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By AMY P. LESHER

(This section will be resumed soon—Editor)

SOLAR OBSERVATIONS

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

SOLAR RADIATION OBSERVATIONS, FEBRUARY, 1940

By IRVING F. HAND

Measurements of solar radiant energy received at the surface of the earth are made at nine stations maintained by the Weather Bureau, and at ten 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 at 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, 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 Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and 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, then 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.

During the latter part of 1939 a broken Eppley pyrheliometer was replaced with a new one of the same type at New Orleans. In order to completely modernize the pyrheliometric equipment at Tulane University, Dr. Laurens also replaced the now obsolete Richard microammeter with a Leeds and Northrup recording microamax potentiometer. All apparatus was thoroughly calibrated to retain the proper pyrheliometric standards.

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

Total solar and sky radiation was below normal at all stations except Washington, Lincoln, New York, Fairbanks, Miami, Blue Hill, Newport, and Friday Harbor. In general the coastal stations received more sunshine than did the inland sections.

No polarization observations were obtained at Madison, owing to continual snow and ice cover.

TABLE 1.—*Solar radiation intensities during February 1940*

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

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	e
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
WASHINGTON, D. C.											
Feb. 3	1.78				1.58						2.16
Feb. 15	1.52				1.55						1.52
Feb. 16	1.52		1.14	1.29	1.44						1.45
Feb. 26	1.32		1.22	1.38	1.58						1.32
Means			(1.18)	(1.34)	1.54						
Departures			+.25	+.33	+.33						
MADISON, WIS.											
Feb. 2	1.19			1.19	1.45	1.78					2.16
Feb. 7	2.26			1.13	1.39	1.71					2.49
Feb. 13	1.45				1.40						2.26
Means				(1.16)	1.41	(1.74)					
Departures				−.04	+.04						
LINCOLN, NEBR.											
Feb. 9	0.74							1.20	1.17	1.10	1.32
Feb. 10	1.07	0.93	0.99	1.08							1.96
Feb. 21	1.88				1.37						3.00
Feb. 26	3.00						1.32				1.88
Feb. 27	2.49			1.22	1.40						4.57
Means		(0.93)	(0.99)	1.30	(1.38)		(1.32)	(1.20)	(1.17)	(1.10)	
Departures		±0.	−0.4	+0.13	+.01		−.04	−.04	+.15	+.18	
BLUE HILL, MASS.											
Feb. 1	1.3	1.04	1.13	1.23							1.7
Feb. 3	1.1	(1.02)						1.19	0.90	0.82	1.7
Feb. 4	1.4	1.05	1.13	1.26	1.40	(1.56)					1.5
Feb. 5	1.9						1.12	1.00	.83	.67	2.2
Feb. 6	2.1			.88							3.2
Feb. 8	2.3	.99			1.37		1.30	1.03			2.5
Feb. 9	3.0						(1.35)				1.8
Feb. 12	2.6				(1.22)						3.8
Feb. 16	1.7	.98	1.07	1.17	1.34	(1.50)	1.37	1.22	1.10	.97	2.2
Feb. 17	1.9	.96	1.06	1.19	1.36	(1.53)	1.33	1.17	1.01	.96	3.0
Feb. 22	1.3	.88	1.00	1.12	(1.34)	(1.46)	1.23	(1.05)	(.94)	.83	2.3
Feb. 23	1.5						(.97)	(.85)	(.74)	(.65)	2.4
Feb. 26	1.3	.99	1.09	1.21	1.37	(1.54)	1.40	1.24	1.12	1.03	1.1
Feb. 27	.9	1.10	1.20	1.30	1.40	(1.53)					1.1
Feb. 29	2.0		(.65)	(.78)	(.99)	(1.33)	1.24	1.05	(.88)	.80	1.9
Means		1.00	1.04	1.13	1.31	1.49	1.26	1.09	.94	.84	
Departures		+.07	−.01	+.03	+.02	+.03	−.02	−.06	−.09	−.10	
LATE DATA											
BLUE HILL, MASS.											
Jan. 1	0.8	0.72	0.85								1.5
Jan. 2	1.5	.47	.54	0.68		1.07		0.67	0.53	0.42	1.6
Jan. 3	1.7	.93	1.04			1.46		1.16	1.06	.95	1.9
Jan. 4	1.9	.90	1.10	1.24		1.58		1.26	1.12	.99	1.5
Jan. 6	1.5			1.12		1.37			1.04	.93	1.5
Jan. 7	.7	1.13	1.22	1.33		1.57		1.32	1.22	1.13	.6
Jan. 9			.95	1.07		1.52			.91	.77	2.0
Jan. 16	1.3	.98	1.11								1.1
Jan. 19	1.8	.54				1.47		1.02	.85	.73	1.3
Jan. 23	.7	.93	1.07	1.22		1.59		1.22	1.07	.98	1.0
Jan. 25	2.4	.87	.96	1.05		1.25			.86	.77	1.8
Jan. 27	1.1	.93	1.03	1.21		1.49		1.12	.95	.90	1.4
Jan. 28	1.3	.95	1.04	1.18		1.48		1.19	1.05	.94	1.5
Jan. 29	1.3	1.03	1.12	1.24		1.52		1.22	1.09	.99	1.4
Jan. 30	1.3			1.21		1.45		1.10	.98	.86	1.3
Jan. 31	1.4	.92	1.03	1.15	1.30	1.46	1.30	1.19	1.08	.98	1.7
Means		.88	1.00	1.14	(1.30)	1.45	(1.30)	1.13	.99	.88	
Departures		.02	0	+.04	+.01	−.01	+.02	−.03	−.05	−.08	

