

Solar Bulletin

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Peter O. Taylor, editor
 P O Box 5685
 Athens, GA 30604-5685 USA



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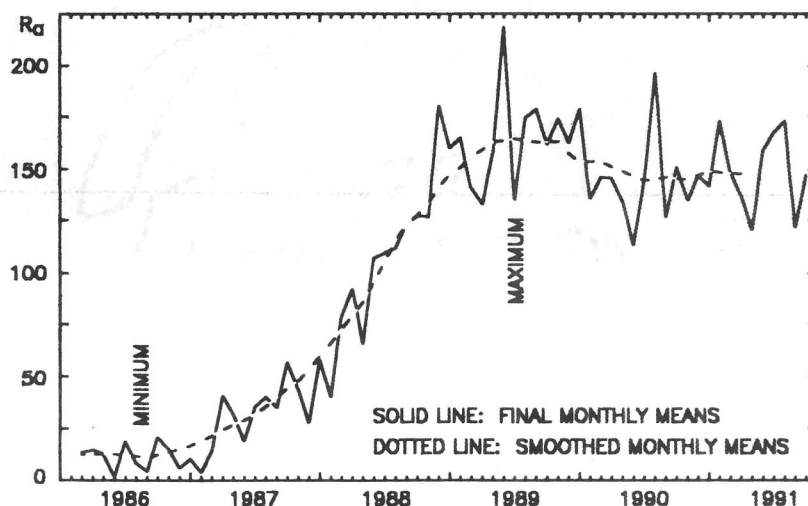
October 1991

American Relative Sunspot Numbers for October

R _a Final	
1) 150	11) 143
2) 159	12) 130
3) 160	13) 137
4) 147	14) 128
5) 158	15) 128
6) 131	16) 133
7) 118	17) 110
8) 114	18) 108
9) 139	19) 88
10) 144	20) 88
	21) 86
	22) 92
	23) 111
	24) 144
	25) 168
	26) 183
	27) 213
	28) 236
	29) 247
	30) 222
	31) 215

Mean: 146.1

Number of reports: 98



Solar activity was mixed between the 1st and 11th. Eleven class M flares were recorded, mainly in adjacent NOAA/USAF Regions 6850 (S12, L179, FKC) and 6853 (S20, L173, FKO). However, the month's first major flare, a M5.2/SB, occurred on the 4th in Region 6861 (N09, L129, DSO). A sudden impulse was recorded at Boulder on the 1st and GOES-6 experienced a brief magnetopause crossing. Minor to major geomagnetic storm conditions ensued, probably rooted in earlier flare and disappearing filament occurrences.

Thirteen class M flares were recorded during the following week. Two of these were major flares. They included a M6.0/1N on the 13th in Region 6879 (N23, L299, CAO), and a M6.6/3N on the 14th in Region 6878 (S21, L334, EAO). The remaining class M flares were without optical correlation or also occurred in these spot-groups.

Activity declined to low until the 22nd when old Region 6850 returned for a third appearance (the group was born on the visible hemisphere in early September as Region 6818, then returned as Region 6850), and promptly began to spawn major flares. This group, now named Region 6891 (S12, L183, FKC) attained its largest area during this transit, ~2600 millionths solar hemisphere or 7800 million km², and contained over 100 individual spots. Old Region 6853 also returned on the 22nd, but as a rather small DAO-type group (Region 6892).

Solar activity was high during most of the remainder of October. Region 6891 produced four major flares. These included the most powerful event since the (estimated) X12/3B Tenflare in Region 6659 on 15 June: a X6.1/3B Tenflare on the 27th. Other major events in Region 6891 were a X1.7/2N Tenflare on the 26th, a X1.9/2B which preceded the X6 on the 27th, and a X2.5/3B Tenflare on the 30th.

Sudden impulses (SI) were recorded on the 26th (43 nT) and 28th (54 nT); the latter event was followed by a second shock several hours later. A Forbush decrease (~10%), small proton event and PCA also took place on the 28th. Severe geomagnetic storm conditions prevailed on the 28th and 29th, and again on the 31st. K-indices of 7-8 at mid-latitudes were common until midday (UT) on the 29th, and aurorae were sighted at stations in Canada and the United States. A second proton event began on the 30th, was enhanced at about the same time that a third SI was recorded, and ended on the 31st. All of these occurrences are thought to be flare-related. April smoothed mean: 146.7.

