POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1940	*h m*		°	°	°	°				
Jan. 28	11 10	6741	−64	111	+12	66	630	10	G	U. S. Naval.
		6741	−47	128	+11	50	776	12		
		6740	+33	208	−7	33	97	10		
				(175)	(−6)		1503	32		
Jan. 29	11 14	6741	−49	113	+12	52	630	10	G	Do.
		6741	−32	130	+11	36	776	17		
		6740	+47	209	−7	47	97	10		
				(162)	(−6)		1503	37		
Jan. 30	14 50	6742	−76	71	+7	76	388	2	P	Do.
		6743	−75	72	−24	76	97	1		
		6741	−34	113	+12	38	533	6		
		6741	−18	129	+11	25	679	7		
		6740	+61	208	−7	61	48	1		
				(147)	(−6)		1745	17		
Jan. 31	13 10	(*)	−73	62	−8	73	12	1	VG	Do.
		6743	−68	67	−23	68	12	1		
		6742	−62	73	−7	62	242	2		
		6743	−61	74	−24	63	121	1		
		6741	−21	114	+12	27	533	15		
		6741	−5	130	+11	17	679	8		
				(135)	(−6)		1599	28		

Mean daily area for 27 days=1023.

*=not numbered VG=very good; G=good; F=fair; P=poor.

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR JANUARY 1940

[Dependent alone on observations at Zurich]

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

January 1940	Relative numbers	January 1940	Relative numbers	January 1940	Relative numbers
1	*Ec* 39	11	*Ec* 50	21	*a* 71
2	37	12	29	22	* 75
3	42	13	34	23	52
4	--	14	61	24	34
5	*b* --	15	**Ec* 33	25	*d* --
6	* 55	16	*a* 61	26	* 54
7	--	17	--	27	--------
8	38	18	64	28	--------
9	*Mc* --	19	59	29	--------
10	41	20	*Mac* 88	30	--------

Mean, 20 days =50.9.

* Observed at Chur.
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 lowest mean free-air pressures for January prevailed over northeastern Canada (Newfoundland Airport, 48°58′ N., 54°35′ W.), Sault Ste. Marie, Mich., and Fairbanks, Alaska, at all levels (charts VIII, IX, X, and XI). Highest mean pressure occurred in the South, being centered over Miami, Fla. However, at 5,000 feet (chart VIII), pressure was slightly highest over the Rocky Mountain region (southern Colorado). During the current month the Alaskan mean pressures were higher than those recorded in any preceding month. Also, the Fairbanks, Alaska, pressures, which heretofore have been lower than those observed at Sault Ste. Marie, Mich., were higher during January.

The pressure gradient between the regions of high and low pressures (Miami, Fla., and Sault Ste. Marie, Mich., respectively) increased steadily with altitude up to 8 kilometers, and then slowly diminished. This gradient showed a mean difference of 9, 18, 27, 35, 39, 35, 29, and 20 millibars at 0.5, 1.5, 3, 5, 8, 10, 12, and 14 kilometers, respectively.

The persistence of outstanding low-surface temperatures during January was reflected by the minimum mean free-air temperatures (° C.) recorded by radiosondes and airplanes. Lowest mean temperatures occurred over Sault Ste. Marie, Mich., in all levels up to 9 kilometers; then over Bismarck, N. Dak., at 10 kilometers; Boise, Idaho, and Oklahoma City, Okla., at 11 kilometers; Medford, Oreg., at 12 kilometers; and Miami, Fla., at 14, 15, 16, 17, 18, and 19 kilometers. A low mean temperature of −74.2° C. was noted over Miami, Fla., at 17 kilometers. Highest mean temperatures occurred also over Miami, Fla., in all lower levels up to 11 kilometers; then over Joliet, Ill., at 12, 13, 14, and 15 kilometers; and over Nashville, Tenn., at 16 and 17 kilometers. Alaskan mean temperatures were warmer than those recorded at several stations within the United States proper. Up to 9 kilometers, Sault Ste. Marie., Mich., averaged about 4° C. colder than Fairbanks, Alaska, at all levels.

Mean temperatures were colder than those occurring in all previous months of record, even at those stations with 18 months of radiosonde observations. This condition persisted up to 11 kilometers, but above that level January was generally warmer than most previous months. Comparing January with the corresponding month of 1939 at those stations having a complete year of radiosonde observations, it was found that the current month was colder over all portions of the country except the western slope of the Rockies. The greatest tendency toward lower 1940 temperatures occurred over the northern and eastern portions of the United States during January.

Individual minimum temperatures were lowest over the far South and West, with the extremes occurring at Miami, Fla. (−78.0° C.), El Paso, Texas (−76.1° C.), Phoenix, Ariz. (−75.0° C.), San Diego, Calif. (−72.0° C.), and Medford, Oreg. (−72.0° C.). However, these individual temperatures were generally warmer than extreme minimum temperatures recorded during previous months at altitudes ranging from 16 to 18 kilometers.

The levels of mean freezing temperatures (0° C.) in the free air ranged from a surface line reaching from North Carolina, Alabama, Oklahoma, Arizona, Nevada, and Washington, to altitudes of 3,710 meters over Miami,

Fla.; 2,950 meters over San Antonio, Texas; 2,100 meters over Albuquerque, N. Mex.; 2,940 meters over Phoenix, Ariz.; and 2,190 meters over Medford, Oreg.

Resultant-wind directions were predominantly northwesterly over the northern and eastern portions of the country, except in Florida. This flow of air, appearing during a month of abnormal cold, showed directions to be decidedly more northerly than in the same month of 1939. A similar situation existed at 5 and 10 kilometers (charts X and XI), and intermediate levels as shown in table 2, where the observations are based on 5 p. m. observations.

The resultant velocities were high in the East at 1.5 kilometers (chart VIII), and in the Southwest at 3 and 5 kilometers (charts IX and X, respectively). Outstanding resultant velocities of 31.0, 47.8, and 51.7 meters per second, at 5, 8, and 10 kilometers, respectively, occurred over Greensboro, N. C. Except for the South, the current velocities were generally lower than in January 1939.

