PROVISIONAL SUNSPOT RELATIVE NUMBERS, FEBRUARY 1937

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

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

February 1937	Relative numbers	February 1937	Relative numbers	February 1937	Relative numbers
1	*a* 211	11	*a* ---	21	*a* 130
2	224	12	*Macd* 77	22	*add* 167
3	*a* 181	13	---	23	*a* 155
4	*Ec* 152	14	89	24	*ad* 164
5	*a* 146	15	79	25	*aa* 164
6	*Wc* ---	16	*d* 101	26	*Eac* 167
7	98	17	92	27	149
8	*Ec* 90	18	*ad* 88	28	*Wac* ---
9	*Ec* 76	19	*d* 97		
10	---	20	*d* 100		

Mean, 23 days=130.3.

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

AEROLOGICAL OBSERVATIONS

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

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

The mean surface temperatures for February (see chart 1) were generally above normal over the Great Lakes and northeast sections of the country as well as in Texas, Oklahoma, and eastern New Mexico and Arizona; also in southern Florida and a small area in South Dakota and Wyoming. The mean surface temperatures in the remainder of the country were generally below normal. The largest positive departures at the surface were principally concentrated in the immediate vicinity of the Great Lakes and east thereof, with values ranging from less than +1° C. to about +3.7° C., the latter prevailing on the northern New England coast. The positive departures elsewhere averaged nearly 1° C. The largest negative departures at the surface were confined to portions of the Western Plateau Region, with values ranging from −1° C. to −4° C. Elsewhere the negative departures were close to −1° C., except in the north-central part of the country where −2° C. was near the lower limit.

The mean free-air temperatures for the month up to 5 km above sea level (see table 1) generally did not depart very much from normal. Departures of this element from normal were mostly positive by slight amounts over the eastern part of the country, with maxima at Lakehurst, N. J., and Wright Field (Dayton), Ohio (+1.9° to +2.9° C., and 1.4° to 2.4° C., respectively, at all levels up to 5 km). The appreciable negative departures found at the surface in the north-central part of the country apparently were not merely confined to the surface, as shown by the departures of −2° to −2.7° C. from 1 to 5 km at Omaha, Nebr. Elsewhere the deviations from normal temperature were not notable except perhaps at Kelly Field (San Antonio), Tex., in the upper strata (+1.1° to 2.3° C. from 3 to 5 km).

The mean free-air relative humidities and specific humidities are given in table 2. In the eastern part of the country, except perhaps in the extreme southeast, the mean relative humidities were generally below normal by slight to moderate amounts (−2 to −12 percent) at almost all elevations up to 5 km, with most marked negative departures at Washington, D. C. where values from −10 to −12 percent prevailed in the stratum 1.5 to 3 km. In the north-central part of the country, Omaha, Nebr., showed slight positive departures (+1 to +5 percent) in humidity at all levels up to 5 km, hence of opposite sign to the departures of temperature from normal noted previously. In the northwest slight to moderate excesses over normal humidities generally prevailed. By comparison of the relative humidities for Salt Lake City, Utah, with those for surrounding stations, it may be inferred that they were at least moderately in excess of the normal at practically all elevations up to 5 km. On the southern California coast the humidities near the surface were moderately greater than normal, but approximately normal at greater elevations as shown by the results for San Diego, Calif. Elsewhere the departures of relative humidity did not appear significant.

Table 3 shows the monthly mean free-air barometric pressures and equivalent potential temperatures. The place of lowest average pressure during February at elevations up to 5 km, with the exception of the very lowest stratum near the ground, was located in the vicinity of Sault Ste. Marie, Mich., hence somewhat to the east of its position in January when it was centered over Fargo, N. Dak. However, it may be noted that the gradient between these two stations was relatively small in February (difference 3 to 1 mb). The (statistical) center of highest average pressure occurred over the region near Miami, Fla.

