SECTION 1.—AEROLOGY.

SOLAR AND SKY RADIATION MEASUREMENTS DURING JULY, 1918.

By HERBERT H. KIMBALL, Professor of Meteorology.

[Dated: Weather Bureau, Washington, D. C., Aug. 31, 1918.]

For a description of instrumental exposures, and an account of the methods of obtaining and reducing the measurements, the reader is referred to the REVIEW for January, 1918, **46:2.**

The monthly means and departures from normal values given in Table 1 show that direct solar radiation averaged above normal at Madison, Wis., and slightly below normal at Washington, D. C., and Santa Fe, N. Mex., although at Washington the p. m. measurements averaged slightly above normal. At Lincoln, Nebr., due to a change in observers, but few measurements were obtained.

Table 3 shows a deficiency for the month at Lincoln of about 4.7 per cent, and only unimportant departures at Washington and Madison.

Skylight polarization measurements obtained on 5 days at Washington give a mean of 56 per cent with a maximum of 64 per cent on the 2d. Measurements on 10 days at Madison, Wis., give a mean of 65 per cent, with a maximum of 72 per cent on the 1st. These measurements are considerably above the July average for the respective stations.

TABLE 1.—*Solar radiation intensities during July, 1918.*

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

Washington, D. C.

Date.	Sun's zenith distance. 0.°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass. 1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
1918. A. M.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 1	1.38									
2	1.42	1.28	1.05	0.90	0.76	0.66				
3		0.99	0.89	0.79	0.65	0.55				
6		0.93								
8					0.90					
9	1.33	1.22	1.08	0.96	0.83	0.75	0.68	0.62		
15		1.12	1.01	0.90	0.81					
16	1.08	1.03	0.93	0.82	0.73	0.66				
20		0.88								
23			0.92							
24	1.18		0.85	0.78						
25		0.96	0.68	0.61						
Monthly means	1.28	1.05	0.93	0.82	0.78	0.66	(0.68)	(0.62)		
Departure from 10-year normal	+0.02	−0.06	−0.04	−0.07	−0.07	−0.08	−0.02	−0.07		
P. M.										
July 1		1.20	1.08	0.96	0.87	0.79	0.71			
2		1.25	1.13	1.04	0.97	0.88	0.79			
15			1.01	0.90						
Monthly means		(1.22)	1.07	0.97	(0.92)	(0.84)	(0.75)			
Departure from 10-year normal		+0.15	+0.05	+0.07	+0.09	+0.05	±0.00			

TABLE 1.—*Solar radiation intensities during July, 1918*—Continued.

Madison, Wis.

Date.	Sun's zenith distance. 0.°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass. 1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
1918. A. M.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 1	1.45	1.34	1.26	1.18	1.10	1.02	0.96	0.89		
5	1.35									
6	1.32									
8	1.43									
10	1.40	1.27	1.15	1.08	0.99	0.91				
11	1.37				0.89					
12			1.14	1.04	0.95	0.86		0.77		
18		1.25	1.16	1.09	1.02	0.96	0.91			
19	1.28									
27	1.32	1.16			0.95					
29		1.30	1.21	1.13	1.04	0.96	0.89			
30	1.45	1.35		1.17	1.10	1.04	0.98			
31		1.33					0.97			
Monthly means	1.37	1.29	1.18	1.12	1.00	0.96	0.94	(0.83)		
Departure from 9-year normal	+0.12	+0.17	+0.16	+0.17	+0.07	+0.05	+0.07			
P. M.										
July 2		1.21								
5		1.16								
8		1.31								
19		1.02								
Monthly means		1.18								
Departure from 9-year normal		+0.07								

Lincoln, Nebr.

1918. A. M.										
July 1	1.43									
11	1.36									
19		1.13	1.01	0.95	0.85					
24							0.92			
31			1.09	1.04						
Monthly means	(1.40)	(1.13)	(1.05)	(1.00)	(0.85)		(0.92)			
Departure from 4-year normal	+0.06	−0.07	−0.05	−0.02	−0.06		+0.11			
P. M.										
July 1		1.20	1.07	0.97	0.88	0.79	0.72			
2		1.08	0.97	0.88	0.79	0.71				
11		1.12								
19				1.00	0.94	0.88				
Monthly means		1.13	(1.02)	0.95	0.87	0.79	(0.72)			
Departure from 4-year normal		−0.07	−0.06	−0.03	−0.04	−0.05	−0.05			

Santa Fe, N. Mex.

