

Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS — SOLAR DIVISION

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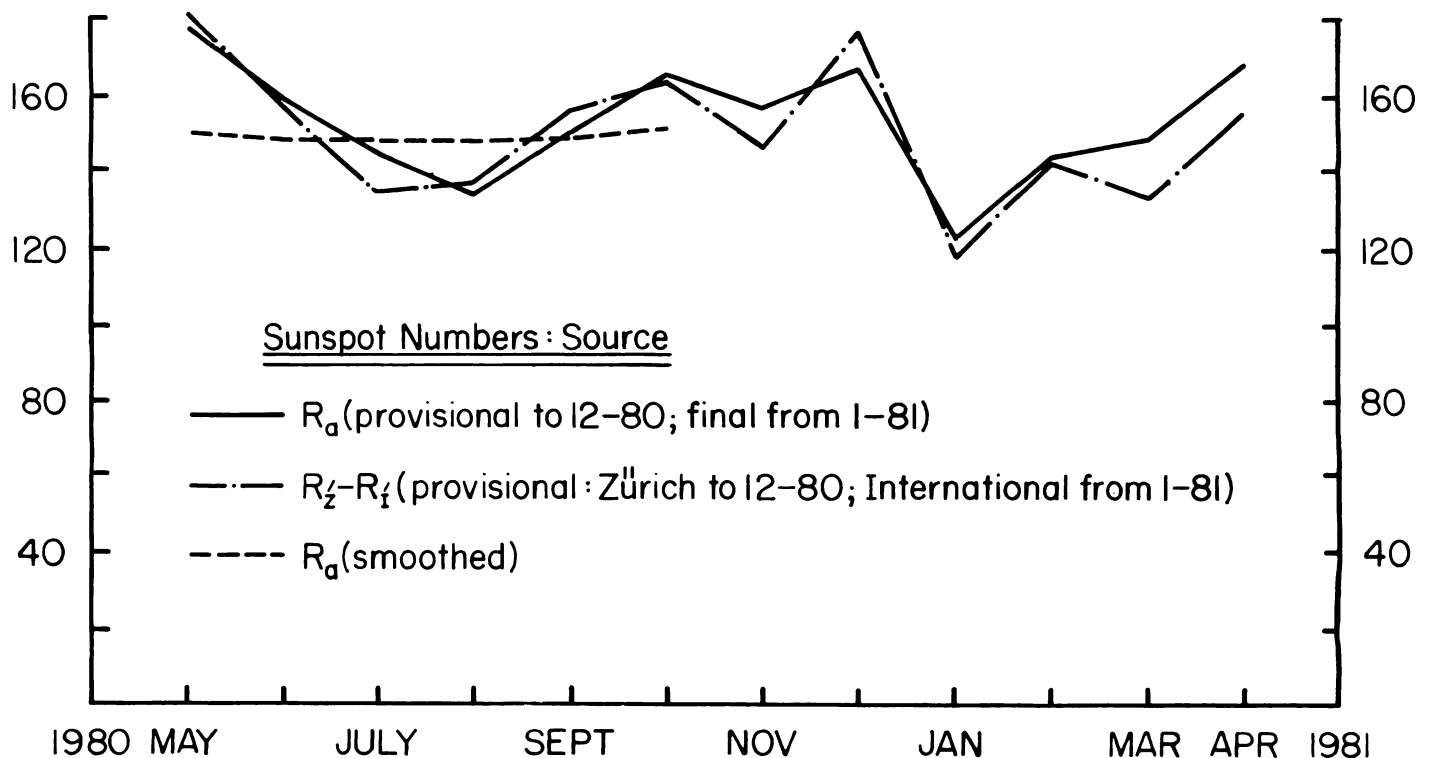
Number 4