The (mean) isobaric charts for February were in marked contrast to those for the preceding month. Cyclonic curvature of the isobars of less notable degree than in January prevailed in the north-central portion of the country, while in the southern portion the isobars were straight east to west on the average instead of southwest to northeast or anticyclonic in the southeastern portion as in the previous period. Moreover, there was some evidence that the isobars at elevations from 1.5 to 4 km were perturbed from an east-west trend over the Western Plateau Region, so that an anticyclonic curvature prevailed thereover with the maximum pressure centered in the southwest where approximately straight east-west isobars appeared.

Comparison of the pressure differences between Miami and Fargo during the months of January and February indicates that the average pressure gradient between these two stations was from 12 to 24 percent greater in the former than in the latter month in the stratum from 1 to 5 km above sea level. There was, however, very little change in the average gradient between Miami and Sault Ste. Marie during these two months, except perhaps that from 1 to 2 km it became about 2.5 to 5 percent larger in February than it was in January. The data for Oakland and Fargo indicate that the pressure gradient from the former to the latter became appreciably greater in the second month of the year than it was in the first (+60 to +12 percent from 1 to 5 km). On the other hand, the gradient from San Antonio to Oakland decreased somewhat (−12 to −38 percent in the stratum 1.5 to 5 km).

Table 4 shows the free-air resultant winds based on pilot balloon observations made near 5 a. m. (75th meridian time) during the month of February. Generally speaking, the directions of the resultant winds were approximately normal, except at some places along the Pacific coast and the west Gulf coast near the surface. In particular, at Oakland, Calif., from 0.5 to 4 km, the resultant winds for the month were oriented from about 90° to 30° counterclockwise from normal, hence with much more pronounced westerly components and subdued northerly components. On the other hand, at Seattle, Wash., from 0.5 to 4 km, the resultants were similarly oriented from about 10° to 90° (respectively), hence with more accentuated southerly components than usual and subdued westerly components.

The resultant wind velocities were significantly below normal along the northeastern coastal region, where a departure of as much as −8 m. p. s. occurred at 2.5 km over Newark, N. J. The regime of negative departures associated with that region extended over considerably larger areas with increase of height, as may be exemplified by the facts that at 0.5 km it was confined to the area north and east of a line running from northern Michigan to southern New England, while at 3 km the line of division ran from North Dakota to southern Georgia. The departures in the region just specified averaged perhaps −2 to −2.5 m. p. s.

In regions other than those just specified, positive departures from normal resultant velocities generally prevailed with a few minor exceptions. Positive departures were most outstanding at Seattle, Wash. (+3.5 to +6.6 m. p. s. from 1.5 to 3 km). It is perhaps significant that at 3 km, Miami, Fla., Pensacola, Fla., Oklahoma City, Okla., and Cheyenne, Wyo., had supernormal velocities by amounts ranging from +3.2 to +3.9 m. p. s.; while at 4 km, at Salt Lake City, Utah, Cheyenne, Wyo., and Albuquerque, N. Mex., the amounts were +4.1 to +4.7 m. p. s. Elsewhere they were not in general so pronounced.

Table 5 shows maximum free-air wind velocities and directions for various sections of the United States during February as determined by pilot balloon observations. The extreme maximum was 57.2 m. p. s. from the WNW at 8 km above sea level over Modena, Utah.

The mean monthly equivalent potential temperatures and specific humidities shown in tables 2 and 3, respectively, when regarded as semiconservative elements and plotted on charts, give support by their distribution to the conception of the general circulation for the month derived from the barometric and wind data already discussed. From these considerations it appears that there was slightly more than normal transport of relatively cold air across the west coast and the Northwest from the Pacific and western Canada, respectively, into the center of the country and thence eastward; while the transport of warm, moist, air from the Gulf of Mexico was decidedly deficient except in the extreme southeast.

The weather situations during February which gave rise to the conditions discussed above were radically different from those which prevailed in January; the North Pacific HIGH was not nearly so well developed, and was displaced considerably westward and somewhat southward. A number of cyclones, mostly in an occluded state, appeared along the Pacific Northwest coast, while a number of younger cyclones crossed the Pacific coast farther south. The majority of these disturbances appear to have originated as offshoots of the Aleutian LOW, with (relatively) warm NPP and TP air acting against colder PP air. Alternating with these were a number of anticyclones from the Pacific, characterized by deep and extensive domes of PP air. The interplay of the air masses thus brought into juxtaposition had as its consequence excessive precipitation along the entire west coast and over part of the central portion of the Western Plateau Region, accompanied by subnormal temperatures.

