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	h. m.	°	°	°			
Apr. 17 (Naval Observatory).	11 58	−41.0	49.5	−10.0	6		
		+13.5	104.0	−9.0		9	
		+14.5	105.0	+7.5		9	
		+17.5	108.0	−9.5		6	
		+22.0	112.5	−10.0	25		
		+22.0	112.5	+10.0	154		
		+28.0	118.5	−7.5	123		
		+40.0	130.5	+17.5		46	378
Apr. 18 (Naval Observatory).	12 12	+35.0	112.2	−10.0	19		
		+35.5	112.7	+9.5	139		
		+41.0	118.2	−7.5	123		
		+53.5	130.7	+17.5		15	296
Apr. 19 (Naval Observatory).	13 7	−78.0	345.5	−11.0	204		
		−72.0	351.5	−9.5	31		
		+0.5	64.0	−8.0		15	
		+49.5	113.0	−10.5	9		
		+50.0	113.5	+9.0	170		
		+54.5	118.0	−7.5	93		522
Apr. 20 (Naval Observatory).	12 27	−65.0	345.6	−11.0	154		
		−59.5	351.1	−9.5		31	
		+12.5	63.1	−8.0		46	
		+60.5	111.1	−10.0	6		
		+61.5	112.1	+9.0	185		
		+67.5	118.1	−7.5	108		530
Apr. 21 (Harvard)	11 21	−51.0	347.0	−12.5	315		
		+79.5	117.5	+10.0	314		
		+87.0	125.0	−6.5	382		1,011
Apr. 22 (Mount Wilson)	12 45	−53.0	331.0	+9.5		49	
		−39.0	345.0	−12.0	307		356
Apr. 23 (Yerkes)	12 16	−25.0	347.0	−16.0	300		300
Apr. 24 (Naval Observatory).	11 36	−80.0	278.3	−18.0	93		
		−75.0	283.3	−13.5		185	
		−24.5	333.8	+8.5		25	
		−12.5	345.8	−12.0		185	488
Apr. 25 (Naval Observatory).	11 46	−79.0	266.0	−18.5		185	
		−72.0	273.0	−14.0	77		
		−69.0	276.0	−16.5		93	
		−61.5	283.5	−13.5	278		
		−17.5	327.5	+10.5		31	
		−12.0	333.0	+8.0		62	
		+0.5	345.5	−12.0	216		942
Apr. 26 (Naval Observatory).	11 42	−67.5	264.3	−18.5		185	
		−59.5	272.3	−14.0	77		
		−57.0	274.8	−17.0	31		
		−48.0	283.8	−13.5	247		
		−10.0	321.8	+18.0	9		
		+1.5	333.3	+8.0	31		
		+13.0	344.8	−12.0	154		734
Apr. 27 (Harvard)	10 20	−77.0	242.5	+9.5	786		
		−51.0	268.5	−18.0		317	
		−35.0	284.5	−14.5	393		
		+28.0	347.5	−11.5	271		1,767

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	h. m.	°	°	°			
Apr. 28 (Mount Wilson)	14 15	−67.0	236.9	+22.0		74	
		−59.0	244.9	+10.0		242	
		−38.0	265.9	−17.0		293	
		−20.0	283.9	−14.0	327		
		+30.0	333.9	+8.0		8	
		+42.0	345.9	−11.0	230		1,174
Apr. 29 (Naval Observatory).	11 40	−58.0	234.2	+9.5		31	
		−54.5	237.7	+22.5		154	
		−48.0	244.2	+9.5		247	
		−35.0	257.2	+14.5	31		
		−27.5	264.7	−18.0		139	
		−20.0	272.2	−14.5	31		
		−8.5	283.7	−13.5	247		
		+54.5	346.7	−12.0	185		1,065
Apr. 30 (Naval Observatory).	12 2	−77.5	201.2	−11.0		216	
		−70.0	208.7	−11.0		108	
		−41.0	237.7	+22.0		62	
		−37.5	241.2	+9.0		46	
		−32.5	246.2	+10.5		216	
		−15.0	263.7	−13.5		22	
		−14.5	264.2	−19.0		46	
		−7.0	271.7	−14.0	25		
		+4.5	283.2	−13.5	185		
		+16.0	294.7	−19.0		31	
		+68.5	347.2	−12.0	154		1,111
Mean daily area for April							1,137

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR APRIL, 1928

[Data furnished by Prof. A. Wolfer, University of Zurich, Switzerland]

March	Relative numbers	March	Relative numbers	March	Relative numbers
1		11	125	21	22
2		12	110	22	21
3	76	13	93	23	24
4	95	14	82	24	28
5	111	15	91	25	44
6	126	16	82	26	52
7	121	17		27	50
8	136	18	26	28	55
9	134	19	39	29	67
10	109	20	40	30	92

Number of observations, 27; mean, 76.0.

AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures were decidedly below normal for the month with the exception of those at Washington, where small positive departures occurred at most levels. In agreement with Climatological Chart 1, the largest negative departures occurred in the extreme northern and southern sections of the country. It will be seen from Table 1 that unusually large temperature departures persisted to the highest levels at Groesbeck, Ellendale, and Royal Center.

Notwithstanding the subnormal free-air temperatures, the average relative humidities were likewise below normal at practically all stations. This fact is apparently of significance in connection with the small amount of precipitation which occurred at most of the stations during the month, Royal Center having the smallest amount on record for April.

Vapor pressures averaged below normal at all stations and altitudes with the exception of the lower levels at Washington.

Free-air resultant wind velocities were considerably in excess of the average at Washington and Ellendale and near the average at the other stations. Resultant directions for the month showed a decided lack of southerly component at most stations and levels. This was in harmony with the negative temperature departures

Record minimum temperatures for April accompanied high-pressure areas on the 7th–9th, 14th, and 27th–28th. Temperature departures ranged from 20° C. below the average at 1,500 meters at Ellendale on the 8th to 14° C. below at 2,000 meters at Due West on the 28th.

Conditions of special interest occurred on the 27th and 28th when northeasterly winds prevailed at exceptionally high altitudes over the Lake region. At the time this section of the country was situated between a high-pressure area to the west and a low to the east. The 6 a. m. pilot-balloon observation of the 27th at Royal Center revealed a north-northeast wind from 500 to 5,000 meters. Both the velocity (10 m. p. s.) and direction of this wind were remarkably steady throughout this great depth. A kite flight made at the same time showed an unusually uniform lapse rate (0.59° C. per 100 meters) from the top of the St. Cu. layer (650 meters) to the maximum altitude reached (5,000 meters) with the relative humidity throughout this layer under 40 per cent.

At 5,000 meters an abrupt shift in the wind direction from north-northeast to southwest occurred. It was accompanied by a tremendous increase in velocity which reached more than 40 m. p. s. at 8,000 meters. At 1:45 p. m. of the 27th at Sault Ste. Marie this north-northeast wind extended to 7,000 meters, at which altitude the balloon was lost sight of.

The northeasterly winds at these high elevations appear to be associated with the extreme southerly course taken by this high-pressure area instead of the more usual easterly one. On the morning of the 29th its *center* was apparently over the Gulf of Mexico.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during April, 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)		Washington, D. C. (7 meters) [1]	
	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	13.7	−1.7	14.1	−2.6	2.7	−3.0	14.8	−3.1	8.6	−1.6	13.6	+1.6
250	13.6	−1.7	13.8	−2.6			14.0	−3.2	8.4	−1.5	11.5	+1.3
500	11.9	−1.8	11.9	−2.3	2.2	−3.2	12.0	−3.6	5.9	−1.8	9.3	+0.8
750	10.3	−2.0	10.6	−2.1	0.3	−3.7	10.6	−4.0	4.1	−2.3	7.5	+0.5
1,000	9.1	−2.2	9.5	−2.0	−0.7	−3.6	10.4	−3.6	2.9	−2.5	5.8	+0.1
1,250	8.0	−2.3	8.2	−2.0	−1.6	−3.4	11.0	−2.4	2.0	−2.3	4.2	−0.3
1,500	7.0	−2.2	6.8	−2.0	−2.6	−3.3	11.0	−1.8	1.2	−2.1	3.0	−0.2
2,000	5.7	−1.2	4.4	−1.5	−5.0	−3.2	8.7	−2.0	−1.2	−2.2	1.3	+0.1
2,500	3.3	−0.7	2.8	−0.7	−7.9	−3.3	6.8	−1.3	−3.6	−2.0	0.6	+1.2
3,000	−0.1	−1.0	0.4	−0.5	−11.2	−3.6	3.4	−1.8	−6.0	−1.8	−3.4	−0.4
3,500	−3.5	−1.3	−2.5	−0.8	−14.5	−3.9	0.0	−2.3	−8.6	−1.8		
4,000	−6.9	−1.7	−5.5	−1.2	−17.0	−3.3	−4.2	−3.3	−11.8	−2.6		
4,500	−9.5	−1.4			−19.7	−3.1	−8.1	−4.4	−15.1	−3.1		
5,000									−18.2	−3.3		

