Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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ISSN 0271-8480

Volume 54 Number 3

March 1998

American Relative Sunspot Numbers, R_a, for March 1998

Date	R_a Final		Date	R_a Final		Date	R_a Final
1	77		11	74		21	86
2	69		12	75		22	96
3	45		13	77		23	68
4	41		14	88		24	62
5	39		15	80		25	71
6	35		16	76		26	60
7	50		17	71		27	65
8	42		18	78		28	70
9	44		19	83		29	60
10	61		20	81		30	60
						31	66

Monthly Mean = 66.1

(Based on 826 observations contributed by 57 observers)

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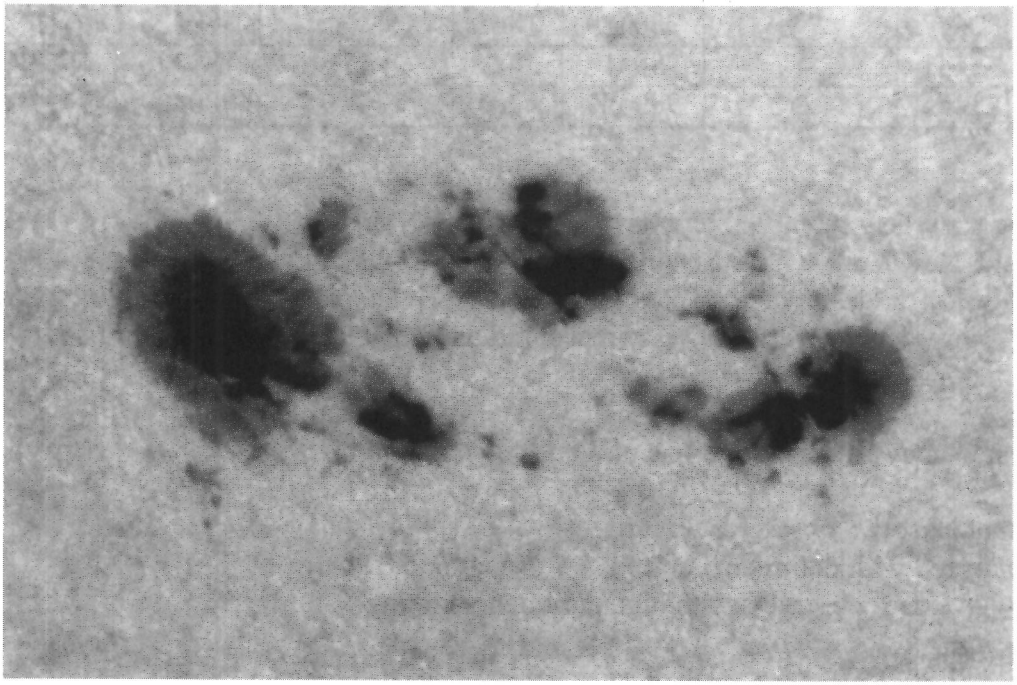

Photograph of sunspot group in NOAA/USAF Region #8179 taken March 15, 1998, by Art Whipple with a 4.5-inch refractor through a narrow-bandpass continuum filter. North is Up and East is to the left. The width of the group is one-quarter the solar radius, and it was photographed on the solar meridian.

Betty Stephenson, Chair
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Sudden Ionospheric Disturbance Report

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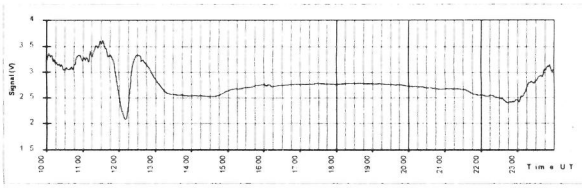