Shallow layers of cold PC air from the northwest frequently spread over the central part of the country, reinforced by deeper strata of PP or NPP air lying thereover. These air masses moved as far as the Gulf of Mexico and on many occasions prevented the transport of warm, moist air from that region northward up over the center of the country. Moreover, the spread of subsiding Polar air masses over the Gulf doubtless contributed in no small measure to the dryness and lack of precipitation obtaining over a large portion of the watershed of the Mississippi River and its principal tributaries (see inset of chart V), since the fresh outbreaks of Polar air operated to reduce the efficiacy of the Gulf as a source region of TG (or TM) air masses which are generally so important for precipitation in central and eastern United States.

Wave cyclones forming along the front of polar air in the Gulf of Mexico and the extreme southeastern section of the country were instrumental in the occurrence of the excessive precipitation (100–400 percent of normal) in the latter area.

The occluded cyclones which passed along the northern tier of states, and the few younger and more energetic cyclones from the southwest which were associated with vigorous transport of TP and TG air as far as the Great Lakes, served to provide the abundant precipitation that took place over a part of the extreme North Central States.

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

Stations	Altitude (meters) m. s. l.																			
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Number of obs.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	
Barksdale Field [1] (Shreveport), La. (52 m)	26	8.0	------	7.3	------	6.4	------	5.9	------	4.3	------	2.4	------	−0.1	------	−4.6	------	------	------	
Billings, Mont.[2] (1,089 m)	28	−8.3	+1.3	------	------	------	------	−5.3	+0.6	−6.1	+0.1	−8.4	−0.4	−11.4	−0.9	−17.3	−0.3	−23.6	0.0	
Boston, Mass.[1] (5 m)	26	−1.4	------	−1.9	------	−3.9	------	−5.4	------	−6.6	------	−9.0	------	−11.5	------	−16.5	------	−25.2	------	
Cheyenne, Wyo.[2] (1,873 m)	28	−5.7	+0.7	------	------	------	------	------	------	−5.1	+0.4	−6.9	−1.3	−9.2	−1.0	−14.5	0.0	−21.5	+0.1	
Coco Solo, Canal Zone [3] (15 m)	27	24.9	------	21.7	------	18.5	------	15.7	------	13.4	------	11.5	------	10.2	------	5.4	------	−0.2	------	
El Paso, Tex.[2] (1,194 m)	28	5.2	------	------	------	------	------	7.8	------	5.5	------	3.2	------	0.7	------	−4.3	------	−9.8	------	
Fargo, N. Dak.[2] (274 m)	26	−16.5	−0.2	−12.7	+1.0	−11.0	+1.2	−10.4	+1.1	−11.0	+1.1	−12.6	+0.9	−14.9	+0.7	−20.6	+0.5	−26.8	+0.4	
Kelly Field (San Antonio), Tex.[1] (206 m)	25	7.8	+0.8	10.5	+0.8	10.2	−0.2	9.9	−0.1	8.2	−0.1	6.2	+0.5	3.9	+1.1	−2.0	+1.5	−8.2	+2.3	
