SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING FEBRUARY, 1928

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**: 319.

Table 1 shows that solar radiation intensities were close to the normal values for February at Washington, D. C., and Madison, Wis., and above the normal at 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 Washington, and a deficiency at Madison and Lincoln, as compared with the February normals for these stations.

Skylight polarization measurements at Washington made on three days give a mean of 59 per cent, with a maximum of 53 per cent on the 28th. These are close to the corresponding normal values for Washington for February. At Madison no polarization measurements were made during the month on account of the presence of ice and snow.

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

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

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] 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. 1	3.63				1.06						3.81
2	1.19	0.85	0.98	1.14	1.31						1.78
4	3.63		0.61	0.75	1.11		1.12	0.87			4.37
6	1.68				1.13						2.06
9	4.57				1.31						3.45
11	3.30		0.71								3.45
21	1.19	0.53	0.67	0.91	1.22	1.57	1.12	0.91	0.72	0.58	1.12
27	1.96	0.83	0.93	1.09	1.27	1.55	1.26	0.99	0.90	0.71	2.62
28	3.30	0.65	0.75	0.90	1.06						2.62
Means		0.72	0.78	0.96	1.18	(1.56)	1.17	0.92	(0.81)	(0.64)	
Departures		+0.01	−0.03	−0.02	+0.01		−0.02	−0.05	−0.03	−0.12	
Madison, Wis.											
Feb. 1	1.19		1.07	1.23	1.44	1.67		1.29			1.19
3	2.49				1.20			1.06			3.45
9	2.87	1.04	1.15	1.28	1.44	1.63	1.44	1.25			2.74
11	3.45	0.98	1.06	1.16	1.30	1.47					3.30
20	1.02						1.28				0.81
23	1.60						1.46				0.81
24	1.12		1.12	1.27	1.42	1.62					0.79
25	0.64		1.08	1.22	1.37						0.86
27	2.36			1.25	1.43	1.55	1.42				2.49
Means		(1.01)	1.10	1.24	1.37	1.55	1.40	1.20			
Departures		+0.06	−0.01	+0.01	±0.00		+0.03	+0.02			
Lincoln, Nebr.											
Feb. 1	1.07	0.51	0.82	1.25				1.23	1.04	0.93	1.45
9	2.87							1.21			3.63
10	3.45		1.04	1.24							3.81
16	1.96			1.30	1.46	1.63					2.16
19	3.15		1.04	1.20	1.32	1.45					3.00
23	0.86		1.16	1.29	1.47	1.68	1.49	1.33	1.21	1.10	0.96
24	0.96	1.02	1.19	1.30	1.45						1.19
27	2.16	0.99	1.14	1.30	1.43						2.36
Means		0.84	1.06	1.27	1.43	1.59	(1.49)	1.26	(1.12)	(1.02)	
Departures		−0.11	+0.11	+0.06	+0.05		+0.14	+0.08	+0.08	+0.10	

[1] 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
1928	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Jan. 29	252	186	214	107	160	[1] 150	+56	−5	−21
Feb. 5	158	170	211	108	156	260	−45	−37	−48
Feb. 12	175	194	250	87	114	282	−47	−36	−35
Feb. 19	298	291	297	158	277	243	+47	+39	−12
Excess or deficiency since first of year on Feb. 25							+189	−511	−770

[1] Six-day mean.

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]

(The differences of longitude measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column)

