

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi-tude	Lati-tude	Spot	Group	
July 27 (Naval Observa-tory).	10 49	°	°	°			
		-24.0	33.5	-22.0		170	
		-7.5	50.0	-12.5		154	
		+10.0	67.5	+6.5	46		370
July 28 (Naval Observa-tory).	10 46	-12.5	31.8	-22.5		108	
		+7.0	51.3	-12.0		170	
		+22.5	66.8	+6.5	40		318
July 29 (Naval Observa-tory).	10 50	-22.0	9.0	+9.5	3		
		+2.5	33.5	-21.0		154	
		+22.0	53.0	-10.5		123	
		+36.0	67.0	+7.5	31		311
July 30 (Naval Observa-tory).	10 46	-74.5	303.3	+6.0	9		
		-37.0	340.8	+21.0		12	
		-30.0	347.8	-8.0	9		
		-4.5	13.3	+3.0	3		
		+10.0	27.8	+30.0	3		
		+16.0	33.8	-20.5		170	
		+36.0	53.8	-10.5		93	
		+50.0	67.8	+7.0	37		336
July 31 (Naval Observa-tory).	10 46	-75.5	289.1	-3.5		154	
		-30.0	334.6	-8.0	3		
		-23.0	341.6	+21.5		46	
		+29.0	33.6	-20.5		123	
		+50.0	54.6	-10.5	62		
		+63.0	67.6	+7.5	31		419
Mean daily area for July							715

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR JULY, 1929

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

July, 1929	Relative numbers	July, 1929	Relative numbers	July, 1929	Relative numbers
1	71	11	95	21	100
2	82	12	79	22	78
3	86	13	86	23	63
4	¹ 65	14	³ 76	24	E ² 50
5	W ² 67	15	² 92	25	40
6	⁴ 68	16	88	26	M ² 46
7	79	17	⁴ 70	27	67
8	73	18	70	28	¹ 58
9	M ³ 57	19	73	29	⁴ 45
10	⁴ 73	20	¹ 73	30	E ² 43
				31	² 60

Mean (31 days) = 70.1.

- ¹ = Passage of an average-sized group through the central meridian.
- ² = New formation of a large or average-sized center of activity; E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.
- ³ = Entrance of a large or average-sized center of activity on the east limb.
- ⁴ = Passage of a large group through the central meridian.

AEROLOGICAL OBSERVATIONS

By RICHMOND T. ZOCH

Free-air temperatures were below normal at all levels at Broken Arrow and Due West and above normal at Ellendale and Washington. (See Table 1.) The inverse relationship found between the temperature and relative humidity departures is exceptionally striking.

Free-air vapor pressure departures were variable and of small magnitude. This fact is self-explanatory on account of the inverse relation of the temperature and humidity departures. In agreement with the small vapor pressure departures, the total precipitation for the month was close to the normal at these stations, excepting Washington, where it was considerably below normal.

In the lower levels the resultant winds were southerly over practically the entire country. At the 3,000-meter level the resultant winds were easterly in the extreme Southern States and westerly over the remainder of the country. Above the 3,000-meter level they remained easterly in the extreme South but changed to north-westerly in the northeastern part of the country and to southwesterly on the Pacific coast.

The number of observations made (see Table 3) includes 4 captive balloon and 10 limited-height sounding balloon flights. These types of observations will probably be increasingly used.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during July, 1929