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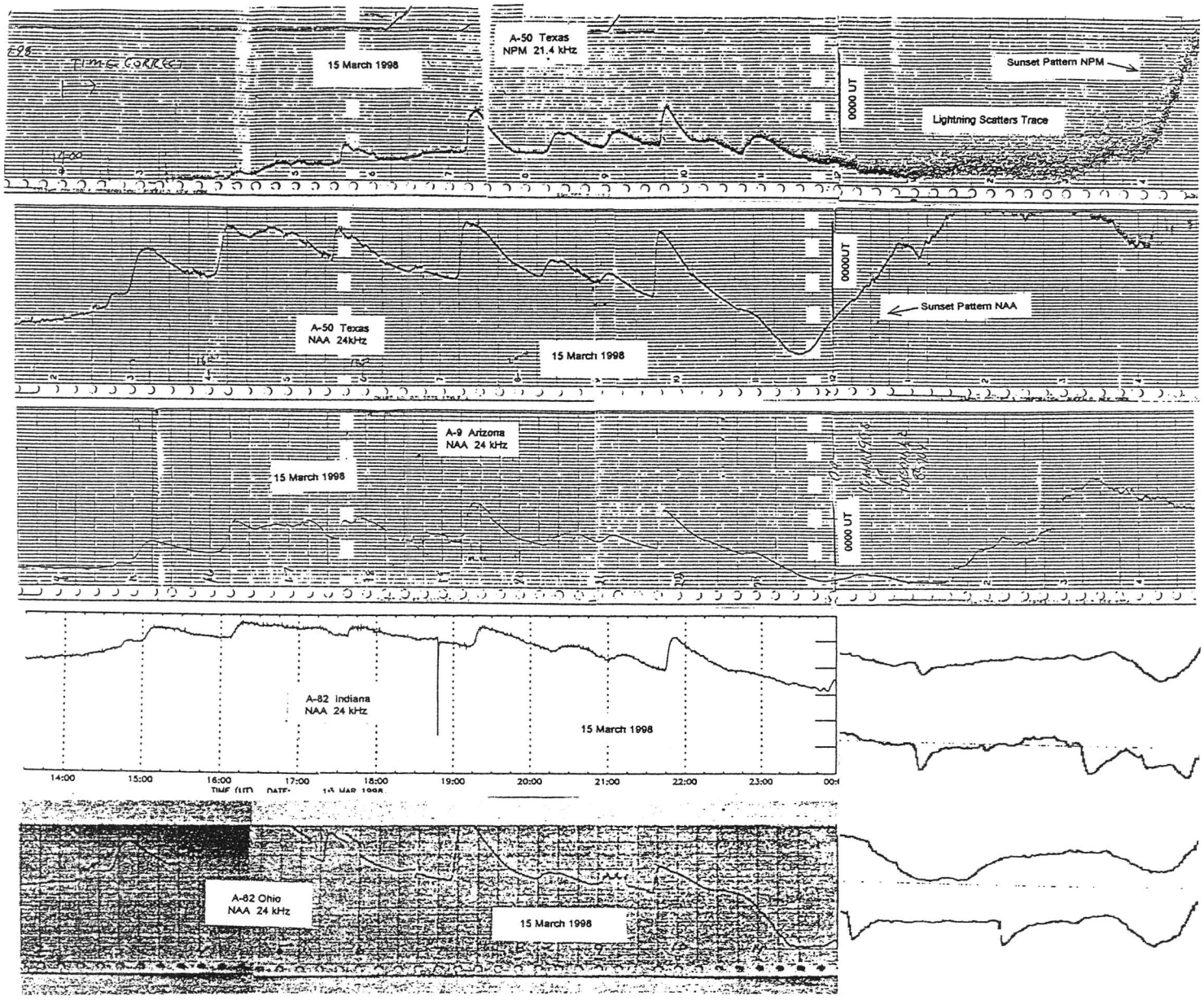
Sudden Ionospheric Disturbances Recorded During March 1998

Date	Start	Importance	Date	Start	Importance	Date	Start	Importance
980303	2040	1-	980315	1543	1+	980320	1231	1-
980303	2053	1+	980315	1605	1+	980320	1530	1+
980303	2202	1-	980315	1631	1	980320	1945	1-
980304	0719	1+	980315	1700	1+	980322	0659	2+
980304	1736	1	980315	1736	2	980322	0834	1
980304	1914	1+	980315	1912	2+	980322	1633	1-
980304	2133	1	980315	2018	2	980322	2016	1
980305	0912	1	980315	2100	2	980322	2239	1
980305	1235	1-	980315	2143	2+	980323	2143	2
980305	1506	1+	980315	2247	2	980324	1836	1-
980305	1734	1+	980316	2205	2	980324	2008	1-
980305	2008	1	980317	1253	1	980325	1232	3
980308	1907	1+	980317	1334	1	980326	1247	2+
980313	2053	1+	980318	1100	2	980327	1316	1-
980313	2108	2	980319	0516	2	980327	2214	3
980314	1447	2	980319	1845	2	980328	0715	2
980315	1441	1	980319	2027	1+	980328	1953	1+
980315	1455	2+	980320	1205	1-	980329	1727	1+

The following observers submitted reports and/or charts for March:
A-05 Hossfield, New York * A-09 Scharlach, Arizona * A-50 Winkler, Texas
A-52 Overbeek & Toldo, Republic of South Africa * A-62 Stokes, Ohio * A-72 Witkowski, Florida
A-81 Landry, New Hampshire * A-82 Lawrence, Indiana * A-87 Hill, Massachusetts
A-89 Dormann, Washington.

