SOLAR OBSERVATIONS.

SOLAR AND SKY RADIATION MEASUREMENTS DURING JANUARY, 1923.

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For a description of instruments and exposures, and an account of the method of obtaining and reducing the measurements, the reader is referred to this REVIEW for April, 1920, **48**:225, and a note in the REVIEW for November, 1922, **50**:595.

From Table 1 it is seen that direct solar radiation intensities averaged below the normal values for January at Washington and Madison, and close to normal at Lincoln. There were few days on which measurements could be made at the two latter stations, however.

Table 2 shows that the total solar and sky radiation received on a horizontal surface averaged below the January normal at all three stations, although at Lincoln there was more than the average radiation after the first week.

Skylight polarization measurements were obtained at Washington on the 11th only, and gave a percentage of polarization of 66 per cent. At Madison the ground was covered with snow throughout the month, and no measurements were obtained.

TABLE 1.—*Solar radiation intensities during January, 1923.*

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

Date.	Sun's zenith distance.										
	8 a. m.	77.8°	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.*
Washington, D. C.											
Jan. 2	3.30	0.65	0.81	0.95	1.19	.....	.....	.....	.....	.....	3.45
4	3.63	0.50	0.62	0.77	.....	.....	.....	.....	.....	.....	3.30
11	2.06	0.67	0.79	0.94	.....	.....	.....	.....	.....	.....	2.36
12	4.17	0.58	0.73	0.90	1.10	.....	.....	1.04	0.93	0.82	3.45
13	2.16	.....	.....	.....	1.08	.....	.....	0.92	0.71	0.52	2.16
17	1.37	0.82	0.96	1.10	.....	.....	.....	.....	.....	.....	1.52
Means	.....	0.64	0.78	0.93	1.12	.....	.....	(0.98)	(0.82)	(0.67)	.....
Departures	.....	−0.12	−0.09	−0.08	−0.10	.....	.....	−0.13	−0.13	−0.15	.....
Madison, Wis.											
Jan. 3	2.62	.....	1.05	1.18	.....	.....	.....	.....	.....	.....	3.30
10	3.15	0.95	1.07	.....	.....	.....	.....	.....	.....	.....	3.63
15	2.74	.....	1.12	1.23	.....	.....	.....	.....	.....	.....	2.87
16	3.00	.....	.....	1.25	.....	.....	.....	.....	.....	.....	2.74
22	2.16	0.95	1.10	1.16	1.30	1.41	.....	.....	.....	.....	2.36
Means	.....	(0.95)	1.08	1.20	(1.30)	.....	.....	.....	.....	.....	.....
Departures	.....	±0.00	−0.01	−0.05	−0.06	.....	.....	.....	.....	.....	.....
Lincoln, Nebr.											
Jan. 4	2.49	0.87	.....	.....	.....	.....	.....	.....	.....	.....	3.15
10	1.12	.....	0.88	.....	.....	.....	.....	.....	.....	.....	1.52
11	2.36	.....	0.95	1.22	1.44	.....	.....	1.24	1.07	0.92	2.49
15	2.49	0.89	0.97	.....	.....	.....	.....	.....	.....	0.90	3.00
28	2.74	.....	.....	.....	1.36	.....	.....	1.13	1.00	0.78	2.49
Means	.....	(0.88)	0.93	(1.22)	(1.40)	.....	.....	(1.18)	(1.04)	0.87	.....
Departures	.....	−0.03	−0.09	+0.06	+0.05	.....	.....	−0.01	±0.00	−0.05	.....

* Extrapolated.

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

Week beginning—	Average daily radiation.			Average daily departure for the week.			Excess or deficiency since first of year.		
	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Jan. 1	119	105	120	−38	−37	−68	−267	−257	−478
8	147	109	212	−16	−43	+16	−378	−559	−368
15	136	171	230	−36	+ 5	+23	−628	−527	−208
22	110	144	206	−74	−42	−19	−1,145	−824	−341

MEASUREMENTS OF THE SOLAR CONSTANT OF RADIATION AT CALAMA, CHILE.

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[Smithsonian Institution, Washington, Feb. 28, 1923.]

In continuation of preceding publications, the following table contains further results for the solar constant of radiation obtained at Montezuma, near Calama, Chile. The values of ρ/ρ_{sc} are given at air mass 2, or if not the air mass is stated. The reader is referred for further statements regarding the arrangement and meaning of the table to the REVIEW for February, August, and September, 1919.

The values given for June 1 and 2 are to be substituted for the value of June 2 in the REVIEW for September, 1922, and those of July 2 and 15 are to be added to those given for July in the same number of the REVIEW.

