SOLAR RADIATION DATA FOR NOVEMBER 1948

[Solar Radiation Investigation Section, I. F. HAND, in Charge]

Explanation of Tables 1 and 2 and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the MONTHLY WEATHER REVIEW, vol. 72, No. 1, January 1944, p. 43. A list of pyrheliometric stations is given on page 45 of that issue. An explanation of the formula used in computing the air mass values for each station listed in Table 1 appears in vol. 75, No. 3, March 1947, p. 47.

Beginning with this issue, values of total solar and sky radiation received on a horizontal surface at Inyokern, California, will appear regularly in Table 2. Mr. Edward V. Ashburn of the Astrophysical Section, U. S. Naval Ordnance Test Station at Inyokern has furnished the following data concerning the station:

> The solar radiation station on the Naval Ordnance Test Station, Inyokern, China Lake, California, is at Longitude 117°40′ E., Latitude 35°39′ N. The pyrheliometer is mounted on the south elevator tower of Michelson Laboratory. There are no adjacent obstructions but the distant mountains average about 1° above the horizon. Michelson Laboratory is in the Indian Wells Valley about fifteen miles east of the Sierra Nevada range. The adjacent residential area occasionally produces noticeable smoke and haze during the winter months but usually the air is remarkably clear and dry. An Eppley 50-junction pyrheliometer Serial No. 1620 is used with a Brown continuous recording potentiometer.

TABLE 1.—*Solar radiation intensities during November 1948*

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

Date	Sun's zenith distance									Vapor pressure	
	A. M.				0.0°	P. M.					
	78.7°	75.7°	70.7°	60.0°		60.0°	70.7°	75.7°	78.7°	7:30 a. m.[1]	1:30 p. m.[1]
MADISON, WIS.											
	Air mass										
	4.81	3.84	2.88	1.92	1.92	2.88	3.84	4.81			
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	0.52	0.64	0.75	0.95	1.29	------	------	------	------	7.8	12.7
15	.76	.92	1.01	------	1.33	------	------	------	------	5.3	6.1
17	.98	1.08	1.18	------	1.43	------	------	------	------	4.8	5.3
29	.75	.91	1.08	------	------	------	------	------	------	3.0	3.8
Means	.75	.89	1.00	.95	1.35	------	------	------	------	------	------
Departures	−.09	−.09	−.14	−.35	−.16	------	------	------	------	------	------
BLUE HILL, MASS.											
	Air mass										
	4.86	3.89	2.92	1.94	*0.97	1.94	2.92	3.89	4.86		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
2	0.84	0.97	1.10	1.29	------	1.35	1.22	1.10	1.01	5.3	6.4
8	.85	------	------	------	------	1.25	1.12	------	------	6.6	5.8
11	1.00	1.09	1.21	1.40	------	1.37	1.18	1.07	.94	6.9	4.6
14	.99	1.09	1.18	------	------	------	1.22	1.13	1.03	3.9	3.8
16	.74	.84	.96	------	------	------	------	------	------	5.2	5.4
18	.94	1.07	1.18	------	------	1.27	1.05	.92	.81	6.1	5.2
19	.83	.92	1.07	------	------	------	------	------	------	5.1	6.5
21	.69	.82	.92	------	------	------	------	------	------	7.3	6.4
26	------	------	.93	------	------	------	------	.93	.83	5.9	6.9
28	.97	1.05	------	------	------	------	------	------	------	5.0	5.2
30	.99	1.09	------	------	------	------	1.21	1.07	.95	3.8	5.7
Means	.88	.99	1.07	(1.34)	------	1.31	1.17	1.04	.93	------	------
Departures	−.03	−.02	−.04	+.06	------	+.05	+.06	+.06	+.07	------	------

See footnotes at end of table

TABLE 1.—*Solar radiation intensities during November 1948*—Con.

