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# SOLAR OBSERVATIONS

## SOLAR RADIATION MEASUREMENTS DURING AUGUST 1935

By IRVING F. HAND, Assistant in Solar Radiation Investigations

For a description of instruments employed and their exposures, the reader is referred to the January 1935 REVIEW, page 24.

Table 1 shows that solar radiation intensities averaged above normal for August at all three stations for which normals have been computed. During this month the Marvin pyrheliometers at Madison and Lincoln were compared with substandard Smithsonian silver-disk pyrheliometer no. 1. The instrument at Madison was found to be in excellent condition with no apparent change in its characteristics. However, the Marvin pyrheliometer at Lincoln read slightly more than 1 percent low in the large number of comparisons made and new factors were determined for use at that station.

Table 2 shows an excess in the amount of total solar and sky radiation received on a horizontal surface at all stations except Madison, Lincoln, Riverside, and Fairbanks. About the middle of the month a new Eppley thermoelectric pyrheliometer was installed on the roof of the experiment station building at Lincoln, replacing the old Callendar receiver which had become defective. The new pyrheliometer records on a Leeds and Northrup micromax potentiometer, also installed at the same time, replacing the Callendar Wheatstone bridge formerly in use at Lincoln.

Neither turbidity nor polarization measurements were made in Washington during August because of reduced personnel during that month. Polarization measurements made at Madison on 8 days give a mean of 54 percent with a maximum of 58 percent on the 27th. Both of these values are below the August normals for that station.

TABLE 1.—*Solar radiation intensities during August 1935*

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

**WASHINGTON, D. C.**

| Date | Sun's zenith distance | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 a. m. | 78.7° | 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* |
| Aug. 5 | 14.10 | | | | 0.78 | 1.44 | | | | | 8.81 |
| Aug. 6 | 12.24 | 0.68 | 0.80 | 0.93 | 1.12 | 1.35 | | | | | 10.97 |
| Aug. 12 | 18.59 | | | .95 | 1.11 | 1.24 | | | | | 17.96 |
| Aug. 14 | 18.59 | | | .68 | .86 | 1.14 | | | | | 19.23 |
| Aug. 24 | 8.81 | | | 1.00 | 1.20 | 1.43 | | | | | 7.04 |
| Means | | (.68) | (.80) | .89 | 1.01 | 1.32 | | | | | |
| Departures | | +.05 | +.11 | +.12 | +.07 | +.08 | | | | | |

**MADISON, WIS.**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 4 | 13.61 | | | | 1.17 | | | | | | 14.10 |
| Aug. 8 | 15.11 | | | | | 1.30 | | | | | 16.79 |
| Aug. 13 | 10.97 | | .91 | 1.05 | 1.21 | 1.39 | | | | | 10.59 |
| Aug. 14 | 10.97 | .65 | .81 | .92 | 1.13 | 1.38 | | | | | 13.11 |
| Aug. 15 | 13.61 | .52 | .63 | .79 | 1.00 | | | | | | 14.10 |
| Aug. 21 | 19.23 | | | 1.13 | 1.26 | | | | | | 11.38 |
| Aug. 23 | 12.68 | | | .99 | 1.16 | | | | | | 12.24 |
| Aug. 24 | 13.13 | | | .93 | 1.09 | | | | | | 12.68 |
| Aug. 26 | 13.61 | | | 1.05 | 1.22 | 1.45 | | | | | 10.59 |
| Aug. 27 | 8.81 | | | 1.15 | 1.30 | 1.46 | | | | | 8.18 |
| Aug. 28 | 6.76 | | | 1.19 | 1.33 | 1.51 | | | | | 7.29 |
| Aug. 31 | 7.04 | | .94 | 1.08 | | | | | | | 6.76 |
| Means | | (.58) | .82 | 1.03 | 1.19 | 1.42 | | | | | |
| Departures | | −.17 | .00 | +.09 | +.09 | +.09 | | | | | |

**LINCOLN, NEBR.**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 5 | 14.10 | | | | 1.19 | | | 0.78 | 0.62 | 0.49 | 15.11 |
| Aug. 6 | 17.96 | | | | | 1.38 | 1.18 | .95 | .77 | .65 | 16.20 |
| Aug. 7 | 18.62 | | | | | | 1.10 | .91 | .75 | .62 | 19.23 |
| Aug. 8 | 16.79 | | .75 | .91 | 1.11 | | | | | | 11.38 |
| Aug. 9 | 15.65 | | .81 | .96 | 1.08 | 1.35 | | | | | 11.38 |
| Aug. 10 | 17.37 | .53 | .63 | .84 | 1.00 | 1.29 | | | | | 13.13 |
| Aug. 11 | 12.24 | | | | | 1.43 | | | | | 10.59 |
| Aug. 12 | 10.21 | | | | | | 1.10 | .97 | .85 | .76 | 7.57 |

TABLE 1.—*Solar radiation intensities during August 1935*—Contd.