Altitude m. s. l.	TEMPERATURE (°C.)											
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C. (Naval air station) (7 meters)	
	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal
Meters												
Surface	26.3	-0.3	24.8	-2.0	22.8	+1.8	25.3	-1.3	23.1	-1.8	26.5	+1.3
500	24.5	-0.4	21.8	-2.2	22.4	+1.8	24.1	+0.2	21.1	-1.0	23.2	+1.3
1,000	21.7	-0.5	19.3	-1.4	20.4	+2.4	21.3	-0.4	18.4	-0.2	20.7	+1.3
1,500	18.5	-0.7	16.6	-0.8	17.6	+2.0	18.4	-0.7	15.5	+0.1	17.9	+1.5
2,000	15.5	-0.7	13.4	-0.7	14.6	+1.7	16.8	+0.4	12.7	+0.2	15.1	+1.7
2,500	12.9	-1.1	10.1	-0.9	11.0	+1.0	14.1	+0.6	9.7	-0.1	12.2	+1.6
3,000	8.8	-1.1	6.7	-1.4	7.7	+0.6	11.5	+0.9	6.6	-0.5	9.2	+1.3
4,000			0.1	-2.3	2.5	+1.1			0.6	-0.9	4.8	+2.8
5,000											-2.3	+2.8
	RELATIVE HUMIDITY (%)											
Surface	72	+3	73	+6	59	-10	83	+8	73	+11	67	-4
500	71	+5	78	+9	59	-9	81	+4	72	+8	63	-5
1,000	70	+7	72	+2	51	-11	73	+6	71	+4	59	-5
1,500	68	+6	78	+6	51	-7	63	+1	71	+5	57	-8
2,000	62	+3	77	+5	51	-4	52	-7	61	-1	56	-10
2,500	66	+8	73	+2	51	-2	47	-11	55	-1	54	-10
3,000	62	+4	75	+6	51	0	42	-15	60	+10	52	-7
4,000			66	+3	47	-3			45	+4	33	-17
5,000											36	-17
	VAPOR PRESSURE (mb.)											
Surface	24.62	+0.59	23.00	-0.15	16.13	-0.98	26.57	+0.94	21.02	+1.53	23.52	+0.52
500	21.74	+0.79	20.46	+0.08	15.68	-0.86	23.94	+1.46	18.50	+1.49	18.06	+0.17
1,000	18.08	+1.05	16.13	-0.95	12.15	-0.69	18.76	+1.75	15.38	+1.01	14.68	+0.15
1,500	14.43	+0.59	14.74	+0.37	9.98	-0.31	13.44	-0.05	12.86	+1.31	11.91	-0.29
2,000	11.07	+0.11	12.01	+0.29	8.27	-0.01	9.57	-1.40	9.14	+0.29	9.92	-0.21
2,500	9.40	+0.60	9.08	-0.28	6.48	-0.23	7.41	-1.62	6.50	+0.01	7.83	+0.30
3,000	7.17	-0.01	7.39	-0.17	5.46	+0.06	5.62	-1.99	5.50	+0.63	6.15	-0.08
4,000									2.01	-0.81	2.29	-1.11
5,000											0.47	-1.11

TABLE 2.—Free-air resultant winds (meters per second), based on pilot-balloon observations made near 7 a. m., (E. S. T.), during July, 1929

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,868 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (40 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
<i>Meters</i>	°		°		°		°		°		°		°		°		°		°	
Surface	S 5 E	1.9	S 15 W	2.0	N 87 W	2.1	S 10 E	0.1	S 63 W	0.7	S 4 E	1.6	N 22 E	0.1	S 45 W	0.6	S 60 E	2.1	N 64 W	0.9
500	S 27 W	6.3	S 51 W	4.0			N 89 W	2.2	S 46 W	1.1	S 18 W	7.6	S 38 W	1.8	S 90 E	5.4	S 90 E	5.4	N 80 E	0.7
1,000	S 42 W	8.5	N 84 W	4.7			N 75 W	2.3	S 70 W	3.0	S 12 W	7.3	N 61 W	1.0	S 28 W	1.7	S 55 E	5.3	N 87 E	0.9
1,500	S 43 W	4.7	N 81 W	6.6			N 74 W	1.8	N 85 W	4.0	S 2 E	5.4	N 66 W	3.0	S 20 W	0.8	S 60 E	4.1	S 85 W	1.2
2,000	S 54 W	2.0	N 83 W	8.0	S 75 W	3.9	N 63 W	2.3	N 81 W	4.2	S 21 E	3.9	N 73 W	4.1	S	1.2	S 54 E	3.8	S 75 W	2.9
2,500	S 70 W	1.0	N 70 W	8.6	S 83 W	4.0	N 60 W	2.7	N 70 W	5.3	S 56 E	2.7	N 88 W	6.2	S 13 E	1.3	S 41 E	2.4	S 54 W	3.0
3,000	S 46 W	0.8	N 76 W	9.8	N 88 W	2.9	N 60 W	2.7	N 60 W	8.2	S 77 E	2.3	S 77 W	8.2	S 7 E	0.9	S 17 E	1.6	S 23 W	3.6
4,000	S 25 E	1.0	N 71 W	10.4	N 74 W	2.9	N 63 W	3.5	N 71 W	10.0	N 75 E	2.9	S 71 W	12.0	S 8 E	1.5	S 10 E	1.4	S 11 W	4.9
5,000	N 80 E	1.0			S 56 W	2.9	N 78 W	2.2	N 69 W	10.4	N 61 E	2.3	S 79 W	14.7	S 41 E	0.8	S 55 E	0.2	S 5 W	2.1

