Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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ISSN 0271-8480

Volume 58 Number 5 **May 2002**

Table I. Mean Sunspot Numbers (Ra) for May 2002 [boldface = maximum, minimum]

Day	N	Raw	s.d.	Ra	s.d.	s.e.
1	49	154	4.9	122	2.9	0.41
2	33	171	7.0	131	4.0	0.70
3	47	206	7.3	158	2.7	0.39
4	41	235	7.6	**184**	4.7	0.73
5	52	227	8.6	171	3.0	0.42
6	44	213	9.4	162	3.9	0.59
7	35	214	10.6	171	3.6	0.61
8	38	198	10.1	153	4.1	0.67
9	32	168	9.2	129	4.9	0.87
10	38	171	9.0	131	3.6	0.58
11	41	183	8.4	139	3.3	0.52
12	39	175	8.0	131	3.3	0.53
13	34	136	6.3	101	3.0	0.51
14	46	109	5.7	**81**	3.1	0.46
15	53	110	3.8	85	2.8	0.38
16	47	105	3.8	83	2.2	0.32
17	31	111	4.5	88	2.2	0.40
18	41	129	5.0	100	2.7	0.42
19	45	135	4.8	103	2.6	0.39
20	48	157	5.5	117	2.4	0.35
21	51	184	7.2	138	3.2	0.45
22	50	205	8.3	150	3.4	0.48
23	51	190	7.7	142	3.1	0.43
24	45	189	9.5	142	3.5	0.52
25	44	189	9.6	139	3.1	0.47
26	40	182	8.5	137	2.7	0.43
27	44	174	7.3	128	3.4	0.51
28	37	168	6.6	127	2.8	0.46
29	38	160	8.5	119	4.9	0.79
30	45	155	6.4	116	2.3	0.34
31	46	160	5.9	123	3.3	0.49

Means: 42.7 169.7 129.1

Total No. of Observers: 76

Total No. of Observations: 1325

Table II. May Observers

11	AAP	P.Abbott
5	ANDE	E.Anderson
15	ATON	A.Attanasio
11	BARH	H.Barnes
6	BATR	R.Battaiola
16	BEB	R.Berg
12	BERJ	J.Berdejo
2	BEU	E.Blankenship
22	BMF	M.Boschat
23	BOSB	B.Bose
30	BRAB	B.Branchett
26	BRAD	D.Branchett
29	BRAR	R.Branch
30	BROB	R.Brown
1	BURS	S.Burgess
6	CAMP	P.Cambell
17	CARJ	J.Carlson
31	CHAG	G.Morales
22	CKB	B.Cudnik
9	CLZ	C.Laurent
16	COMT	T.Compton
31	CORA	A.Coroas
26	CR	T.Cragg
21	DELS	S.Delaney
25	DGP	G.Dyck
16	DRAJ	J.Dragesco
22	DUBF	F.Dubois
31	ELR	E.Reed
15	FEEC	C.Feehrer
12	FERJ	J.Fernandez
24	FLET	T.Fleming
20	FUJK	K.Fujimori
24	GIOR	R.Giovanoni
9	GOTS	S.Gottschalk
2	HALB	Brain Halls
4	HAYK	K.Hay
27	JAMD	D.James
13	JEFT	T.Jeffrey
9	JENJ	J.Jenkins
18	KHAR	R.Khan
15	KNJS	J&S Knight
4	LARJ	J.Larriba
13	LERM	M.Lerman
18	LEVM	M.Leventhal
16	LIZT	T.Lizak
16	LUBT	T.Lubbers
11	MARE	E.Mariani
26	MARJ	J.Maranon
13	MAV	D.Matsnev
19	MCE	E.Mochizuki
14	MILJ	J.Miller
10	MMI	M.Moeller
7	MUDG	G.Mudry
19	OBSO	IPS Observatory
11	RICE	E.Richardson
23	RITA	A.Ritchie
25	SCGL	G.Schott
9	SCHG	G.Scholl
14	SIMC	C.Simpson
28	STAB	B.Gordon-States
6	STEF	G.Stefanopoulis
24	STEM	G.Stemmler
20	STQ	N.Stoikidis
18	SUZM	M.Suzuki
30	SZAK	K.Szatkowski
23	SZUM	M.Szulc
25	TESD	D.Teske
8	THR	R.Thompson
12	TJV	J.Temprano
29	URBP	P.Urbanski
25	VALD	D.delValle
16	VARG	A.Vargas
21	VIDD	D.Vidican
17	WILW	W.Wilson
24	WITL	L.Witkowski
27	YESH	H.Yesilyaprak

