SOUNDING-BALLOON OBSERVATIONS MADE AT ROYAL CENTER, IND., DURING THE INTERNATIONAL MONTH, FEBRUARY, 1931

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[Weather Bureau, Washington, D. C., August, 1931]

In cooperation with the International Commission for the Exploration of the Upper Atmosphere, the Weather Bureau conducted a series of sounding-balloon observations at the Royal Center,[1] Ind., aerological station during the international month, February, 1931. The same general program was followed as during the international months of previous years since 1926, and the reader is referred to references (1), (2), (3), and (4) for further details regarding this.

In several respects, however, new features were introduced during this series which proved to be of material advantage. These were: (1) An increase in the length of the cord between the balloon and the meteorograph to approximately 80 feet. This eliminated the vibration of the instrument and resulted in very satisfactory traces on the record sheet; (2) the use of a device which permitted the balloon, after bursting, to become detached from the meteorograph and parachute. This resulted in a more satisfactory rate of descent of the instrument. A detailed description of this detaching device may be found in reference (5); (3) the difficulty of launching a balloon with the meteorograph tied a considerable distance below it during a moderate or strong wind was overcome by launching it from an automobile while driving with the wind.

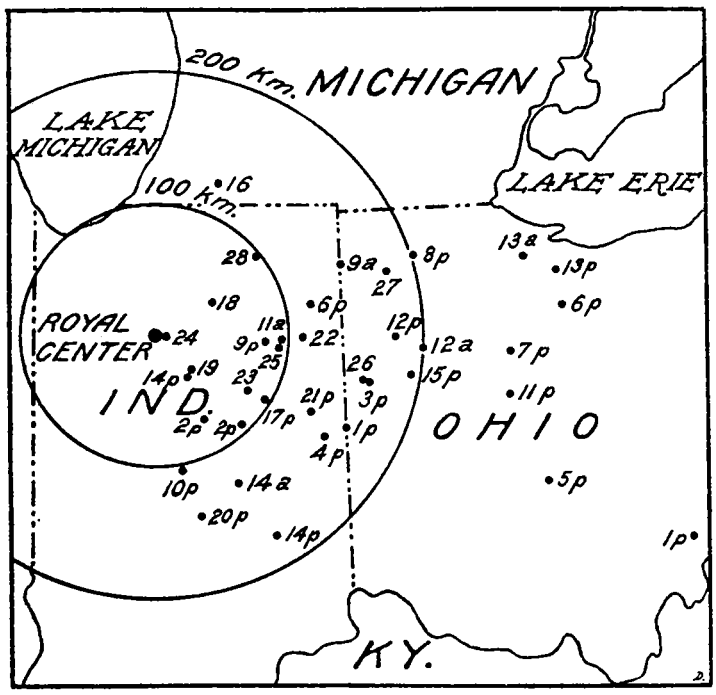

FIGURE 1.—Landing places (with dates of ascent) of meteorographs released from Royal Center, Ind., during February, 1931

There were 38 balloons released during the month and in 7 cases two meteorographs were attached to the same balloon in order to determine the agreement between the individual records. In only 2 of the 7 cases (seventh and eleventh) was it possible to make detailed comparisons. In these the agreement was found to be excellent, the temperature at all points in the records agreeing to within 2° C. at any particular altitude. In the record of the seventh the maximum altitudes as determined separately by the two instruments were 16,963 and 17,043 meters, respectively, or a variation of only one-half per cent. Further details regarding this comparison may be found in reference (6).

In four cases additional balloons were released shortly after sunset to determine the effect of insolation upon the meteorograph. The plan was to compare the temperature record with that obtained in the regular observation made about one hour before sunset. In only one case (the flights of the second) was a comparison possible. The temperatures in this case agreed to within 1° C. at any particular altitude within the troposphere, but the record of the second instrument indicated a temperature of about 5° C. lower in the stratosphere. Whether this was a result of insolation or instrumental error is uncertain and additional tests of this kind are therefore desirable. Further details regarding this comparison may be found in reference (6).

Out of a total of 45 meteorographs released, 42 (93 per cent) were returned.

Table 1 contains a summary of the individual observations. The landing places are shown in Figure 1.

The average altitude reached during the series was 13,665 meters, and the extreme height reached was 27,683 meters on the 15th. The next highest altitude reached was 18,074 meters on the 24th.

Following are some of the significant features of the tropopause obtained for the more recent monthly series of sounding-balloon observations made in this country.

Place	Date	Mean height of tropopause	Mean temperature of tropopause	Maximum height of tropopause observed	Minimum height of tropopause observed	Range in height of tropopause observed
		Meters, M. S. L.	*°C.*	*Meters, M. S. L.*	*Meters, M. S. L.*	*Meters*
Royal Center, Ind.	February, 1931	10,307	−61.1	11,550	8,344	3,206
Royal Center, Ind. (4)	September, 1930	12,914	−59.3	14,615	10,898	3,717
Broken Arrow, Okla. (3)	December, 1929	10,083	−54.0	12,212	7,728	4,484
Groesbeck, Tex. (2)	October, 1927	14,823	−65.5	17,467	11,695	5,772
Royal Center, Ind. (1)	May, 1926	12,011	−58.4	15,840	8,878	6,962

The lower average height of the tropopause at Royal Center in February than in September and May is to be expected; likewise, the correspondingly lower temperature for a winter month.

The mean temperature curve for the month, together with the altitude and temperature of the tropopause for the individual observations and the corresponding dates, is shown in Figure 2. The portion of the curve above 18 kilometers must be accepted with reservation since it is based on only a single observation.

The maximum monthly average lapse rate and the altitude interval at which it occurred is given below for the various monthly series referred to in the preceding table.

Place	Date	Maximum average lapse rate	Altitude interval of occurrence
		°C./100 m	*Km*
Royal Center, Ind.	February, 1931	0.84	7–8
Royal Center, Ind. (4)	September, 1930	.77	9–10
Broken Arrow, Okla. (3)	December, 1929	.77	6–7
Groesbeck, Tex. (2)	October, 1927	.79	7–8
Royal Center, Ind. (1)	May, 1926	.71	7–8

[1] Lat. 40° 53′ N., long. 86° 29′ W.

It will be noted that the maximum average lapse rate for the present series was greater than that for the months of May and September at this station in previous series.

In Figure 3, are shown the individual temperature-altitude curves. The surface temperature is indicated at the bottom of each curve and the temperature at the maximum altitude at the top. The wind directions, whenever observed, are indicated for the standard levels adjacent to the corresponding curves. Conspicuous in these wind directions are those for the 24th, when an easterly component persisted throughout the troposphere. The winds in the stratosphere on this date were westerly. The continuation of easterly winds to such high elevations in the winter season at this latitude is observed only occasionally and was evidently the result of abnormally high temperatures over the Great Lakes which resulted in a reversal of the normal latitudinal temperature gradient.

In Figure 4 are shown the free-air isotherms for the month with dates indicated across the top.

The relatively small fluctuation in the height of the tropopause throughout the month is noticeable.

Figure 5 shows the mean wind velocity and direction curves for the month. The increase indicated in the average velocity after the stratosphere is reached is doubtful, since the curve is based on less than five observations at and above 12 kilometers. The mean direction is very constant.

In Table 2 are given the tabulated data of the individual ascents. The elevation of the tropopause has been indicated in each case where it was observed. The relative humidities as recorded have been included, but the uncertainty of hair hygrographs at temperatures below −15° C. must be kept in mind.

References to sounding-balloon observations made in this country previous to 1926 may be found listed on page 302 of reference (1).

REFERENCES

(1) Monthly Weather Review, July, 1927.
(2) Monthly Weather Review, June, 1929.
(3) Monthly Weather Review, August, 1931.
(4) Monthly Weather Review, November, 1931.
(5) Monthly Weather Review, February, 1931.
(6) Monthly Weather Review, June, 1931.

TABLE 1.—*Summary of sounding-balloon ascents made at Royal Center, Ind., during February, 1931*

Date	Time of release, 90th mer.	Stratosphere		Maximum height reached, M. S. L.	Minimum temperature recorded	Balloon followed with		Meteorograph found	
		Height of base, M.S.L.	Temperature at base			2 theodolites	1 theodolite	Distance from station	Direction from station
		Meters	*°C.*	*Meters*	*°C.*	*Min. obsrd.*	*Min. obsrd.*	*Km.*	
1	4:08 p. m.	10,625	−61.4	14,090	−61.4	6	7	456	ESE.
2	3:55 p. m.	10,021	−61.7	11,382	−61.7	3	--------	73	SSE.
2	5:18 p. m.	11,014	−65.1	12,847	−65.1	0	0	94	SE.
3	4:12 p. m.	--------	--------	[1] 11,589	--------	51	--------	(2)	
3	5:46 p. m.	9,787	−60.1	13,158	−61.6	0	0	163	ESE.
4	4:02 p. m.	10,121	−62.0	[1] 13,706	−62.6	71	73	146	ESE.
5	4:18 p. m.	--------	--------	9,899	−54.7	7	9	313	ESE.
6	4:06 p. m.	--------	--------	3,534	−6.6	13	15	307	E.
6	4:40 p. m.	--------	--------	10,078	−63.9	0	0	118	E.
7	4:11 p. m.	11,288	−64.5	17,043	−64.7	0	0	266	E.
8	3:58 p. m.	11,024	−66.9	12,160	−67.1	5	--------	202	ENE.
9	7:06 a. m.	10,914	−58.0	13,831	−58.0	31	36	153	ENE.
9	4:01 p. m.	(3)	--------	[1] 2,123	--------	7	7¾	80	E.
10	7:04 a. m.	--------	--------	[1] 11,952	--------	40	--------	(1)	
10	4:10 p. m.	9,333	−63.3	9,522	−63.3	26	34	102	S.
11	7:29 a. m.	--------	--------	7,171	−36.5	1	8	94	E.
11	4:18 p. m.	9,404	−58.5	14,515	−59.9	0	5½	270	ESE.
12	7:44 a. m.	10,378	−62.3	16,799	−62.3	4	--------	200	E.
12	4:01 p. m.	9,715	−63.6	11,970	−63.6	9	--------	180	E.
13	7:26 a. m.	10,236	−61.1	10,929	−61.1	0	1½	283	E.
14	7:17 a. m.	8,344	−47.6	10,373	−47.6	3½	--------	127	SSE.
14	4:10 p. m.	9,170	−57.4	12,577	−57.4	23	39	175	SSE.
15	4:30 p. m.	10,338	−56.6	27,683	−64.4	7	--------	193	E.

[1] Obtained from 2-theodolite observations. [2] Not found. [3] Poor record.

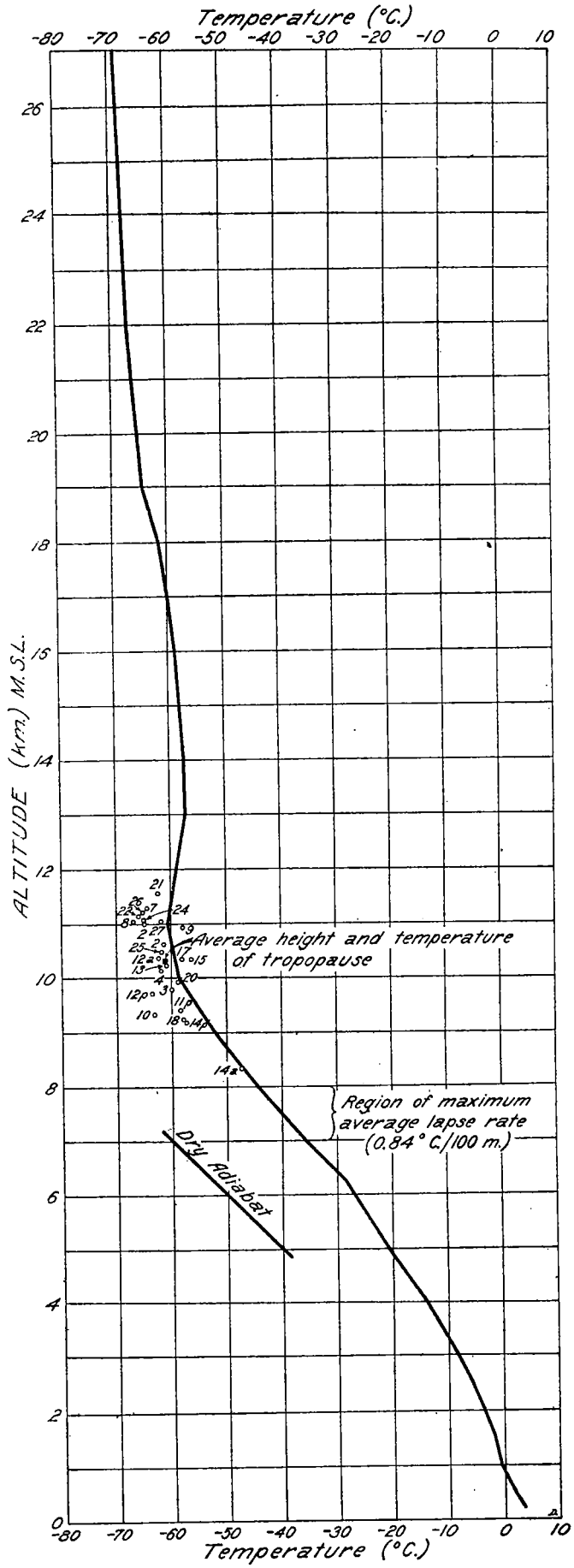

FIGURE 2.—Mean temperature (°C) for February, 1931, Royal Center, Ind. Circles indicate height and temperature of tropopause with corresponding dates

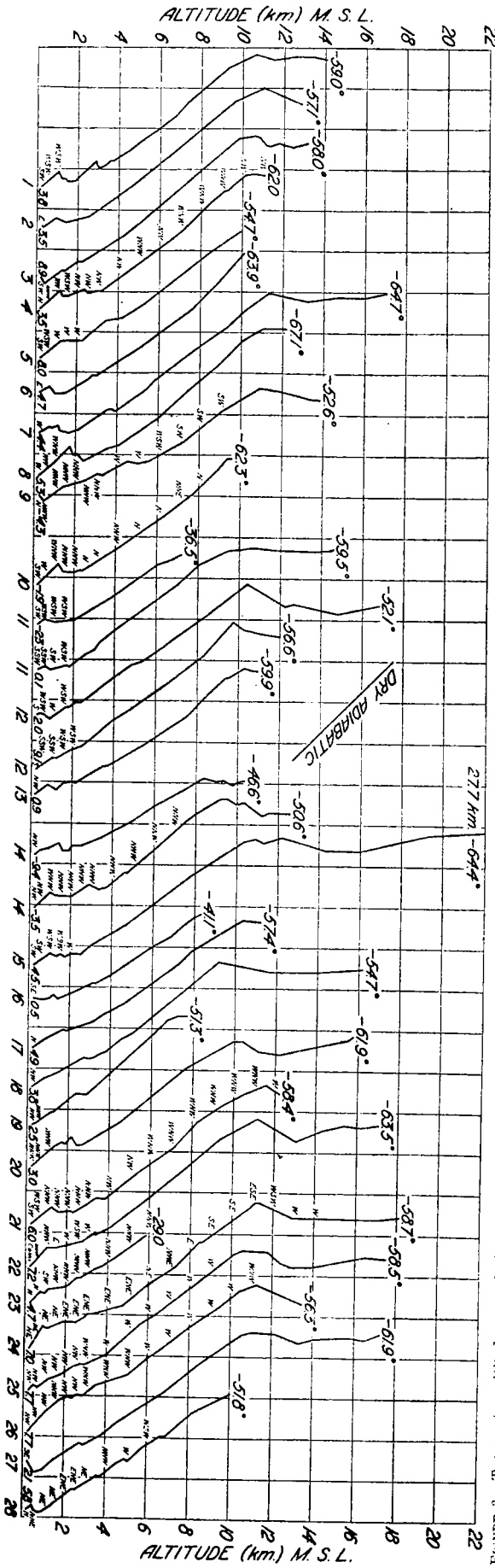

FIGURE 3.—Temperature-altitude curves for individual observations made at Royal Center, Ind., during February, 1931. Dates indicated below; figures at bottom and at top of curves indicate corresponding temperatures (°C.). (Abscissa value of each square represents 20° C.)