Lakehurst, N. J.[3] (39 m)	22	−1.4	+2.1	−1.5	+2.7	−3.2	+2.0	−4.0	+1.9	−5.2	+2.2	−7.3	+2.2	−9.3	+2.4	−15.5	+2.1	−19.6	+2.9	
Maxwell Field (Montgomery), Ala.[1] (52 m)	22	7.5	+0.7	7.2	+0.2	5.9	+0.3	4.4	0.0	2.6	−0.1	1.1	+0.3	−0.4	+0.9	−5.2	+1.1	−10.9	+1.7	
Miami, Fla.[2] (4 m)	28	16.3	------	17.4	------	14.8	------	12.9	------	11.3	------	9.0	------	6.0	------	1.0	------	−4.0	------	
Mitchel Field (Hempstead, Long Island), N. Y.[1] (29 m)	22	−2.1	+1.7	−0.9	+2.4	−2.6	+1.7	−3.9	+1.1	−5.7	+0.7	−7.8	+0.5	−9.8	+0.6	−15.8	−0.2	------	------	
Murfreesboro, Tenn.[2] (174 m)	25	4.6	+2.2	3.7	+1.6	2.6	+1.4	1.3	+1.0	−0.1	+0.9	−2.3	+0.8	−4.4	+0.8	−9.4	+1.1	−15.1	+1.5	
Norfolk, Va.[3] (10 m)	16	2.7	−1.5	3.0	−1.2	1.0	−1.8	−0.7	−0.3	−1.7	−1.4	−3.9	−0.1	−6.2	−1.2	−12.4	−1.1	−15.4	+0.2	
Oakland, Calif.[2] (2 m)	28	6.9	------	7.4	------	5.1	------	3.4	------	1.7	------	−0.4	------	−2.8	------	−8.2	------	−14.4	------	
Oklahoma City, Okla.[2] (391 m)	28	0.9	+0.7	2.3	+0.8	2.8	+0.6	3.1	+0.1	1.6	−0.3	−1.0	−0.6	−3.8	−0.5	−9.5	−0.2	−16.0	0.0	
Omaha, Nebr.[2] (300 m)	28	−7.3	−0.5	−6.9	−0.9	−6.0	−2.0	−5.5	−2.2	−6.8	−2.7	−8.5	−2.5	−10.9	−2.3	−16.3	−1.9	−22.9	−2.1	
Pensacola, Fla.[3] (13 m)	13	8.7	------	9.8	------	9.1	------	7.1	------	5.7	------	4.5	------	2.1	------	−3.3	------	−8.8	------	
St. Thomas, Virgin Islands [3] (8 m)	27	22.6	------	21.3	------	18.6	------	15.7	------	13.2	------	11.5	------	10.7	------	6.0	------	0.3	------	
Salt Lake City, Utah [2] (1,288 m)	28	−2.5	------	------	------	------	------	−0.6	------	−1.2	------	−3.7	------	−6.5	------	−12.1	------	−17.2	------	
San Diego, Calif.[3] (10 m)	24	9.0	−2.9	10.2	−1.7	9.2	−1.2	7.7	+0.5	5.8	0.0	3.8	+1.2	1.4	+0.1	−3.7	+1.3	−10.4	+1.3	
Sault Ste. Marie, Mich.[2] (221 m)	25	−10.1	------	−8.3	------	−9.5	------	−10.8	------	−11.9	------	−13.6	------	−15.6	------	−21.0	------	−27.4	------	
Scott Field (Belleville), Ill.[1] (135 m)	21	−3.0	------	−2.8	------	−2.1	------	−2.6	------	−4.6	------	−6.1	------	−8.3	------	−14.0	------	−20.1	------	
Seattle, Wash.[3] (10 m)	9	3.9	------	2.4	------	0.2	------	−3.2	------	−6.2	------	−9.6	------	−13.1	------	−21.6	------	------	------	
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	25	−3.6	------	−3.5	------	−4.4	------	−5.1	------	−6.7	------	−9.1	------	−10.9	------	−16.1	------	−21.9	------	
Spokane, Wash.[2] (596 m)	28	−3.5	+1.3	------	------	−1.2	+2.2	−2.1	+1.9	−5.1	+0.6	−8.3	−0.2	−11.3	−0.5	−17.1	−0.4	−22.7	0.0	
Washington, D. C.[3] (13 m)	23	0.0	+0.8	−0.7	+0.2	−2.7	−0.5	−4.2	0.0	−5.2	−0.4	−6.6	+0.2	−9.2	−0.6	−15.0	−1.6	−20.9	−1.5	
Wright Field (Dayton), Ohio [1] (244 m)	24	−2.4	+1.9	−2.1	+2.4	−2.9	+2.0	−3.4	+1.6	−4.6	+1.5	−6.6	+1.5	−8.7	+1.4	−13.8	+1.4	−19.8	+1.4	

NOTE.—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.