The events listed above meet at least one of the following criteria:

1) reported in at least two observers' reports.
2) visually analyzed with definiteness rating = 5 on submitted charts
3) reported by overseas observers with high definiteness rating



The above charts show solar flares recorded by the SID method on 15 march, a day of very high activity. The top chart by A-50 shows how extra time coverage can be had by recording a signal far to the West . In this case A-50 is recording NPM in Hawaii on 21.4 kHz. Notice how the start of the sunset rise is delayed until 0400 UT on the 16th. Below is A-50's recording of NAA in Maine on the Northeast US coast. The NAA sunset rise starts at 2330 because the sun is beginning to set on the entire NAA propagation path by then. At this time most of the propagation path to Hawaii is still sunlit and an SID starting at 2245 is clearly recorded. The four charts below, all recording NAA, show at best, only a hint of the SID. A-9 farther West in Arizona still had some of his propagation path sunlit so his recording does show the SID clearly if you look close.

A-50 made the Hawaii recording with an experimental receiver of his own design that is more sensitive to distant signals than the receivers most of us use. He will describe this receiver in a coming Technical Bulletin that will be mailed with the Solar Bulletin. The Technical Bulletin mailed with this Bulletin describes the recording system that made the inverted SID recordings of 16.8 kHz and sent by Fax. Four days are shown in the lower right-hand corner. The second from the top is the 15th. A-82 also recorded by computer but uses a different system that is easier to publish in the Bulletin. The A-62 chart was recorded on a digital camera and sent by E-mail as an attachment. I was not able to balance the contrast but it is clear enough to analyze. It shows promise of being an easy way to collect charts for analysis.

Sudden Ionospheric Disturbance Technical Bulletin

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The Solar Division is pleased to receive for publication a description of sudden ionospheric disturbance (SID) monitoring research from our overseas observer Dr. Walter Moos (A-84). Periodically as relevant article submissions are received, the Solar Division will publish these articles in this technical bulletin. All Solar Division SID observing contributors are encouraged to submit articles pertaining to solar observing technique, equipment, and data analysis for consideration.

- Joseph Lawrence, AAVSO SID Analyst

More About the Use of A/D Converter Interfacing for VLF Receivers

by Walter S. Moos and K. Wenger

In the SID Technical Bulletin of April 1997 the application of an A/D converter for VLF receivers has been described by J. Lawrence. We have come to the same conclusion as Mr. Lawrence about direct recordings of VLF receiver outputs on stripcharts. The replacement of recording paper is not very satisfactory and after a while the price of the chart paper is not exactly negligible. In addition, reviewing the recordings for analysis and comparison can be rather frustrating on account of the long "snakes" of paper which have to be handled. The mailing of the rolls of paper to its final destination is time consuming, not very reliable, and costly. For these reasons we decided early in 1995 to change to a system which allowed us to record data from several sources over long periods of time. This system has been implemented to record the following items:

- concurrently monitor three different frequencies with VLF receivers (16.8, 19.6, 23.4 KHz)
- daily light cycle
- outside temperature
- barometric pressure
- radioactivity
- general electromagnetic noise between 10 and 13 KHz.

To achieve our measurements, we bought an A/D-converter board from one of the local electronic part suppliers (Conrad Electronic, Oberburg, Switzerland) for about $70. This is an eight channel, 12 bit converter with a nonlinearity of 0.2% which can be used for unipolar or bipolar input voltages between -8.5 and +8.5 Volts. This board can be installed easily in almost any PC with a 400 MB or larger hard disk.

Instead of buying the software available with this board, we decided to develop our own program to more closely fit our specific applications. This program was written in Turbo C programming language by K.Wenger. This system and the program allows us to record 24 hours of data from all eight channels unattended for the duration of almost one year at a measurement interval of 3 minutes. The time interval can be selected from 1 to 60 minutes, if so desired. We found a 3 minute sampling interval to be a convenient compromise without causing a serious loss of details and allowing us to copy the data once weekly on a regular 1.2 MB diskette for analysis. Usually each diskette stores 4 to 5 weeks of data which can easily be recalled and analyzed without having to interrupt the actual measurements.

