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SPECIAL OBSERVATIONS.

SOLAR AND SKY RADIATION MEASUREMENTS DURING JUNE, 1920.

By HERBERT H. KIMBALL, Professor of Meteorology.

(Weather Bureau Solar Radiation Investigations Section, Washington, July 29, 1920.)

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.

The monthly means and departures from normal in Table 1 indicate that solar radiation intensities were above normal at all four stations, the excess for air mass 2.0 averaging about 6 per cent.

Table 2 shows an excess in the total radiation received on a horizontal surface at Washington and Madison during the five weeks, May 28 to July 1, inclusive, although at Washington there was a deficiency during the three weeks, June 4 to 24, inclusive. Owing to a broken wire in one of the grids of the callendar pyrheliometer in use at Lincoln it has been necessary to temporarily discontinue the automatic record of solar and sky radiation at that station.

Skylight polarization measurements obtained at Washington on four different days give a maximum of 54 per cent and a mean far the month of 48 per cent. Measurements obtained at Madison on two days give a maximum of 72 per cent and a mean of 70 per cent. These are average values for June for Washington, and above the average for Madison.

TABLE 1.—*Solar radiation intensities during June, 1920.*

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

WASHINGTON, D. C.

Date.	Sun's zenith distance.										
	8 a.m.	77.8°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	77.8°	Noon.
	75th meridian 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.*
June 1	13.13					1.33					11.38
2	13.13				0.92						15.11
7	8.48			1.01	1.16	1.27					7.29
14	15.11					1.41					12.24
24	13.61			0.73	0.91	1.10					11.81
25	12.24					1.34	1.01				10.21
26	9.83		0.69	0.83	1.00						7.87
Means			(0.69)	0.86	1.00	1.29	(1.01)				
Departures			+0.04	+0.10	+0.09	+0.02	+0.02				

TABLE 1.—*Solar radiation intensities during June, 1920*—Contd.

MADISON, WIS.

Date.	Sun's zenith distance.										
	8 a.m.	77.8°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	77.8°	Noon.
	75th meridian 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.*
June 2	11.38						1.22				9.14
3	6.76			1.12	1.25	1.39					6.27
8	10.59			1.06	1.21	1.42	1.13	0.92			9.83
16	17.37				1.09						15.11
18	8.81					1.36					8.48
22	11.38					1.30					9.47
24	11.38					1.18					10.21
28	17.37					1.14					18.59
30	14.10		0.82	0.95	1.10	1.34					13.61
Means			(0.82)	1.04	1.16	1.30	(1.18)	(0.92)			
Departures			−0.05	+0.08	+0.03	±0.00	+0.12	+0.04			

LINCOLN, NEBR.

June 2	8.18					1.46					5.79
5	7.04			1.06	1.25	1.47	1.19	0.98	0.86	0.74	7.57
8	17.37						1.04				17.37
12	12.24			0.84							14.10
21	9.14					1.45					7.04
23	9.14			0.90	1.13	1.43	1.15	0.95	0.82		7.57
Means				0.93	(1.19)	1.45	1.13	(0.96)	(0.84)	(0.74)	
Departures				+0.01	+0.11	+0.09	+0.03	+0.05	+0.07		

SANTA FE, N. MEX.

June 4	6.27			1.06							7.29
14	6.76		1.02	1.08	1.27	1.49					5.36
15	5.56		1.06	1.11	1.34	1.55	1.32	1.16	1.01		2.87
16	4.17		1.04	1.20	1.27	1.60					2.87
17	4.37		1.08								3.45
18	5.56			1.15	*1.31						5.79
21	4.37			1.30	1.39						2.74
24	5.79					1.59					3.63
28	7.87						1.32	1.14			9.83
29	7.29		1.05	1.14	1.26						7.04
Means			1.05	1.15	1.31	1.56	(1.32)	(1.15)	(1.01)		
Departures			+0.10	+0.09	+0.08	+0.10	±0.00	−0.01	±0.00		

* Extrapolated.

TABLE 2.—*Total radiation received on a horizontal surface from the sun and sky.*

Week beginning—	Average daily radiation.		Average daily departure for the week.		Excess or deficiency since first of year.	
	Washington.	Madison.	Washington.	Madison.	Washington.	Madison.
	Cal.	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*
May 28	673	566	179	77	1,321	182
June 4	454	582	—44	79	1,012	734
11	463	480	—50	—38	665	465
18	446	548	—77	17	126	571
25	620	519	96	—21	801	426

SOLAR RADIATION INTENSITIES IN THE PACIFIC COAST STATES.

By HERBERT H. KIMBALL, Professor of Meteorology.

[Weather Bureau, Washington, D. C., July 26, 1920.]

In the REVIEW for November, 1919, **47**:775, an approximate estimate was made of radiation intensities in the Pacific Coast States, based on the intensities measured at Washington and the difference in surface vapor pressures in the two regions.

