SOLAR OBSERVATIONS

SOLAR-RADIATION MEASUREMENTS DURING APRIL 1933

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For a description of instruments and their exposures, the reader is referred to the January 1932 REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged close to normal at Washington and Lincoln, and slightly above normal at Madison.

Table 2 shows an excess in the total solar radiation received on a horizontal surface at Washington, Lincoln, Chicago, New York, Fresno, and Pittsburgh and a deficiency at all other stations for which normals have been computed.

Table 3 shows marked variations in the values of β on each of the 3 days when these measurements were made, due in large part to incipient cloudiness.

Polarization measurements made on 4 days at Washington give a mean of 54 percent, with a maximum of 63 percent on the 3d. At Madison, measurements made on 6 days give a mean of 59 percent, with a maximum of 61 percent on the 14th. These are slightly below normal for the month at both stations.

TABLE 1.—*Solar-radiation intensities during April 1933*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D.C.

Date	Sun's zenith distance										
	8a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A.M.					P.M.				
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*mm*
Apr. 3	5.56			0.76	1.08						4.37
Apr. 5	4.37	0.31	0.42	.60							4.57
Apr. 13	4.37	.81	.91	1.03	1.19	1.52					2.87
Apr. 14	5.56				1.07	1.33					5.37
Apr. 18	7.57					1.31					5.56
Apr. 24	4.57					1.45					2.49
Apr. 26	2.49			1.05	1.20	1.41					2.74
Apr. 27	3.00			.94	1.16						2.62
Apr. 28	6.50				.80	1.30					6.53
Apr. 29	9.14				1.10						9.14
Means		(.56)	(.66)	.88	1.09	1.55					
Departures		−.14	−.12	−.01	+.01	+.19					

TABLE 1.—*Solar-radiation intensities during April 1933*—Con.

Madison, Wis.

Date	Sun's zenith distance										
	8a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A.M.					P.M.				
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*cal*	*mm*
Apr. 4	3.81			0.84							3.81
Apr. 11	3.00		0.94	1.12							2.74
Apr. 12	3.45				1.28						3.30
Apr. 15	3.45			.97	1.18	1.41					3.30
Apr. 21	6.27			.94	1.17						7.04
Apr. 22	3.81			1.15	1.31	1.51					3.30
Apr. 24	3.81			.87	1.06						5.36
Apr. 25	3.63					1.54					3.45
Apr. 26	3.99			1.00	1.23	1.58	1.21				2.16
Apr. 27	2.62					1.43					2.16
Means			(.94)	.98	1.20	1.49	(1.21)				
Departures			+.01	−.05	±.00	+.06	+.12				

Lincoln, Nebr.

Apr. 3	4.37	0.79	0.90	1.08							4.17
Apr. 7	3.45	.79	.92	1.08							3.99
Apr. 10	3.30					1.51	1.28	1.04	0.92	0.80	3.00
Apr. 11	2.74			1.10	1.32	1.50					2.36
Apr. 17	6.02		.69	.87	1.16	1.47					8.18
Apr. 18	6.50	.59	.74	.92	1.12	1.40	1.08	.81	.62	.52	8.48
Apr. 25	6.02						1.21	1.00	.88	.80	3.81
Apr. 28	6.76	.88	.97	1.08	1.22	1.44	1.24				6.27
Means		.76	.84	1.02	1.20	1.46	1.20	.95	.81	.71	
Departures		+.04	+.01	+.04	±.00	+.02	+.02	−.03	−.04	−.01	

Blue Hill, Mass.

Apr. 5	3.6				1.20	1.57	1.21	1.11			2.9
Apr. 10	4.8				1.19	1.47	1.09				4.0
Apr. 20	4.2					1.43	1.16				4.0
Apr. 21	3.1				1.18	1.40					4.8
Apr. 22	4.6						1.26	1.07			2.3
Apr. 24	3.4				1.09	1.36	1.04				4.6
Apr. 26	7.9								0.93		5.6
Apr. 30	7.3						1.00				8.8
Means					1.17	1.45	1.13	1.09	(.93)		

* Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning—	Gram calories per square centimeter												
	Washington	Madison	Lincoln	Chicago	New York	Fresno	Pittsburgh	Fairbanks	Twin Falls	La Jolla	Gainesville	Miami	New Orleans
1933	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
April 2	382	182	404	204	280	568	248	397	472	289	335	407	370
April 9	444	352	487	372	348	628	320	385	(*)	416	268	464	240
April 16	342	335	437	358	346	624	293	348	216	374	530	404	360
April 23	610	547	510	503	486	535	509	437	467	283	522	482	382
	Departures from weekly normals												
April 2	−5	−192	−22	−88	−33	+42	−42		+62	−121	−150	−61	
April 9	+40	−54	+57	+45	+11	+72	−9			−14	−208	±0	
April 16	−81	−62	+11	+28	−10	+60	−62		−236	−58	+7	−71	
April 23	+172	+109	+59	+158	+112	−21	+127		−20	−130	−58	−22	
	Accumulated departures on April 30												
	+3,276	−3,584	−189	+3,563	+2,842	+3,262	+651		−259	−3,829	−7,994	−1,645	

* Defective pyrheliometer.

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.