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

[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: Skylight polarization, P., clouds, etc.
1933									
Jan. 24			*gr. cal.*	*gr. cal.*	*gr. cal.*				
2:38 a	21-08	2.76	1.107	*.853*	.693	.070			
2:28 a	20-22	2.61	1.139	.856	*.699*	.070			
2:04 a	25-04	2.36	1.145	.870	*.703*	.080			
0:52 a	30-38	1.96	1.241	*.945*	.711	.070	4		P=55.8.
0:44 a	30-59	1.94	1.274	*.945*	.714	.065			
0:04 a	31-54	1.89	1.276	.945	*.747*	.075			
0:00 noon	31-54	1.89	1.300	.945	*.748*	.070			
1:08 p	29-45	2.01	1.292	.916	*.746*	.065			
1:12 p	29-30	2.02	1.303	*.918*	.747	.060			
2:08 p	24-39	2.39	1.200	*.907*	.705	.055			
2:12 p	24-13	2.43	1.203	.970	.708	.055			
Jan. 30									
3:28 a	15-28	3.70	1.067	*.964*	.702	.065		355	
3:17 a	16-31	3.49	1.150	.967	*.704*	.040			
2:30 a	23-31	2.50	1.200	.948	*.786*	.045			
2:24 a	24-15	2.43	1.216	*.951*	.789	.045			
1:41 a	28-56	2.06	1.355	.999	.814	.060			
1:33 a	29-21	2.04	1.310	1.015	.817	.085			
Jan. 31									
3:36 a	14-27	3.97	.909	.717	*.606*	.070		389	
3:31 a	15-14	3.77	.906	.720	.609	.080			
3:08 a	18-39	3.11	1.016	*.802*	.655	.080			
3:02 a	19-30	2.98	1.029	.804	*.658*	.085			
3:42 a	22-15	2.63	1.032	.846	*.693*	.115			
2:34 a	23-16	2.51	1.126	*.847*	.697	.080			
2:03 a	26-54	2.21	1.174	*.885*	.711	.085			
1:58 a	27-24	2.17	1.174	.888	*.712*	.085			
1:22 a	30-35	1.96	1.221	.897	*.723*	.080	5		P=58.3.
1:18 a	30-53	1.94	1.243	.900	.726	.075			

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Nava 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	$h.$	$m.$	°	°	°			
Jan. 1 (Naval Observatory)	12	29	No spots.					
Jan. 2 (Naval Observatory)	11	40	No spots.					
Jan. 3 (Naval Observatory)	13	23	−70.0	328.1	+11.0	185		185
Jan. 4 (Naval Observatory)	11	3	−74.0	313.3	+11.0		185	
			−59.0	328.3	+11.0	170		355
Jan. 5 (Naval Observatory)	14	6	−59.0	313.5	+10.0		154	
			−44.0	328.5	+10.0	154		308
Jan. 6 (Naval Observatory)	12	15	−46.0	314.3	+9.0	93		
			−32.0	328.3	+10.0	154		247
Jan. 7 (Mount Wilson)	12	50	−32.0	314.9	+9.0	110		
			−18.0	328.9	+11.0	126		236
Jan. 8 (Naval Observatory)	13	1	−18.0	315.6	+10.0	123		
			−4.0	329.6	+11.0	154		277
Jan. 9 (Mount Wilson)	13	50	−5.0	315.0	+9.0	109		
			+9.0	329.0	+11.0	166		275
Jan. 10 (Naval Observatory)	11	55	+8.0	315.8	+10.0		154	
			+22.0	329.8	+11.0	139		293
Jan. 11 (Perkins Observatory)	15	40	+20.0	312.6	+11.0	70		
			+32.0	324.6	+11.0	70		140

