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	
1929	h. m.	°	°	°			
Mar. 11 (Naval Observatory).	11 42	−58.0	23.2	−13.5	22		
		−50.0	31.2	−7.5		170	
		−37.5	43.7	+22.5		46	
		−26.0	55.2	+7.0	25		
		+12.5	93.7	−9.0		802	
		+45.0	126.2	−7.5		262	1,327
Mar. 12 (Naval Observatory).	11 55	−44.5	23.4	−13.5	12		
		−35.5	32.4	−7.0		201	
		−25.0	42.9	+23.5		77	
		−12.5	55.4	+7.0	9		
		+25.5	93.4	−9.0		802	
		+27.0	94.9	+17.5		6	
		+59.0	126.9	−7.5		247	1,354
Mar. 13 (Harvard)	13 9	−28.0	26.0	−14.0	17		
		−18.5	35.5	−7.0		159	
		+42.0	96.0	−8.0		1,043	
		+74.5	128.5	−6.0		310	1,529
Mar. 14 (Yerkes)	10 25	−14.5	27.8	−7.5		50	
		−2.8	39.5	−8.3		50	
		+52.3	94.6	−9.6		800	900
Mar. 15 (Mount Wilson)	11 20	−80.0	308.7	+8.0	355		
		+7.0	35.7	−8.0		60	
		+23.0	51.7	+7.0	3		
		+42.0	70.7	−14.0		28	
		+66.0	94.7	−9.0		984	1,430
Mar. 16 (Naval Observatory).	11 46	−70.5	304.8	+9.5		432	
		+7.5	22.8	−15.0	6		
		+21.0	36.3	−7.5		31	
		+37.5	52.8	+7.5	15		
		+55.5	70.8	−13.5		93	
		+80.5	95.8	−9.0		540	1,117
Mar. 17 (Naval Observatory).	11 39	−57.0	305.2	+9.5		417	
		+69.0	71.2	−14.0		93	510
Mar. 18 (Naval Observatory).	11 43	−43.0	305.9	+9.5		309	
		+80.0	68.9	−15.0	46		355
Mar. 19 (Naval Observatory).	12 41	−27.0	308.2	+9.5		293	293
Mar. 20 (Naval Observatory).	11 28	−13.5	309.2	+9.5		293	293
Mar. 21 (Naval Observatory).	11 45	+0.5	309.9	+9.0		247	247
Mar. 22 (Harvard)	10 50	+15.0	312.0	+8.0	394		394
Mar. 23 (Yerkes)	9 47	+26.6	310.7	+7.8		300	300
Mar. 24 (Naval Observatory).	11 12	−53.5	216.6	−12.5		123	
		+40.5	310.6	+9.0		170	293
Mar. 25 (Naval Observatory).	14 25	−38.0	217.2	−12.5		139	
		+56.5	311.7	+8.5	170		309
Mar. 26 (Naval Observatory).	11 5	−26.5	217.3	−12.5		170	
		−1.0	242.8	−5.5	6		
		+68.0	311.8	+8.5	185		361

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	
1929—Continued	h. m.	°	°	°			
Mar. 27 (Naval Observatory).	11 32	−12.0	218.4	−12.5		170	
		+11.0	241.4	−5.0		37	
		+82.0	312.4	+8.5	170		377
Mar. 28 (Naval Observatory).	11 55	+2.0	219.0	−12.5		201	201
Mar. 29 (Naval Observatory).	11 45	+16.5	220.4	−12.5		185	185
Mar. 30 (Yerkes)	9 20	+23.6	215.7	+9.9		75	
		+26.7	218.8	+9.8		100	
		+28.9	221.0	−13.4		75	250
Mar. 31 (Harvard)	12 20	−79.5	97.5	−10.5		472	
		−54.5	122.5	−3.0		52	
		+42.0	219.0	+10.5		231	
		+45.0	222.0	−13.5		90	845
Mean daily area for March							776

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR MARCH, 1929

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

March, 1929	Relative numbers	March, 1929	Relative numbers	March, 1929	Relative numbers
1	[4] 44	11	E [2 3] 92	21	[2] 11
2	47	12	94	22	
3	W [3] 59	13	77	23	E [3] ?
4		14	66	24	
5	53	15	W [1 4 3] 65	25	22
6	73	16	58	26	35
7	74	17	40	27	39
8	[3] 90	18	24	28	[1] 18
9	103	19	19	29	W [3] 20
10	[2] 91	20	15	30	40
				31	55

Mean, 27 days: 52.7.

[1] Passage of an average-sized group through the central meridian.
[2] Passage of a large group through the central meridian.
[3] New formation of a larger 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.
[4] Entrance of a larger group on the east limb.

AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Beginning this month certain intermediate levels are omitted from Tables 1 and 2 and the wind resultants shown in Table 2 are based on pilot-balloon instead of kite observations. The number of stations shown in this table has been increased.