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

**LINCOLN, NEBR.**—Continued

| Date | Sun's zenith distance | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 a. m. | 78.7° | 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* |
| Aug. 13 | 9.87 | | | | | 1.40 | 1.09 | .88 | .72 | .60 | 8.48 |
| Aug. 14 | 10.21 | .71 | .83 | .96 | 1.18 | 1.42 | 1.15 | .94 | .79 | 68 | 9.14 |
| Aug. 15 | 14.10 | | .89 | 1.02 | 1.21 | | 1.10 | .92 | .79 | .66 | 12.24 |
| Aug. 20 | 14.10 | | | | | 1.47 | 1.19 | 1.03 | .89 | .78 | 11.81 |
| Aug. 21 | 12.24 | | | | | 1.44 | | | | | 11.81 |
| Aug. 24 | 11.38 | .50 | .67 | .87 | 1.11 | 1.34 | | | | | 7.04 |
| Aug. 27 | 8.18 | .93 | 1.03 | 1.18 | 1.33 | 1.50 | | | | | 6.50 |
| Means | | .67 | .80 | .96 | 1.15 | 1.40 | 1.13 | .92 | .77 | .67 | |
| Departures | | −.02 | +.01 | +.05 | +.06 | +.09 | +.05 | +.03 | +.01 | +.01 | |

**BLUE HILL, MASS.**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 1 | 14.3 | | | | 1.12 | 1.25 | | | | | 12.8 |
| Aug. 3 | 10.3 | | .97 | 1.07 | 1.27 | 1.45 | 1.26 | | | | 9.2 |
| Aug. 4 | 11.5 | | .86 | 1.04 | 1.19 | 1.36 | 1.22 | 1.11 | | | 12.3 |
| Aug. 7 | 12.3 | | .93 | 1.04 | 1.23 | 1.45 | 1.21 | 1.05 | | | 8.8 |
| Aug. 8 | 11.1 | .79 | .91 | 1.04 | 1.14 | 1.40 | 1.23 | 1.10 | | | 10.3 |
| Aug. 9 | 10.7 | .62 | .84 | .98 | 1.14 | 1.33 | 1.11 | | | | 11.5 |
| Aug. 10 | 13.2 | | | | 1.13 | 1.21 | .98 | | | | 13.3 |
| Aug. 12 | 13.7 | | | | | 1.15 | | | | | 16.9 |
| Aug. 15 | 14.7 | | | .94 | 1.11 | 1.30 | 1.10 | | | | 13.2 |
| Aug. 16 | 16.4 | | | | .94 | 1.12 | | | | | 12.8 |
| Aug. 17 | 16.9 | | | .90 | 1.04 | 1.24 | .90 | .72 | .59 | | 12.8 |
| Aug. 18 | 13.7 | | | .79 | .96 | 1.24 | .96 | | | | 15.8 |
| Aug. 19 | 13.7 | | | 1.05 | 1.23 | 1.28 | 1.11 | .82 | | | 10.3 |
| Aug. 21 | 19.5 | | | | | 1.20 | | | | | 15.3 |
| Aug. 23 | 13.2 | | | | | 1.38 | 1.18 | .96 | | | 11.1 |
| Aug. 24 | 10.7 | | | | 1.25 | 1.50 | 1.34 | | | | 7.6 |
| Aug. 25 | 8.6 | | | | 1.06 | 1.45 | 1.20 | 1.07 | | | 7.9 |
| Aug. 26 | 9.6 | | | | | 1.45 | 1.15 | | | | 9.3 |
| Aug. 29 | 8.8 | | .91 | 1.08 | 1.28 | 1.43 | | | | | 9.2 |
| Aug. 31 | 10.7 | | | | | 1.25 | 1.19 | | | | 10.3 |
| Means | | .70 | .90 | .99 | 1.14 | 1.32 | 1.14 | .98 | .59 | | |

* Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

| Week beginning— | Washington | Madison | Lincoln | Chicago | New York | Fresno | Pittsburgh | Fairbanks | Twin Falls | La Jolla | Miami | New Orleans | Riverside | Blue Hill | Friday Harbor | Ithaca | San Juan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gram-calories per square centimeter | | | | | | | | | | | | | | | | |
| 1935 | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* | *cal.* |
| July 30 | 518 | 355 | 535 | 369 | 512 | 718 | 547 | 248 | 660 | 594 | 557 | 512 | 558 | 647 | 513 | 367 | 762 |
| Aug. 6 | 477 | 434 | 567 | 456 | 425 | 670 | 419 | 290 | 668 | 590 | 485 | 377 | 511 | 569 | 582 | 394 | 612 |
| Aug. 13 | 522 | 442 | 514 | 354 | 478 | 665 | 625 | 307 | 615 | 444 | 526 | 335 | 539 | 602 | 494 | 517 | 727 |
| Aug. 20 | 494 | 477 | 497 | 480 | 466 | 594 | 646 | 377 | 574 | 473 | 451 | 374 | 439 | 582 | 519 | 552 | 774 |
| Aug. 27 | 312 | 411 | 238 | 366 | 306 | 615 | 445 | 269 | 545 | 286 | 447 | 474 | 398 | 314 | 439 | 377 | 555 |
| | Departures from weekly normals | | | | | | | | | | | | | | | | |
| July 30 | +25 | −108 | +22 | +1 | +93 | +63 | | −76 | +118 | | −52 | +129 | −23 | | | | |
| Aug. 6 | +15 | −20 | +72 | +77 | +57 | +38 | | −16 | +116 | | +39 | +7 | −55 | | | | |
| Aug. 13 | +67 | −3 | +27 | −31 | +118 | +52 | | −50 | +130 | | −53 | +2 | −5 | | | | |
| Aug. 20 | +61 | +34 | +15 | +79 | +143 | +18 | | +3 | +49 | | +47 | +30 | −76 | | | | |
| Aug. 27 | −130 | +5 | −201 | +10 | −46 | +55 | | −39 | +54 | | +36 | +100 | −102 | | | | |
| | Accumulated departures on Sept. 2 | | | | | | | | | | | | | | | | |
| | −3,675 | −8,694 | −7,476 | +252 | +5,789 | +4,844 | | +1,624 | +4,648 | | −3,346 | +308 | −6,580 | | | | |

