

Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS— SOLAR DIVISION

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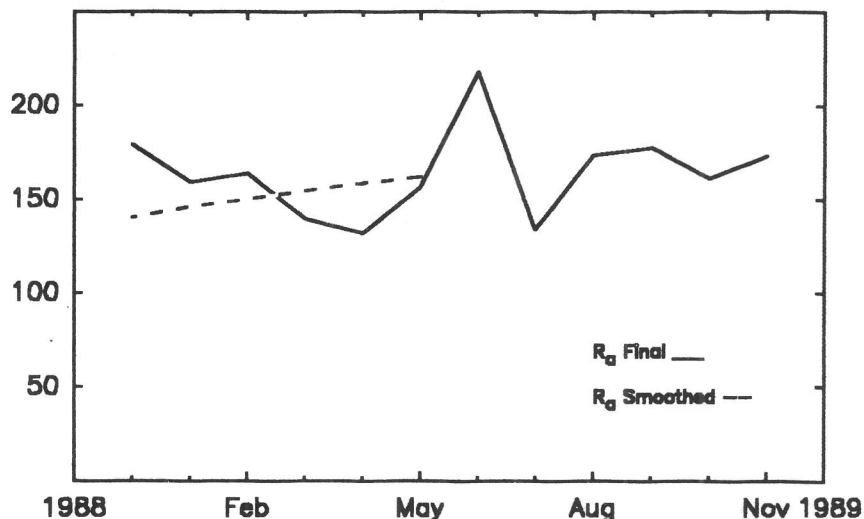
Volume 45 Number 11

November 1989

American Relative Sunspot Numbers for November

| R _a Final | | |
|----------------------|---------|---------|
| 1) 155 | 11) 169 | 21) 181 |
| 2) 173 | 12) 154 | 22) 160 |
| 3) 201 | 13) 145 | 23) 134 |
| 4) 230 | 14) 139 | 24) 172 |
| 5) 230 | 15) 130 | 25) 180 |
| | | |
| 6) 228 | 16) 125 | 26) 184 |
| 7) 208 | 17) 140 | 27) 199 |
| 8) 204 | 18) 142 | 28) 176 |
| 9) 201 | 19) 152 | 29) 179 |
| 10) 188 | 20) 149 | 30) 160 |

Mean = 172.9



The smoothed-mean American Relative Sunspot Number for May 1989 is 161.9. One-hundred four members of the international network of American Sunspot Program collaborators submitted reports for November. Solar activity was moderate and high during the month. Fifty-eight M-level, and nine X-class flares were recorded. SESC Region 5783 (N18, L295, FKI on 12 Nov) produced the month's first X-class event on the 12th, which was rated at X1.5/SN. Region 5786 (N13, L255, EAO on 7 Nov) followed with three additional X-level flares, an X3.2/3B and an X1.8/2B on the 15th, and an X1.1/2B on the 16th. Region 5747, a prolific flare producer during its previous disk passage, returned to the visible disk and was split into two groups: the preceding member was numbered 5788 while the following portion was assigned 5793 (S25, L197, EKI on 20 Nov). Region 5793 also yielded three X-class solar flares, on the 19th (X1.1/2B); 20th (X1.0/2B) and 21st (X4.0/2B). The month's final X-class events were produced by Region 5800 (N25, L080, EKI on 25 Nov), an X1.0/2N on the 25th, and a long-duration X2.6/3B on the 30th. The x-ray emission from the second event remained at M-level or above for nearly four hours. The geomagnetic field was at major to severe storm levels on the 17-18th in response to the X3.2/3B flare which occurred on the 15th. Solar 10.7 centimeter radio flux and background x-radiation levels were at 249 and C1.8 on the 30th.

The *estimated* American Sunspot Number for 1-14 December is 169. The Sun's activity has declined during this period: only ten M-class x-ray solar flares have occurred thus far during December. Fifteen to seventeen separate spot groups have been visible on some days, but only a few have been magnetically complex.

References: SESC PRF, Numbers 740-44; SESC SDF, Numbers 340-348 (1989).

Predicted Smoothed Relative Sunspot Numbers

McNish - Lincoln Method:

June 168 (11); July 171 (16); August 174 (21); September 181 (24); October 186 (26); November 189 (28).

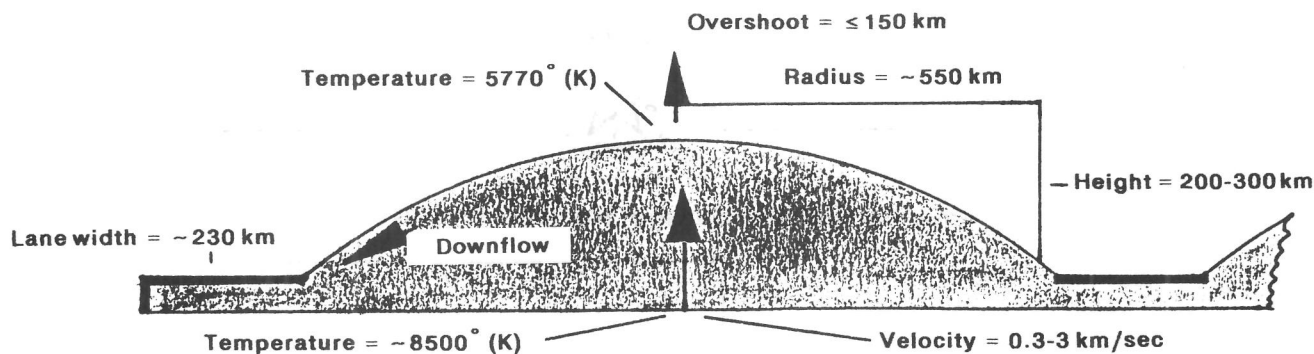
Solar-Geophysical Data, 542, I, 28.