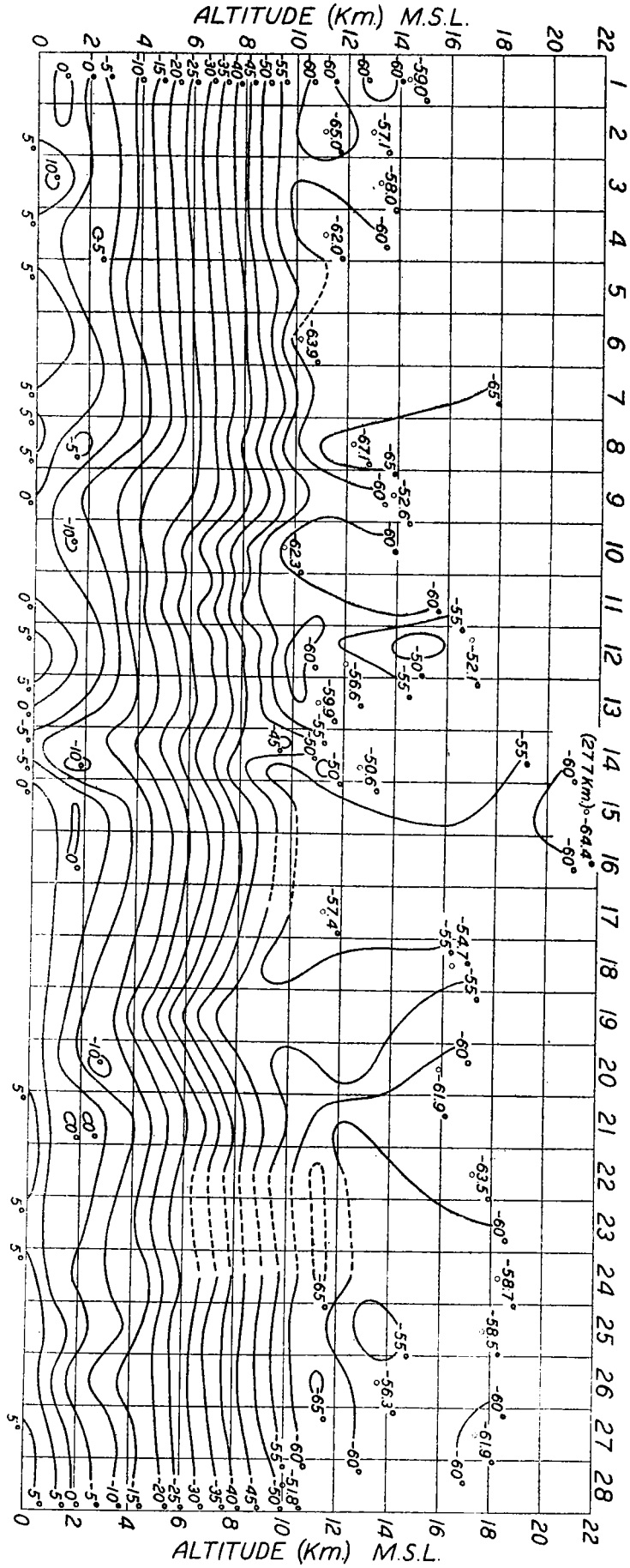

FIGURE 4.—Free-air isotherms (°C.) observed at Royal Center, Ind., during February, 1931. (Broken lines drawn between dates with missing data)

TABLE 1.—*Summary of sounding-balloon ascents made at Royal Center, Ind., during February, 1931*—Continued

Date	Time of release 90th mer.	Stratosphere: Height of base, M.S.L.	Stratosphere: Temperature at base	Maximum height reached, M.S.L.	Minimum temperature recorded	Balloon followed with: 2 theodolites	Balloon followed with: 1 theodolite	Meteorograph found: Distance from station	Meteorograph found: Direction from station
		Meters	°*C.*	*Meters*	°*C.*	*Min. obsrd.*	*Min. obsrd.*	*Km.*	
16	4:07 p. m.	-------	-------	8,333	−41.1	0	0	126	NNE.
17	4:06 p. m.	10,353	−58.2	11,189	−58.2	0	0	95	ESE.
18	4:10 p. m.	9,205	−57.8	16,172	−57.8	0	0	50	ENE.
19	4:15 p. m.	-------	-------	7,690	−51.3	1½	-------	40	SE.
20	4:17 p. m.	9,930	−58.9	15,749	−61.9	2¾	-------	140	SSE.
21	4:12 p. m.	11,550	−62.5	[1] 17,321	−62.5	68	83	130	ESE.
22	4:13 p. m.	11,149	−66.0	17,034	−66.0	13¾	-------	110	E.
23	4:10 p. m.	-------	-------	[1] 15,518	−29.0	65	66	80	ESE.
24	4:11 p. m.	11,067	−65.2	18,074	−65.2	77	-------	9	E.
25	4:12 p. m.	10,474	−61.8	17,483	−61.8	0	40	95	E.
26	4:11 p. m.	11,211	−65.5	13,420	−65.5	45	48	158	ESE.
27	8:24 p. m.	11,036	−61.9	17,263	−61.9	0	0	178	ENE.
28	4:19 p. m.	-------	-------	10,047	−61.8	29	-------	96	NE.

[1] Obtained from 2-theodolite observations.

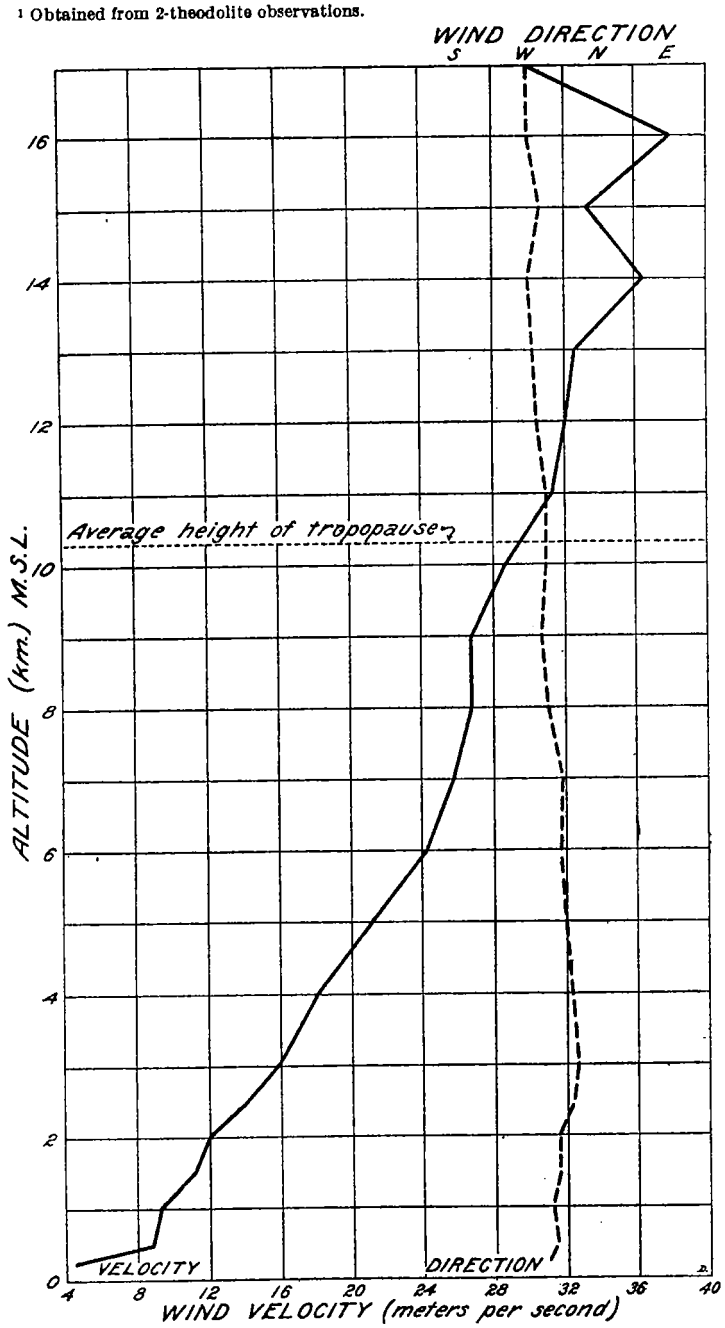

FIGURE 5.—Mean wind velocity (m. p. s.) and direction curves for February, 1931, Royal Center, Ind.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*

FEBRUARY 1, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*		*P. ct.*	*Mb.*		*M.p.s.*	
4:08	225	990.5	3.8	-------	60	4.81	sw.	5.8	8 St. Cu., WNW ?
	500	956.2	1.3	-------	73	4.90	wsw.	12.1	
	1,000	904.1	−3.3	-------	98	4.56	wsw.	13.0	
4:14	1,041	894.6	−3.7	0.92	100	4.50	wsw.	13.2	
4:16	1,197	877.1	0.0	−2.37	53	3.24	-------	-------	
4:18	1,379	857.4	0.3	−0.16	44	2.75	-------	-------	
	1,500	844.5	1.5	-------	57	3.88	-------	-------	
4:20	1,511	843.4	1.6	−0.98	58	3.98	-------	-------	
4:22	1,816	812.1	1.1	0.16	82	5.42	-------	-------	
	2,000	793.9	−0.7	-------	85	4.90	-------	-------	
	2,500	745.3	−5.5	-------	94	3.64	-------	-------	
4:29	2,835	713.9	−8.8	0.97	100	2.91	-------	-------	
4:30	2,891	708.7	−6.9	−3.39	100	3.43	-------	-------	
	3,000	699.4	−6.0	-------	86	3.18	-------	-------	
4:32	3,034	695.9	−5.7	−0.84	82	3.12	-------	-------	
4:33	3,153	685.3	−6.2	0.42	67	2.44	-------	-------	
4:35	3,296	672.9	−6.9	0.49	80	2.74	-------	-------	
4:37	3,544	651.8	−8.8	0.77	82	2.39	-------	-------	
4:39	3,656	642.4	−8.9	0.09	67	1.93	-------	-------	
	4,000	614.3	−11.2	-------	67	1.57	-------	-------	
4:43	4,012	613.5	−11.3	0.67	67	1.56	-------	-------	
4:49	4,470	577.8	−14.0	0.59	51	0.93	-------	-------	
	5,000	538.1	−18.3	-------	48	0.59	-------	-------	
4:56	5,059	534.3	−18.8	0.81	48	0.56	-------	-------	
5:05	5,734	487.5	−24.4	0.83	48	0.33	-------	-------	
	6,000	469.2	−26.2	-------	49	0.28	-------	-------	
5:15	6,730	424.4	−31.1	0.67	52	0.18	-------	-------	
	7,000	409.6	−34.2	-------	51	0.12	-------	-------	
5:25	7,343	388.8	−38.1	1.14	50	0.08	-------	-------	
	8,000	354.8	−43.7	-------	50	0.04	-------	-------	
5:38	8,422	331.4	−47.3	0.85	50	0.03	-------	-------	
	9,000	303.7	−52.3	-------	50	0.01	-------	-------	
5:49	9,329	288.3	−55.2	0.87	50	0.01	-------	-------	
	10,000	259.7	−58.4	-------	49	0.01	-------	-------	
6:08	10,625	234.7	−61.4	0.48	48	(1)	-------	-------	Tropopause.
	11,000	221.3	−60.3	-------	46	(1)	-------	-------	
6:18	11,516	203.5	−58.8	−0.29	43	0.01	-------	-------	
	12,000	188.8	−59.5	-------	43	(1)	-------	-------	
6:37	12,569	171.2	−60.3	0.14	43	(1)	-------	-------	
	13,000	160.7	−60.3	-------	43	(1)	-------	-------	
6:56	13,479	148.7	−60.4	0.01	43	(1)	-------	-------	
	14,000	136.8	−59.2	-------	43	0.01	-------	-------	
7:12	14,090	134.9	−59.0	−0.23	43	0.01	-------	-------	

