SOLAR RADIATION AND SUNSPOT DATA FOR SEPTEMBER 1944

[Solar Radiation Investigations Section, I. F. Hand, in charge]

SOLAR RADIATION OBSERVATIONS

EXPLANATIONS of the tables and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the January 1944 REVIEW, page 43. A list of the pyrheliometric stations also is given on page 45 of the same REVIEW.

Beginning with this issue, values of illumination received on a horizontal surface in Boston will be included at the end of table 2. The spectral response of the receiver is very close to the visibility curve, which includes that portion between 0.3μ and 0.74μ. A modified photronic cell is used as the receiver. A slightly raised disk of milk glass not only diffuses the illumination, but also largely compensates for the partial failure of the cosine law. Owing to peculiarities of the functioning of the photronic cell under varying meteorological conditions, we do not believe that the values of illumination are as consistent as those of total solar and sky radiation. Nevertheless, they probably are sufficiently accurate for most practical purposes.

Values of normal-incidence radiation received at the Federal Building in Boston also appear for the first time in this issue. A Clark vacuum pyrheliometer in conjunction with an eye-read potentiometer is used for these measurements. Owing to the smoke pall which hangs over Boston during much of the time in the colder months, comparative readings made simultaneously in Boston and at Blue Hill Observatory, 10 miles to the south, should furnish excellent information relative to the depleting effect of city contamination. The percentage loss owing to this vitiation is indicated at the bottom of the Boston table in table 1.

TABLE 1.—*Solar radiation intensities during September 1944*

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

MADISON, WIS.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.				*1.0	P. M.				
	e	5.0	4.0	3.0	2.0		2.0	3.0	4.0	5.0	e
	mb.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*
Sept. 2	17.7	0.52	0.69	0.80	0.99	1.12	------	------	------	------	19.6
Sept. 4	17.0	.70	.80	.88	1.04	1.26	------	------	------	------	17.0
Sept. 7	9.8	.66	.79	.92	1.08	1.30	------	------	------	------	8.7
Sept. 8	8.4	.65	.75	.81	1.10	1.27	------	------	------	------	20.4
Sept. 15	13.2	------	------	------	.77	1.06	------	------	------	------	13.7
Sept. 20	19.0	------	------	------	.80	------	------	------	------	------	21.8
Sept. 21	15.8	.80	.92	1.10	1.21	1.44	------	------	------	------	11.4
Sept. 22	9.8	.81	.92	1.02	1.22	------	------	------	------	------	9.4
Sept. 25	11.0	------	------	------	1.06	1.35	------	------	------	------	12.7
Sept. 26	12.7	.49	.61	.69	.83	1.32	------	------	------	------	15.3
Sept. 27	15.8	.32	.42	.60	.83	1.16	------	------	------	------	20.4
Means	------	.62	.74	.85	.99	1.25	------	------	------	------	------
Departures	------	−.11	−.13	−.15	−.15	−.13	------	------	------	------	------

TABLE 1.—*Solar radiation intensities during September 1944*—Con.

LINCOLN, NEBR.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.				*1.0	P. M.				
	e	5.0	4.0	3.0	2.0		2.0	3.0	4.0	5.0	e
	mb.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*
Sept. 1	12.3	------	------	0.90	1.09	1.41	------	------	------	------	16.4
Sept. 2	15.8	------	0.67	.84	1.01	1.27	0.94	0.71	0.56	0.43	18.3
Sept. 4	14.6	------	------	.94	1.11	1.35	------	------	------	------	16.4
Sept. 6	11.8	------	------	------	------	1.36	1.19	.97	.77	.67	9.8
Sept. 7	9.8	------	------	------	------	1.28	.97	.77	.62	.50	9.8
Sept. 8	11.8	------	------	------	------	1.31	.99	.79	.67	.56	14.6
Sept. 11	11.0	------	------	.72	.94	------	------	------	------	------	11.8
Sept. 14	15.3	------	------	------	------	1.44	.99	.77	.60	.47	14.2
Sept. 15	16.4	------	.64	.79	.97	1.24	.99	------	------	------	18.3
Sept. 16	16.9	------	------	------	------	1.37	1.06	.77	.64	.54	19.0
Sept. 19	16.9	------	------	------	.86	1.25	------	------	------	------	21.1
Sept. 21	13.7	0.90	.99	1.10	1.27	1.50	1.23	1.06	.92	.82	11.4
Sept. 28	11.0	------	------	------	------	1.45	1.27	1.11	.96	.85	10.6
Sept. 29	7.8	------	------	------	1.22	1.51	1.25	1.06	.92	.81	9.1
Means	------	(.90)	.77	.88	1.06	1.37	1.09	.89	.74	.63	------
Departures	------	+.16	−.07	−.09	−.08	−.05	−.06	−.08	−.09	−.09	------

ALBUQUERQUE, N. MEX.