Also, diurnal variations in direction at 1.5 and 3 kilometers (charts VIII and IX, and table 2) indicated that the 5 p. m. winds were more northerly than the early morning winds over all of the country except the far West at 1.5 kilometers, and over all but the south-central portion at 3 kilometers. Afternoon velocities were higher than at 5 a. m. in the extreme North and South at both levels.

At 1.5 and 3 kilometers the January 5 a. m. wind directions departed from the established normals at a number of well-located stations by clockwise rotations over the entire United States, with the exception of the far Northwest, where current departures backed away from normal in counterclockwise rotations. The wind velocities were greater than normal in all sections except the Northeast at 1.5 kilometers, and less than normal everywhere but the far South, at 3 kilometers.

Table 3 shows individual maximum wind velocities for January. These were not particularly outstanding, although somewhat greater than usual. The velocity of 86 meters per second recorded over Atlanta, Ga., at 9,990 meters, was the greatest to occur in the Southeast in the upper air, and has been exceeded but four times elsewhere during the past several years.

MEAN MONTHLY ISENTROPIC CHART [1]

In the mean isentropic chart, $\theta=296°$, for January 1940 (chart XII), strong west and northwest winds extend over most of the United States with no indication of an anticyclonic eddy. Judging from the light easterly wind at Merida, Yucatan, a weak anticyclonic eddy probably exists over the southern portion of the Gulf of Mexico; and in the Far West there exists a distinct anticyclonic ridge as shown both by winds and moisture.

Precipitation amounts were mostly subnormal over the central and eastern parts of the country, probably a consequence of the almost continuous regime of polar air over these regions and the blocking of moisture transport from the Gulf of Mexico. The interesting contrast on the west coast of precipitation deficit in the North Pacific States and excess in California apparently cannot be explained by the pattern shown on the chart.

[1] Prepared by Division of Research and Education.

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

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																											
	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Billings, Mont. (1,089 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (824 m.)				Buffalo, N. Y. (220 m.)				Charleston, S. C. (14 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	31	838	0.8	62	31	985	−3.1	73	31	894	−10.1	84	31	962	−18.7	88	31	919	−0.2	87	29	989	−8.5	85	31	1,018	0.4	78
500					31	960	−3.3	72													29	954	−9.3	80	31	959	2.1	65
1,000					31	902	−2.0	69					31	901	−13.0	85	31	904	0.1	85	29	894	−12.0	83	31	901	0.6	62
1,500					31	847	−1.9	59	31	848	−5.7	80	31	844	−11.2	82	31	850	−1.1	81	29	837	−13.8	81	31	846	−0.4	57
2,000	31	800	0.5	59	31	795	−3.2	56	31	795	−6.8	77	31	790	−11.4	80	31	798	−2.9	81	29	783	−15.7	79	31	795	−1.5	51
2,500	31	751	−2.0	60	31	746	−4.9	56	31	746	−8.9	76	31	741	−12.9	77	31	749	−5.0	80	29	733	−17.1	75	31	747	−3.3	49
3,000	31	705	−4.4	60	31	700	−6.8	57	31	699	−11.8	78	31	693	−15.3	77	31	702	−7.5	79	29	685	−18.9	71	31	701	−5.5	48
4,000	31	620	−9.2	55	31	615	−11.3	53	31	612	−17.1	75	31	606	−20.8	76	31	617	−13.2	72	29	598	−24.4	68	31	616	−10.2	46
5,000	31	545	−15.4	49	31	539	−17.0	50	31	535	−23.2	74	31	529	−27.4	75	30	540	−19.6	68	29	521	−30.7	67	31	540	−16.1	44
6,000	31	476	−22.4	43	30	471	−23.6	48	30	466	−30.0	73	31	460	−34.1	75	30	472	−26.7	66	29	452	−37.5	65	31	472	−22.4	44
7,000	31	415	−29.7	39	30	410	−31.0	47	30	404	−37.0	69	31	398	−41.2	76	29	410	−34.3	63	29	390	−43.9	64	30	412	−29.4	43
8,000	31	359	−38.1	39	30	355	−38.7	46	29	349	−44.3		28	342	−48.4		28	354	−41.5	63	29	335	−49.1		30	357	−36.9	41
9,000	30	310	−45.9		29	306	−46.5		29	300	−51.3		24	293	−54.7		28	305	−49.2		28	288	−52.7		29	308	−44.3	
10,000	29	266	−53.0		29	263	−52.1		29	256	−57.1		22	250	−59.0		26	261	−56.2		26	246	−54.3		28	264	−50.2	
11,000	26	227	−58.7		29	225	−56.0		27	219	−59.3		19	213	−58.7		24	223	−60.2		25	211	−54.4		25	227	−54.5	
12,000	26	194	−58.9		29	192	−57.4		27	186	−58.3		17	182	−56.8		23	190	−60.1		24	180	−54.1		23	194	−56.5	
13,000	24	165	−58.9		27	164	−58.8		27	159	−57.6		9	155	−55.9		18	162	−59.1		21	154	−54.6		18	165	−58.9	
14,000	24	141	−60.7		26	140	−60.8		24	136	−58.0		9	132	−55.9		17	138	−59.2		17	131	−55.3		15	140	−61.5	
15,000	23	120	−63.4		23	119	−63.1		17	115	−58.9						12	118	−61.3		12	112	−56.3		10	118	−63.9	
16,000	16	102	−65.6		20	101	−64.3		15	98	−59.6						9	100	−62.6						9	100	−64.9	
17,000	9	86	−66.7		11	86	−64.3		6	83	−60.0						6	85	−63.0									
18,000					5	73	−63.0																					

