TABLE 3.—*Solar-radiation measurements, and determinations of atmospheric-turbidity factor, β, Washington, D.C., April 1933*

[Values in italicis have been interpolated]

Date and solar hour angle	Solar altitude, *h*.	Air mass, *m*.	I_m	I_y	I_r	β	Blueness of sky	Atmospheric dust particles per cubic centimeter	Notes: (sky-light polarization, P.) clouds, etc.
Apr. 3			*gr.cal.*	*gr.cal.*	*gr.cal.*				
4:44 a	18–07	3.17	0.711	*0.630*	0.500	0.160		420	
4:35 a	19–12	3.02	.755	.637	*.507*	.140			
4:24 a	21–57	2.66	.946	.674	*.559*	.080			
4:20 a	22–43	2.58	.956	*.676*	.562	.080			
3:34 a	31–18	1.92	1.047	*.757*	.574	.085	5		P=56.6%.
3:27 a	32–33	1.87	1.107	.762	*.578*	.065			
Apr. 13									
5:22 a	13–04	4.34	.877	*.691*	.559	.055		461	
5:18 a	13–50	4.13	.913	.694	*.565*	.045			
5:08 a	15–47	3.64	.971	.709	*.603*	.055			
5:01 a	17–10	3.37	1.031	*.715*	.609	.040			
4:48 a	19–41	2.95	1.041	*.770*	.629	.060			
4:45 a	20–16	2.86	1.051	.773	*.632*	.060			
4:14 a	26–14	2.26	1.158	.829	*.665*	.065			
4:09 a	27–12	2.18	1.171	*.834*	.668	.065			
3:13 a	37–38	1.63	1.256	*.882*	.712	.085			
3:09 a	38–22	1.61	1.264	.888	*.715*	.085			
0:41 a	58–46	1.17	1.458	.932	*.772*	.065			
0:37 a	59–01	1.17	1.447	*.934*	.771	.070			
Apr. 26									
4:50 a	22–00	2.65	1.108	*.884*	.637	.045		502	
4:44 a	23–08	2.53	1.132	.790	*.638*	.040			
3:58 a	32–01	1.88	1.216	.857	*.692*	.070	4		P=45.0%.
3:53 a	33–00	1.83	1.255	*.864*	.697	.070			
2:26 a	48–57	1.32	1.394	*.884*	.762	.070			

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Perkins, 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: Diff. long.	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day
1933	*h. m.*	°	°	°			
Apr. 1 (Naval Observatory)	13 11	+64.0	24.1	+5.0	93	------	93
Apr. 2 (Mount Wilson)	12 50	+78.0	25.1	+5.0	128	------	128
Apr. 3 (Naval Observatory)	10 40	No spots			------	------	------
Apr. 4 (Naval Observatory)	11 41	No spots			------	------	------
Apr. 5 (Naval Observatory)	11 11	No spots			------	------	------
Apr. 6 (Mount Wilson)	12 25	+22.0	276.5	+3.0	------	8	8
Apr. 7 (Naval Observatory)	11 6	No spots			------	------	------
Apr. 8 (Naval Observatory)	10 34	No spots			------	------	------
Apr. 9 (Mount Wilson)	11 0	No spots			------	------	------
Apr. 10 (Naval Observatory)	10 56	No spots			------	------	------

