Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS— SOLAR DIVISION

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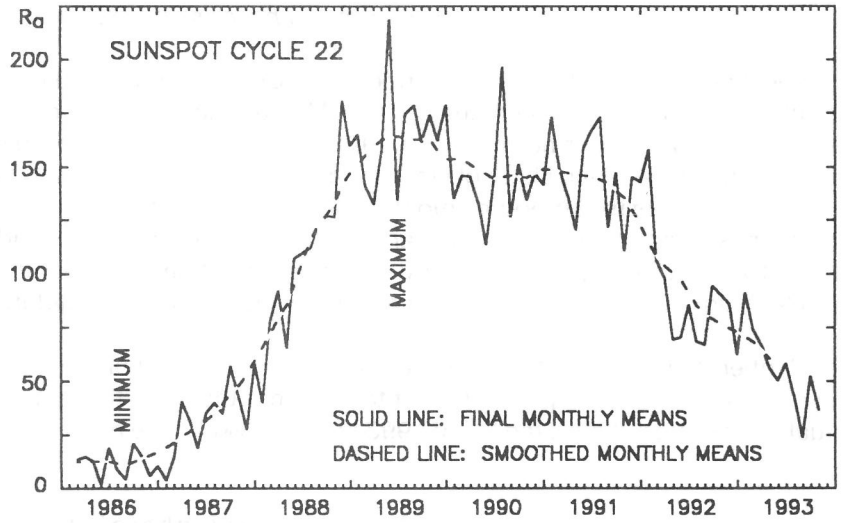
American Relative Sunspot Numbers for November

	R_a Final				
1)	21	11)	19	21)	55
2)	19	12)	15	22)	54
3)	18	13)	22	23)	54
4)	20	14)	27	24)	53
5)	32	15)	27	25)	40
6)	34	16)	33	26)	42
7)	31	17)	36	27)	43
8)	27	18)	35	28)	54
9)	22	19)	40	29)	57
10)	24	20)	43	30)	71

Mean: 35.6
Number of reports: 99



***** THE EDITOR AND SOLAR DIVISION COMMITTEE WISH ALL CONTRIBUTORS A HAPPY HOLIDAY SEASON AND PRODUCTIVE NEW YEAR *****

November Summary: Solar activity continued to be low and very low between the 1st and 4th of November. Only one spot group - NOAA/USAF Region 7613, a moderately-sized type E in the Southern Hemisphere - was visible on the 3rd and 4th. The Earth's magnetic field remained at quiet levels until the 4th when major to severe storm conditions began. That disturbance is thought to be coronal hole related.

Levels continued to be very low between the 5th and 10th, then increased to low on the 11th after the occurrence of an optically uncorrelated class C9 flare. This event may have been associated with the west limb departure of Region 7613. The geomagnetic field was generally unsettled with occasional periods of storm conditions at high latitudes, mostly due to coronal hole effects.

Solar activity was moderate on the 12th and 13th, and low or very low during the ensuing five day period. Moderate conditions occurred after three class M flare eruptions in Region 7618 (N08, L337, EKI); one on the 12th, and two on the 13th. With the exception of the 14th and 17th when small type A spot-groups made brief appearances, Region 7618 was the only group on the visible hemisphere between the 12th and 18th. The geomagnetic field was mainly quiet to active until midday on the 18th when a sudden impulse occurred (16 nT at Boulder), followed by minor to severe storm conditions at high latitude stations. Both *GOES* spacecraft experienced magnetopause crossings later in the day. This disturbance was linked to coronal hole activity.

Low activity levels dominated between the 19th and 25th. Sunspot activity continued to be centered in the Northern Hemisphere, and particularly in Region 7620 (N05, L267, ESI). Big Bear Observatory and other sites reported some mixed magnetic polarities within this group. The Sun's Southern Hemisphere produced spot-groups on only two days during the two week interval extending from the 12th through 25th. Some brief storm conditions occurred at the beginning of the period, but otherwise the geomagnetic field was predominately quiet.

Low or very low activity was the rule during the final few days of November. Region 7627 (S18, L105, DAO) produced an eruptive prominence which extended to 0.18 solar radii as it rotated onto the visible hemisphere on the 30th, but with this exception, little of interest occurred. The geomagnetic field continued to be quiet. The smoothed mean American Relative Sunspot Number for May, 1993, declined to 59.7.

The mean estimated American Relative Sunspot Number for 1-14 December is 52. Solar activity has been low and very low during the first half of December. No solar flares have reached the class M X-ray intensity level.

More Predictions for the Minimum of Cycle 22

Some features of cycle 22 suggest that the cycle is running faster than 10 years. For example, the pulse of geomagnetic disturbances which were the first sign of cycle 22 came unexpectedly early in the declining phase of cycle 21. Cycle 22 then rose very rapidly and reached its maximum in the record short time of 2.8 years. The interval between the maxima of cycles 21 and 22 was then only 9.6 years. With this length we can then expect the next solar minimum in April, 1996.