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

Date	Sun's zenith distance									Vapor pressure	
	A. M.				0.0°	P. M.					
	78.7°	75.7°	70.7°	60.0°		60.0°	70.7°	75.7°	78.7°	7:30 a. m.[1]	1:30 p. m.[1]
BOSTON, MASS.											
	Air mass										
	4.96	3.96	2.97	1.98	*0.99	1.98	2.97	3.96	4.96		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	------	0.60	0.75	------	------	------	------	------	------	9.1	8.1
2	------	.65	.93	------	------	------	------	------	------	5.8	6.4
16	------	------	.78	------	------	------	------	------	------	5.8	5.1
18	------	.85	1.00	------	------	------	------	------	------	6.8	6.1
19	------	------	.41	------	------	------	------	------	------	6.8	8.1
30	0.68	.59	------	------	------	------	------	------	------	4.1	5.4
Means	(.68)	.67	.77	------	------	------	------	------	------	------	------
Departures	−.04	−.13	−.14	------	------	------	------	------	------	------	------
CLIMAX, COLORADO											
	Air mass										
	3.24	2.59	1.94	1.29	*0.65	1.29	1.94	2.59	3.24		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	------	------	1.37	1.46	------	1.50	1.39	1.30	1.22	------	------
5	------	------	------	1.55	------	1.56	1.43	1.31	------	------	------
12	------	------	------	1.46	------	1.48	1.34	1.24	1.12	------	------
13	------	------	------	1.56	------	1.48	1.41	1.30	1.22	------	------
14	------	------	------	1.54	------	1.54	1.42	1.30	1.22	------	------
15	1.30	1.39	1.46	1.58	------	1.57	1.44	------	1.21	------	------
21	------	1.16	1.28	1.42	------	1.16	------	------	------	------	------
28	------	------	------	------	------	------	1.43	1.32	1.26	------	------
29	------	------	------	------	------	------	1.46	1.37	1.29	------	------
30	1.44	1.49	1.55	------	------	------	1.36	1.16	1.00	------	------
Means	(1.37)	1.35	1.42	1.51	------	1.47	1.41	1.29	1.19	------	------
Departures	+.14	+.02	−.01	−.02	------	−.03	+.02	+.01	+.02	------	------
LINCOLN, NEBR.											
	Air mass										
	4.77	3.81	2.86	1.91	*0.95	1.91	2.86	3.81	4.77		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
6	0.94	1.07	1.18	1.34	------	1.34	1.16	1.05	0.94	5.3	5.8
13	------	.86	1.10	1.27	------	1.27	1.11	.96	.81	3.7	4.8
15	------	------	------	------	------	------	1.03	.90	.82	6.9	7.8
16	------	------	------	------	------	1.31	1.16	1.03	.92	6.6	6.6
23	.81	.94	1.09	------	------	------	------	------	------	4.2	5.1
29	------	1.01	1.18	------	------	------	1.16	1.05	------	4.2	4.8
Means	(0.88)	0.97	1.14	(1.30)	------	1.31	1.12	1.00	0.87	------	------
Departures	−.01	−.04	−.02	−.06	------	−.02	−.05	−.02	−.04	------	------
TABLE MOUNTAIN, CALIF.											
	Air mass										
	3.76	3.01	2.26	1.51	*0.75	1.51	2.26	3.01	3.76		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	1.14	1.22	1.33	1.45	------	------	------	------	------	------	------
2	------	------	------	1.46	------	------	------	------	------	------	------
3	------	------	------	1.49	------	------	------	------	------	------	------
5	------	------	------	1.49	------	------	------	------	------	------	------
9	1.22	1.30	1.40	1.52	------	------	------	------	------	------	------
13	------	------	------	1.51	------	------	------	------	------	------	------
14	1.25	1.33	1.42	1.54	------	------	------	------	------	------	------
16	------	------	------	1.49	------	------	------	------	------	------	------
23	1.15	1.24	1.35	1.47	------	------	------	------	------	------	------
25	------	------	------	1.55	------	------	------	------	------	------	------
30	------	------	------	1.57	------	------	------	------	------	------	------
Means	1.19	1.27	1.38	1.50	------	------	------	------	------	------	------
Departures	+.02	+.01	+.02	.00	------	------	------	------	------	------	------

Note.—Figures in parenthesis are interpolated.

*Extrapolated.

[1] 75th Meridian Time.