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

Notes on the Solar Granulation

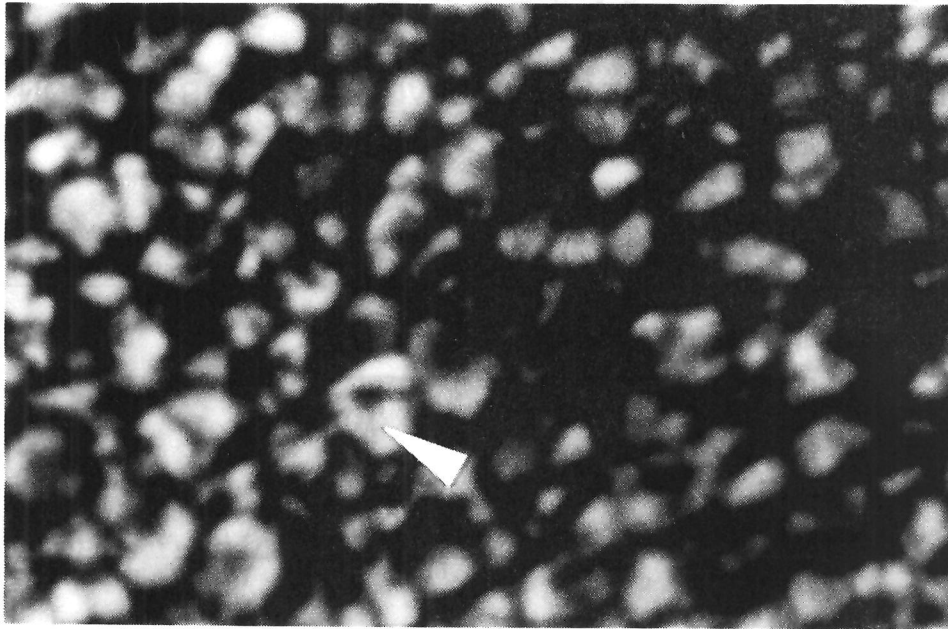
Thomas G. Compton

It has long been realized that the 'surface' of the Sun, the photosphere, is not smooth, but is made up of a myriad of comparatively tiny granules. This phenomenon gives the Sun a mottled or grainy appearance when it is viewed with a moderately-sized telescope under excellent seeing conditions.

However, 'movies' of these features taken with the *Solar Optical Universal Polarimeter (SOUP)* aboard Spacelab 2 show that the situation is far more complex than once believed. The original images were taken within a 1000-angstrom-wide band centered at 6000 angstroms, digitized and computer processed. The Spacelab Instrument Pointing System minimized image stability to the degree that virtually all have better than 0.5 arc second resolution. Several of the more interesting results to emerge from this research have been summarized in Title et al. (1988).

Although they were once thought to occur rarely, the *SOUP* movies illustrate that exploding granules - granules which expand rapidly and develop a dark central region which is often 'Y-shaped' (see photo, page 2) - are a routine feature of granulation evolution. Exploders tend to occur inside of mesogranules. Their expansion velocities are on the order of 1-2 kilometer sec⁻¹, with an average diameter of 4.2 arc seconds at their maximum size.

Surprisingly, at least half of the Sun's nonmagnetic surface appears to be affected by the expansion circles of exploding granules, and neighboring granules are often destroyed or distorted by an exploder. Even though the lifetime of an average granule is relatively short,



somewhere on the order of 5-10 minutes or more, the lifetime of an individual granule varies considerably since it is influenced by events in the immediate location.

Exploding granules seem to repeat and produce new exploders, but they are not evenly distributed over the Sun's surface. Furthermore, there appears to be no typical pattern of granulation evolution. Instead, the solar surface is comprised of brightness fluctuations which are caused by a combination of convection, turbulence, waves and magnetic fields. Interestingly enough, while exploding granules are a common feature of the Sun, they almost never appear in the strongly magnetized areas around sunspots.

References:

Title, A. 1991, (private communication to T.G. Compton).

Title, A. et al. 1988, BAAS, Volume 20, Number 2, p679.

(Photo courtesy of D.F. Neidig, National Solar Observatory - Sacramento Peak.)

Sudden Ionospheric Disturbances (SES) Recorded During September 1991

Records were received from A1,3,9,19,40,50,52,59,61,62,63,64,65,66,67,68,69,70,71,72,73,74.