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

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Dayton, Ohio[1] (150 m.)				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 observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	22	990	−9.0	77	31	837	−8.1	78	31	884	2.4	65	31	810	−5.3	88	30	993	−15.8	72	31	998	−11.3	87	31	1,008	0.5	73
500	22	958	−10.2	82													30	950	−11.4	74	31	956	−11.9	88	31	953	−1.3	72
1,000	22	897	−11.9	84													30	890	−10.2	72	31	896	−11.7	85	31	895	−3.3	73
1,500	22	841	−12.4	78					31	852	5.3	59					30	834	−9.2	71	31	839	−10.8	78	31	839	−5.0	75
2,000	22	788	−13.2	77	31	797	−3.7	72	31	801	3.6	54	31	800	−3.6	83	30	782	−10.4	72	31	786	−12.0	75	30	787	−6.8	78
2,500	21	737	−14.2	78	31	748	−5.5	67	31	753	1.8	52	31	752	−3.1	76	30	732	−12.9	69	31	736	−13.7	72	30	738	−8.8	80
3,000	19	690	−15.6	76	31	702	−7.4	66	31	707	−0.9	52	31	705	−5.4	74	30	685	−15.9	68	31	689	−15.8	69	30	692	−11.2	81
4,000	16	603	−20.5	75	31	616	−13.0	68	31	623	−6.9	45	31	620	−10.8	68	30	599	−22.3	68	31	603	−21.3	65	28	607	−16.5	76
5,000	12	526	−26.5	76	31	540	−18.7	69	31	548	−13.2	42	31	544	−17.3	65	30	522	−28.9	66	31	526	−27.3	63	28	530	−23.3	75
6,000	9	457	−33.0	77	31	471	−25.7	67	31	480	−19.9	39	31	475	−24.1	62	29	453	−36.2	64	28	457	−34.1	60	26	462	−30.6	74
7,000					30	409	−33.0	65	31	418	−27.3	38	31	413	−31.7	59	28	391	−43.1	63	28	395	−41.2	56	22	400	−37.9	72
8,000					30	355	−40.8	65	31	363	−35.0	37	31	358	−39.4	58	27	337	−49.8		27	341	−47.2		20	345	−45.3	
9,000					30	305	−48.8		31	314	−43.1		30	309	−47.2		27	288	−55.6		24	292	−52.3		18	296	−52.4	
10,000					28	262	−54.8		31	270	−50.6		29	265	−54.1		27	246	−58.7		22	250	−54.8		17	253	−58.0	
11,000					27	224	−58.6		29	231	−56.8		29	227	−59.5		25	210	−58.3		16	214	−54.8		12	216	−57.9	
12,000					25	191	−58.6		29	197	−59.4		29	193	−59.4		21	179	−57.1		15	182	−53.9		10	184	−55.6	
13,000					23	163	−57.6		27	168	−60.5		28	164	−58.2		17	152	−56.6		13	156	−53.6		10	158	−55.2	
14,000					18	139	−57.4		25	143	−62.8		28	140	−59.3		15	130	−56.7		11	133	−54.3		8	135	−55.7	
15,000					14	119	−59.1		23	121	−65.9		26	119	−61.6		10	111	−57.3		7	114	−55.5		7	115	−56.4	
16,000					9	101	−60.4		20	103	−68.2		24	102	−63.1		8	94	−58.4						5	98	−57.3	
17,000					5	86	−61.6		13	87	−69.4		16	87	−63.8		8	79	−58.4									
18,000													8	73	−62.0		5	68	−58.4									

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Lakehurst, N. J.[2] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Minneapolis, Minn. (263 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[3] (10 m.)				Oakland, Calif. (2 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	29	1,012	−7.6	73	28	968	4.6	86	31	1,019	12.3	88	31	989	−14.6	84	31	1,000	−5.3	77	19	1,020	−3.7	64	31	1,017	9.8	82
500	29	953	−8.1	73	28	957	4.8	81	31	961	13.5	74	31	958	−14.0	85	31	960	−5.9	80	19	958	−5.7	60	31	958	9.9	78
1,000	29	894	−9.8	72	28	900	5.7	64	31	905	11.3	70	31	898	−12.6	79	31	900	−7.0	80	19	898	−7.0	57	31	902	8.5	71
1,500	29	837	−10.9	74	28	847	4.1	58	31	853	9.5	60	31	841	−12.6	75	31	845	−6.7	76	19	842	−7.5	52	31	850	5.9	67
2,000	29	785	−11.9	72	28	796	1.1	56	31	803	8.0	53	31	787	−13.3	70	31	792	−7.1	74	19	790	−8.9	49	31	799	3.7	60
2,500	29	735	−13.6	70	28	748	−1.9	54	31	755	6.5	46	31	737	−14.8	68	31	743	−8.3	70	19	741	−10.2	47	31	751	0.9	58
3,000	29	688	−15.4	68	28	702	−4.8	55	31	710	3.8	45	31	690	−17.3	67	30	696	−10.3	65	19	694	−12.2	47	31	705	−2.0	55
4,000	29	602	−20.4	60	27	617	−11.0	53	31	628	−1.6	43	31	602	−22.7	64	29	611	−14.6	62	19	608	−17.4	47	31	621	−8.1	50
5,000	25	524	−26.7	60	27	541	−17.4	51	31	553	−7.0	40	31	525	−29.1	61	29	534	−20.0	58	13	532	−23.9	48	31	545	−14.5	50
6,000	25	456	−33.3	63	27	473	−25.0	50	30	485	−13.5	37	31	456	−35.9	59	29	466	−26.7	55					31	477	−21.4	48
7,000	25	395	−39.7	69	26	411	−32.0	50	30	425	−20.4	36	29	394	−43.1	59	28	405	−33.0	51					31	416	−28.5	47
8,000	25	341	−45.2		26	356	−39.8		30	371	−27.2	36	28	339	−48.9		28	350	−39.8	50					31	361	−36.5	47
9,000	24	294	−50.0		24	306	−47.4		30	322	−34.6	35	27	290	−53.6		27	302	−46.5						31	311	−36.5	
10,000	23	252	−53.3		23	262	−53.9		30	278	−42.2		26	248	−56.3		25	259	−51.9						31	268	−44.6	
11,000	22	216	−55.1		21	224	−59.0		30	240	−49.2		25	212	−56.3		19	222	−54.3						30	229	−52.2	
12,000	20	184	−55.0		20	191	−61.4		30	205	−55.3		24	181	−55.5		18	190	−54.5						30	195	−57.9	
13,000	18	158	−55.7		19	163	−60.4		29	175	−60.7		22	155	−55.3		17	163	−55.0						30	166	−59.8	
14,000	17	135	−56.1		16	139	−60.2		28	149	−65.0		19	132	−55.8		15	139	−55.8						29	142	−59.7	
15,000	17	115	−56.6		13	118	−61.4		27	126	−68.7		13	113	−56.5		10	118	−56.4						27	120	−60.2	
16,000	9	98	−58.9		10	101	−62.4		26	106	−71.9						8	101	−56.6						26	102	−61.7	
17,000	8	83	−59.5		7	86	−62.3		24	90	−74.2						5	86	−56.3						20	87	−63.5	
18,000									21	76	−74.1														11	74	−64.5	
19,000									8	63	−71.0														5	62	−64.1	

