Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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ISSN 0271-8480

Volume 58 Number 6 **June 2002**

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

Day	N	Raw	s.d.	Ra	s.d.	s.e.
1	55	150	5.2	118	2.5	0.34
2	47	160	5.7	125	3.3	0.48
3	45	179	7.1	132	2.8	0.42
4	40	193	8.4	**145**	3.8	0.60
5	32	176	9.6	126	3.0	0.53
6	34	179	9.2	131	3.9	0.67
7	40	182	6.2	137	2.9	0.46
8	42	155	5.9	119	2.9	0.45
9	49	148	5.6	112	2.4	0.34
10	50	117	4.8	90	2.2	0.31
11	50	90	3.1	71	1.9	0.27
12	40	88	4.0	70	2.1	0.33
13	37	70	3.7	54	2.5	0.41
14	38	81	3.4	62	2.2	0.36
15	41	91	4.4	67	2.2	0.34
16	42	97	5.4	72	2.8	0.43
17	49	82	3.6	63	1.8	0.26
18	54	112	4.6	88	2.4	0.33
19	46	107	4.7	82	2.4	0.35
20	52	85	4.0	67	2.2	0.31
21	46	66	4.3	**48**	1.9	0.28
22	49	81	3.4	60	2.0	0.29
23	47	85	4.0	63	2.1	0.31
24	46	93	4.9	74	2.6	0.38
25	46	98	5.0	79	2.6	0.38
26	45	99	5.0	79	2.5	0.37
27	44	87	3.8	67	2.3	0.35
28	43	81	3.8	63	2.7	0.41
29	42	88	3.5	70	2.4	0.37
30	39	86	3.7	66	1.8	0.29
31	---	---	---	---	---	---

Means: 44.3 113.5 86.7

Total No. of Observers: 81

Total No. of Observations: 1330

Table II. June Observers

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

Day	RG	S:G	Day	RG	S:G	Day	RG	S:G	Day	RG	S:G
1	9.7	5.5	**9**	9.6	5.4	**17**	5.7	4.4	**25**	6.4	5.3
2	9.8	6.3	**10**	7.8	5.0	**18**	7.9	4.2	**26**	6.4	5.5
3	10.4	7.2	**11**	5.9	5.3	**19**	7.8	3.7	**27**	6.0	4.5
4	11.4	6.9	**12**	6.1	4.4	**20**	6.2	3.7	**28**	6.0	3.5
5	10.3	7.1	**13**	5.3	3.2	**21**	4.4	5.0	**29**	6.4	3.8
6	11.3	5.8	**14**	6.4	2.7	**22**	5.1	5.9	**30**	5.4	5.9
7	11.5	5.8	**15**	6.4	4.2	**23**	5.4	5.7	**31**	---	---
8	10.0	5.5	**16**	6.8	4.3	**24**	5.6	6.6	**Mn.**	**7.5**	**5.1**

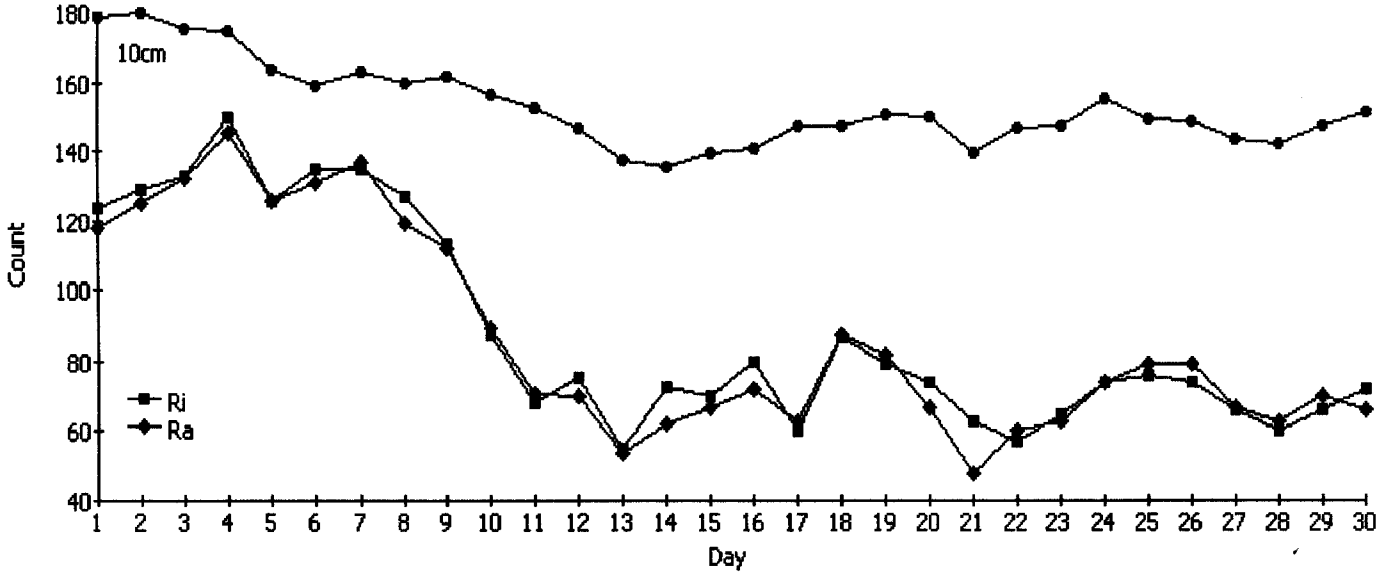

Fig. 1. 10 cm Solar Flux and Comparison of Ri (provisional) with Ra Estimates for June; r=0.986).
Ri source: http://www.sidc.oma.be/index.php3
10 cm source: http://www.drao.nrc.ca/icarus