The decline of cycle 22 has been rapid and is between three and eight months ahead of those for cycles 18, 19 and 21 (unlike these and the current cycle, cycle 20 was a very low-amplitude cycle and is not considered). This also supports an early solar minimum in the first half of 1996. Therefore, the evidence seems in favor of a solar minimum in the first half of 1996. However, there is some chance that the minimum could be very early - perhaps late 1995 - giving cycle 22 another distinction as one of the shortest on record.

Dr Richard Thompson (IPS Radio & Space Services - Sidney, Australia)

Dr Andre Koeckelenbergh of the Sunspot Index Data Center brings a multi-faceted approach to the SIDC predictions of sunspot minimum, explaining: When one applies (M. Waldmeier's) solar cycle intensity curves to this problem the result shows that minimum will occur between mid-1995 and mid-1996, most probably during December, 1995.

On the other hand, if the mean slope of smoothed sunspot numbers during the 12 months centered on the time that the level $R_{max}/2$ (i.e., 50% of the smoothed monthly Relative Sunspot Number at maximum) is attained during the decreasing phase, minimum should occur very much earlier; sometime between May and November, 1994.

Since these two methods generally overstate and understate the predicted time of minimum (respectively), a third forecasting technique can be based on their arithmetic mean. This procedure gives a most likely minimum date of April, 1995.

Dr Koeckelenbergh also notes that a prediction may be founded on the observation that minimum for the last several cycles occurs approximately 3 years (32 months ± 6 months) after the first spotless day of the descending cycle phase. If that actually took place during the fall of 1993 (which is likely) the most probable time for minimum is during the spring of 1996.

Dr Andre Koeckelenbergh (Sunspot Index Data Center - Brussels, Belgium)

Sudden Ionospheric Disturbances (SES) Recorded During October 1993

Records were received from A9,40,50,59,61,62,63,65,66,67,68,69,70,71,72,73,74,75,76,77,78,80,81

Day	Max	Imp	Def	Day	Max	Imp	Def	Day	Max	Imp	Def	Day	Max	Imp	Def
1	0846	1-	5	3	1307	2	5	9	1343	1-	5	20	1000	1+	5
1	1124	1	5	3	1534	1-	5	9	1354	1-	5	24	0945	1-	5
1	1156	1-	5	3	2034	2+	5	9	1553	1	5	24	1028	1	5
1	1213	1-	5	4	0045	2+	5	9	1744	1-	5	25	1612	1	5
1	1337	1+	5	4	0725	1-	5	9	1804	1-	5	25	1704	1-	5
1	1418	1-	5	4	1858	2	5	9	1810	2+	5	25	1743	1-	3
1	1448	1-	5	4	2022	1-	5	9	1913	2+	5	25	2005	1	5
1	1547	1-	3	4	2055	1-	5	9	2239	1-	5	25	2237	1	5
1	1607	1+	5	4	2100	1-	5	10	1523	1-	5	26	0045	2	5
1	1745	1+	5	5	1134	1-	5	10	2329	1	5	26	0647	1-	5
1	2216	1-	5	5	1629	2+	5	11	0905	1+	5	26	1018	2	5
1	2353	2	5	5	1934	2	5	12	1125	1-	5	26	1222	1+	5
2	0632	1	5	6	1402	1-	5	12	2049	2+	5	26	1302	1-	5
2	0741	1+	5	6	1558	1	5	13	1750	3	5	26	1646	2+	5
2	1119	1-	5	6	1725	1-	5	13	2038	1-	5	26	1733	1+	5
2	1212	2	5	7	1212	1-	5	14	0808	2+	5	27	1131	1-	5
2	1724	2+	5	7	1458	2	5	15	1211	1-	5	27	1322	1	5
3	0016	1-	5	7	1815	1-	5	15	1300	1	5	28	1517	1-	5
3	0258	1+	5	7	1920	1-	5	16	2016	1-	5	29	1316	2+	4
3	0732	1-	5	7	2140	1	5	16	2048	1	5	29	1809	1-	5
3	0906	1-	5	8	1419	2	5	17	1445	1-	5	30	1108	2	5
3	0929	2	5	9	0809	2	5	18	1930	1-	5	30	1422	1-	5
3	1249	1	5												

Analysts: J. Ellerbe; S. Hansen; M. Hayden; J. Knight; A. Landry; R. Papp; C. Ranft; A. Stokes; M. Taylor; P. Taylor; L. Witkowski
Frequencies recorded (kHz): 16.8; 18.3; 19.6; 21.4; 23.4; 24.0; 24.8; 28.5; 30.6; 48.5; 51.6; 73.6; 77.15

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