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
1933	*h. m.*	°	°	°			
Apr. 11 (Mount Wilson)	11 0	No spots			------	------	------
Apr. 12 (Naval Observatory)	13 17	No spots			------	------	------
Apr. 13 (Naval Observatory)	10 35	No spots			------	------	------
Apr. 14 (Naval Observatory)	11 51	No spots			------	------	------
Apr. 15 (Mount Wilson)	9 10	No spots			------	------	------
Apr. 16 (Mount Wilson)	11 0	No spots			------	------	------
Apr. 17 (Naval Observatory)	13 6	−29.0	79.9	+10.0	------	62	62
Apr. 18 (Naval Observatory)	10 13	−18.0	79.3	+10.0	------	62	62
Apr. 19 (Harvard Observatory)	13 13	+9.5	92.0	+14.0	------	170	170
Apr. 20 (Mount Wilson)	12 30	+8.0	77.6	+10.0	7	------	------
		+18.0	87.6	+3.0	------	4	11
Apr. 21 (Naval Observatory)	13 49	+22.0	79.7	+11.0	------	9	9
Apr. 22 (Naval Observatory)	11 59	No spots			------	------	------
Apr. 23 (Naval Observatory)	13 23	No spots			------	------	------
Apr. 24 (Naval Observatory)	11 4	No spots			------	------	------
Apr. 25 (Naval Observatory)	11 47	No spots			------	------	------
Apr. 26 (Naval Observatory)	10 30	No spots			------	------	------
Apr. 27 (Naval Observatory)	10 18	No spots			------	------	------
Apr. 28 (Naval Observatory)	11 4	No spots			------	------	------
Apr. 29 (Naval Observatory)	11 52	No spots			------	------	------
Apr. 30 (Naval Observatory)	12 42	No spots			------	------	------
Mean daily area for April	------	------	------	------	------	------	18

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR APRIL 1933

(Dependent alone on observations at Zurich and its station at Arosa)

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

April 1933	Relative numbers	April 1933	Relative numbers	April 1933	Relative numbers
1	9	11	0	21	8
2	8	12	0	22	0
3	0	13	0	23	0
4	0	14	0	24	0
5	0	15	0	25	0
6	0	16	0	26	0
7	0	17	*Ec* 13	27	0
8	0	18	13	28	0
9	0	19	*a* 20	29	7
10	0	20	10	30	0

Mean: 30 days=2.9.

a=Passage of an average-sized or smaller group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, W. R. Gregg, in charge]

By L. T. SAMUELS

Free-air temperatures during April were close to the normals in practically all cases. (See table 1.) At most stations and levels the relative humidity departures were small and of opposite sign to those for temperature.

Resultant free-air wind directions were generally close to normal, except at the extreme northwestern stations where northerly components predominated. Resultant velocities were above normal, except over the north-central and northeastern sections where they were below normal. The greatest excess in resultant velocities occurred over the southeastern section of the country.

TABLE 1.—*Free-air temperatures and relative humidities during April 1933*

TEMPERATURE (° C.)

Altitude (meters) m.s.l.	Atlanta, Ga. (303 meters)[1]		Boston, Mass. (6 meters)[2]		Chicago, Ill. (187 meters)[3]		Cleveland, Ohio (246 meters)[3]		Dallas, Tex. (146 meters)[4]		Ellendale, N.Dak. (444 meters)		Norfolk, Va. (3 meters)[5]		Omaha, Nebr. (300 meters)[6]		Pensacola, Fla. (2 meters)[5]		San Diego, Calif. (9 meters)[5]		Washington, D.C. (2 meters)[5]	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	11.0	(7)	7.7	+1.6	5.1	(7)	6.4	(7)	13.4	(7)	4.4	−1.2	12.4	+0.6	6.4	(7)	17.9	+0.1	15.6	−1.1	9.6	−1.6
500	11.9	(7)	3.5	−.8	5.5	(7)	7.2	(7)	15.8	(7)	4.1	−1.1	11.4	0	7.3	(7)	16.6	+.1	12.9	−.8	8.9	0
1,000	11.1	−0.3	2.0	+.2	5.3	−0.5	5.1	−0.7	15.1	+1.8	2.1	−.6	9.6	+.4	6.6	+1.0	14.7	+.2	10.3	−2.1	8.2	+1.4
1,500	8.7	+.1	.7	+1.3	4.1	+.6	2.7	−.8	13.3	+1.5	.4	−.1	------	------	4.7	+1.1	------	------	------	------	------	------
2,000	6.2	+.4	−1.3	+1.2	1.4	+.2	0	−1.2	10.4	+.8	−2.0	+.1	5.0	+.5	2.3	+1.0	10.9	+.7	5.5	−3.2	3.4	−.3
2,500	3.6	+.2	−3.5	+1.0	−1.3	0	−2.1	−.8	7.7	+.8	−4.1	+.8	------	------	−.4	+.9	------	------	------	------	------	------
3,000	.5	−.2	−5.8	+1.0	−3.9	−.1	−4.8	−1.0	4.5	+.6	−6.4	+1.5	−.2	+.3	−3.2	+.9	4.7	0	1.1	−1.9	−.7	−1.8
4,000	−6.1	−1.5	−11.2	------	−10.2	−1.2	−11.1	−2.1	−2.0	+.4	−11.5	+2.5	------	------	−10.0	+.2	−2.7	−.1	−4.8	−1.9	−6.0	−1.8
5,000	−13.4	------	−17.6	------	−17.5	−2.9	−18.0	−3.4	−9.0	−.8	------	------	------	------	−17.1	−1.0	−9.8	−.1	------	------	------	------