FEBRUARY 2, 1931

P. m.									
3:55	225	996.4	6.9	-------	69	6.87	e.	4.5	9 St. Cu., NNE.
	500	958.5	4.3	-------	78	6.47	-------	-------	
	1,000	904.1	−0.5	-------	94	5.51	-------	-------	
3:59	1,129	891.1	−1.7	0.95	98	5.20	-------	-------	Altitude of St. Cu. base, 982 m., m. s. l.
	1,500	850.0	2.0	-------	59	4.16	-------	-------	
4:00	1,517	849.0	2.2	−1.01	57	4.08	-------	-------	
4:02	1,763	823.4	0.8	0.57	53	3.43	-------	-------	
4:02½	1,912	808.1	1.2	−0.27	52	3.46	-------	-------	
	2,000	799.4	0.9	-------	51	3.33	-------	-------	
	2,500	751.3	−0.8	-------	48	2.75	-------	-------	
4:05	2,651	737.2	−1.3	0.34	47	2.58	-------	-------	
	3,000	705.5	−4.1	-------	47	2.04	-------	-------	
	4,000	619.0	−12.1	-------	48	1.04	-------	-------	
4:15	4,798	558.0	−18.5	0.80	49	0.59	-------	-------	
	5,000	542.1	−20.1	-------	49	0.50	-------	-------	
	6,000	474.0	−28.0	-------	49	0.23	-------	-------	
4:24	6,877	419.5	−35.0	0.79	49	0.11	-------	-------	
	7,000	412.0	−36.0	-------	49	0.10	-------	-------	
	8,000	356.8	−44.1	-------	47	0.04	-------	-------	
4:34	8,810	316.0	−50.6	0.81	45	0.02	-------	-------	
	9,000	306.9	−52.3	-------	45	0.01	-------	-------	
	10,000	263.7	−61.5	-------	45	(1)	-------	-------	
4:43	10,021	262.4	−61.7	0.92	45	(1)	-------	-------	Tropopause.
	11,000	226.2	−58.2	-------	45	0.01	-------	-------	
4:48	11,382	212.6	−56.8	−0.46	45	0.01	-------	-------	

FEBRUARY 2, 1931

P. m.									
5:18	225	996.5	3.5	-------	84	6.59	e.	4.0	Few A. St., N ?
5:19	304	986.8	4.3	−1.01	84	6.97	-------	-------	
	500	960.0	2.9	-------	89	6.69	-------	-------	
5:21	932	913.1	−0.3	0.73	100	5.96	-------	-------	
	1,000	905.0	0.0	-------	93	5.68	-------	-------	
5:23	1,389	862.4	1.4	−0.37	56	3.79	-------	-------	
	1,500	850.0	1.1	-------	55	3.64	-------	-------	
	2,000	800.0	−0.2	-------	50	3.00	-------	-------	
	2,500	751.0	−1.5	-------	45	2.43	-------	-------	
5:26	2,551	746.1	−1.6	0.26	45	2.41	-------	-------	
	3,000	706.0	−4.9	-------	45	1.83	-------	-------	
	4,000	617.0	−12.2	-------	45	0.97	-------	-------	
5:36	4,780	559.0	−18.0	0.74	45	0.57	-------	-------	
	5,000	543.0	−19.8	-------	45	0.48	-------	-------	
	6,000	474.0	−28.1	-------	44	0.21	-------	-------	

[1] Less than 0.01 mb.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 2, 1931—Continued

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	Δt/100 m.	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
5:45	6,621	434.5	−33.2	0.83	44	0.12			
	7,000	414.0	−36.4		44	0.08			
	8,000	357.0	−45.0		43	0.03			
5:54	8,304	340.5	−47.6	0.86	43	0.02			
	9,000	307.0	−53.2		42	0.01			
6:03	9,716	274.7	−59.0	0.81	40	(1)			
	10,000	263.5	−60.3		40	(1)			
	11,000	224.5	−65.0		40	(1)			
6:09	11,014	224.1	−65.1	0.47	40	(1)			Tropopause.
	12,000	191.0	−60.8		42	(1)			
6:20	12,847	167.3	−57.1	−0.44	43	0.01			

[1] Less than 0.01 mb.

FEBRUARY 3, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	Δt/100 m.	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
5:46	225	988.2	8.9		62	7.07	sw.	3.1	1 Ci. St., NW.; 10 Light Haze.
5:47	367	969.8	12.1	−2.25	53	7.48			
	500	953.0	11.0		53	6.96			
	1,000	899.0	7.6		57	5.95			
5:50	1,275	869.5	5.5	0.73	58	5.24			
5:51	1,326	861.5	5.7	−0.39	56	5.13			
	1,500	843.0	4.6		56	4.75			
	2,000	794.0	0.8		56	3.62			
5:54	2,009	792.8	0.8	0.72	56	3.62			
5:56	2,193	773.3	0.8	0.00	46	2.98			
	2,500	743.0	−1.1		42	2.34			
	3,000	698.0	−4.4		37	1.57			
6:01	3,126	686.5	−5.3	0.65	35	1.38			
	4,000	614.0	−10.8		30	0.73			
6:07	4,213	597.3	−12.3	0.64	29	0.62			
6:08	4,473	574.2	−14.7	0.92	32	0.55			
6:11	4,962	538.6	−18.3	0.74	29	0.36			
	5,000	537.0	−18.7		29	0.34			
	6,000	466.5	−27.1		29	0.15			
6:18	6,655	425.4	−32.9	0.86	29	0.08			
	7,000	405.0	−35.9		29	0.06			
	8,000	349.5	−44.8		29	0.02			
6:25	8,206	338.8	−46.7	0.89	29	0.02			
	9,000	300.5	−53.3		29	0.01			
6:32	9,787	265.1	−60.1	0.85	29	(1)			Tropopause.
	10,000	257.0	−60.5		29	(1)			
6:37	10,577	234.4	−61.6	0.19	29	(1)			
6:38	10,812	225.3	−61.0	−0.26	29	(1)			
	11,000	219.0	−58.7		29	(1)			
6:40	11,154	214.0	−56.5	−1.32	29	(1)			
6:42	11,256	210.4	−56.3	−0.20	26	(1)			
6:45	11,735	195.0	−57.8	0.31	26	(1)			
	12,000	186.7	−57.0		26	(1)			
6:50	12,398	175.4	−55.9	−0.29	26	(1)			
	13,000	158.8	−57.4		26	(1)			
6:56	13,158	154.9	−58.0	0.28	26	(1)			

[1] Less than 0.01 mb.

FEBRUARY 4, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	Δt/100 m.	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:02	225	994.6	3.5		48	3.77	n.	1.8	1 Ci. St., WNW.
	500	959.0	0.9		50	3.26	nnw.	2.2	
	1,000	903.0	−3.7		53	2.38	nw.	2.4	
4:06	1,158	884.9	−5.2	0.93	54	2.14	nw.	2.3	
4:06½	1,272	872.2	−2.0	−2.81	44	2.28	nw.	2.4	
	1,500	847.0	−2.2		41	2.09	wnw.	3.8	
4:07	1,540	843.2	−2.2	0.07	40	2.04	wnw.	4.2	
	2,000	795.0	−4.1		38	1.65	nw.	7.6	
4:10	2,272	768.7	−5.2	0.41	37	1.47	nw.	8.9	
4:11	2,338	762.3	−5.2	0.00	35	1.39	nw.	9.4	
	2,500	746.0	−3.8		34	1.52	nw.	10.4	
4:11½	2,522	744.6	−3.6	−0.87	34	1.54	nw.	10.4	
4:14	2,943	705.8	−4.8	0.28	37	1.52	nw.	10.4	
	3,000	703.0	−4.9		36	1.47	nw.	10.4	
4:15	3,139	688.4	−5.0	0.10	35	1.41	nw.	10.8	
	4,000	615.0	−11.5		35	0.80	nw.	12.3	
4:23	4,904	547.0	−18.3	0.75	35	0.43	nw.	14.4	
	5,000	540.0	−19.0		35	0.40	wnw.	14.5	
	6,000	472.0	−26.5		33	0.18	nw.	18.7	
4:30	6,473	441.8	−30.0	0.75	32	0.12	nw.	20.4	
	7,000	411.0	−35.1		32	0.07	wnw.	20.0	
4:33	7,088	404.8	−35.9	0.96	32	0.06	wnw.	20.0	
	8,000	355.0	−44.5		32	0.02	wnw.	20.5	
4:41	8,484	330.3	−49.0	0.94	32	0.01	wnw.	21.5	
	9,000	305.0	−53.4		32	0.01	wnw.	22.6	
4:45	9,079	301.7	−54.1	0.86	32	0.01	wnw.	24.0	
4:45½	9,296	292.2	−54.9	0.37	32	0.01	wnw.	25.2	
4:47	9,570	279.7	−57.5	0.95	32	(1)	nw.	25.9	
	10,000	262.0	−61.0		32	(1)	nw.	25.6	
4:50	10,121	256.5	−62.0	0.82	32	(1)	nw.	25.2	Tropopause.
4:52	10,521	240.6	−62.6	0.15	32	(1)	nw.	22.8	
	11,000	223.0	−62.1		32	(1)	nw.	24.0	
4:55	11,055	221.7	−62.0	−0.11	32	(1)	nw.	25.0	
	12,000						nw.	27.2	
	13,000						wnw.	26.8	
5:08	13,706						wnw.	28.0	

[1] Less than 0.01 mb.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 5, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	Δt/100 m.	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:18	225	985.6	8.0		54	5.79	sw.	3.1	1 Ci. Cu., NW., 4 A. Cu., NW., 3 St. Cu., W.
	500	955.0	5.7		56	5.13	sw.	10.7	
	1,000	897.5	1.4		59	3.99	w.	12.1	
4:21	1,217	872.5	−0.4	0.85	61	3.61	w.	12.6	
	1,500	841.0	−0.4		56	3.31	w.	15.8	
	2,000	791.0	−0.4		48	2.84	w.	18.6	
4:26	2,232	768.5	−0.4	0.00	44	2.60			
	2,500	742.0	−2.8		48	2.33			
	3,000	697.5	−7.3		56	1.85			
4:31	3,351	666.6	−10.5	0.90	62	1.56			
	4,000	613.5	−11.6		57	1.29			
4:34	4,202	596.5	−11.9	0.16	56	1.24			
	5,000	537.0	−17.4		47	0.63			
4:40	5,251	519.5	−19.1	0.69	44	0.50			
	6,000	470.0	−25.1		41	0.26			
4:50	6,948	411.6	−32.6	0.80	38	0.11			
	7,000	411.0	−33.0		38	0.11			
	8,000	353.0	−40.4		38	0.05			
4:59	8,544	327.1	−44.5	0.75	38	0.03			
	9,000	304.5	−47.9		38	0.02			
5:05	9,899	266.6	−54.7	0.75	38	0.01			

FEBRUARY 6, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	Δt/100 m.	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:06	225	990.2	4.7		72	6.15	e.	8.9	10 A. St., W.
	500	958.0	2.6		77	5.67	ese.	13.9	
4:08	612	942.8	1.7	0.78	79	5.45	ese.	13.3	
4:09	851	916.6	5.3	−1.51	68	6.06	se.	11.7	Altitude of A. St. base, 3,305 m., m. s. l.
	1,000	900.0	5.4		67	6.01	sse.	10.2	
4:10	1,117	887.2	5.4	−0.04	67	6.01	sse.	9.4	
	1,500	845.5	4.8		51	4.39	ssw.	8.0	
4:11	1,568	839.4	4.7	0.16	48	4.10	ssw.	7.9	
	2,000	795.5	1.9		60	4.20	sw.	10.1	
	2,500	745.5	−1.2		76	4.20	sw.	14.9	
4:16	2,722	727.4	−2.6	0.63	83	4.09	sw.	15.0	Pressure trace missing; altitudes from 612 to 2,722 meters inclusive were obtained from the 2-theodolite observation; the altitudes 3,414 and 3,534 meters were obtained from ascensional rate; pressures computed from altitudes and temperatures.
4:19	3,414	666.2	−6.6	0.58	94	3.31			
4:20	3,534	656.1	−6.5	−0.08	94	3.34			

FEBRUARY 6, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	Δt/100 m.	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:40	225	990.2	4.7		72	6.15	e.	8.9	10 A. St., W.?
	500	954.0	3.0		76	5.76			
4:42	683	936.2	2.1	0.57	77	5.47			
4:43	979	903.4	5.5	−1.15	67	6.05			
	1,000	899.0	5.3		64	5.70			
4:45	1,438	852.4	5.1	0.09	54	4.74			
	1,500	844.0	4.7		57	4.87			
	2,000	796.0	1.5		77	5.24			
	2,500	745.0	−1.6		98	5.25			
4:49	2,575	740.0	−2.1	0.63	100	5.14			
4:50	2,734	726.1	−3.6	0.94	100	4.54			
4:51	2,958	706.3	−3.6	0.00	96	4.36			
	3,000	703.0	−3.9		96	4.24			
4:53	3,774	635.4	−9.5	0.72	100	2.74			
4:54	3,896	625.4	−10.2	0.57	77	1.98			
	4,000	617.0	−10.9		79	1.91			
4:56	4,498	578.5	−13.8	0.60	91	1.69			
4:57	4,855	553.3	−16.3	0.70	75	1.11			
	5,000	543.0	−17.3		72	0.97			
4:59	5,294	520.5	−19.3	0.68	67	0.75			
5:00	5,528	504.5	−21.2	0.81	68	0.63			
	6,000	474.0	−24.9		73	0.47			
5:03	6,222	459.5	−26.5	0.76	75	0.41			
	7,000	413.0	−32.1		68	0.21			
5:08	7,558	381.0	−36.3	0.73	65	0.13			
	8,000	358.0	−40.7		64	0.08			
5:13	8,894	313.5	−49.9	1.02	65	0.02			
	9,000	309.0	−51.0		64	0.02			
	10,000	264.0	−62.9		62	(1)			
5:19	10,078	261.1	−63.9	1.18	62	(1)			