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

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Billings, 82 (3); Cheyenne, 85 (3); Fargo, 78 (3); Kelly Field, 68 (3); Lakehurst, 59 (3); Maxwell Field, 65 (3); Mitchel Field, 70 (3); Murfreesboro, 79 (3); Norfolk, 77 (4); Oklahoma City, 81 (3); Omaha, 164 (6); San Diego, 161 (8); Spokane, 83 (3); Washington, 153 (9); Wright Field, 69 (3).

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

Stations	Altitude (meters) m. s. l.																						
	Surface				500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
	Number of observations	q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.	
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.
Barksdale Field, La	26	5.0	75	----	4.7	68	----	4.0	60	----	3.6	53	----	2.9	45	----	2.3	39	----	2.1	38	----	1.7	40	----	----	----	----
Billings, Mont	28	1.7	73	+9	----	----	----	----	----	----	1.9	62	+6	1.8	60	+7	1.7	61	+7	1.3	59	+3	1.0	64	+5	0.7	62	+4
Boston, Mass	26	2.5	74	----	2.4	70	----	2.3	72	----	2.2	71	----	1.9	64	----	1.7	64	----	1.4	63	----	1.0	57	----	0.6	62	----
Cheyenne, Wyo	28	1.7	57	−4	----	----	----	----	----	----	----	----	----	1.9	56	−3	1.7	56	+1	1.6	56	+1	1.1	55	+1	0.7	55	+3
Coco Solo, Canal Zone	27	16.7	85	----	15.5	91	----	13.2	89	----	11.3	86	----	9.3	77	----	7.3	65	----	5.4	50	----	2.9	32	----	1.2	19	----
El Paso, Tex	28	3.2	51	----	----	----	----	----	----	----	3.6	46	----	3.0	42	----	2.5	39	----	2.2	38	----	1.5	33	----	1.0	32	----
Fargo, N. Dak	26	0.8	79	0	1.2	76	−1	1.4	72	+1	1.4	64	+1	1.3	58	+1	1.1	57	+3	1.0	57	+2	0.6	53	0	0.4	50	−1
Kelly Field, Tex	25	5.2	78	−1	5.8	70	−2	5.4	64	+1	4.7	52	0	4.4	52	+5	3.8	48	+3	3.2	46	+2	2.3	43	+2	1.6	42	+1
Lakehurst, N. J	22	2.5	71	+4	2.2	67	−3	1.9	54	−2	1.8	49	−4	1.6	42	−7	1.5	44	−4	1.4	46	0	1.0	44	+1	0.1	20	−9
Maxwell Field, Ala	22	4.4	68	−2	3.9	58	−1	3.3	52	0	2.9	47	+1	2.6	44	+3	2.0	35	−1	1.7	33	−2	1.5	34	+3	1.0	36	+2
Miami, Fla	28	9.8	87	----	9.9	76	----	8.6	73	----	6.7	62	----	5.4	52	----	4.9	50	----	4.3	51	----	3.4	51	----	2.7	51	----