Reporting Addresses

Sunspot Reports **-- email:** solar@aavso.org
postal mail: AAVSO, 25 Birch St. Cambridge, MA 02138
FAX *(AAVSO):* (617) 354-0665

SES Reports **-- email:** noatak@aol.com
postal mail: Mike Hill
114 Prospect St. Marlboro, MA 01752

Magnetometer Reports **-- email:** capaavso@aol.com
postal mail: Casper Hossfield
PO Box 23, New Milford, NY 10959
FAX: (973) 853-2588 or (407) 482-3963

Table III. Means of Raw Group Counts (RG) and Ratios of Spots to Groups (S:G) in May

Day	RG	S:G	Day	RG	S:G	Day	RG	S:G	Day	RG	S:G
1	10.6	4.5	**9**	10.8	5.6	**17**	7.5	4.8	**25**	10.0	8.9
2	11.0	5.6	**10**	10.8	5.8	**18**	8.3	5.5	**26**	10.0	8.2
3	12.5	6.5	**11**	10.7	7.1	**19**	8.0	7.0	**27**	10.7	6.3
4	13.9	6.9	**12**	10.0	7.5	**20**	9.2	7.1	**28**	11.4	4.7
5	14.3	5.9	**13**	8.4	6.2	**21**	10.1	8.2	**29**	10.3	5.5
6	14.0	5.2	**14**	7.1	5.4	**22**	11.3	8.1	**30**	9.2	6.9
7	14.3	5.0	**15**	7.9	3.9	**23**	10.1	8.8	**31**	10.1	5.8
8	12.8	5.5	**16**	7.7	3.6	**24**	10.1	8.7	**Mn.**	**10.4**	**6.3**

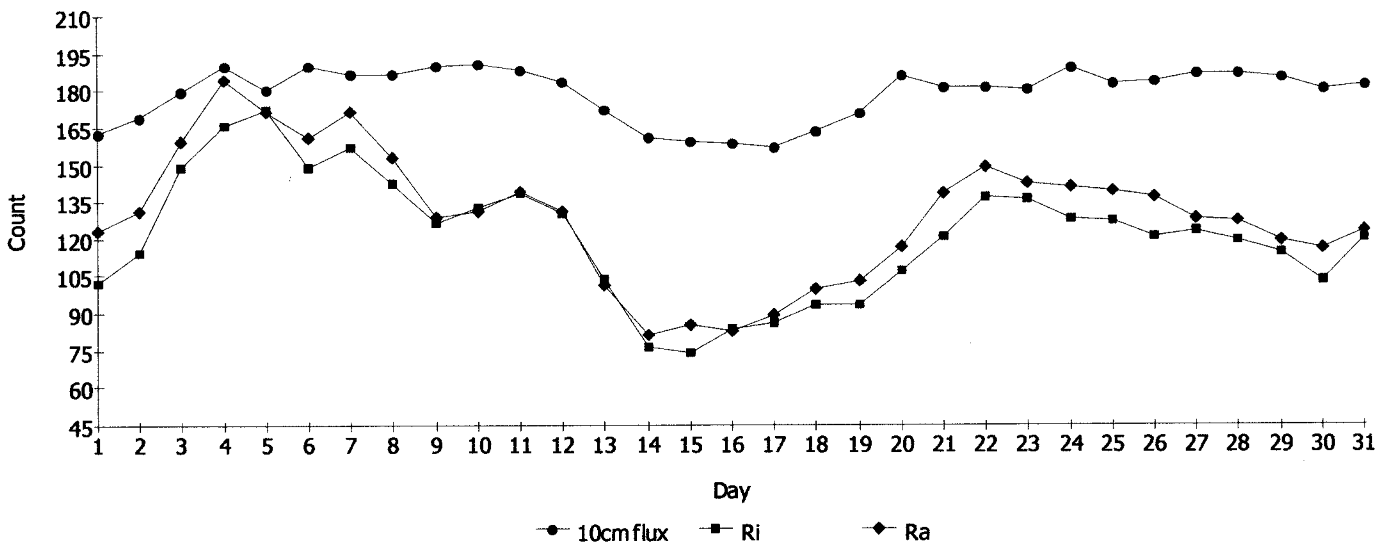

Fig. 1. 10 cm Solar Flux and Comparison of Ri (provisional) with Ra Estimates for May; r = 0.970).
Ri source: http://www.sidc.oma.be/index.php3
10 cm source: http://www.drao.nrc.ca/icarus

