Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS— SOLAR DIVISION

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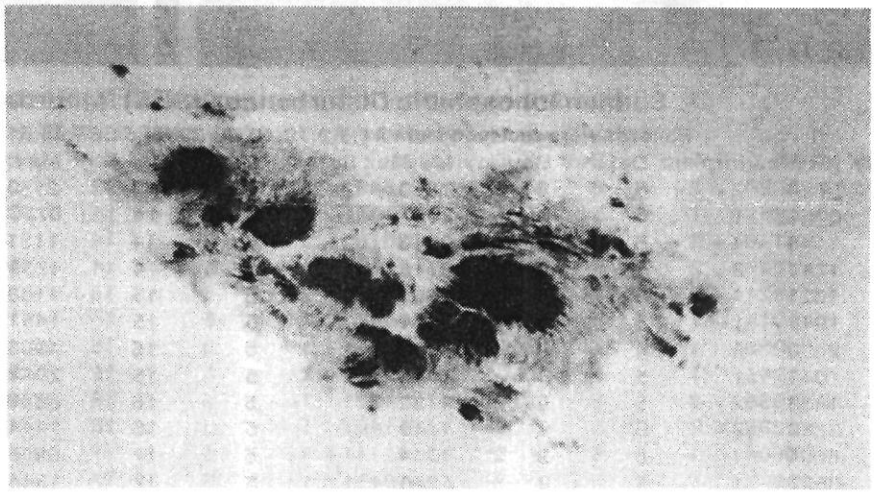
American Relative Sunspot Numbers for June

	R_a Final				
1)	162	11)	200	21)	125
2)	162	12)	196	22)	126
3)	160	13)	157	23)	114
4)	172	14)	158	24)	125
5)	172	15)	166	25)	143
6)	164	16)	159	26)	142
7)	162	17)	138	27)	140
8)	194	18)	143	28)	160
9)	197	19)	135	29)	175
10)	200	20)	113	30)	188

Mean: 158.3
Number of reports: 98



Note: The fine photographs of Region 6659 shown above and on page 2 of the Bulletin were taken by our collaborator in France, Dr Jean Dragesco. The final X12+ event in Region 6659 reached maximum less than one hour before the flare photograph was taken.

Activity was moderate and high during the first week of June. SESC Region 6659 (N31, L244, FKC on 11 June) produced three solar flares which saturated the GOES X-ray sensors at the X12 level, becoming the first sunspot group of cycle twenty-two to yield three or more flares of this magnitude, and eventually the first on record to spawn five. The first three events included a X12+/1F Tenflare from just behind the east limb on 1 June that was accompanied by a bright spray of material visible out to 0.5 solar radii; a X12+/3B Tenflare on the 4th; and a X12+/4B Tenflare on the 6th. According to SESC, these are the strongest X-ray flares since the (estimated) X15 event during October 1989. Twenty M-level flares were also recorded during this period, the largest a M5.2 on the 2nd which was also assigned to Region 6659.

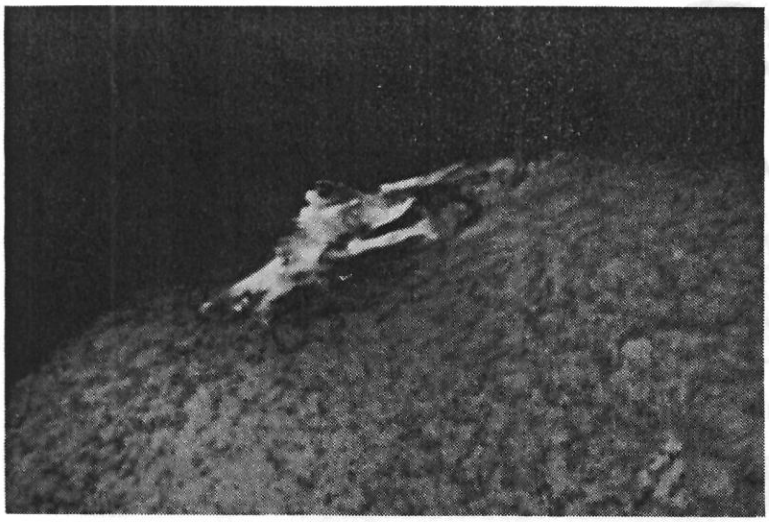
The geomagnetic field experienced minor to severe storm conditions throughout most of the week as a result of these events, and the activity which took place at the end of May. The proton event which began in late May peaked early on the 1st and ended on the 3rd. A new satellite level proton event and sudden commencement-type shock were recorded on the 4th, a likely result of the X12+ flare which erupted earlier. Severe storm levels were encountered by the 5th, and the daily magnetic index during this interval became the second highest to be recorded this cycle (behind March 1989). GOES satellites underwent magnetopause crossings on the 4th and 5th.

