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SOLAR OBSERVATIONS

SOLAR RADIATION OBSERVATIONS DURING AUGUST 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 below normal for August at Washington and Madison, and close to normal at Lincoln.

Table 2 shows an excess in the amount of total solar and sky radiation received on a horizontal surface at all stations with the exception of Washington, Miami, New Orleans, Blue Hill and Friday Harbor—all enumerated stations being comparatively close to the Coasts.

TABLE 1.—*Solar radiation intensities during August 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
	75th mer. time	Air mass									Local mean solar time
		A. M.				[1] 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.*
Aug. 2	16.79	------	0.36	0.42	0.62	------	------	------	------	------	13.13
Aug. 3	15.65	------	------	.83	.97	1.26	------	------	------	------	14.10
Aug. 4	16.20	0.42	.51	.59	.86	------	------	------	------	------	14.10
Aug. 5	18.59	------	------	------	.76	------	------	------	------	------	17.37
Aug. 16	14.60	------	.76	.91	1.12	------	------	------	------	------	11.81
Aug. 17	14.10	------	------	.71	.95	------	------	------	------	------	14.60
Aug. 19	19.89	------	.42	.60	.86	------	------	------	------	------	19.89
Aug. 20	18.59	------	------	.56	.78	1.23	------	------	------	------	19.89
Aug. 21	19.89	------	------	------	.87	------	------	------	------	------	20.57
Means	------	(.42)	.51	.66	.87	1.24	------	------	------	------	------
Departures	------	−.21	−.17	−.10	−.07	−.01	------	------	------	------	------

[1]Extrapolated.

Polarization measurements made at Madison on 9 days give a mean of 52 percent with a maximum of 62 percent on the 4th. Both of these values are slightly below the corresponding August normals.

TABLE 1.—*Solar radiation intensities during August 1937*—Contd.

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

MADISON, WIS.

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
	75th mer. time	Air mass									Local mean solar time
		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.*
Aug. 4	14.60	------	------	1.04	1.22	1.42	------	------	------	------	17.96
Aug. 5	10.21	------	------	.97	1.13	1.36	------	------	------	------	9.47
Aug. 6	13.13	------	------	------	------	1.34	------	------	------	------	10.97
Aug. 7	14.10	------	.68	.80	1.08	------	------	------	------	------	13.13
Aug. 9	16.79	------	------	------	.98	1.32	------	------	------	------	17.37
Aug. 12	10.21	------	------	------	------	------	1.08	------	------	------	15.65
Aug. 13	11.38	------	------	.96	1.12	1.28	------	------	------	------	12.24
Aug. 14	11.81	------	------	.82	1.00	1.30	------	------	------	------	12.24
Aug. 23	11.38	------	------	.67	------	1.30	------	------	------	------	10.97
Aug. 24	12.68	------	------	------	------	1.34	------	------	------	------	13.13
Aug. 25	13.13	------	------	.70	.85	------	------	------	------	------	13.13
Aug. 27	16.20	------	.67	.86	------	------	------	------	------	------	15.65
Aug. 30	15.11	------	.56	.65	.88	------	------	------	------	------	14.10
Means	------	------	.64	.83	1.03	1.33	(1.08)	------	------	------	------
Departures	------	------	−.16	−.10	−.06	+0.01	+0.03	------	------	------	------

LINCOLN, NEBR.

Aug. 4	18.59	.64	.73	.86	1.10	1.38	------	------	------	------	16.20
Aug. 5	16.79	.65	.76	.93	1.10	------	------	------	------	------	11.81
Aug. 6	12.68	.60	.69	.86	1.06	1.40	------	------	------	------	13.13
Aug. 9	19.89	.58	.72	.86	1.08	1.37	------	------	------	------	19.23
Aug. 12	11.81	.80	.87	.95	1.24	1.47	------	------	------	------	9.83
Aug. 14	11.81	.72	.84	1.00	1.19	1.40	------	------	------	------	14.10
Aug. 16	15.65	.68	.80	.95	1.16	1.38	------	------	------	------	13.13
Aug. 20	16.79	------	------	------	------	------	1.17	0.99	0.79	0.68	13.61
Aug. 21	11.38	.84	.93	1.07	1.27	1.46	------	------	------	------	10.59
Aug. 27	15.65	------	.76	.91	1.16	1.43	------	------	------	------	15.11
Aug. 28	15.65	.63	.76	.89	1.12	1.35	------	------	------	------	12.24
Aug. 31	12.68	------	.72	.88	1.15	1.34	------	------	------	------	11.38
Means	------	.68	.78	.93	1.15	1.40	(1.17)	(0.99)	(0.79)	(0.68)	------
Departures	------	.00	.00	+.02	+.06	+.08	+0.10	+0.10	+0.04	+0.03	------

