	4.6	51	12	630	−0.3	38	12	633	2.0	69	27	635	1.9	44	13	634	4.7	22
5,000	29	556	−4.6	42	13	557	−3.6	41	13	563	−1.9	54	12	556	−6.1	37	12	558	−3.5	63	25	560	−4.0	38	13	560	−2.2	22
6,000	29	489	−10.5	41	13	490	−10.4	36	13	496	−7.6	62	12	488	−12.7	37	12	492	−9.2	56					13	493	−8.8	21
7,000	29	429	−17.0	43	13	430	−17.5	34	13	435	−13.5	61	12	428	−19.6	35	12	432	−15.4	54					12	433	−16.4	20
8,000	29	375	−24.1	43	13	375	−25.4	34	13	381	−20.0	60	12	373	−27.5	31	12	378	−22.4	53					12	377	−24.7	20
9,000	29	326	−31.3	41	13	326	−33.6	35	13	332	−27.4	56	12	324	−35.2	32	12	328	−30.8	53					12	328	−32.7	21
10,000	29	283	−38.9		13	282	−41.7		13	288	−35.3	52	12	280	−42.7		12	285	−38.3						12	284	−40.7	
11,000	29	244	−46.2		13	242	−49.8		13	249	−43.6		12	241	−50.0		12	246	−46.9						12	245	−48.7	
12,000	28	210	−52.8		13	208	−57.2		13	214	−51.6		11	206	−56.0		12	211	−54.9						12	209	−55.6	
13,000	28	179	−58.1		13	177	−61.5		13	183	−58.9		11	176	−59.6		12	180	−60.2						12	179	−60.2	
14,000	28	153	−61.5		13	151	−60.3		13	156	−64.9		10	150	−58.3		11	153	−63.3						12	152	−61.7	
15,000	28	130	−63.2		12	129	−59.5		12	132	−68.7		10	127	−58.0		11	130	−64.7						12	130	−62.2	
16,000	28	111	−63.0		11	110	−60.0		12	112	−70.3		9	109	−58.0		10	110	−65.2						12	110	−63.1	
17,000	27	95	−61.5		11	93	−60.0		12	94	−70.2		9	92	−57.6		10	94	−64.6						12	94	−62.8	
18,000	24	81	−59.5		10	80	−59.4		10	80	−67.7		9	79	−57.2		8	79	−63.0						10	80	−61.7	
19,000	16	68	−57.2		10	68	−58.1		9	68	−64.7		6	67	−55.6		8	67	−60.9						8	68	−59.9	
20,000	8	57	−55.0						6	57	−61.5						5	57	−57.9						6	58	−57.7	

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pearl Harbor, T. H.[1 2] (6 m.)				Pensacola, Fla.[1] (24 m.)				Phoenix, Ariz. (339 m.)				St. Louis, Mo. (171 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	13	972	21.1	82	13	984	22.0	57	30	1,015	23.9	82	30	1,016	26.1	79	13	970	30.9	26	13	999	21.5	68
500	13	960	21.6	77	13	962	22.4	53	30	960	21.8	82	30	962	24.0	73	13	953	34.5	22	13	961	22.2	62
1,000	13	906	20.1	68	13	908	20.1	53	30	906	18.5	87	30	909	21.0	67	13	902	34.4	18	13	908	19.6	62
1,500	13	855	17.9	60	13	856	17.1	55	30	855	16.4	76	30	858	17.9	65	13	853	30.8	18	13	856	15.8	66
2,000	13	806	17.0	48	13	807	14.4	56	30	806	14.3	66	30	809	14.8	64	13	806	26.3	18	13	807	12.5	67
2,500	13	760	15.0	41	13	760	12.6	50	30	759	13.1	45	30	762	11.8	61	13	761	22.2	18	13	760	11.0	54
3,000	13	716	12.3	38	13	716	9.8	46	30	716	11.0	34	30	718	9.2	60	13	718	18.0	19	13	716	9.1	44
4,000	13	635	5.9	37	13	634	3.9	47	30	634	4.9	32	30	636	3.6	57	13	638	10.0	24	13	634	3.7	33
5,000	13	561	−1.2	42	13	560	−2.3	46					30	562	−1.9	46	13	565	2.5	25	13	560	−2.4	31
6,000	13	494	−8.7	48	12	493	−8.8	42					27	495	−7.3	41	13	498	−4.9	26	13	493	−9.4	31
7,000	13	434	−14.6	43	12	433	−15.6	40					25	434	−13.3	41	13	438	−11.8	26	13	433	−16.2	32
8,000	13	379	−22.3	41	12	378	−22.5	39					23	380	−20.0	51	13	384	−19.5	26	13	378	−23.5	31
9,000	13	330	−29.6	40	12	329	−29.9	38					23	330	−27.4	52	13	334	−27.6	25	13	328	−31.6	28
10,000	13	286	−37.7		11	285	−37.8						21	288	−35.0	46	13	291	−35.6	24	13	285	−39.4	
11,000	13	247	−45.2		11	246	−45.8						18	249	−43.0		13	251	−43.3		12	245	−47.0	
12,000	13	212	−52.2		11	212	−53.0						17	214	−51.0		13	216	−50.5		12	211	−54.0	
13,000	13	181	−57.9		11	181	−57.7						13	183	−58.2		13	185	−56.9		12	180	−57.7	
14,000	12	154	−63.0		11	154	−59.7						11	155	−64.7		13	158	−61.6		12	153	−60.2	
15,000	12	131	−65.3		11	131	−61.6						8	132	−68.3		12	134	−65.7		10	131	−61.4	
16,000	12	111	−66.9		10	112	−62.0						8	112	−70.4		12	114	−69.5		9	111	−61.9	
17,000	10	94	−67.0		10	95	−61.5						5	94	−71.0		12	96	−69.1		9	95	−61.2	
18,000	9	80	−66.3		9	81	−60.3										10	81	−65.7		9	80	−59.1	
19,000	8	68	−63.9		9	69	−58.9										8	69	−61.9		7	69	−57.2	
20,000	5	58	−60.8														7	59	−59.4		6	58	−55.0	
21,000																					6	50	−52.9	