Sept. 1	6.3	0.61	0.71	0.82	0.98	------	------	------	------	------	6.3
Sept. 2	6.8	.77	.86	.99	1.14	------	------	------	------	------	8.2
Sept. 3	5.8	.71	.84	.91	1.13	1.48	------	------	------	------	8.2
Sept. 4	8.8	------	------	------	------	------	1.22	------	------	------	10.2
Sept. 5	9.1	------	------	------	1.11	1.46	1.14	------	------	------	7.9
Sept. 6	7.9	------	------	------	1.18	1.46	1.28	1.16	1.11	1.04	6.8
Sept. 7	6.8	------	------	------	1.22	1.47	1.20	1.13	1.06	1.02	7.6
Sept. 8	5.4	------	------	------	1.22	1.44	1.30	1.20	1.14	1.07	7.6
Sept. 9	7.0	------	------	------	------	------	1.18	1.10	1.01	.92	7.9
Sept. 11	6.5	.73	.84	.98	1.16	1.41	1.28	1.18	1.14	1.08	7.9
Sept. 12	6.3	------	------	------	1.18	1.40	1.25	1.14	------	.95	8.8
Sept. 13	7.0	------	------	------	1.07	1.45	1.28	1.16	1.10	.99	7.3
Sept. 14	6.0	------	------	------	1.13	1.46	1.27	------	------	------	6.8
Sept. 17	9.8	.80	.92	1.01	1.15	1.52	------	1.16	1.13	1.07	11.0
Sept. 18	7.9	.77	.88	1.03	1.16	1.46	1.27	1.17	1.13	1.09	9.5
Sept. 19	6.5	.96	.99	1.12	1.25	1.56	1.34	1.26	1.24	1.18	8.8
Sept. 20	5.6	1.00	1.08	1.16	1.32	1.65	1.39	1.32	1.24	1.20	6.8
Sept. 21	4.8	.90	.97	1.10	1.25	------	------	------	------	------	6.8
Sept. 22	7.3	.65	.89	1.04	1.16	1.58	------	------	------	------	9.8
Means	------	.79	.90	1.02	1.16	1.49	1.27	1.18	1.13	1.06	------
Departures	------	−.05	−.06	−.06	−.06	+.01	.00	+.07	+.12	+.13	------

BLUE HILL, MASS.

Sept. 2	25.0	------	------	------	------	------	------	------	0.58	------	21.1
Sept. 4	13.2	------	0.72	0.93	1.10	------	------	------	------	------	15.9
Sept. 7	21.1	------	------	------	------	------	------	0.90	------	0.77	16.4
Sept. 8	8.4	0.84	------	------	------	------	------	------	------	------	11.4
Sept. 10	12.7	------	.77	.92	1.14	------	1.07	.86	.74	.66	11.4
Sept. 11	13.2	.73	.85	.98	1.15	------	.87	.67	.54	.44	12.3
Sept. 15	21.1	------	------	------	------	------	------	------	.62	.48	19.0
Sept. 16	17.0	.50	.57	.66	.83	------	------	------	------	------	17.0
Sept. 17	18.3	.61	.71	.89	------	1.31	------	------	------	------	17.0
Sept. 22	11.8	.93	1.02	1.12	1.26	------	1.23	------	.92	------	10.2
Sept. 23	9.1	------	.98	------	1.29	1.51	1.31	------	------	.92	6.6
Sept. 24	5.8	------	------	------	------	1.54	1.31	1.21	1.10	1.01	6.9
Sept. 25	6.1	.97	1.07	1.18	------	------	------	1.02	.94	.84	7.8
Sept. 29	11.0	------	------	------	1.32	1.52	1.31	1.14	1.06	.96	9.4
Sept. 30	8.7	.91	1.01	1.08	1.31	1.54	------	------	------	------	8.4
Means	------	.79	.86	.97	1.18	1.48	1.18	.97	.81	.76	------
Departures	------	.00	−.03	−.03	+.04	+.11	+.05	+.03	+.01	+.09	------

*Extrapolated.

TABLE 1.—*Solar radiation intensities during September 1944*—Con.