Mitchel Field, N. Y	22	2.3	71	0	2.4	63	−2	2.0	57	−4	1.9	56	−3	1.8	55	−4	1.5	50	−8	1.3	47	−8	0.9	48	−5	----	----	----
Murfreesboro, Tenn	25	3.8	70	−6	3.7	70	−3	3.3	65	−4	2.7	54	−7	2.0	45	−10	2.0	45	−8	1.7	44	−7	1.3	43	−7	1.0	48	−3
Norfolk, Va	16	3.9	75	0	3.7	61	−4	3.1	58	−3	2.7	55	−3	2.5	49	−3	2.0	44	−6	1.7	42	−6	1.2	44	0	1.6	62	+11
Oakland, Calif	28	5.4	87	----	5.0	74	----	4.3	70	----	3.6	61	----	3.0	55	----	2.5	50	----	2.1	47	----	1.6	49	----	1.1	49	----
Oklahoma City, Okla	28	3.0	74	+2	3.1	67	0	2.8	54	−2	2.5	45	−3	2.1	41	−2	1.9	38	−4	1.6	37	−5	1.1	38	−4	0.8	40	−2
Omaha, Nebr	28	1.8	83	+5	1.8	78	+4	1.9	68	+5	1.9	61	+4	1.6	57	+4	1.5	54	+1	1.3	54	+1	0.9	54	+2	0.6	51	+3
Pensacola, Fla	13	6.4	85	----	6.5	76	----	6.0	72	----	5.3	68	----	4.8	65	----	4.0	57	----	3.2	50	----	2.1	44	----	2.6	48	----
St. Thomas, Virgin Islands	27	15.4	91	----	14.7	89	----	12.8	87	----	10.6	82	----	8.5	72	----	6.4	58	----	4.7	41	----	2.4	26	----	1.1	18	----
Salt Lake City, Utah	28	2.7	74	----	----	----	----	----	----	----	3.0	70	----	2.8	65	----	2.6	66	----	2.2	65	----	1.6	64	----	1.1	60	----
San Diego, Calif	24	5.9	84	+8	5.9	72	+5	5.0	61	+3	4.1	52	0	3.4	46	+2	2.6	40	−1	2.2	37	+2	1.7	35	−2	1.0	33	−3
Sault Ste. Marie, Mich	25	1.4	82	----	1.7	78	----	1.6	74	----	1.4	68	----	1.2	60	----	1.1	60	----	1.0	62	----	0.7	60	----	0.5	64	----
Scott Field, Ill	21	2.3	73	----	2.3	68	----	2.2	59	----	1.8	50	----	1.7	48	----	1.6	47	----	1.4	45	----	1.0	46	----	0.7	49	----
Seattle, Wash	9	4.1	81	----	3.5	74	----	2.9	68	----	2.2	65	----	1.8	62	----	1.4	60	----	1.2	59	----	0.6	57	----	----	----	----
Selfridge Field, Mich	25	2.3	79	----	2.3	76	----	2.1	69	----	1.7	56	----	1.4	50	----	1.3	50	----	1.2	49	----	0.9	51	----	0.7	54	----
Spokane, Wash	28	2.6	82	0	----	----	----	2.8	74	−2	2.7	68	−1	2.3	68	+2	1.8	68	+4	1.6	65	+4	1.0	63	+5	0.7	59	+4
Washington, D. C	23	2.5	67	−4	2.1	55	−8	1.9	53	−7	1.6	49	−11	1.4	42	−12	1.3	42	−10	1.1	42	−12	0.9	45	−5	0.5	44	−2
Wright Field, Ohio	24	2.5	76	−1	2.6	74	−3	2.4	68	−5	2.0	55	−9	1.6	47	−9	1.5	45	−9	1.2	45	−8	1.1	52	+1	0.9	56	+5