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	San Antonio, Tex. (174 m.)				San Diego, Calif.[1] (19 m.)				Sault Ste. Marie, Mich. (221 m.)				Seattle, Wash.[1] (27 m.)				St. Thomas, V. I.[1 2] (8 m.)				Spokane, Wash. (598 m.)				Washington, D. C.[1] (7 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	13	996	24.5	80	30	1,011	18.5	83	13	994	11.9	86	20	1,013	17.5	73	30	1,018	28.0	79	11	944	22.2	34	30	1,017	20.4	85
500	13	960	24.1	76	30	957	19.0	62	13	962	15.4	65	20	958	15.7	67	30	963	23.0	95					30	961	20.4	66
1,000	13	905	21.8	76	30	903	21.6	34	13	906	13.4	59	20	904	13.0	66	30	910	19.7	90	11	902	24.3	30	30	906	18.1	62
1,500	13	855	18.8	76	20	852	22.4	24	13	854	9.7	62	20	851	10.0	67	30	858	16.4	85	11	852	20.7	28	30	855	15.0	63
2,000	13	806	16.0	70	30	804	20.0	24	13	803	6.0	66	20	801	7.7	64	30	809	14.9	72	11	803	16.5	29	30	805	12.0	60
2,500	13	760	13.7	61	30	759	16.6	24	13	755	2.5	69	20	754	5.0	60	30	762	13.1	58	11	757	12.7	31	30	758	9.5	54
3,000	13	716	11.6	50	30	716	13.5	24	13	710	−0.5	66	20	709	2.5	55	30	718	10.3	50	11	713	8.4	34	30	714	6.9	50
4,000	12	635	5.7	46	30	633	6.4	28	13	626	−5.6	54	20	626	−3.4	48	30	636	4.3	49	11	630	1.2	39	30	631	1.7	44
5,000	12	562	−1.2	47	30	560	−2.9	32	13	550	−11.3	48	19	550	−9.4	37					11	556	−5.7	38	30	557	−3.8	42
6,000	11	495	−6.8	43	28	493	−9.9	34	12	483	−17.6	50	17	483	−15.8	41					11	489	−12.4	38	27	490	−9.6	39
7,000	11	434	−13.3	37	28	433	−17.1	21	12	421	−25.0	47	16	422	−23.4	44					11	428	−19.3	40	27	430	−16.0	37
8,000	11	380	−20.3	35	28	379	−24.6		12	366	−33.0	44	15	368	−31.2	46					11	374	−26.8	41	18	376	−23.0	33
9,000	11	332	−27.6	35	28	330	−32.7		12	316	−41.0		15	319	−38.8	44					11	324	−34.6	40	18	328	−30.6	34
10,000	11	288	−35.5	34	28	286	−39.8		12	273	−47.5		12	276	−45.8						11	281	−42.7		17	284	−38.0	
11,000	11	249	−42.9		27	246	−46.9		12	234	−51.5		10	237	−51.9						11	242	−50.4		16	244	−45.9	
12,000	11	214	−49.7		26	212	−53.8		11	201	−54.8		7	203	−52.4						11	207	−56.4		12	210	−53.0	
13,000	11	184	−56.1		25	181	−59.9		11	171	−54.7		7	174	−50.1						11	176	−57.9		11	179	−59.1	
14,000	11	156	−61.9		25	154	−65.2		11	146	−54.0		6	150	−50.3						11	150	−55.7		7	153	−61.1	
15,000	11	133	−66.7		24	130	−69.6		10	125	−54.7		5	129	−51.2						10	128	−55.7		7	130	−63.5	
16,000	11	112	−68.6		21	110	−71.0		9	107	−55.8										10	110	−56.2		6	111	−63.4	
17,000	10	95	−69.1		18	94	−69.5		5	91	−54.9										9	94	−56.0		5	94	−61.8	
18,000	10	80	−65.9		16	80	−67.3														9	81	−55.3					
19,000	8	68	−63.7		12	68	−65.3														8	69	−53.9					
20,000	8	58	−60.5		7	56	−63.2																					

