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SOLAR OBSERVATIONS

SOLAR OBSERVATIONS DURING APRIL 1937

By IRVING F. HAND, Assistant in Solar Radiation Investigations

For a description of instruments employed and their exposures, the reader is referred to the January 1935 REVIEW, page 24.

Table 1 shows that solar radiation intensities averaged above normal during April at Washington, Madison, and Blue Hill. The intensities at Lincoln averaged below normal, chiefly because of dust storms. On the afternoon of the 14th, although there were no condensed water-vapor clouds present, dust depleted radiation receipt to such a degree that the values at Lincoln are considerably less than 10 percent of those taken a week later. Observations taken through dust when other clouds are not present are included in the mean values because this is the simplest manner of determining the effect of dust storms in absorbing, scattering, and reflecting radiation from the sun and sky.

With the exception of three stations near the seacoasts, Fresno, New Orleans, and Riverside, all values of the total solar and sky radiation received on a horizontal surface at the other stations during April were below normal.

More turbidity measurements were made by the Weather Bureau during April than during any previous month.

TABLE 1.—*Solar radiation intensities during April 1937*

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

WASHINGTON, D. C.

Date	Sun's zenith distance											
	8 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon	Local mean solar time
	75th mer. time	Air mass										
		A. M.				*1.0	P. M.					
	e	5.0	4.0	3.0	2.0		2.0	3.0	4.0	5.0	e	
	mm	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm*	
Apr. 12	3.45	0.83	0.94	1.07	1.27	1.50	1.18	1.00	------	------	3.00	
Apr. 14	7.87	------	------	------	.77	------	------	------	------	------	7.04	
Apr. 17	2.87	------	------	------	1.28	------	------	------	------	------	2.62	
Apr. 19	66.50	------	------	------	1.14	1.47	------	------	------	------	3.63	
Apr. 20	5.56	------	------	------	------	1.39	------	------	------	------	3.81	
Apr. 22	7.57	------	------	------	1.13	------	------	------	------	------	7.04	
Apr. 23	5.36	------	------	.82	.88	------	.98	------	------	------	6.02	
Apr. 30	7.57	------	------	.93	1.15	------	------	------	------	------	3.15	
Means	------	(.83)	(.94)	.94	1.09	1.45	(1.08)	(1.00)	------	------	------	
Departures	------	+.13	+.15	+.05	+.01	+.09	−.01	+.11	------	------	------	

MADISON, WIS.

Apr. 9	2.62	------	------	1.19	1.35	1.70	------	------	------	------	2.62	
Apr. 10	3.45	------	1.10	1.20	------	------	------	------	------	------	2.49	
Apr. 13	5.56	------	.97	1.13	1.32	1.70	------	------	------	------	4.57	
Apr. 19	4.75	------	------	1.03	1.27	------	------	------	------	------	3.99	
Apr. 22	4.17	------	------	1.17	1.31	1.52	------	------	------	------	4.75	
Means	------	------	(1.04)	1.14	1.31	1.64	------	------	------	------	------	
Departures	------	------	+.12	+.10	+.11	+.19	------	------	------	------	------	

*Extrapolated.

Polarization observations made at Madison on 3 days give a mean of 58.0 percent with a maximum of 62 percent on the 13th. These are slightly below the corresponding normals for the month. No readings were made at Washington because the polarimeter had become defective.

TABLE 1.—*Solar radiation intensities during April 1937*—Continued

LINCOLN, NEBR.

Date	Sun's zenith distance										
	8 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon	Local mean solar time
	75th mer. time	Air mass										
		A. M.				*1.0	P. M.					
	e	5.0	4.0	3.0	2.0		2.0	3.0	4.0	5.0	e	
Apr. 9	3.63	------	1.00	1.20	1.39	1.59	------	------	------	------	3.00	
Apr. 12	6.50	------	1.09	1.26	1.39	1.55	------	------	------	------	4.95	
Apr. 13	6.27	------	------	------	.54	------	------	------	------	------	4.57	
Apr. 14	5.56	------	------	------	------	------	------	0.09	0.07	0.05	6.27	
Apr. 19	4.56	0.81	.96	1.14	1.40	1.53	------	------	------	------	5.16	
Apr. 21	6.02	------	.89	1.00	1.24	1.48	1.26	1.02	.84	.69	5.56	
Apr. 22	7.57	------	------	.52	.90	------	1.06	------	------	------	5.94	
Apr. 30	6.27	------	.74	.80	1.10	1.52	------	------	------	------	7.29	
Means	------	(.81)	.94	.99	1.14	1.53	(1.16)	(1.56)	(.46)	(.37)	------	
Departures	------	+.10	+.11	+.02	−.05	+.08	.00	−.39	−.35	−.30	------	

