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

[Values in italics 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.
July 6			*gr. cal.*	*gr. cal.*	*gr. cal.*				
5:55 a	14–55	3.84	0.881	*0.652*	0.504	0.035	------	449	------
5:51 a	15–40	3.65	.899	.655	*.607*	.040	------	------	------
5:40 a	17–43	3.26	.985	.700	*.664*	.042	------	------	------
5:36 a	18–28	3.13	1.008	*.704*	.568	.040	------	------	------
5:06 a	24–05	2.44	1.071	*.772*	.596	.055	------	------	------
5:01 a	25–01	2.35	1.108	.775	*.598*	.045	6	------	P=58.4%
0:38 a	71–58	1.05	1.421	.828	*.690*	.038	------	------	------
0:33 a	72–21	1.05	1.411	*.830*	.690	.040	------	------	------
3:24 p	43–55	1.44	1.302	.830	.640	.035	------	------	------
3:28 p	43–08	1.46	1.304	.832	*.640*	.035	------	------	------
3:52 p	38–19	1.61	1.257	.754	*.630*	.040	------	------	------
3:56 p	37–42	1.63	1.226	*.756*	.628	.045	------	------	------
4:26 p	32–09	1.88	1.223	*.864*	.660	.055	------	------	------
4:36 p	31–30	1.91	1.192	.865	*.658*	.070	------	------	------
July 7									
5:56 a	14–38	3.92	.485	.284	*.220*	.065	------	905	------
5:52 a	15–27	3.72	.512	*.286*	.222	.070	------	------	------
5:34 a	18–50	3.08	.615	*.348*	.288	.065	------	------	------
5:28 a	19–58	2.92	.633	.349	*.290*	.070	------	------	------
4:49 a	27–24	2.17	.910	.550	*.460*	.072	------	------	------
4:44 a	28–21	2.10	.917	*.552*	.462	.075	5	------	P-55.7%
3:21 a	44–28	1.43	1.147	*.732*	.608	.100	------	------	------
3:16 a	45–26	1.39	1.130	.734	*.610*	.120	------	------	------
1:20 a	66–22	1.09	1.232	.823	*.650*	.090	------	------	------
:16 a	67–00	1.09	1.223	*.825*	.626	.095	------	------	------

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			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1933	*h. m.*	°	°	°			
July 1 (Naval Observatory)	10 40	No spots			------	------	------
July 2 (Naval Observatory)	14 8	No spots			------	------	------
July 3 (Mount Wilson)	9 4	No spots			------	------	------
July 4 (Naval Observatory)	10 21	No spots			------	------	------
July 5 (Naval Observatory)	11 15	No spots			------	------	------
July 6 (Naval Observatory)	10 5	−66.0	66.3	+6.0	------	31	31
July 7 (Naval Observatory)	13 24	−78.0	39.3	+6.0	------	12	------
		−53.0	64.3	+7.0	------	22	34
July 8 (Naval Observatory)	10 32	−65.0	40.6	+6.5	9	------	------
		−40.5	65.1	+7.5	------	19	28

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	
1933	*h. m.*	°	°	°			
July 9 (Mount Wilson)	8 30	−51.0	42.5	+7.0	3	------	------
		−29.0	64.5	+7.0	------	8	11
July 10 (Mount Wilson)	8 40	−15.0	65.2	+7.0	------	4	4
July 11 (Perkins Observatory)	13 30	No spots			------	------	------
July 12 (Naval Observatory)	13 46	−65.0	345.9	−4.0	------	9	------
		+14.0	64.9	+7.5	------	15	24
July 13 (Naval Observatory)	10 29	No spots			------	------	------
July 14 (Mount Wilson)	8 35	−42.0	345.2	−5.0	------	4	------
		+38.0	65.2	+5.0	------	7	11
July 15 (Mount Wilson)	8 25	+52.0	66.0	+7.0	2	------	2
July 16 (Naval Observatory)	12 56	No spots			------	------	------
July 17 (Naval Observatory)	14 48	No spots			------	------	------
July 18 (Naval Observatory)	11 24	No spots			------	------	------
July 19 (Naval Observatory)	11 3	No spots			------	------	------
July 20 (Naval Observatory)	13 36	No spots			------	------	------
July 21 (Naval Observatory)	11 32	No spots			------	------	------
July 22 (Naval Observatory)	11 35	No spots			------	------	------
July 23 (Naval Observatory)	12 34	No spots			------	------	------
July 24 (Naval Observatory)	10 45	No spots			------	------	------
July 25 (Mount Wilson)	8 38	No spots			------	------	------
July 26 (Mount Wilson)	11 20	No spots			------	------	------
July 27 (Mount Wilson)	9 6	No spots			------	------	------
July 28 (Perkins Observatory)	12 15	No spots			------	------	------
July 29 (Naval Observatory)	11 5	No spots			------	------	------
July 30 (Naval Observatory)	11 10	No spots			------	------	------
July 31 (Perkins Observatory)	14 5	No spots			------	------	------
Mean daily area for July	------	------	------	------	------	------	5

