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	
1928—Continued	H. m.	°	°	°			
Aug. 26 (Mount Wilson).	11 0	−60.0	98.3	−15.0		55	
		−56.0	102.3	+5.0	134		
		−31.0	127.3	+18.0		319	
		−18.0	140.3	−16.0		16	
		−16.0	142.3	+15.0	322		
		−8.0	150.3	−22.0	172		
		+8.0	166.3	−10.0		13	
		+22.0	180.3	+5.0		17	
		+64.0	222.3	−14.0		218	
		+72.0	230.3	−7.0	372		1,638
Aug. 27 (Naval Observatory).	13 14	−68.0	75.9	+23.0		123	
		−44.0	99.9	−15.0		93	
		−40.0	103.9	+4.5	123		
		−19.5	124.4	+19.0		278	
		−16.0	127.9	+17.5		93	
		−13.0	130.9	+17.0	139		
		−2.0	141.9	−15.0		31	
		−1.0	142.9	+14.5	123		
		+7.0	150.9	−21.0	108		
		+22.5	166.4	−10.0	31		
		+40.5	184.4	+5.0	31		
		+82.0	225.9	−13.0		463	1,636
Aug. 28 (Naval Observatory).	11 38	−86.0	45.6	+9.0	93		
		−39.0	92.6	−9.5		15	
		−31.5	100.1	−15.5		62	
		−28.0	103.6	+4.5	139		
		−27.5	104.1	−14.0		31	
		−7.0	124.6	+18.0		278	
		−1.5	130.1	+16.0	216		
		+11.0	142.6	+14.5	170		
		+19.0	150.6	−21.0	154		
		+35.5	167.1	−10.0	22		
		+52.5	184.1	+5.0	31		1,211
Aug. 29 (Naval Observatory).	11 41	−80.0	38.3	+20.0	62		
		−72.5	45.8	+8.0	123		
		−70.0	48.3	+18.0	31		
		−18.0	100.3	−15.5		31	
		−13.5	104.8	+5.0	93		
		−13.0	105.3	−14.0		31	
		+7.0	125.3	+18.0		185	
		+22.0	140.3	+16.0	216		
		+24.5	142.8	+14.5	154		
		+31.5	149.8	−21.0	139		
		+49.5	167.8	−10.0	9		1,074
Aug. 30 (Naval Observatory.)	11 39	−67.0	38.1	+20.0	46		
		−59.5	45.6	+8.0	108		
		−57.0	48.1	+18.0	31		
		−4.0	101.1	−15.0		22	
		0.0	105.1	+5.0		93	
		+2.0	107.1	−13.5		31	
		+20.0	125.1	+18.5		93	
		+25.5	130.6	+15.5	185		

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	
1928—Continued	H. m.	°	°	°			
Aug. 30 (Naval Observatory)—Continued.	11 39	+37.5	142.6	−17.0		31	
		+38.0	143.1	+14.5	154		
		+45.0	150.1	−21.5	108		902
Aug. 31 (Mount Wilson).	12 45	−48.0	43.3	+19.0		19	
		−45.0	46.3	+8.0	133		
		+15.0	106.3	+6.0	94		
		+38.0	129.3	+17.0		202	
		+52.0	143.3	+15.0	237		
		+60.0	151.3	−21.0	8		693
Mean daily area for August							1,147
July 23 (Mount Wilson).	9 30	−81.0	167.7	+7.0		21	
		−44.0	204.7	+14.0		169	
		−38.0	210.7	−20.0		42	
		+35.0	283.7	+5.0		70	
		+45.0	293.7	−20.0		40	
		+50.0	298.7	+9.0		423	
		+75.0	323.7	−22.0		36	801

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR AUGUST, 1928

(Data furnished by Prof. A. Wolfer, University of Zurich, Switzerland)

August	Relative numbers	August	Relative numbers	August	Relative numbers
1	107	11	73	21	71
2	116	12	74	22	79
3	126	13	90	23	101
4	100	14	89	24	91
5	80	15	73	25	104
6	67	16	76	26	112
7	79	17	58	27	110
8	59	18	41	28	
9	59	19	53	29	
10	80	20	58	30	84
				31	80

Number of observations, 29: mean, 82.4.

AEROLOGICAL OBSERVATIONS

By L. T. Samuels

Free-air temperature departures for the month were of only moderate magnitude in practically all cases, being negative in the lower levels at all stations and positive in the higher levels at Broken Arrow, Due West, and Royal Center. (See Table 1.)

It will be noted that positive relative humidity departures occurred with positive temperature departures at a number of upper levels at Broken Arrow and Due West and negative relative humidity departures with negative temperature departures at Groesbeck. It is of interest to note in this connection the exceptionally heavy total monthly rainfall at Broken Arrow (10.11 inches) and Due West (13.90 inches) and the extremely light precipitation at Groesbeck (0.01 inch).

As might be expected, in these cases, the monthly mean free-air vapor pressures were greatly in excess of their normal at Broken Arrow and Due West and below normal at Groesbeck.

The resultant free-air winds for the month were in general close to normal. (See Table 2.)