BLUE HILL, MASS.

Apr. 1	1.8	------	------	1.15	1.37	1.42	1.15	1.00	0.77	------	1.8
Apr. 4	3.6	------	0.89	1.02	1.20	1.41	------	------	------	------	3.2
Apr. 7	4.2	------	------	------	------	1.40	1.03	.94	.84	0.75	3.7
Apr. 11	3.6	------	------	------	1.19	1.41	------	------	------	------	3.4
Apr. 12	3.8	------	------	------	1.27	1.42	------	------	------	------	3.8
Apr. 13	3.5	------	------	------	------	1.42	1.26	------	------	------	3.3
Apr. 14	5.8	------	------	------	1.03	1.32	------	------	------	------	4.6
Apr. 17	2.9	------	------	------	1.30	1.43	------	------	------	------	2.8
Apr. 19	5.8	------	------	------	1.04	1.29	1.14	1.01	.93	.86	4.8
Apr. 20	3.6	------	------	1.14	1.27	1.43	1.16	.94	.76	------	4.0
Apr. 24	3.3	------	------	1.05	1.29	1.48	1.28	1.20	1.05	.95	3.5
Apr. 25	2.6	.95	1.03	1.24	1.27	1.41	------	------	------	------	2.4
Apr. 26	3.0	------	------	1.15	1.29	1.46	1.16	1.00	------	------	2.3
Apr. 30	5.2	------	------	------	1.28	1.48	1.29	1.18	1.08	------	2.5
Means	------	(.95)	(.96)	1.12	1.23	1.41	1.19	1.04	.90	.85	------
Departures	------	+.07	+.01	+.02	+.04	+.01	+.07	+.03	−.03	.00	------

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

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	San Juan	Friday Harbor	Ithaca
	Gram-calories per square centimeter															
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Apr. 2	332	277	326	170	260	516	281	399	509	420	467	510	265	494	312	276
Apr. 9	341	470	565	392	327	601	336	431	437	435	543	525	342	538	317	257
Apr. 16	509	379	525	333	383	676	306	525	570	486	505	580	383	643	320	272
Apr. 23	385	252	193	292	428	629	431	439	623	452	408	590	410	648	395	317
	Departures from weekly normals															
Apr. 2	−37	−150	−83	−119	−64	+4	−43	−32	--------	−45	+94	+20	−93	--------	+31	+1
Apr. 9	−49	+52	+114	+52	+10	+22	−47	−43	--------	−41	+150	+21	−2	--------	+4	−4
Apr. 16	+80	−35	+74	−1	+18	+77	−79	+55	--------	+14	+86	+53	−38	--------	−79	−37
Apr. 23	−62	−197	−245	−60	+49	+49	+27	−65	--------	−26	+24	+74	−52	--------	−98	−37
	Accumulated departures on Apr. 29															
	−3,101	−1,267	−2,611	+7	+1,561	+1,715	−581	−1,260	--------	−2,702	−3,605	−511	−3,283	--------	+875	+833

TABLE 3.—*Total, I_m, and screened, I_y, I_r, solar radiation intensity measurements, obtained during April 1937, and determinations of the atmospheric turbidity factor, β, and water-vapor content, w=depth in millimeters, if precipitated*

AMERICAN UNIVERSITY, WASHINGTON, D. C.