1918. A. M.										
July 9	1.40									
10		1.22	1.21	1.10	1.05	1.00				
11	1.36	1.25								
12		1.22								
13	1.43									
16	1.44	1.35	1.25	1.17	1.09					
17	1.45	1.33	1.25	1.18	1.12	1.06				
18	1.42	1.29	1.16	1.04						
19	1.43	1.27	1.18	1.09	1.01	0.95	0.91	0.85		
22	1.43		1.18							
23		1.32								
24			1.19							
25		1.23	1.11				0.81	0.75		
26	1.40		1.16							
29		1.29	1.18	1.07	0.91					
30		1.28	1.19	1.10	1.08		0.93			
31	1.39	1.25	1.12	1.05	0.97	0.91	0.85	0.79	0.74	
Monthly means	1.42	1.28	1.18	1.10	1.03	0.98	0.88	0.80	(0.74)	
Departure from 6-year normal	±0.00	−0.02	−0.03	−0.05	−0.05	−0.06	−0.08	−0.06		
P. M.										
July 23		1.26								
Monthly means		(1.26)								

TABLE 2.—*Vapor pressures at pyrheliometric stations on days when solar radiation intensities were measured.*

Washington, D. C.			Madison, Wis.			Lincoln, Nebr.			Santa Fe, N. Mex.		
Date.	8 a.m.	8 p.m.	Date.	8 a.m.	8 p.m.	Date.	8 a.m.	8 pm..	Date.	8 a.m.	8 p.m.
1918.	*mm.*	*mm.*	1918.	*mm.*	*mm.*	1918.	*mm.*	*mm.*	1918.	*mm.*	*mm.*
July 1	11.38	9.47	July 1	8.81	9.14	July 1	9.83	9.14	July 9	9.14	7.04
2	7.04	7.04	2	11.38	12.24	2	13.13	13.13	10	7.29	7.04
3	9.83	10.59	5	14.10	14.10	11	6.76	8.48	11	8.48	7.29
6	15.11	12.68	6	9.83	6.76	19	13.13	10.59	12	8.48	6.50
8	9.47	10.21	8	6.27	11.81	24	15.11	17.37	13	8.48	7.04
9	7.29	9.47	10	9.47	9.47	31	12.68	11.81	16	9.14	7.29
15	12.68	14.10	11	10.21	9.14	.....	.....	.....	17	6.27	4.75
16	15.11	14.60	12	10.21	9.14	.....	.....	.....	18	8.18	9.14
20	15.11	16.20	18	11.38	11.38	.....	.....	.....	19	9.14	10.97
23	16.79	16.79	19	13.13	14.60	.....	.....	.....	22	9.14	10.59
24	16.20	16.68	27	15.11	13.61	.....	.....	.....	23	9.14	7.57
25	17.96	14.60	29	11.81	10.21	.....	.....	.....	24	7.29	7.57
.....	.....	.....	30	7.57	7.57	.....	.....	.....	25	9.14	6.27
.....	.....	.....	31	7.04	7.57	.....	.....	.....	26	6.02	9.47
.....	.....	.....	.....	.....	.....	.....	.....	.....	29	8.48	8.48
.....	.....	.....	.....	.....	.....	.....	.....	.....	30	9.14	7.29
.....	.....	.....	.....	.....	.....	.....	.....	.....	31	8.81	9.14

TABLE 3.—*Daily totals and departures of solar and sky radiation during July, 1918.*

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily totals.			Departures from normal.			Excess or deficiency since first of month.		
	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 1	690	626	767	181	80	187	181	80	187
2	730	645	742	222	100	162	403	180	349
3	643	322	681	136	−222	101	539	− 42	450
4	622	538	310	116	− 5	−270	655	− 47	180
5	306	666	474	−199	124	−106	456	77	74
6	608	673	322	103	133	−257	559	210	− 183
7	436	673	165	− 68	134	−413	491	344	− 596
8	393	737	708	−110	200	131	381	544	− 465
9	568	354	347	65	−182	−229	446	362	− 694
10	451	674	524	− 51	140	− 51	395	502	− 745
11	500	654	696	− 1	121	122	394	623	− 623
12	376	655	494	−125	124	− 79	269	747	− 702
13	338	407	420	−162	−123	−172	107	624	− 874
14	678	283	379	179	−245	−192	286	379	−1,066
15	653	85	395	154	−442	−175	440	− 63	−1,241
16	600	385	387	102	−139	−181	542	−202	−1,422
17	262	492	151	−235	− 29	−415	307	−231	−1,837
18	586	685	711	89	167	147	396	− 64	−1,690
19	354	596	695	−142	81	133	254	17	−1,557
20	557	616	710	62	104	150	316	121	−1,407
Decade departure							− 79	−381	− 662
21	618	597	634	124	88	76	440	209	−1,331
22	567	528	427	74	22	−129	514	231	−1,460
23	538	271	452	46	−232	−102	560	− 1	−1,562
24	485	253	709	− 6	−247	157	554	−248	−1,405
25	449	529	564	− 41	32	14	513	−216	−1,391
26	497	407	653	8	− 87	105	521	−303	−1,286
27	538	637	676	50	146	130	571	−157	−1,156
28	285	300	558	−202	−188	14	369	−345	−1,142
29	386	575	737	−100	90	195	269	−255	− 947
30	231	679	636	−254	197	96	15	− 58	− 851
31	129	645	562	−355	166	24	−340	108	− 827
Decade departure							−656	− 13	+ 580
Excess or deficiency since first of year						gr.-cal.	−932	+786	+ 672
						per cent.	−1.2	+1.0	+ 0.7