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1928	*h. m.*	°	°	°			
Jan. 18 (Harvard)	12 55	−53.0	143.5	+17.0		1,380	
		+6.0	202.5	+18.5	17		
		+6.5	203.0	+14.5	15		
		+76.5	273.0	−11.0		248	1,660
Jan. 24 (Harvard)	10 42	−79.0	39.5	−14.5	144		
		−72.5	46.0	−19.5		359	
		−23.0	95.5	+9.0	68		
		−14.5	104.0	+8.0	80		
		−6.5	112.0	+6.5		402	
		+8.5	127.0	+11.0		111	
		+25.5	144.0	+16.0		302	1,466
Jan. 30 (Harvard)	15 7	−3.0	34.0	−10.5	45		
		−1.0	36.0	−7.0	330		
		+8.0	45.0	−21.5		363	
		+36.0	73.0	−11.0		167	
		+69.5	106.5	+8.0		737	1,642
Feb. 1 (Naval Observatory)	11 50	−66.0	306.4	+9.0		62	
		−55.5	316.9	−15.5	31		
		−31.5	340.9	+15.0		31	
		+22.5	34.9	−7.5	247		
		+32.0	44.4	−22.0		309	
		+63.0	75.4	−11.0	93		773
Feb. 2 (Naval Observatory)	11 45	−80.0	279.2	−11.0		123	
		−72.5	286.7	−11.0		93	
		−52.0	307.2	+8.5	31		
		−43.5	315.7	−17.5		15	
		+37.0	36.2	−8.0	231		
		+45.0	44.2	−21.5		247	
		+77.0	76.2	−11.0	62		802
Feb. 3 (Naval Observatory)	11 48	−68.0	278.0	−11.0		108	
		−59.0	287.0	−11.5	77		
		−39.5	306.5	+9.0	31		
		−32.0	314.0	−17.5		15	
		+50.5	36.5	−8.0	247		
		+57.5	43.5	−21.5	278		
		+73.0	59.0	+1.5		46	802
Feb. 4 (Naval Observatory)	11 48	−55.0	277.9	−11.0	31		
		−45.5	287.4	−11.0	62		
		+63.0	35.9	−8.0	278		
		+71.0	43.9	−21.5		309	680
Feb. 5 (Yerkes)	16 1	−37.0	283.0	−14.0	75		
		−28.0	292.0	−14.0	75		150
Feb. 6 (Naval Observatory)	11 47	−56.5	250.1	−22.0	25		
		−35.0	271.6	−19.5		15	
		−28.0	278.6	−11.0	25		
		−18.0	288.6	−11.0	46		111
Feb. 7 (Mount Wilson)	14 0	−42.0	250.1	−23.0		87	
		−21.0	271.1	−19.0		12	
		−8.0	284.1	−12.0		55	104
Feb. 8 (Mount Wilson)	14 15	−29.5	249.4	−23.0		29	
		+10.0	288.9	−12.0	44		73
Feb. 9 (Naval Observatory)	11 47	+14.0	281.0	−11.5		31	
		+21.5	288.5	−12.5		31	62