The wind velocity at Sheridan, Wyo., on the 21st increased from a calm at the surface to 50 m. p. s. at 10 km., the maximum altitude. The direction remained west above 1 km. This observation was taken to the west of the center of a high-pressure area and as might be expected from such a strong wind a very marked change in the pressure distribution occurred during the following 24 hours. The high moved rapidly eastward and was replaced by an extensive depression. A pilot balloon observation made on the 22d at Cheyenne in the southern part of this low revealed a rapid increase in the wind from 7 meters per second at the ground to 42 meters per second at 3 km. The direction was west-southwest throughout.

An observation made at Knoxville on the 9th, at which time a tropical hurricane was centered over Tampa, Fla., indicated a northerly wind up to 2,500 meters superim-

posed by a southerly wind to 5,000 meters. Above this altitude the wind was light and variable. During the following 48 hours the storm center moved northward to about 100 miles east of Knoxville.

On the morning of the 14th when another hurricane was centered over Apalachicola, Fla., the winds at Knoxville were easterly to 5,000 meters. The path of this storm, it is noted, extended farther westward than that of the first storm and the second storm likewise dissipated more rapidly, particularly after it recurved toward the northeast.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during August, 1928*

TEMPERATURE (°C.)

Altitude m. s. l.	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)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Meters										
Surface	26.0	−0.7	25.7	−0.2	20.0	−0.2	25.3	−1.5	22.2	−1.3
250	25.9	−0.7	25.4	−0.1			25.1	−0.9	22.0	−1.3
500	25.1	−0.2	23.6	+0.5	19.7	−0.3	24.1	−0.2	20.1	−1.1
750	24.2	0.0	22.4	+0.9	18.4	−0.7	23.0	−0.3	18.5	−1.0
1,000	23.0	0.0	20.8	+0.8	17.5	−0.6	22.0	−0.2	17.4	−0.6
1,250	21.8	+0.3	19.3	+0.8	16.4	−0.5	20.7	−0.2	16.3	−0.2
1,500	20.2	+0.3	17.6	+0.6	15.3	−0.2	19.3	−0.2	15.0	−0.1
2,000	16.7	+0.2	14.2	+0.1	12.6	0.0	16.2	−0.4	12.7	+0.4
2,500	13.4	+0.3	11.3	+0.2	9.5	−0.1	13.2	−0.5	10.1	+0.4
3,000	10.2	+0.3	9.1	+0.7	5.8	−0.8	10.4	−0.6	7.4	+0.5
3,500	7.6	+0.9			2.5	−1.2	6.6	−1.7	4.6	+0.4
4,000	4.8	+1.0			−0.7	−1.5			1.6	0.0
4,500	2.2	+1.5			−3.1	−0.9				

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures durihg August, 1928.*—Continued

RELATIVE HUMIDITY (%)

Altitude m. s. l.	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)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Meters										
Surface	77	+10	79	+10	69	+3	81	+8	76	+9
250	77	+10	79	+10			79	+5	76	+9
500	71	+7	77	+6	68	+4	76	+2	76	+10
750	67	+5	73	+2	64	+4	67	−1	74	+8
1,000	63	+2	73	+2	62	+4	58	−4	71	+5
1,250	62	+1	71	0	61	+4	56	−4	68	+2
1,500	63	+2	71	+1	59	+2	55	−5	64	−1
2,000	70	+7	78	+10	53	−2	58	−1	52	−9
2,500	71	+8	75	+8	52	−2	53	−4	43	−12
3,000	70	+7	77	+11	58	+4	47	−6	39	−12
3,500	47	−13			62	+10	57	+9	35	−12
4,000	35	−20			63	+13			32	−14
4,500	25	−27			63	+14				

VAPOR PRESSURE (*mb.*)

Altitude m. s. l.	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)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	25.60	+2.61	25.90	+3.09	16.27	+1.13	26.13	+0.80	20.59	+1.34
250	25.40	+2.59	25.43	+2.95			25.25	+0.73	20.33	+1.30
500	22.62	+2.19	22.38	+2.22	15.81	+1.05	22.80	+0.60	18.03	+1.23
750	20.19	+1.82	19.80	+1.40	13.82	+0.72	18.99	−0.12	15.76	+0.46
1,000	17.63	+0.92	18.06	+1.19	12.58	+0.72	15.70	−0.83	14.04	−0.01
1,250	16.24	+0.96	16.16	+0.79	11.43	+0.63	13.95	−0.89	12.57	−0.20
1,500	15.09	+1.18	14.45	+0.61	10.24	+0.43	12.57	−0.97	10.79	−0.64
2,000	13.33	+1.71	12.87	+1.74	7.80	−0.08	11.01	−0.18	7.32	−1.57
2,500	11.02	+1.65	10.33	+1.24	6.19	−0.22	8.48	−0.68	4.97	−1.68
3,000	8.82	+1.33	9.17	+1.71	5.51	+0.20	6.50	−0.88	3.93	−1.17
3,500	5.06	−0.59			4.56	+0.28	5.93	+0.09	2.74	−1.14
4,000	3.34	−0.76			3.54	+0.07			2.09	−1.15
4,500	2.12	−0.84			2.71	−0.10				