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure (P.) in millibars, temperature (T.) in degrees Centigrade, and relative humidities (R. H.) in percent, obtained by airplanes and radiosondes during July 1940*—Continued

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level: Atlantic Station No. 1[3] (5 m.)				Atlantic Station No. 2[4] (5 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	1,020	23.5	86	25	1,026	22.5	86
500	31	963	19.7	85	25	968	19.3	88
1,000	31	908	17.0	77	25	914	16.6	82
1,500	31	857	14.5	71	25	861	14.6	71
2,000	31	807	12.3	65	25	812	12.6	65
2,500	31	760	9.6	65	25	764	10.4	61
3,000	31	716	7.0	61	25	720	7.7	57
4,000	30	633	1.1	60	25	637	1.7	51
5,000	28	559	−4.2	56	25	562	−4.2	46
6,000	28	492	−9.8	51	25	494	−9.5	38
7,000	28	431	−16.1	48	24	434	−15.8	34
8,000	28	377	−23.4	47	24	379	−23.0	32
9,000	27	328	−30.5	47	23	330	−30.4	35
10,000	26	284	−37.9	47	23	286	−38.3	32
11,000	25	245	−45.0	----	20	247	−46.1	----
12,000	24	211	−52.0	----	19	212	−53.5	----
13,000	24	180	−57.2	----	18	181	−59.1	----
14,000	23	154	−60.5	----	16	154	−61.6	----
15,000	23	131	−61.2	----	16	131	−63.0	----
16,000	22	112	−61.3	----	15	112	−62.2	----
17,000	19	95	−60.7	----	13	94	−61.3	----
18,000	19	81	−59.0	----	10	80	−59.7	----
19,000	16	69	−57.4	----	7	69	−57.5	----
20,000	11	58	−56.0	----	5	58	−55.8	----
21,000	8	50	−54.5	----	----	----	----	----

NOTE.—All observations taken at 1 a. m., 75th meridian time, except those at Washington, D. C., Lakehurst, N. J., Norfolk, Va., and Pensacola, Fla., where they are taken before 5 a. m., 75th meridian time. At Pearl Harbor, T. H., observations are taken after sunrise.

None of the means included in this table are based on less 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 −40.0° C.