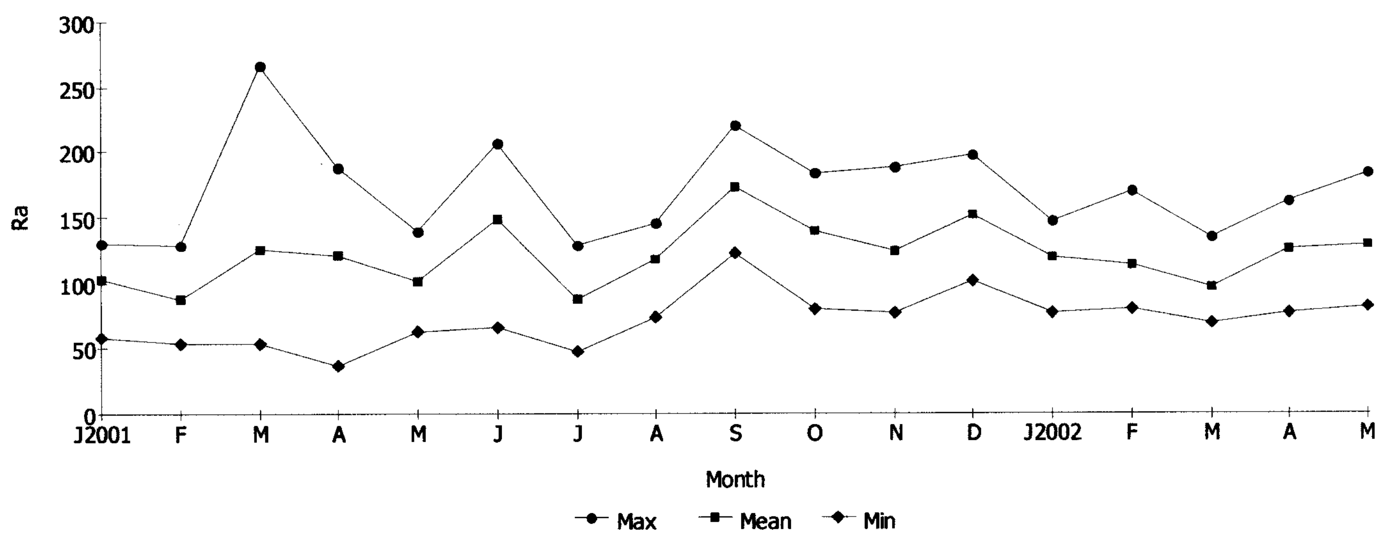

Fig. 2. Maximum, Mean, and Minimum Values of Ra for Each Month from January 2001 to Present.

Sudden Ionospheric Disturbance Report

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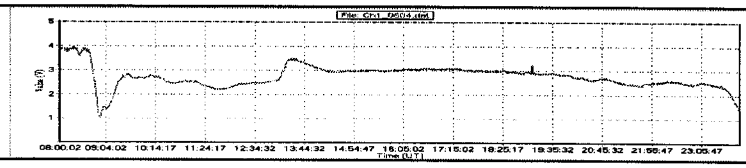


Sudden Ionospheric Disturbances (SID) Recorded During May 2002

(Analysis performed by Michael Hill, SID Analyst)