**BLUE HILL METEOROLOGICAL OBSERVATORY OF HARVARD UNIVERSITY**

TABLE 3.—*Total, $I_m$, and screened, $I_y$, $I_r$, solar radiation intensity measurements, obtained during August 1935, and determinations of the atmospheric turbidity factor, $\beta$, and water-vapor content, $w$=depth in millimeters, if precipitated*

| Date and hour angle | Solar altitude | | Air mass | $I_m$ | $I_y$ | $I_r$ | $\beta I_{m-r}$ | $\beta I_{y-r}$ | $\beta_{mean}$ | $\frac{I_{w-e}}{1.94}$ | $\frac{I_{w-e}-I_m}{1.94}$ | $w$ | Air-mass type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ′ | m | gr. cal. | gr. cal. | gr. cal. | | | | Percent | Percent | mm | |
| *Aug. 1, 1935* | | | | | | | | | | | | | |
| 4:38 a. m. | 27 | 01 | 2.20 | 1.111 | 0.786 | 0.630 | 0.046 | 0.066 | 0.056 | 71.2 | 12.2 | 7.5 | $T_s$ |
| *Aug. 3* | | | | | | | | | | | | | |
| 3:51 a. m. | 35 | 18 | 1.73 | 1.295 | .878 | .709 | .020 | .074 | .047 | 75.9 | 12.8 | 8.4 | $N_{PC}$ |
| 1:54 a. m. | 55 | 08 | 1.22 | 1.409 | .942 | .746 | .025 | .058 | .042 | 83.2 | 8.4 | 11.2 | $T_s$ aloft |
| 1:46 p. m. | 56 | 10 | 1.20 | 1.392 | .918 | .729 | .020 | .077 | .048 | 82.7 | 8.9 | 11.5 | |
| 2:54 p. m. | 45 | 35 | 1.40 | 1.367 | .908 | .714 | .011 | .049 | .030 | 85.3 | 12.8 | 10.2 | $T_c$ aloft |
| *Aug. 4* | | | | | | | | | | | | | |
| 5:28 a. m. | 17 | 19 | 3.33 | .990 | .726 | .592 | .039 | .069 | .054 | 62.1 | 9.7 | 3.8 | $N_{PC}$ |
| 3:20 a. m. | 40 | 50 | 1.53 | 1.202 | .840 | .697 | .089 | .089 | .089 | 71.7 | 7.9 | 8.7 | $T_s$+$T_c$ aloft |
| 1:44 a. m. | 56 | 37 | 1.19 | 1.321 | .898 | .714 | .032 | .087 | .060 | 81.9 | 10.8 | 11.8 | |
| 0:46 a. m. | 63 | 10 | 1.12 | 1.352 | .903 | .719 | .054 | .096 | .075 | 79.9 | 8.2 | 16.2 | |
| 2:42 p. m. | 47 | 29 | 1.36 | 1.285 | .858 | .694 | .047 | .086 | .066 | 78.1 | 10.0 | 10.2 | |
| *Aug. 7* | | | | | | | | | | | | | |
| 5:08 a. m. | 20 | 28 | 2.84 | 1.055 | .778 | .629 | .044 | .052 | .048 | 68.3 | 12.9 | 5.7 | $P_A$ |
| 4:41 a. m. | 25 | 28 | 2.32 | 1.131 | .808 | .656 | .049 | .070 | .060 | 69.0 | 9.1 | 5.9 | $T_s$ aloft |
| 0.44 a. m. | 62 | 45 | 1.12 | 1.417 | .954 | .742 | .017 | .023 | .020 | 85.7 | 10.6 | 6.3 | |
| 0:24 a. m. | 63 | 47 | 1.12 | 1.417 | .951 | .736 | .016 | .025 | .020 | 87.7 | 12.6 | 12.9 | $T_c$ aloft |
| 0:22 p. m. | 62 | 40 | 1.11 | 1.392 | .921 | .734 | .036 | .086 | .061 | 81.5 | 7.7 | 11.5 | |
| 2:32 p. m. | 48 | 35 | 1.33 | 1.372 | .911 | .719 | .069 | .093 | .081 | 76.2 | 3.8 | 9.3 | |
| 4:56 p. m. | 22 | 41 | 2.58 | 1.075 | .783 | .620 | .043 | .044 | .044 | 71.3 | 14.3 | 5.6 | |
| *Aug. 8* | | | | | | | | | | | | | |
| 5:11 a. m. | 18 | 55 | 3.06 | 1.032 | .743 | .613 | .039 | .066 | .052 | 64.5 | 9.8 | 4.5 | $P_A$ |
| 4:26 a. m. | 28 | 16 | 2.10 | 1.136 | .793 | .642 | .047 | .083 | .065 | 70.0 | 9.8 | 7.6 | $T_s$ aloft |
| 3:26 a. m. | 37 | 30 | 1.64 | 1.200 | .875 | .662 | .052 | .054 | .053 | 76.8 | 13.2 | 8.7 | |
| 1:57 a. m. | 53 | 59 | 1.24 | 1.324 | .884 | .682 | .024 | .056 | .040 | 82.8 | 12.6 | 11.5 | |
| 1:24 p. m. | 58 | 36 | 1.17 | 1.373 | .894 | .711 | .020 | .094 | .057 | 80.4 | 7.6 | 11.0 | |
| 3:10 p. m. | 41 | 58 | 1.49 | 1.325 | .885 | .700 | .013 | .063 | .038 | 75.2 | 5.0 | 8.2 | |
| 4:44 p. m. | 24 | 50 | 2.37 | 1.160 | .800 | .650 | .028 | .072 | .050 | 70.5 | 9.0 | 5.8 | |