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during April, 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)		Washington, D. C. (7 meters) [1]	
	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	60	−4	68	+7	61	−4	73	+1	63	−1	57	−3
250	60	−4	68	+7			73	+1	63	−1	58	−2
500	57	−6	67	+5	61	−3	74	+3	65	+1	58	−1
750	57	−5	64	+2	61	−1	73	+4	65	+2	58	0
1,000	56	−4	61	−1	59	−1	63	0	64	+3	59	+1
1,250	54	−3	61	−1	56	−3	52	−5	61	+2	58	0
1,500	52	−3	60	−1	51	−6	43	−7	56	−2	56	−3
2,000	40	−10	52	−6	50	−5	41	−3	51	−5	53	−5
2,500	39	−10	44	−8	50	−4	31	−11	43	−9	48	−8
3,000	43	−6	42	−7	52	−2	30	−11	38	−11	42	−12
3,500	47	−3	39	−5	54	−1	30	−13	39	−10		
4,000	45	−3	42	−2	28	−27			41	−7		
4,500	29	−20			4	−48			37	−8		
5,000									39	−4		

VAPOR PRESSURE (MB.)

Surface	9.83	−1.83			4.45	−1.39	13.08	−2.20	7.29	−1.14	9.31	+0.38
250	9.72	−1.83	11.11	−0.78			12.54	−2.05	7.14	−1.14	8.31	+0.27
500	8.33	−1.87	10.92	−0.77	4.32	−1.36	11.38	−1.58	6.22	−0.95	7.35	+0.24
750	7.42	−1.68	9.69	−0.71	3.74	−1.28	10.12	−1.49	5.54	−0.90	6.54	+0.16
1,000	6.76	−1.43	8.65	−0.82	3.36	−1.19	8.51	−1.61	5.09	−0.72	5.87	+0.06
1,250	6.08	−1.20	7.75	−0.99	2.95	−1.18	7.03	−1.64	4.57	−0.70	5.17	−0.22
1,500	5.45	−1.06	7.10	−0.85	2.52	−1.19	5.36	−1.78	3.91	−0.88	4.55	−0.47
2,000	3.37	−1.62	6.15	−0.90	2.04	−0.93	3.89	−1.49	3.11	−0.85	3.71	−0.51
2,500	2.57	−1.38	4.27	−1.10	1.64	−0.76	2.31	−2.01	2.13	−0.87	3.33	−0.15
3,000	2.07	−1.14	3.05	−0.90	1.43	−0.50	1.69	−1.84	1.68	−0.67	2.18	−0.46
3,500	1.61	1.04	2.31	−0.62	1.19	−0.39	1.17	−1.82	1.39	−0.60		
4,000	0.95	1.13	1.77	−0.46	0.69	−0.57			1.11	−0.59		
4,500			1.46	−0.30	0.37	−0.54			0.73	−0.64		
5,000									0.64	−0.55		

[1] U. S. Naval Air Station, Washington, D. C.