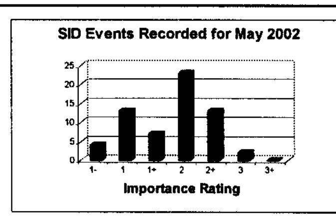
Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
020503	1810	2	020517	0204	1-	020527	2127	1
020503	2020	2	020517	0523	2	020528	1636	2
020503	2121	2	020517	0742	3	020529	1449	1
020504	1325	2+	020517	1608	2+	020529	1506	2
020504	1859	2	020518	0923	1	020529	1552	2
020504	2141	1+	020518	1545	2	020529	1752	1
020504	2155	1+	020518	1832	1	020530	1427	2+
020505	0813	1	020519	1619	1	020530	1541	2
020505	1225	2	020519	1712	2	020530	1626	2
020505	1445	2	020519	1846	1	020530	1718	2+
020505	1917	2	020519	1914	1	020531	1304	1
020507	0853	1-	020520	0746	1-	020531	1527	2+
020508	1324	2+	020520	0807	1			
020508	1445	2	020520	1030	2			
020508	1551	2+	020520	1056	1+			
020510	0941	1-	020520	1529	2			
020511	0252	1+	020520	2025	2+			
020511	0655	1	020521	0507	2			
020511	1132	2+	020521	1025	1			
020511	1650	2	020521	2136	2+			
020511	1741	2	020522	1602	2			
020512	0955	1+	020524	0650	2+			
020514	0954	1+	020527	1712	2			
020514	1314	2+	020527	1810	2+			
020515	0812	3	020527	1905	1+			

Importance rating : Duration(min)	-1: <19	1: 19-25	1+: 26-32	2: 33-45	2+: 46-85	3: 86-125	3+: >125

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

1) Reported in at least two observer reports
2) Visually analyzed with definiteness rating = 5
3) Reported by overseas observers with high definiteness rating

Observer	Code	Station(s) monitored
A Clerkin	A29	NAA
J Winkler	A50	NAA
D Toldo	A52	NAA, NWC, HWU
J Ellerbe	A63	ICV
A Panzer	A83	NAA
W Moos	A84	FTA
M Hill	A87	NAA
G DiFillipo	A93	HWU
R Battaiola	A96	HWU
J Wallace	A97	NAA
M King	A99	HWU
P Campbell	A100	NLK