Date and hour angle	Solar altitude	Air mass	I_m	I_y	I_r	$\beta_{I_{m-r}}$	$\beta_{I_{y-r}}$	β_{mean}	$\frac{I_{w-o}}{1.94}$ (Percentage of solar constant)	$\frac{I_{w-o}-I_m}{1.94}$ (Percentage of solar constant)	w	Air-mass type	Temperature	Wind
1937	° ′	*m*	*gr. cal.*	*gr. cal.*	*gr cal.*						*mm*			
Apr. 12:														
0:52 p. m.	57 39	1.18	1.435	1.034	0.822	0.069	0.032	0.050	82.3	8.1	4.8	N_{PC}	5° C.	N-10.
0:56 p. m.	57 19	1.19	1.452	1.032	.820	.054	.031	.042	84.0	8.9	6.2			
3:59 p. m.	28 51	2.07	1.182	.872	.705	.066	.060	.063	71.0	9.9	7.9			
4:02 p. m.	29 18	2.10	1.167	.870	.705	.068	.066	.067	70.5	10.1	8.1			
4:27 p. m.	23 31	2.50	1.096	.806	.672	.070	.086	.078	63.3	6.6	2.3			
4:31 p. m.	22 44	2.58	1.063	.804	.675	.079	.089	.084	61.4	6.4	2.1			
Apr. 14:														
4:24 a. m.	24 33	2.40	.671	.489	.392	.141	.159	.150	51.1	16.4	34.8	$N_P \rightarrow T_A$	10° C.	SW-8.
4:19 a. m.	25 30	2.32	.684	.486	.390	.138	.164	.151	51.8	16.2	35.2			
3:58 a. m.	29 30	2.02	.763	.550	.442	.146	.182	.164	53.8	14.3	34.0			
3:54 a. m.	30 18	1.98	.777	.552	.444	.142	.178	.160	54.1	13.9	31.8			
Apr. 17:														
4:11 a. m.	27 42	2.14	1.252	.933	.750	.046	.034	.040	73.9	8.8	4.3	P_C	7° C.	SE-6.
4:08 a. m.	28 16	2.10	1.247	.935	.752	.052	.037	.044	74.1	9.3	5.0			
3:00 a. m.	40 57	1.53	1.367	.982	.785	.046	.046	.046	79.2	8.2	4.0			
2:58 a. m.	41 19	1.51	1.367	.985	.787	.048	.046	.047	79.2	8.2	4.0			
Apr. 19:														
3:10 a. m.	39 39	1.57	1.230	.916	.738	.094	.074	.084	72.2	8.3	4.0	N_{PC}	6° C.	NW-10.
3:04 a. m.	40 42	1.53	1.252	.919	.740	.087	.077	.082	73.6	8.5	4.2			
2:42 a. m.	44 37	1.42	1.270	.938	.754	.095	.075	.085	74.2	8.2	4.0			
2:39 a. m.	45 08	1.41	1.281	.940	.757	.090	.076	.083	74.2	7.7	3.8			
2:08 a. m.	50 17	1.30	1.327	.980	.783	.090	.060	.075	77.3	8.4	4.8			
2:05 a. m.	50 47	1.29	1.335	.982	.785	.086	.062	.074	77.2	7.8	4.0			
1:01 a. m.	59 10	1.17	1.405	.994	.794	.066	.064	.065	81.4	8.4	5.1			
0:58 a. m.	59 26	1.16	1.368	.996	.797	.090	.066	.078	78.6	7.5	3.9			
1:11 p. m.	58 07	1.18	1.351	.968	.764	.078	.051	.064	80.4	10.1	10.4			
1:14 p. m.	57 48	1.18	1.353	.971	.766	.081	.053	.067	80.2	9.8	10.0			
2:09 p. m.	50 07	1.30	1.295	.973	.736	.078	.058	.068	78.6	11.2	17.0			
2:12 p. m.	49 39	1.31	1.309	.931	.736	.064	.060	.062	78.8	10.7	15.0			
Apr. 20:														
3:24 p. m.	37 07	1.65	1.053	.787	.658	.150	1.66	.158	60.0	5.2	1.7	N_{PC}	7° C.	NW-9.
3:30 p. m.	36 00	1.70	1.014	.783	.653	.170	1.50	.160	59.0	6.2	2.1			
Apr. 22:														
4:09 a. m.	29 10	2.05	1.119	.858	.686	.082	.056	069	69.6	11.4	14.0	N_P	3° C.	N-12.
4:06 a. m.	29 44	2.01	1.135	.860	.689	.082	.060	.071	69.2	10.2	8.0			
3:02 a. m.	41 46	1.50	1.183	.891	.707	.112	.068	.090	71.6	10.1	9.9			
2:58 a. m.	42 29	1.48	1.191	.893	.712	.112	.072	.092	72.0	10.1	9.9			
2:40 a. m.	46 01	1.39	1.230	.884	.731	.108	.150	.129	68.7	4.7	1.6			
2:33 a. m.	46 54	1.37	1.162	.886	.731	.170	.150	.160	65.0	4.6	1.6			
Apr. 23:														
5:03 a. m.	18 52	3.07	.799	.677	.564	.142	.088	.115	52.6	10.9	8.1	P_C	4 °C.	SE-8.
5:01 a. m.	19 17	3.00	.803	.682	.571	.136	.092	.114	52.0	9.1	5.0			
4:13 a. m.	28 36	2.08	.852	.674	.550	.186	.140	.163	53.5	9.6	6.4			
4:10 a. m.	29 05	2.06	.870	.766	.637	.154	.142	.148	55.7	10.4	8.6			
Apr. 30:														
4:48 a. m.	23 08	2.54	.994	.806	.651	.108	.058	.082	62.5	10.7	8.8	N_{PA}	5° C.	SE-7.
4:43 a. m.	24 05	2.44	1.052	.806	.651	.078	.068	.073	64.8	10.1	7.2			
1:03 a. m.	62 11	1.13	1.445	.996	.799	.046	.072	.059	81.8	6.6	3.0			
1:00 a. m.	62 31	1.12	1.400	.996	.799	.078	.074	.076	79.6	6.8	3.1			