The program creates a new "day-file" at midnight and closes the previous one which protects against loss of data of more than one day. Correction and calibration factors for the various measurement parameters can be applied by means of software and therefore eliminates most adjustments at the sensors and their amplifiers.

The collected and copied data are imported into a EXCEL 4.0 spreadsheet for plotting on a 7 day basis. The EXCEL program was "MACRO-programmed" in such a manner that the VLF receiver data appears as seven 24 hour curves stacked on top of each other. This allows easy evaluation and comparison of the recorded signals for one whole week. Printout is carried out on european standard A4 paper which allows us to adjust the time mark line spacing to about 1 cm. Provision was made to plot the 24 hour light intensity which makes it quite comfortable to identify the times of sunrise or sunset and consequently check its influence on the SID curves. Naturally it is no problem to provide plots at different time or signal strength scale expansions to study curves in more details. Usually the entire one week data plotting of all 8 channels consumes less than 45 minutes of work.

Sample plots are attached to this text and we would enjoy receiving comments or suggestions for improvements from our colleagues. Requests for details about the processing software can be sent to *wmoos@swissonline.ch*. For the future (1 to 2 years), we are considering the possibility of making our data available online and in realtime via the LINUX system on a 24 hour basis. If we succeed, it would allow any interested investigator to compare his own data with ours, especially if special events are being observed.

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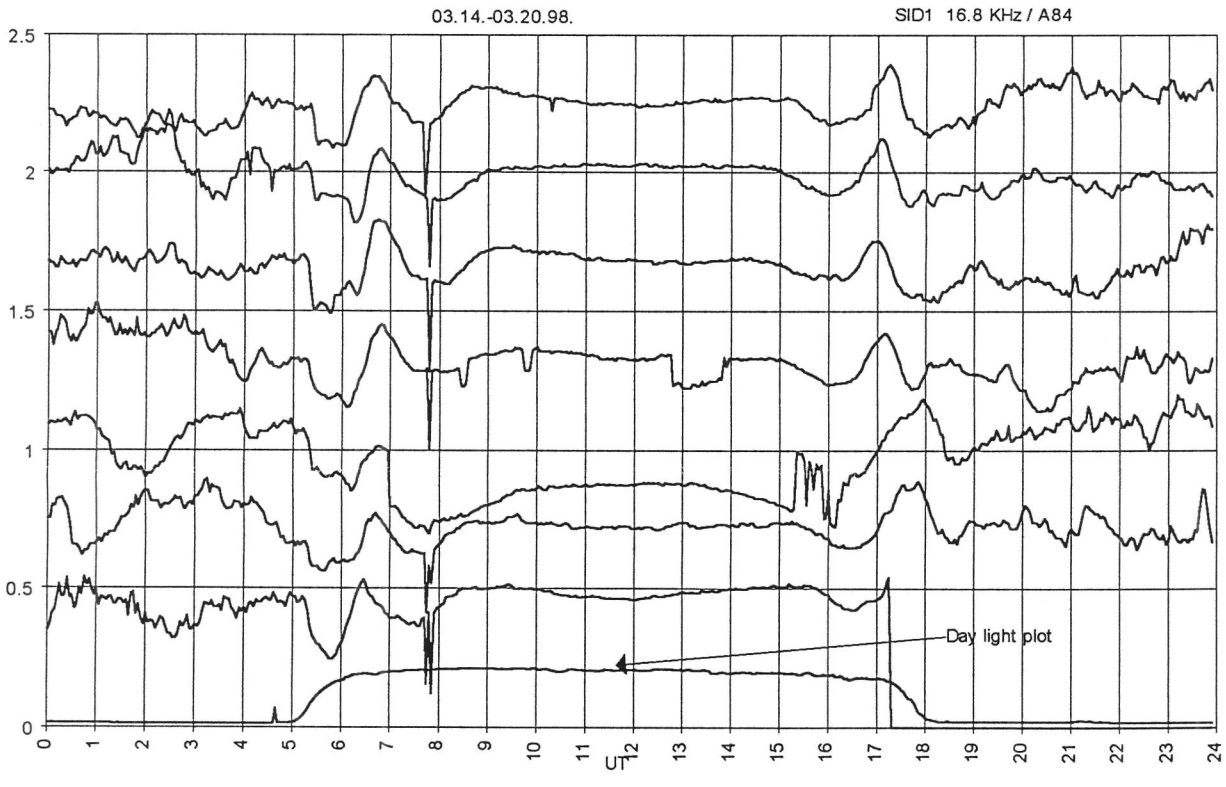

(Plot Provided by Dr. Moos)