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	Newport
	Gram-calories per square centimeter																
1937	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 30	504	557	592	526	516	706	337	599	544	460	448	562	474	500	613	512	525
Aug. 6	402	489	597	423	329	690	291	571	480	448	412	578	441	594	384	286	459
Aug. 13	522	503	565	508	464	650	269	556	416	440	343	540	511	551	574	490	479
Aug. 20	215	479	571	453	217	652	259	547	486	411	296	528	511	546	385	270	265
Aug. 27	398	489	550	426	332	640	219	465	543	422	376	482	409	575	486	290	375
	Departures from weekly normals																
July 30	+30	+88	+73	+138	+86	+62	+2	+53	--------	−19	−25	+25	−24	--------	+71	+60	--------
Aug. 6	−37	+31	+95	+30	−43	+71	−22	+24	--------	−60	−41	+33	−61	--------	−149	−140	--------
Aug. 13	+83	+60	+71	+111	+94	+49	−17	+66	--------	−22	−59	−6	+4	--------	+37	+56	--------
Aug. 20	−194	+37	+83	+50	−103	+58	−35	+18	--------	−71	−107	+10	+17	--------	−108	−136	--------
Aug. 27	−19	+83	+102	+69	−17	+62	−64	−24	--------	−54	−58	−8	−28	--------	+36	−67	--------
	Accumulated departures on Sept. 2																
	−2,520	+5,943	+3,682	+3,814	+4,943	+5,887	+637	+1,050	--------	−7,826	+4,641	−3,388	−1,330	--------	−651	−4431	--------

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory. Data furnished by the U. S. Naval Observatory in cooperation with Harvard and Mount Wilson Observatories. The difference in longitude is measured from the central meridian positive west. The north latitude is positive. Areas are corrected for foreshortening and are expressed in millionths of the sun's visible hemisphere. The total area for each day includes spots and groups]