Readers will note how very low the solar constant values are now running, compared with what they were in the earlier years of observations in South America when the average value of 1.95 prevailed. This, as readers of Volume IV of the *Annals of the Astrophysical Observatory* will recognize, is perhaps to be expected, in view of the minimum of sun spots which now prevails, for all the history of our observing indicates that high solar constant values attend maximum of sunspots and vice versa. On the other hand, as pointed out in Volume IV of the *Annals*, it not infrequently happens that individual sun spots are attended with temporary low values of the solar radiation. This was notably the case in March, 1920, and unpublished observations at Mount Harqua Hala, Ariz., indicate that it was true also for the sun-spot group which began to form about October 17, 1922. It is to be regretted that owing to sickness no observations were had in Chile during the extremely interesting period from October 12 to October 29, 1922, when this phenomenon was reported from Arizona.

I am inclined to attribute this dual association with sun spots to these considerations: (1) High solar constant values prevail at periods of maximum sun spots because the increased solar circulation brings up hotter material to the radiating surface of the sun. (2) Individual sun spots are often accompanied by protruding masses of diminished transparency, and while these protruding shafts point toward the earth they diminish the solar radiation. As the sun rotates such shafts of diminished transparency pass by, and the solar radiation recovers its normal intensity.

Date.	Solar constant.	Method.	Grade.	Transmission coefficient at 0.5 micron.	Humidity. ρ/ρ_{sc}	Humidity. V. P.	Humidity. Relative humidity.	Remarks.
1922.								
P. M.	*cal.*					*cm.*	*Per cent.*	
June 1	1.906	$M_{2.5}$	S.	0.878	[1]0.572	0.24	16	Small cumuli in east.
	1.903	$M_{2.13}$						
2	1.911	$M_{2.32}$	S—	.881	[2].560	.31	20	Distant cumuli over high peaks.
	1.890	$M_{2.18}$						
	1.904	W. M.						
P. M.								
July 2	1.870	$M_{2.44}$	S—	.888	[3].865	.12	19	Cloudless.
	1.894	$M_{2.13}$						
	1.903	$M_{1.89}$						
	1.893	W. M.						
A. M.								
July 15	1.927	$M_{1.60}$	S.	.879	[4].636	.14	7	Small patches of cirri in southeast.
	1.931	$M_{1.56}$						
	1.929	W. M.						
P. M.								
Aug. 1	1.883	$M_{2.6}$	S—	.885	.680	.26	7	Cloudless.
	1.920	$M_{1.61}$						
	1.908	W. M.						
5	1.915	$M_{2.12}$	S—	.886	[5].742	.13	17	Do.
8	1.931	$M_{1.61}$	S—	.886	[6].778	.11	5	Do.
11	1.907	$M_{2.69}$	S—	.888	[7].804	.12	6	Do.
	1.899	$M_{2.42}$						
	1.903	W. M.						
A. M.								
Aug. 12	1.976	E_0	VG+	.875	.747	.08	9	Cloudness.
	1.926	$M_{2.5}$						
	1.934	$M_{2.6}$						
	1.921	$M_{1.5}$						
	1.934	W. M.						
P. M.								
Aug. 19	1.904	$M_{2.10}$	S—	.889	.836	.19	10	Cloudless.
	1.909	$M_{2.6}$						
	1.907	W. M.						
26	1.906	$M_{2.88}$	S—	.885	[8].749	.09	17	Do.
27	1.909	$M_{2.85}$	S—	.884	.737	.16	12	Do.
	1.941	$M_{2.01}$						
	1.920	W. M.						
A. M.								
Aug. 28	1.937	$M_{1.24}$	S—	.879	[9].795	.19	7	Cloudless.
P. M.								
Aug. 30	1.850	$M_{1.74}$	S—	.887	[10].855	.09	5	Cloudless.
	1.902	$M_{1.56}$						
	1.925	$M_{1.32}$						
	1.917	W. M.						
Sept. 15	1.936	$M_{1.57}$	U.	.885	[11].771	.17	8	Do.
16	1.925	$M_{2.5}$	S—	.878	.658	.15	10	Do.
	1.920	$M_{2.10}$						
	1.936	$M_{1.77}$						
	1.927	W. M.						
20	1.934	$M_{2.14}$	S—	.875	[12].622	.20	11	Do.
A. M.								
Sept. 27	1.936	$M_{2.5}$	S.	.878	.674	.14	8	Cloudless.
	1.912	$M_{2.0}$						
	1.911	$M_{2.0}$						
	1.919	W. M.						
28	1.976	$M_{1.20}$	S—	.874	[13].743	.69	13	Cumuli low in east.
P. M.								
Sept. 29	1.908	$M_{1.21}$	S.	.881	.645	.17	9	Scattered cumuli in north and east.
	1.911	$M_{1.55}$						
	1.916	$M_{1.38}$						
	1.912	W. M.						
A. M.								
Oct. 1	1.923	$M_{2.03}$	S.	.874	.550	.39	21	Patches of cumuli low in east.
	1.925	$M_{1.80}$						
	1.924	W. M.						
P. M.								
Oct. 4	1.914	$M_{1.87}$	S—	.880	[14].648	.15	13	Cloudless.
A. M.								
Oct. 5	1.913	$M_{1.81}$	S.	.880	[15].669	.13	12	Cloudless.
	1.913	$M_{1.36}$						
	1.912	$M_{1.39}$						
	1.913	W. M.						
6	1.913	E_0	E.	.871	.642	.33	37	Do.
	1.918	$M_{2.0}$						
	1.922	$M_{1.5}$						
	1.918	W. M.						

