POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. C. S. Freeman, Superintendent U. S. Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1929	h. m.	°	°	°			
July 1 (Naval Observatory).	11 20	−76.5	324.7	+10.0	46		
		−62.0	339.2	−9.0		694	
		−43.5	357.7	−13.0	3		
		−37.0	4.2	−8.0		15	
		−35.5	5.7	+6.5		139	
		−12.5	28.7	−18.0		12	
		−6.0	35.2	+8.0		25	
		−2.5	38.7	−13.0		31	
		+39.5	80.7	−16.5	123		1,088
July 2 (Naval Observatory).	11 14	−66.0	322.1	+10.0		49	
		−48.5	339.6	−9.0		525	
		−22.0	6.1	+6.5		154	
		−20.5	7.6	−9.5		3	
		+8.0	36.1	+7.0		15	
		+11.5	39.6	−12.5		62	
		+52.0	80.1	−16.5		154	962
July 3 (Naval Observatory).	11 3	−53.5	321.4	+10.0		9	
		−35.5	339.4	−9.5		417	
		−8.5	6.4	+6.5		139	
		+22.5	37.4	+6.5	3		
		+23.0	37.9	−13.0		46	
		+65.0	79.9	−16.0	139		753
July 4 (Naval Observatory).	10 48	−84.5	277.3	+6.5		216	
		−22.0	339.8	−9.0		324	
		+6.5	8.3	+5.5		139	
		+35.0	36.8	−13.5		31	
		+79.5	81.3	−16.5	139		849
July 5 (Naval Observatory).	10 51	−69.5	279.1	+6.5		139	
		−8.0	340.6	−8.5		309	
		+20.5	9.1	+5.0	93		
		+43.0	31.6	−20.5		139	
		+48.5	37.1	−14.0		15	695
July 6 (Naval Observatory).	10 34	−84.5	251.0	−6.5	93		
		−57.0	278.5	+6.0		83	
		−16.5	319.0	+8.0		15	
		+5.5	341.0	−9.0		247	
		+32.0	7.5	+23.0		12	
		+32.0	7.5	+6.0		139	
		+56.5	32.0	−21.0		262	851
July 7 (Naval Observatory).	11 3	−69.5	252.5	−6.5	56		
		−43.5	278.5	+6.5		77	
		−18.5	303.5	−7.5		9	
		+19.5	341.5	−8.5		201	
		+47.5	9.5	+6.0	108		
		+71.0	33.0	−21.5		170	621
July 8 (Naval Observatory).	11 9	−80.0	228.7	+16.5	9		
		−56.5	252.2	−6.0	46		
		−30.0	278.7	+6.5		62	
		−2.5	306.2	−7.5	3		
		+33.5	342.2	−8.5		139	
		+61.0	9.7	+5.5	108		
		+80.5	29.2	−23.0	62		429
July 9 (Naval Observatory).	11 10	−66.5	228.9	+16.5	15		
		−43.5	251.9	−6.0	34		
		−17.5	277.9	+6.5		34	
		−17.0	278.4	−6.5		77	
		+47.0	342.4	−8.0		108	
		+73.5	8.9	+5.5	108		376
July 10 (Naval Observatory).	11 10	−88.0	194.2	−15.5	247		
		−53.0	229.2	+16.5	6		
		−29.5	252.7	−6.5	37		
		−4.5	277.7	+5.0	12		
		−3.0	279.2	−6.0		401	
		+60.5	342.7	−8.0		46	749
July 11 (Naval Observatory).	13 5	−72.0	195.9	−16.5		278	
		−38.0	229.9	+16.5	3		
		−15.0	252.9	−6.5	31		
		+10.5	278.4	+5.5		25	
		+12.0	279.9	−5.5		741	
		+76.5	344.4	−8.0	31		1,109
July 12 (Mt. Wilson)	9 30	−60.0	196.7	−16.0		621	
		−2.5	254.2	−7.0	22		
		+22.0	278.7	+5.0		16	
		+24.0	280.7	−5.0		1,112	1,771
July 13 (Naval Observatory).	10 40	−47.5	195.3	−16.0		370	
		−33.5	209.3	+ 8.5	6		
		−6.0	236.8	+15.0	6		
		+11.0	253.8	−7.0	15		
		+35.0	277.8	+5.0	6		
		+38.5	281.3	−5.0		617	1,020