| 5:12 p. m. | 19 | 39 | 2.96 | 1.100 | .785 | .625 | .021 | .037 | .029 | 71.8 | 13.5 | 4.9 | |
| *Aug. 9* | | | | | | | | | | | | | |
| 4:47 a. m. | 24 | 05 | 2.44 | 1.071 | .772 | .628 | .050 | .069 | .060 | 68.0 | 11.2 | 5.8 | |
| 4:29 a. m. | 27 | 25 | 2.15 | 1.130 | .804 | .655 | .040 | .068 | .054 | 71.6 | 11.7 | 6.6 | $P_A$ |
| 0:17 a. m. | 63 | 32 | 1.11 | 1.310 | .877 | .692 | .053 | .121 | .087 | 78.4 | 9.0 | 12.3 | |
| 0:32 p. m. | 62 | 54 | 1.12 | 1.320 | .886 | .706 | .057 | .105 | .081 | 78.9 | 9.0 | 13.2 | |
| 2:41 p. m. | 46 | 46 | 1.37 | 1.237 | .852 | .679 | .043 | .094 | .068 | 77.2 | 11.6 | 10.4 | |
| *Aug. 10* | | | | | | | | | | | | | |
| 4:30 a. m. | 26 | 41 | 2.22 | 1.130 | .793 | .643 | .044 | .079 | .062 | 74.3 | 14.5 | 7.4 | $N_{PA}$ |
| 1:20 a. m. | 58 | 24 | 1.18 | 1.195 | .818 | .652 | .094 | .098 | .096 | 76.2 | 1.29 | 12.2 | |
| 3:26 p. m. | 36 | 58 | 1.66 | 1.094 | .776 | .622 | .099 | .104 | .102 | 68.5 | 8.8 | 8.4 | |
| 4:17 p. m. | 29 | 27 | 2.03 | .966 | .703 | .575 | .102 | .130 | .116 | 62.0 | 11.1 | 6.9 | |
| *Aug. 12* | | | | | | | | | | | | | |
| 1:51 a. m. | 53 | 53 | 1.24 | 1.004 | .730 | .592 | .190 | .195 | .192 | 63.7 | 10.5 | 11.2 | $T_s$ |
| *Aug. 15* | | | | | | | | | | | | | |
| 3:34 a. m. | 36 | 18 | 1.69 | 1.163 | .808 | .641 | .058 | .080 | .069 | 73.6 | 12.1 | 8.4 | $N_{PP}$ |
| 1:27 a. m. | 56 | 16 | 1.20 | 1.272 | .865 | .681 | .035 | .055 | .045 | ---- | ---- | ---- | |
| 0:24 a. m. | 61 | 31 | 1.13 | 1.302 | .877 | .681 | .049 | .058 | .054 | 82.2 | 13.3 | 12.7 | $T_s$ aloft |
| 0:18 a. m. | 61 | 43 | 1.13 | 1.295 | .872 | .686 | .049 | .058 | .054 | 82.2 | 13.7 | 12.8 | |
| 1:32 p. m. | 55 | 40 | 1.21 | 1.292 | .870 | .681 | .057 | .107 | .082 | 81.7 | 13.4 | 11.9 | |
| 4:23 p. m. | 27 | 53 | 2.13 | 1.078 | .765 | .599 | .058 | .136 | .097 | 63.7 | 6.7 | 6.2 | |
| *Aug. 16* | | | | | | | | | | | | | |
| 1:56 a. m. | 52 | 13 | 1.27 | 1.058 | .758 | .600 | .149 | .116 | .148 | 70.1 | 14.2 | 11.5 | $N_{PP}$ $T_s$+$T_c$ aloft |
| *Aug. 17* | | | | | | | | | | | | | |
| 5:06 a. m. | 19 | 01 | 3.05 | .895 | .685 | .550 | .070 | .063 | .066 | 61.2 | 13.9 | 4.8 | |
| 4:22 a. m. | 27 | 09 | 2.19 | 1.080 | .750 | .610 | .050 | .092 | .071 | 67.3 | 10.2 | 6.3 | $N_{PP}$ |
| 3:27 a. m. | 37 | 09 | 1.65 | 1.100 | .795 | .640 | .098 | .105 | .102 | 68.7 | 10.6 | 8.5 | |
| 1:41 a. m. | 53 | 20 | 1.25 | 1.200 | .835 | .660 | .089 | .098 | .094 | 75.0 | 11.6 | 11.4 | $T_s$ aloft |
| 2:47 p. m. | 44 | 05 | 1.44 | 1.025 | .685 | .600 | .157 | .091 | .124 | 68.6 | 14.2 | 10.1 | |
| 3:06 p. m. | 41 | 22 | 1.51 | 1.005 | .680 | .595 | .135 | .083 | .109 | 69.6 | 16.8 | 9.8 | |
| 5:23 p. m. | 15 | 53 | 3.61 | .630 | .490 | .402 | .101 | .103 | .102 | 46.0 | 12.7 | 9.0 | |
| *Aug. 18* | | | | | | | | | | | | | |
| 4:44 a. m. | 22 | 54 | 2.56 | .847 | .631 | .513 | .091 | .140 | .115 | 56.0 | 11.5 | 5.5 | $T_c$ |
| 3:54 a. m. | 32 | 03 | 1.88 | 1.000 | .725 | .585 | .093 | .121 | .107 | 68.2 | 15.4 | 8.4 | $T_s$ aloft |
| 0:44 a. m. | 59 | 31 | 1.16 | 1.210 | .825 | .660 | .091 | .150 | .120 | 75.0 | 11.1 | 10.4 | |
| 0:58 p. m. | 58 | 16 | 1.18 | 1.210 | .830 | .670 | .094 | .158 | .126 | 72.4 | 8.5 | 11.9 | |
| 2:20 p. m. | 48 | 08 | 1.34 | 1.176 | .817 | .639 | .084 | .086 | .085 | 75.2 | 13.1 | 10.7 | |