See footnotes at end of table.

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

Altitude (meters) m. s. l.	Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pearl Harbor, T. H.[3] (6 m.)				Pensacola, Fla.[3] (24 m.)				Phoenix, Ariz. (339 m.)				St. Louis, Mo. (171 m.)				San Antonio, Tex. (174 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	30	978	−6.0	80	31	988	−14.9	81	31	1,011	19.3	89	28	1,021	3.1	70	31	977	9.3	56	31	1,002	−10.2	83	31	1,003	4.0	71
500	30	963	−5.9	79	31	962	−13.5	81	31	955	19.1	74	28	962	2.8	61	31	959	13.1	57	31	960	−11.8	85	31	964	5.4	67
1,000	30	904	−4.7	70	31	901	−10.6	74	31	901	15.1	79	28	905	3.6	49	31	903	11.8	55	31	899	−10.8	84	31	906	4.2	61
1,500	30	849	−3.6	62	31	845	−8.5	66	31	850	13.4	66	28	851	3.1	44	31	850	8.6	54	31	843	−9.6	79	31	852	3.7	58
2,000	30	796	−3.6	60	31	791	−9.3	62	31	800	11.4	53	28	800	2.1	42	31	800	5.4	56	31	790	−9.9	74	31	801	3.2	57
2,500	30	747	−5.0	58	31	742	−11.2	61	31	754	9.9	38	28	751	0.7	38	31	753	2.6	55	31	740	−11.6	70	31	753	2.0	55
3,000	30	701	−6.9	56	31	695	−13.6	60	31	710	7.3	29	28	705	−1.3	37	31	707	−0.3	54	31	693	−13.9	67	31	707	−0.2	51
4,000	28	616	−11.8	51	31	608	−18.5	60	31	627	1.4	24	28	622	−5.8	31	31	624	−6.3	49	31	607	−18.8	64	31	624	−5.3	48
5,000	28	540	−17.4	48	31	532	−24.5	59					28	547	−11.4	31	31	548	−12.9	45	31	530	−24.8	61	31	549	−11.6	46
6,000	28	472	−24.7	50	29	462	−30.8	58					23	479	−17.8	34	31	480	−20.2	43	30	461	−31.7	59	28	481	−18.6	46
7,000	28	410	−32.1	49	28	401	−38.0	57					23	419	−24.9	35	30	418	−27.8	42	30	399	−38.9	57	28	420	−26.1	44
8,000	28	356	−39.9	49	28	346	−45.2						20	364	−32.3	37	30	363	−35.5	41	30	344	−45.6		28	365	−33.6	44
9,000	25	306	−47.8		28	297	−51.7						20	315	−39.4	37	30	313	−43.5	39	29	296	−51.6		28	315	−41.3	
10,000	20	262	−55.4		27	254	−56.9						16	272	−46.4		29	270	−51.0		29	253	−55.7		27	271	−48.8	
11,000	18	224	−60.2		26	217	−58.4						13	233	−52.0		29	231	−57.2		27	216	−56.6		25	232	−54.9	
12,000	16	190	−60.6		26	184	−57.7						11	199	−55.0		26	197	−58.3		27	184	−55.6		24	198	−58.0	
13,000	12	162	−60.0		23	157	−57.1						8	170	−57.9		25	168	−59.0		26	157	−56.3		24	169	−60.7	
14,000	8	137	−60.7		20	134	−57.7						6	144	−60.6		23	143	−61.0		22	134	−57.1		24	144	−62.7	
15,000					14	114	−58.5										18	122	−63.6		13	114	−58.3		21	122	−65.4	
16,000					9	97	−59.2										11	103	−65.9		8	97	−58.5		16	103	−67.5	
17,000																	7	88	−67.5						8	88	−67.8	
18,000																	5	74	−65.6									