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR JULY 1933

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

[Observations furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

July 1933	Relative numbers	July 1933	Relative numbers	July 1933	Relative numbers
1	0	11	8	21	0
2	0	12	7	22	0
3	0	13	0	23	0
4	0	14	0	24	0
5	0	15	0	25	0
6	*Ec* 7	16	0	26	0
7	17	17	0	27	0
8	17	18	0	28	0
9	18	19	0	29	0
10	14	20	0	30	0
				31	0

Mean: 31 days=2.8.

c=New formation of a very small center of activity; E, on the eastern part of the sun's disk.

AEROLOGICAL OBSERVATIONS

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

By L. T. Samuels

Free-air July temperatures averaged moderately above normal at the stations listed in table 1, except Norfolk, Pensacola, and San Diego, where negative departures predominated. Relative humidity departures were small to moderate and in most cases of opposite sign to those of the temperature.

Resultant free-air wind velocities in the lower levels were generally less than normal with an excess of southerly components at a number of stations east of the Rockies. (See table 2.) At the higher levels the resultants were mostly close to normal with some excess of northerly components at a few of the central stations.

TABLE 1.—*Free-air temperatures and relative humidities obtained by airplanes during July 1933*

Altitude (meters) m.s.l.	Cleveland, Ohio (246 meters) [1]		Dallas, Tex. (146 meters) [2]		Norfolk, Va. (3 meters) [2]		Omaha, Nebr. (300 meters) [4]		Pensacola, Fla. (2 meters) [2]		San Diego, Calif. (9 meters) [3]		Washington, D.C. (2 meters) [2]	
	TEMPERATURE (°C.)													
	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	17.9	(5)	25.1	(5)	22.8	−2.6	20.4	(5)	26.0	−0.3	19.5	−2.3	22.6	−2.2
500	21.6	(5)	25.5	(5)	21.0	−3.1	21.8	(5)	24.3	−0.3	17.1	−1.7	22.5	0.0
1,000	20.2	+1.4	23.9	+1.9	18.5	−3.5	22.0	+0.7	21.7	−0.4	21.5	−1.1	21.5	+1.1
1,500	16.6	+1.0	21.2	+2.0			19.2	+0.8						
2,000	13.1	+0.4	18.2	+1.8	12.7	−3.1	16.3	+0.9	15.4	−0.5	23.3	+2.0	15.7	+1.1
2,500	10.5	+0.6	15.2	+1.8			13.1	+0.9						
3,000	8.2	+1.0	12.4	+2.0	7.6	−2.7	10.1	+1.2	9.3	−0.6	15.2	−3.1	9.5	+0.6
4,000	3.3	+1.6	7.0	+2.6			3.6	+1.3	3.9	−0.5	7.7	−3.1	4.5	+1.1
5,000	−2.5	+0.7	1.7	+1.8			−3.3	+0.3	−2.4	−0.7				
	RELATIVE HUMIDITY (PERCENT)													
Surface	77	(5)	79	(5)	77	+2	83	(5)	88	+3	80	+6	79	+8
500	57	(5)	74	(5)	68	+1	70	(5)	84	+5	86	+6	71	+5
1,000	51	−15	68	+1	66	+4	56	−3	80	+6	58	+9	64	+3
1,500	56	−9	68	+6			55	−3						
2,000	60	−1	70	+11	57	−2	53	−3	72	+3	31	0	63	+2
2,500	53	−2	68	+10			52	−3						
3,000	46	−5	64	+7	51	0	46	−8	65	+1	42	+2	58	+3
4,000	34	−7	56	−3			35	−17	63	+3	53	+2	49	+1
5,000	30	−19	51	+15			33	−19	52	+3				

[1] Temperature and humidity departures based on normals of Royal Center, Ind.
[2] 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.
[3] Naval air stations.
[4] Includes period from July 12-31 only. Temperature and humidity departures based on normals of Drexel, Nebr.
[5] 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.