BLUE HILL METEOROLOGICAL OBSERVATORY OF HARVARD UNIVERSITY

Date and angle hour (1937)	Solar altitude	Air mass	I_m	I_y	I_r	$\frac{I_y}{.889+C}$	$\frac{I_r}{.878+C}$	β mean	$\frac{I_{w-o}}{1.94}$ (Percentage of solar constant)	$\frac{I_{w-o}-I_m}{1.94}$ (Percentage of solar constant)	w	Air-mass type
Apr. 1	° ′	*m*	*gr. cal.*	*gr. cal.*	*gr. cal.*	*gr. cal.*	*gr. cal.*				*mm*	
4:19 a. m.	21 14	2.75	1.176	0.789	0.649	0.925	0.773	0.048	67.0	6.3	3.8	N_{LC}.
2:45 a. m.	41 23	1.52	1.292	.845	.681	.983	.803	.072	73.9	7.2	5.9	
0:18 p. m.	51 35	1.22	1.375	.885	.707	1.022	.834	.070	58.0	6.9	6.3	
2:35 p. m.	28 38	1.60	1.215	.805	.646	.945	.771	.063	70.0	7.2	5.6	
4:55 p. m.	14 57	3.80	.797	.578	.478	.678	.570	.071	55.3	17.2	8.9	
Apr. 4												
4:09 a. m.	24 34	2.39	.889	.618	.543	.724	.571	.062	67.0	22.2	14.5	N_{PC}.
Apr. 7												
4:32 a. m.	20 31	3.84	.964	.683	.562	.913	.668	.026	65.0	15.0	7.7	P_C.
Apr. 11												
8:30 a. m.	34 30	1.76	1.272	.852	.693	.995	.826	.076	71.8	6.2	4.7	P_C.
Apr. 12												
3:25 a. m.	32 00	1.88	1.283	.834	.677	.978	.805	.057	74.7	8.6	6.3	P_C.
0:22 a. m.	55 32	1.21	1.392	.886	.714	1.037	.849	.075	78.7	6.9	6.3	
Apr. 13												
0:09 p. m.	56 43	1.19	1.419	.897	.826	1.035	.860	.086	76.6	3.5	6.0	N_{PC}.
Apr. 14												
3:20 a. m.	35 53	1.70	1.059	.682	.560	.800	.667	.128	61.7	7.4	5.4	N_{PC}.
Apr. 17												
3:26 a. m.	34 45	1.75	1.335	.866	.672	1.014	.799	.037	78.9	10.1	7.7	P_C.
1:00 p. m.	55 55	1.20	1.453	.908	.714	1.064	.849	.046	82.9	8.0	7.1	
Apr. 19												
3:22 a. m.	35 33	1.72	1.106	.726	.596	.852	.709	.115	64.5	7.5	5.8	N_{PC}.