Date	Eastern standard civil time	Heliographic: Diff. long.	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day
	h. m.	°	°	°			
Feb. 10 (Naval Observatory)	11 46	−46.0	207.9	+17.5		77	
		+28.0	281.9	−12.0		62	
		+34.5	288.4	−12.5	31		170
Feb. 11 (Mount Wilson)	13 45	−33.0	206.5	+18.0		137	
		+34.0	273.5	+11.0		29	
		+46.0	285.5	−12.0		18	184
Feb. 12 (Naval Observatory)	11 44	−18.0	209.6	+17.5		216	
		+45.0	272.6	+11.0		31	
		+49.0	276.6	+11.5	77		324
Feb. 13 (Naval Observatory)	11 46	−80.5	133.9	−22.0	77		
		−9.0	205.4	+18.5		93	
		−0.5	213.9	+16.5	108		
		+57.5	271.9	+11.0		77	
		+62.0	276.4	+11.5	108		463
Feb. 14 (Harvard)	11 37	−65.5	136.0	−22.5	100		
		−61.0	140.5	+21.0		66	
		+8.5	210.0	+17.5		99	
		+77.5	279.0	+11.5		452	717
Feb. 14 (Mount Wilson)	12 45	−81.0	119.7	+19.5		40	
		−66.0	134.7	−22.0	29		
		−63.0	137.7	+20.5		32	
		+9.5	210.2	+18.0		125	
		+76.0	276.7	+11.5		296	522
Feb. 15 (Naval Observatory)	11 47	−77.0	111.0	+6.5		802	
		−62.0	126.0	+19.5		46	
		−53.0	135.0	−22.0	43		
		−48.0	140.0	+20.5		31	
		+16.0	204.0	+18.5		31	
		+27.0	215.0	+16.5	108		
		+86.0	274.0	+11.0	62		1,123
Feb. 16 (Mount Wilson)	11 0	−67.0	108.0	+6.0		770	
		−54.0	121.0	+19.5		66	
		−41.0	134.0	−22.0	26		
		−39.0	136.0	+21.0	28		
		−18.0	157.0	−10.0		97	
		+35.0	210.0	+18.0		97	1,084
Feb. 17 (Mount Wilson)	11 45	−54.0	108.8	+8.0		1,409	
		−38.0	124.8	+20.5		87	
		−28.0	134.8	−22.0	12		
		−24.0	138.0	+21.0		25	
		−10.5	152.3	−17.0		44	
		−5.0	157.8	−10.0		184	
		+53.0	215.8	+17.0		116	1,877
Feb. 17 (Harvard)	11 45	−49.5	112.5	+5.5		995	
		−39.0	123.0	+19.0	11		
		−32.5	129.5	+18.5		19	
		−9.5	152.5	−17.0		39	
		−3.0	159.0	−9.5		75	
		+52.5	214.5	+15.5		107	1,246
Feb. 18 (Naval Observatory)	11 39	−38.5	110.1	+7.5	432		
		−37.0	111.6	+4.5		463	
		−29.0	119.6	+19.5	15		
		−23.5	125.1	+10.0	6		
		−21.0	127.6	+19.0		31	
		−9.5	139.1	+20.5		31	
		+1.5	150.1	−17.5		15	
		+5.5	154.1	−17.0	25		
		+5.0	153.6	−9.5		31	
		+10.5	159.1	−9.5	93		
		+61.0	209.6	+17.0		108	1,250
Feb. 19 (Naval Observatory)	11 44	−80.0	56.4	−12.0	123		
		−25.0	110.4	+7.5	340		
		−23.0	112.4	+4.5		340	
		+3.5	138.9	+20.5		123	
		+17.5	152.9	−17.5		123	
		+19.5	154.9	−9.5	31		
		+25.0	160.4	−10.0	108		1,188
Feb. 20 (Naval Observatory)	12 54	−82.0	39.6	−20.0	93		
		−65.0	56.6	−12.0	123		
		−12.0	109.6	+3.5		123	
		−11.0	110.6	+7.5	309		
		−7.5	114.1	+5.0		185	
		+2.0	123.6	−23.0		77	
		+17.5	139.1	+21.0		46	
		+31.0	152.6	−17.5		170	
		+39.5	161.1	−10.0	93		1,219
Feb. 21 (Naval Observatory)	12 7	−72.0	36.9	−8.5	247		
		−69.0	39.9	−20.0	123		
		−67.0	41.9	−5.0	46		
		−60.0	48.9	−9.0	31		
		−51.5	57.4	−11.5		123	
		+0.5	109.4	+3.5		123	
		+2.0	110.9	+7.5	293		
		+7.0	115.9	+4.5		123	
		+15.0	123.9	−22.5		77	
		+44.0	152.9	−17.0		154	
		+51.0	159.9	−10.0	108		1,448
Feb. 22 (Naval Observatory)	11 43	−59.0	36.9	−8.5	185		
		−56.0	39.9	−20.0	108		
		−53.5	42.4	−5.0	31		