Day	Max	Imp	Def	Day	Max	Imp	Def	Day	Max	Imp	Def	Day	Max	Imp	De
1	0456	1+	5	6	1411	2	5	8	1836	2+	5	22	1606	1-	5
1	1345	1	5	6	1546	1-	5	8	1908	1-	5	23	0726	1-	5
1	1752	1-	5	6	1606	1+	5	8	2039	2+	5	23	0745	1	4
2	0710	1	5	6	1622	1	5	8	2235	2+	5	23	1136	1-	5
2	0819	1+	5	6	1641	1	5	9	0610	2+	5	23	1757	2	5
2	1230	1	5	6	1758	2+	5	9	0911	2+	5	23	2015	2	5
2	1254	1	5	6	1910	1-	5	9	1654	1-	5	23	2144	1-	5
2	1622	2	5	6	2007	1-	5	9	1749	1	5	24	0537	1	5
2	2115	1	5	6	2017	1-	5	9	2112	1-	5	24	0623	2+	5
3	0825	1-	5	6	2044	1	5	9	2210	1-	5	24	0753	2+	5
3	1521	1	5	6	2222	2	5	10	1348	1+	5	24	0923	1-	5
3	1645	1	5	7	0753	2+	5	10	1506	2	5	24	1104	3	5
3	1807	2+	5	7	1008	2	5	10	1708	1+	5	24	1235	1	5
3	1846	1+	5	7	1235	1-	5	10	1744	2	5	24	1321	1	5
3	2003	2	5	7	1247	2+	5	10	2049	1	5	24	2025	1-	5
3	2300	1-	5	7	1523	2	5	10	2109	2+	5	24	2300	1	5
4	0004	1	5	7	1731	1+	5	11	2059	2+	5	25	1114	1	5
4	1115	2	5	7	1750	1+	5	12	1246	1	5	25	1449	1+	5
4	1211	1-	5	7	1828	2+	5	12	1821	1	5	25	1532	1	5
4	1431	2+	5	7	1846	1-	5	13	0520	1	5	25	1625	1	5
4	1716	1	5	7	1923	2+	5	13	1752	2	5	25	1652	1	5
4	1842	2+	5	7	2148	1	5	14	1224	1	5	25	2015	1	5
4	2024	1-	5	7	2251	2+	5	14	1347	2	5	25	2240	1+	5
4	2040	2	5	7	2325	1-	5	14	1542	1-	5	26	0655	1-	5
4	2123	1	5	7	2339	2	5	14	1647	1-	4	26	1232	2+	5
5	0042	1	5	8	0541	1+	5	15	1425	2+	5	26	1356	1-	5
5	0111	2+	5	8	0642	2	5	16	0756	2+	5	26	1600	1-	5
5	0525	2	5	8	0817	1	5	16	1550	1-	5	26	1704	1-	5
5	1208	2+	5	8	0914	2+	5	16	2118	1	5	26	2050	2+	5
5	1237	1-	5	8	1130	1-	5	17	1223	1-	5	27	0351	1+	5
5	1552	1-	5	8	1137	2+	5	17	1553	2+	5	27	1524	2+	5
5	1600	1+	5	8	1200	1-	5	17	1902	2+	5	27	1615	2+	5
5	1648	1-	5	8	1303	1+	5	18	0920	1-	5	27	1640	2+	5
5	1754	1-	5	8	1433	1-	5	18	1353	1	5	28	1947	1+	4
5	1821	1-	5	8	1441	2	5	18	1413	2+	5	29	1315	2	5
5	2030	1	5	8	1529	1	5	18	1723	2	5	29	1524	2+	5
5	2131	2	5	8	1559	1+	5	19	1100	2	4	29	1607	1-	5
5	2203	2+	5	8	1627	1	5	21	0907	1+	5	29	1923	1+	5
6	0648	2	5	8	1655	2+	5	22	1122	2	5	30	0455	2	5
6	1301	1	5	8	1741	1	5	22	1338	1	5	30	1433	2+	5
6	1347	1-	5	8	1800	1+	5	22	1407	1-	5	30	1500	2+	5
								22	1552	2+	5	30	2230	2+	5

SPAN: 9555::ptaylor

INTERNET: ptaylor%SELVAX.dnet@east.gsfc.nasa.gov

FAX: [USA] 404-353-2336