TABLE 2.—*Free-air resultant winds (m. p. s.) during August, 1928*

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)			
	Mean		Normal		Mean		Normal		Mean		Normal	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°	
Surface	S. 9 W.	3.0	S.	3.2	S. 78 W.	2.2	N. 78 W.	0.5	S. 21 E.	0.6	S. 23 W.	0.8
250	S. 10 W.	3.4	S.	3.4	S. 76 W.	2.4	N. 80 W.	0.6				
500	S. 15 W.	5.5	S. 11 W.	4.9	S. 82 W.	3.7	N. 79 W.	1.1	S. 19 E.	1.1	S. 14 W.	1.2
750	S. 21 W.	6.0	S. 19 W.	5.5	S. 84 W.	3.8	N. 77 W.	1.3	S. 4 E.	3.0	S. 21 W.	2.5
1,000	S. 28 W.	5.8	S. 27 W.	5.6	N. 88 W.	4.4	N. 83 W.	1.6	S. 13 W.	3.6	S. 36 W.	2.7
1,250	S. 33 W.	5.3	S. 35 W.	5.4	S. 89 W.	4.1	N. 87 W.	2.0	S. 39 W.	4.0	S. 46 W.	3.1
1,500	S. 42 W.	4.4	S. 42 W.	5.4	S. 80 W.	4.4	W.	2.9	S. 47 W.	4.6	S. 59 W.	3.5
2,000	S. 51 W.	3.3	S. 50 W.	4.8	S. 75 W.	4.2	N. 87 W.	3.7	S. 58 W.	5.6	S. 74 W.	4.7
2,500	S. 49 W.	2.9	S. 54 W.	4.8	S. 84 W.	5.7	N. 89 W.	4.9	S. 67 W.	7.4	S. 85 W.	8.1
3,000	S. 48 W.	3.2	S. 55 W.	5.2	N. 85 W.	8.3	N. 89 W.	6.5	S. 74 W.	8.9	S. 89 W.	8.6
3,500	S. 41 W.	2.6	S. 52 W.	6.2					S. 78 W.	9.0	N. 85 W.	11.1
4,000	S. 35 W.	3.2	S. 61 W.	7.1					W.	12.2	N. 83 W.	11.8
4,500	N. 13 W.	1.3	S. 82 W.	7.5					W.	11.5	N. 84 W.	12.4
5,000	N. 56 W.	1.2	N. 81 W.	8.4								

Altitude m. s. l.	Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)				Washington, D. C. (34 meters)			
	Mean		Normal		Mean		Normal		Mean		Normal	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°	
Surface	S. 18 W.	2.6	S. 17 W.	3.1	N. 6 W.	0.5	S. 56 E.	1.1	S. 81 W.	0.4	N. 37 W.	0.5
250	S. 18 W.	4.1	S. 18 W.	4.2	N. 29 W.	0.4	S. 58 W.	1.3	S. 85 W.	1.6	N. 58 W.	1.2
500	S. 24 W.	5.9	S. 22 W.	5.8	S. 81 W.	1.1	S. 65 W.	2.9	N. 65 W.	2.8	N. 53 W.	1.9
750	S. 26 W.	6.6	S. 22 W.	6.1	S. 88 W.	1.9	S. 72 W.	3.8	N. 52 W.	3.5	N. 50 W.	2.0
1,000	S. 26 W.	6.8	S. 22 W.	6.0	N. 80 W.	3.5	S. 79 W.	4.7	N. 58 W.	3.5	N. 55 W.	3.0
1,250	S. 22 W.	6.5	S. 20 W.	5.4	N. 82 W.	5.4	S. 84 W.	5.4				
1,500	S. 19 W.	5.9	S. 17 W.	4.7	N. 84 W.	6.5	S. 89 W.	6.2	N. 67 W.	4.8	N. 62 W.	4.2
2,000	S. 15 W.	5.4	S. 12 W.	3.9	N. 79 W.	5.8	N. 89 W.	7.1	N. 75 W.	5.7	N. 66 W.	5.0
2,500	S. 14 W.	5.5	S. 14 W.	3.8	N. 82 W.	6.9	N. 86 W.	8.4	N. 77 W.	6.3	N. 72 W.	6.3
3,000	S. 25 W.	4.5	S. 22 W.	3.6	S. 85 W.	8.7	N. 85 W.	9.8	N. 79 W.	6.5	N. 73 W.	7.0
3,500	S. 5 E.	1.0	S. 25 W.	3.6	S. 85 W.	10.1	N. 86 W.	11.0	N. 71 W.	6.9	N. 72 W.	7.5
4,000	S. 45 W.	7.0	S. 48 W.	3.0	S. 75 W.	10.8	N. 87 W.	12.1	N. 74 W.	7.3	N. 71 W.	7.7
4,500									N. 82 W.	7.1	N. 75 W.	7.4
5,000									N. 83 W.	7.8	N. 72 W.	7.1