[1] U. S. Navy.
[2] Airplane observations.
[3] In or near the 5° square: Lat. 35°00′ N. to 40°00′ N. Long. 55°00′ W. to 60°00′ W.
[4] In or near the 5° square: Lat. 40°00′ N. to 45°00′ N. Long. 40°00′ W. to 45°00′ W.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during July 1940. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (870 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (18 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (157 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	173	3.3	31	238	2.5	31	68	0.5	31	84	1.4	31	163	1.3	31	321	3.6	31	129	5.8	30	247	3.4	31	220	0.8	30	153	1.5	31	209	0.3	31	162	1.0	31	32	1.6
500	----	----	----	----	----	----	31	76	.8	----	----	----	----	----	----	----	----	----	31	141	7.1	30	259	4.6	31	267	1.7	29	162	1.5	31	297	.4	31	233	.8	----	----	----
1,000	31	166	3.6	----	----	----	30	131	.9	----	----	----	31	120	1.6	31	324	4.2	30	152	5.8	30	266	5.3	31	281	3.1	28	268	.5	31	248	1.8	31	265	1.4	----	----	----
1,500	31	173	3.8	----	----	----	26	251	1.0	31	120	1.3	31	166	1.7	31	311	2.6	28	153	4.7	30	267	5.4	30	289	5.1	23	316	1.3	30	241	3.1	30	253	2.1	----	----	----
2,000	30	167	3.2	31	240	2.8	21	267	1.9	31	185	1.5	31	228	2.3	31	251	2.7	27	155	4.5	30	277	7.1	28	285	5.8	21	307	1.1	27	264	3.3	30	271	3.0	31	52	1.5
2,500	30	184	1.5	31	253	1.5	20	266	2.4	31	233	3.1	29	266	4.4	31	238	4.3	25	156	4.0	28	281	7.5	24	281	6.6	18	263	2.2	26	265	3.6	26	279	3.0	31	56	1.5
3,000	28	159	0.3	31	260	1.1	21	260	2.4	31	242	4.9	29	275	6.4	31	226	6.1	24	156	3.4	25	289	7.7	18	285	7.3	17	254	2.7	26	279	4.3	25	281	4.3	30	117	.9
4,000	28	356	1.3	30	353	2.0	19	252	2.6	27	247	8.8	24	278	9.2	30	226	8.7	22	140	3.0	22	298	10.4	13	292	6.6	12	264	3.9	21	307	6.4	18	297	3.6	28	270	1.8
5,000	26	5	3.2	26	349	3.7	14	271	3.7	24	250	12.6	21	280	12.2	30	227	11.3	19	110	2.8	20	298	12.1	----	----	----	----	----	----	19	316	9.0	16	306	4.6	25	281	4.0
6,000	26	17	2.5	23	329	2.6	13	258	3.1	24	252	15.2	17	283	15.4	28	229	13.6	16	104	2.4	16	301	11.7	----	----	----	----	----	----	13	308	9.3	13	302	6.7	17	273	3.8
8,000	22	28	3.1	19	308	4.7	11	250	1.7	17	246	18.3	12	275	18.9	26	234	17.4	12	127	1.1	10	304	10.4	----	----	----	----	----	----	11	309	12.8	----	----	----	10	268	7.9
10,000	22	31	3.9	15	246	2.8	10	225	3.6	10	238	22.8	----	----	----	21	227	22.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
12,000	20	38	3.0	10	352	5.3	----	----	----	----	----	----	----	----	----	12	227	30.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
14,000	11	4	1.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (766 m.)			Jacksonville, Fla. (14 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (79 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)			Minneapolis, Minn. (261 m.)			Mobile, Ala. (10 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	151	1.9	31	202	4.8	31	324	1.1	30	27	.2	29	56	0.7	30	132	1.8	31	155	4.3	31	143	0.8	31	313	3.3	31	109	3.1	31	165	1.2	31	186	2.4	30	287	0.5
500	----	----	----	----	----	----	----	----	----	30	270	0.4	----	----	----	30	152	1.9	----	----	----	31	155	1.6	31	315	3.6	31	115	4.3	31	176	1.8	31	209	4.2	30	243	.4
1,000	----	----	----	----	----	----	----	----	----	30	231	1.5	29	57	1.5	29	218	1.7	31	175	4.6	27	183	1.1	31	314	3.1	31	110	3.8	31	201	2.5	30	218	3.7	30	218	.7
1,500	31	161	2.1	----	----	----	31	326	1.2	29	259	2.2	29	92	.4	27	271	2.2	31	179	4.5	25	215	1.1	31	271	2.2	30	101	3.2	30	230	3.6	28	224	3.7	29	222	1.0
2,000	30	146	1.6	31	202	4.9	31	322	1.4	26	262	2.5	29	234	1.9	23	264	2.4	31	187	5.0	24	259	.7	30	223	4.0	30	96	2.5	27	244	5.4	24	251	2.8	26	260	.9
2,500	31	117	1.2	31	201	5.8	31	277	1.4	24	291	2.8	29	243	4.8	25	254	2.0	31	198	6.1	23	3	.8	29	205	5.9	30	98	1.8	22	258	6.8	21	253	3.0	23	249	2.1
3,000	29	109	1.0	31	205	5.3	31	256	2.2	25	285	3.4	27	257	7.6	22	260	2.1	31	206	7.0	23	358	1.4	28	214	7.6	29	121	1.6	19	268	7.1	19	257	4.0	22	258	2.9
4,000	28	64	1.7	31	201	6.6	30	252	5.1	20	293	3.2	19	257	11.7	21	265	2.9	31	213	6.8	18	1	2.5	27	223	9.7	27	118	1.7	14	297	9.9	15	257	3.6	18	281	3.0
5,000	23	63	2.3	29	210	6.8	26	241	6.3	18	302	4.3	15	254	14.4	18	242	3.7	31	210	6.9	13	357	1.0	27	225	12.2	23	116	2.4	12	292	11.6	11	208	2.5	13	304	1.6
6,000	14	80	1.5	26	224	9.8	21	242	5.9	16	299	3.7	----	----	----	13	245	2.7	29	217	8.0	----	----	----	25	227	15.1	22	121	1.5	10	283	12.6	----	----	----	----	----	----
8,000	11	83	2.6	24	228	13.3	----	----	----	15	264	4.4	----	----	----	11	71	1.6	28	214	10.0	----	----	----	21	231	18.9	12	135	2.4	----	----	----	----	----	----	----	----	----
10,000	----	----	----	21	230	18.4	----	----	----	12	250	5.8	----	----	----	----	----	----	27	223	14.8	----	----	----	16	232	23.6	11	123	3.4	----	----	----	----	----	----	----	----	----
12,000	----	----	----	16	235	20.4	----	----	----	12	278	4.3	----	----	----	----	----	----	24	230	18.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
14,000	----	----	----	16	228	17.7	----	----	----	10	327	4.4	----	----	----	----	----	----	24	229	15.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
16,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	20	223	7.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
18,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	11	176	4.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during July 1940. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second*—Continued