Table 1 shows a rather striking temperature relationship for the month in that the departures are all positive in the lower levels and negative in the upper levels, the latter increasing appreciably at the highest level, 4,000 meters. In view of this abnormally cold air aloft surmounting abnormally warm air it might be expected that conditions were exceptionally favorable for precipitation. However, with the negative relative humidity departures occurring coincidently with negative temperature departures there was no appreciable excess in the monthly precipitation except at Due West, where the total was 10.94 inches. At this station however, the negative temperature departures were smallest.

Vapor pressure departures were positive in the lowest levels and negative above.

Resultant winds for the month were light and variable at the surface and lower levels (see Table 2). At 1,000 meters the directions were mostly westerly and the velocities about 5 m. p. s. At 4,000 meters, the westerly component is pronounced and the velocities range mostly between 10 and 15 m. p. s.

A sudden drop of 4° C. in the surface temperature occurred shortly after 8 a. m. on the 14th at Due West coincidently with a moderately heavy shower. A kite flight extending to a little more than 1,000 meters above the surface had just ended and this showed an unusually high lapse rate (0.66° C.) for this time of day for the first 500 meters. Although the rain continued throughout the day and night, another kite flight was made at 2 p. m. of the 14th which reached to 2,588 meters (M. S. L.). This flight was of particular interest in that it showed an inversion throughout the first 500 meters, practically an adiabatic lapse rate (0.91° C.) for the next 800 meters, and 0.84° C. throughout the remaining 1,000 meters.

Surface temperature inversions in the midafternoon are extremely rare and in this case the cause was obviously a cooling of the surface air as a result of the rain, while the air at 500 meters was actually warmer in the afternoon than in the morning, due to the continuous southerly winds which prevailed in the front sector of the LOW. A flight made in the early afternoon of the same day (14th) at Royal Center under the influence of a LOW centered to the north showed an unusually strong lapse rate (0.86° C.) from the surface to the maximum altitude (2,616 meters). However, with the relative humidities around 60 per cent there was no precipitation and only about 5/10 Cu. clouds.

A kite flight on the morning of the 12th at Groesbeck was made during the passage of a wind-shift line. The record shows the greatest fall in temperature during the flight (5.3° C.) to be at 1,500 meters whereas the surface temperature had fallen only 3° C. during the same interval (45 minutes).

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

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)		Washington, D. C.[1] (7 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Meters												
Surface	10.5	+0.5	13.0	+0.9	−0.1	+1.9	13.2	−0.1	6.9	+2.6	12.6	+5.0
500	9.6	+1.2	12.0	+1.6	−0.4	+1.8	12.7	+0.6	4.5	+2.2	10.8	+4.6
1,000	8.7	+1.2	9.7	+0.6	−0.6	+2.1	11.8	+0.4	2.8	+1.3	9.1	+4.1
1,500	6.3	−0.3	7.5	−0.3	−1.3	+2.0	10.4	−0.3	1.0	+0.3	6.2	+2.7
2,000	4.1	−0.7	5.3	−0.3	−4.1	+1.0	8.0	−1.2	−1.6	−0.6	3.0	+1.7
2,500	1.3	−1.2	2.8	−0.5	−7.6	−0.1	5.5	−1.5	−4.5	−1.2	0.2	+1.1
3,000	−1.0	−1.0	1.3	+0.2	−10.8	−0.5	3.2	−1.2	−7.1	−1.4	−2.6	+0.8
4,000	−6.4	−3.4	−3.8	−1.9	−16.8	−3.7	------	------	−13.1	−4.7	−9.5	−2.7

RELATIVE HUMIDITY (%)

Surface	65	+1	66	+2	77	+4	82	+11	72	+1	68	+2
500	61	−1	57	−5	77	+5	71	+3	74	+4	63	−7
1,000	51	−9	55	−6	65	−3	58	−6	68	+2	56	−2
1,500	48	−8	52	−8	59	−7	42	−17	60	−2	55	−7
2,000	46	−4	49	−7	57	−7	38	−13	57	−2	54	−4
2,500	45	−1	46	−5	64	0	37	−10	53	−4	51	−3
3,000	41	−3	31	−13	72	+7	35	−10	51	−6	42	−8
4,000	35	−8	13	−31	52	−10	------	------	51	−5	64	+14

VAPOR PRESSURE (*mb.*)