RELATIVE HUMIDITY (PERCENT)

Altitude (meters) m.s.l.	Atlanta, Ga.		Boston, Mass.		Chicago, Ill.		Cleveland, Ohio		Dallas, Tex.		Ellendale, N.Dak.		Norfolk, Va.		Omaha, Nebr.		Pensacola, Fla.		San Diego, Calif.		Washington, D.C.	
Surface	85	(7)	70	0	82	(7)	76	(7)	72	(7)	64	−1	61	−3	72	(7)	80	+2	61	−6	70	+8
500	78	(7)	70	+6	76	(7)	67	(7)	60	(7)	64	0	55	0	67	(7)	72	+3	66	−7	65	+7
1,000	67	+7	67	0	68	+6	67	+5	48	−13	61	+1	51	+1	60	−2	68	+7	61	0	57	+2
1,500	65	+6	65	−3	66	+6	66	+6	40	−8	56	−1	------	------	54	−5	------	------	------	------	------	------
2,000	62	+6	65	−2	62	+4	66	+8	36	−7	52	−3	42	−3	53	−4	56	+7	47	+8	54	0
2,500	58	+6	63	−5	60	+6	60	+6	36	−5	48	−6	------	------	55	−2	------	------	------	------	------	------
3,000	57	+7	59	−9	54	+3	59	+8	37	−2	46	−8	39	−2	52	−4	52	+10	29	+2	50	+2
4,000	51	+3	54	------	46	−2	58	+10	41	−1	40	−16	------	------	47	−8	51	+9	22	+2	50	+3
5,000	48	------	51	------	42	−5	56	+9	38	0	------	------	------	------	46	−6	44	+9	------	------	------	------

Weather Bureau airplane observations made near 5 a.m.; Navy airplane observations near 7 a.m.; Ellendale kite observations near 9 a.m. (75th meridian time).

[1] Temperature and humidity departures based on normals of Due West, S.C.

[2] Airplane observations made by Massachusetts Institute of Technology; departures based on normals obtained from kite observations made at Blue Hill Meteorological Observatory.

[3] Temperature and humidity departures based on normals of Royal Center, Ind.

[4] Temperature departures based on normals determined by interpolating between those of Groesbeck, Tex. and Broken Arrow, Okla. Humidity departures based on normals of Groesbeck, Tex.

[5] Naval air stations.

[6] Temperature and humidity departures based on normals of Drexel, Nebr.

[7] Surface and 500-meter level departures omitted because of difference in time of day between airplane observations and those of kites upon which the normals are based.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 7 a.m. (E.S.T.) during April 1933*

[Wind from N=360°; E=90°, etc.]