		−46.5	49.4	−9.0	9		
		−44.0	51.9	−16.0		31	
		−37.5	58.4	−10.5		93	
		+14.5	110.4	+3.0		123	
		+15.0	110.9	+7.5	309		
		+19.0	114.9	+5.0		62	
		+28.0	123.9	−22.0		77	
		+51.5	147.4	−17.5		46	
		+61.0	156.9	−17.5		108	
		+64.5	160.4	−10.0	108		1,290
Feb. 23 (Naval Observatory)	13 0	−44.5	37.5	−8.5	123		
		−41.5	40.5	−19.5	123		
		−29.5	52.5	−16.0		31	
		−26.0	56.0	−12.0		40	
		−21.5	60.5	−10.0		46	
		+28.0	110.0	+3.5		31	
		+29.0	111.0	+7.5	293		
		+32.0	114.0	+4.0		40	
		+44.0	126.0	−23.0		154	
		+48.5	130.5	+12.0		15	
		+54.5	136.5	+21.0		62	
		+67.0	149.0	−17.0		62	
		+75.0	157.0	−18.0		77	
		+79.0	161.0	−10.0	62		1,159
Feb. 24 (Naval Observatory)	14 28	−30.0	38.0	−8.5	139		
		−28.0	40.0	−20.0	93		
		−14.5	53.5	−15.0	15		
		−7.5	60.5	−10.5		62	
		+7.0	75.0	−25.5	31		
		+42.5	110.5	+7.5	293		
		+43.0	111.0	+3.5		62	
		+55.5	123.5	−26.5	77		
		+58.0	126.0	−22.0		93	
		+60.0	128.0	+12.0	31		
		+81.0	149.0	−17.5		123	1,019
Feb. 25 (Harvard)	9 52	−16.5	41.0	−7.5	241		
		−14.5	43.0	−19.0	184		
		+6.5	64.0	−10.0		195	
		+56.0	113.5	+6.5		418	1,038
Feb. 25 (Mount Wilson)	14 15	−80.0	335.0	−18.0	62		
		−18.0	37.0	−8.0	137		
		−16.0	39.0	−19.5	100		
		−3.0	52.0	−16.0	6		
		+6.0	61.0	−11.0		195	
		+20.0	75.0	−27.0		18	
		+59.5	114.5	+6.0		348	
		+69.0	124.0	−26.0		104	970
Feb. 26 (Naval Observatory)	11 50	−79.0	324.2	−8.0		154	
		−67.5	335.7	−19.5	93		
		−60.0	343.2	−17.5		31	
		−5.0	38.2	−8.5	139		
		−2.5	40.7	−19.5	108		
		+19.0	62.2	−11.5		494	
		+30.5	73.7	−26.0		93	
		+68.5	111.7	+7.5	278		1,390
Feb. 27 (Naval Observatory)	11 54	−67.0	323.0	−7.0	185		
		−54.0	336.0	−19.5	77		
		−47.0	343.0	−18.5		93	
		+8.0	38.0	−8.5	139		
		+10.5	40.5	−19.5	93		
		+23.0	53.0	−4.5		77	
		+30.0	60.0	−11.5		340	
		+36.0	66.0	−12.0	309		
		+40.0	70.0	−28.0		46	
		+46.5	76.5	−25.5		46	
		+82.0	112.0	+7.5	309		1,714
Feb. 28 (Naval Observatory)	11 47	−57.5	319.3	−7.0	6		
		−53.0	323.8	−6.5	185		
		−41.0	335.8	−19.5	43		
		−33.5	343.3	−18.5		77	
		+21.0	37.8	−9.0	139		
		+22.0	38.8	−19.5	77		
		+36.5	53.3	−4.5		185	
		+42.0	58.8	−11.5		278	
		+48.0	64.8	−12.5	278		
		+55.5	72.3	−27.0		77	1,345
Feb. 29 (Naval Observatory)	11 37	−50.5	313.2	−7.5		62	
		−40.0	323.7	−6.0	247		
		−28.5	335.2	−19.5	37		
		−21.5	342.2	−19.5	31		
		−18.0	345.7	−19.0		40	
		+34.0	37.7	−8.5	108		
		+35.5	39.2	−19.0	77		
		+48.5	52.2	−4.0		247	
		+55.0	58.7	−11.0		185	
		+61.5	65.2	−12.5	494		
		+65.0	68.7	−28.0		31	1,559
Mean daily area for February							851

PROVISIONAL SUN SPOT RELATIVE NUMBERS FOR FEBRUARY, 1928

[Data furnished by Prof. A. Wolfer, University of Zurich, Switzerland]

February	Relative numbers	February	Relative numbers	February	Relative numbers
1		11	28	21	109
2	49	12	38	22	130
3	66	13		23	140
4	31	14	28	24	89
5	48	15		25	109
6		16	70	26	99
7	35	17	77	27	129
8	30	18	70	28	110
9	23	19	109	29	96
10	32	20	120		

Number of observations, 25; mean, 74.6.