Weather Bureau observations made near 5 a.m.; Navy, observations near 7 a.m. (75th meridian time).

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

[Wind from N=360°; E=90°, etc.]

Altitude (meters) m.s.l.	Albuquerque, N. Mex. (1,554 meters)		Altanta, 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			5	0.4	51	1.1	147	1.5	176	2.1	260	2.8	185	0.5	190	1.2	149	1.8	123	0.6	176	0.5	124	2.9
500			186	0.6			170	8.7	212	3.3			225	3.5	255	3.1	200	5.1			203	2.8	124	5.7
1,000			164	1.4	160	2.3	173	8.7	285	3.2			243	2.7	293	3.5	214	5.2	206	1.2	206	3.2	133	5.1
1,500			187	1.4	259	1.2	167	7.0	293	5.8			274	3.4	290	2.4	231	1.6	301	2.2	209	3.0	136	3.7
2,000			217	1.8	265	2.8	161	5.0	292	6.3	242	4.3	287	2.4	288	3.9	325	1.0	286	4.1	191	2.6	140	3.6
2,500			235	1.8	276	4.6	136	3.5	291	5.6	220	5.3	297	2.2	293	3.8	343	1.0	275	7.3	185	3.0	144	3.6
3,000			210	1.7	274	5.9	121	3.7	318	5.0	245	4.6	317	2.3	285	4.5	328	0.7	269	8.8	184	2.6	135	2.5
4,000			37	0.9	278	7.8	80	3.7	324	3.8	275	4.0	344	2.7	287	4.6	16	1.3	256	13.7	211	1.4	170	1.2
5,000			15	1.7			71	3.6	277	7.2	277	5.8	355	2.2	294	6.5	78	0.8	260	14.9	227	1.3	185	1.2

Altitude (meters) m.s.l.	Los Angeles, Calif. (217 meters)		Medford, Oreg. (410 meters)		Memphis, Tenn. (83 meters)		New Orleans, La. (2 meters)		Oakland, Calif. (8 meters)		Oklahoma City, Okla. (402 meters)		Omaha, Nebr. (306 meters)		Phoenix, Ariz. (338 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	344	0.3	213	0.5	150	0.9	169	0.5	309	1.6	166	2.9	129	1.1	93	1.4	146	4.3	91	0.6	64	0.5	352	0.6
500	55	0.7	267	1.0	203	3.0	207	3.7	256	1.8	171	4.4	167	4.6	156	1.0			190	1.1	25	2.5	326	2.2
1,000	22	1.2	292	1.7	217	2.8	195	3.9	300	3.6	208	7.5	203	6.0	244	1.4			265	3.0	340	1.6	337	2.3
1,500	335	2.8	15	0.6	249	1.8	188	3.4	300	1.8	222	4.2	230	5.0	254	1.3	162	6.7	279	4.5	311	1.4	306	2.1
2,000	263	1.8	292	0.3	302	1.6	198	3.2	240	1.7	277	1.3	248	4.0	247	0.6	181	5.6	277	6.6	263	2.9	303	3.7
2,500	205	1.8	236	3.2	315	2.2	182	2.5	224	3.2	356	2.0	280	2.1	76	0.3	206	3.3	284	7.9	256	4.0	304	4.2
3,000	149	4.0	226	5.2	310	2.1	225	1.8	218	3.3	8	2.3	345	2.5	85	1.4	228	3.2	289	8.6	254	4.9	304	4.6
4,000	142	4.7	233	7.0	307	1.7					26	3.7	3	5.0	113	3.3	250	4.8	299	8.5	244	8.1	304	5.6
5,000			243	6.8	298	0.9					6	3.5	357	3.9	83	5.6	254	4.4	300	9.2			312	5.4