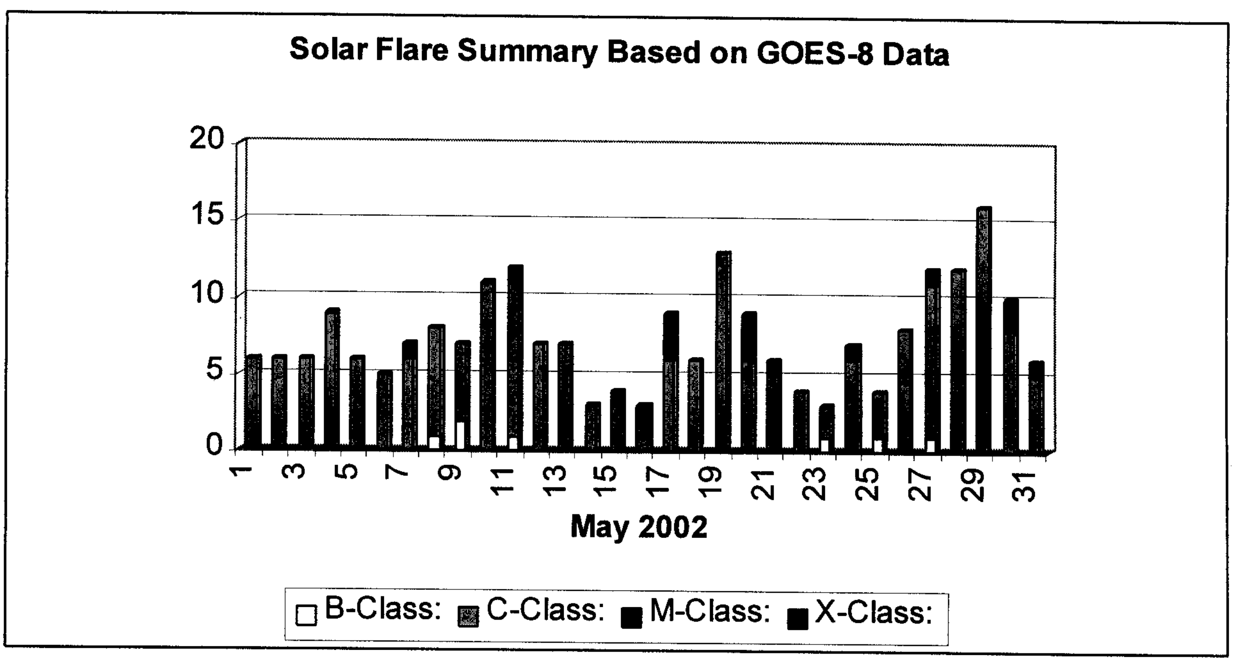
Solar Events

Activity levels seemed to drop off a bit this month. Although there were still many X-Ray flares, as recorded by the GOES Spacecraft (231 events), most were smaller C-Class events. There were only 14 M-Class and a single X-Class event. There were a lot of sunspots and many of them, especially towards the 17th- 20th of the month had the capability to produce major events. That did not happen except on the 20th, on which there were two M-Class and the single X-Class flare event. Our observers recorded 62 correlated SID events. The most active times were during the previously mentioned time frame of the 17th – 20th and again towards the end of the month. There were 4 events of note that almost all observers recorded: 5/11 – 1132UT (M1.4), 5/17 – 1608UT (M2.9), 5/20 – 1029UT (M4.7), 5/20 – 1053UT (M5.0). Curiously, only 4 of 11 observers recorded the X-Class event on 5/20 – 1527UT.

Many thanks go to observer Andy Clerkin (A29) for finding the location of our data in the NGDC archives. It is now being updated regularly; however, the location on the web has changed as well as the format of the web site and data archiving facility. To locate the data follow the directions below:

http://sgd.ngdc.noaa.gov

Goto: Part 1 – Prompt Report 2
SID Data
Select month/year to display a PDF document for that time frame.



SOLAR BULLETIN of the American Association of Variable Star Observers. Vol. 58, No 5,May, 2002

SUDDEN IONOSPHERIC DISTURBANCES SUPPLEMENT

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SUDDEN IONOSPHERIC DISTURBANCES RECORDED DURING MAY, 2002

MORE ON X-RAY TRANSIENT XRF 020427

Last month in the April issue of the SID Supplement I described how Len Anderson, A-91, in South Perth, West Australia had recorded the x-ray transient as an SID and reproduced his recording of the event. I sent a copy of that SID Supplement to Dr. Gerald J. (Jerry) Fishman, Chief Scientist for Gamma-Ray Astronomy at the NASA-Marshall Space Flight Center in Huntsville, Alabama, USA and asked him what he thought of it. He liked it very much and wrote a GCN Circular to announce what he considered an important gamma ray burst observation. GCN Circulars are issued regularly to announce important gamma ray burst (GRB) observations. GCN stands for GRB Coordinates Network and the circulars go out to about 500 professional observatories throughout the world. Here is the GCN circular Dr. Fishman posted:

Subj: [AAVSO-GRB] XRF 020427: Sudden Ionospheric Disturbance (SID)
Date: 5/24/02 8:50:17 PM GMT Daylight Time
From: grb@aavso.org
Sender: aavso-grb-list-admin@informer2.cis.McMaster.CA
To: aavso-grb-list@informer2.cis.McMaster.CA

The following is a GCN Circular circulated via the AAVSO network.
For an archive and more information on circulars visit:
http://lheawww.gsfc.nasa.gov/docs/gamcosray/legr/bacodine/gcn3_archive.html

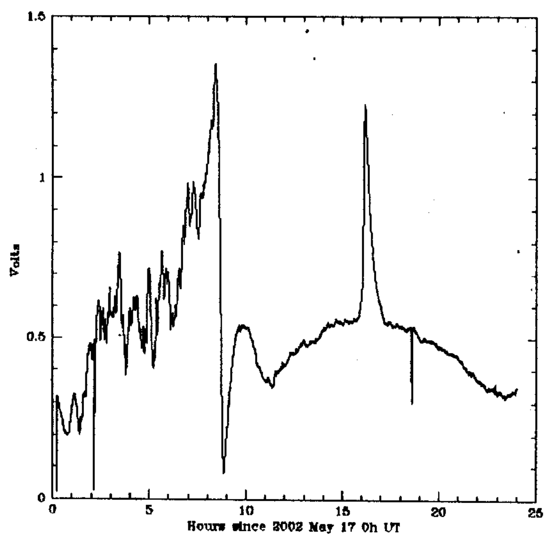
TITLE: GCN GRB OBSERVATION REPORT
NUMBER: 1394
SUBJECT: XRF 020427: Sudden Ionospheric Disturbance (SID)
DATE: 02/05/24 19:16:01 GMT
FROM: Peter Woods at UAH/MSFC <peter.woods@msfc.nasa.gov>