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (344 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	193	1.5	31	264	5.4	31	158	5.1	31	140	2.7	31	257	1.7	31	121	3.7	31	158	1.5
500	31	242	2.2	31	271	3.4	31	159	5.9	31	141	3.5	31	262	2.0				31	148	1.1
1,000	28	276	3.7	30	261	3.6	31	173	5.7	31	160	4.6	31	254	2.6	31	123	3.6	31	171	1.6
1,500	27	290	4.7	30	240	3.3	30	191	5.1	31	188	4.9	31	237	3.0	31	146	4.0	29	162	1.0
2,000	25	302	6.4	30	235	2.7	29	207	3.0	29	205	5.4	31	226	3.2	31	162	4.0	28	206	1.1
2,500	23	305	6.0	30	222	3.5	28	235	1.8	28	229	4.5	31	213	3.6	30	198	3.8	28	282	.8
3,000	18	307	5.7	30	224	4.3	27	307	.8	27	261	4.3	31	215	3.0	28	241	3.9	27	319	1.8
4,000	13	303	6.6	30	227	6.4	28	347	2.5	26	287	5.3	29	194	2.8	26	252	7.2	26	337	3.6
5,000	11	300	6.6	30	223	8.0	28	357	4.3	23	312	6.0	29	174	4.4	26	259	10.1	24	333	4.9
6,000				29	220	9.9	25	352	5.1	18	311	6.8	25	193	3.3	22	264	13.7	22	318	7.0
8,000				27	222	13.2	24	2	2.7	15	302	8.9	19	265	2.6	10	266	16.9	19	312	7.5
10,000				24	219	16.6	22	16	3.6	14	314	11.0	17	239	6.7				14	318	4.9
12,000				19	223	18.0	20	36	2.6	14	312	8.8	14	250	9.9						
14,000				17	228	18.6	15	283	3.0	13	313	8.3	11	267	6.7						
16,000				13	212	10.2				12	296	6.0									

Altitude (meters) m. s. l.	San Antonio, Tex. (183 m.)			San Diego, Calif. (15 m.)			Sault Ste. Marie, Mich. (230 m.)			Seattle, Wash. (14 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (10 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	124	2.6	31	294	3.8	31	287	2.9	31	233	1.9	31	212	2.6	30	234	1.2
500	31	131	3.6	31	296	3.4	31	285	4.9	31	233	2.0				30	269	1.8
1,000	31	135	3.5	31	270	1.4	31	273	5.4	28	225	2.8	31	223	3.5	30	287	2.6
1,500	31	148	3.3	30	273	2.4	30	285	5.4	27	215	3.4	30	224	3.6	30	294	3.4
2,000	30	162	2.6	30	259	3.2	28	292	5.2	26	212	4.0	30	222	4.3	30	297	4.3
2,500	29	153	2.1	29	243	3.6	27	292	6.1	23	202	4.7	28	217	5.0	29	299	5.3
3,000	27	133	.8	28	239	3.4	26	292	7.4	20	202	5.9	26	216	5.9	26	299	5.3
4,000	24	55	1.5	27	219	5.2	23	295	11.7	19	209	9.1	23	221	10.2	22	296	6.3
5,000	16	38	.9	26	196	6.2	20	307	12.8	16	216	11.1	21	222	11.7	18	289	5.6
6,000	13	33	1.3	26	209	5.4	18	307	13.4	12	225	15.4	18	232	14.1	17	275	6.3
8,000	10	25	2.7				13	317	15.5				15	230	15.8	11	280	9.9
10,000													11	234	17.0			
12,000																		
14,000																		
16,000																		