April 1981

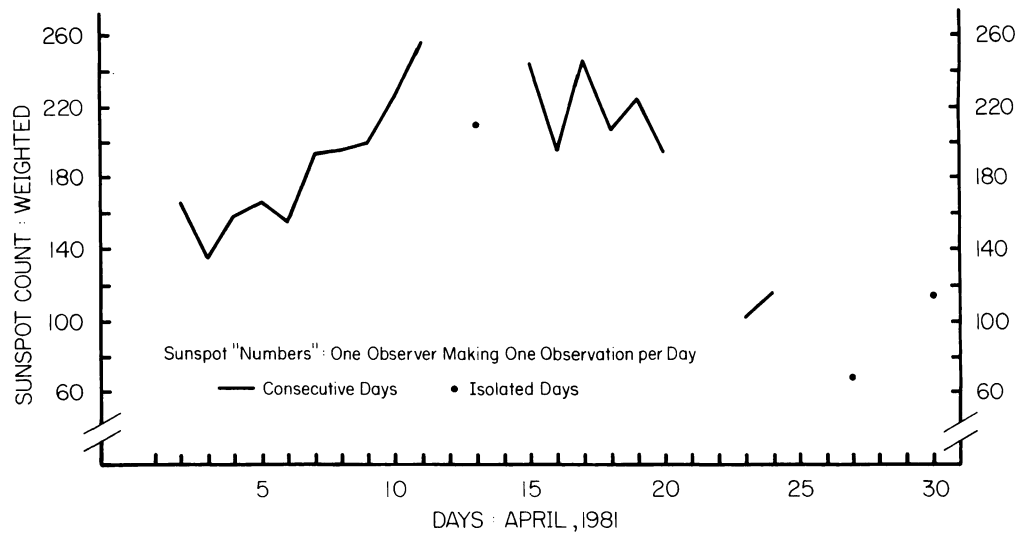
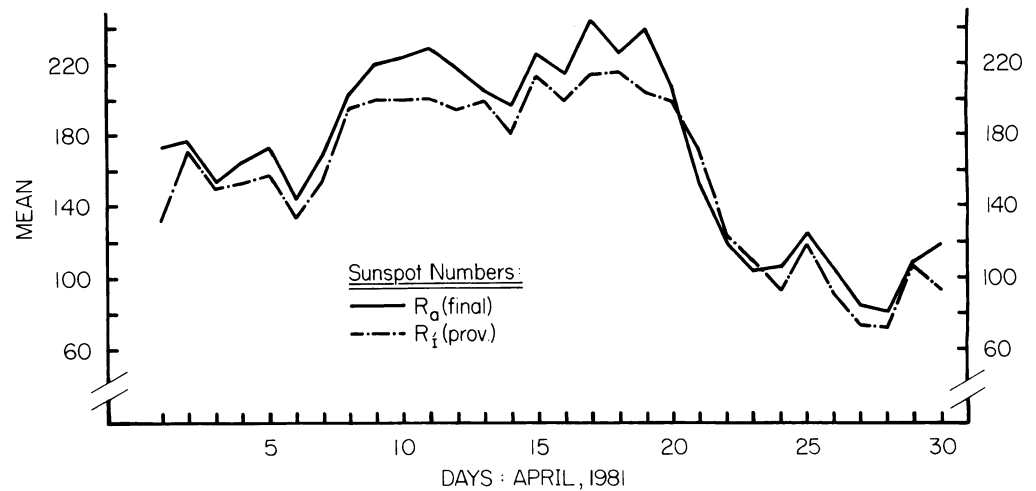
SOLAR ACTIVITY DURING APRIL 1981

Sunspot data are given in the graph at the bottom of this page and on page 3, where there are the usual table of daily numbers and two further graphic analyses. A marked increase in solar activity was reflected in the increase of the smoothed mean of AAVSO sunspot numbers from 149.1 for September 1980 to 151.6 for October 1980, and more directly in the jump of the monthly mean from 149.2 for March 1981 to 169.2 for April 1981. Final daily AAVSO numbers varied greatly, reaching a high of 243 (April 17) and falling to a low of 80 (April 28). The high and increasingly higher sunspot numbers over the first three weeks of the month were due to extended active regions consisting of numerous small groups and a disproportionately large number of complex groups with many individual spots (e.g., April 17, 5 groups, each with 25 or more spots). Numbers decreased through the last 10 days of the month as the larger groups and highly active regions rotated around the limb, leaving scattered smaller groups.

Sudden Enhancements of Signal (SEs) detected by 17 participants in the AAVSO Indirect Solar Flare Patrol, and meeting criteria for listing, are given on page 2. Only SEs of high certainty (4 and 5 on a scale of 1 to 5) are listed, as in March. Even with less certain events (1 to 3 on a 5-point scale) excluded, the remaining 235 flare-produced SEs in April represent a new high for this cycle, again exceeding the previous highs, 182 in March and 148 in February. Most SEs were detected on April 12 (22!). On page 4 are nine examples of "morning effects" in VLF station signal amplitude recordings, including most of the forms commonly observed.



April 1981		
RELATIVE SUNSPOT NUMBERS (R):		
AAVSO (a),		
INTERNATIONAL (I)		
Day	R _a (final)	R _I (prov)
1	173	132
2	177	170
3	151	148
4	164	151
5	171	157
6	142	132
7	167	152
8	202	195
9	220	199
10	222	199
11	228	200
12	218	193
13	203	197
14	196	180
15	223	212
16	214	197
17	243	213
18	225	214
19	239	203
20	208	199
21	151	170
22	119	122
23	101	108
24	104	92
25	124	119
26	103	90
27	83	73
28	80	72
29	108	106
30	118	92
Mean	169.2	156.2

