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SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

SOLAR RADIATION OBSERVATIONS, JUNE 1939

By IRVING F. HAND

Measurements of solar radiant energy received at the surface of the earth are made at eight stations maintained by the Weather Bureau, and at nine cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory of Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, 65: 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses.) At Lincoln the observations are made with the Marvin pyrheliometer; at Washington, Madison, and Blue Hill they are obtained with a recording thermopile, checked by a Marvin pyrheliometer at Washington and with a Smithsonian pyrheliometer at Blue Hill. The table also gives vapor pressures at 8 a. m. (seventy-fifth meridian time) and at noon (local mean solar time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Direct radiation averaged close to normal for June at Madison, Lincoln, and Blue Hill, and above normal at Washington.

Total solar and sky radiation was above normal at all stations with the exception of New Orleans and Friday Harbor.

Polarization observations made at Madison on 5 days give a mean of 60 percent with a maximum of 65 percent on the 3d. Both of these values are close to the corresponding June normals.

TABLE 1.—*Solar radiation intensities during June, 1939*

[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.					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.*
June 5	10.59	0.69	0.81	0.93	1.11	1.33					7.87
June 6	13.13	.64	.75	.87	1.01	1.31					11.81
June 9	16.79				0.88						16.20
June 12	12.68				.86						12.68
June 15	16.79	.72	.80	.86	.91						13.61
June 16	19.23			.80	.94						17.96
June 21	11.81				1.10						11.81
Means		**.75**	**.79**	**.86**	**.97**	**(1.32)**					
Departures		**+.12**	**+.11**	**+.07**	**+.02**						

MADISON, WIS.

June 3	9.47		1.00	1.19	1.24						8.81
June 5	9.83		0.93	1.06	1.20	1.42					12.24
June 6	14.10		.77	0.96	1.11	1.39					15.65
June 7	17.37		.59	.68	1.18	1.44					19.89
June 13	7.29		.89	1.08	1.18						7.87
June 20	15.65		.86	1.01	1.20						13.61
June 24	13.13	0.69	.76	.92	1.13						11.81
June 30	11.81	.64	.75	.88	1.07						10.59
Means		**(.66)**	**.82**	**.97**	**1.16**	**1.42**					
Departures		**−.08**	**−.03**	**0**	**+.10**	**+.09**					

LINCOLN, NEBR.

June 1	13.61				1.01						13.61
June 3	7.87		1.00	1.13	1.30		1.24				8.81
June 5	12.68			1.05	1.24	1.47					15.11
June 6	15.65						0.95	0.75	0.60		16.79

TABLE 1.—*Solar radiation intensities during June, 1939*—Continued

LINCOLN NEBR.—Continued

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.					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.*
June 7	16.79							.88	.76		20.57
June 9	13.11						1.17				14.10
June 13	10.21						1.20	.91			10.21
June 16	14.10			0.58	0.87						7.87
June 17	15.11		0.78	.94	1.12	1.40					15.65
June 18	13.61						.86	.67	.57		17.37
June 23	10.97			1.15	1.39						10.21
June 29	14.60			1.03							10.59
June 30	11.81			1.09	1.26	1.48					9.47
Means			**(.89)**	**1.00**	**1.17**	**1.45**	**1.08**	**.80**	**.64**		
Departures			**+.10**	**+.06**	**+.06**	**+.09**	**−.02**	**−.11**	**−.14**		

BLUE HILL, MASS.

June 2	7.9					1.33	1.02	0.82	0.70		8.2
June 3	7.1					1.39	1.11	.99	.86		7.4
June 4	8.6							.86	.61		11.1
June 6	8.2					1.38			.93		5.4
June 11	15.8						0.98	.82			18.2
June 13	9.6				0.87	1.11					11.9
June 15	9.9				1.10	1.29	1.12	.93			8.8
June 18	8.8			1.01	1.16	1.39					7.1
June 19	8.6					1.37					6.5
June 22	7.9			1.02	1.17	1.35	1.04	.90			9.2
June 24	10.3						.98				11.5
June 28	12.8							.48			13.7
Means				**(1.02)**	**1.08**	**1.33**	**1.04**	**.83**	**.78**		
Departures				**+.01**	**+.01**	**+.04**	**−.11**	**−.14**	**−.03**		

* Extrapolated.

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

[Gram-calories per square centimeter]

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
1939	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
June 4	692	518	586	532	510	740	414	645	679	536	403	627	561	578	525		577
June 11	647	584	571	503	565	736	576	601	629	442	457	643	589	672	510		568
June 18	544	529	632	495	478	723	478	700	524	532	474	590	639	653	485		626
June 25	539	571	592	485	444	721	511	638	600	410	374	607	430	721	618		521
DEPARTURES FROM WEEKLY NORMALS																	
June 4	+184	+3	+32	+78	+70	+66	−61	+57	+101	+29	−66	+71	+34	−6	−97		+1
June 11	+143	+74	+21	+50	+115	+30	+72	−17	+43	−38	−30	+41	+67	+112	−8		+42
June 18	+50	−2	+47	+22	+42	−1	−37	+24	−41	+79	+4	−12	+88	+101	−97		+112
June 25	+17	+38	−8	+40	+6	+2	+44	+2	+36	−69	−66	+12	−63	+166	+36		+14
ACCUMULATED DEPARTURES ON JULY 1																	
	+8,673	+5,460	−3,255	+8,518	+3,206	−98	−469	+343	+3,311	+903	+3,703	−1,057	+42	+4,800	+3,745		−364