| 2:43 p. m. | 44 | 27 | 1.42 | 1.145 | .812 | .639 | .096 | .090 | .093 | 73.3 | 12.8 | 10.3 | |
| *Aug. 19* | | | | | | | | | | | | | |
| 4:23 a. m. | 26 | 32 | 2.24 | 1.157 | .817 | .666 | .048 | .104 | .076 | 67.5 | 6.4 | 5.8 | $T_G$ |
| 3:38 a. m. | 34 | 43 | 1.75 | 1.247 | .865 | .684 | .036 | .091 | .064 | 75.3 | 9.5 | 9.2 | |
| 2:27 a. m. | 46 | 47 | 1.37 | 1.300 | .875 | .695 | .042 | .117 | .080 | 75.8 | 7.1 | 9.7 | $T_s$ aloft |
| 1:20 a. m. | 55 | 57 | 1.20 | 1.282 | .879 | .687 | .062 | .122 | .092 | 76.4 | 8.7 | 11.4 | |
| 1:08 a. m. | 57 | 12 | 1.19 | 1.282 | .874 | .687 | .064 | .138 | .101 | 75.0 | 7.3 | 11.2 | |
| 1:27 p. m. | 53 | 57 | 1.24 | 1.262 | .867 | .676 | .062 | .118 | .090 | 76.1 | 9.4 | 10.9 | |
| 2:35 p. m. | 45 | 11 | 1.41 | 1.242 | .857 | .671 | .051 | .122 | .086 | 74.1 | 8.5 | 9.6 | |
| 3:26 p. m. | 36 | 51 | 1.67 | 1.188 | .820 | .656 | .050 | .132 | .091 | 70.2 | 7.5 | 7.9 | $T_c$ |
| *Aug. 21* | | | | | | | | | | | | | |
| 9:44 a. m. | 51 | 35 | 1.17 | 1.293 | .859 | .679 | .052 | .100 | .076 | 77.7 | 9.3 | 11.7 | $T_s$ aloft |
| *Aug. 23* | | | | | | | | | | | | | |
| 0:45 a. m. | 57 | 41 | 1.18 | 1.337 | .895 | .696 | .031 | .025 | .028 | 80.0 | 9.5 | 11.6 | $N_{PC}$ |
| 0:09 a. m. | 59 | 19 | 1.16 | 1.322 | .885 | .696 | .045 | .042 | .044 | 82.6 | 12.9 | 12.4 | $T_c$ aloft |
| 0:04 p. m. | 59 | 22 | 1.16 | 1.342 | .895 | .696 | .032 | .025 | .028 | 85.9 | 15.1 | 12.4 | |
| 2:00 p. m. | 49 | 46 | 1.30 | 1.322 | .890 | .696 | .032 | .033 | .032 | 83.9 | 14.1 | 11.3 | |
| 3:29 p. m. | 35 | 13 | 1.73 | 1.233 | .850 | .671 | .031 | .035 | .033 | 80.2 | 15.1 | 8.5 | |
| *Aug. 24* | | | | | | | | | | | | | |
| 4:07 a. m. | 28 | 21 | 2.10 | 1.232 | .867 | .691 | .028 | .043 | .036 | 75.6 | 79.0 | 10.4 | $P_C$ |
| 2:16 a. m. | 47 | 10 | 1.39 | 1.403 | .947 | .748 | .016 | .025 | .020 | 84.4 | 10.5 | 10.0 | |
| 0:31 a. m. | 58 | 40 | 1.17 | 1.453 | .972 | .754 | .003 | .018 | .010 | 86.7 | 10.1 | 11.8 | |
| 1:15 p. m. | 55 | 17 | 1.21 | 1.448 | .954 | .764 | .034 | .077 | .056 | 81.3 | 7.0 | 10.8 | |
| *Aug. 25* | | | | | | | | | | | | | |
| 4:25 p. m. | 24 | 55 | 2.37 | 1.152 | .802 | .638 | .027 | ---- | .027 | 75.6 | 14.9 | 6.2 | $N_{PC}$ |
| *Aug. 26* | | | | | | | | | | | | | |
| 9:39 a. m. | 57 | 14 | 1.19 | 1.408 | .924 | .736 | .018 | .079 | .048 | 81.9 | 7.8 | 11.2 | $N_{PC}$ |
| 2:57 p. m. | 40 | 10 | 1.55 | 1.250 | .850 | .670 | .038 | .051 | .044 | 79.6 | 13.8 | 8.7 | $T_c$ aloft |
| 4:27 p. m. | 24 | 38 | 2.39 | 1.065 | .750 | .595 | .042 | .062 | .052 | 69.2 | 13.1 | 6.0 | |
| *Aug. 29* | | | | | | | | | | | | | |
| 5:15 a. m. | 14 | 28 | 3.94 | .915 | .675 | .565 | .048 | .085 | .065 | 55.5 | 7.4 | 3.4 | $P_C$ |
| 4:00 a. m. | 28 | 12 | 2.12 | 1.250 | .865 | .700 | .037 | .063 | .050 | 72.9 | 7.2 | 6.2 | |
| 1:49 a. m. | 41 | 14 | 1.32 | 1.382 | .920 | .735 | .029 | .024 | .026 | 84.9 | 12.2 | 6.1 | |
| *Aug. 31* | | | | | | | | | | | | | |
| 0:31 a. m. | 55 | 57 | 1.20 | 1.245 | .850 | .682 | .083 | .112 | .098 | 72.4 | 7.0 | 5.7 | $N_{PC}$ |
| 2:24 p. m. | 44 | 02 | 1.44 | 1.275 | .855 | .690 | .046 | .101 | .074 | 75.2 | 8.2 | 5.4 | |
| 3:17 p. m. | 35 | 32 | 1.72 | 1.230 | .835 | .675 | .050 | .097 | .074 | 71.2 | 6.6 | 4.8 | |