TABLE 3.—*Total, I_m, and screened, I_y, I_r, solar radiation intensity measurements, obtained during April 1937, and determinations of the atmospheric turbidity factor, β, and water-vapor content, w=depth in millimeters, if precipitated*—Continued

BLUE HILL METEOROLOGICAL OBSERVATORY OF HARVARD UNIVERSITY—Continued

Date and angle hour (1937)	Solar altitude	Air mass	I_m	I_y	I_r	$\frac{I_y}{.889+C}$	$\frac{I_r}{.878+C}$	β mean	$\frac{I_{w=0}}{1.94}$ (Percentage of solar constant)	$\frac{I_{w=0}-I_m}{1.94}$ (Percentage of solar constant)	w	Air-mass type
	° ′	m	gr. cal.	gr. cal.	gr. cal.	gr. cal.	gr. cal.				mm	
Apr. 20												
3:17 a. m.	37 20	1.65	1.309	0.830	0.644	0.930	0.766	0.064	73.8	6.3	4.9	N_{PC}.
1:36 a. m.	52 26	1.26	1.390	.874	.696	.985	.793	.055	77.9	6.8	6.1	
2:45 p. m.	42 51	1.47	1.341	.850	.672	.945	.759	.065	76.5	7.4	6.2	
Apr. 24												
3:38 a. m.	38 10	1.61	1.297	.858	.694	.965	.782	.065	75.0	8.1	6.4	P_A.
1:05 a. m.	58 00	1.18	1.432	.930	.740	1.046	.843	.060	81.4	7.6	6.9	
3:07 p. m.	39 50	1.56	1.381	.880	.720	.991	.807	.044	77.5	6.3	5.1	
Apr. 25												
4:46 a. m.	22 10	2.63	1.025	.706	.579	.794	.659	.070	69.0	2.7	1.7	P_A.
0:14 p. m.	60 35	1.14	1.385	.880	.716	.890	.815	.092	75.7	4.3	4.1	
Apr. 26												
3:52 a. m.	32 20	1.87	1.281	.854	.694	.961	.790	.076	59.0	7.0	5.2	P_A.
0:14 p. m.	60 46	1.14	1.436	.914	.722	1.028	.822	.043	83.0	9.0	8.6	
2:59 p. m.	41 34	1.50	1.326	.858	.678	.965	.772	.065	76.0	8.0	5.4	
Apr. 30												
4:26 a. m.	26 51	2.21	1.165	.790	.638	.889	.727	.054	69.6	9.4	6.4	P_A.
1:09 a. m.	58 25	1.18	1.420	.900	.714	1.001	.813	.059	81.0	7.8	7.2	
1:45 p. m.	54 08	1.24	1.397	.878	.702	.988	.800	.059	80.0	7.0	6.3	
4:39 p. m.	24 34	2.39	1.257	.706	.567	.794	.646	.062	68.1	3.3	2.2	
Mar. 1												
2:59 a. m.	20 44	2.22	1.302	.992	.685	.004	.012	.008	74.0	6.9	4.4	P_C.
1:44 a. m.	34 54	1.74	1.413	.921	.775	.022	.083	.052	76.0	4.4	3.1	
0:11 p. m.	40 41	1.53	1.417	.903	.734	.030	.085	.058	78.4	6.5	5.5	
2:16 p. m.	31 24	1.92	1.318	.851	.687	.095	.099	.097	70.8	4.3	2.9	
3:17 p. m.	23 05	2.54	1.121	.760	.624	.088	.056	.072	68.5	11.7	7.2	
Mar. 2												
3:32 a. m.	20 59	2.77	.925	.649	.543	.062	.125	.094	48.0	2.7	1.6	P_C.
0:48 a. m.	39 23	1.57	1.101	.734	.615	.058	.056	.057	79.0	13.3	10.5	
Mar. 3												
3:39 a. m.	20 10	2.88	1.200	.801	.655	.090	.054	.072	65.1	4.2	2.5	P_C.
1:07 a. m.	38 39	1.60	1.421	.913	.733	.020	.047	.034	77.2	5.2	3.9	
1:10 p. m.	36 21	1.69	1.445	.927	.744	.030	.069	.050	76.0	2.8	1.9	
2:57 p. m.	25 41	2.30	1.316	.881	.701	.013	.035	.024	79.8	12.6	5.5	
Mar. 7												