TABLE 2.—*Free-air resultant winds (m. p. s.) during April, 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. 35 W.	2.6	S. 9 W.	2.5	S. 13 W.	1.1	S. 69 W.	1.4	N. 35 W.	2.9	N. 18 W.	1.6
250	S. 36 W.	2.6	S. 11 W.	2.6	S. 2 W.	0.9	S. 73 W.	1.4				
500	S. 36 W.	3.1	S. 13 W.	3.9	S. 45 W.	2.1	S. 69 W.	2.6	N. 36 W.	2.9	N. 17 W.	1.7
750	S. 31 W.	3.2	S. 17 W.	4.7	S. 51 W.	3.2	S. 67 W.	3.3	N. 46 W.	3.8	N. 32 W.	1.3
1,000	S. 41 W.	4.0	S. 30 W.	5.2	S. 62 W.	4.4	S. 66 W.	4.3	N. 49 W.	4.3	N. 55 W.	1.6
1,250	S. 53 W.	3.6	S. 41 W.	5.3	S. 68 W.	6.2	S. 69 W.	6.0	N. 49 W.	4.5	N. 61 W.	2.3
1,500	S. 68 W.	4.1	S. 54 W.	5.9	S. 77 W.	7.5	S. 71 W.	7.3	N. 49 W.	5.3	N. 64 W.	2.8
2,000	S. 79 W.	5.1	S. 65 W.	7.0	S. 67 W.	9.2	S. 77 W.	8.5	N. 47 W.	5.3	N. 74 W.	3.3
2,500	S. 88 W.	6.3	S. 72 W.	7.7	S. 74 W.	11.0	S. 78 W.	10.1	N. 53 W.	6.8	N. 80 W.	5.0
3,000	S. 80 W.	8.1	S. 79 W.	7.8	S. 75 W.	10.3	S. 79 W.	10.8	N. 51 W.	9.3	N. 76 W.	6.8
3,500	N. 88 W.	9.9	S. 87 W.	9.8	N. 89 W.	11.2	N. 89 W.	11.6	N. 55 W.	13.0	N. 75 W.	8.2
4,000	N. 87 W.	11.8	S. 81 W.	11.0	N. 84 W.	10.8	N. 83 W.	12.3	N. 42 W.	16.4	N. 70 W.	9.7
4,500	N. 45 W.	11.0	W.	11.7					N. 28 W.	13.6	N. 58 W.	9.2
5,000	N. 22 W.	9.9	N. 81 W.	10.3								

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. 9 W.	2.5	S.	2.4	S. 56 W.	2.2	S. 47 W.	1.5	S. 74 W.	0.8	N. 40 W.	1.3
250	S. 6 W.	2.8	S. 2 E.	3.1	S. 56 W.	2.3	S. 45 W.	1.7	S. 77 W.	4.6	N. 69 W.	2.7
500	S. 3 W.	3.9	S. 2 W.	4.6	S. 48 W.	4.8	S. 45 W.	3.4	S. 84 W.	7.3	N. 74 W.	4.2
750	S. 4 W.	4.2	S. 10 W.	5.1	S. 53 W.	6.4	S. 52 W.	4.4	S. 88 W.	8.9	N. 68 W.	5.3
1,000	S. 16 W.	4.7	S. 20 W.	5.7	S. 61 W.	7.1	S. 59 W.	4.8	S. 88 W.	8.6	N. 64 W.	5.8
1,250	S. 29 W.	4.9	S. 31 W.	6.0	S. 73 W.	7.4	S. 71 W.	5.9				
1,500	S. 40 W.	4.5	S. 37 W.	6.6	S. 80 W.	8.0	S. 80 W.	6.7	N. 85 W.	11.3	N. 63 W.	7.9
2,000	S. 64 W.	6.6	S. 50 W.	7.5	N. 82 W.	9.8	S. 88 W.	8.1	N. 75 W.	12.2	N. 71 W.	8.9
2,500	S. 68 W.	6.6	S. 59 W.	8.1	N. 73 W.	12.6	N. 85 W.	9.0	N. 68 W.	14.0	N. 66 W.	10.9
3,000	S. 89 W.	9.2	S. 65 W.	9.9	N. 77 W.	13.0	N. 83 W.	10.8	N. 72 W.	13.3	N. 83 W.	18.1
3,500	N. 73 W.	11.3	S. 71 W.	9.9	N. 76 W.	13.0	W.	12.1	N. 80 W.	13.3	N. 71 W.	10.6
4,000					N. 80 W.	9.5	N. 86 W.	12.9	N. 66 W.	14.0	N. 74 W.	12.5
4,500					N. 80 W.	10.7	N. 75 W.	13.5	N. 70 W.	14.5	N. 73 W.	12.2
5,000					N. 81 W.	10.6	N. 76 W.	12.0	N. 68 W.	17.4	N. 70 W.	13.0