Altitude (meters) m. s. l.	San Diego, Calif.[3] [4] (19 m.)				Sault Ste. Marie, Mich. (221 m.)				Seattle, Wash.[3] (10 m.)				Shreveport, La.[2] (51 m.)				Spokane, Wash. (598m.)				Washington, D. C.[3] (7 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	29	1,016	13.4	83	31	987	−11.5	92	26	1,015	5.1	75	25	1,017	0.4	78	31	950	−1.9	81	27	1,020	−6.3	71
500	29	959	13.0	71	31	952	−11.7	95	26	958	5.5	60	25	962	0.0	75					27	958	−7.4	68
1,000	29	903	11.4	59	31	892	−13.7	96	26	901	3.3	60	25	905	−0.1	72	31	902	−2.2	78	27	898	−8.9	72
1,500	29	850	9.2	51	31	835	−15.4	94	24	847	1.3	62	25	851	−0.7	70	31	847	−3.5	76	26	842	−9.9	72
2,000	29	801	6.9	42	31	781	−17.0	91	22	796	−1.1	62	25	799	−1.7	68	31	795	−5.6	77	26	789	−10.2	65
2,500	29	753	4.5	36	31	731	−18.3	88	21	747	−3.5	61	25	749	−3.0	64	31	746	−7.3	75	26	739	−11.6	59
3,000	29	708	1.6	37	31	683	−20.4	85	18	701	−5.9	61	24	703	−4.6	63	31	699	−9.5	73	26	692	−13.6	60
4,000	28	624	−5.1	43	31	596	−25.9	82	10	617	−12.2	63	23	619	−9.1	61	31	613	−15.2	71	26	605	−18.8	60
5,000	15	549	−11.9	49	31	518	−32.5	80	5	540	−19.1	65	20	542	−14.3	56	31	537	−21.4	69	26	529	−24.9	60
6,000	14	480	−18.3	54	31	449	−39.4	77					15	472	−19.5	53	30	468	−28.4	69	26	461	−31.2	59
7,000	14	419	−25.1	54	29	387	−46.9						10	414	−26.7	51	30	406	−35.7	68	26	399	−38.0	64
8,000	14	365	−32.7	55	29	332	−52.4						5	358	−34.9		30	351	−43.1	64	24	344	−44.8	
9,000	14	317	−40.2		25	284	−56.7										30	301	−50.1		24	295	−50.0	
10,000	13	274	−46.6		22	243	−57.8										29	258	−56.1		22	253	−53.0	
11,000	12	235	−51.7		21	207	−56.7										28	220	−59.5		17	217	−53.8	
12,000	12	201	−54.3		13	176	−55.3										28	188	−59.3		14	186	−54.4	
13,000	11	173	−56.1		8	151	−55.1										27	160	−58.1					
14,000	9	148	−57.8		6	129	−55.5										24	136	−58.0					
15,000	7	126	−59.4														21	116	−58.5					
16,000	7	107	−62.5														15	99	−58.5					
17,000																	12	84	−58.5					

[1] U. S. Army, Patterson Field (Fairfield), Ohio.
[2] U. S. Army, Barksdale Field, La.
[3] U. S. Navy.
[4] Airplane Jan. 1 to 16, incl., and radiosonde Jan. 17 to 31, inclusive.

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., and Seattle, Wash., observations are taken after sunrise. 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.

LATE REPORT MAY 1939 (Humidity data only)

Altitude (meters) m. s. l.	Relative humidity: At sea (5 m.)	Relative humidity: Halifax, Nova Scotia (5 m.)	Altitude (meters) m. s. l.	Relative humidity: At sea (5 m.)	Relative humidity: Halifax, Nova Scotia (5 m.)
Surface	93	87	4,000	58	67
500	89	82	5,000	55	64
1,000	84	78	6,000	53	61
1,500	77	79	7,000	52	59
2,000	69	78	8,000	52	57
2,500	64	77	9,000	51	
3,000	62	73			

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 44° N. and from longitudes 47° to 53° W.

LATE REPORT JUNE 1939 (Humidity data only)

Altitude (meters) m. s. l.	Relative humidity: At sea (5 m.)	Relative humidity: Halifax, Nova Scotia (5 m.)	Altitude (meters) m. s. l.	Relative humidity: At sea (5 m.)	Relative humidity: Halifax, Nova Scotia (5 m.)
Surface	92	88			
500	90	83	4,000	55	58
1,000	84	77	5,000	51	59
1,500	78	73	6,000	48	55
2,000	76	69	7,000	44	50
2,500	69	65	8,000	43	48
3,000	62	62	9,000	42	48

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 44° N. and from longitudes 47° to 53° W.

TABLE 2.—*Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (75th meridian time) during January 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. (1,554 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	30	314	1.4	31	296	1.6	26	307	4.4	29	244	3.3	31	292	2.7	29	140	1.1	25	46	2.1	27	256	4.2	31	306	0.6	26	277	2.3	30	272	3.5	30	239	2.6	29	49	0.7
500	---	---	---	---	---	---	26	304	5.1	---	---	---	---	---	---	---	---	---	25	85	1.8	27	250	5.1	30	282	2.5	26	278	3.9	30	278	3.8	30	244	4.1	---	---	---
1,000	29	284	2.0	---	---	---	25	312	6.6	---	---	---	30	301	7.1	29	145	1.9	21	164	1.8	22	257	7.0	27	288	6.2	24	286	6.0	23	297	7.6	23	273	6.8	---	---	---
1,500	28	288	4.8	---	---	---	24	308	8.1	29	255	6.0	24	307	6.1	29	168	2.0	16	257	2.4	15	282	5.5	24	306	7.4	23	288	9.5	19	305	10.7	20	287	10.2	---	---	---
2,000	26	287	5.4	31	291	2.9	22	297	11.0	28	280	6.9	20	302	7.3	29	223	1.6	10	291	4.2	11	276	5.9	18	308	7.1	23	283	13.2	18	305	12.1	17	292	12.5	29	338	1.3
2,500	26	286	9.0	31	296	6.0	20	289	15.0	24	289	8.9	20	308	9.1	24	264	4.8	---	---	---	---	---	---	13	307	7.6	21	276	14.0	18	305	13.4	14	296	14.1	25	307	3.9
3,000	25	287	12.5	30	298	8.9	21	283	17.4	24	295	8.7	19	305	9.2	20	291	7.0	---	---	---	---	---	---	---	---	---	18	272	17.1	17	305	14.4	12	301	14.7	25	300	6.7
4,000	24	291	16.1	23	300	13.6	20	277	23.0	20	307	13.8	14	308	11.7	15	293	7.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	25	309	12.7
5,000	23	292	20.0	19	295	14.4	18	274	28.6	17	308	16.9	---	---	---	12	274	8.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	24	305	15.5
6,000	20	291	21.2	18	294	16.3	18	268	33.0	16	309	19.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	22	304	17.9
8,000	17	286	23.5	14	300	17.4	---	---	---	13	309	25.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	18	302	26.4
10,000	14	288	23.8	11	296	24.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	11	296	26.8

