# Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS— SOLAR DIVISION

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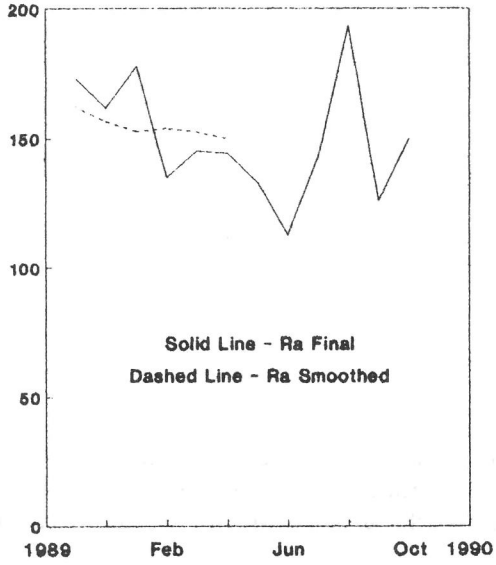
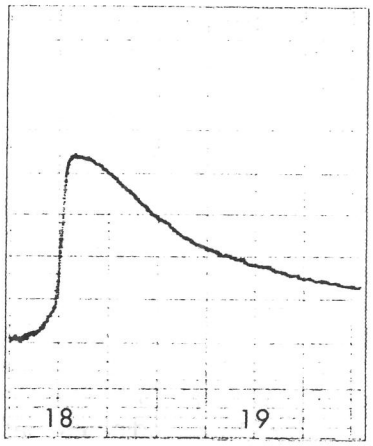
**American Relative Sunspot Numbers for October**

| | $R_a$ Final | |
|---|---|---|
| 1) 120 | 11) 199 | 21) 141 |
| 2) 130 | 12) 190 | 22) 143 |
| 3) 146 | 13) 207 | 23) 137 |
| 4) 147 | 14) 208 | 24) 132 |
| 5) 130 | 15) 221 | 25) 130 |
| 6) 136 | 16) 193 | 26) 111 |
| 7) 150 | 17) 190 | 27) 110 |
| 8) 155 | 18) 185 | 28) 107 |
| 9) 156 | 19) 173 | 29) 108 |
| 10) 173 | 20) 152 | 30) 89 |
| | | 31) 84 |

Mean: 150.1
Number of contributors: 103




Solar activity was low during the first week of October. Only limited flaring at the mid-C X-ray level or below was detected. The first M-level flare to be recorded during the month occurred on the 8th, an optically un-correlated M1.5 event. One additional M-class flare was detected on each of the following three days. Two of these events were associated with **SESC** Region 6314 (S18, L140, Eki on 10 October), which was the largest group (~650 millionths solar hemisphere) to appear on the disk during October. Brief intervals of severe geomagnetic storming took place at high latitudes on the 11th; however the cause of this activity was uncertain.

Just two solar flares reached M-class intensity between the 13th and 19th. The strongest of these events, a M2.8/1N in Region 6321 (S23, L103, Eao on 15 October), took place on the 15th. However, relative sunspot numbers peaked at mid-month, with up to twenty separate spot groups present on the disk.

Activity entered the high range on the 20th when the strongest flare (M8.5/1N) to arise since the X3/2B event in old Region 6233 on 27 August, erupted in Region 6311 (N16, L153, Cko on 20 October). One example of the sudden ionospheric disturbance (SID) which occurred as a result of this major flare is shown above. This event was followed by three additional M-level flares on the 21st (M1 and M3 events from Region 6311, and a M1 in Region 6327), and a M2.9/SF on the 22nd in Region 6322 (S07, L095, Cso on 22 October).

Flare activity then declined to the low level for the remainder of October. On the 25th, Region 6327 (N20, L030, Fsi on 25 October) spawned a number of new intermediate spots in a reverse polarity configuration, but most were short-lived and the group produced only small flares thereafter. Sunspot numbers decreased to their lowest level of the month as October ended.

In spite of the relatively high mean in the number of sunspots which were observed during October, the smoothed monthly-mean for April 1990 decreased to 149.9. Consequently, it has become more unlikely that the value for July 1989 ($R_a$ smoothed mean = 163.2) will be exceeded during the rest of cycle twenty-two, and the cycle's ascending branch will be the shortest of record (2.83 years).

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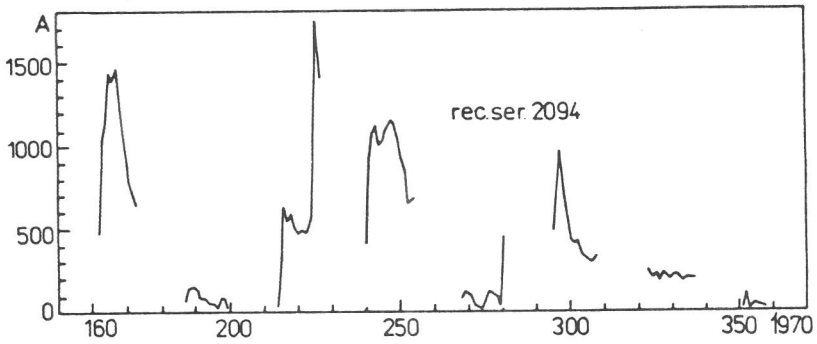
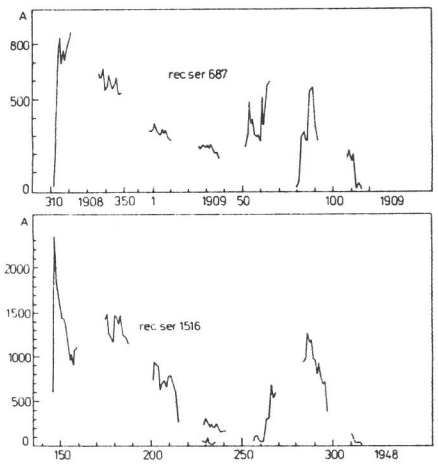
The estimated mean American Relative Sunspot Number for 1-15 November is 159. Activity has been low and moderate thus far in November. Six solar flares have attained M-level X-ray intensity, but their energy outputs have been towards the lower portion of the scale.