TABLE 3.—*Maximum free air wind velocities (m. p. s.), for different sections of the United States, based on pilot-balloon observations during July 1940*

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]	24.3	WSW	830	25	Buffalo, N. Y.	30.8	WNW	3,590	1	Columbus, Ohio	54.2	WSW	9,290	13	Caribou, Maine.
East-Central [2]	22.9	W	2,500	1	Norfolk, Va	35.3	WNW	4,110	1	Elkins, W. Va	65.2	WSW	9,860	4	Washington, D. C.
Southeast [3]	19.9	ESE	910	5	Atlanta, Ga	22.7	ENE	4,250	12	Tallahasee, Fla	43.0	SSW	10,150	18	Atlanta, Ga.
North-Central [4]	33.4	WSW	1,255	24	Minneapolis, Minn.	51.4	SW	4,600	6	Alpena, Mich	52.0	NW	7,680	1	Milwaukee, Wis.
Central [5]	31.4	WSW	1,690	25	Sioux City, Iowa	35.8	WNW	4,600	1	Chicago, Ill	44.8	WNW	9,760	2	Chicago, Ill.
South-Central [6]	27.8	SSE	1,190	17	Big Spring, Tex	23.3	SE	2,630	16	Amarillo, Tex	36.2	NE	10,540	18	Lake Charles, La.
Northwest [7]	32.4	WSW	2,350	5	Pocatello, Idaho	34.4	W	4,560	6	Pocatello, Idaho	52.5	WSW	9,460	27	Boise, Idaho.
West-Central [8]	36.7	SSW	2,277	12	Modena, Utah	61.8	WNW	3,330	6	Casper, Wyo	64.9	WSW	9,780	24	Redding, Calif.
Southwest [9]	27.2	E	1,850	12	Albuquerque, N. Mex.	28.3	SW	3,350	23	San Diego, Calif	53.3	SW	11,428	19	Las Vegas, Nev.

[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 extreme west Texas), 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.

TABLE 4.—*Mean altitudes and temperatures of significant points identifiable as tropopauses during July 1940, classified according to the potential temperatures (10° intervals between 290° and 409° A.) with which they are identified (based on radiosonde observtaions)*

Potential temperatures, °A.	Albuquerque, N. Mex.			Atlanta, Ga.			Billings, Mont.			Bismarck, N. Dak.		
	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.
290–299												
300–309												
310–319												
320–329	1	8.6	−31.1									
330–339	3	10.3	−42.0	5	11.2	−50.6	15	11.9	−58.7	12	11.2	−52.3
340–349	9	12.8	−60.4	13	12.9	−62.0	8	12.9	−63.8	12	12.7	−61.3
350–359	2	13.4	−63.0	2	13.4	−62.5	4	13.5	−63.0	2	13.3	−61.0
360–369	6	14.6	−67.0	4	14.4	−66.5	2	14.3	−65.0			
370–379	2	15.8	−70.5	2	15.2	−63.5						
380–389	1	16.2	−69.0	5	16.7	−69.8	4	15.6	−64.2	2	15.4	−61.0
390–399	4	16.7	−70.5	3	16.4	−68.3	2	16.2	−64.0	3	15.6	−59.7
400–409	1	17.0	−69.0	2	17.2	−70.0	1	16.4	−65.0	4	16.1	−59.5
Weighted means		13.8	−61.7		14.0	−63.4		13.2	−61.8		13.0	−57.9
Mean potential temperature °A. (weighted)	360.0			360.4			351.8			354.8		
No. days with observations	11			12			14			12		