G.J. Fishman, P.M.. Woods, C. Hossfield and L. Anderson report that the X-ray rich event of April 27, 2002 was detected as a Sudden Ionospheric Disturbance (SID) by Len Anderson in South Perth Australia, indicating that XRF 020427 (GCN 1383), produced a prodigious amount of ionizing x-ray flux. The disturbance is clearly seen, lasting about one minute, in a low-resolution all-day strip chart recording from a Very Low Frequency (VLF) radio receiver near Perth. Although a quantitative measure of the flux of this event could not be determined by this method, the SID magnitude (and thus the ionizing flux) is comparable to that observed from the Aug. 27, 1998 super-flare from SGR 1900+14 (Inan, et al., Geophys. Res. Lett., v.26, p.3357, 1999). A large flux of x-rays below ~15 keV was deduced from that flare (op. cit.). One intense gamma-ray burst, GRB830801, was also observed to produce a SID but at a much weaker level (Fishman and Inan, Nature v.331, p.418,1988). The strong ionizing present in this burst confirms that this is a long, x-ray rich event of unknown origin, as suggested by in't Zand et al. (GCN 1383).

Note: SIDs have been used to study solar flares since the 1950s. In this case, the SID was observed as a major change in the propagation of a continuous VLF radio transmission at 19.8 kHz from Northwest Cape, Australia. The VLF radio receiver trace can be seen at: http://gammaray.nsstc.nasa.gov/~woods/xrf020427.html This message may be cited.

It is quite an honor for Len to have his recording of XRF 020427 sent out by NASA as a GCN Circular. It shows that NASA considers it valuable scientific data. They want us to continue to search for GRBs in our SID recordings we make to detect solar flares for NOAA. Now we have a chance to make our work valuable for NASA too. But there are valuable lessons to be learned from Len's GCN Circular. One thing Dr. Fishman mentioned is the chart recording must be for a whole day and show the sunrise and sunset patterns so scientists looking at the chart can put the SID in context and see that it is something unique that happened that day. Len's chart fulfills that requirement because it is free of interference all day and the trace is nice and clean so the GRB's SID stands out clearly. The GCN Circular compares Len's SID to that of SGR 1900+14 that was published in the peer reviewed journal, Science, and also in Sky & Telescope magazine. Unfortunately Len's SID will not make it into those prestigious publications because his time is off by one hour. Therein lies another valuable lesson. You must keep your chart time correct. If you record on a strip chart recorder as Len and many others do it is probably best to run your chart on local civil time starting and ending at midnight each day. Mark the Civil day on each chart just before the sunrise pattern. Mark local noon at 12:00 and also the Universal time of local noon each day. Also mark 0000 UT each day and the UT day that starts there. It is easy to get confused if you switch your civil time to daylight saving time. Here's how to make sure your UT time at civil noon is correct: Watch for a prominent SID and look up its time of maximum at the NOAA Web site: http://www.sel.noaa.gov/ftpmenu/indices/events.html >> Mark the UT hour immediately preceding the maximum of the SID and count forward or back to noon to make sure you are marking the correct UT of local civil noon each day. This chart will now be the correct format for a GCN Circular and the time of all events, Solar and GRB, will show the correct universal time and date. It is also important to have chart time set correct to the nearest minute. An easy way to do this is to subscribe to the free service of the US National Institute of Standards and Technology, NIST. It is available anywhere in the world. It will keep your computer clock accurate and reset it to within a few milliseconds when you click its icon on Desktop. Subscribe to it at: http://www.boulder.nist.gov/timefreq/service/its.html >> Here's how you can also use it to set your strip chart recorder time accurate to the nearest minute. Advance your chart to the next minute line and turn off the chart drive motor. In the case of a Rustrak recorder there is a time line every 15 minutes. Click on the NISTIME icon on Desktop and it will bring up a real time window where the seconds are being displayed. Watch for the time of the line your recorder has been advanced to and restart the chart drive motor on the 59th second before that time.

There is good news to report. We have a new SID observe in Hamilton, Ontario, Canada. He is Douglas Welch, A-104. Who records VLF station NAA in Cutler, Maine transmitting on 24 kHz. Doug is a long time member of the AAVSO. He became interested in astronomy at an early age and joined the AAVSO as a teenager to become a variable star observer. This deepened his interest in astronomy and lead him to choose it as his life work and become a professional astronomer. He is now a professor in the Department of Physics and Astronomy at McMaster University in Hamilton, Ontario, Canada. Find out more at: http://www.physics.mcmaster.ca/people/faculty/Welch_DL.html >> and click on his homepage. Here is a chart he made showing a nice SES on 17 May.