Surface	8.59	+0.37	10.75	+1.13	4.81	+0.87	13.18	+1.61	7.82	+1.48	10.31	+2.60
500	7.66	+0.37	8.96	+0.42	4.70	+0.87	11.15	+0.75	6.97	+1.46	8.74	+1.79
1,000	5.74	−0.91	7.48	−0.34	3.80	+0.34	8.43	−0.91	5.70	+0.74	6.85	+0.63
1,500	4.59	−1.41	5.95	−1.09	3.20	−0.03	5.19	−3.11	4.36	−0.13	5.56	−0.08
2,000	3.88	−1.05	4.62	−1.14	2.58	−0.25	3.60	−3.01	3.60	−0.34	4.46	−0.16
2,500	3.32	−0.85	3.79	−0.89	2.22	−0.24	2.92	−2.69	2.69	−0.75	3.36	−0.38
3,000	2.73	−0.87	2.32	−1.30	1.96	−0.16	2.06	−2.85	2.38	−0.73	2.09	−0.95
4,000	1.83	−1.29	0.80	−2.38	0.74	−1.11	------	------	2.28	−0.54	1.83	−0.87

[1] Naval air station.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during March, 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
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 13 W	1.1	S 25 W	2.2	N 66 W	5.4	S 48 W	0.2	N 61 W	1.7	S 20 E	0.6	S 77 W	1.8	S 11 W	1.0	S 65 E	2.3	N 51 E	1.1
500	S 23 W	4.4	S 66 W	4.7	------	------	S 56 W	2.0	N 75 W	2.1	S 36 W	4.9	------	------	S 17 W	3.8	S 50 E	5.5	S 77 E	0.6
1,000	S 35 W	5.9	N 80 W	7.1	------	------	N 88 W	3.7	N 79 W	6.4	S 74 W	5.5	S 77 W	5.4	S 34 W	4.3	S 39 E	4.5	N 25 W	1.0
1,500	S 19 W	4.4	N 69 W	10.6	------	------	N 82 W	7.9	N 77 W	7.4	N 85 W	6.9	S 88 W	7.9	S 58 W	4.6	S 36 E	3.4	N 61 W	3.1
2,000	S 81 W	6.1	N 81 W	11.6	N 64 W	10.1	N 85 W	10.6	N 77 W	9.0	N 84 W	7.5	N 78 W	8.7	S 78 W	7.8	S 36 E	2.7	N 41 W	4.6
2,500	N 89 W	8.1	------	------	N 67 W	15.0	N 84 W	12.8	N 74 W	9.4	S 84 W	8.0	N 68 W	9.0	S 83 W	9.3	S 56 E	1.1	N 36 W	5.0
3,000	W	8.6	------	------	N 63 W	14.4	N 86 W	14.5	N 65 W	9.5	S 71 W	8.9	N 74 W	10.7	N 86 W	11.0	N 38 W	0.2	N 29 W	6.2
4,000	N 88 W	10.6	------	------	N 69 W	7.1	N 83 W	15.5	N 68 W	11.8	------	------	N 80 W	10.5	S 87 W	12.5	N 46 W	3.7	------	------
5,000	S 73 W	12.1	------	------	N 46 W	6.2	N 81 W	19.8	N 53 W	16.6	------	------	------	------	S 89 W	16.3	N 73 W	4.4	------	------

Altitude m. s. l.	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
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 18 E	0.4	S 14 W	1.3	N 87 E	0.5	N 9 W	0.3	S 65 W	1.3	S 62 W	1.4	S 25 W	0.2	N 25 E	0.6	S 24 E	3.5	S 83 W	1.0
500	S 21 E	0.4	S 45 W	4.5	S 11 E	2.1	S 79 W	1.9	S 50 W	5.0	------	------	N 47 W	3.5	N 65 W	2.0	S 33 W	4.5	S 83 W	8.8
1,000	S 13 W	0.8	S 66 W	5.3	S 73 W	3.9	S 87 W	6.8	S 78 W	6.9	------	------	N 23 W	4.8	N 44 W	5.5	S 65 W	2.9	N 83 W	9.5
1,500	S 53 W	1.5	S 80 W	6.5	N 78 W	6.8	N 82 W	7.6	S 88 W	8.3	S 31 E	1.8	N 24 W	4.6	N 40 W	7.8	S 63 W	2.2	N 69 W	10.2
2,000	S 63 W	3.5	S 79 W	6.7	N 78 W	7.4	N 80 W	9.0	S 82 W	8.9	S 76 W	1.7	N 27 W	5.3	N 60 W	9.4	------	------	N 79 W	10.7
2,500	S 83 W	4.8	S 75 W	7.8	N 84 W	9.3	N 76 W	9.8	S 87 W	9.2	N 75 W	2.8	N 21 W	4.7	N 39 W	8.3	------	------	N 86 W	14.8
3,000	N 67 W	7.2	S 72 W	9.1	S 86 W	9.2	N 75 W	11.5	N 77 W	12.5	N 70 W	3.2	N 22 W	5.1	------	------	------	------	S 85 W	16.8
4,000	------	------	S 78 W	10.5	N 86 W	11.9	------	------	N 84 W	16.8	N 85 W	8.4	N 21 W	6.2	------	------	------	------	N 82 W	16.4
5,000	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------