Potential temperatures, °A.	Boise, Idaho			Buffalo, N. Y.			Charleston, S. 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.
290–299									
300–309									
310–319				4	8.3	−41.2			
320–329	2	9.9	−44.0	6	9.6	−46.0			
330–339	8	11.6	−55.8	8	11.1	−53.0			
340–349	12	12.7	−60.3	11	12.6	−58.4	12	12.7	−59.2
350–359	1	13.2	−61.0	4	12.8	−57.5	6	14.0	−65.8
360–369				1	13.6	−62.0	2	14.6	−67.0
370–379	1	14.6	−63.0				2	15.4	−68.5
380–389	2	15.4	−62.5	4	14.4	−55.8	4	16.0	−69.5
390–399	2	15.9	−63.0				5	16.5	−69.0
400–409	2	16.2	−61.5	4	15.7	−57.8	1	17.3	−70.0
Weighted means		12.9	−58.5		12.0	−53.6		14.4	−64.7
Mean potential temperature °A. (weighted)	351.6			347.7			361.2		
No. days with observations	12			13			12		

TABLE 4.—*Mean altitudes and temperatures of significant points indentifiable as tropopauses during July 1940, classified according to the potential temperatures (10° intervals between 290° and 409° A.) with which they are identified (based on radiosonde observations).*—Continued

Potential temperatures, °A.	Denver, Colo.			El Paso, Tex.			Ely, Nev.			Fairbanks, Alaska			Joliet, Ill.			Juneau, Alaska			Lakehurst, N. J.		
	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.
290-299																					
300-309																					
310-319										5	8.5	−42.6				6	8.8	−45.3	1	7.7	−32.0
320-329							1	9.9	−42.0	8	9.9	−49.4	2	9.6	−43.5	9	10.4	−55.7	3	9.7	−47.0
330-339	6	10.9	−48.5				11	10.9	−48.3	8	11.3	−56.4	7	11.3	−52.7	3	11.2	−58.0	10	11.2	−52.9
340-349	13	12.4	−57.1	10	12.4	−55.4	15	12.3	−57.2	4	12.0	−56.5	5	12.3	−57.4				17	12.1	−54.0
350-359	3	14.1	−66.7	5	14.0	−64.0	6	13.7	−63.7	1	13.5	−62.0	5	13.4	−62.4				9	13.6	−62.7
360-369	1	14.6	−64.0	5	14.9	−68.2													9	14.8	−67.4
370-379	2	15.2	−67.0	3	16.0	−72.0	2	14.8	−64.0				1	14.3	−61.0				3	14.6	−62.0
380-389	3	15.7	−65.7	5	16.5	−72.4	4	15.7	−66.0										4	15.4	−63.8
390-399	1	16.0	−64.0	2	16.7	−72.0	4	16.1	−65.2				1	15.5	−61.0				1	16.8	−68.0
400-409	1	16.6	−65.0	1	17.4	−72.0	3	16.6	−65.0				2	16.0	−60.0				2	15.8	−59.0
Weighted means		13.1	−58.6		14.5	−64.8		13.1	−57.8		10.5	−51.8		12.5	−56.4		10.0	−52.6		12.9	−57.9
Mean potential temperature °A. (weighted)	353.7			363.7			355.8			330.5			350.2			322.2			352.7		
Number days with observations	10			12			13			13			10			9			28		

Potential temperatures, °A.	Medford, Oreg.			Miami, Fla.			Minneapolis, Minn.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Nebr.		
	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.
290-299																					
300-309																					
310-319																					
320-329							3	9.1	−38.3				2	8.9	−35.5						
330-339	12	11.3	−53.5	3	11.4	−51.3	9	10.9	−50.4	3	12.0	−59.3	9	11.2	−51.2	4	10.7	−46.2	5	11.4	−53.8
340-349	16	12.6	−60.4	10	12.6	−57.6	9	12.6	−59.4	7	12.5	−58.7	11	12.4	−58.6	10	13.3	−59.2	8	12.3	−55.5
350-359	3	13.1	−61.0	9	14.0	−65.1	5	13.2	−60.4	4	13.5	−62.0	8	13.5	−62.8	7	14.0	−65.6	5	13.2	−59.0
360-369	1	14.0	−64.0	5	14.9	−68.4				2	14.2	−66.0	1	14.2	−62.0	8	14.4	−64.4	2	15.0	−68.0
370-379				3	15.7	−71.0				1	15.4	−66.0	2	14.8	−61.5	1	15.7	−71.0	1	15.1	−62.0
380-389				5	16.5	−73.4				3	15.3	−64.0	3	15.6	−65.0	4	15.9	−67.8	1	15.4	−62.0
390-399	1	16.0	−64.0	2	16.6	−70.0	1	15.3	−61.0	2	16.3	−67.5	2	15.2	−64.0	1	17.2	−73.0	3	16.0	−63.0
400-409	1	16.3	−62.0	1	17.0	−66.0	1	15.9	−60.0	2	17.2	−67.5				1	16.6	−65.0	2	16.6	−62.0
Weighted means		12.5	−58.3		14.4	−64.3		12.0	−54.5		13.9	−62.4		12.7	−57.6		13.6	−60.3		13.5	−58.6
Mean potential temperature °A (weighted)	345.3			361.1			344.6			361.2			351.1			357.5			359.4		
Number days with observations	13			12			11			11			12			13			11		