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
	h. m.	°	°	°			
July 14 (Naval Observatory).	11 57	−81.5	147.3	−10.0	123		
		−79.5	149.3	+7.5	25		
		−33.0	195.8	−16.0	324		
		−19.0	209.8	+7.0		9	
		+9.0	237.8	+15.0		15	
		+25.0	253.8	−7.0	9		
		+50.0	278.8	+5.5	3		
		+53.0	281.8	−4.5		617	1,125
July 15 (Naval Observatory).	10 32	−84.0	132.4	+15.0	62		
		−78.0	138.4	−5.0	62		
		−69.0	147.4	+6.5		216	
		−68.0	148.4	−10.0		154	
		−20.0	196.4	−16.5	309		
		+19.0	235.4	+15.5		37	
		+38.0	254.4	−7.0	9		
		+66.5	282.9	−5.0		617	1,466
July 16 (Naval Observatory).	10 59	−69.0	133.9	+14.5	62		
		−62.5	140.4	−4.5	56		
		−56.0	146.9	+6.5		185	
		−54.0	148.9	−9.5		139	
		−6.0	196.9	−16.0	293		
		+32.5	235.4	+16.0		40	
		+78.5	281.4	−4.5		710	1,485
July 17 (Naval Observatory).	11 6	−69.0	120.6	−3.5	9		
		−57.0	132.6	+15.0	34		
		−49.5	140.1	−4.5	40		
		−42.5	147.1	+6.5		170	
		−40.0	149.6	−9.5		123	
		+7.5	197.1	−16.0	355		
		+45.0	234.6	+16.0		25	756
July 18 (Naval Observatory).	11 7	−55.5	120.9	−3.0	6		
		−44.0	132.4	+15.0	25		
		−35.5	140.9	−4.5	34		
		−28.5	147.9	+6.0		139	
		−27.0	149.4	−10.0		129	
		+20.5	196.9	−16.0		324	657
July 19 (Naval Observatory).	14 17	−29.5	131.9	+15.0	15		
		−20.0	141.4	−4.5		37	
		−14.0	147.4	+6.5		93	
		−13.0	148.4	−10.0	123		
		+36.0	197.4	−16.0		340	608
July 20 (Naval Observatory).	10 26	−68.0	82.3	−15.0	31		
		−43.5	106.8	+3.5	12		
		−18.5	131.8	+15.0	9		
		−9.0	141.3	−4.0	37		
		−3.0	147.3	+6.5		93	
		+0.5	150.8	−9.5		185	
		+47.0	197.3	−16.0	340		707
July 21 (Naval Observatory).	10 37	−69.0	68.0	+6.0	77		
		−55.5	81.5	−14.5	12		
		−54.5	82.5	+2.5	6		
		−29.5	107.5	+3.0		31	
		−17.5	119.5	−2.0	3		
		+4.5	141.5	−4.0		15	
		+10.5	147.5	+7.0		62	
		+12.5	149.5	−9.5		170	
		+61.0	198.0	−16.0	293		669
July 22 (Naval Observatory.	14 15	−54.5	67.2	+6.0	62		
		−39.5	82.2	−14.5	6		
		−13.0	108.7	+3.0	6		
		0.0	121.7	−3.0		15	
		+21.0	142.7	−3.5	9		
		+26.5	148.2	+7.0		25	
		+27.0	148.7	−9.0		108	
		+77.5	199.2	−16.0	278		509
July 23 (Naval Observatory).	10 39	−44.5	66.0	+6.5		62	
		−28.5	82.0	−14.0	6		
		+12.0	122.5	−3.5	9		
		+32.5	143.0	−3.5	9		
		+38.0	148.5	−9.0	93		
		+38.0	148.5	+7.0		46	225
July 24 (Naval Observatory).	10 45	−60.0	37.2	−21.5		93	
		−30.5	66.7	+6.5	46		
		−15.0	82.2	−14.5	6		
		+45.5	142.7	−3.5	6		
		+51.5	148.7	+7.5	9		
		+51.5	148.7	−9.0	93		253
July 25 (Naval Observatory).	11 6	−48.5	35.3	−22.0		154	
		−17.0	66.8	+6.5	46		
		−4.0	79.8	−15.5	9		
		+66.0	149.8	−9.5	108		317
July 26 (Naval Observatory).	10 57	−36.0	34.6	−21.5		139	
		−20.5	50.1	−12.5		77	
		−3.0	67.6	+6.5	46		
		+9.5	80.1	−15.5	6		
		+80.0	150.6	−9.5	108		376

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard civil time	Heliographic: Diff. long.	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day
	h. m.	°	°	°			
July 27 (Naval Observatory).	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 Observatory).	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 Observatory).	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 Observatory).	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 Observatory).	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	[3] 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] [3] 67	15	[3] 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 [2] 57	19	73	29	[4] 45
10	[4] 73	20	[1] 73	30	E [2] 43
				31	[3] 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 northwesterly 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*

TEMPERATURE (°C.)

Altitude m. s. l.	Broken Arrow, Okla. (233 meters): Mean	Broken Arrow: Departure from normal	Due West, S. C. (217 meters): Mean	Due West: Departure from normal	Ellendale, N. Dak. (444 meters): Mean	Ellendale: Departure from normal	Groesbeck, Tex. (141 meters): Mean	Groesbeck: Departure from normal	Royal Center, Ind. (225 meters): Mean	Royal Center: Departure from normal	Washington, D. C. (Naval air station) (7 meters): Mean	Washington: Departure 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	12.0	−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 (%)

Altitude m. s. l.	Broken Arrow: Mean	Broken Arrow: Departure from normal	Due West: Mean	Due West: Departure from normal	Ellendale: Mean	Ellendale: Departure from normal	Groesbeck: Mean	Groesbeck: Departure from normal	Royal Center: Mean	Royal Center: Departure from normal	Washington: Mean	Washington: Departure from normal
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.*)

Altitude m. s. l.	Broken Arrow: Mean	Broken Arrow: Departure from normal	Due West: Mean	Due West: Departure from normal	Ellendale: Mean	Ellendale: Departure from normal	Groesbeck: Mean	Groesbeck: Departure from normal	Royal Center: Mean	Royal Center: Departure from normal	Washington: Mean	Washington: Departure from normal
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			4.13	−0.68	3.73	+0.02			2.01	−0.81	2.29	−1.11
5,000											0.47	−1.11