SOLAR RADIATION AND SUNSPOT DATA FOR FEBRUARY 1941

SOLAR RADIATION OBSERVATIONS

By HELEN CULLINANE

Measurements of solar radiant energy received at the surface of the earth are made at 9 stations maintained by the Weather Bureau and at 10 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 two Weather Bureau stations (Madison, Wis.; Lincoln, Nebr.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau station at Madison and at Blue Hill Observatory.

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, pp. 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 Madison and Blue Hill they are obtained with a recording thermopile, checked by observations with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian 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.

Recalibration work is at present being conducted at all the stations measuring total solar and sky radiation, and from time to time there will appear in the MONTHLY WEATHER REVIEW information regarding any changes made necessary in the normals for the different stations. Recalibration has already been completed at the Massa-

chusetts Institute of Technology, Cambridge, Mass., and corrected figures for that station for January will be found below under "Late Data."

Total solar and sky radiation was considerably deficient at Lincoln, Fresno, Twin Falls, La Jolla, and Riverside, and somewhat above normal at Washington, Madison, Chicago, New York, and Friday Harbor.

Normal incidence measurements at Blue Hill Observatory showed a considerable excess in radiation during both January and February.

TABLE 1.—Solar radiation intensities during January 1941

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

Blue Hill Observatory												
Date	Sun's zenith distance											
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.	
	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	
Jan. 1	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.	
Jan. 6	3.0						1.35	1.24	1.13	1.03	3.2	
Jan. 7	2.1						1.30	1.19	1.10	1.10	2.0	
Jan. 8	1.0						1.43	1.30	1.18	1.08	1.3	
Jan. 13	0.9	1.15	1.23	1.32			1.46	1.30	1.17	1.10	1.4	
Jan. 14	1.8	0.98	1.02	1.18				1.26	1.15	1.07	2.1	
Jan. 20	0.6	1.06	1.19	1.30			1.45	1.31	1.19	1.08	0.7	
Jan. 21	1.0	0.75	0.87	0.96	1.37			1.00	0.88	0.79	1.4	
Jan. 31	0.8		1.22	1.32	1.45			1.30	1.18	1.10	1.0	
Jan. 31	1.9							1.20	1.04	0.94	2.1	
Means		0.98	1.11	1.22	1.41		1.42	1.25	1.12	1.03		
Departures		+ .02	+ .07	+ .07	+ .10		+ .10	+ .08	+ .08	+ .09		

Solar radiation intensities during February 1941

Feb. 1	1.5	1.05	1.15	1.25	1.37				1.29	1.16	1.04	0.92	2.1
Feb. 4	2.2								1.38	1.23	1.11	.99	2.3
Feb. 5	1.6	1.10	1.19	1.32	1.44				1.30	1.18	1.06	.95	1.8
Feb. 6	2.0	1.06	1.14	1.25					1.45	1.29	1.16	1.04	2.4
Feb. 8	4.0											.62	2.1
Feb. 10	0.8	1.08	1.18	1.30	1.41				1.38	1.21	1.07	.97	1.0
Feb. 11	2.1	0.93	1.05	1.13	1.38				1.19	1.00	0.88	.69	1.9
Feb. 16	1.2	1.07	1.18	1.30	1.46				1.45	1.29	1.16	1.04	1.4
Feb. 19	1.6	0.74	0.88	1.03									1.6
Feb. 20	1.5	0.86			1.30								2.0
Feb. 23	2.5	.92	1.03	1.13	1.29				1.30	1.18	1.06	.95	2.6
Feb. 24	1.4	1.04	1.13	1.24	1.40				1.39	1.27	1.14	1.05	1.5
Feb. 26	1.1	0.95	1.07	1.20	1.36				1.34	1.15	1.00	0.91	1.3
Feb. 27	1.1	.93	1.04						1.38	1.13	0.98	.88	1.4
Means	0.98	1.09	1.22	1.38					1.34	1.18	1.05	0.90	
Departures	+0.04	+0.03	+0.12	+0.08					+0.06	+0.03	+0.02	-.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	Cambridge	Fairbanks	Twin Falls	La Jolla	Newport	New Orleans	Riverside	Blue Hill	Albuquerque	Friday Harbor
Jan. 29	cal. 204	cal. 247	cal. 183	cal. 125	cal. 195	cal. 152	cal. 182	cal. 27	cal. 249	cal. 334	cal. 203	cal. 241	cal. 317	cal. 188	cal. 285	cal. 105
Feb. 5	275	224	276	138	221	166	246	72	140	200	278	263	221	274	361	121
Feb. 12	241	208	221	146	194	242	188	69	218	233	216	383	223	199	361	279
Feb. 19	371	351	218	273	332	252	296	110	254	304	311	222	253	300	308	196

