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SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING DECEMBER, 1927

By HERBERT H. KIMBALL, Solar Radiation Investigations

For a description of instruments and exposures and an account of the method of obtaining and reducing the measurements, the reader is referred to the REVIEW for January, 1924, **52**:42, January, 1925, **53**:29, and July, 1925, **53**:318.

Table 1 shows that solar radiation intensities were above the normal values for December at all three stations except during afternoons at Madison, Wis., and Lincoln, Nebr.

Table 2 shows a slight excess in the total solar radiation received on a horizontal surface directly from the sun and diffusely from the sky, at all three stations for which normals have been determined, as compared with the December normals for these stations.

Skylight polarization measurements at Washington made on six days give a mean of 52 per cent, with a maximum of 57 per cent on the 5th. These are considerably below the corresponding normal values for Washington for December. At Madison the ground was covered with snow during most of the month and in consequence no skylight polarization measurements were made.

TABLE 1.—*Solar radiation intensities during December, 1928*

[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.*
Dec. 5	4.37	0.81	0.98	1.09	1.28	------	1.31	1.13	0.99	0.81	4.57
6	3.81	0.84	0.99	1.09	1.19	------	------	------	------	------	4.75
8	12.24	------	------	------	------	------	1.37	1.22	1.12	1.01	3.00
9	0.79	0.87	0.99	1.17	1.37	------	------	1.17	1.01	0.87	0.86
10	1.88	0.73	0.85	0.99	1.25	------	------	1.10	0.96	------	1.37
17	1.52	0.94	1.05	1.20	1.38	------	------	1.17	1.07	0.93	1.88
19	1.07	------	------	------	1.28	------	------	------	------	------	1.12
27	2.36	0.59	0.75	0.92	1.08	------	------	1.00	------	------	2.87
28	3.30	------	------	------	1.32	------	------	------	------	------	3.15
Means	------	**0.80**	**0.94**	**1.08**	**1.27**	------	**(1.34)**	**1.13**	**1.03**	**0.90**	------
Departures	------	**+0.01**	**+0.04**	**+0.03**	**+0.04**	------	------	**+0.10**	**+0.12**	**+0.11**	------

MADISON, WIS.

Dec. 2	1.32	------	------	1.30	------	------	------	------	------	------	1.52
20	1.78	1.08	1.18	1.28	1.39	1.51	------	1.27	------	------	2.26
21	1.68	0.85	1.02	1.15	------	------	------	1.04	------	------	2.36
23	1.45	1.00	1.11	1.24	1.38	1.53	------	1.21	------	------	1.96
Means	------	**0.98**	**1.10**	**1.24**	**(1.38)**	**(1.52)**	------	**1.17**	------	------	------
Departures	------	**+0.02**	**±0.00**	**+0.02**	**+0.06**	------	------	**−0.10**	------	------	------

LINCOLN, NEBR.

Dec. 8	0.86	------	1.19	1.39	1.49	1.60	------	1.01	1.01	0.92	0.71
9	0.51	0.84	1.01	1.14	------	------	------	1.09	0.98	0.77	1.78
14	3.15	0.81	1.06	1.16	------	------	------	------	------	------	4.75
15	0.96	1.07	1.20	1.33	------	1.64	------	------	1.19	1.05	0.86
16	0.91	------	0.86	1.09	------	------	------	------	------	------	1.12
17	0.96	1.09	1.21	1.29	1.36	------	------	1.16	0.99	------	0.96
19	0.86	1.00	1.12	1.31	1.50	------	------	------	------	------	0.81
20	1.07	------	1.11	1.22	------	------	------	1.17	1.03	0.98	0.96
21	1.52	------	1.07	1.15	------	------	------	------	------	------	1.96
Means	------	**0.96**	**1.09**	**1.23**	**1.45**	**(1.62)**	------	**1.11**	**1.04**	**0.93**	------
Departures	------	**+0.02**	**+0.03**	**±0.00**	**+0.06**	------	------	**−0.09**	**−0.03**	**−0.03**	------

* Extrapolated.