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(Note: Network collaborators should utilize these reporting facilities whenever possible.)

Granular Explosions

Thomas G. Compton



Granular Cell Geometry

In recent years, great strides have been made in the research on solar granulation. One of the latest results of these studies concerns a phenomenon known as granular fragmentation. Granulation is a convection effect which causes the Sun to have a mottled appearance when viewed through a moderately sized telescope under excellent observing conditions. Its properties do not seem to vary with the solar cycle (Gibson, 1973). Individual granules are around a thousand kilometers in diameter, have lifetimes near eighteen minutes and a "bubble" velocity of approximately two kilometers per second (Zirin, 1988).

According to Zirin, research by the Lockheed group using information obtained with special instruments aboard *SpaceLab II*, indicates that approximately forty-percent of granules explode, while sixty-percent decay normally or coalesce with neighboring cells. The explosions are so intense that the surrounding granules are actually pushed away by the sudden release of energy. Since the cells which explode also have a decisive effect upon nearby granules, the majority of cells are affected by this phenomenon.

Because these events would result in a horizontal photospheric velocity which is greater than the vertical, the effect could cause the broadened Fraunhofer lines which are observed near the Sun's limb. This new knowledge has significantly changed the long-standing concept of a "quiet" Sun, and may eventually modify our understanding of many of the properties which are associated with the Sun's convective system.

Gibson, E.G. 1973, The Quiet Sun, NASA SP-303, U.S. Government Printing Office, Washington, DC.
Zirin, H. 1988, Astrophysics of the Sun, Cambridge University Press, Cambridge, England.

Sudden Ionospheric Disturbances Recorded During October

Records were received from A1,3,9,19,46,50,52,61,62,63,64,65.

| Day | Max | Imp | Day | Max | Imp | Day | Max | Imp | Day | Max | Imp | Day | Max | Imp |
|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|
| 2 | 18:09 | 1- | 13 | 05:29 | 3+ | 18 | 12:14 | 1- | 21 | 14:17 | 2+ | 26 | 20:46 | 2 |
| 4 | 08:47 | 2+ | 13 | 15:56 | 1 | 18 | 15:10 | 2 | 21 | 18:27 | 2 | 27 | 11:35 | 1+ |
| 6 | 06:20 | 2+ | 14 | 07:00 | 2 | 18 | 16:55 | 1 | 21 | 19:20 | 1+ | 27 | 19:02 | 2 |
| 6 | 17:47 | 1- | 14 | 08:36 | 1 | 18 | 17:51 | 1+ | 21 | 20:44 | 1+ | 28 | 09:41 | 1 |
| 7 | 05:00 | 2+ | 14 | 17:52 | 1 | 18 | 18:20 | 3 | 22 | 12:53 | 1+ | 29 | 04:10 | 2 |
| 10 | 08:16 | 1 | 14 | 18:16 | 1+ | 19 | 09:13 | 2 | 22 | 13:41 | 1+ | 30 | 08:55 | 1- |
| 10 | 13:37 | 1+ | 14 | 18:58 | 1- | 19 | 12:50 | 3+ | 22 | 16:00 | 2 | 30 | 10:15 | 1- |
| 10 | 16:48 | 1+ | 15 | 12:39 | 2 | 20 | 03:40 | 2 | 22 | 17:47 | 2+ | 30 | 19:46 | 2 |
| 11 | 04:51 | 2 | 15 | 14:28 | 2+ | 20 | 05:31 | 2 | 23 | 12:43 | 2 | 30 | 21:15 | 2+ |
| 12 | 03:28 | 2+ | 16 | 10:11 | 1- | 20 | 07:51 | 1+ | 23 | 19:02 | 1+ | 31 | 08:15 | 1- |
| 12 | 04:45 | 2+ | 16 | 10:40 | 1- | 20 | 15:25 | 2+ | 24 | 14:15 | 1 | 31 | 10:15 | 1+ |
| 12 | 15:12 | 2+ | 17 | 18:56 | 2+ | 20 | 21:46 | 1+ | 24 | 18:14 | 3 | 31 | 16:18 | 3+ |
| 13 | 03:00 | 2+ | 18 | 04:42 | 1- | 21 | 07:00 | 1- | 25 | 05:01 | 1+ | 31 | 19:02 | 2 |
| 13 | 04:18 | 1 | 18 | 05:02 | 1- | 21 | 07:16 | 1- | 25 | 16:37 | 1 | 31 | 20:42 | 2+ |
| 13 | 04:25 | 1- | 18 | 09:15 | 1- | 21 | 08:30 | 1 | 26 | 17:27 | 1- | | | |

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