DEPARTURES FROM WEEKLY NORMALS

Jan. 29	+2	+60	-37	+8	+38	-33	-9	-16	+55	+63	-9	+10	+78	-27	-11	0
Feb. 5	+6	+21	+16	+2	+57	-90	+30	+9	-56	-14	+34	+35	-58	+40	+19	+9
Feb. 12	+15	-16	-45	-1	+16	-44	-42	-12	-38	-58	-39	+28	-80	-34	+12	+124
Feb. 19	+112	+96	-64	+91	+125	0	+28	+6	0	-51	+26	-55	-82	+34	-34	+36

ACCUMULATED DEPARTURES ON FEBRUARY 25, 1941

+1,148	+364	-2,085	+392	+2,310	-1,659	+91	+112	-70	-1,239	+98	+1,232	-2,896	-455	-70	+1,844
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LATE DATA AND CORRECTIONS TO TABLE 2

	Fairbanks		Cambridge*	
	Gram-calories	Departures	Gram-calories	Departures
Jan. 1.....	9	+8	139	+7
Jan. 8.....	17	+11	165	+18
Jan. 15.....	27	+16	119	-21
Jan. 22.....	38	+27	153	+1
Accumulated departures on January 28.....	+203		+42	

* The figures for Cambridge are 94.6% of the original figures.

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count.

Date	East-ern stand-ard time	Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Difference in longitude	Longitude	Latitude	Distance from center of disk				
1941	h m		°	°	°	°				
Feb. 1...	11 7	8018	-39	233	-12	39	97	11	VG	U. S. Naval.
		8019	-31	301	+9	35	48	2		
		8018	-27	305	-12	27	218	5		
		8016	+2	334	-1	6	145	1		
		8015	+8	340	-10	9	6	3		
		8014	+21	353	+12	28	436	24		
		8020	+28	0	-10	28	24	3		
		8017	+76	48	-1	77	48	4		
			(332)	(-6)			1022	53		
Feb. 2...	10 55	8021	-75	244	-15	75	12	2	G	Mt. Wilson.
		8018	-26	293	-12	27	97	11		
		8019	-19	300	+9	24	36	1		
		8018	-16	303	-11	16	218	6		
		8016	+8	327	-3	10	24	3		
		8016	+15	334	-1	16	121	1		
		8014	+34	353	+12	40	436	18		
		8020	+41	0	-11	41	48	6		
			(319)	(-6)			992	48		
Feb. 3...	12 3	8022	-80	225	-9	80	194	1	VG	U. S. Naval.
		8021	-62	243	-15	63	12	1		
		8018	-12	293	-12	13	97	10		
		8019	-4	301	+10	16	36	2		
		8018	-1	304	-11	5	218	5		
		8016	+29	334	-1	30	97	1		
		8014	+49	354	+12	53	242	15		
		8020	+53	358	-12	53	24	3		
			(305)	(-6)			920	38		
Feb. 4...	11 23	8022	-68	224	-9	68	121	1	F	Do.
		8025	-29	263	-10	29	24	3		
		8018	-1	291	-11	5	48	3		
		8019	+8	300	+10	18	24	2		
		8018	+12	304	-10	13	242	13		
		8024	+16	308	-4	16	6	1		
		8023	+23	315	+5	26	24	1		
		8016	+42	334	-1	43	73	1		
		8014	+64	356	+12	69	194	6		
		8020	+65	357	-12	65	48	2		
			(292)	(-6)			804	33		
Feb. 5...	11 33	8026	-79	200	+14	80	145	4	G	Do.
		8022	-54	225	-10	54	73	3		
		8025	-14	265	-8	14	73	14		
		8018	+12	291	-11	13	48	3		
		8019	+20	299	+10	26	12	4		
		8018	+26	305	-11	27	145	11		
		8023	+38	317	+4	40	48	13		
		8016	+56	335	-1	57	24	2		
		8014	+78	357	+12	80	145	4		
		8020	+78	357	-12	78	12	1		
			(279)	(-6)			725	59		
Feb. 6...	11 39	8026	-65	201	+14	70	121	2	F	Do.
		8026	-60	206	+14	65	121	4		
		8022	-40	226	-9	40	73	1		
		8025	0	266	-8	2	48	5		
		8018	+26	292	-10	26	48	1		
		8018	+40	306	-10	40	145	6		
		8023	+53	319	+4	56	24	4		
			(206)	(-6)			580	23		

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS—Con.

