Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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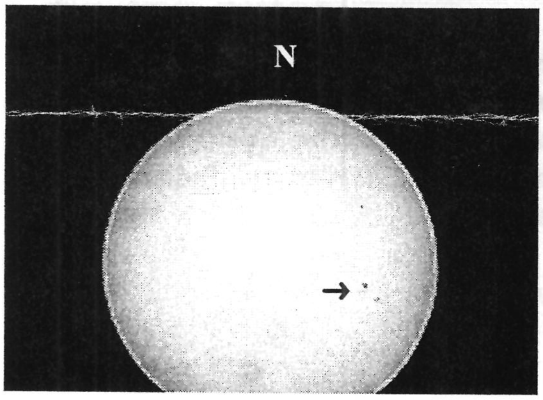
American Relative Sunspot Numbers, R_a, for November 1997

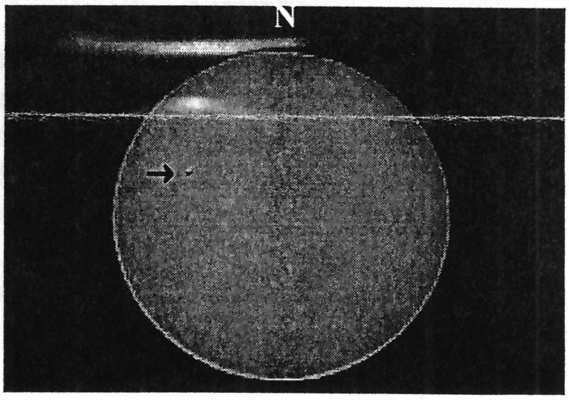
Date	R_a Final		Date	R_a Final		Date	R_a Final
1	44		11	32		21	43
2	68		12	18		22	44
3	54		13	26		23	64
4	68		14	40		24	56
5	60		15	35		25	30
6	53		16	37		26	30
7	43		17	42		27	35
8	36		18	46		28	45
9	26		19	45		29	53
10	25		20	42		30	43

Monthly Mean = 44.7

(Based on 500 observations contributed by 42 observers.)



11/29/97, 1500 CST



12/4/97, 1259 CST

These two photos were taken by Jerry Winkler (A50) of Houston, Texas USA, using a Celestron 80mm refractor with image projection and a Kodak DC-20 camera. The photo on the right contains some reflections from the eyepiece.

Betty Stephenson

Sudden Ionospheric Disturbance Report

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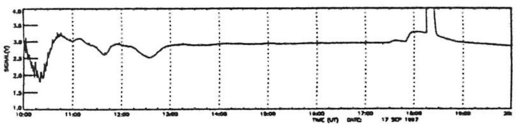

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Sudden Ionospheric Disturbances Recorded During November 1997

DATE	START	DATE	START	DATE	START	DATE	START
971101	1522	971105	1132	971113	1430	971126	1050
971102	2047	971105	1528	971113	1430	971126	1836
971103	0903	971105	1630	971113	1507	971127	1305
971103	1021	971105	1740	971113	1622	971127	1314
971103	1811	971105	1840	971113	1745	971127	1505
971103	1905	971106	0817	971113	1802	971127	1615
971103	1959	971106	0908	971113	1902	971128	0456
971103	2008	971106	1025	971113	2010	971128	1110
971103	2125	971106	1130	971114	0905	971128	1513
971103	2221	971106	1152	971114	1255	971128	1542
971103	2300	971107	0915	971114	1655	971128	1825
971104	0557	971110	1250	971115	1025	971128	1930
971104	0800	971111	0714	971116	1740	971128	2000
971104	0945	971111	1400	971116	1825	971129	0506
971104	1020	971112	1055	971117	1505	971129	0923
971104	1727	971112	1318	971121	1550	971130	2046
971104	2110	971112	1711	971123	1715		
971105	0915	971112	2058	971125	0531		
971105	1002	971113	1312	971125	1940		