Altitude (meters) m.s.l.	Albuquerque, N. Mex. (1,554 meters)		Atlanta, Ga. (309 meters)		Bismarck, N.Dak. (518 meters)		Brownsville, Tex. (12 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,873 meters)		Chicago, Ill. (192 meters)		Cleveland, Ohio (245 meters)		Dallas, Tex. (154 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (14 meters)		Key West, Fla. (11 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	289	1.9	240	0.3	45	0.9	135	1.5	155	1.6	299	5.4	329	0.3	162	1.8	164	1.3	257	0.2	305	1.0	128	1.8
500	------	------	267	.6	------	------	167	5.5	195	4.7	------	------	191	1.5	196	4.2	194	4.3	------	------	301	2.5	141	3.7
1,000	------	------	254	2.8	268	.7	186	3.1	248	4.0	------	------	242	3.4	232	5.2	238	6.3	265	1.7	275	4.1	183	2.1
1,500	------	------	278	4.5	284	3.4	199	3.0	276	5.0	------	------	253	3.7	246	5.7	259	6.4	279	2.3	268	6.1	235	2.6
2,000	287	4.0	276	7.3	294	4.2	217	3.4	284	8.2	299	8.1	293	4.9	251	5.1	277	7.2	282	4.7	274	7.6	249	3.8
2,500	290	5.9	256	9.3	308	8.0	256	3.9	298	9.4	306	10.5	307	5.4	262	6.8	284	8.0	288	5.3	278	8.7	265	4.2
3,000	281	6.7	261	11.2	303	9.7	254	4.6	279	4.6	308	8.6	329	4.8	271	7.8	288	9.2	305	4.7	278	11.1	291	4.7
4,000	269	10.3	260	12.6	295	10.7	------	------	280	4.6	299	10.1	------	------	283	9.8	------	------	327	9.7	282	12.7	294	8.9
5,000	268	12.4	------	------	------	------	------	------	------	------	------	------	------	------	292	11.4	------	------	------	------	274	13.2	303	14.6

Altitude (meters) m.s.l.	Los Angeles, Calif. (217 meters)		Medford, Oreg. (410 meters)		Memphis, Tenn. (83 meters)		New Orleans, La. (1 meter)		Oakland, Calif. (8 meters)		Oklahoma City, Okla. (402 meters)		Omaha, Nebr. (306 meters)		Phoenix, Ariz. (356 meters)		Salt Lake City, Utah (1,294 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Washington, D.C. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	84	0.4	235	0.2	194	0.1	75	0.5	284	1.7	186	1.1	77	1.5	89	1.4	160	1.8	60	0.9	113	1.1	340	0.5
500	110	.7	309	.6	232	4.3	187	2.4	312	3.2	197	2.5	80	1.6	108	.3	------	------	60	2.1	287	.8	302	2.2
1,000	72	.4	322	1.1	257	6.0	263	3.4	353	4.6	244	5.8	314	1.3	271	1.6	------	------	18	1.6	340	1.7	297	5.1
1,500	324	1.4	33	1.0	268	7.4	268	5.6	332	3.6	269	6.9	310	4.2	244	1.9	169	3.0	321	3.4	313	1.7	281	7.1
2,000	314	2.3	359	2.0	278	8.7	264	5.7	318	3.9	259	7.0	294	5.5	240	2.3	194	2.4	309	6.1	310	2.3	272	7.6
2,500	333	4.2	332	4.2	286	10.1	270	8.5	330	4.0	272	7.7	299	8.1	232	3.9	272	2.2	305	6.7	323	3.1	274	10.2
3,000	344	4.1	317	4.8	281	10.1	272	12.2	326	5.5	274	9.6	290	8.7	240	4.2	299	3.2	301	7.5	322	5.9	275	10.5
4,000	321	7.6	323	6.3	283	11.6	271	16.2	319	7.9	269	14.7	------	------	254	7.6	310	5.6	287	7.1	327	6.0	273	10.0
5,000	------	------	322	7.9	------	------	------	------	------	------	------	------	------	------	262	8.2	322	9.0	255	4.8	------	------	259	11.1