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

Stations	Altitude (meters) m. s. l.																			
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Number of observations	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	
Barksdale Field, La	26	1,013	294	960	297	904	299	850	303	800	305	752	306	706	309	622	313			
Billings, Mont	28	888	279					842	287	790	291	741	294	695	294	609	298	533	301	
Boston, Mass	26	1,014	277	953	281	895	284	840	288	788	291	739	293	693	295	608	299	533	299	
Cheyenne, Wyo	28	806	290							793	292	743	295	697	298	611	302	535	304	
Coco Solo, Canal Zone	27	1,010	344	954	343	907	338	848	336	800	333	753	330	709	330	628	328	556	327	
El Paso, Tex	28	883	298					850	305	800	306	752	308	707	310	624	313	550	316	
Fargo, N. Dak	26	983	260	954	267	894	275	838	280	786	285	736	288	689	290	603	294	525	298	
Kelly Field, Tex	25	996	296	962	303	907	307	853	310	804	313	756	315	711	316	628	317	554	319	
Lakehurst, N. J	22	1,013	277	956	281	898	284	843	288	791	291	742	294	697	297	611	300	536	304	
Maxwell Field, Ala	22	1,014	292	961	295	904	297	850	299	800	302	751	304	706	307	622	312	548	315	
Miami, Fla	28	1,018	315	961	322	907	320	855	319	806	319	758	320	714	321	632	324	558	327	
Mitchel Field, N. Y	22	1,013	277	955	282	897	285	842	288	791	292	741	294	695	297	610	300			
Murfreesboro, Tenn	25	998	288	959	291	902	294	848	296	797	298	748	300	703	303	618	307	543	311	
Norfolk, Va	16	1,018	285	958	290	901	291	846	294	795	297	746	299	700	301	614	304	541	312	
Oakland, Calif	28	1,019	293	958	298	902	299	848	301	797	303	749	304	704	305	620	309	544	312	
Okalhoma City, Okla	28	972	285	958	288	901	292	847	297	796	300	748	302	703	303	618	306	543	309	
Omaha, Nebr	28	981	272	956	275	896	281	841	287	789	290	739	293	693	295	608	299	531	302	
Pensacola, Fla	13	1,020	298	963	304	907	307	853	308	802	311	754	313	709	314	626	316	552	322	
St. Thomas, Virgin Islands	27	1,016	337	962	340	908	337	856	333	807	329	760	328	715	327	634	326	561	327	
Salt Lake City, Utah	28	871	290					848	294	797	299	748	300	703	302	617	305	541	309	
San Diego, Calif	24	1,018	297	960	304	903	305	850	306	800	308	752	309	707	311	624	314	549	316	
Sault Ste. Marie, Mich	25	987	268	952	274	892	277	836	280	783	284	733	287	687	290	600	294	524	298	
Scott Field, Ill	21	1,004	276	958	280	898	286	843	289	791	292	741	296	696	298	610	302	536	305	
Seattle, Wash	9	1,014	287	953	289	895	290	840	290	789	291	739	292	692	292	607	292			
Selfridge Field, Mich	25	993	276	954	280	895	283	841	287	789	289	740	292	694	294	608	299	532	304	
Spokane, Wash	28	942	281			896	289	842	293	790	293	741	294	695	296	608	299	532	303	
Washington, D. C	23	1,019	279	956	282	898	285	843	287	791	291	742	294	696	296	610	301	535	304	
Wright Field, Ohio	24	988	278	956	282	898	286	843	289	792	292	743	295	697	297	611	302	536	306	

LATE REPORT

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

Station	Altitude (meters) m. s. l.																		
	Number of observations	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
		t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.
Coco Solo, Canal Zone [1] (15 m)	29	24.2	------	22.1	------	19.1	------	16.2	------	13.8	------	11.7	------	9.3	------	3.6	------	−2.6	------

[1] Navy.

LATE REPORT

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

Station	Altitude (meters) m. s. l.																						
	Number of observations	Surface			500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.	
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.
Coco Solo, Canal Zone	29	17.2	91	----	15.8	90	----	13.9	89	----	12.0	88	----	10.3	83	----	7.8	68	----	5.5	54	----	4.0	50	----	2.4	42	----

LATE REPORT

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

Station	Altitude (meters) m. s. l.																		
	Number of observations	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
		P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E
Coco Solo, Canal Zone	29	1,008	345	952	344	898	341	847	338	798	337	752	333	708	329	626	329	554	329