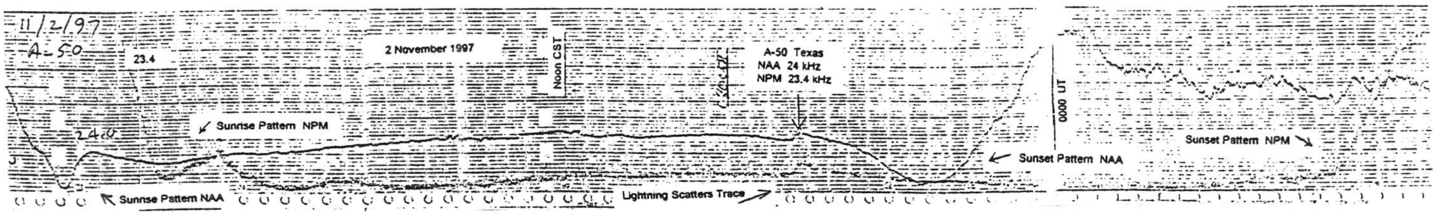
The following observers submitted reports and/or charts for November:
A-05* Hossfield, New York/ A-09 Scharlach, Arizona/ A-40 Parker, California/ A-50* Winkler, Texas/ A-52* Overbeek-Toldo, Republic of South Africa/ A-62* Stokes, Ohio/ A-63* Ellerbe, Spain/ A-72* Witkowski, Florida/ A-80* King, England/ A-81* Landry, New Hampshire/ A-82* Lawrence, Indiana/ A-84 Moos, Switzerland/ A-87** Hill, Massachusetts/ A-89** Dormann, Washington.

* observers who analyzed their own charts and submitted an e-mail report
** new observers, first time report

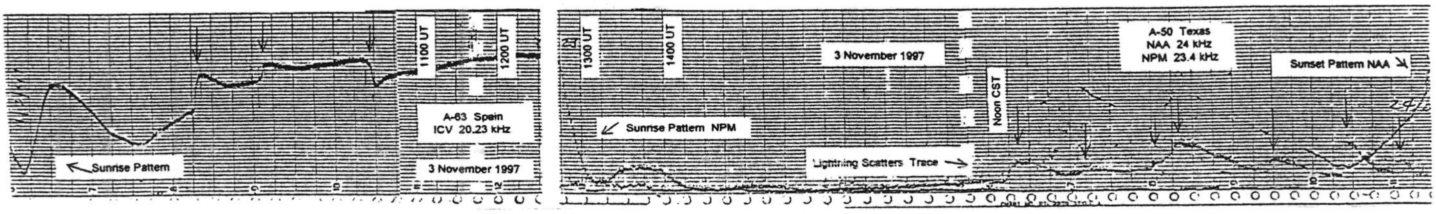
The events listed above meet at least one of the following criteria:

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

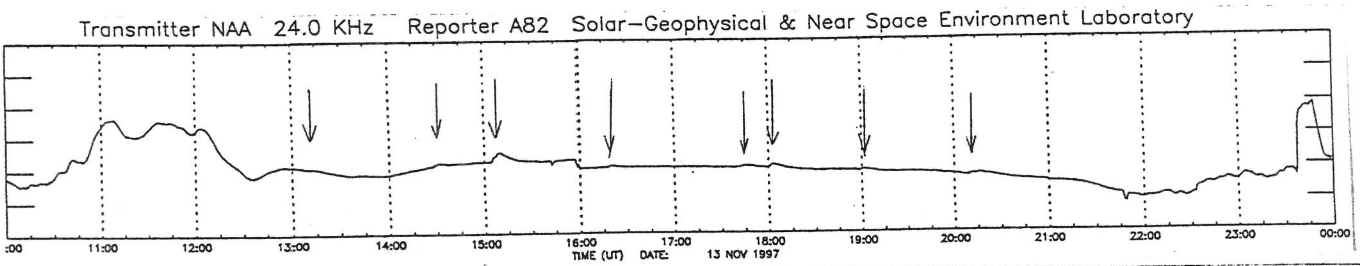
Joseph Lawrence

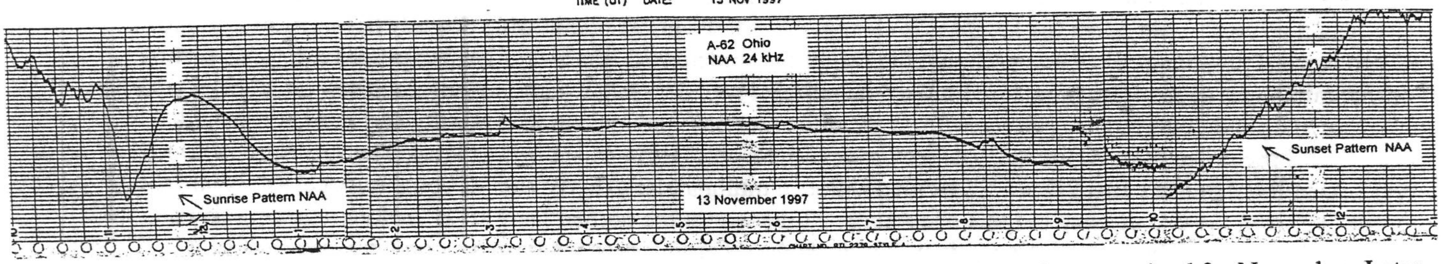


The above multiplexed chart by A-50 records NSS on 24 kHz and NPM on 23.4 kHz. Although this chart was labeled as a recording of NSS on 21.4 kHz it has the two humps in its sunrise pattern that are characteristic of NPM's sunrise pattern. Also the sunset rise occurs 5-hours later than the NAA sunset rise which clearly identifies it as NPM in Hawaii. As such A-50 could record SIDs as late as 0300 UT. A-52 in South Africa recorded an SID starting at 0456 UT later this month on the 27th so there are only two hours out of the 24 that AAVSO cannot record SIDs provided someone is recording NPM.



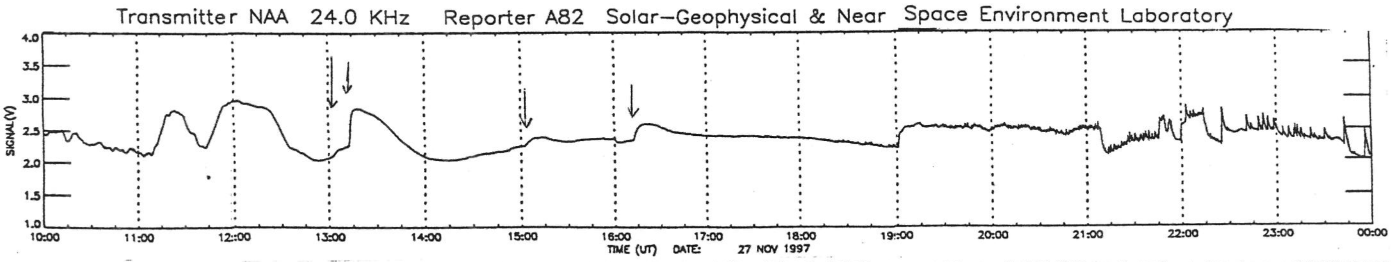
Ten SIDs are recorded in two charts placed end-to-end above. The early UT hours are covered by A-63 in Spain and the late UT hours by A-52's NPM trace. The only US observers who reported these SIDs by e-mail were A-52 and A-72. All other US observers who had a receiver operating that day were tuned to NAA on 24 kHz. November 3rd was a Monday when NAA was down for its weekly maintenance. A-72 claims to be recording NSS on 21.4 but he too must be tuned to NPM in Hawaii. As Art Stokes has pointed out, NSS went off the air long ago never to return.