**Atmospheric conditions during solar radiation measurements. Blue Hill Observatory of Harvard University**

| Date and time from apparent noon | Air temperature | Wind, Beaufort scale | Visibility (scale 0-10) | Skyblueness | Cloudiness and remarks |
|---|---|---|---|---|---|
| *August 1935* | ° C. | | | | |
| 1; 4:34 a. m. | 21.1 | W 4 | 8 | ------ | |
| 3; 4:06 a. m. | 17.8 | NW 2 | 9 | 6 | |
| 3; 0:04 p. m. | 24.2 | NW 3 | 9 | 6 | |
| 4; 4:36 a. m. | 20.0 | NE 3 | 9 | 8 | 2 Acu, light haze. |
| 4; 1:00 a. m. | 22.8 | NE 2 | 9 | 9 | Few Acu, 1 Cu. |
| 4; 2:30 p. m. | 26.2 | W 2 | 9 | 8 | Few Acu, C Cu, no haze. |
| 7; 4:52 a. m. | 13.9 | NW 3 | 8 | 9 | 4 Acu, Ci, inversion, light haze. |
| 7; 0:38 a. m. | 19.4 | NE 4 | 9 | 9 | 3 Ci, few Acu, 1 Cu, light haze to N. |
| 7; 2:44 p. m. | 21.7 | E 3 | 9 | 12 | 2 Ci, few Acu, few Cu, light haze to W. |
| 8; 4:36 a. m. | 17.8 | NE 2 | 8 | 4 | |
| 8; 1:41 a. m. | 20.6 | NE 2 | 9 | 6 | |
| 8; 0:37 p. m. | 20.7 | NE 2 | 9 | ------ | |
| 8; 4:58 p. m. | 20.6 | NE 3 | 9 | 11 | Few Ci, few Acu, few Cu, no haze. |
| 9; 4:32 a. m. | 17.2 | N 4 | 8 | ------ | Cist over sun? |
| 9; 0:22 a. m. | 22.8 | NE 3 | 9 | ------ | Cist. |
| 9; 3:26 p. m. | 23.4 | E 3 | 9 | 4 | Ci over sun. |
| 10; 1:27 a. m. | 23.9 | SSW 4 | 8 | 4 | Ci haze. |
| 12; 2:18 a. m. | 21.1 | WSW 2 | 8 | ------ | |
| 15; 0:48 p. m. | 24.8 | E 3 | 8 | 6 | Ci haze, Cu. |
| 15; 4:25 p. m. | 25.6 | E 2 | 8-9 | 6 | |
| 16; 0:37 a. m. | 28.2 | E 2 | 7 | 6 | 4 Cu, mod. haze. |
| 17; 4:30 a. m. | 24.4 | NNE 2 | 7 | 10 | No clouds, dense haze. |
| 17; 0:32 a. m. | 28.8 | ENE 2 | 8 | 6 | 2 Cu, mod. haze. |
| 17; 3:00 p. m. | 30.0 | SE 2 | 8 | 4 | 1 Cu, Frcu, mod. haze. |
| 18; 3:58 a. m. | 23.9 | NW 2 | 7-8 | 10 | Few Ci, light haze. |
| 18; 2:34 p. m. | 31.7 | ESE 3 | 8 | 8 | 3 Ci, few Cu, light haze. |
| 19; 2:05 a. m. | 23.9 | WSW 2 | 8 | 8 | 1 Ci, light haze. |
| 19; 1:53 a. m. | 25.0 | SSW 0 | 8 | 8 | Few Ci, light haze. |
| 19; 1:29 p. m. | 26.7 | SSW 3 | 9 | 8 | Few Ci, light haze. |
| 19; 1:25 p. m. | 30.0 | S 3 | 8-9 | 8 | 0 clouds, light haze. |
| 23; 1:45 p. m. | 19.4 | SSW 5 | 9 | 8 | 2 Cu. |
| 23; 3:17 p. m. | 19.4 | NE 4 | 9 | 10 | 2 Cu. |
| 24; 2:33 a. m. | 15.6 | NW 3 | 10 | 10 | 1 Stcu. |
| 24; 2:00 a. m. | 16.1 | NW 4 | 10 | 10 | Cu. |
| 24; 0:59 p. m. | 18.9 | NNW 4 | 10 | 10 | 1 Cu. |
| 25; 4:27 p. m. | 20.0 | NW 6 | 10 | ------ | |
| 26; 0:17 a. m. | 23.3 | WSW 4 | 9 | 12 | Few Acu, light haze on horizon. |
| 26; 2:45 p. m. | 25.0 | WSW 5 | 9 | 12 | 1 Acu, light haze. |
| 29; 4:21 a. m. | 15.0 | WNW 2 | 9 | 10 | 1 Ci, light water haze. |
| 29; 2:07 a. m. | 18.3 | WNW 3 | 9 | 10 | Light water haze. |
| 31; 1:58 p. m. | 19.4 | W 3 | 9 | 7 | 7 Cu, light haze. |

## PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR AUGUST 1935

[Dependent alone on observations at Zurich and its station at Arosa]

[Data furnished through the courtesy of Prof. W. Brunner, Eidgen Sternwarte, Zurich, Switzerland]

| August 1935 | Relative numbers | August 1935 | Relative numbers | August 1935 | Relative numbers |
|---|---|---|---|---|---|
| 1 | 10 | 11 | 29 | 21 | 55 |
| 2 | 11 | 12 | 38 | 22 | 39 |
| 3 | ------ | 13 | ------ | 23 | 34 |
| 4 | *ad* 23 | 14 | *d* -- | 24 | *d* 35 |
| 5 | 18 | 15 | 29 | 25 | ------ |
| 6 | 28 | 16 | 26 | 26 | 29 |
| 7 | 43 | 17 | *Wc* 20 | 27 | *a* 13 |
| 8 | 49 | 18 | 29 | 28 | 25 |
| 9 | 26 | 19 | 23 | 29 | *d* 28 |
| 10 | *a* 33 | 20 | *Mca* 52 | 30 | 24 |
| | | | | 31 | *d* 37 |

Mean, 27 days=29.9.

*a*=Passage of an average-sized group through the central meridian.
*b*=Passage of a large group or spot through the central meridian.
*c*=New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.
*d*=Entrance of a large or average-sized center of activity on the east limb.

## POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy, Superintendent U. S. Naval Observatory. Data furnished by the U. S. Naval Observatory in cooperation with Harvard and Mount Wilson Observatories. The difference in longitude is measure from the central meridian, positive west. The north latitude is positive. Areas are corrected for foreshortening and are expressed in millionths of the sun's visible hemisphere. The total area for each day includes spots and groups]