[1] Less than 0.01 mb.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 7, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:11	225	990.2	4.4	------	98	8.19	w.	3.6	10 St., W.
	500	955.0	2.8	------	98	7.32	------	------	
4:13	678	936.4	1.7	0.60	98	6.76	------	------	
4:13½	805	921.8	2.1	−0.31	96	6.82	------	------	
	1,000	899.5	1.2	------	95	6.33	------	------	
4:14	1,096	889.1	0.7	0.48	94	6.03	------	------	
4:15	1,214	876.3	3.6	−2.46	90	7.11	------	------	
4:16	1,345	862.2	3.8	−0.15	89	7.14	------	------	
	1,500	845.5	4.1	------	77	6.31	------	------	
4:17	1,622	833.4	4.4	−0.22	67	5.60	------	------	
	2,000	794.5	3.2	------	47	3.61	------	------	
4:20	2,079	787.6	2.9	0.33	43	3.23	------	------	
	2,500	745.0	0.0	------	42	2.57	------	------	
	3,000	703.0	−3.5	------	40	1.83	------	------	
4:27	3,500	658.8	−7.0	0.70	39	1.33	------	------	
4:27½	3,693	642.7	−7.2	0.10	34	1.14	------	------	
4:28½	3,836	631.4	−6.2	−0.70	27	0.98	------	------	
	4,000	620.0	−7.4	------	26	0.86	------	------	
	5,000	543.5	−14.5	------	23	0.40	------	------	
4:36	5,376	516.5	−17.2	0.77	22	0.30	------	------	
4:38	5,769	490.1	−21.5	1.09	22	0.20	------	------	
	6,000	476.0	−23.3	------	22	0.17	------	------	
	7,000	413.5	−31.0	------	22	0.08	------	------	
4:46	7,541	383.3	−35.2	0.77	22	0.05	------	------	
	8,000	357.5	−38.5	------	21	0.03	------	------	
	9,000	310.0	−45.6	------	20	0.01	------	------	
4:53	9,271	298.4	−47.5	0.71	20	0.01	------	------	
	10,000	267.0	−54.5	------	20	(1)	------	------	
4:57	10,091	263.6	−55.4	0.96	20	(1)	------	------	
	11,000	228.0	−62.3	------	21	(1)	------	------	
5:04	11,288	218.8	−64.5	0.76	21	(1)	------	------	Tropopause.
	12,000	195.0	−63.0	------	21	(1)	------	------	
	13,000	167.0	−60.8	------	20	(1)	------	------	
5:14	13,199	161.8	−60.4	−0.21	20	(1)	------	------	
	14,000	142.0	−61.6	------	20	(1)	------	------	
5:23	14,623	129.1	−62.6	0.15	20	(1)	------	------	
	15,000	121.0	−62.5	------	20	(1)	------	------	
5:33	15,911	105.2	−62.2	−0.03	20	(1)	------	------	
	16,000	103.5	−62.4	------	20	(1)	------	------	
	17,000	88.5	−64.6	------	18	(1)	------	------	
5:41	17,043	87.8	−64.7	0.22	18	(1)	------	------	

[1] Less than 0.01 mb.

FEBRUARY 8, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
3:58	225	989.5	5.3	------	66	5.88	w.	4.5	5 Ci. St., NW? 5 St. Cu., WNW.
	500	954.0	2.8	------	72	5.38	nw.	12.2	
4:01	931	906.7	−1.1	0.91	82	4.58	w.	9.4	
	1,000	900.0	−1.7	------	83	4.41	wnw.	9.3	
	1,500	843.5	−6.1	------	92	3.38	------	------	
4:04	1,690	823.5	−7.7	0.87	96	3.07	------	------	
4:05	1,860	805.8	−4.9	−1.65	82	3.34	------	------	
4:06	1,997	792.4	−5.3	0.29	74	2.91	------	------	
4:07	2,341	758.1	−2.1	−0.93	46	2.36	------	------	
	2,500	743.0	−2.9	------	46	2.21	------	------	
	3,000	700.0	−5.4	------	47	1.83	------	------	
4:12	3,503	654.1	−7.9	0.50	48	1.51	------	------	
	4,000	613.5	−9.4	------	39	1.08	------	------	
4:15	4,054	609.3	−9.6	0.31	38	1.03	------	------	
	5,000	538.0	−16.3	------	38	0.56	------	------	
	6,000	471.5	−23.5	------	38	0.28	------	------	
4:23	6,018	469.5	−23.6	0.71	38	0.28	------	------	
4:24	6,222	456.2	−26.1	1.23	40	0.23	------	------	
	7,000	410.0	−33.1	------	49	0.14	------	------	Altitude of St. Cu. base, 1,333 m., m. s. l.
4:30	7,380	388.4	−36.5	0.90	53	0.10	------	------	
	8,000	355.0	−41.7	------	53	0.06	------	------	
4:33	[2] 8,195	344.6	−43.3	0.84	53	0.05	------	------	
4:36	8,917	309.8	−49.5	0.86	53	0.02	------	------	
	9,000	305.0	−50.3	------	53	0.02	------	------	
	10,000	262.0	−60.5	------	53	0.01	------	------	
4:41	10,047	260.8	−61.0	1.02	53	(1)	------	------	
	11,000	224.0	−66.7	------	53	(1)	------	------	
4:45	11,024	223.4	−66.9	0.60	53	(1)	------	------	Tropopause.
	12,000	191.0	−67.1	------	50	(1)	------	------	
4:50	12,160	186.2	−67.1	0.02	50	(1)	------	------	

[1] Less than 0.01 mb.
[2] Altitudes above 8,195 meters were obtained by using mean ascensional rate. Pressures above this altitude computed from altitudes and temperatures.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 9, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
7:06	225	989.0	−4.3	------	93	3.98	n.	3.6	1 Ci. St., NW? few St. Cu. NW.
7:07	459	957.2	−2.1	−0.94	93	4.78	nnw.	7.2	
	500	954.0	−2.4	------	93	4.66	nnw.	7.8	
	1,000	896.0	−6.2	------	78	2.84	nnw.	7.6	
7:10	1,408	847.6	−9.3	0.76	67	1.86	nnw.	8.6	
	1,500	840.0	−9.6	------	66	1.79	nnw.	9.4	
	2,000	785.5	−10.9	------	56	1.36	nw.	12.8	
7:14	2,479	734.0	−12.2	0.27	47	1.01	wnw.	16.7	
	2,500	732.0	−12.6	------	47	0.98	wnw.	16.8	
7:16	2,999	686.7	−15.6	0.65	52	0.82	wnw.	18.1	
7:17	3,305	661.1	−15.0	−0.20	43	0.72	w.	18.4	
	4,000	603.0	−19.0	------	37	0.43	w.	21.7	
7:20	4,478	564.1	−21.7	0.57	33	0.29	w.	28.9	
7:22	4,998	528.6	−20.9	−0.15	32	0.31	w.	36.8	
7:24	5,549	489.1	−22.1	0.22	30	0.26	wsw.	40.5	
	6,000	462.0	−24.4	------	29	0.20	wsw.	41.3	
	7,000	402.0	−30.2	------	28	0.11	sw.	45.3	
7:29	7,227	388.5	−31.4	0.55	28	0.09	sw.	44.9	
	8,000	348.0	−37.8	------	28	0.05	sw.	47.8	
	9,000	302.0	−46.0	------	28	0.02	sw.	49.5	
7:35	9,119	296.4	−46.9	0.82	28	0.02	sw.	49.0	
	10,000	258.5	−52.4	------	28	0.01	------	------	
7:41	10,914	223.6	−58.0	0.58	28	(1)	------	------	
7:41	11,000	222.0	−57.9	------	28	(1)	------	------	
7:45	11,873	192.8	−56.4	−0.19	28	(1)	------	------	
	12,000	190.0	−56.1	------	28	0.01	------	------	
	13,000	162.0	−53.6	------	28	0.01	------	------	
7:51	13,352	153.5	−52.8	−0.24	28	0.01	------	------	
7:53	13,831	142.3	−52.6	−0.04	28	0.01	------	------	

[1] Less than 0.01 mb.

FEBRUARY 10, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:10	225	997.0	−1.9	------	60	3.14	sw.	1.3	Few Ci., St., NW. 1 A. Cu., NW.
	500	960.0	−4.9	------	62	2.52	w.	2.1	
	1,000	901.0	−10.0	------	67	1.76	wnw.	3.4	
4:14	1,173	880.7	−11.7	1.03	68	1.53	wnw.	4.7	
4:15	1,418	856.4	−8.0	−1.51	58	1.81	nw.	5.0	
	1,500	844.0	−7.9	------	58	1.83	nnw.	4.5	
4:17	1,877	806.0	−7.7	0.07	52	1.66	nnw.	5.6	
	2,000	793.0	−8.0	------	52	1.62	nnw.	6.3	
4:18	2,234	769.4	−8.6	0.25	52	1.54	n.	7.3	
4:19	2,346	754.3	−8.6	0.00	53	1.57	n.	7.9	
	2,500	742.0	−9.6	------	51	1.38	n.	12.0	
	3,000	695.0	−12.8	------	53	1.08	n.	13.7	
	4,000	610.0	−19.3	------	54	0.60	nnw.	16.6	
4:25	4,182	595.6	−20.3	0.64	57	0.58	nnw.	16.5	
	5,000	533.0	−26.1	------	55	0.32	n.	20.2	
	6,000	462.2	−33.3	------	55	0.15	n.	21.1	
4:33	6,207	449.6	−34.7	0.71	55	0.13	n.	19.2	
	7,000	402.0	−40.8	------	55	0.06	nne.	26.2	
4:38	7,645	367.2	−45.9	0.78	55	0.04	n.	25.2	
	8,000	347.0	−49.4	------	55	0.02	n.	23.1	
4:44	8,823	309.2	−57.4	0.98	55	0.01	------	------	
	9,000	295.0	−59.6	------	55	0.01	------	------	
4:48	9,333	282.0	−63.3	1.18	55	(1)	------	------	Tropopause.
4:49	9,522	272.8	−63.3	0.00	55	(1)	------	------	

[1] Less than 0.01 mb.

FEBRUARY 11, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:29	225	994.2	−2.3	------	75	3.80	sw.	6.7	8 A. St., W.; 1 A. Cu., W.
7:30	469	961.5	−4.4	0.86	------	------	wsw.	8.8	
	500	959.0	−4.3	------	------	------	wsw.	9.2	
	1,000	901.5	−3.4	------	------	------	wsw.	15.2	
7:33	1,056	893.5	−3.3	−0.19	------	------	wsw.	15.0	
	1,500	843.0	−3.7	------	------	------	wsw.	13.5	
7:37	1,979	793.5	−4.2	0.10	------	------	------	------	
	2,000	791.5	−4.3	------	------	------	------	------	
	2,500	741.0	−7.4	------	------	------	------	------	
	3,000	694.8	−10.6	------	------	------	------	------	
7:48	3,794	625.9	−15.6	0.63	------	------	------	------	
	4,000	611.0	−17.1	------	------	------	------	------	
	5,000	534.8	−24.4	------	------	------	------	------	
7:56	5,141	524.8	−25.5	0.73	------	------	------	------	
	6,000	466.0	−31.4	------	------	------	------	------	
8:04	6,008	465.6	−31.6	0.70	------	------	------	------	
8:13	6,661	423.4	−33.7	0.32	------	------	------	------	
	7,000	404.0	−35.5	------	------	------	------	------	
8:24	7,171	394.6	−36.5	0.55	------	------	------	------	

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 11, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:18	225	989.0	0.1	-------	98	6.03	ssw.	5.8	10 St., W.
	500	954.0	−1.3	-------	100	5.49	ssw.	23.8	
4:19	571	943.8	−1.7	0.52	100	5.31	ssw.	25.6	Snowing.
4:20	836	913.9	0.1	−0.68	98	6.03	ssw.	29.6	
	1,000	894.0	−0.3	-------	100	5.96	sw.	30.7	
	1,500	840.0	−1.8	-------	100	5.27	wsw.	42.2	
4:23	1,622	829.7	−2.1	0.28	100	5.14	wsw.	44.4	
4:24	1,754	815.2	−1.7	−0.30	100	5.31	wsw.	44.4	
	2,000	790.0	−3.6	-------	100	4.54	-------	-------	
4:27	2,458	742.2	−7.3	0.80	100	3.31	-------	-------	
	2,500	735.9	−7.7	-------	95	3.04	-------	-------	
4:29	2,978	697.2	−10.1	0.54	64	1.66	-------	-------	
	3,000	694.0	−10.4	-------	65	1.64	-------	-------	
4:30	3,213	675.9	−13.6	1.49	70	1.33	-------	-------	
	4,000	606.0	−19.7	-------	92	0.98	-------	-------	
4:34	4,172	591.7	−21.1	0.78	96	0.90	-------	-------	
	5,000	530.0	−27.1	-------	94	0.49	-------	-------	
4:40	5,477	495.4	−30.7	0.74	92	0.33	-------	-------	
	6,000	461.0	−34.5	-------	84	0.20	-------	-------	
4:48	6,956	401.7	−41.5	0.73	70	0.08	-------	-------	
	7,000	399.0	−42.2	-------	70	0.07	-------	-------	
	8,000	343.0	−51.6	-------	53	0.02	-------	-------	
4:55	8,027	342.0	−51.8	0.96	52	0.02	-------	-------	
	9,000	294.0	−56.6	-------	50	0.01	-------	-------	
5:01	9,404	277.3	−58.5	0.49	50	0.01	-------	-------	Tropopause.
	10,000	252.0	−59.2	-------	49	0.01	-------	-------	
5:08	10,659	226.5	−59.9	0.11	46	0.01	-------	-------	
	11,000	215.0	−59.6	-------	46	0.01	-------	-------	
5:15	11,750	190.8	−58.7	−0.11	42	0.01	-------	-------	
	12,000	183.0	−58.6	-------	42	0.01	-------	-------	
5:22	12,770	162.0	−58.5	−0.02	42	0.01	-------	-------	
	13,000	156.0	−58.4	-------	40	0.01	-------	-------	
5:30	13,617	140.9	−58.3	−0.02	36	(1)	-------	-------	
	14,000	133.0	−58.6	-------	34	(1)	-------	-------	
5:38	14,331	126.2	−58.9	0.08	32	(1)	-------	-------	
5:47	14,515	121.8	−59.5	0.33	30	(1)	-------	-------	

[1] Less than 0.01 mb.