	Medford, Oreg. (446 meters)		Memphis, Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (313 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,280 meters)		San Francisco, Calif. (60 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (67 meters)		Washington, D. C. (34 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
<i>Meters</i>	°		°		°		°		°		°		°		°		°		°	
Surface	S 40 E	1.1	S 12 W	1.5	N 81 E	0.4	S 34 E	1.0	S 1 W	0.8	S 26 E	2.7	S 70 W	1.0	°	S 56 E	0.8	N 54 W	0.3	
500	S 36 E	0.9	S 47 W	4.5	S 18 W	1.5	S 12 W	3.9	S 52 W	3.4			N 83 W	2.7	S 87 W	3.3	N 33 E	0.6	N 51 W	3.8
1,000	S 32 W	0.8	S 57 W	3.9	S 13 E	2.3	S 36 W	5.7	S 86 W	4.8			N 47 W	5.7	N 81 W	6.6	N 48 W	1.4	N 47 W	3.5
1,500	N 55 E	0.4	S 71 W	2.9	S 22 E	2.3	S 58 W	4.1	N 85 W	5.8			N 48 W	3.0	N 72 W	7.0	N 77 W	0.7	N 63 W	4.6
2,000	11 W	0.8	S 59 W	2.1	S 26 E	2.0	S 74 W	3.3	N 85 W	6.1	S 26 E	5.2	N 56 W	1.6	N 69 W	7.3	S 62 W	2.7	N 69 W	4.9
2,500	S 39 W	5.4	S 77 W	2.2	S 44 E	2.2	S 85 W	4.2	N 79 W	5.6	S 13 E	4.0	S 81 W	3.3	N 67 W	9.2	S 53 W	3.6	N 81 W	5.4
3,000	S 39 W	7.8	N 88 W	2.1	S 67 E	1.9	N 88 W	5.4	N 69 W	5.8	S 11 W	2.8	S 80 W	5.1	N 63 W	10.2	S 61 W	4.2	N 69 W	7.1
4,000	S 49 W	9.3	N 71 W	1.4	N 69 E	2.0	N 69 W	7.3	N 55 W	6.5	S 36 W	1.7			N 66 W	11.0	S 71 W	7.3	N 73 W	6.8
5,000			N 51 W	2.3	N 16 E	1.2	N 77 W	8.0	N 44 W	6.0	S 60 W	2.8			N 68 W	10.8			N 51 W	5.6

TABLE 3.—Observations by means of kites, captive and limited-height sounding balloons, and airplanes during July, 1929

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.	Naval Air Station, D. C.
Mean altitudes (meters), m. s. l., reached during month	2,339	2,387	2,871	2,085	2,676	3,365
Maximum altitude (meters), m. s. l., reached and date	3,879	4,612	4,707	3,586	4,475	5,221
Number of flights made	28	16	31	24	22	21
Number of days on which flights were made	28	15	25	24	22	20

In addition to the above there are approximately 100 pilot balloon observations made daily at 45 Weather Bureau stations in the United States.

551.506 (73) WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By P. C. DAY

GENERAL CONDITIONS

July was notable chiefly for the variable conditions existing during the several parts of the month, though none of these were so pronounced as to make it unusual to any important extent. Tornadoes were notably few and unimportant and no tropical hurricanes occurred.

PRESSURE AND WINDS

Barometric pressure during July, 1929, exhibited about the usual conditions as to distribution, being high over the southeastern district and along the coast of the far Northwest.

The departures from normal were not pronounced, but the monthly means were above normal over practically all sections of the country, except for small areas in the Middle Plateau region and locally in North Dakota and

near-by States, where there were a few negative departures.

The changes from the preceding month were also small, being above the June values in practically all sections save at a few points in or near the Middle Plateau where they were slightly less than those for June.

No important barometric depressions appeared on the daily weather maps and only one cyclonic storm was traced for any considerable distance. Depressions causing important precipitation occurred during the 1st and 2d, when beneficial rains occurred in the middle Mississippi and Ohio Valleys and thence northeastward to the Atlantic coast, heavy rains occurring over local areas in that general region, which, during the 3d extended southward into portions of the Gulf States. On the 4th and 5th precipitation was rather general from the upper Mississippi Valley northeastward over the Lake region to New England, and on the 6th a new depression developed in the middle Missouri Valley and general rains occurred over a narrow area from the middle Rocky Mountains eastward to the Atlantic and northeastward