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	30	281	2.1	28	128	0.8	29	206	0.3	26	280	2.5	26	280	1.5	31	303	1.6	31	70	1.3	28	349	1.4	29	340	0.6	31	320	1.1	30	292	3.7	30	341	2.0	27	287	2.1
500	---	---	---	---	---	---	---	---	---	26	286	3.6	---	---	---	30	281	3.6	---	---	---	28	294	2.6	29	83	.2	31	306	2.1	30	298	5.6	29	326	3.0	27	273	3.1
1,000	---	---	---	---	---	---	---	---	---	26	291	5.2	26	279	4.1	28	278	6.3	31	68	2.0	25	286	4.3	28	156	4.2	29	286	3.7	27	328	7.5	28	318	4.9	26	282	3.8
1,500	30	281	2.5	---	---	---	29	186	.4	26	300	8.2	26	285	7.8	26	279	8.9	29	29	.8	25	311	7.8	27	174	5.7	29	277	6.0	26	332	8.9	28	294	7.3	24	300	8.1
2,000	28	284	3.8	28	135	.7	29	93	.1	24	294	11.5	26	293	8.9	23	284	12.3	28	28	1.3	25	305	9.7	26	202	6.6	26	274	8.6	22	330	11.0	27	287	10.7	19	301	10.4
2,500	28	289	7.4	28	245	1.4	26	241	1.2	24	290	14.3	20	290	10.6	22	279	14.4	27	287	2.7	22	301	13.5	24	210	6.2	24	273	10.6	19	331	11.2	26	285	13.7	19	296	12.7
3,000	27	286	9.9	26	289	2.4	26	278	3.6	23	286	18.0	18	292	11.4	22	275	16.7	27	278	4.3	21	300	16.0	23	216	6.8	23	275	12.7	16	332	12.4	24	282	16.5	16	298	14.5
4,000	25	288	11.6	24	303	7.7	17	303	7.6	22	283	23.0	---	---	---	21	274	23.2	27	290	7.8	17	301	21.0	19	250	4.5	20	265	18.5	12	318	14.8	16	276	19.4	11	292	19.7
5,000	23	279	11.5	21	304	10.1	13	303	11.2	21	281	31.0	---	---	---	19	274	28.0	26	291	10.1	11	291	23.3	16	283	9.1	19	260	21.6	11	324	16.4	12	277	21.2	---	---	---
6,000	17	278	11.6	16	309	10.6	---	---	---	20	278	36.7	---	---	---	18	275	32.2	22	297	13.3	---	---	---	15	280	8.6	16	260	26.2	---	---	---	---	---	---	---	---	---
8,000	12	270	11.7	12	302	9.6	---	---	---	16	271	47.8	---	---	---	---	---	---	17	288	14.4	---	---	---	10	309	13.9	11	258	34.8	---	---	---	---	---	---	---	---	---
10,000	---	---	---	---	---	---	---	---	---	11	266	51.7	---	---	---	---	---	---	12	294	13.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

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.)			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	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	29	297	5.4	27	157	1.3	28	339	4.1	29	316	3.8	31	279	0.1	29	337	3.9	27	279	3.5	31	28	2.0	28	268	2.5	24	248	0.8	28	141	0.9	30	82	2.0	29	302	3.3
500	29	302	6.6	27	158	2.1	28	341	4.0	29	318	4.8	31	228	0.6	---	---	---	27	281	7.4	31	33	2.1	28	266	1.7	24	263	1.5	28	136	3.3	---	---	---	29	303	6.8
1,000	27	308	8.8	22	171	2.5	28	325	4.4	29	327	7.3	31	255	0.8	29	337	4.1	27	296	8.9	30	320	1.6	25	138	1.2	19	280	3.1	27	145	4.5	30	110	2.1	28	292	8.1
1,500	24	302	9.5	21	226	3.2	27	301	6.7	27	328	8.6	31	249	1.7	29	317	6.7	23	294	10.0	25	293	4.9	23	111	0.6	12	300	3.2	24	190	3.1	27	207	1.7	27	295	9.0
2,000	18	295	10.3	19	224	4.0	22	296	9.3	21	325	9.8	31	266	3.0	26	313	8.0	20	302	10.3	25	284	6.5	21	272	0.4	---	---	---	18	200	4.3	22	243	2.0	23	296	9.9
2,500	16	292	12.8	18	231	3.4	22	297	10.9	21	322	10.2	29	288	4.0	26	313	8.9	17	305	11.1	22	288	8.2	21	268	2.1	---	---	---	16	195	4.0	19	267	3.8	21	293	11.8
3,000	14	292	15.1	16	246	3.6	20	304	12.8	21	319	12.3	29	292	5.4	24	314	11.6	15	298	10.7	22	288	9.7	17	283	2.5	---	---	---	15	200	2.6	18	285	4.9	18	289	13.8
4,000	---	---	---	14	219	6.5	20	298	17.7	21	317	16.5	22	298	7.9	18	309	13.7	---	---	---	21	287	12.4	15	313	5.3	---	---	---	12	210	1.9	13	308	7.3	14	289	18.0
5,000	---	---	---	10	252	3.8	19	299	23.0	20	316	20.5	17	296	9.5	17	317	15.7	---	---	---	21	279	13.2	15	308	8.6	---	---	---	10	218	2.7	---	---	---	12	286	20.8
6,000	---	---	---	---	---	---	18	300	26.1	19	319	21.5	11	300	9.7	15	316	20.2	---	---	---	19	274	13.6	12	304	8.1	---	---	---	---	---	---	---	---	---	---	---	---
8,000	---	---	---	---	---	---	---	---	---	19	315	26.4	---	---	---	10	317	26.6	---	---	---	14	279	13.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10,000	---	---	---	---	---	---	---	---	---	12	310	28.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3.—*Maximum free-air wind velocities (M. P. S.), for different sections of the United States*