FEBRUARY 12, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:44	225	988.6	2.0	-------	84	5.92	s.	3.6	2 Cl. St., W. ?.
7:45	386	969.0	1.6	0.25	85	5.83	sw.	7.0	7 St. Cu., WSW.
	500	956.0	1.9	-------	85	5.95	wsw.	8.4	Altitude of St. Cu.,
7:46	556	948.9	2.0	−0.24	85	5.99	w.	8.8	base, 1,633 m.,
7:47	878	911.9	4.2	−0.68	72	5.94	w.	8.8	m. s. l.
	1,000	900.0	3.3	-------	76	5.88	w.	7.6	
	1,500	843.0	−0.2	-------	90	5.41	wsw.	7.0	
7:49	1,605	833.2	−0.9	0.70	93	5.27	wsw.	7.0	
7:50	1,819	811.1	−1.7	0.37	93	4.94	-------	-------	
	2,000	794.0	−3.0	-------	95	4.53	-------	-------	
7:51	2,137	779.1	−3.9	0.69	96	4.24	-------	-------	
7:52	2,325	760.8	−3.7	−0.11	82	3.69	-------	-------	
	2,500	743.0	−4.9	-------	72	2.93	-------	-------	
7:53	2,762	719.6	−6.6	0.66	57	2.01	-------	-------	
	3,000	700.0	−8.6	-------	57	1.69	-------	-------	
7:56	3,494	654.6	−12.9	0.86	57	1.15	-------	-------	
7:58	3,847	624.8	−15.2	0.65	73	1.20	-------	-------	
	4,000	613.0	−16.3	-------	73	1.08	-------	-------	
8:01	4,841	546.7	−22.5	0.74	70	0.57	-------	-------	
	5,000	537.0	−23.1	-------	69	0.53	-------	-------	
8:03	5,278	515.0	−24.1	0.37	67	0.47	-------	-------	
8:05	5,758	482.0	−27.2	0.65	69	0.35	-------	-------	
	6,000	466.0	−28.9	-------	66	0.28	-------	-------	
8:07	6,405	440.3	−31.7	0.69	62	0.20	-------	-------	
8:08	6,560	430.7	−33.3	1.03	52	0.14	-------	-------	
	7,000	405.0	−36.5	-------	52	0.10	-------	-------	
	8,000	347.0	−43.6	-------	54	0.05	-------	-------	
8:16	8,466	325.8	−47.0	0.72	54	0.03	-------	-------	
	9,000	300.0	−51.3	-------	55	0.02	-------	-------	
	10,000	255.0	−59.3	-------	56	0.01	-------	-------	
8:24	10,378	241.8	−62.3	0.80	56	(1)	-------	-------	Tropopause.
	11,000	219.0	−58.5	-------	54	0.01	-------	-------	
	12,000	187.0	−52.3	-------	51	0.02	-------	-------	
8:33	12,126	183.6	−51.5	−0.62	51	0.02	-------	-------	
8:35	12,621	170.1	−52.5	0.20	48	0.01	-------	-------	
	13,000	161.0	−51.7	-------	47	0.02	-------	-------	
	14,000	137.0	−49.7	-------	44	0.02	-------	-------	
8:48	14,770	122.5	−48.2	−0.20	42	0.02	-------	-------	
	15,000	118.0	−48.6	-------	42	0.02	-------	-------	
	16,000	101.5	−50.6	-------	41	0.02	-------	-------	
9:00	16,799	89.9	−52.1	0.19	-----	-------	-------	-------	

[1] Less than 0.01 mb.

FEBRUARY 12, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:01	225	984.8	9.1	-------	68	7.86	s.	4.5	8 Cl. St., W. 1 St.
	500	952.0	7.2	-------	74	7.52	ssw.	11.7	Cu., SW.
	1,000	894.3	3.6	-------	83	6.56	ssw.	16.2	
4:04	1,010	894.1	3.4	0.73	81	6.31	ssw.	16.2	Altitude of St. Cu.
4:05	1,183	875.0	3.6	−0.12	90	7.11	sw.	18.7	base, 2,120 m,
	1,500	840.0	1.6	-------	93	6.38	wsw.	21.9	m. s. l.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 12, 1931—Continued

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:09	1,897	800.6	−0.6	0.59	96	5.58	wsw.	19.5	
	2,000	790.0	−1.0	-------	89	5.01	wsw.	20.8	
4:12	2,448	746.0	−2.6	0.36	52	2.56	-------	-------	
	2,500	740.0	−3.1	-------	53	2.51	-------	-------	
4:14	2,887	703.9	−6.1	0.80	55	2.02	-------	-------	
	3,000	696.0	−7.1	-------	57	1.92	-------	-------	
4:17	3,871	619.6	−15.1	0.92	66	1.09	-------	-------	
	4,000	610.0	−15.8	-------	69	1.07	-------	-------	
4:21	4,651	559.7	−19.8	0.60	84	0.89	-------	-------	
	5,000	535.0	−22.2	-------	84	0.71	-------	-------	
	6,000	465.0	−29.9	-------	84	0.33	-------	-------	
4:28	6,283	446.8	−32.1	0.75	84	0.26	-------	-------	
	7,000	404.0	−37.2	-------	83	0.15	-------	-------	
	8,000	348.0	−44.7	-------	80	0.06	-------	-------	
4:36	8,303	333.0	−47.1	0.74	80	0.04	-------	-------	
	9,000	300.0	−55.0	-------	79	0.02	-------	-------	
4:45	9,715	268.3	−63.6	1.17	78	0.01	-------	-------	Tropopause.
	10,000	256.0	−61.5	-------	76	0.01	-------	-------	
4:48	10,282	244.5	−59.7	−0.69	74	0.01	-------	-------	
4:49	10,674	229.4	−59.3	−0.10	72	0.01	-------	-------	
4:50	10,996	217.8	−58.1	−0.37	68	0.01	-------	-------	
4:55	11,970	186.8	−56.6	−0.15	67	0.01	-------	-------	

FEBRUARY 13, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:26	225	985.4	0.9	-------	90	5.87	nw.	3.1	10 St., NNW.
	500	953.0	−1.2	-------	95	5.25	-------	-------	
7:28	801	918.2	−3.4	0.75	100	4.61	-------	-------	
	1,000	892.0	−2.2	-------	86	4.39	-------	-------	
7:30	1,239	868.8	−1.1	−0.52	66	3.68	-------	-------	Altitude of St.,
	1,500	837.0	−3.5	-------	74	3.39	-------	-------	base, 631 m.,
7:31½	1,571	829.7	−4.4	0.99	76	3.22	-------	-------	m. s. l.
7:32	1,683	820.3	−4.4	0.00	81	3.43	-------	-------	
7:33½	2,004	785.9	−4.9	0.16	92	3.74	-------	-------	
7:34	2,137	771.6	−4.6	−0.23	96	4.00	-------	-------	
	2,500	736.0	−6.6	-------	98	3.45	-------	-------	
7:37	2,836	706.8	−8.3	-------	100	3.04	-------	-------	
	3,000	691.0	−9.6	-------	100	2.71	-------	-------	
7:39	3,463	650.4	−12.6	0.60	100	2.08	-------	-------	
7:40	3,718	629.0	−12.9	0.12	96	1.94	-------	-------	
	4,000	607.0	−14.5	-------	96	1.68	-------	-------	
	5,000	534.0	−20.6	-------	96	0.95	-------	-------	
7:46	5,442	501.0	−23.3	0.60	96	0.73	-------	-------	
	6,000	465.0	−27.0	-------	93	0.49	-------	-------	
	7,000	405.0	−34.0	-------	86	0.22	-------	-------	
7:55	7,548	373.4	−37.9	0.69	82	0.13	-------	-------	
	8,000	350.0	−42.6	-------	81	0.08	-------	-------	
8:01	8,476	325.8	−48.0	1.09	80	0.04	-------	-------	
	9,000	302.0	−53.0	-------	81	0.02	-------	-------	
8:05	9,313	286.5	−56.0	0.96	81	0.02	-------	-------	
8:06	9,563	275.0	−56.8	0.32	81	0.01	-------	-------	
	10,000	257.0	−59.6	-------	80	0.01	-------	-------	
8:08	10,236	247.3	−61.1	0.64	80	0.01	-------	-------	Tropopause.
8:11	10,929	221.5	−59.9	−0.17	76	0.01	-------	-------	

FEBRUARY 14, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:17	225	1,001.3	−9.4	-------	84	2.32	nw.	5.4	10 St., NW.
	500	968.0	−11.8	-------	85	1.90	-------	-------	
7:18	510	967.0	−11.8	0.84	86	1.92	-------	-------	Altitude of St. base
7:19	836	924.8	−12.6	0.25	93	1.93	-------	-------	1,319 m., m. s. l.
	1,000	905.0	−13.8	-------	95	1.77	-------	-------	
7:21	1,408	856.2	−17.0	0.77	98	1.36	-------	-------	
7:21½	1,499	846.2	−12.6	−4.84	94	1.96	-------	-------	
7:22	1,591	836.2	−11.4	−1.30	84	1.94	-------	-------	
7:23	1,856	810.0	−11.4	0.00	70	1.62	-------	-------	
	2,000	794.0	−12.6	-------	63	1.31	-------	-------	
7:25	2,203	771.5	−13.8	0.69	57	1.06	-------	-------	
7:26	2,499	740.8	−14.0	0.07	48	0.88	-------	-------	
	3,000	696.0	−16.1	-------	46	0.69	-------	-------	
7:31	3,458	652.9	−18.2	0.44	44	0.55	-------	-------	
	4,000	609.0	−21.1	-------	42	0.39	-------	-------	
	5,000	532.0	−26.7	-------	40	0.22	-------	-------	
7:39	5,080	525.2	−27.1	0.55	40	0.21	-------	-------	
7:42	5,906	468.9	−33.1	0.73	40	0.11	-------	-------	
	6,000	463.0	−33.8	-------	40	0.10	-------	-------	
	7,000	401.0	−39.4	-------	40	0.06	-------	-------	
7:48	7,222	389.2	−40.6	0.57	41	0.05	-------	-------	
	8,000	347.0	−45.2	-------	41	0.03	-------	-------	
7:53	8,344	329.4	−47.6	0.62	41	0.02	-------	-------	Tropopause.
	9,000	298.0	−45.9	-------	40	0.03	-------	-------	
7:55	9,027	296.7	−45.8	−0.26	40	0.03	-------	-------	
7:56	9,313	284.7	−46.2	0.14	41	0.02	-------	-------	
7:58	9,751	265.6	−44.2	−0.46	40	0.03	-------	-------	
7:59	9,965	257.2	−45.6	0.65	40	0.03	-------	-------	
	10,000	256.9	−45.7	-------	40	0.03	-------	-------	
8:00	10,373	242.6	−46.6	0.24	40	0.02	-------	-------	

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 14, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:10	225	1,001.5	−3.5	-------	67	3.07	nw.	3.6	Few St. Cu. WNW.
	500	970.0	−6.0	-------	70	2.59	nw.	3.6	
4:13	959	911.6	−10.8	0.99	78	1.90	wnw.	5.6	
	1,000	907.0	−10.5	-------	75	1.88	wnw.	5.8	
4:14	1,265	878.3	−9.6	−0.39	60	1.63	nnw.	7.4	
	1,500	849.0	−9.4	-------	56	1.55	nnw.	9.6	
4:16	1,693	828.8	−9.4	−0.05	54	1.49	nnw.	10.5	
	2,000	799.0	−9.0	-------	56	1.60	nnw.	13.0	
4:17	2,030	793.0	−9.0	−0.12	55	1.57	nnw.	13.2	
	2,500	745.0	−12.8	-------	56	1.14	nnw.	16.0	
4:23	2,856	710.8	−15.2	0.75	56	0.92	n.	17.3	
	3,000	700.0	−14.2	-------	55	0.99	nnw.	18.3	
4:25	3,325	670.1	−12.6	−0.55	55	1.14	nnw.	20.4	
4:28	3,692	637.7	−13.6	0.27	54	1.03	nnw.	22.0	
	4,000	613.0	−16.0	-------	52	0.79	nnw.	24.7	
4:33	4,590	567.1	−20.9	0.81	51	0.49	nnw.	22.4	
4:34	4,692	559.9	−20.9	0.00	50	0.48	nnw.	24.8	
	5,000	537.0	−23.5	-------	50	0.37	nnw.	23.7	
	6,000	467.0	−32.3	-------	48	0.14	nnw.	26.0	
4:43	6,018	465.3	−32.6	0.88	48	0.14	nnw.	26.0	
	7,000	406.0	−41.6	-------	53	0.06	nnw.	30.0	
4:50	7,415	381.2	−45.5	0.92	55	0.04	nnw.	40.0	
4:52	7,854	356.3	−49.0	0.80	55	0.02	-------	-------	
	8,000	348.0	−49.8	-------	55	0.02	-------	-------	
	9,000	299.0	−56.2	-------	57	0.01	-------	-------	
4:57	9,170	290.7	−57.4	0.64	56	0.01	-------	-------	Tropopause.
4:59	9,537	274.0	−57.4	0.00	55	0.01	-------	-------	
5:00	9,945	256.7	−55.0	−0.59	54	0.01	-------	-------	
	10,000	254.5	−55.0	-------	53	0.01	-------	-------	
5:02	10,333	242.3	−55.8	0.21	54	0.01	-------	-------	
	11,000	218.0	−50.8	-------	55	0.02	-------	-------	
5:05	11,210	211.5	−49.2	−0.75	54	0.02	-------	-------	
5:06	11,475	202.6	−50.6	0.53	52	0.02	-------	-------	
	12,000	184.0	−50.6	-------	50	0.02	-------	-------	
5:11	12,424	174.9	−50.6	0.00	50	0.02	-------	-------	
5:12	12,577	170.7	−50.6	0.00	50	0.02	-------	-------	