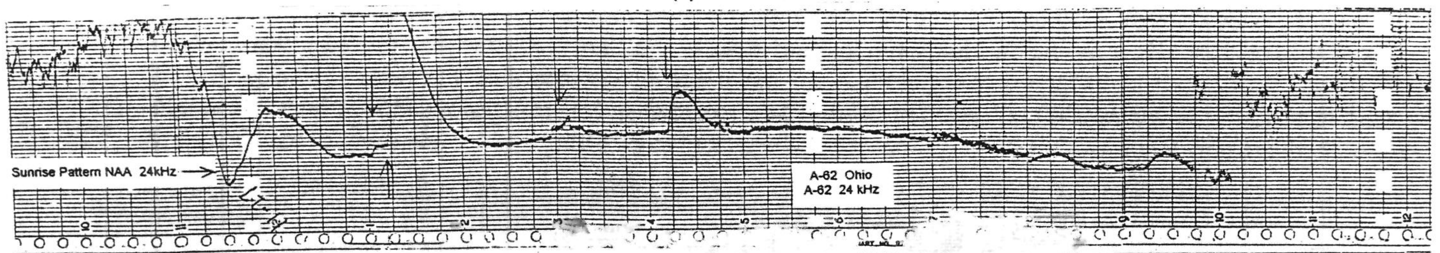


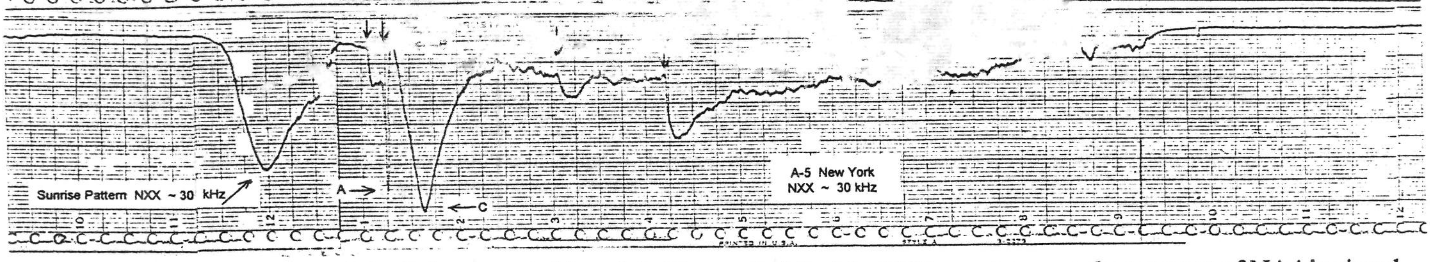


I found four definite SIDs in the A-62 chart above in my preliminary visual analysis of charts received for November. Later I compared this chart to others received and was able to add four more. All of these are small and I was curious as to how small the flares were that produced them. I always do my visual analysis without reference to the preliminary report because I feel we should send NGDC an independent report of solar activity that is made without reference to data easily found on the Internet. Anybody can compare their chart to the NGDC Preliminary Report and find little interference irregularities in the trace that look like an SID because they coincide in time with something in the Preliminary report. I feel it is more scientific to prepare an objective report letting the charts speak for themselves which they do very well if they are interference free. Objectivity is after all, the essence of science. The charts above show this to be true. I had A-82 check the preliminary report for the 13th to satisfy my curiosity about our eight small SIDs. Six of them were caused by C-class flares and two by smaller B-class flares. During our time frame the preliminary report also showed a B5.1 and a B7.2 neither of which show on A-62's chart which is the most sensitive I have for the 13th. There is not even a hint of them so if I had consulted the Preliminary Report I still would only have the same eight SIDs for the 13th. It is true I compared three charts but individuals such as A-52 can do the same by multiplexing three signals. The 13th shows once again that Art Stokes's famous gyrator receiver is only slightly less sensitive to flares than million-dollar satellites. We can do very well without the Preliminary Report.