A recent trip through California and Oregon afforded an opportunity to measure intensities on the Pacific coast at La Jolla, Calif., and at several interior points the coordinates of which are as follows:

Station.	Latitude.	Longitude.	Elevation above sea level.	
	° ′	° ′	*Feet.*	*Meters.*
La Jolla, Calif.	32 50 N.	117 15 W.	100	30
Pomona, Calif.	34 03 N.	117 45 W.	870	265
Fresno, Calif.	36 43 N.	119 49 W.	360	110
Red Bluff, Calif.	40 10 N.	122 15 W.	360	110
Medford, Oreg.	42 20 N.	122 49 W.	1,425	468

The measurements were made with Smithsonian silver disk pyrheliometer No. 1, usually from the roof of the hotel at which I happened to be stopping; but at Fresno and also at Red Bluff, Calif., the instrument was exposed on the roof of the building in which the Weather Bureau office is located.

Table 1 gives a summary of the pyrheliometric measurements. Table 2 gives the surface vapor pressure at the Weather Bureau station nearest to the point of observation, on days when pyrheliometric measurements were obtained. San Diego observations undoubtedly represent sufficiently well the hygrometric conditions at La Jolla, which is only about 16 miles distant along the coast. Those for Los Angeles may not approximate so closely the conditions at Pomona, which is farther inland, and presumably drier. In February, however, the difference between the two stations probably is not great.

Comparing the data of Tables 1 and 2 with corresponding data for February and March given in the REVIEW for April, 1920, page 226, Table 1, it will be seen that while vapor pressures are markedly higher than at Washington, Madison, and Lincoln, the radiation intensities are considerably higher than corresponding normal values for Washington, slightly higher than for Lincoln, and slightly lower than the Madison normals. Furthermore, the intensities show much less change from day to day and from place to place notwithstanding considerable changes in elevation, than do measurements at the stations east of the Rocky Mountains. Apparently, therefore, solar radiation intensities on the coast of southern California, as well as in the interior valleys of California and southern Oregon, are comparable with intensities in the Central and Southern Plains States, at least in the late winter and early spring months.

TABLE 1.—*Solar radiation intensity measurements in California and Oregon during February–April, 1920.*

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

POMONA, CALIF.

Date.	Sun's zenith distance.										
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°	80.7°
	Air mass.										
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Feb. 26a	1.59	1.45	1.33	1.23	1.13	1.05	0.98	0.91	0.85	0.80	.....
26p	.....	1.43	1.21	1.03	0.90	0.80	0.72	0.67	.....	.....	.....
28a	.....	1.37	.....	.....	.....	.....	.....	.....	.....	.....	.....

LA JOLLA, CALIF.

Mar. 2p	1.55	1.41	1.29	1.18	1.10	1.03	0.96	0.91	.....	.....	.....
3p	1.51	1.41	1.32	1.24	1.17	1.10	1.04	0.98	.....	.....	.....
4 a. m.	1.56	1.45	1.34	1.25	1.16	1.08	1.02	0.96	.....	.....	.....
4 p. m.	.....	1.45	1.34	1.25	1.16	1.08	1.02	0.96	0.90	0.86	0.81

FRESNO, CALIF.

Mar. 14a	1.52	1.42	1.34	1.26	1.18	1.11	1.05	0.98	0.91	0.85	.....
14p	1.52	1.42	1.33	1.24	1.15	1.07	1.00	0.93	0.87	0.82	.....

RED BLUFF, CALIF.

Mar. 23a	1.50	1.41	1.32	1.23	1.15	1.07	.....	.....	.....	.....	.....
25a	.....	1.40	.....	.....	.....	.....	.....	.....	.....	.....	.....

MEDFORD, OREG.

Mar. 28a	1.55	1.42	1.31	1.21	1.12	1.05	0.98	.....	.....	.....	.....
29a	.....	.....	1.15	.....	.....	.....	.....	.....	.....	.....	.....
29p	1.47	1.37	1.27	1.18	1.10	1.02	0.96	0.91	0.86	0.82	.....
30a	.....	.....	.....	.....	0.90	.....	.....	.....	.....	.....	.....
Apr. 5p	.....	1.40	.....	1.22	1.14	.....	.....	.....	.....	.....	.....
Means	1.53	1.42	1.29	1.21	1.11	1.04	0.97	0.91	0.88	0.83	.....

TABLE 2.—*Surface-water vapor pressures.*

Station.	Date, 1920.	Time (120th meridian).		
		5 a. m.	Noon.	5 p. m.
		mm.	*mm.*	*mm.*
Los Angeles, Calif.	Feb. 26	7.04	5.56	7.57
	Feb. 28	7.04	9.14	8.81
San Diego, Calif.	Mar. 2	.....	8.81	8.48
	Mar. 3	7.87	8.18	7.87
	Mar. 4	6.27	8.18	9.14
Fresno, Calif.	Mar. 14	5.16	4.75	3.99
Red Bluff, Calif.	Mar. 23	6.27	6.76	5.16
	Mar. 24	6.76	4.75	5.36
Medford, Oreg.	Mar. 28	6.02	.....	.....
	Mar. 29	4.95	.....	5.56
	Mar. 30	3.99	.....	.....
	Apr. 5	.....	.....	6.50