FEBRUARY 15, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P.m.									
4:30	225	988.4	4.5	-------	47	3.96	sw.	5.8	4 St. Cu., W.
	500	952.0	2.2	-------	47	3.37	sw.	10.6	
4:32	1,000	897.5	−1.1	0.72	47	2.62	wsw.	15.9	A line of clouds passing over. Sky clear before and after the line passed. Balloon went into the line of clouds.
4:34	1,326	856.1	0.1	−0.37	42	2.58	wsw.	20.1	
	1,500	839.0	−0.3	-------	40	2.38	wsw.	21.3	
4:35	1,520	837.3	−0.5	0.31	40	2.34	wsw.	21.3	
4:36	1,724	817.7	0.5	−0.49	40	2.53	w.	20.5	
	2,000	788.0	−1.0	-------	47	2.65	w.	18.7	
4:37	2,020	785.0	−1.1	0.54	47	2.62	w.	18.4	
4:40	2,468	739.9	−0.7	−0.09	55	3.17	-------	-------	
	2,500	735.0	−1.0	-------	55	3.10	-------	-------	
	3,000	690.0	−5.3	-------	57	2.24	-------	-------	
4:44	3,050	687.1	−5.5	0.82	57	2.21	-------	-------	
	4,000	607.0	−11.4	-------	55	1.27	-------	-------	
4:53	4,621	561.4	−15.0	0.60	52	0.87	-------	-------	
	5,000	534.0	−18.0	-------	52	0.66	-------	-------	
4:59	5,783	479.5	−23.8	0.76	47	0.34	-------	-------	
	6,000	466.0	−25.5	-------	47	0.29	-------	-------	
	7,000	406.0	−33.0	-------	45	0.13	-------	-------	
5:08	7,879	357.6	−40.1	0.78	42	0.05	-------	-------	
	8,000	353.0	−40.7	-------	42	0.05	-------	-------	
	9,000	304.0	−47.6	-------	42	0.02	-------	-------	
	10,000	262.5	−54.4	-------	42	0.01	-------	-------	
5:16	10,338	251.5	−56.6	0.67	42	0.01	-------	-------	Tropopause.
5:17	10,924	228.0	−57.8	0.20	42	0.01	-------	-------	
	11,000	226.0	−57.3	-------	42	0.01	-------	-------	
5:18	11,297	215.5	−56.0	−0.48	42	0.01	-------	-------	
	12,000	193.0	−57.8	-------	42	0.01	-------	-------	
5:21	12,199	186.2	−58.6	0.29	42	0.01	-------	-------	
	13,000	164.5	−56.3	-------	42	0.01	-------	-------	
	14,000	140.5	−53.4	-------	42	0.01	-------	-------	
5:28	14,290	134.1	−52.6	−0.29	42	0.01	-------	-------	
	15,000	120.0	−52.5	-------	42	0.01	-------	-------	
	16,000	103.5	−52.2	-------	42	0.01	-------	-------	
5:30	16,019	102.2	−52.2	−0.02	42	0.01	-------	-------	
	17,000	87.8	−54.7	-------	42	0.01	-------	-------	
	18,000	75.5	−57.0	-------	42	0.01	-------	-------	
	19,000	64.6	−59.7	-------	43	(1)	-------	-------	
5:38	19,278	62.2	−60.4	0.25	43	(1)	-------	-------	
	20,000	55.0	−60.7	-------	43	(1)	-------	-------	
	21,000	47.0	−61.5	-------	43	(1)	-------	-------	
	22,000	39.9	−62.3	-------	42	(1)	-------	-------	
5:45	22,471	37.1	−62.6	0.07	42	(1)	-------	-------	
	23,000	33.8	−62.7	-------	42	(1)	-------	-------	
	24,000	29.0	−63.0	-------	42	(1)	-------	-------	
	25,000	24.7	−63.4	-------	42	(1)	-------	-------	
	26,000	21.1	−63.8	-------	42	(1)	-------	-------	
	27,000	17.8	−64.2	-------	42	(1)	-------	-------	
5:53	27,683	16.0	−64.4	0.03	42	(1)	-------	-------	

[1] Less than 0.01 mb.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 16, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:07	225	981.2	0.5	-------	98	6.20	se.	2.7	Rain and snow and low clouds.
4:08	347	961.6	0.7	−0.16	100	6.42	-------	-------	
	500	945.0	1.0	-------	98	6.43	-------	-------	
4:09	663	925.9	1.3	−0.19	98	6.58	-------	-------	
4:11	1,000	889.0	0.5	0.24	100	6.33	-------	-------	
4:13	1,204	863.7	−1.1	0.78	100	5.58	-------	-------	
4:15	1,408	839.6	0.7	−0.88	100	6.42	-------	-------	
	1,500	830.0	0.3	-------	100	6.24	-------	-------	
	2,000	781.0	−1.8	-------	100	5.27	-------	-------	
4:23	2,326	746.7	−3.1	0.41	100	4.73	-------	-------	
	2,500	730.0	−4.1	-------	100	4.35	-------	-------	
	3,000	686.0	−6.3	-------	100	3.61	-------	-------	
4:29	3,131	673.8	−6.9	0.47	100	3.43	-------	-------	
4:30	3,254	664.2	−6.9	0.00	100	3.43	-------	-------	
4:38	3,998	602.7	−11.1	0.56	85	2.02	-------	-------	
	5,000	529.0	−17.9	-------	83	1.05	-------	-------	
4:48	5,131	517.8	−18.9	0.69	82	0.95	-------	-------	
	6,000	461.0	−25.1	-------	78	0.49	-------	-------	
4:57	6,018	458.0	−25.3	0.72	78	0.48	-------	-------	
5:05	6,885	405.6	−29.7	0.51	70	0.28	-------	-------	
	7,000	401.0	−30.5	-------	70	0.25	-------	-------	
5:13	7,558	368.5	−35.9	0.92	70	0.14	-------	-------	
5:19	7,987	345.7	−39.5	0.84	70	0.10	-------	-------	
	8,000	345.0	−39.8	-------	70	0.09	-------	-------	
5:23	8,333	328.6	−41.1	0.46	70	0.08	-------	-------	

FEBRUARY 17, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:06	225	983.1	4.9	-------	93	8.05	n.	2.0	10 St. N. Misting.
	500	951.0	2.7	-------	94	6.97	-------	-------	
4:08	826	918.0	0.6	0.72	98	6.25	-------	-------	
	1,000	892.5	−0.3	-------	98	5.84	-------	-------	Altitude of St. base 649 m., m. s. l.
	1,500	838.0	−3.0	-------	99	4.72	-------	-------	
4:11	1,693	817.5	−4.1	0.54	100	4.35	-------	-------	
4:11½	1,826	804.1	−3.5	−0.45	100	4.58	-------	-------	
	2,000	787.0	−4.1	-------	99	4.31	-------	-------	
	2,500	736.0	−5.8	-------	96	3.62	-------	-------	
4:16	2,723	716.1	−6.5	0.33	96	3.41	-------	-------	
	3,000	689.0	−7.9	-------	84	2.65	-------	-------	
4:18	3,121	678.5	−8.2	0.43	80	2.46	-------	-------	
4:22	3,728	628.6	−12.3	0.68	95	2.02	-------	-------	
	4,000	606.0	−13.8	-------	85	1.58	-------	-------	
4:27	4,641	554.6	−17.2	0.54	62	0.84	-------	-------	
	5,000	531.0	−19.9	-------	62	0.65	-------	-------	
	6,000	462.5	−27.0	-------	62	0.32	-------	-------	
4:36	6,217	446.7	−28.8	0.74	62	0.27	-------	-------	
	7,000	402.0	−34.5	-------	57	0.14	-------	-------	
4:41	7,288	384.6	−36.8	0.75	55	0.10	-------	-------	
4:44	7,895	351.9	−43.1	1.04	55	0.05	-------	-------	
	8,000	346.0	−43.8	-------	55	0.05	-------	-------	
	9,000	297.0	−50.0	-------	56	0.02	-------	-------	
	10,000	255.0	−56.2	-------	57	0.01	-------	-------	
4:53	10,353	242.0	−58.2	0.61	58	0.01	-------	-------	Tropopause.
	11,000	219.0	−57.6	-------	55	0.01	-------	-------	
4:55	11,189	212.7	−57.4	−0.10	54	0.01	-------	-------	

FEBRUARY 18, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:10	225	990.7	3.8	-------	90	7.22	nw.	2.7	10 St. NW.; lt. fog.
	500	959.0	1.6	-------	95	6.52	-------	-------	
4:12	775	928.7	−0.3	0.75	100	5.96	-------	-------	Altitude of St. base, 502 m., m. s. l.
	1,000	900.5	−1.3	-------	100	5.49	-------	-------	
	1,500	844.0	−3.6	-------	100	4.54	-------	-------	
4:16	1,612	834.6	−4.0	0.44	100	4.39	-------	-------	
	2,000	795.0	−6.1	-------	100	3.67	-------	-------	
	2,500	744.0	−9.3	-------	100	2.78	-------	-------	
4:20	2,713	722.8	−10.4	0.58	100	2.53	-------	-------	
4:20½	2,938	702.7	−10.0	−0.18	100	2.62	-------	-------	
	3,000	697.0	−10.0	-------	90	2.36	-------	-------	
4:22	3,167	681.2	−10.4	0.17	56	1.42	-------	-------	
4:23	3,529	650.1	−12.6	0.61	51	1.06	-------	-------	
4:24	3,626	642.8	−12.8	0.21	50	1.02	-------	-------	
4:24½	3,738	631.8	−13.6	0.71	48	0.91	-------	-------	
	4,000	611.0	−15.6	-------	53	0.84	-------	-------	
4:28	4,483	573.6	−19.6	0.80	62	0.68	-------	-------	
	5,000	536.0	−22.5	-------	42	0.34	-------	-------	
4:31	5,023	534.8	−22.5	0.54	41	0.34	-------	-------	
4:34	5,539	499.1	−27.0	0.87	37	0.19	-------	-------	
	6,000	467.0	−30.8	-------	38	0.13	-------	-------	
4:39	6,503	434.9	−35.2	0.85	37	0.08	-------	-------	
	7,000	406.0	−39.0	-------	40	0.06	-------	-------	
4:44	7,609	370.6	−44.0	0.80	44	0.04	-------	-------	
	8,000	349.0	−47.4	-------	42	0.02	-------	-------	
	9,000	300.5	−56.0	-------	40	0.01	-------	-------	
4:50	9,205	290.8	−57.8	0.86	40	0.01	-------	-------	Tropopause.
	10,000	258.0	−56.2	-------	38	0.01	-------	-------	
	11,000	221.0	−54.2	-------	38	0.01	-------	-------	
5:01	11,694	198.1	−52.9	−0.20	36	0.01	-------	-------	
	12,000	189.0	−52.8	-------	36	0.01	-------	-------	
	13,000	162.0	−52.8	-------	35	0.01	-------	-------	
5:11	13,913	139.8	−52.9	0.00	34	0.01	-------	-------	
	14,000	138.0	−53.0	-------	35	0.01	-------	-------	
	15,000	119.5	−53.7	-------	36	0.01	-------	-------	
	16,000	102.0	−54.6	-------	36	0.01	-------	-------	
5:20	16,172	99.3	−54.7	0.08	36	0.01	-------	-------	

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 19, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:15	225	989.6	2.5	------	88	6.43	nw.	5.4	Clouds at various levels at various times during afternoon, changing quickly. Altitude of St. base, 638 m., m. s. l.
4:16	399	968.5	1.7	0.46	90	6.21	nnw.	14.2	
	500	955.5	1.0	------	92	6.04	nnw.	18.0	
	1,000	899.9	−2.5	------	99	4.92	------	------	
4:18	1,068	890.8	−3.0	0.70	100	4.77	------	------	
4:19	1,259	869.5	−3.4	0.21	86	3.96	------	------	
	1,500	842.5	−5.4	------	89	3.47	------	------	
	2,000	790.0	−9.5	------	96	2.63	------	------	
4:23	2,348	755.9	−12.4	0.83	100	2.12	------	------	
	2,500	739.5	−12.4	------	84	1.78	------	------	
4:25	2,871	705.8	−12.4	0.00	45	0.95	------	------	
	3,000	693.0	−13.6	------	45	0.86	------	------	
	4,000	605.5	−22.7	------	41	0.33	------	------	
4:30	4,349	578.7	−25.9	0.91	40	0.23	------	------	
	5,000	529.0	−32.1	------	41	0.13	------	------	
	6,000	458.8	−41.5	------	42	0.04	------	------	
4:36	6,070	452.7	−42.2	0.95	42	0.04	------	------	
4:38	6,731	410.0	−48.9	1.01	42	0.02	------	------	
	7,000	396.0	−50.1	------	41	0.02	------	------	
4:40	7,214	380.8	−51.1	0.46	40	0.01	------	------	
4:43	7,690	353.9	−51.3	0.04	38	0.01	------	------	

FEBRUARY 20, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:17	225	993.7	3.0	------	70	5.31	nnw.	5.4	10 St. Cu., NNW. Altitude of St. Cu. base, 1,057 m., m. s. l.
	500	960.0	0.4	------	72	4.53	nnw.	13.3	
	1,000	902.0	−4.1	------	87	3.78	nnw.	7.8	
4:21	1,321	866.0	−7.2	0.93	80	2.67	------	------	
	1,500	846.0	−8.0	------	80	2.50	------	------	
4:22	1,703	825.1	−9.1	0.50	80	2.26	------	------	
4:23	1,770	817.6	−8.0	−1.64	81	2.53	------	------	
	2,000	794.0	−10.1	------	82	2.13	------	------	
4:24	2,117	780.9	−11.6	1.04	82	1.86	------	------	
4:26	2,397	751.6	−7.4	−1.50	80	2.63	------	------	
	2,500	742.5	−7.6	------	76	2.45	------	------	
4:27	2,652	727.7	−7.6	0.08	70	2.26	------	------	
	3,000	697.0	−10.0	------	68	1.78	------	------	
	4,000	612.5	−16.4	------	60	0.88	------	------	
4:36	4,417	580.0	−19.3	0.66	58	0.65	------	------	
4:37	4,488	573.7	−19.3	0.00	56	0.63	------	------	
	5,000	536.0	−23.4	------	54	0.40	------	------	
	6,000	467.0	−31.8	------	50	0.16	------	------	
4:46	6,181	455.0	−33.3	0.83	51	0.14	------	------	
	7,000	404.0	−40.3	------	50	0.06	------	------	
4:53	7,711	364.1	−46.2	0.84	48	0.03	------	------	
	8,000	349.5	−47.7	------	48	0.02	------	------	
	9,000	294.0	−54.0	------	48	0.01	------	------	
5:00	9,930	257.7	−58.9	0.57	47	0.01	------	------	Tropopause.
	10,000	255.0	−59.0	------	47	0.01	------	------	
5:02	10,389	239.7	−59.1	0.02	47	0.01	------	------	
	11,000	218.0	−55.2	------	47	0.01	------	------	
5:05	11,133	212.6	−54.2	−0.66	47	0.01	------	------	
	12,000	186.5	−53.9	------	46	0.01	------	------	
5:08	12,179	181.2	−53.8	−0.04	46	0.01	------	------	
	13,000	159.0	−56.1	------	45	0.01	------	------	
	14,000	136.0	−58.9	------	44	0.01	------	------	
5:19	14,499	125.1	−60.2	0.28	44	(1)	------	------	
	15,000	115.9	−60.8	------	44	(1)	------	------	
5:25	15,749	102.6	−61.9	0.14	44	(1)	------	------	

[1] Less than 0.01 mb.