POSITIONS AND AREAS OF SUN SPOTS—Continued

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Date	Eastern standard civil time		Heliographic			Area		Total area for each day
			Diff. long.	Longitude	Latitude	Spot	Group	
1933	$h.$	$m.$	°	°	°			
Jan. 12 (Naval Observatory)	13	30	+4.0	284.6	+8.0		31	
			+36.0	316.6	+10.0	123		
			+49.0	329.6	+11.0	139		293
Jan. 13 (Perkins Observatory)	15	0	+5.0	271.7	+5.0		45	
			+34.0	300.7	+15.0		50	
			+46.0	312.7	+11.0	70		
			+59.0	325.7	+11.0	70		235
Jan. 14 (Mount Wilson)	12	0	+20.0	275.1	+3.0		53	
			+51.0	306.1	+15.0		74	
			+62.0	317.1	+10.0	85		
			+75.0	330.1	+11.0	171		383
Jan. 15 (Naval Observatory)	13	16	+33.0	274.2	+3.0		37	
			+66.0	307.2	+14.0		62	
			+76.0	317.2	+10.0	108		207
Jan. 16 (Naval Observatory)	10	43	+46.0	275.5	+2.0		19	19
Jan. 18 (Harvard Observatory)			No spots.					
Jan. 19 (Perkins Observatory)	13	15	No spots.					
Jan. 20 (Naval Observatory)	11	5	No spots.					
Jan. 22 (Naval Observatory)	16	25	No spots.					
Jan. 23 (Naval Observatory)	10	20	No spots.					
Jan. 24 (Naval Observatory)	10	44	No spots.					
Jan. 28 (Naval Observatory)	10	47	−58.0	13.4	+6.0		31	31
Jan. 29 (Naval Observatory)	11	19	−44.0	14.0	+5.0		154	154
Jan. 30 (Naval Observatory)	10	56	−79.0	326.0	+12.0	123		
			−33.0	12.0	+4.0		50	
			−26.0	19.0	+5.0		77	250
Jan. 31 (Naval Observatory)	11	5	−88.0	303.8	+16.0	247		
			−64.0	327.8	+12.0		108	
			−15.0	16.8	+6.0		216	571
Mean daily area for January								172

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR JANUARY, 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]

January, 1933	Relative numbers	January, 1933	Relative numbers	January, 1933	Relative numbers
1	0	11	17	21	0
2	0	12	*Mc* 26	22	0
3	*d* 7	13	37	23	0
4	14	14	32	24	0
5	17	15	27	25	0
6	17	16	14	26	0
7	19	17	7	27	0
8		18	0	28	*Ec* 9
9	*a*	19		29	10
10	*a* 18	20	0	30	
				31	*a* 35

Mean: 27 days=11.3.

a=Passage of an average-sized 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 January averaged decidedly above normal except at San Diego, where small negative departures occurred. (See Table 1.) The largest positive departures occurred in the lower levels at Omaha and Washington. Relative humidities averaged close to normal at most stations, with the greatest deviations occurring at Omaha where the departures were negative.

In harmony with the large positive temperature departures, the monthly free-air resultant wind directions contained either greater southerly or smaller northerly components than normal at the corresponding stations. In most cases the resultant velocities were above normal. At 3,000 meters elevation and above, however, but little deviation from the normal directions occurred.

Airplane observations were made daily throughout the month at the Weather Bureau stations, with the exception of the 21st at Chicago when, dense fog continued all day.

TABLE 1.—*Free-air temperatures and relative humidities during January, 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)		Omaha, Nebr. (300 meters)[5]		Pensacola, Fla. (2 meters)[6]		San Diego, Calif. (9 meters)[6]		Washington, D. C. (2 meters)[6]	
	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	7.2	(7)	1.6		0	(7)	1.3	(7)	8.4	(7)	−8.8	+2.3	−1.3	(7)	13.3	+1.7	10.5	−2.0	4.0	+3.3
500	8.3	(7)	−.8		.2	(7)	1.3	(7)	11.2	(7)	−8.5	+2.5	−.2	(7)	13.2	+1.9	11.4	−.1	5.8	+4.8
1,000	8.3	+3.3	−2.6		−.1	+5.3	0	+5.4	10.6	+4.9	−4.2	+4.6	1.9	+6.5	11.4	+1.5	9.8	0	5.8	+5.7
1,500	7.1	+3.6	−3.2		−.8	+5.1	−1.2	+4.7	8.9	+3.9	−4.6	+3.5	1.4	+5.5						
2,000	5.3	+3.6	−4.4		−2.8	+4.1	−2.5	+4.4	7.3	+3.9	−7.4	+2.2	−.3	+5.1	7.8	+.8	5.4	+.1	2.8	+5.3
2,500	2.8	+3.0	−6.2		−5.2	+3.5	−4.5	+4.2	5.0	+3.7	−10.6	+1.2	−3.1	+4.5						
3,000	.3	+2.7	−8.7		−8.3	+2.7	−7.3	+3.7	2.1	+3.2	−13.3	+1.1	−6.1	+4.0	3.6	+.6	.4	−.3	−1.8	+4.1
4,000	−5.1	+2.5	−15.0		−14.3	+1.5	−12.6	+3.2	−3.9	+2.7	−19.9	−.1	−12.4	+3.0	−1.6	+.6	−4.8	−.3		
5,000	−12.0	+1.2	−20.2		−21.1	+1.5	−19.1	+3.5	−10.5	+2.2			−19.2	+2.3						