[Based on pilot-balloon observations during January 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]	45.6	SW	1,320	30	Akron, Ohio	43.2	WNW	3,770	17	Columbus, Ohio	40.0	WNW	6,830	6	Columbus, Ohio.
East-Central [2]	39.2	WNW	2,500	5	Elkins, W. Va	49.8	WNW	4,530	17	Knoxville, Tenn	79.5	W	9,120	21	Greensboro, N. C.
Southeast [3]	34.4	WSW	2,010	14	Atlanta, Ga	47.2	WSW	5,000	14	Atlanta, Ga	86.0	W	9,990	15	Atlanta, Ga.
North-Central [4]	34.6	WNW	2,450	15	Detroit, Mich	40.0	WNW	4,070	16	Detroit, Mich	61.6	NW	8,400	11	Huron, S. Dak.
Central [5]	37.4	NNW	1,290	14	Des Moines, Iowa	48.6	WNW	3,520	17	Moline, Ill	66.0	NNW	12,520	29	Omaha, Nebr.
South-Central [6]	38.4	WNW	1,500	13	Dallas, Tex	63.0	W	5,000	12	Amarillo, Tex	72.0	W	11,350	15	Abilene, Tex.
Northwest [7]	36.8	W	1,900	16	Billings, Mont	43.7	NW	4,620	14	Billings, Mont	55.0	NW	8,820	24	Billings, Mont.
West-Central [8]	39.2	WNW	2,480	16	Cheyenne, Wyo	41.0	NNW	4,600	12	Sacramento, Calif	70.4	NW	8,860	6	Modena, Utah.
Southwest [9]	29.3	WNW	2,370	11	El Paso, Tex	37.0	WNW	3,700	28	Albuquerque, N. Mex.	86.0	NNW	7,120	22	Albuquerque, N. Mex.

[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.

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

Potential temperatures	Albuquerque, N. Mex.			Atlanta, Ga.			Billings, Mont.			Bismarck, N. Dak.			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.	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	1	6.4	−39.0	1	5.3	−34.0	2	6.7	−44.0	5	7.4	−50.8	1	7.4	−50.0	11	6.6	−45.4	1	5.8	−36.0
300-309	2	6.5	−32.5	3	7.8	−46.0	10	8.0	−48.8	14	8.8	−57.3	4	9.0	−57.8	24	8.2	−52.3	5	7.5	−43.4
310-319	14	9.4	−52.4	19	9.2	−52.3	30	9.6	−56.8	19	9.9	−61.8	14	9.6	−55.9	17	9.7	−58.2	9	8.8	−46.3
320-329	25	10.9	−59.8	21	10.5	−57.2	19	10.7	−60.6	4	10.5	−60.8	20	10.8	−60.4	6	10.4	−60.2	24	10.2	−53.8
330-339	8	11.8	−62.2	6	11.5	−60.0	9	11.5	−62.1	1	11.4	−61.0	8	11.5	−61.2	3	10.8	−57.3	12	11.4	−59.1
340-349	1	12.4	−63.0	3	12.2	−62.3	1	11.6	−56.0				2	12.8	−64.0				2	12.1	−57.5
350-359				4	13.1	−61.5															
360-369	1	14.7	−69.0																4	13.0	−56.7
370-379	1	14.4	−66.0	2	14.6	−65.0													2	14.6	−64.5
380-389	2	15.6	−68.0	3	14.8	−64.7	1	15.0	−62.0				1	14.6	−63.0				3	14.9	−64.0
390-399	2	15.8	−65.5	4	15.6	−65.5							1	15.6	−67.0				1	16.3	−68.0
400-409	2	16.4	−67.0	4	16.2	−66.8	2	15.8	−63.5												
Weighted means		11.1	−58.1		11.2	−57.3		10.1	−57.2		9.4	−58.9		10.6	−59.2		8.7	−53.7		10.6	−54.0
Mean potential temperature (weighted)	331.8			336.6			321.3			310.1			324.0			308.9			331.6		

Potential temperatures	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							1	7.0	−43.0	7	7.1	−51.1	2	7.8	−53.5	4	5.7	−32.2	8	6.2	−41.0
300-309	4	8.4	−49.8				3	8.0	−49.0	13	8.4	−54.1	12	8.1	−50.9	10	8.0	−48.4	11	7.7	−47.4
310-319	18	9.4	−55.2	6	9.3	−51.7	17	9.5	−54.6	24	9.7	−59.9	24	9.4	−55.7	15	9.7	−58.1	12	9.4	−54.8
320-329	22	10.7	−59.5	19	10.2	−57.3	31	10.9	−60.5	8	10.6	−60.9	7	10.5	−58.1	3	10.2	−56.3	8	10.3	−57.0
330-339	8	13.3	−62.1	21	11.6	−60.7	9	11.6	−60.9	3	10.2	−53.7	1	10.8	−57.0	2	10.4	−54.5	7	11.2	−59.3
340-349	1	12.9	−68.0	10	12.6	−63.5	2	12.1	−61.5	2	11.6	−61.0				1	11.1	−54.0			
350-359	1	11.8	−55.0							1	13.1	−63.0									
360-369	2	12.8	−56.5	2	14.4	−66.5							1	12.9	−57.0						
370-379	1	13.4	−66.0	4	15.0	−67.8	1	14.8	−65.0										1	13.0	−55.0
380-389	1	14.7	−60.0	3	15.3	−65.0	1	14.9	−65.0										2	13.6	−54.0
390-399	1	15.5	−63.0	1	15.8	−66.0	3	15.4	−65.3	1	14.5	−57.0							1	14.0	−55.0
400-409				6	16.8	−70.2	5	16.4	−65.8				1	15.2	−57.0				1	15.4	−59.0
Weighted means		10.6	−58.0		12.1	−61.0		11.0	−59.1		9.5	−57.4		9.4	−54.9		8.9	−51.9		9.4	−52.0
Mean potential temperature (weighted)	326.1			342.5			332.0			315.5			317.0			312.5			321.0		