* 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	Albuquerque	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	Newport	Friday Harbor	Cambridge
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Jan. 29	253	152	191	79	217	140	308	37	172	210	412	308	156	265	254	145	240
Feb. 5	197	192	225	93	116	292	411	48	165	351	341	194	352	191	171	87	180
Feb. 12	249	230	220	141	229	308	422	101	175	367	408	148	360	272	272	148	271
Feb. 19	265	255	233	189	235	238	405	122	227	287	414	272	277	235	200	206	202
DEPARTURES FROM WEEKLY NORMALS																	
Jan. 29	+51	−33	−31	−38	+62	−48	-------	−8	−18	−48	+68	+78	−71	+46	+48	+41	-------
Feb. 5	−15	−10	−34	−43	−44	+28	-------	−14	−36	+45	−3	−30	+64	−37	−54	−23	-------
Feb. 12	+24	+6	−48	−6	+52	+18	-------	+18	−84	+65	+59	+93	+45	+34	+28	+13	-------
Feb. 19	+10	+3	−63	+12	+36	−14	-------	+18	−27	−79	+48	−11	−58	−26	−55	+52	-------
ACCUMULATED DEPARTURES ON FEB. 25, 1940																	
	+1,148	+427	−679	+448	+1,274	−833	-------	+133	−2,247	−1,064	+1,708	+441	−2,128	+805	+203	+679	-------

POSITIONS AND AREAS OF SUN SPOTS

Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.) Superintendent, U. S. Naval Observatory. Data from measurements at the U. S. Naval Observatory from plates obtained 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 forshortening and expressed in millionths of Sun's hemisphere. For each day below longitude, latitude, area of spot or groups, and spot count, are given respectively the assumed longitude of the center of the disk, assumed latitude of the center of the disk, total area of spots and groups, and total spot count]