| Date | Eastern standard time | | Heliographic: Diff. in longitude | Heliographic: Longitude | Heliographic: Latitude | Area: Spot | Area: Group | Total area for each day | Observatory |
|---|---|---|---|---|---|---|---|---|---|
| 1935 | *h.* | *m.* | ° | ° | ° | | | | |
| Aug. 1 | 13 | 20 | −45.0 | 186.4 | −19.0 | ------ | 46 | ------ | U. S. Naval. |
| | | | −39.0 | 192.4 | −16.5 | 62 | ------ | 108 | |
| Aug. 2 | 14 | 14 | −25.0 | 192.7 | −17.0 | 46 | ------ | ------ | Do. |
| | | | −10.5 | 207.2 | −24.0 | ------ | 23 | 69 | |
| Aug. 3 | 11 | 5 | −11.5 | 194.7 | −17.0 | 46 | ------ | ------ | Do. |
| | | | +1.0 | 207.2 | −23.0 | ------ | 31 | 77 | |
| Aug. 4 | 12 | 0 | −75.0 | 117.5 | −18.0 | 127 | ------ | ------ | Mount Wilson. |
| | | | +2.0 | 194.5 | −16.0 | ------ | 58 | ------ | |
| | | | +16.0 | 208.5 | −24.0 | ------ | 10 | 195 | |
| Aug. 5 | 11 | 3 | −60.0 | 119.8 | −19.5 | 123 | ------ | ------ | U. S. Naval. |
| | | | +15.5 | 195.3 | −17.0 | ------ | 39 | 162 | |
| Aug. 6 | 11 | 2 | −68.0 | 98.6 | +28.0 | ------ | 69 | ------ | Do. |
| | | | −48.5 | 118.1 | −19.0 | ------ | 123 | ------ | |
| | | | +28.5 | 195.1 | −17.5 | ------ | 62 | 254 | |
| Aug. 7 | 9 | 5 | −57.0 | 97.5 | +25.0 | ------ | 18 | ------ | Mount Wilson. |
| | | | −55.0 | 99.5 | −29.0 | ------ | 25 | ------ | |
| | | | −36.0 | 118.5 | −19.0 | ------ | 165 | ------ | |
| | | | +44.0 | 198.5 | −17.0 | ------ | 50 | 258 | |
| Aug. 8 | 8 | 50 | −42.0 | 99.4 | −28.0 | ------ | 50 | ------ | Do. |
| | | | −39.0 | 102.4 | +26.0 | 4 | ------ | ------ | |
| | | | −23.0 | 118.4 | −19.0 | ------ | 120 | ------ | |
| | | | +47.0 | 188.4 | +26.0 | ------ | 9 | ------ | |
| | | | +56.0 | 197.4 | −17.0 | ------ | 15 | 198 | |
| Aug. 9 | 11 | 54 | −27.0 | 99.4 | −28.0 | ------ | 31 | ------ | U. S. Naval. |
| | | | −9.0 | 117.4 | −19.0 | 62 | ------ | 93 | |
| Aug. 10 | 11 | 14 | −13.5 | 100.1 | −29.0 | 23 | ------ | ------ | Do. |
| | | | −12.0 | 101.6 | −21.0 | ------ | 31 | ------ | |
| | | | +3.5 | 117.1 | −19.0 | 62 | ------ | 116 | |
| Aug. 11 | 12 | 30 | −48.0 | 51.6 | −18.0 | ------ | 6 | ------ | Mount Wilson. |
| | | | +0.5 | 100.1 | −28.0 | 5 | ------ | ------ | |
| | | | +1.0 | 100.6 | −22.0 | ------ | 9 | ------ | |
| | | | +4.0 | 103.6 | +24.0 | 4 | ------ | ------ | |
| | | | +18.0 | 117.6 | −19.0 | 89 | ------ | 113 | |
| Aug. 12 | 10 | 59 | −36.0 | 51.3 | −18.5 | ------ | 77 | ------ | U. S. Naval. |
| | | | +11.5 | 98.8 | −28.0 | 15 | ------ | ------ | |
| | | | +15.0 | 102.3 | −20.5 | ------ | 46 | ------ | |
| | | | +29.5 | 116.8 | −19.5 | 108 | ------ | 246 | |
| Aug. 13 | 11 | 6 | +42.0 | 116.0 | −19.5 | ------ | 93 | 93 | Do. |
| Aug. 14 | 10 | 55 | −80.0 | 340.9 | +19.0 | 62 | ------ | ------ | Do. |
| | | | +42.0 | 102.9 | −20.0 | 8 | ------ | ------ | |
| | | | +58.0 | 118.9 | −18.5 | ------ | 139 | ------ | |
| | | | +81.0 | 141.9 | +22.0 | ------ | 39 | 248 | |
| Aug. 15 | 11 | 5 | −68.0 | 339.6 | +19.0 | 139 | ------ | ------ | Do. |
| | | | +68.0 | 115.6 | −19.5 | 46 | ------ | 185 | |
| Aug. 16 | 12 | 25 | −55.0 | 338.6 | +19.0 | ------ | 174 | ------ | Mount Wilson. |
| | | | −41.0 | 352.6 | +29.0 | ------ | 5 | ------ | |
| | | | +17.0 | 50.6 | −18.0 | 1 | ------ | ------ | |
| | | | +82.0 | 115.6 | −18.0 | 60 | ------ | 240 | |
| Aug. 17 | 11 | 3 | −48.0 | 333.1 | +19.5 | ------ | 8 | ------ | U. S. Naval. |
| | | | −41.0 | 340.1 | +19.5 | 139 | ------ | ------ | |
| | | | +28.5 | 49.6 | −19.0 | ------ | 62 | 209 | |
| Aug. 18 | 10 | 48 | −29.0 | 339.1 | +19.0 | 123 | ------ | ------ | Do. |
| | | | +42.0 | 50.1 | −18.5 | ------ | 108 | 231 | |
| Aug. 19 | 11 | 0 | −15.0 | 339.7 | +19.0 | 108 | ------ | ------ | Do. |
| | | | +57.0 | 51.7 | −18.5 | ------ | 201 | 309 | |
| Aug. 20 | 12 | 45 | −0.5 | 340.1 | +19.0 | 166 | ------ | ------ | Mount Wilson. |
| | | | +16.0 | 356.1 | +28.0 | ------ | 428 | ------ | |
| | | | +75.0 | 55.6 | −18.0 | ------ | 126 | 720 | |
| Aug. 21 | 12 | 38 | +12.0 | 339.4 | +18.5 | 123 | ------ | ------ | U. S. Naval. |
| | | | +28.0 | 355.4 | +28.5 | ------ | 525 | 648 | |
| Aug. 22 | 14 | 41 | +27.0 | 340.1 | +18.5 | 123 | ------ | ------ | Do. |
| | | | +43.0 | 356.1 | +28.0 | ------ | 648 | 771 | |
| Aug. 23 | 11 | 4 | +39.0 | 340.8 | +18.5 | 93 | ------ | ------ | Do. |
| | | | +55.0 | 356.8 | +28.0 | ------ | 710 | 803 | |
| Aug. 24 | 11 | 12 | −82.0 | 206.6 | +30.5 | 154 | ------ | ------ | Do. |
| | | | +51.0 | 339.6 | +18.5 | 93 | ------ | ------ | |
| | | | +70.0 | 358.6 | +28.0 | ------ | 463 | 710 | |
| Aug. 25 | 13 | 53 | −66.0 | 208.0 | +29.5 | 350 | ------ | ------ | Harvard. |
| | | | +67.5 | 341.5 | +19.0 | 130 | ------ | ------ | |
| | | | +77.0 | 351.0 | +29.5 | 240 | ------ | 720 | |
| Aug. 26 | 12 | 45 | −56.0 | 205.3 | +30.0 | ------ | 339 | ------ | Mount Wilson. |
| | | | −4.0 | 257.3 | −28.0 | 2 | ------ | ------ | |
| | | | +80.0 | 341.3 | +17.0 | 16 | ------ | 357 | |
| Aug. 27 | 14 | 59 | −42.5 | 204.3 | +30.5 | 216 | ------ | 216 | U. S. Naval. |
| Aug. 28 | 14 | 32 | −88.0 | 145.9 | +20.5 | 93 | ------ | ------ | Do. |
| | | | −30.0 | 203.9 | +30.5 | ------ | 278 | ------ | |
| | | | +61.0 | 294.9 | −21.5 | ------ | 46 | ------ | |
| | | | +78.0 | 311.9 | −29.0 | 31 | ------ | 448 | |
| Aug. 29 | 11 | 40 | −76.0 | 146.2 | +21.0 | 362 | ------ | ------ | Mount Wilson. |
| | | | −18.0 | 204.2 | +31.0 | ------ | 194 | ------ | |
| | | | +79.0 | 301.2 | −22.0 | 3 | ------ | 559 | |
| Aug 30 | 13 | 44 | −60.0 | 147.9 | +20.5 | 278 | ------ | ------ | U. S. Naval. |
| | | | −7.0 | 200.9 | +30.0 | ------ | 139 | 417 | |
| Aug. 31 | 11 | 3 | −72.0 | 124.2 | +27.0 | 62 | ------ | ------ | Do. |
| | | | −50.0 | 146.2 | +20.5 | 247 | ------ | ------ | |
| | | | +6.5 | 202.7 | +30.0 | ------ | 123 | 432 | |
| Mean daily area for 31 days | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 329 | |