RELATIVE HUMIDITY (PER CENT)

Surface	84	(7)	69		82	(7)	80	(7)	81	(7)	82	+1	77	(7)	85	+2	70	+5	78	+7
500	77	(7)	67		75	(7)	78	(7)	66	(7)	81	+2	71	(7)	80	+4	62	+1	64	+2
1,000	68	+11	67		67	+2	72	+7	60	−1	68	+2	56	−10	76	+7	59	+5	54	−3
1,500	63	+10	62		59	+1	61	+3	53	−1	64	+5	47	−12						
2,000	57	+8	59		54	+1	49	−4	45	−4	63	+5	41	−16	70	+13	50	+8	45	−6
2,500	50	+5	55		50	−3	47	−6	43	−3	65	+7	40	−16						
3,000	45	+2	52		48	−6	47	−7	42	0	64	+6	39	−17	61	+13	41	+9	41	−2
4,000	40	−2	52		47	−8	49	−6	39	+1	66	+12	38	−15	54	+13	33	+9		
5,000	36	−15	48		43	−16	45	−14	41	+5			37	−17						
					42															

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

[1] Temperature and humidity departures based on normals of Due West, S. C.
[2] Observations made by Massachusetts Institute of Technology.
[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] Temperature and humidity departures based on normals of Drexel, Nebr.
[6] Naval air stations.
[7] Surface and 500-meter departures omitted because of difference in time 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 January, 1933*

[Wind from N=360°; E=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,528 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	26	0.7	314	1.4	300	0.8	149	1.0	199	1.6	274	6.1	228	2.5	211	3.9	178	1.9	253	2.6	263	0.8	45	1.8
500			278	3.4			156	6.3	227	5.2			234	9.1	233	7.8	219	5.4			251	3.5	90	3.1
1,000			256	5.9	281	7.3	165	7.0	246	7.2			247	12.0	258	11.0	248	7.2	252	8.5	256	3.9	145	1.9
1,500			269	6.4	284	9.8	179	5.7	259	8.7			258	13.5	268	10.7	257	6.8	269	11.0	271	4.5	237	1.4
2,000	278	2.6	278	7.2	287	11.0	218	4.7	289	9.0	267	9.4	268	13.1	269	12.2	262	9.3	276	12.1	294	5.2	259	2.1
2,500	266	5.3	281	8.2	282	13.4	255	2.9	295	8.9	273	15.8	277	13.1	269	14.0	257	11.5	274	12.5	294	6.4	256	3.2
3,000	266	8.4	278	9.2	276	13.6	241	2.6	265	7.8	280	16.4			271	13.0	261	12.3	275	12.8	288	8.9	262	3.2
4,000	268	11.5	284	10.6			262	8.7			284	13.9					262	12.8	256	8.6			248	2.7
5,000	284	8.3									264	7.9											266	9.3

Altitude (meters) m. s. l.	Los Angeles, Calif. (217 meters)		Medford, Oreg. (410 meters)		Memphis, Tenn. (83 meters)		New Orleans, La. (25 meters)		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	98	1.0	169	0.5	206	1.7	62	1.0	90	1.5	201	3.1	223	0.9	91	1.5	167	3.3	134	0.5	155	3.0	306	1.8
500	106	1.2	176	1.3	250	5.5	191	2.2	31	1.9	212	4.1	234	4.1	102	2.0			171	1.5	197	6.6	278	6.6
1,000	287	0.6	231	2.7	265	6.3	237	3.3	334	3.6	248	8.3	269	8.2	108	1.8			220	2.5	209	7.0	277	8.5
1,500	274	1.4	260	3.8	280	6.6	217	3.8	331	4.7	253	8.5	273	10.5	194	2.2	180	4.8	273	4.1	238	5.9	292	10.1
2,000	310	2.5	282	5.5	274	8.4	268	4.0	328	6.3	251	9.9	276	11.8	233	4.1	199	4.2	274	4.7	281	5.3	294	11.0
2,500	306	5.0	289	5.6	272	10.9	267	4.3	329	7.4	256	11.1	274	13.5	242	5.0	244	4.8	265	5.5			283	12.7
3,000	303	6.4	314	6.2	268	13.1			314	8.5	270	11.4	267	13.2	250	6.5	262	6.7	282	8.0			280	14.1
4,000	289	6.7							313	7.0	294	10.1			274	10.1	287	9.2						
5,000															267	8.3								