3:14 a. m.	25 16	2.33	1.413	.937	.769	.020	.008	.014	81.2	10.0	6.5	P_C.
1:48 a. m.	36 21	1.66	1.509	.938	.782	.023	.024	.024	81.3	4.7	3.5	
2:26 p. m.	23 23	2.51	1.401	.957	.758	.000	.013	.006	82.7	8.5	5.1	
Mar. 10												
3:03 a. m.	27 55	2.55	1.362	.915	.752	.005	.049	.027	76.0	6.5	3.1	P_C.
Mar. 11												
2:31 a. m.	28 40	2.08	1.072	.754	.612	.078	.108	.093	65.7	8.7	5.9	P_C.
Mar. 12												
2:26 p. m.	33 46	1.79	1.143	.637	.570	.078	----------	.078	65.7	12.7	9.9	P_C.
Mar. 18												
2:35 a. m.	41 37	1.50	1.139	.780	.606	.018	.058	.038	82.5	24.3	20.0	P_C+P_A.
Mar. 19												
3:37 a. m.	25 20	2.33	1.207	.774	.635	.023	.086	.054	70.0	11.1	7.3	P_C+P_A.
Mar. 20												
3:36 a. m.	25 39	2.23	1.151	.768	.629	.025	.099	.062	71.7	12.8	8.4	P_C+P_A.
Mar. 22												
3:20 a. m.	28 11	2.11	1.258	.850	.703	.034	.082	.058	70.0	5.5	3.6	P_C.
0:32 a. m.	47 42	1.36	1.445	.925	.742	.056	.046	.051	80.0	5.9	4.9	
2:32 p. m.	35 52	1.70	1.371	.889	.719	.142	.007	.074	71.8	1.1	.6	
4:34 p. m.	15 48	3.63	1.008	.715	.576	.035	.051	.043	61.2	9.6	4.9	
Mar. 23												
3:29 a. m.	27 58	2.12	1.235	.818	.681	.042	.062	.052	72.5	9.3	7.2	P_C.
Mar. 24												
4:52 a. m.	22 42	2.58	1.275	.808	.665	.040	.073	.056	67.5	7.3	5.5	P_C.
3:08 a. m.	31 25	1.95	1.282	.842	.691	.068	.101	.084	67.0	1.9	1.2	
0:42 a. m.	48 07	1.34	1.398	.873	.715	.030	.091	.060	79.6	8.2	6.9	
Mar. 26												
3:21 a. m.	25 51	2.29	1.147	.746	.611	.042	.098	.050	72.0	11.8	7.7	P_C.
0:50 a. m.	48 27	1.33	1.393	.875	.716	.082	.029	.056	80.0	8.6	7.3	
Mar. 27												
3:30 a. m.	28 54	2.06	1.290	.854	.699	.055	.075	.065	70.4	3.9	2.2	P_C.
Mar. 28												
3:18 p. m.	31 02	1.94	1.314	.856	.689	.018	.056	.037	79.8	12.2	8.8	P_C.
4:44 p. m.	16 45	3.45	1.143	.778	.835	.013	.054	.034	71.1	12.4	6.6	
Mar. 29												
3:26 a. m.	30 00	2.00	1.286	.844	.675	.021	.057	.039	76.5	10.3	7.1	P_C.
1:31 a. m.	46 11	1.39	1.413	.899	.715	.056	.100	.078	84.0	11.3	9.4	
1:54 p. m.	43 36	1.45	1.417	.893	.703	.020	.030	.025	84.5	11.5	9.4	
4:55 p. m.	14 17	3.94	.992	.699	.562	.024	.038	.031	66.0	8.6	4.2	
Mar. 30												
3:28 a. m.	30 03	2.00	1.330	.875	.715	.048	.024	.036	72.0	3.5	2.8	P_C.
0:41 a. m.	50 30	1.29	1.461	.933	.746	.023	.074	.048	82.4	7.1	6.1	
2:22 p. m.	39 59	1.55	1.413	.913	.725	.050	.012	.031	71.9	5.7	4.4	
5:02 p. m.	13 16	4.28	.961	.685	.560	.046	.026	.036	62.5	7.2	3.4	
Mar. 31												
0:23 a. m.	52 34	1.26	1.358	.873	.696	.044	.092	.068	79.0	9.1	7.9	P_C.
2:29 p. m.	40 13	1.55	1.286	.828	.655	.069	.098	.084	72.0	5.8	4.3	
3:32 p. m.	29 53	2.00	1.112	.754	.603	.062	.098	.080	67.7	10.4	7.2	