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

[Wind from N=360°, E=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 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	331	2.2	296	2.5	263	3.4	310	2.5	267	4.9	249	3.4	-----	-----	238	2.4	282	2.3	39	1.8	98	1.5	169	0.8	208	0.9
500	-----	-----	282	3.3	-----	-----	321	5.2	-----	-----	259	6.6	-----	-----	243	5.4	290	3.6	94	1.1	113	3.3	176	1.2	215	5.0
1,000	-----	-----	292	5.6	-----	-----	304	5.5	-----	-----	272	11.8	-----	-----	256	9.7	299	6.4	267	2.0	162	1.7	180	2.3	240	8.2
1,500	-----	-----	277	8.6	243	8.3	298	7.8	-----	-----	283	10.5	-----	-----	254	10.3	300	8.3	286	6.2	252	3.3	225	4.5	267	8.9
2,000	310	3.9	281	11.5	271	8.1	288	9.5	269	7.1	292	10.8	-----	-----	268	10.7	288	10.7	281	6.4	263	4.9	240	5.5	277	10.4
2,500	294	6.4	288	12.2	280	9.4	298	9.3	280	13.2	303	11.1	-----	-----	297	10.7	293	11.7	287	9.3	270	6.1	258	6.9	285	12.4
3,000	291	9.8	279	11.1	284	12.2	303	7.8	288	16.0	314	7.4	-----	-----	-----	-----	298	10.2	295	9.6	289	7.5	269	5.7	279	10.7
4,000	290	15.4	-----	-----	290	14.7	-----	-----	285	15.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
5,000	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Altitude (meters) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Peral Harbor, Territory of Hawaii[1] (68m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	299	3.2	109	0.7	58	0.4	315	1.8	-----	-----	4	3.5	269	2.5	154	3.0	350	0.6	23	0.2	164	0.9	211	1.3	307	2.1
500	310	6.6	263	0.8	210	2.2	303	4.0	-----	-----	40	0.6	262	6.0	-----	-----	309	1.3	243	1.1	183	3.6	-----	-----	298	6.3
1,000	309	7.3	260	2.3	241	4.8	299	7.4	-----	-----	274	3.0	278	9.4	-----	-----	336	0.7	277	3.2	185	6.3	222	3.2	301	7.9
1,500	296	8.2	235	3.2	270	5.2	300	11.2	-----	-----	288	5.9	286	10.7	166	5.1	226	0.7	306	5.7	186	7.0	240	5.8	299	8.1
2,000	294	5.5	252	2.6	286	7.7	299	11.9	-----	-----	287	7.5	281	11.4	191	6.5	290	1.5	323	7.3	196	8.7	242	6.4	278	9.1
2,500	298	3.7	273	2.5	287	11.8	298	11.3	-----	-----	285	10.1	291	14.0	237	5.4	302	3.1	303	7.2	187	8.7	260	7.8	245	8.8
3,000	304	5.3	295	3.2	290	12.5	278	8.8	-----	-----	276	11.0	280	11.3	255	7.4	311	4.8	335	6.9	198	10.0	245	7.0	-----	-----
4,000	-----	-----	293	5.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	280	10.7	299	6.5	-----	-----	-----	-----	-----	-----	-----	-----
5,000	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	281	5.1	-----	-----	-----	-----	-----	-----	-----	-----

[1] Navy stations.

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

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station
Northeast [1]	44.0	SW	1,600	8	Cleveland, Ohio	49.2	WSW	4,310	9	Columbus, Ohio	30.6	NNW	8,380	19	Boston, Mass.
East-Central [2]	41.6	SW	1,650	8	Knoxville, Tenn	50.2	NW	2,550	14	Knoxville, Tenn	54.4	WNW	5,580	26	Greensboro, N. C.
Southeast [3]	41.8	W	2,320	25	Spartanburg, S. C	41.0	W	3,040	25	Spartanburg, S. C	46.6	WNW	8,220	17	Charleston, S. C.
North-Central [4]	37.7	NW	1,510	13	Bismarck, N. Dak	41.3	WSW	5,000	9	Detroit, Mich	44.0	WSW	5,510	9	Detroit, Mich.
Central [5]	44.5	NW	2,420	14	St. Louis, Mo	51.5	WSW	4,570	9	Indianapolis, Ind	41.6	WSW	5,560	9	Indianapolis, Ind.
South-Central [6]	36.5	W	2,090	21	Houston, Tex	40.0	WSW	4,850	9	Memphis, Tenn	55.2	WSW	7,690	9	Oklahoma City, Okla.
Northwest [7]	47.3	SW	1,440	17	Pendleton, Oreg	54.0	WNW	4,290	12	Spokane, Wash	41.0	WNW	5,980	16	Boise, Idaho.
West-Central [8]	34.8	W	2,480	5	Cheyenne, Wyo	48.9	NNE	3,010	14	Redding, Calif	57.2	WNW	8,050	3	Modena, Utah.
Southwest [9]	40.7	WNW	1,970	20	Albuquerque, N. Mex.	41.0	WSW	3,560	7	Winslow, Ariz	56.2	WSW	5,720	26	Winslow, Ariz.

[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, Louisana, 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.