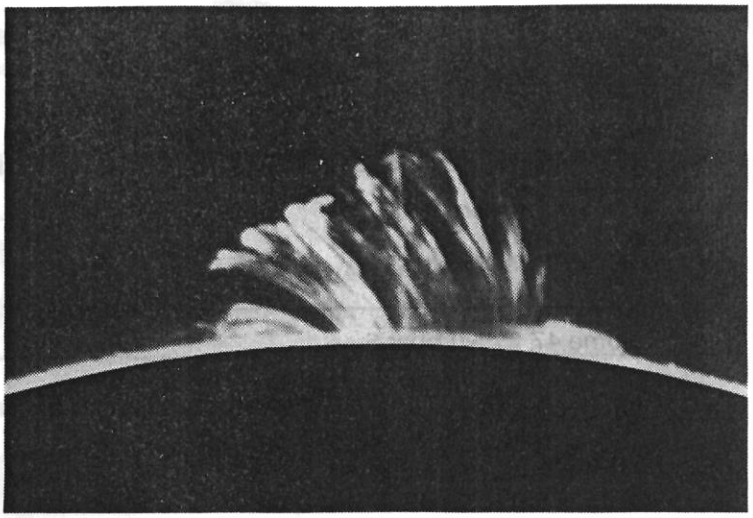
The Sun was at a high level of activity between the 9th and 14th, as Region 6659 continued to produce major flares. The more noteworthy of these were a X10.0/3B Tenflare on the 9th; a M6.4/1N on the 10th; a fourth X12+/3B Tenflare and a long-duration M5.3/1B on the 11th; a M5.4/1F on the 13th, and a M7.3/2N on the 14th. At ~2200 millionths solar hemisphere (about thirteen times the surface area of the Earth), Region 6659 was the largest group on the visible hemisphere during June, and one of the more sizable this cycle. Magnetic observatories at mid and high-latitudes continued to record major to severe storm conditions during the second week of June. The greater than 10 MeV proton event which began on the 4th was continually bolstered by the major flares in Region 6659 and eventually reached a peak flux of 3000 p.f.u. on 11 June, at about the same time that a ground level event (GLE) was recorded. Additional sudden impulses (SIs) or storm commencements were recorded at Boulder on the 9th, 12th and 13th. A Forbush decrease with a maximum decrease of ~18% was recorded on the 13th, and auroral activity was widely observed down to mid-latitudes during the period. The long duration proton event and associated polar cap absorption (PCA) finally ended on the 14th.

The third week of June began with activity in the high range. Region 6659 produced its fifth solar flare at or above the X12 level: a X12+/3B Tenflare on the 15th (see page 2). Later in the day, Region 6666 (S15, L239, FAI on 15 June) also contributed a major event, rated M5.5/2B. By the 15th a new satellite proton event and PCA were in progress. This event, enhanced by the earlier X12+ flare, reached a maximum of 1400 p.f.u. on the 15th. A second GLE also took place before midday on the 15th. Region 6659 spawned the week's only other major flare on the 17th (M5.2) as it passed behind the Sun's western limb. Boulder noted a storm commencement on the 17th, but by the 19th both PCA and proton events ended, and the magnetic field had calmed to quiet or unsettled conditions with a majority of solar activity indices declining accordingly.

Activity was relatively quiet for several days, then became high on the 28th when a major flare (M6.0) was recorded near the location of old Region 6659, over two days away from a return disk appearance. According to SESC, this event would have been much larger had the group (now re-numbered 6703) been present on the visible hemisphere. A SI and satellite proton event on the 30th were probably caused by this flare. June's final major flare occurred on the 30th, a M5.0/1N Tenflare in Region 6693 (S06, L356, EKI on 30 June). The smoothed mean American Relative Sunspot Number for December 1990 climbed to 145.2.

[A portion of this information was obtained from the **SESC** data base.]





Sudden Ionospheric Disturbances (SES) Recorded During May 1991

Records were received from A1,3,9,19,40,50,52,59,61,62,63,64,65,66,67,68,69,70,71,72.