FEBRUARY 21, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:12	225	997.5	6.0	------	61	5.70	sw.	0.9	Few Ci., W. ?; 1 Cu., NW.
	500	962.0	3.7	------	65	5.17	wsw.	1.8	
	1,000	907.0	−0.1	------	71	4.30	nnw.	3.6	
4:16	1,204	883.5	−1.9	0.81	75	3.92	nnw.	5.0	
	1,500	848.0	0.2	------	70	4.34	nnw.	5.5	
4:17	1,540	846.0	0.3	−0.65	70	4.37	nnw.	5.6	
	2,000	799.0	−0.3	------	62	3.70	nnw.	7.2	
4:19	2,111	789.4	−0.3	0.11	61	3.64	nnw.	8.9	
4:19½	2,244	775.3	0.3	−0.45	58	3.62	nnw.	9.6	
	2,500	748.0	−1.0	------	52	2.93	nnw.	9.0	
4:22	2,856	716.4	−2.9	0.52	46	2.21	nnw.	7.9	
	3,000	703.0	−4.0	------	47	2.06	nnw.	7.6	
4:23	3,376	672.4	−6.7	0.73	53	1.85	nnw.	7.1	
4:25	3,805	632.8	−6.3	−0.09	55	1.99	nw.	7.6	
	4,000	618.0	−7.9	------	54	1.70	nw.	8.6	
	5,000	544.0	−15.8	------	51	0.79	nw.	11.9	
4:30	5,498	509.8	−19.9	0.80	50	0.52	nw.	13.3	
	6,000	476.0	−23.5	------	48	0.36	wnw.	18.7	
	7,000	414.0	−31.0	------	47	0.16	wnw.	18.0	
4:36	7,089	409.0	−31.6	0.74	47	0.15	wnw.	18.2	
	8,000	358.0	−41.9	------	50	0.05	wnw.	21.2	
4:41	8,235	346.4	−44.5	1.13	50	0.04	wnw.	21.0	
	9,000	309.0	−49.5	------	48	0.02	wnw.	20.3	
4:45	9,485	286.5	−52.6	0.65	48	0.01	wnw.	20.8	
	10,000	264.5	−55.3	------	48	0.01	wnw.	21.9	
4:50	10,586	241.1	−58.4	0.53	48	0.01	wnw.	21.9	
	11,000	226.0	−60.2	------	48	(1)	wnw.	23.8	

[1] Less than 0.01 mb.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 21, 1931—Continued

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:54	11,550	206.6	−62.5	0.43	48	(1)	wnw.	19.2	Tropopause.
	12,000	192.8	−59.6	------	48	0.01	w.	20.6	
4:57	12,180	186.8	−58.4	−0.65	48	0.01	w.	22.7	
	13,000	------	------	------	------	------	w.	20.2	
	14,000	------	------	------	------	------	w.	20.8	
	15,000	------	------	------	------	------	wnw.	18.0	
	16,000	------	------	------	------	------	w.	22.6	
	17,000	------	------	------	------	------	w.	14.6	
	17,321	------	------	------	------	------	w.	15.5	

[1] Less than 0.01 mb.

FEBRUARY 22, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:13	225	995.4	7.2	------	72	7.32	calm	------	10 A. St., W. ?.
	500	961.0	4.1	------	74	6.06	nnw.	0.6	
4:14	510	959.5	4.1	1.09	74	6.06	nnw.	0.7	
	1,000	907.0	−1.8	------	87	4.58	nnw.	2.2	
4:17	1,050	899.9	−2.2	1.17	88	4.49	nnw.	2.2	
4:19	1,458	853.0	−2.2	0.00	82	4.18	ese.	1.0	
	1,500	850.0	−2.3	------	81	4.10	e.	1.1	
	2,000	798.0	−3.7	------	70	3.15	w.	3.9	
	2,500	748.0	−5.0	------	60	2.42	wsw.	5.6	
4:24	2,800	720.9	−5.7	0.26	55	2.09	wsw.	6.0	
	3,000	703.0	−7.4	------	60	1.97	w.	6.7	
4:26	3,244	681.9	−9.2	0.79	67	1.88	w.	7.7	
4:27	3,386	670.1	−9.0	−0.14	72	2.06	w.	8.3	
	4,000	618.0	−12.3	------	82	1.75	------	------	
4:29	4,080	612.2	−12.6	0.52	82	1.71	------	------	
	5,000	541.0	−19.6	------	87	0.95	------	------	
4:36	5,845	482.0	−25.9	0.75	90	0.53	------	------	
	6,000	472.0	−27.2	------	90	0.46	------	------	
	7,000	411.5	−35.4	------	90	0.19	------	------	
4:43	7,487	382.6	−39.6	0.83	90	0.12	------	------	
	8,000	354.9	−43.9	------	90	0.07	------	------	
	9,000	305.0	−52.7	------	90	0.02	------	------	
4:52	9,384	287.4	−56.2	0.88	90	0.02	------	------	
	10,000	262.0	−59.7	------	90	0.01	------	------	
	11,000	224.0	−65.2	------	90	(1)	------	------	
4:58	11,149	219.2	−66.0	0.56	90	(1)	------	------	Tropopause.
5:02	11,924	192.7	−61.6	−0.57	87	0.01	------	------	
	12,000	190.8	−61.2	------	86	0.01	------	------	
5:05	12,995	163.0	−55.2	−0.60	84	0.02	------	------	
	14,000	138.8	−59.4	------	79	0.01	------	------	
5:12	14,260	133.3	−60.4	0.41	78	0.01	------	------	
	15,000	118.4	−62.2	------	80	0.01	------	------	
5:18	15,351	111.7	−63.1	0.25	80	0.01	------	------	
	16,000	100.2	−62.1	------	79	0.01	------	------	
5:23	16,157	97.6	−61.9	−0.15	78	0.01	------	------	
	17,000	85.2	−63.3	------	72	(1)	------	------	
5:28	17,034	84.8	−63.5	0.18	72	(1)	------	------	

[1] Less than 0.01 mb.

FEBRUARY 23, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:10	225	991.3	4.7	------	73	6.23	n.	5.4	6 Ci., W.; few Cu., NW.
	500	958.0	1.4	------	75	5.07	n.	5.5	
4:11	699	936.6	−0.6	1.12	76	4.42	n.	4.0	
4:12	943	910.1	−0.1	−0.20	82	4.97	w.	2.1	
	1,000	902.5	−0.7	------	83	4.79	sw.	1.9	
4:13	1,163	881.0	−2.0	0.86	84	4.35	sw.	1.9	
4:14	1,346	862.3	−2.2	0.11	80	4.08	wnw.	2.7	
	1,500	846.0	−2.3	------	77	3.90	nnw.	4.1	
4:17	1,826	813.0	−2.8	0.12	68	3.30	nnw.	4.6	
	2,000	795.0	−3.7	------	68	3.06	nnw.	4.9	
4:18	2,106	783.8	−4.0	0.43	68	2.99	nnw.	5.0	
	2,500	744.0	−7.3	------	63	2.09	nnw.	5.2	
4:21	2,519	740.7	−7.6	0.87	62	2.00	nnw.	5.2	
4:21½	2,693	725.9	−7.8	0.11	64	2.03	nnw.	6.0	
	3,000	698.0	−9.8	------	65	1.74	nnw.	7.4	
4:25	3,356	665.5	−11.9	0.62	66	1.46	n.	9.2	
4:27	3,733	633.2	−13.5	0.42	68	1.31	nnw.	6.5	
	4,000	612.0	−15.2	------	68	1.12	nnw.	6.0	
4:32	4,641	561.9	−19.7	0.68	68	0.73	nnw.	5.8	
4:34	4,865	546.1	−21.4	0.76	67	0.61	nnw.	6.8	
	5,000	537.0	−22.3	------	66	0.55	nnw.	7.5	
4:39	5,860	476.6	−29.0	0.76	60	0.26	nnw.	9.4	
	6,000	------	------	------	------	------	nnw.	9.2	
	7,000	------	------	------	------	------	nw.	12.3	
	8,000	------	------	------	------	------	wnw,	12.9	
	9,000	------	------	------	------	------	nnw.	11.5	
	10,000	------	------	------	------	------	nw.	9.3	
	11,000	------	------	------	------	------	wnw.	17.5	
	12,000	------	------	------	------	------	wnw.	17.0	
	13,000	------	------	------	------	------	w.	15.4	
	14,000	------	------	------	------	------	w.	22.5	
	15,000	------	------	------	------	------	w.	19.1	
	15,518	------	------	------	------	------	w.	20.2	

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 24, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:11	225	990.3	7.0	-------	50	5.01	ne.	4.9	Cloudless.
	500	958.0	4.7	-------	51	4.36	ne.	6.3	
4:13	893	914.1	1.2	0.87	52	3.46	ne.	6.1	
4:14	984	902.7	2.1	−0.99	48	3.41	ne.	5.8	
	1,000	901.0	2.0	-------	47	3.31	ne.	5.7	
4:15	1,209	878.7	1.7	0.18	45	3.10	ne.	4.7	
	1,500	846.0	0.5	-------	44	2.79	ne.	4.2	
4:17	1,846	810.3	−1.2	0.46	40	2.21	ne.	5.0	
4:18	2,004	795.3	−1.2	0.00	42	2.32	ene.	5.3	
4:20	2,423	751.1	−3.7	0.60	41	1.84	ene.	6.4	
	2,500	745.0	−3.8	-------	40	1.78	ene.	6.5	
	3,000	700.0	−4.9	-------	39	1.59	ene.	7.0	
4:22	3,050	693.5	−4.9	0.19	38	1.55	ene.	7.1	
4:23	3,223	679.9	−4.9	0.00	38	1.55	ene.	7.7	
	4,000	614.0	−9.9	-------	38	1.00	ene.	9.4	
4:30	4,784	555.1	−14.6	0.62	38	0.66	ene.	5.0	
	5,000	539.5	−16.4	-------	38	0.56	ene.	4.7	
4:35	5,901	477.4	−24.6	0.90	36	0.24	ne.	4.8	
	6,000	471.0	−25.2	-------	36	0.23	ne.	4.0	
	7,000	411.0	−31.8	-------	33	0.10	nne.	3.7	
4:42	7,308	392.7	−34.0	0.67	32	0.08	nne.	2.4	
	8,000	355.0	−41.0	-------	32	0.04	e.	1.9	
4:47	8,456	331.6	−45.8	1.03	32	0.02	sse.	2.8	
4:48	8,502	329.1	−45.8	0.00	32	0.02	sse.	2.9	
	9,000	304.0	−49.6	-------	32	0.01	se.	4.7	
4:52	9,802	269.4	−55.4	0.74	32	0.01	se.	8.6	
	10,000	262.0	−56.9	-------	32	0.01	se.	8.6	
4:57	10,873	227.5	−63.2	0.73	32	(1)	ese.	6.8	
	11,000	223.0	−64.6	-------	32	(1)	ese.	6.6	
4:58	11,067	220.4	−65.2	1.03	32	(1)	se.	6.4	Tropopause.
4:59	11,286	212.2	−65.2	0.00	32	(1)	sw.	6.8	
	12,000	189.0	−62.0	-------	32	(1)	wsw.	10.3	
5:06	12,929	162.4	−57.9	−0.44	32	(1)	w.	15.4	
	13,000	161.0	−57.8	-------	32	(1)	w.	15.2	
	14,000	136.0	−57.5	-------	32	(1)	w.	18.6	
5:13	14,765	120.1	−57.4	−0.03	32	(1)	-------	-------	
	15,000	116.0	−57.4	-------	32	(1)	-------	-------	
	16,000	99.0	−57.4	-------	32	(1)	-------	-------	
	17,000	84.5	−57.4	-------	32	(1)	-------	-------	
5:23	17,034	84.0	−57.4	0.00	32	(1)	-------	-------	
	18,000	72.5	−58.4	-------	31	(1)	-------	-------	
5:29	18,074	71.5	−58.7	0.12	31	(1)	-------	-------	

[1] Less than 0.01 mb.

FEBRUARY 25, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:12	225	990.3	7.7	-------	71	7.46	nw.	5.4	Few Ci., SW.?; 10 dense haze.
4:13	439	960.3	5.0	1.26	75	6.54	nw.	5.0	
	500	954.0	5.5	-------	73	6.59	nw.	4.8	
4:14	653	939.1	6.3	−0.61	68	6.49	wnw.	4.4	
	1,000	899.0	3.7	-------	70	5.57	nw.	4.5	
4:16	1,193	877.8	2.1	0.78	71	5.04	nw.	6.0	
	1,500	842.5	0.9	-------	78	5.09	nw.	7.1	
4:17	1,744	820.5	0.0	0.38	82	5.01	nnw.	6.7	
	2,000	792.0	−1.9	-------	80	4.18	nw.	5.4	
4:19	2,326	758.5	−4.1	0.70	79	3.44	nw.	7.1	
	2,500	742.0	−4.9	-------	74	3.01	nw	8.5	
4:20	2,683	723.6	−5.6	0.42	67	2.57	wnw.	8.9	
4:21	2,887	707.0	−5.4	−0.10	60	2.34	wnw.	8.6	
	3,000	694.0	−6.1	-------	57	2.09	whw.	8.7	
4:26	3,958	616.6	−10.2	0.45	41	1.05	w.	10.2	
	4,000	612.0	−10.7	-------	41	1.01	w.	10.2	
	5,000	535.0	−20.0	-------	47	0.49	w.	9.5	
4:35	5,579	493.4	−25.5	0.94	50	0.36	wnw.	13.8	
	6,000	466.5	−28.4	-------	48	0.22	w.	15.2	
4:38	6,273	448.6	−30.1	0.66	46	0.17	w.	13.6	
	7,000	406.0	−35.8	-------	46	0.10	w.	15.4	
4:42	7,079	402.2	−36.3	0.77	45	0.09	w.	15.6	
	8,000	351.0	−43.2	-------	45	0.04	w.	20.0	
4:48	8,446	328.2	−46.7	0.76	44	0.03	w.	22.0	
	9,000	302.0	−51.2	-------	44	0.02	w.	24.6	
	10,000	258.0	−59.3	-------	44	0.01	-------	-------	
4:56	10,104	253.8	−60.0	0.80	44	(1)	-------	-------	
4:57	10,474	239.1	−61.8	0.49	46	(1)	-------	-------	Tropopause.
	11,000	221.5	−61.6	-------	46	(1)	-------	-------	
5:03	11,688	196.6	−61.4	−0.03	45	(1)	-------	-------	
	12,000	189.2	−59.1	-------	45	0.01	-------	-------	
5:06	12,373	179.0	−55.8	−0.82	45	0.01	-------	-------	
5:10	12,893	164.9	−54.1	−0.33	45	0.01	-------	-------	
	13,000	162.5	−54.1	-------	45	0.01	-------	-------	
5:14	13,872	141.6	−53.9	−0.02	45	0.01	-------	-------	
	14,000	139.2	−54.2	-------	45	0.01	-------	-------	
	15,000	118.8	−56.2	-------	44	0.01	-------	-------	
	16,000	101.6	−58.3	-------	43	0.01	-------	-------	

[1] Less than 0.01 mb.