A portion of this information was obtained from the **SELDADS** data base.

## Long-lived Sunspot Groups

Sunspot groups with lifetimes which exceed two or three solar rotations are very rare. In 1984, M. Kopecky investigated three spot groups which are believed to be the longest-lived complexes to occur between 1874 and 1976, the period which is encompassed by the Greenwich Photoheliographic Results. The area development of these groups is depicted in the figures below, which are reproduced from his paper. According to Kopecky, the group with the greatest longevity (recurrent series Number 2094) was observed between 11 June and 23 December, 1970; an interval which spanned eight rotations. Only two other groups in the Greenwich record have approached this lifetime. Each was seen to appear for seven successive rotations; the first (Number 687) during 1908-09, and the second (Number 1516) in 1948.




More recently, Istanbul University Observatory astronomers, F. Es ín and T. Özisik, have proposed that another long-lived group may have occurred during the ascent of solar cycle twenty-two. Their description (Es ín and Özisik, 1990) indicates that the group first observed by them on 15 June, 1988 and initially designated **NOAA** Region 5047 (S16, L154), returned to the visible hemisphere during seven additional rotations, or until early January 1989. Furthermore, their observations suggest that the cluster may also have made a final appearance as a small unipolar group in a nearby location during the rotation following the early January passage.

*- Editor -*


Es ín, F. and T. Özisik 1990, Publications of the Istanbul University Observatory, No. 151.
Kopecky, M. 1984, Solar Physics, **93**, 181-87.


## Sudden Ionospheric Disturbances Recorded During September 1990

Records were received from A1,9,19,40,50,52,61,62,63,64,65,66,67,68,69,70,71.

| Day | Max | Imp | Def | Day | Max | Imp | Def | Day | Max | Imp | Def | Day | Max | Imp | De |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0708 | 1+ | 5 | 7 | 0531 | 2+ | 4 | 17 | 1409 | 2 | 5 | 22 | 1926 | 2 | 5 |
| 1 | 1717U | 3 | 4 | 7 | 0756 | 2 | 5 | 17 | 1801 | 1- | 5 | 22 | 2245 | 2+ | 4 |
| 1 | 2221 | 1- | 4 | 8 | 2217 | 2+ | 4 | 17 | 1853 | 2+ | 5 | 23 | 1312 | 2+ | 5 |
| 3 | 0742 | 1- | 4 | 12 | 1905 | 2+ | 5 | 17 | 2158 | 2+ | 5 | 24 | 1352 | 1 | 5 |
| 3 | 0947 | 2+ | 5 | 13 | 1409 | 2 | 5 | 18 | 2037 | 1- | 5 | 24 | 1612 | 2 | 4 |
| 3 | 1345 | 1+ | 5 | 13 | 1755 | 2 | 4 | 19 | 0910 | 1+ | 5 | 24 | 1859 | 2+ | 5 |
| 3 | 1935 | 2 | 5 | 14 | 0416 | 2 | 5 | 19 | 1416 | 1- | 4 | 25 | 1036 | 1+ | 4 |
| 4 | 0810 | 2+ | 4 | 14 | 1335 | 3 | 5 | 19 | 1639 | 2 | 5 | 26 | 1330 | 2+ | 4 |
| 4 | 1446 | 3 | 5 | 14 | 2014 | 2+ | 5 | 19 | 2058 | 1- | 4 | 26 | 1434 | 1 | 5 |
| 5 | 0437 | 2+ | 4 | 15 | 0751 | 1 | 5 | 20 | 0624 | 2 | 4 | 26 | 1602 | 2 | 5 |
| 5 | 1552 | 2+ | 5 | 15 | 0815 | 1 | 5 | 20 | 1324 | 1+ | 5 | 26 | 1841 | 1+ | 5 |
| 5 | 1927 | 1 | 5 | 15 | 1841 | 1 | 5 | 20 | 1525 | 2 | 5 | 28 | 1412 | 1- | 5 |
| 5 | 2200 | 1 | 4 | 16 | 1424 | 2 | 5 | 20 | 1721 | 1 | 5 | 29 | 0408 | 1+ | 5 |
| 6 | 1600 | 2+ | 4 | 17 | 1330 | 1- | 5 | 20 | 1859 | 3 | 5 | 29 | 2313 | 1+ | 4 |
| 6 | 2130 | 2+ | 5 | 17 | 1347 | 2+ | 5 | 21 | 1305 | 1 | 4 | 30 | 0745 | 2 | 5 |

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