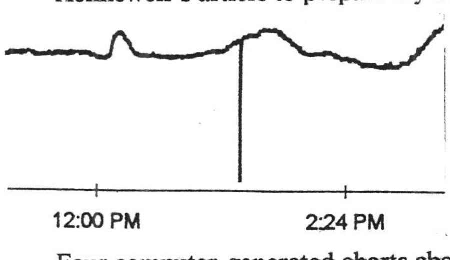
Three charts at the top of the following page show Novembers biggest SID which occurred starting at 1312 UT. It records an intense burst of X-rays from an X-2.6 flare. The trace went off scale on A-62's chart but this is the price he pays for having his gain set high so he recorded the little SIDs on the 13th so clearly. It is better to decapitate the big ones in order

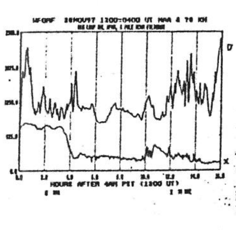


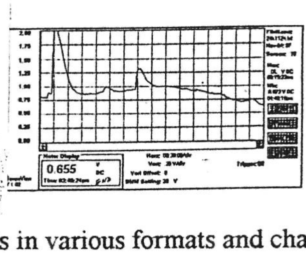


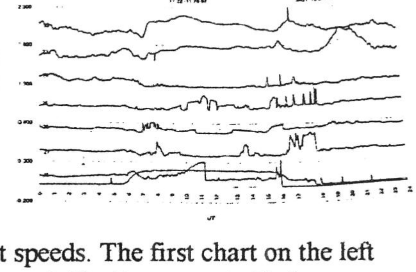


to make nicer recordings of the little ones. A-82 and A-62 recorded the big 1213 event as an enhancement of NAA's signal, SES, but A-5 recorded it inverted as a sudden phase anomaly, SPA, of the anonymous 30 khz signal. The phase anomaly phenomenon is explained in Technical Bulletin, Volume 6, Number 4. In that instance A-76 recorded a phase anomaly of NSS's 21.4 kHz signal during an annular eclipse of the sun. Figure 2 in that publication shows A-76's multiplexed recording of NAA and NSS in which the station identifications are accidentally switched. John A. Kennewell, Principal Physicist at the Learmouth Solar Observatory in Exmouth, Australia wrote the article. Dr. Kennewell explained how the eclipse diminished the Ultraviolet flux that maintains the D-layer thereby raising the effective height of D-layer. A-76's 21.4 trace is a recording is an interference pattern between a sky wave and a ground wave. As the effective height of the D-layer rose the phase relationship between the down-coming sky wave and the ground wave reached 180 degrees out of phase twice about 30 minutes apart with a small reversal in between. The top of the little reversal represents the maximum effective height of the D-layer when the height was enough to push the phase relationship Slightly beyond 180 degrees as the eclipse reached maximum. Beyond maximum the height lowered and the phase relationship passed through a second 180-degree minimum as the trace progressed toward its normal level. The NAA trace is ionospherically propagated with no ground wave to form an interference pattern with. It therefore sees only the free electron density and rises as it would at sunset as the eclipse progresses. Beyond eclipse maximum it falls off to its normal daytime level. The A-5 trace of 30 kHz shows the same interference pattern that NSS formed with two minima marked "A" and "C" on the A-5 chart. Again there is a reversal between the two minima but this one returns all the way to the normal level at "B" before returning down to the second minimum at "C". The tuned-filter receiver that made the recording does not have a smoothing capacitor so it faithfully traces the fast-moving 30kHz signal level through the phase anomaly. An explanation of phase anomalies can also be found in a paper published back in the '30s that describes an experiment at the Cavindish Laboratory in England. The signal source was GBR in Rugby, England on 16 kHz. The outputs of two identical VLF receivers were mixed and attached to the "X" and "Y" coordinates of an oscilloscope. One receiver used a vertical antenna to display the ground wave and the other a loop antenna to display the down-coming sky wave.. The receivers and their antennas were mounted on a truck and carried various distances from GBR to show the phase relationship on the oscilloscope as an ellipse, the shape and orientation of which represented the phase relationship between the ground and sky waves. I have used this paper and Dr. Kennewell's article to prepare my analysis above.









Four computer-generated charts above record November SIDs in various formats and chart speeds. The first chart on the left is by new observer, Mike Hill, A-87,in Massachusetts. The second is by another new observer, Mike Dorman, A-89, in Washington State. The 3rd and 4th charts are by A-83 in Ohio and A-84 in Switzerland.