Doug's receiver is the hexagonal loop antenna receiver described in the April SID Supplement of the Solar Bulletin. He wound the loop with # 14 wire and it is in his basement and picks up little if any interference. The vertical scale is enhanced which required me to reduce the size of the whole chart to make it fit on this page. Doug had trouble tuning to 24 kHz and made a tuner to make it easier. The problem is you can compute the capacity you need but when you make this from readily available capacitors their 5% inaccuracy can tune the loop too far from where you intended. A tuner will allow you to tune exactly to the stations frequency with 5% accuracy capacitors. I tuned my 1.5 meter loop with 24-turns of # 14 wire with a precision decade capacitor bank made by Cornell-Dubilier to determine the actual capacities needed . Here are accurate values for the capacitors needed to tune to some popular VLF stations.

TABLE 1

60 kHz, WWVB Fort Collins, Colorado, USA.......0.002 mfd	37.5 kHz, NRK Grindavik Iceland ......0.008 mfd
25.2 kHz (no call letters) La Mourie, North Dakota, USA...0.0175 mfd	24.8 kHz , Jim Creek, WA, USA ....0.0178 mfd
NAA 24 kHz Cutler, Maine, USA ......0.0185 mfd	21.4 kHz, NPM Hawaii, USA...........0.023 mfd

You can make a tuner to find these stations from two Radio Shack 8-position DIP switches. These consist of eight little single-pole, single-throw switches side by side that mount on a printed circuit board. Radio Shack only carries the capacitors you need for this tuner in ceramic dielectric so you should use their ceramic capacitors. Below are the capacities for the sixteen capacitors you will need. Mount each switch on a little circuit board and connect one capacitor to each switch so when all 8 switches are in the on position all eight capacitors are connected in parallel. Leave the leads long when you solder them into the tuner so later when you have determined the combination of capacitors that tune to the station of your choice you can unsolder them with long enough leads to span the distance between the ends of your loop.

TABLE 2

Switch Number One:		Switch Number Two:	
Position # 1.....100 pfd	5.....100 pfd	Position # 1...0.001 mfd	5...0.0047 mfd
2.....100 pfd	6.....470 pfd	2...0.001 mfd	6....0.01 mfd
3.....100 pfd	7.....470 pfd	3...0.001 mfd	7....0.01 mfd
4.....100 pfd	8...0.001mfd	4...0.0047 mfd	8....0.01 mfd

These two tuners should make it possible to find your station without an oscilloscope and signal generator. Connect them temporarily with Alligator clip leads across your Loop. It will take some patience but you can choose a combinations that add up to the values given in Table 1 to get close. Then tune up and down in 100 pfd increments until you peak on a strong signal. Use a multimeter or your recorder to measure signal strength. Record the strong signal you have found for a few days to make sure it shows sunrise and sunset patterns. If it shows these patterns you have successfully tuned your receiver to a suitable signal and it should record solar flares as SESs. Unsolder the selected capacitors from the tuners and solder them across the ends of your loop. There is no need to protect them from the weather. I have left loop tuning capacitors exposed to all kinds of weather for years with no problems so long as the connections are soldered.

Experience so far has shown that because the loop antenna receiver's amplifier is connected directly to the loop antenna it can be easily damaged by nearby lightning unless you protect it with a lightning arrestor. An automotive spark plug makes a good lightning arrestor. Shorten its gap to about 0.2 mm or 0.008 thousandths of an inch and connect it across the ends of the loop. If your receiver produces strange results it might be a good idea to add the spark plug lightning arrestor and replace the TL082 op amp. If lightning strikes very nearby it will probably Zap the TL082 completely. My experience has been that nearby lightning damaged the TL082 so that it produced a distorted sine wave signal and produced an unsteady trace. Before it was damaged the signal was a pure sine wave and the trace was steady. On another occasion the signal disappeared completely but had returned by the next day as a distorted sine wave as viewed on my oscilloscope.

The chart below was made by Werner Scharlach, A-9, in Tucson, Arizona, USA who records NAA in Cutler, Maine, USA transmitting on 24 kHz. It shows the same 17 May SID as is shown above on the previous page with the difference that this chart was made with a Rustrak strip chart recorder and the vertical scale is not enhanced.