BOSTON, MASS.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.				*1.0	P. M.				
	e	5.0	4.0	3.0	2.0		2.0	3.0	4.0	5.0	e
	mb.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*
Sept. 4	14.2	------	------	0.87	1.05	1.27	------	------	------	------	14.8
Sept. 8	9.1	------	------	1.06	------	------	------	------	------	------	11.4
Sept. 11	12.3	------	------	------	------	1.12	------	------	------	------	13.7
Sept. 15	19.0	------	------	1.01	1.18	1.36	------	------	------	------	22.6
Sept. 16	18.3	------	------	.61	.68	------	------	------	------	------	17.7
Sept. 22	12.3	------	------	1.01	1.27	------	------	------	------	------	10.2
Sept. 25	8.4	------	------	------	------	1.12	------	------	------	------	9.8
Sept. 27	12.3	------	------	.62	.79	------	------	------	------	------	15.3
Sept. 29	11.0	------	------	1.12	1.25	1.56	------	------	------	------	11.4
Sept. 30	8.4	------	------	.98	1.27	1.55	------	------	------	------	12.3
Means	------	------	------	.91	1.07	1.33	------	------	------	------	------
Ratio, Boston-Blue Hill on comparable dates											
	------	------	------	.92	.95	------	------	------	------	------	------

TABLE 1.—*Solar radiation intensities during September 1944*—Con.

LATE DATA

BOSTON, MASS.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.				°1.0	P. M.				
	e	5.0	4.0	3.0	2.0		2.0	3,0	4.0	5.0	e
	mb.	*cal.*	*ca.l*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*
Aug. 1	19.0	------	------	0.66	0.87	------	------	------	------	------	18.3
Aug. 4	22.6	------	0.53	.66	.87	------	------	------	------	------	24.2
Aug. 5	24.2	------	------	------	.50	------	------	------	------	------	23.4
Aug. 8	14.8	------	------	------	1.16	1.40	------	------	------	------	16.4
Aug. 9	14.2	------	.74	.92	1.08	1.41	------	------	------	------	14.2
Aug. 11	19.0	------	.44	.56	.76	.98	------	------	------	------	19.0
Aug. 14	27.7	------	------	------	.48	------	------	------	------	------	23.4
Aug. 15	25.0	------	------	------	.64	------	------	------	------	------	21.1
Aug. 17	25.0	------	------	------	.65	------	------	------	------	------	25.0
Aug. 19	11.0	------	------	------	1.03	1.40	------	------	------	------	11.4
Aug. 23	12.7	------	------	.97	------	------	------	------	------	------	9.1
Aug. 25	11.4	------	------	------	1.00	1.33	------	------	------	------	10.6
Aug. 26	10.2	------	------	.88	1.10	1.44	------	------	------	------	14.2
Aug. 28	12.3	------	------	.94	.96	------	------	------	------	------	13.7
Aug. 30	14.2	------	------	.82	------	------	------	------	------	------	14.8
Aug. 31	15.3	------	------	.97	1.09	1.33	------	------	------	------	14.8
Means	------	------	(.57)	.82	.87	1.33	------	------	------	------	------
Ratio, Boston-Blue Hill on comparable dates											
	------	------	.79	.91	.88	------	------	------	------	------	------