Date	East-ern stand-ard time	Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Difference in longitude	Longitude	Latitude	Distance from center of disk				
1940	h m		°	°	°	°	°			
Feb. 7...	11 2	8026	-51	202	+15	56	73	3	G	Mt. Wilson.
		8026	-43	210	+15	49	12	2		
		8022	-27	226	-9	27	24	4		
		8025	+13	266	-9	13	48	4		
		8018	+40	293	-10	40	24	1		
		8018	+55	308	-10	55	145	8		
		8023	+67	320	+4	69	24	5		
			(253)	(-7)			350	27		
Feb. 8...	11 22	8026	-37	202	+16	44	48	4	VG	U. S. Naval.
		8026	-27	212	+15	35	24	1		
		8022	-13	226	-9	13	24	1		
		8025	+28	267	-9	28	36	2		
		8018	+53	292	-11	53	6	1		
		8018	+68	307	-11	68	24	1		
			(239)	(-7)			162	10		
Feb. 9...	10 55	8028	-82	145	-10	82	145	1	G	Mt. Wilson.
		8027	-44	183	+9	48	48	7		
		8026	-23	204	+15	32	48	5		
		8026	-14	213	+14	26	12	1		
		8022	-3	224	-7	3	12	3		
		8025	+41	268	-10	41	24	1		
			(227)	(-7)			289	18		
Feb. 10...	10 50	8028	-68	145	-10	68	145	1	F	U. S. Naval.
		8027	-32	181	+10	36	48	2		
		8026	-12	201	+15	26	36	3		
		8026	-3	210	+15	23	12	1		
		8022	+11	224	-6	11	12	3		
		8025	+55	268	-9	55	6	1		
			(213)	(-7)			259	11		
Feb. 11...	11 25	8028	-55	145	-10	55	97	3	F	Do.
		8027	-17	183	+9	24	24	3		
		8026	+12	212	+13	23	73	6		
			(200)	(-7)			194	12		
Feb. 12...	10 52	8028	-42	145	-11	42	73	2	F	Do.
		8026	+27	214	+13	34	97	3		
			(187)	(-7)			170	5		
Feb. 13...	11 30	8030	-58	116	+4	60	48	6	G	Mt. Wilson.
		8028	-28	146	-12	28	97	1		
		8029	0	174	+12	19	24	2		
		8026	+40	214	+13	45	121	10		
			(174)	(-7)			290	19		
Feb. 15...	12 28	8031	-80	67	-3	80	48	1	F	U. S. Naval.
		8030	-25	122	+5	29	48	3		
		8028	-1	146	-12	5	97	1		
		8026	+71	218	+13	74	97	1		
			(147)	(-7)			290	6		
Feb. 16...	12 2	8031	-68	66	-3	68	145	4	F	Do.
		8028	+12	146	-12	13	97	1		
			(134)	(-7)			242	5		
Feb. 17...	12 3	8031	-55	66	-3	55	145	4	G	Do.
		8028	+25	146	-12	25	97	2		
			(121)	(-7)			242	6		
Feb. 18...	12 21	8031	-47	60	-5	47	48	3	F	Do.
		8031	-40	67	-1	41	24	1		
		8028	+39	146	-12	39	121	2		
			(107)	(-7)			193	6		
Feb. 19...	11 49	8031	-33	61	-5	33	36	3	G	Do.
		8031	-27	67	-2	28	12	1		
		(*)	+35	129	-13	35	97	11		
		8028	+52	146	-12	52	73	1		
			(94)	(-7)			218	16		
Feb. 20...	12 1	8031	-13	68	-2	15	48	4	F	Do.
		(*)	+49	130	-13	49	145	6		
		8028	+65	146	-13	65	48	1		
			(81)	(-7)			241	11		
Feb. 21...	11 3	8032	-77	351	+15	79	73	4	F	Do.
		(*)	+60	128	-15	60	48	3		
		(*)	+68	136	-13	68	121	1		
			(68)	(-7)			242	8		
Feb. 23...	11 5	8032	-49	353	+17	54	291	5	F	Do.
			(42)	(-7)			291	5		