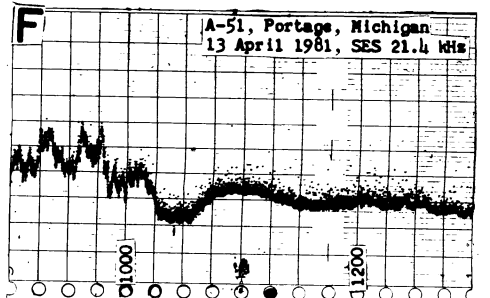
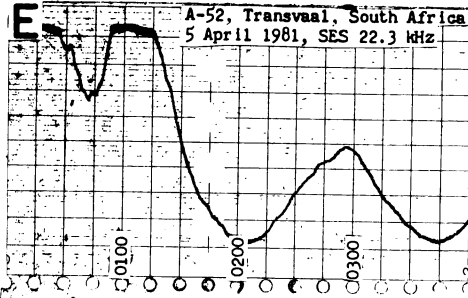
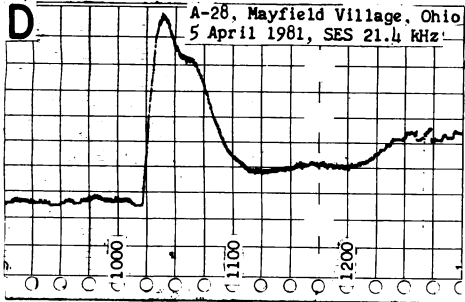
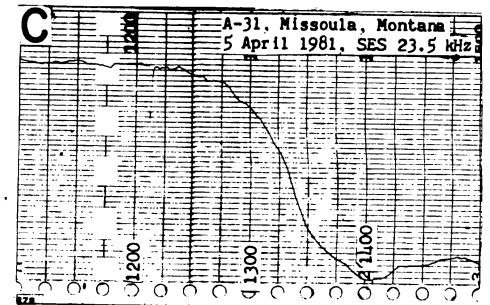
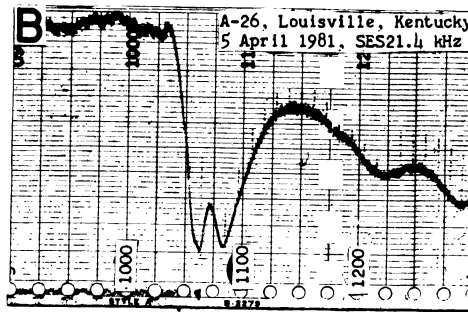
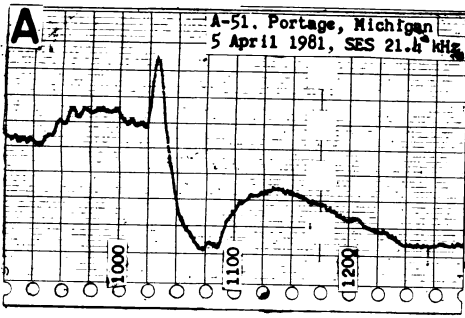


The above table and two figures represent standard ways of looking at sunspot numbers. The table appears each month in the Solar Bulletin, giving R_a (AAVSO final numbers) by days, and R_I (International provisional numbers) by days, each point a mean for ten to fifty observers, number depending on weather, holidays, mail service, sickness, vacations, etc. The upper figure shows the R_a mean values as listed in the table, while the lower figure shows daily numbers for one observer. All values ("Wolf numbers", "sunspot numbers", "relative sunspot numbers") are based on the "Wolf" formula:

$$R = k (10g + s) \quad \text{where } s \text{ is number of individual spots, } g \text{ is number of sunspot groups, and } k \text{ is a weight specific to locale, equipment, and observer.}$$

Actual numerical values, as in the table, are necessary for mathematical analysis. A stable, representative R, as in the upper figure above, can only be obtained by averaging reports from a number of observers and geographical locations. Individual observers are of course more variable in their daily counts and therefore their daily numbers for many reasons, including local overcast weather and appearance-disappearance of spots within periods of a few hours. The lower of the two figures gives typical data from one excellent observer in a location of average to good characteristics for solar observing.

VARIETIES OF SUNRISE EFFECTS IN VLF STATION AMPLITUDE RECORDS



The March 1981 Solar Bulletin included a section showing forms of SESs (Sudden Enhancements of Signal). This present page gives examples of "sunrise" or "morning" effects. Record segments A through I are of superior quality, providing samples of major phenomena associated with sunrise.

The top section of the page presents six examples (A through F) of sunrise effects, all but one on the same day (April 5): A, a spike, sharp drop, and post-rest "bump"; B, a spike between the sharp drop and post-sunrise bump; C, no spike at all; D, a peculiar effect probably related to observer's equipment interacting with location -- an SES-like sharp rise, peak, and slow drop, with no post-sunrise bump; E, a typical 22.3 kHz sunrise effect, with a drop and diminishing post-sunrise "waves" (sometimes 7 or 8); F, little change in level of trace, a small post-sunrise bump, and quite different traces night and day.

The bottom section of the page gives longer sections of amplitude recordings for the same VLF station, made by one observer on one frequency on three consecutive days. Overall similarity of daily sunrise patterns is striking, and internal similarity of these patterns even more so. The same four features of the morning effect can be found on each of the three days, at approximately 12:40, 12:55, 13:05, and 13:20 U.T. The variations in form merely provide a small challenge to the analyst-interpreter. Note the SESs during the days represented.

Stable features within morning effects can be used by the investigator in many ways: checking and correcting for timing errors in the record; estimation of the longitude of an unidentified signal source; simple checking of the degree of damage to a station record by interfering noise; bolstering confidence in the ultimate success of efforts to account for the phenomena; etc.