Date	Eastern standard time	Mount Wilson group no.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Spot or group	Spot count	Plate quality	Observatory
1940	*h m*		°	°	°	°				
Feb. 1	10 34	6743	−56	67	−24	57	24	5	VG	U. S. Naval.
		6742	−50	73	−7	49	242	3		
		6743	−49	74	−24	19	73	2		
		(*)	−38	85	+12	42	48	2		
		6741	−9	114	+12	20	485	12		
		6741	+7	130	+11	18	679	5		
				(123)	(−6)		1,551	29		
Feb. 2	11 45	(*)	−44	65	−8	43	24	5	VG	Do.
		6742	−37	72	−7	36	339	7		
		6743	−37	72	−24	40	73	5		
		6741	+4	113	+12	17	582	15		
		6741	+20	129	+11	25	679	12		
				(109)	(−6)		1,697	44		
Feb. 3	10 32	(*)	−30	66	−8	29	24	2	F	Do.
		6742	−23	73	−7	23	339	6		
		6743	−23	73	−23	27	73	1		
		6741	+16	112	+12	17	436	7		
		6741	+31	127	+11	35	630	4		
				(96)	(−6)		1,502	20		
Feb. 4	15 14	6743	−7	74	−23	19	97	1	F	Do.
		6742	−6	75	−7	6	339	4		
		6741	+31	112	+12	35	436	3		
		6741	+48	129	+11	50	630	3		
				(81)	(−6)		1,502	11		
Feb. 5	11 14	6744	−20	50	+6	23	24	3	G	Do.
		6743	+2	72	−24	18	97	3		
		6742	+6	76	−6	6	242	9		
		6741	+41	111	+12	45	388	3		
		6741	+60	130	+11	62	630	2		
				(70)	(−6)		1,381	20		
Feb. 6	11 28	6744	−5	51	+5	12	24	4	F	Mt. Wilson.
		(*)	+3	59	−22	17	24	8		
		6743	+16	72	−24	24	97	3		
		6742	+20	76	−5	19	388	11		
		6741	+56	112	+12	59	339	4		
		6741	+73	129	+11	75	582	2		
				(56)	(−6)		1,454	32		
Feb. 7	14 48	6746	−52	349	−9	51	73	10	VG	U. S. Naval.
		6745	−51	350	+14	56	170	12		
		6743	+31	72	−25	36	97	1		
		6742	+34	75	−6	33	315	18		
		6741	+69	110	+12	70	218	1		
				(41)	(−6)		873	42		

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group no.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Spot or group	Spot count	Plate quality	Observatory
1940	*h m*		°	°	°	°				
Feb. 8	12 0	6747	−69	321	−10	68	12	7	VG	U. S. Naval.
		(*)	−58	332	−12	57	12	6		
		6746	−40	350	−8	39	36	9		
		(*)	−40	350	−5	39	24	5		
		6745	−39	351	+15	43	218	16		
		6743	+42	72	−25	44	73	1		
		6742	+45	75	−11	44	48	6		
		6742	+47	77	−7	46	182	16		
		6741	+83	113	+12	82	218	1		
				(30)	(−6)		823	67		
Feb. 9	11 22	6747	−57	320	−10	56	73	5	G	Do.
		6748	−42	335	−13	41	24	2		
		6746	−27	350	−5	26	97	4		
		6745	−26	351	+15	32	291	8		
		6743	+55	72	−25	56	48	2		
		6742	+59	76	−11	58	97	4		
		6742	+60	77	−8	59	145	7		
				(17)	(−7)		775	32		
Feb. 10	11 4	6747	−43	321	−12	42	48	9	VG	Mt. Wilson.
		6748	−29	335	−14	29	36	16		
		6746	−15	349	−5	14	48	14		
		6745	−12	352	+15	23	303	27		
		6746	−11	353	−7	10	145	28		
		6743	+70	74	−25	69	24	2		
		6742	+72	76	−10	70	48	7		
		6742	+73	77	−8	71	121	4		
				(4)	(−7)		773	107		
Feb. 11	11 36	6749	−80	271	+10	80	388	3	VG	U. S. Naval.
		6747	−28	323	−11	28	48	10		
		6748	−18	333	−13	19	24	5		
		6746	+2	353	−6	1	242	15		
		6745	+2	353	+14	21	267	12		
				(351)	(−7)		969	45		
Feb. 12	10 56	6749	−67	271	+10	68	339	3	G	Do.
		6747	−16	322	−11	16	24	3		
		6748	−3	335	−12	7	36	4		
		6748	+2	340	−12	6	12	1		
		6745	+14	352	+14	25	194	11		
		6746	+15	353	−6	50	242	12		
				(338)	(−7)		847	34		
Feb. 13	12 0	6749	−60	264	+11	62	12	1	G	Do.
		6750	−55	269	−15	55	6	1		
		6749	−53	271	+0	55	291	5		
		6747	−3	321	−11	7	48	6		
		6748	+14	338	−13	16	97	9		
		6745	+27	351	+13	32	230	14		
		6746	+28	352	−7	27	242	7		
				(324)	(−7)		926	43		
Feb. 15	11 15	6751	−58	240	−9	57	24	1	G	Do.
		6750	−30	268	−12	30	339	15		
		6749	−28	270	+9	32	291	10		
		6748	+40	338	−13	41	339	17		
		6745	+54	352	+13	57	145	6		
		6746	+58	356	−9	57	170	3		
				(298)	(−7)		1,308	52		