Meteorological conditions during solar observations, Blue Hill, Mass.

Date	Time from local noon	Temperature ° C.	Wind Beaufort	Visibility	Blue sky	Cloudiness and remarks
Apr. 1	4.20 a.m.	0.3	WNW 3	7	7	Few Ci; moderate haze.
1	2.17 a.m.	3.3	NNW 3	9	8	Few Ci; light haze.
1	0.16 p.m.	7.3	NW 3	9	8	Few Ci; few Cu.
1	2.34 p.m.	8.6	W 3	9	8	2 Cu; light haze.
1	4.52 p.m.	8.8	NW 3	9	8	Trace Ci; trace Cu; light haze.
4	4.17 a.m.	1.7	NW 2	6	7	3 Ci; few Acu; few Cu; moderate, dense haze.
7	4.34 p.m.	9.4	NW 3	8	7	2 Ci; light haze.
11	3.18 a.m.	1.8	NW 3	9	7	1 Acu; few Stcu; light haze to north.
11*	3.08 a.m.	3.1	NW 3	9	7	1 Acu; 1 Cu; stcu, light haze to north, instrument indoors.
12	3.27 a.m.	4.5	NW 3	8	8	1 Acu; few Cu; moderate haze to north.
12	0.24 a.m.	7.8	NNW 3	8	8	5 Cu; light haze to north, west, and south.
12	2.35 p.m.	7.9	NE 2	9	8	9 stcu; light haze to north.
13	0.06 p.m.	13.3	WSW 3	9	8	2 Ci; light haze.
14	3.23 a.m.	10.1	S 3	7	8	2 Ci; moderate haze.
17	3.33 a.m.	4.0	NNE 4	9	7	Zero clouds, light haze.
17*	1.22 a.m.	4.7	NNE 5	9	7	Do.
17	1.03 a.m.	4.3	NNE 5	9	7	1 Ci; trace Acu; light haze.
19	3.27 a.m.	10.0	NW 5	7	7	Zero clouds, moderate water haze.
19	0.16 a.m.	13.1	NW 3	8	7	4 Cu; moderate water haze.
19	1.57 p.m.	15.8	NW 2	8	7	1 Cu; moderate haze.
20	3.15 a.m.	9.6	NW 5	9	7	Trace Cu; light haze.
20	1.34 a.m.	11.6	WNW 5	9+	7	1 Cu.
20	2.31 p.m.	14.0	W 6	9+	7	2 Cu.
24	3.41 a.m.	2.9	NNE 5	8	8	Zero clouds moderate haze to north and west.
24*	1.48 a.m.	3.9	NNE 4	8	8	Trace Cu; light haze.
24	1.07 a.m.	3.4	NNE 4	9	8	Trace Cu.
24	3.05 p.m.	4.8	NNE 4	9	8	
25	4.58 a.m.	2.8	NW 3	8	8	1 Ci.
25	0.02 a.m.	9.6	NNE 3	9	8	3 Ci.
26	3.56 a.m.	8.5	E 3	8	8	Trace Ci; moderate haze to north and west.
26	0.08 p.m.	9.6	NE 4	9	8	1 Ci; moderate haze to north and west.
26	2.55 p.m.	7.7	NE 5	9	8	2 Ci; light haze.
30	4.28 a.m.	5.9	NNE 5	8	8	Zero clouds, light haze.
30	1.11 a.m.	8.3	NNE 3	9	7	Light haze.
30	1.43 p.m.	9.5	NNE 4	9	7	Do.
30	4.37 p.m.	10.6	NE 3	10	7	Light haze to north.