TABLE 2.—*Daily totals and weekly means of solar radiation (direct + diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Date	Washington, D. C.	Madison, Wis.	Lincoln, Nebr.	East Lansing, Mich.	New York, N. Y.	Fresno, Calif.	Fairbanks, Alaska	Columbia, Mo.	Boston, Mass.	Nashville, Tenn.	Twin Falls, Idaho	La Jolla, Calif.	Riverside, Calif.	Blue Hill, Mass.	Ithaca, N. Y.	Newport, R. I.	State College, Pa.	Put-in-Bay, Ohio	East Wareham, Mass.	Davis, Calif.	Boulder, Colo.	Tooele, Utah	Illumination—Boston, Mass.
1944	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*Avg. ft. candles*
Sept. 3	456	484	547	417	480	579	196	------	429	485	526	556	514	477	525	430	396	514	441	584	567	676	3,872
Sept. 4	403	531	465	402	241	570	264	------	381	478	532	304	559	422	228	371	255	453	440	573	559	654	3,574
Sept. 5	501	453	270	299	374	566	162	443	108	441	526	240	561	182	205	246	271	337	365	572	525	652	1,345
Sept. 6	487	410	575	157	434	551	160	597	77	186	524	322	539	137	423	296	407	252	166	567	567	652	1,066
Sept. 7	497	546	441	394	533	537	136	590	345	462	514	499	516	372	428	475	466	513	484	554	539	634	3,190
Sept. 8	446	515	530	433	389	537	175	544	451	562	489	487	537	451	105	469	240	564	514	554	453	636	4,087
Sept. 9	475	340	333	466	177	536	317	495	247	544	499	328	541	293	224	426	250	545	453	551	410	640	2,626
Mean	466	468	452	367	376	554	201	534	291	451	516	391	538	333	305	387	326	454	409	565	517	649	2,823
Departure	+75	+92	+11	+33	+12	−7	−10	------	------	+85	+7	−101	+51	−35	−74	−33	−49	+52	+27	−13	------	------	------
Sept. 10	420	398	413	428	511	548	250	486	486	476	500	301	464	485	519	416	487	514	552	488	442	641	4,308
Sept. 11	259	207	424	354	474	507	(140)	140	423	107	495	385	456	452	496	504	518	332	524	487	555	635	3,852
Sept. 12	80	69	256	59	72	513	145	365	179	168	451	176	458	196	123	261	45	101	304	518	549	615	2,021
Sept. 13	135	149	349	228	56	566	70	242	59	467	472	115	356	111	112	94	88	466	130	506	469	588	790
Sept. 14	89	117	500	217	68	543	230	415	186	408	504	135	418	142	131	243	117	310	279	529	328	592	1,980
Sept. 15	434	414	490	238	328	532	302	521	468	446	493	186	440	287	253	------	350	408	------	558	379	653	4,319
Sept. 16	463	225	441	392	342	534	232	353	416	484	331	208	508	427	348	405	364	459	------	423	538	595	3,885
Mean	268	226	411	274	265	535	205	360	317	365	464	215	443	300	283	321	281	370	358	501	466	617	3,022
Departure	−110	−116	−7	−30	−94	+6	−1	------	------	+16	−10	−241	−14	−71	−65	−68	−97	−16	−6	−43	------	------	------
Sept. 17	366	436	396	247	340	550	86	412	436	435	195	72	451	451	472	477	337	441	------	558	519	454	3,943
Sept. 18	102	446	105	346	163	549	68	454	97	414	489	433	514	115	405	251	74	403	------	541	490	329	1,029
Sept. 19	126	124	378	346	41	525	63	422	186	359	484	522	575	230	156	182	111	404	------	513	493	581	1,875
Sept. 20	243	412	419	218	124	321	202	456	104	381	478	------	522	124	383	158	190	315	------	503	526	598	1,200
Sept. 21	274	509	510	365	82	531	212	492	185	386	413	528	527	169	298	153	324	467	------	518	463	562	1,870
Sept. 22	366	349	280	272	369	518	105	488	402	525	457	520	570	443	372	403	295	297	------	524	479	552	3,463
Sept. 23	376	100	138	310	482	504	6	150	460	426	448	431	544	488	462	448	435	341	------	459	460	539	3,618
Mean	264	339	318	301	229	500	106	410	267	418	423	418	529	288	364	260	252	381	------	517	490	516	2,428
Departure	−106	−13	−88	−12	−105	+11	−57	------	------	+79	−13	0	+53	−71	−12	−99	−123	+14	------	+1	------	------	------
Sept. 24	406	244	479	402	492	506	32	403	428	447	445	350	514	440	496	377	493	376	453	496	412	531	3,431
Sept. 25	175	453	393	340	364	484	76	413	417	459	440	243	494	444	358	460	400	453	503	511	296	527	3,320
Sept. 26	426	373	332	314	344	490	65	403	332	228	436	164	493	378	285	375	407	417	391	511	417	520	2,825
Sept. 27	310	362	191	306	296	478	206	99	351	278	426	433	457	349	80	316	385	353	357	467	423	512	2,912
Sept. 28	197	205	439	61	156	460	17	28	90	192	410	415	397	112	345	269	94	61	305	438	399	500	1,007
Sept. 29	74	278	464	358	476	463	33	131	417	65	294	394	299	443	213	407	497	430	441	396	277	188	3,395
Sept. 30	41	364	77	351	113	475	111	257	418	86	136	283	222	456	471	372	141	292	478	474	302	52	3,382
Mean	232	326	340	304	320	479	77	248	350	251	370	326	411	375	321	368	346	340	418	470	361	404	2,896
Departure	−116	+27	−21	−12	+6	+28	−55	------	------	−77	−64	−48	−33	+26	−7	+15	+12	−13	+70	−15	------	------	------
ACCUMULATED DEPARTURES ON SEPT. 30, 1944																							
	−3,798	−1,596	−8,817	------	−4,941	+4,699	------	------	------	+3,367	------	−6,680	------	+1,068	------	−4,397	−1,364	+1,362	+2,609	−1,411	------	------	------