Date	Eastern standard time	Mount Wilson group number	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day	Observatory
1937	*h. m.*		°	°	°				
Aug. 1	11 18	5492	−75.0	229.2	−19.0	97	--------	--------	U. S. Naval.
		5491	−71.0	233.2	−30.0	--------	242	--------	
		5489	−53.0	251.2	+24.0	--------	1018	--------	
		5488	−52.0	252.2	+31.0	--------	242	--------	
		5486	−29.0	275.2	−13.0	--------	97	--------	
		5487	−26.0	278.2	+14.0	--------	24	--------	
		5490	−26.0	278.2	+17.0	--------	24	--------	
		5484	−11.0	293.2	+9.0	24	--------	--------	
		5483	−11.0	293.2	−11.0	--------	291	--------	
		5481	−9.0	295.2	+30.0	170	--------	--------	
		5485	+1.0	305.2	−21.0	--------	73	--------	
		5477	+41.0	345.2	+33.0	--------	1212	--------	
		5477	+60.0	4.2	+29.5	--------	1309	4,823	
Aug. 2	11 11	5492	−61.0	230.1	−19.0	97	--------	--------	Do.
		5491	−59.0	232.1	−30.0	--------	194	--------	
		5489	−41.0	250.1	+24.0	--------	873	--------	
		5488	−40.5	250.6	+31.0	--------	267	--------	
		5486	−16.0	275.1	−12.0	--------	73	--------	
		5490	−14.0	277.1	+18.0	--------	97	--------	
		5484	+1.0	292.1	+9.0	24	--------	--------	
		5483	+2.0	293.1	−11.0	--------	194	--------	
		5481	+5.0	296.1	+30.0	145	--------	--------	
		5485	+14.0	305.1	−21.5	--------	97	--------	
		5477	+54.5	345.6	+33.0	--------	1115	--------	
		5477	+74.0	5.1	+29.5	--------	1212	4,388	
Aug. 3	11 10	5492	−49.0	228.8	−19.0	73	--------	--------	Do.
		5491	−47.0	230.8	−30.0	--------	97	--------	
		5489	−28.0	249.8	+23.0	--------	873	--------	
		5488	−27.5	250.3	+31.0	--------	267	--------	
		5486	−2.0	275.8	−12.0	--------	73	--------	
		5490	−2.0	275.8	+19.0	--------	97	--------	
		5487	−1.0	276.8	+12.5	--------	48	--------	
		5484	+15.0	292.8	+9.0	24	--------	--------	
		5483	+15.0	292.8	−11.0	--------	194	--------	
		5481	+18.5	296.3	+30.0	145	--------	--------	
		5485	+30.0	307.8	−20.0	16	--------	--------	
		5477	+67.0	344.8	+33.0	--------	921	--------	
		5493	+70.0	347.8	+15.0	--------	97	--------	
		5477	+83.0	0.8	+30.0	873	--------	3,798	
Aug. 4	10 40	5499	−74.0	190.9	−9.0	24	--------	--------	Do.
		5497	−73.0	191.9	−11.0	436	--------	--------	
		5492	−36.0	228.9	−19.0	73	--------	--------	
		5491	−35.0	229.9	−30.0	--------	73	--------	
		5489	−15.0	249.9	+23.0	--------	727	--------	
		5488	−14.0	250.9	+30.0	--------	242	--------	
		5495	−3.5	261.4	−14.0	16	--------	--------	
		5486	+11.0	275.9	−12.0	--------	97	--------	
		5487	+11.0	275.9	+12.5	--------	48	--------	
		5490	+12.0	276.9	+18.0	--------	48	--------	
		5483	+28.0	292.9	−11.0	--------	194	--------	
		5484	+28.5	293.4	+9.0	16	--------	--------	
		5481	+30.0	294.9	+30.0	--------	73	--------	
		5485	+42.0	306.9	−20.0	16	--------	--------	
		5493	+80.0	344.9	+17.0	97	--------	--------	
		5477	+80.0	344.9	+33.0	--------	776	2,956	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group number	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day	Observatory
1937	*h. m.*		°	°	°				
Aug. 5	11 14	5499	−60.0	191.4	−9.0	24	--------	--------	U. S. Naval.
		5497	−59.0	192.4	−11.0	436	--------	--------	
		5492	−22.0	229.4	−19.0	--------	73	--------	
		5491	−19.0	232.4	−29.0	--------	73	--------	
		5489	−2.0	249.4	+23.0	--------	582	--------	
		5488	−1.0	250.4	+30.0	--------	242	--------	
		5495	+11.0	262.4	−14.0	--------	73	--------	
		5486	+24.0	275.4	−13.0	--------	48	--------	
		5487	+25.0	276.4	+13.0	--------	97	--------	
		5484	+41.0	292.4	+9.0	24	--------	--------	
		5483	+43.0	294.4	−11.0	--------	121	--------	
		5481	+44.0	295.4	+29.5	12	--------	--------	
		5485	+56.0	307.4	−20.0	24	--------	1,829	
Aug. 6	10 46	5497	−46.0	192.4	−11.5	436	--------	--------	Do.
		5499	−45.0	193.4	−9.0	--------	24	--------	
		5492	−9.5	228.9	−19.5	48	--------	--------	
		5491	−5.0	233.4	−28.0	--------	48	--------	
		5489	+10.0	248.4	+24.0	--------	485	--------	
		5488	+11.5	249.9	+30.0	242	--------	--------	
		5495	+24.0	262.4	−14.0	--------	194	--------	
		5486	+37.0	275.4	−13.0	--------	24	--------	
		5487	+39.0	277.4	+12.0	--------	48	--------	
		5483	+58.0	296.4	−11.0	--------	97	1,646	
Aug. 7	10 51	5500	−59.0	166.1	−13.0	--------	24	--------	Do.
		5497	−32.0	193.1	−11.0	436	--------	--------	
		5499	−30.0	195.1	−9.5	--------	48	--------	
		5492	+3.5	228.6	−19.5	48	--------	--------	
		5491	+12.0	237.1	−28.0	--------	24	--------	
		5489	+21.0	246.1	+24.0	--------	485	--------	
		5488	+24.0	249.1	+31.0	242	--------	--------	
		5495	+38.0	263.1	−14.0	--------	291	--------	
		5486	+52.0	277.1	−12.0	12	--------	--------	
		5483	+71.0	296.1	−12.0	97	--------	1,707	
Aug. 8	8 43	5505	−83.0	130.1	+14.0	24	--------	--------	Mt. Wilson.
		5506	−78.0	135.1	+20.0	--------	97	--------	
		5507	−77.5	135.6	−22.0	--------	194	--------	
		5504	−65.0	148.1	+19.5	--------	24	--------	
		5503	−48.0	165.1	−23.0	--------	48	--------	
		5502	−26.0	187.1	−19.0	--------	73	--------	
		5497	−20.5	192.6	−11.0	--------	436	--------	
		5499	−18.0	195.1	−9.0	--------	121	--------	
		5501	−10.5	202.6	−20.5	--------	12	--------	
		5492	+16.0	229.1	−20.0	--------	36	--------	
		5491	+24.0	237.1	−28.0	--------	24	--------	
		5489	+34.0	247.1	+24.0	--------	194	--------	
		5488	+37.0	250.1	+31.0	242	--------	--------	
		5495	+50.5	263.6	−14.0	--------	388	--------	
		5483	+83.0	296.1	−13.0	97	--------	2,010	
Aug. 9	10 56	5505	−69.0	129.6	+13.0	--------	48	--------	U. S. Naval.
		5507	−67.0	131.6	−23.0	--------	582	--------	
		5506	−64.0	134.6	+18.5	--------	48	--------	
		5504	−48.5	150.1	+18.5	--------	24	--------	
		5503	−33.0	165.6	−25.0	--------	48	--------	
		5502	−9.0	189.6	−20.0	--------	24	--------	
		5497	−6.0	192.6	−13.0	--------	388	--------	
		5499	−2.0	196.6	−10.0	--------	97	--------	
		5501	+6.0	204.6	−21.0	--------	48	--------	
		5492	+30.0	228.6	−20.0	12	--------	--------	
		5509	+35.0	233.6	−35.0	--------	24	--------	
		5491	+39.0	237.6	−28.0	--------	48	--------	
		5489	+49.0	247.6	+22.0	--------	121	--------	
		5488	+50.0	248.6	+30.0	242	--------	--------	
		5508	+65.0	263.6	+14.0	16	--------	--------	
		5495	+65.0	263.6	−13.0	--------	388	2,158	