POSITIONS AND AREAS OF SUN SPOTS

NOTE.—The data for April 1937 will be published in the next issue of the Review.—Editor.

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR APRIL 1937

[Dependent alone on observations at Zurich and its station at Arosa]

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

April 1937	Relative numbers	April 1937	Relative numbers	April 1937	Relative numbers
1	*Mc* 140	11	*Ec* 82	21	*a* 127
2	128	12	62	22	*Mbbc* —
3	*d* 112	13	38	23	*b* 144
4	*Ec* 139	14	—	24	*Mbc* 157
5	*Ec* 149	15	*Eacd* —	25	*MEaac* 190
6	114	16	64	26	157
7	*Mc* 121	17	*a* 63	27	161
8	96	18	*Ec* 76	28	149
9	*ab* 86	19	*Ec* 94	29	*bd* 123
10	71	20	*Ec* 127	30	*b* 94

Mean, 27 days=113.5.

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 group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in charge]

By L. P. HARRISON

Mean free-air data based on airplane weather observations during the month of April 1937 are given in tables 1 to 3. A description of the methods by which the various monthly means and normals herein are computed may be found in this section of the MONTHLY WEATHER REVIEW of January and March 1937.

It will be noted that many of the "normals" are based on only 3 years of observations. Conclusions based on departures from such short-period "normals" must be used with caution.

The mean surface and free-air temperatures for April (see chart I and table 1) were practically normal over the entire country. Departures from normal were generally within the limits ±1° C. At a few isolated stations, however, limits of ±2° C. were reached.

The mean free-air relative humidities and specific humidities are given in table 2. Generally speaking, with the exclusion of the surface layer, several hundred meters in height, the mean relative humidities were slightly below normal in the southern half of the country (south of lat. 40°), except along the Pacific coast where they were mostly in excess of normal, and slightly above normal in the northern half of the country, except near Billings, where the opposite condition prevailed. The most pronounced negative departures from normal occurred over the vicinity of Pensacola, Fla., from 2.5 to 5 km above sea level, where they were −14 to −18 percent. By comparison of the data for El Paso, Tex., with those for surrounding stations, it may be inferred that similar departures occurred at that place, at least in the lower few kilometer above the surface. Elsewhere the negative departures were generally confined to the limits of −2 to −6 percent, but with values from −7 to −9 percent over Maxwell Field (Montgomery), Ala., through the stratum 1.5 to 3 km. The most pronounced positive departures from normal occurred over the vicinity of Spokane, Wash., from 3 to 5 km above sea level, with values from +9 to +14 percent. Departures from +9 to +12 percent occurred over Omaha, Nebr., up to 1.5 km above sea level, while similar departures occurred over Lakehurst, N. J., from 4 to 5 km. Elsewhere, the departures were largely within the limits +2 to +7 percent.

Table 3 shows the monthly mean free-air barometric pressures and equivalent potential temperatures. The lowest mean barometric pressures in the free-air up to 5 km prevailed over the north-central part of the country with minima in the vicinity of Sault Ste. Marie, Mich., and Fargo, N. Dak., at moderate and high elevations, and at Omaha, Nebr., up to about 1.5 km above sea level. A trough of low mean pressure thus apparently occurred over the northern and central portions of the Western Plains States with greatest intensity in the lower strata while similar troughs of appreciably less intensity occurred over the Ohio River Basin just west of the Appalachians and over the extreme northeastern part of the country. The