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

[Gram-calories per square c)ntimeter]

Date	Washington, D. C.	Madison, Wis.	Lincoln, Nebr.	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.	Newport, R. I.	Salt Lake City, Utah	Put-in-Bay, Ohio	State College, Pa.	Davis, Calif.	Toronto, Canada	Ithaca, N. Y.	East Wareham, Mass.	Honolulu, T. H.	Pearl Harbor, T. H.	East Lansing, Mich.	Summit, Mont.	Soda Springs, Calif.	Grand Lake, Colo.	Inyokern, Calif.
1948	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Oct. 29	158	230	87	248	209	4	306	232	310	-----	173	102	262	270	270	274	304	319	31	35	237	394	414	202	262	(90)	133	394
Oct. 30	194	133	334	299	382	16	194	252	242	-----	302	330	295	311	240	234	258	350	159	194	266	559	482	172	164	(354)	282	251
Oct. 31	-----	218	337	246	360	71	245	245	174	-----	358	355	270	296	302	190	177	134	38	122	264	516	493	14	70	116	364	388
Nov. 1	128	243	60	186	322	12	82	268	32	-----	308	322	253	197	230	332	123	60	60	88	245	426	295	113	148	16	375	385
Nov. 2	22	48	292	185	364	16	52	302	80	-----	340	321	305	349	299	158	28	192	57	48	288	512	465	88	96	95	178	366
Nov. 3	6	42	232	48	219	57	42	190	142	-----	111	86	216	207	82	64	25	360	150	164	202	491	444	6	73	279	78	366
Nov. 4	92	80	40	55	365	12	213	41	279	-----	324	360	16	66	244	343	94	363	90	112	94	193	166	97	95	369	204	400
Means	100	142	197	181	317	27	162	218	180	-----	274	268	231	242	238	228	144	253	84	109	228	441	394	99	130	188	230	364
Departures	−138	−39	−31	−22	−6	−18	−11	+54	−35	-----	−63	−43	+21	+27	−2	+34	−34	−31	−22	−44	+20	0	+5	−40	-----	−77	-----	-----
Nov. 5	120	64	40	97	349	18	104	148	25	-----	337	350	131	101	323	148	138	-----	73	147	112	225	185	31	(83)	(330)	270	403
Nov. 6	139	86	325	190	297	35	364	100	181	-----	331	321	80	225	135	289	35	-----	71	61	168	458	420	5	141	144	164	319
Nov. 7	325	188	104	282	351	29	298	139	351	-----	309	268	119	147	341	593	281	-----	135	162	132	218	155	218	178	354	153	378
Nov. 8	269	112	96	207	335	5	173	240	310	275	321	339	252	261	284	542	269	-----	182	168	237	386	356	152	110	(351)	276	396
Nov. 9	84	30	193	114	346	71	122	210	150	260	338	339	222	215	304	129	124	-----	108	134	212	390	407	48	(107)	(337)	141	390
Nov. 10	171	120	230	57	249	11	308	98	344	80	334	313	53	80	87	197	40	-----	15	42	84	347	300	109	(147)	278	155	314
Nov. 11	306	163	78	285	333	12	316	250	332	248	316	307	266	291	119	291	290	-----	209	163	268	455	338	150	(54)	336	217	360
Means	202	109	152	176	323	26	241	169	242	-----	327	320	160	189	228	313	168	-----	113	125	173	354	309	102	117	304	197	366
Departures	−18	−49	−70	−3	+29	−9	+63	+35	+53	-----	+18	+18	−20	−7	+4	+159	+24	-----	+13	−5	+8	−43	−37	+8	-----	+37	-----	-----
Nov. 12	197	87	212	107	339	15	43	118	51	245	333	314	104	139	138	44	106	290	35	39	134	431	312	22	(78)	313	120	365
Nov. 13	179	121	297	111	317	13	336	44	298	224	326	310	26	33	286	84	119	292	78	84	35	415	408	76	(115)	312	300	367
Nov. 14	261	95	286	279	308	14	319	249	306	122	324	312	259	278	275	159	257	224	99	137	263	434	451	74	(56)	(288)	322	353
Nov. 15	147	224	264	196	327	11	320	83	287	102	253	241	145	212	103	238	68	252	68	22	180	503	342	139	56	286	298	310
Nov. 16	227	72	240	175	312	31	184	163	45	44	276	287	212	237	128	132	172	112	139	131	187	355	269	115	(73)	89	103	314