TABLE 2.—*Solar and sky radiation received on a horizontal surface*

[Gram-calories per square centimeter of horizontal surface]

Week beginning—	Average daily radiation						Average daily departure from normal		
	Washington	Madison	Lincoln	Chicago	New York	Twin Falls	Washington	Madison	Lincoln
1927									
Dec. 3	150	125	185	97	105	171	+8	+8	+15
Dec. 10	124	76	183	47	72	132	−17	−44	+10
Dec. 17	182	151	198	78	141	------	+39	+26	+26
Dec. 24	143	85	172	66	112	152	−1	+46	−7
Deficiency at end of year							−8,415	−5,618	−7,035

POSITIONS AND AREAS OF SUN SPOTS

Communicated by Capt. C. S. Freeman, Superintendent U. S. Naval Observatory]

Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson observatories]

Date	Eastern standard civil time	Heliographic		Area [1]		Total area for each day
		Longitude	Latitude	Spot	Group	
1927	*h. m.*	°	°			
Nov. 8 (Harvard)	13 15	−23.0	−8.0	------	153	153
Nov. 10 (Harvard)	10 45	−72.0	+5.5	------	97	------
		−67.0	−5.0	------	795	------
		−17.5	+7.5	------	159	------
		+2.0	−8.0	------	1,082	2,133
Nov. 25 (Harvard)	14 00	+3.0	−15.5	------	1,194	------
		+14.0	−13.0	------	64	------
		+18.5	−13.0	165	------	------
		+51.5	+11.5	------	436	------
		+68.0	−5.5	------	244	2,103
Dec. 1 (Naval Observatory)	11 51	−37.0	+13.5	6	------	------
		−33.5	−11.0	15	------	------
		+25.0	−15.5	------	77	------
		+74.0	−18.0	------	93	------
		+85.0	−16.0	------	463	654
Dec. 2 (Mount Wilson)	11 40	−75.0	+7.0	33	------	------
		−55.0	−14.0	------	24	------
		−20.0	−10.0	31	------	------
		+39.0	−14.0	35	------	123
Dec. 4 (Mount Wilson)	14 15	−25.0	−21.0	------	22	------
		+66.0	−14.0	------	3	25
Dec. 5 (Naval Observatory)	11 42	−83.0	+18.5	62	------	------
		−42.5	−11.5	------	31	------
		−14.5	−22.0	------	108	201
Dec. 6 (Naval Observatory)	11 42	−75.0	−10.5	------	154	------
		−74.0	+18.5	62	------	------
		−66.5	+19.0	62	------	------
		−29.0	−12.0	------	62	------
		−5.0	−21.5	------	46	------
		+0.5	−21.0	------	62	448
Dec. 7 (Harvard)	14 48	−60.0	−10.5	------	468	------
		−55.0	+18.5	------	162	------
		−9.5	−10.5	------	109	------
		+15.0	−21.5	68	------	------
		+29.0	+11.5	------	161	968
Dec. 8 (Naval Observatory)	11 36	−77.0	+4.5	123	------	------
		−49.5	−11.0	------	62	------
		−47.5	+19.0	31	------	------
		−42.5	−9.5	------	77	------
		−37.5	+19.5	46	------	------
		−3.0	−11.5	62	------	------
		+2.0	−11.0	------	62	------
		+6.0	−9.5	46	------	------
		+22.0	−22.0	31	------	------
		+28.5	−21.5	31	------	571
Dec. 9 (Naval Observatory)	11 41	−64.5	+5.0	139	------	------
		−37.5	−10.5	------	46	------
		−34.0	+19.5	31	------	------
		−29.5	−8.5	------	46	------
		−25.0	+20.0	46	------	------
		+9.0	−11.0	------	123	------
		+14.5	−10.0	------	170	------
		+44.5	−11.0	------	37	------
		+48.0	−10.0	31	------	669
Dec. 10 (Naval Observatory)	11 41	−50.5	+5.0	139	------	------
		−23.0	−10.5	------	31	------
		−17.5	−8.5	------	46	------
		+21.5	−12.0	------	247	------
		+26.5	−13.0	------	46	------
		+29.0	−9.5	------	123	------
		+55.0	−19.5	31	------	------
		+58.5	−12.0	46	------	709
Dec. 12 (Harvard)	14 40	−22.0	+4.5	49	------	------
		+13.0	−6.5	171	------	------
		+54.5	−10.0	------	1,864	2,084
Dec. 14 (Naval Observatory)	11 37	+2.5	+5.0	------	139	------
		+14.5	−15.0	6	------	------
		+39.0	−9.0	25	------	------
		+73.0	−14.5	------	216	------
		+77.0	−12.0	------	62	448

[1] Areas are corrected for foreshortening and are expressed in millionths of the sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column.