Day	Max	Imp	Def	Day	Max	Imp	Def	Day	Max	Imp	Def	Day	Max	Imp	Def
1	0020	2+	5	8	1840	2+	5	13	2130	1+	4	27	1955	1	4
1	0951	1-	5	8	2007	1-	5	14	0723	1-	5	27	2015	2+	5
1	1146	1+	5	8	2016	2	5	14	1131	2	3	27	2101	1	5
1	1747	2	5	8	2145	1-	5	14	1739	2	5	27	2222	1	5
1	1821	1+	5	8	2301	2+	5	15	1103	1-	4	27	2313	2	5
1	1948	1+	5	9	0844	1+	5	15	1451	1	5	28	0123	2	5
1	2030	1	4	9	0910	1+	5	15	1908	2+	4	28	0712	1-	5
2	1045	1	5	9	1054	2+	5	15	2044	2+	5	28	0729	2	5
3	1838	2+	5	9	1132	1-	5	16	0649	3+	5	28	0754	1-	5
3	2236	2+	5	9	1149	1-	5	16	1444	1+	5	28	1021	2	5
4	0604	1	5	9	1214	1+	5	17	0906	2+	5	28	1215	1-	5
4	0627	1	5	9	1240	1+	5	17	1344	2+	5	28	1225	1	5
4	1401	1-	4	9	1509	1	5	17	1353	1-	4	28	1313	2+	5
4	1601	1+	5	9	1730	1	4	17	1712	1	4	28	1444	1-	5
4	2234	1	4	9	1750	2+	5	17	1828	1	5	28	1517	1-	5
4	2316	1-	4	9	2023	1-	4	17	2108	1-	5	28	1623	2+	5
5	0421	1	4	10	1915	2	5	17	2222	2+	5	28	1833	1+	5
5	0530	1	5	10	1946	2+	5	17	2306	1	5	28	2014	2+	5
5	0600	2	5	10	2007	1+	4	18	0445	1	4	28	2117	2+	5
5	1015	1-	5	10	2345	2	5	18	0502	3+	5	28	2200	1-	4
5	1045	1-	5	11	0053	1-	5	18	1534	1+	5	28	2213	2+	5
5	1225	1+	4	11	0516	1-	5	18	1613	1+	5	29	0027	1+	5
5	1515	1-	5	11	0642	1+	5	18	1646	1+	5	29	0121	1+	5
5	2001	1-	4	11	0812	2+	5	18	1915	1-	4	29	0301	2	5
5	2033	1-	5	11	1135	2+	5	18	1932	1-	4	29	0448	2	5
5	2045	1-	5	11	1322	2+	5	18	2054	1	5	29	0717	2	4
5	2058	2+	5	11	1421	2	5	18	2116	1-	4	29	1208	2+	5
5	2216	1	5	11	1521	2+	5	19	1354	3+	5	29	1400	1-	4
6	0600	1+	5	11	1614	1	5	21	1651	1-	5	29	1426	2	5
6	1700	2+	5	11	1644	1+	5	22	0007	1	5	29	1533	3	5
6	1946	1-	5	11	1830	1-	4	22	0550	2+	5	29	1633	2+	5
6	2127	1+	5	11	2015	3+	5	22	0643	2	5	29	1954	2+	5
6	2152	1	4	12	0600	2+	4	23	0137	1+	5	29	2344	2+	5
6	2330	2	5	12	0721	1+	5	24	1845	1	5	30	0716	2+	5
7	0006	1+	5	12	0805	2	4	25	1415	2	5	30	0940	2+	5
7	0031	3	5	12	1033	3	4	25	1512	1-	4	30	1128	2+	5
7	0741	2+	5	12	1233	2	5	25	2143	2	5	30	1413	2+	5
7	1007	1	4	12	1321	2	5	25	2215	1-	5	30	1747	1+	4
7	1039	2+	5	12	1614	2+	5	25	2229	2	5	30	2208	1+	5
7	1448	2	5	12	1717	1	5	26	0853	2	5	30	2300	2	5
7	1530	1	5	12	1736	2+	5	26	2030	1-	5	31	0247	1+	5
7	1805	2	5	12	2016	1+	5	27	0144	2	5	31	0410	2+	5
7	1945	2	4	12	2237	1+	5	27	1310	1	5	31	0840	2+	5
7	2242	1	5	12	2300	1-	4	27	1522	2	5	31	1234	1	5
8	0108	1	4	13	0039	1+	5	27	1600	1-	5	31	1432	1+	4
8	0144	2	4	13	0121	3	5	27	1809	1+	5	31	1656	2+	5
8	1601	2+	5	13	0514	2+	5	27	1906	2+	5				

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