Nov. 17	250	219	193	88	199	36	314	7	324	208	291	254	28	27	-----	284	255	307	76	125	31	419	360	180	(70)	327	91	356
Nov. 18	256	71	22	221	303	38	119	181	214	239	277	292	236	254	275	244	244	273	138	150	226	514	449	159	(140)	290	257	340
Means	217	127	216	168	301	22	234	121	218	169	297	287	144	168	201	170	175	250	90	98	151	439	370	109	84	272	213	344
Departures	+15	−26	+8	+14	+55	−5	+22	−14	+9	+7	+12	+11	−19	−15	+8	+16	+4	+45	+2	−12	−25	+13	+11	−6	-----	−3	-----	-----
Nov. 19	45	14	50	57	238	25	36	114	187	81	308	288	205	226	78	66	14	118	13	10	215	437	426	2	(51)	154	269	307
Nov. 20	263	34	119	187	123	10	50	6	301	146	255	274	12	44	51	57	62	292	71	44	35	523	360	27	(46)	(295)	180	338
Nov. 21	257	24	200	232	299	33	155	146	285	121	315	312	175	221	211	203	104	295	45	24	178	482	411	36	(95)	(304)	297	344
Nov. 22	24	43	70	49	302	23	40	16	60	62	335	298	46	55	144	45	17	274	47	17	58	520	358	19	(53)	276	252	320
Nov. 23	187	138	177	169	298	17	309	1	165	164	313	265	7	24	228	45	80	272	102	23	24	482	397	8	(70)	279	107	327
Nov. 24	79	130	164	190	284	5	119	1	146	194	281	256	14	19	84	104	223	196	37	23	78	426	388	57	(48)	216	94	312
Nov. 25	211	88	156	208	229	10	256	2	272	108	281	260	12	37	206	190	205	227	98	83	32	447	375	50	(84)	238	308	328
Means	153	67	134	156	253	18	138	41	202	125	298	279	67	90	143	101	101	239	59	32	88	474	388	28	64	252	215	325
Departures	−31	−62	−60	+15	+19	+2	−16	−57	+25	−30	+11	+3	−79	−66	−27	−17	−31	+14	−15	−79	−51	+32	+20	−60	-----	−6	-----	-----
Nov. 26	208	193	246	111	263	14	184	75	21	167	210	258	188	227	164	37	205	285	48	120	198	519	432	94	(80)	305	263	316
Nov. 27	253	180	78	154	285	7	195	42	80	202	310	286	49	65	138	173	235	274	112	110	58	470	308	49	(107)	(274)	227	335
Nov. 28	16	117	304	75	293	8	233	124	19	202	286	269	144	155	240	54	84	262	57	41	153	467	410	37	(38)	295	317	326
Nov. 29	41	242	259	47	276	4	309	1	33	176	285	275	9	20	206	98	94	278	57	68	23	325	380	145	(73)	291	231	329
Nov. 30	168	206	199	170	234	11	268	144	266	53	279	266	211	222	162	222	154	234	71	75	168	290	248	32	41	200	286	299
Dec. 1	244	208	227	133	256	T	-----	48	254	210	277	262	91	153	226	147	202	264	125	46	135	230	185	116	62	(264)	121	316
Dec. 2	165	185	262	122	252	10	-----	152	139	59	281	260	213	213	205	173	139	194	142	117	204	361	314	132	(38)	(172)	172	317
Means	156	190	225	116	266	8	238	84	116	153	275	268	129	151	192	129	159	256	87	82	134	380	325	86	63	257	231	320
Departures	−11	+62	+45	−13	+61	−3	+60	−12	−41	+9	+15	+14	−20	−6	+64	+18	+29	+70	+13	−7	−7	−24	−21	0	-----	+2	-----	-----

ACCUMULATED DEPARTURES ON DECEMBER 2, 1948

	−7280	+7294	+6279	−7007	+13258	} ----	-----	{−4501	} ----	-----	{−6251	} ----	{−6251	−364	−511	} ----	{−2401	−2744	+1708	−25473	−2100	} ----	-----	{−1288	} ----	-----	-----	-----

TABLE 3.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing south at Blue Hill, Mass., during November 1948*

Date	29	30	31	1	2	3	4	Mean	5	6	7	8	9	10	11	Mean	12	13	14	15
Gm cal/cm²	382	479	426	350	505	302	13	351	143	68	183	445	336	40	511	246	294	23	514	194

Date	16	17	18	Mean	19	20	21	22	23	24	25	Mean	26	27	28	29	30	1	2	Mean
Gm cal/cm²	398	22	477	246	396	7	332	21	4	6	6	110	381	90	251	6	489	91	491	257