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 25, 1931—Continued

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
5:27	16,422	95.0	−59.3	0.21	43	0.01	-------	-------	
	17,000	87.0	−58.9	-------	42	(1)	-------	-------	
5:31	17,483	80.9	−58.5	−0.08	42	0.01	-------	-------	

[1] Less than 0.01 mb.

FEBRUARY 26, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:11	225	996.5	7.7	-------	41	4.31	nw.	3.1	1 Cu., NW.
	500	961.0	4.5	-------	42	3.54	nw.	4.9	
	1,000	905.0	−1.1	-------	43	2.40	nw.	4.1	
4:14	1,081	896.0	−2.1	1.14	43	2.21	nw.	4.0	Pressure record lost between 9,486 and 11,211 meters inclusive; the altitudes from 9,486 to 10,424 meters inclusive, were obtained from the 2-theodolite observation; the altitude 11,211 meters was obtained from the ascensional rate; pressures for levels from 9,486 to 11,211 meters inclusive were computed from altitudes and temperatures.
	1,500	849.0	−5.9	-------	46	1.72	nnw.	5.0	
4:16	1,724	826.5	−7.9	0.90	47	1.48	nnw.	5.8	
	2,000	798.0	−9.0	-------	40	1.14	nw.	6.3	
4:17	2,111	786.5	−9.5	0.41	39	1.07	nw.	6.8	
4:18	2,305	766.5	−9.1	−0.21	36	1.02	nw.	7.2	
	2,500	746.1	−10.1	-------	35	0.91	nw.	8.1	
4:19	2,601	736.9	−10.7	0.54	33	0.81	nw.	9.5	
4:20	2,866	712.4	−10.1	−0.23	30	0.78	wnw.	11.4	
	3,000	702.0	−11.1	-------	30	0.71	wnw.	11.7	
4:23	3,448	661.3	−14.9	0.82	28	0.47	wnw.	12.4	
	4,000	616.0	−17.0	-------	28	0.39	wnw.	19.0	
	5,000	540.0	−20.5	-------	27	0.27	wnw.	27.3	
4:31	5,018	538.4	−20.6	0.36	25	0.25	wnw	27.2	
	6,000	471.0	−28.7	-------	25	0.11	w.	30.4	
4:35	6,018	470.2	−29.0	0.84	25	0.11	w.	30.5	
4:39	6,691	427.5	−34.3	0.79	25	0.06	w.	32.3	
	7,000	408.0	−36.6	-------	25	0.05	w.	31.4	
	8,000	352.5	−44.3	-------	25	0.02	w.	36.1	
4:45	8,038	349.9	−44.6	0.76	25	0.02	w.	36.2	
	9,000	303.0	−51.2	-------	25	0.01	w.	38.4	
4:50	9,486	280.6	−54.6	0.69	25	0.01	w.	52.1	
	10,000	259.0	−58.9	-------	25	(1)	w.	45.1	
4:53	10,424	241.6	−62.4	0.83	25	(1)	wnw.	46.7	
	11,000	218.0	−64.7	-------	25	(1)	wnw.	54.0	
4:56	11,211	209.1	−65.5	0.39	25	(1)	wnw.	54.0	Tropopause.
	12,000	188.5	−62.6	-------	25	(1)	-------	-------	
	13,000	160.5	−58.3	-------	25	(1)	-------	-------	
5:05	13,420	149.9	−56.3	−0.42	25	(1)	-------	-------	

[1] Less than 0.01 mb.

FEBRUARY 27, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
8:24	225	989.8	2.1	-------	89	6.32	se.	3.6	Cloudless.
	500	955.0	7.8	-------	72	7.62	-------	-------	
8:25	525	951.7	8.1	−2.03	70	7.56	-------	-------	
8:26	918	909.8	6.5	0.41	64	6.20	-------	-------	
	1,000	900.0	5.7	-------	64	5.86	-------	-------	
8:28	1,438	851.3	1.7	0.92	64	4.42	-------	-------	
	1,500	844.5	1.4	-------	58	3.92	-------	-------	
8:29	1,540	841.9	1.1	0.59	55	3.64	-------	-------	
	2,000	794.9	−2.0	-------	67	3.47	-------	-------	
	2,500	745.0	−5.8	-------	75	2.83	-------	-------	
8:34	2,723	725.4	−7.3	0.71	80	2.65	-------	-------	
8:35	2,938	706.3	−6.3	−0.47	64	2.31	-------	-------	
	3,000	701.0	−6.8	-------	-------	-------	-------	-------	
8:36	3,295	674.7	−8.3	0.56	-------	-------	-------	-------	
8:38	3,784	631.0	−10.9	0.53	-------	-------	-------	-------	
	4,000	618.0	−12.5	-------	-------	-------	-------	-------	
8:42	4,529	573.9	−16.9	0.81	-------	-------	-------	-------	
	5,000	540.0	−19.9	-------	-------	-------	-------	-------	
	6,000	470.5	−26.6	-------	-------	-------	-------	-------	
8:53	6,783	422.2	−31.9	0.67	-------	-------	-------	-------	
	7,000	410.8	−33.3	-------	-------	-------	-------	-------	
	8,000	352.5	−42.2	-------	-------	-------	-------	-------	
9:01	8,466	329.4	−45.9	0.83	-------	-------	-------	-------	
	9,000	304.0	−49.7	-------	-------	-------	-------	-------	
	10,000	262.0	−56.8	-------	-------	-------	-------	-------	
9:09	10,537	240.0	−60.7	0.71	-------	-------	-------	-------	
	11,000	223.0	−61.9	-------	-------	-------	-------	-------	
9:11	11,036	222.0	−61.9	0.24	-------	-------	-------	-------	Tropopause.
	12,000	189.0	−61.7	-------	-------	-------	-------	-------	
9:17	12,153	184.6	−61.7	−0.02	-------	-------	-------	-------	
	13,000	161.5	−58.2	-------	-------	-------	-------	-------	
9:22	13,321	153.9	−56.9	−0.41	-------	-------	-------	-------	
	14,000	137.5	−58.8	-------	-------	-------	-------	-------	
9:25	14,030	137.0	−58.9	0.28	-------	-------	-------	-------	
	15,000	127.8	−59.5	-------	-------	-------	-------	-------	
9:35	15,733	104.5	−59.9	0.06	-------	-------	-------	-------	
	16,000	102.0	−59.6	-------	-------	-------	-------	-------	
9:41	16,483	93.1	−58.9	−0.13	-------	-------	-------	-------	
	17,000	85.5	−60.8	-------	-------	-------	-------	-------	
9:47	17,263	82.3	−61.9	0.38	-------	-------	-------	-------	

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY 28, 1931

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity		Wind		Remarks
					Relative	Vapor pressure	Direction	Velocity	
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:19	225	988.5	5.8	-------	89	8.21	n.	7.2	10 A. St., WSW.
4:19½	469	958.9	4.2	0.66	93	7.67	nne.	8.8	
	500	955.0	4.5	-------	91	7.66	nne.	8.8	Clouds thinning overhead during flight.
4:20	581	946.2	6.4	−1.96	88	8.46	nne.	8.6	
4:21	745	929.2	7.6	−0.73	78	8.14	ne.	8.3	
4:22	949	904.0	7.2	0.20	67	6.81	ne.	3.7	
	1,000	900.0	7.0	-------	66	6.61	ne.	3.0	
4:23	1,255	871.7	5.2	0.65	60	5.30	ne.	3.0	
	1,500	844.0	3.3	-------	66	5.11	ne.	3.4	
	2,000	796.0	−0.9	-------	80	4.54	ene.	4.1	
4:29	2,397	755.4	−4.0	0.81	90	3.95	ne.	4.3	
	2,500	746.0	−3.9	-------	78	3.45	ene.	3.6	
4:30	2,530	743.3	−3.8	−0.15	70	3.12	ene.	3.5	
	3,000	700.0	−7.0	-------	77	2.62	ne.	6.0	
4:33	3,335	672.5	−9.0	0.65	81	2.32	nne.	3.5	
4:33½	3,478	657.6	−9.8	0.56	81	2.16	n.	3.0	
4.34	3,560	648.8	−11.0	1.46	70	1.68	n.	3.1	

TABLE 2.—*Tabulated data of sounding-balloon ascents at Royal Center, Ind., during February, 1931*—Continued

FEBRUARY, 28, 1931—Continued

Time 90th mer.	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity		Wind		Remarks
					Relative	Vapor pressure	Direction	Velocity	
P. m.	M.	Mb.	°C.		%	Mb.		M.p.s.	
4:35	3,764	631.7	−10.4	−0.29	60	1.52	nnw.	3.7	
	4,000	614.0	−12.4	-------	62	1.31	nnw.	3.5	
4:40	4,529	571.3	−17.0	0.86	67	0.93	nnw.	4.2	
4:42	4,896	546.6	−19.2	0.60	63	0.71	wnw.	3.4	
	5,000	539.0	−19.0	-------	62	0.71	w.	3.6	
4:43	5,090	531.6	−18.4	−0.41	61	0.74	wsw.	3.7	
4:47	5,865	477.1	−25.4	0.90	64	0.39	wsw.	4.2	
	6,000	470.0	−26.4	-------	64	0.36	wsw.	4.6	
4:50	6,650	428.5	−30.3	0.62	69	0.26	-------	-------	
4:52	6,905	415.0	−30.7	0.16	70	0.25	-------	-------	
	7,000	409.0	−31.5	-------	70	0.23	-------	-------	
	8,000	353.0	−40.6	-------	70	0.08	-------	-------	
5:00	8,201	341.8	−42.4	0.90	70	0.07	-------	-------	
	9,000	302.0	−51.0	-------	69	0.02	-------	-------	
	10,000	258.0	−61.3	-------	66	0.01	-------	-------	
5:09	10,047	256.9	−61.8	1.05	66	0.01	-------	-------	

SERIOUS EROSION CAUSED BY HEAVY RAIN OF JULY 30, 1931, NEAR COLFAX, WASH.[1]

By W. A. ROCKIE

On July 30, 1931, the weather conditions near Pullman, Wash., were such as would normally result in a severe thunder storm. A heavy cumulus cloud formed and hung to the west of town for several hours during the afternoon and evening. The storm cloud did not advance eastward toward Pullman as would normally be expected in this region but instead it expended its force and violence practically where it formed. There was but a trace of rain at Pullman; Lewiston had 0.02; Colfax had 0.21; Lacrosse had 0.14; Moscow had 0.06; but none of these points were in the area of the real rain. The real storm occurred over an area of about 50 square miles centering around the point where the Colfax-Almota road crosses Union Flat Creek. No severe rain occurred more than 5 miles from this point. This area is located about 10 miles west of the erosion station farm.

According to climatological data for the Washington section [2] precipitation was recorded on this date at 30 out of 105 stations listed in the Eastern Washington division (approximately eastern three-fifths of the State). The same publication of the Idaho section [3] shows that rain occurred on the same day at 64 out of 103 stations in the State of Idaho. The wide extent and very generally rainy tendency on this date in both Washington and Idaho, even though the rains were generally of negligible amount, shows that conditions were very favorable for precipitation in all parts of the region. The records of both Washington and Idaho are shown because Pullman is only a few miles from the Idaho line.

On the following day the Spokane newspaper contained a very graphic account of a "cloud-burst" that occurred on the area mentioned. The newspaper accounts of this rain were all centered upon the damage to personal property and to physical improvements located in great part downstream from the points where the heaviest rain fell. These reports were apparently very conservatively stated. In fact, they did not begin to tell the story of the damage that had actually occurred.

The several succeeding days were spent examining the area which had suffered from this rain storm. According to all information and evidence the heavy rain must have lasted only a very short period. Verbal accounts of the time of the rain itself differ considerably within the region affected. The only accurate record which we were able to obtain regarding the amount of rain which fell was obtained from Mr. W. P. Gilbert a farmer living just inside the limits of the area which showed evidence of the heavy rainfall. At his house, which was very close to the northeastern edge of the storm, 1.6 inches were recorded in 20 minutes, while on a more distant part of his farm 1 mile to the westward his measuring gage (a straight-sided can) actually caught 3 inches of water. He was at the house during the rain. While it is quite possible that more rain fell at some individual spots within the area than these records indicate we have not been able to secure any other figures. Mr. Gilbert has been keeping rainfall records at his farm in past years and we believe that his records are reliable.

The farm land within the area is typical of Palouse topography and is characterized by Palouse silt loam soil. It has fully as rough a topography as the average within the region, having many cultivated slopes in excess of 50 per cent gradient. The dominant farm crop rotation in the area is winter wheat and summer fallow. Some other crop conditions which were observed following the storm were spring wheat, alfalfa, bunch grass pasture, and fall wheat seeded in summer for summer pasture. A complete survey of the crop conditions was not attempted so other crops were also undoubtedly present.

The damage done to the land through erosion by this heavy rain was directly related to the vegetation which covered any given field on that date. The summer fallow land eroded to plow sole but did not generally go below that line. Individual fields containing several

[1] The writer wishes to express appreciation to P. C. McGrew, agricultural engineer in the Bureau of Agricultural Engineering, for the photographic illustrations which accompany this article. 1. Superintendent, Pacific Northwest Soil Erosion Experiment Station at Pullman, Wash.

[2] Climatological data, Washington section, U. S. Weather Bureau, Vol. XXXV, No. 7, p. 53.

[3] Climatological data, Idaho section, U. S. Weather Bureau, Vol. XXXIV, No. 7, p. 33.