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

Potential temperatures	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	2	6.2	−47.0				12	6.8	−46.3	1	5.2	−26.0				2	5.4	−35.5	3	6.4	−40.3
300-309	1	9.0	−55.0				21	8.2	−52.2	8	6.6	−34.4	2	7.0	−34.5	6	6.9	−38.4	18	7.7	−45.1
310-319	13	9.7	−55.8				17	9.7	−59.5	16	8.9	−48.5	16	9.5	−52.0	13	9.7	−55.3	22	9.7	−57.5
320-329	18	11.1	−61.3	9	9.6	−43.0	7	10.4	−60.1	15	10.2	−54.7	23	10.9	−59.8	15	10.9	−61.1	16	10.4	−58.2
330-339	8	11.6	−62.0	20	10.6	−47.0	2	11.4	−58.5	6	11.2	−59.2	14	11.7	−60.3	3	11.5	−61.7	7	11.1	−59.3
340-349	2	12.2	−62.0	19	12.7	−61.8				2	11.7	−57.0	2	12.0	−56.0	2	12.5	−65.0	4	11.9	−61.2
350-359				7	13.8	−65.9	1	11.0	−52.0	2	12.4	−58.0	3	13.5	−66.0						
360-369	1	12.9	−46.0	11	14.5	−67.1	1	12.6	−56.0				2	14.1	−64.0						
370-379	1	14.2	−65.0	5	15.4	−72.4	1	12.6	−53.0	1	13.2	−56.0	1	13.1	−50.0				2	13.4	−58.5
380-389				8	16.3	−74.2				1	14.7	−63.0	2	15.6	−69.0				1	15.0	−63.0
390-399	2	15.5	−61.5	7	16.8	−73.4							4	15.6	−64.5				1	14.4	−56.0
400-409	1	16.0	−64.0	6	17.6	−76.2	1	15.5	−58.0	1	15.8	−61.0	4	16.6	−68.5				1	16.0	−61.0
Weighted means		11.0	−59.1		13.3	−61.2		9.0	−54.3		9.7	−50.2		11.6	−58.6		9.8	−54.9		9.8	−54.5
Mean potential temperature (weighted)	329.4			356.5			312.6			324.6			338.0			318.6			321.7		

Potential temperatures	Phoenix, Ariz.			St. Louis, Mo.			San Antonio, Tex.			Sault Ste. Marie, Mich.			Spokane, Wash.			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.
290-299	1	5.1	−28.0	8	6.3	−41.0				22	6.9	−48.6	12	6.6	−42.9	6	6.6	−43.0
300-309	1	7.2	−41.0	19	7.5	−45.8				28	8.4	−55.0	4	8.6	−54.0	15	7.7	−46.2
310-319	11	9.3	−50.5	29	9.5	−55.3	8	9.0	−47.1	17	9.7	−60.5	23	9.4	−54.6	13	9.0	−51.6
320-329	18	10.9	−59.3	11	10.5	−59.3	15	10.2	−52.1	4	10.0	−57.2	23	10.7	−60.8	6	10.4	−57.0
330-339	15	11.6	−60.4	7	11.1	−59.1	23	11.7	−58.7				9	11.8	−63.8	2	10.6	−51.5
340-349	1	13.6	−70.0	3	11.1	−53.3	7	12.5	−61.0				2	12.4	−62.0			
350-359	1	14.2	−71.0	1	12.9	−61.0	4	13.1	−61.5									
360-369	2	14.2	−63.5	2	12.9	−58.0	6	14.0	−65.5									
370-379				4	13.4	−57.5	3	15.1	−69.7									
380-389	1	16.0	−71.0	3	13.9	−58.0	4	15.7	−68.8									
390-399	2	16.4	−70.0				3	15.9	−65.7				2	15.4	−60.5			
400-409	3	16.1	−66.3	1	15.7	−64.0	3	16.6	−68.7				1	14.8	−57.0			
Weighted means		11.4	−58.4		9.6	−53.1		12.1	−58.7		8.3	−54.5		10.0	−56.1		8.4	−49.2
Mean potential temperature (weighted)	334.7			322.1			343.8			304.5			319.5			311.0		

RIVERS AND FLOODS

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

By BENNETT SWENSON

Precipitation during December 1939 was generally below normal over the country except in the far Northwest. River stages were low throughout the month with only a few exceptions, due to the continued deficiency of precipitation extending from summer and fall months.

In the Columbia Basin a minor rise occurred on December 15 and 16 but no appreciable flooding resulted. The Trinity River at Liberty, Tex., reached 24.3 feet (flood stage 24 feet) on the 27th but no material damage was reported.

During the 3 days, December 8, 9, and 10, the total precipitation at Eureka, Calif., amounted to 7.25 inches, and proportional amounts of precipitation were reported over the Eel River Basin. Only once in 52 years, February 2–4, 1890, has an equal amount of rain occured during the same period of time at Eureka and then there was a total of 8.28 inches. Although this was one of the greatest rains of record in that basin no flood stages were reached. This was due generally to the extremely depleted state of the ground water, the early slackening of the rain in the important Willits drainage area, the pause between intervals of intense precipitation, and the total absence of a snow cover. Some of the creeks in the vicinity of Eureka overflowed their banks on December 10 when 3.37 inches of rain fell within 9 hours.

The month of January 1940 was characterized by extremely low temperatures through the Central and Southern States east of the Rocky Mountains. On the other hand, the States west of the Rocky Mountains had above normal temperatures. Precipitation was deficient in much of the Mississippi drainage and eastward, except in Kansas and the Southeast, and in the Southwest, while