[1] Air mass 2.13. [2] Air mass 2.12. [3] Air mass 2.12. [4] Air mass 1.60. [5] Air mass 1.61. [6] Air mass 1.61. [7] Air mass 2.42. [8] Air mass 2.88. [9] Air mass 1.24. [10] Air mass 1.74. [11] Air mass 1.57. [12] Air mass 2.14. [13] Air mass 1.20. [14] Air mass 1.87. [15] Air mass 1.81.

Date.	Solar constant.	Method.	Grade.	Transmission coefficient at 0.5 micron.	Humidity. ρ/ρ_{sc}	Humidity. V. P.	Humidity. Relative humidity.	Remarks.
1922.								
A. M.	*cal.*					*cm.*	*Per cent.*	
Oct. 7	1.936	$M_{1.44}$	S.	0.871	[16]0.648	0.20	7	Cloudless.
	1.945	$M_{1.31}$						
	1.948	$M_{1.21}$						
	1.943	W. M.						
8	1.933	$M_{1.38}$	S.	.879	[17].704	.45	38	Do.
	1.933	$M_{1.35}$						
	1.933	W. M.						
P. M.								
Oct. 10	1.921	$M_{1.5}$	S.	.880	.629	.19	11	Cumuli low in east.
	1.929	$M_{2.0}$						
	1.927	$M_{2.0}$						
	1.926	W. M.						
11	1.902	$M_{1.5}$	S—	.888	.729	.26	9	Do.
	1.912	$M_{2.0}$						
	1.945	$M_{2.0}$						
	1.915	W. M.						
A. M.								
Oct. 12	1.956	E_0	E.	.874	.701	.27	44	Cloudless.
	1.939	$M_{2.5}$						
	1.936	$M_{2.0}$						
	1.944	W. M.						
29	1.987	$M_{1.20}$	S—	.878	.809	.18	11	Do.
P. M.								
Nov. 3	1.904	$M_{1.58}$	S—	.862	[18].615	.29	8	Cumuli low in east.
	1.910	$M_{1.51}$						
	1.936	$M_{1.38}$						
	1.919	W. M.						
4	1.930	$M_{1.73}$	S—	.865	[19].624	.26	6	Cloudless.
	1.940	$M_{1.49}$						
	1.965	$M_{1.35}$						
	1.945	W. M.						
A. M.								
Nov. 6	1.920	E_0	V. G.	.873	.535	.24	47	Cloudless.
	1.899	$M_{2.0}$						
	1.893	$M_{1.5}$						
	1.908	W. M.						
P. M.								
Nov. 10	1.939	$M_{2.49}$	S.	.870	.606	.18	12	Cirri low in east.
	1.940	$M_{1.98}$						
	1.943	$M_{1.26}$						
	1.943	W. M.						
A. M.								
Nov. 14	1.957	$M_{1.18}$	S—	.871	[20].740	.24	7	Cloudless.
P. M.								
Nov. 15	1.933	$M_{2.04}$	S—	.859	.597	.38	16	Cumuli low in east.
	1.912	$M_{1.69}$						
	1.925	$M_{1.52}$						
	1.926	W. M.						
20	1.923	$M_{1.28}$	S—	.874	[21].750	.49	20	Do.
25	1.914	$M_{2.6}$	S.	.868	.562	.28	6	Cirri in east and south
	1.916	$M_{2.0}$						
	1.915	W. M.						
30	1.921	$M_{1.61}$	S—	.880	[22].799	.11	13	Cirri low in east.
	1.925	$M_{1.46}$						
	1.923	W. M.						
Dec. 2	1.917	$M_{1.84}$	S—	.877	[23].780	.11	14	Cloudless.
	1.904	$M_{1.57}$						
	1.911	W. M.						
11	1.906	$M_{2.34}$	S—	.889	[24].471	.29	5	Cumuli in east.
12	1.908	$M_{1.77}$	S—	.855	[25].544	.77	25	Cumuli in east. Cirri forming near sun prevented further observations.
14	1.927	$M_{2.15}$	S.	.870	.535	.37	48	Cumuli low in east.
	1.925	M_2						
	1.926	W. M.						
15	1.860	E_0	V. G.	.890	.498	.42	4	Cumuli low in north and east.
	1.936	$M_{1.51}$						
	1.904	$M_{2.0}$						
	1.893	W. M.						
A. M.								
Dec. 25	1.911	$M_{1.43}$	U.	.859	[26].489	.48	.33	Cirri in north and east

[16] Air mass 1.44. [17] Air mass 1.36. [18] Air mass 1 58. [19] Air mass 1.73. [20] Air mass 1.18. [21] Air mass 1.28. [22] Air mass 1.61. [23] Air mass 1.84. [24] Air mass 2.34. [25] Air mass 1.77. [26] Air mass 1.45.