ABSORPTION AND RADIATION OF THE SOLAR ATMOSPHERE.[1]

By S. HIRAYAMA.

[*Reprinted from* Science Abstracts, Sect. A, June 29, 1918, §632.]

Computations of the transmission and radiation of the solar atmosphere by Schuster's method, using the recent measurements at the Smithsonian Astrophysical Observatory, are compared with the results given by Biscoe from the same material, but neglecting the effect of radiation of the solar atmosphere. The tables of residuals indicate that the observations are better represented than in Biscoe's table. The coefficient of transmission increases gradually with the wave length. The radiation due to the solar atmosphere is also tabulated; it is about one-third of the whole radiation for short wave lengths, and approaches to one-half as the wave length increases. Assuming the effective temperature of the sun to be 6,000° A., the temperature of the photosphere is calculated to be about 7,040° A., and that of the absorbing layer about 5,210° A.—*C. P. B[utler]*.

[1] Proc. Math. Phys. Soc., Tokyo, February, 1918, 9:236-240.

INTERNAL TEMPERATURES OF THE SUN.[1]

By A. VÉRONNET.

[*Reprinted from* Science Abstracts, Sect. A, June 29, 1918, §633.]

An investigation is made of the law of densities operating on a gaseous mass of similar nature and at the temperature of the sun, 6,000° A. The variation found would be about 22° per kilometer, indicating that at a certain depth a pressure of 11,000 atmospheres, and a maximum temperature of 60,000° A. would combine to confer on any gaseous masses the potentiality of explosive expansion which when released might produce the surface phenomena with which we are familiar.—*C. P. B[utler]*.

HALO PHENOMENA OBSERVED DURING JULY, 1918.

By WILLIS RAY GREGG, Meteorologist.

[Dated: Aerological Division, Weather Bureau, Aug. 28, 1918.]

During recent years several brief studies of halos in relation to weather[2] have appeared in the MONTHLY WEATHER REVIEW, and, in addition, there have been published from time to time detailed descriptions, with sketches, of occurrences of the more unusual forms. There has been, however, no systematic observation and recording of halos in such manner as to render them readily susceptible of summarization and intercomparison, without considerable labor on the part of the investigator. Moreover, comparatively few exact readings of angular measurements have been made, and, as pointed out by Besson,[3] these measurements are of the utmost importance, particularly in the case of the circumhorizontal arc, tangent arcs of the 22° halo, and other rare forms.

The recent establishment of several aerological stations, well distributed with respect to latitude, longitude, and average cyclonic tracks, makes feasible the inauguration of a statistical study of these optical phenomena, not only with a view to determining the relative frequency of the various forms at different latitudes and by months and seasons and their relation to pressure distribution and precipitation, but also with the hope of adding to our knowledge concerning their angular measurements, distances from the sun or moon, etc. These stations are equipped with theodolites and smoked glasses and are located in country districts, where conditions for observation of this kind are at their best; moreover, the work of obtaining free air records is necessarily conducted in the open, thereby making it easy for observers to keep on the lookout for such phenomena. Accord-

[1] Comptes Rendus, Paris, Jan. 21, 1918, 166:109-111.

[2] See "Selected Bibliography" at end of paper on "Further Study of Halos in Relation to Weather," by Howard H. Martin, MONTHLY WEATHER REVIEW, Mar., 1918, 46:120.

[3] Different Forms of Halos and their Observation, MONTHLY WEATHER REVIEW July 1914, 42:436-440.