Potential temperatures, °A.	Phoenix, Ariz.			Portland, Maine			St. Louis, Mo.			San Antonio, Tex.			San Diego, Calif.			Sault Ste. Marie, Mich.			Seattle, Wash.		
	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.
290-299																					
300-309																					
310-319				4	9.0	−48.8										3	9.4	−50.3			
320-329				6	9.9	−47.5	1	9.8	−43.0				4	10.2	−47.0	5	10.1	−51.0	4	9.4	−44.0
330-339	3	10.4	−39.7	10	11.5	−56.2	9	10.6	−45.6	5	10.2	−39.8	7	10.1	−38.4	8	11.5	−57.4	7	11.0	−52.9
340-349	14	12.1	−51.9	4	12.7	−63.0	10	12.3	−55.0	11	11.4	−46.5	13	12.3	−55.2	3	12.7	−60.7	3	11.9	−53.7
350-359	6	13.5	−59.5	1	13.5	−65.0	5	13.4	−60.0	6	13.4	−58.7	7	13.2	−58.7	1	13.6	−61.0			
360-369	4	14.4	−64.2				3	13.9	−61.7	8	14.8	−67.2	8	14.9	−68.9						
370-379	3	15.3	−67.3				2	15.0	−64.0	8	15.5	−68.8	6	15.6	−69.5						
380-389	11	16.3	−70.7	1	14.2	−56.0	2	15.0	−60.0	4	16.3	−70.8	5	15.9	−69.2	1	15.1	−60.0			
390-399	1	16.9	−72.0	4	15.1	−57.0	2	16.2	−64.5	2	16.8	−68.5	3	16.5	−68.7						
400-409				1	16.0	−59.0	1	16.7	−63.0	2	17.2	−68.5				1	15.5	−57.0			
Weighted means		13.9	−59.8		11.8	−54.9		12.7	−55.1		13.7	−58.8		13.3	−58.6		11.5	−55.7		10.7	−50.5
Mean potential temperature °A. (weighted)	361.2			344.2			353.7			361.8			356.2			337.8			333.4		
No days with observations	12			12			12			11			23			12			8		

Potential temperatures °A.	Spokane, Wash.			Washington, D. C.			Atlantic Station No. 1[1]			Atlantic Station No. 2[2]		
	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.
290-299												
300-309												
310-319							1	8.2	−37.0			
320-329	1	9.7	−45.0							1	9.8	−41.0
330-339	11	11.1	−51.5	3	11.3	−53.3	10	10.8	−48.4	7	11.3	−52.0
340-349	12	12.4	−59.0	5	12.6	−58.4	18	12.5	−57.9	13	12.5	−57.0
350-359	1	13.0	−60.0	3	13.4	−61.0	10	13.6	−61.5	11	13.6	−62.0
360-369				1	14.6	−64.0	3	14.2	−60.7	6	14.6	−66.2
370-379							2	14.6	−58.5	3	15.2	−65.7
380-389				2	15.7	−65.5	2	14.6	−56.0	2	15.9	−68.5
390-399	1	15.1	−57.0				2	16.0	−63.0	3	16.0	−66.0
400-409	3	15.8	−57.7				2	16.6	−64.5			
Weighted means		12.3	−55.5		13.1	−59.3		12.9	−56.9		13.4	−59.9
Mean potential temperature °A, (weighted)	347.7			352.0			352.8			354.7		
No days with observations	11			8			21			18		

[1] In or near the 5° square: Lat. 35°00′ N. to 40°00′ N. Long. 55°00′ W. to 60°00′ W.

[2] In or near the 5° square: Lat. 40°00′ N. to 45°00′ N. Long. 40°00′ W. to 45°00′ W.