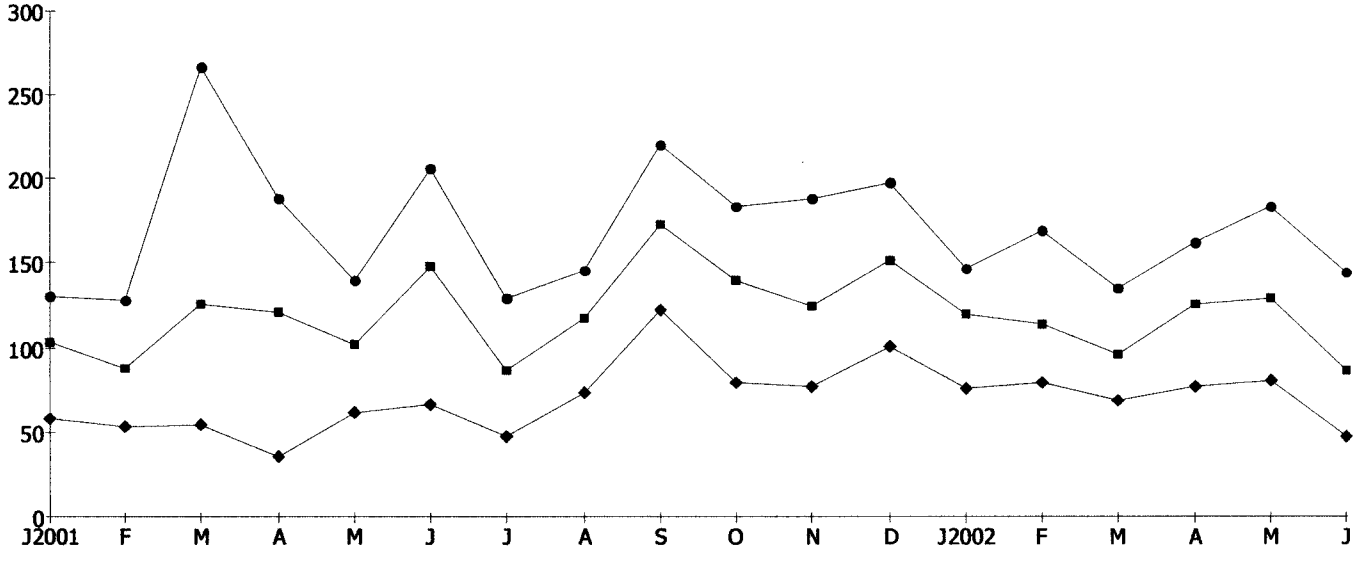

Fig. 2. Maximum, Mean, and Minimum Values of Ra for Each Month from January 2001 to Present.

Sudden Ionospheric Disturbance Report

Michael Hill, SID Analyst
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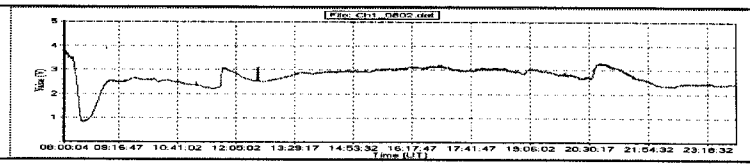
Marlborough, MA 01752 USA
noatak@aol.com



Sudden Ionospheric Disturbances (SID) Recorded During June 2002

(Analysis performed by Michael Hill, SID Analyst)

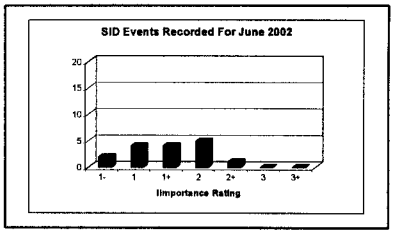
Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
020601	0357	1+						
020601	0357	1						
020601	0639	2						
020601	1048	1+						
020602	0432	1+						
020602	1015	2						
020602	1148	1+						
020602	1701	1						
020602	2045	2+						
020603	0723	1						
020604	1615	2						
020605	0930	2						
020619	1017	2						
020623	0822	1						
020629	0038	1-						
020629	0932	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
P Campbell	A100	NLK
J Winkler	A50	NAA
D Toldo	A52	HWU NAA NWC
J Ellerbe	A63	ICV
A Panzer	A83	NAA
M Hill	A87	NAA
G DiFillipo	A9	HWU
R Battaiola	A96	HWU
J Wallace	A97	NAA
M King	A99	HWU

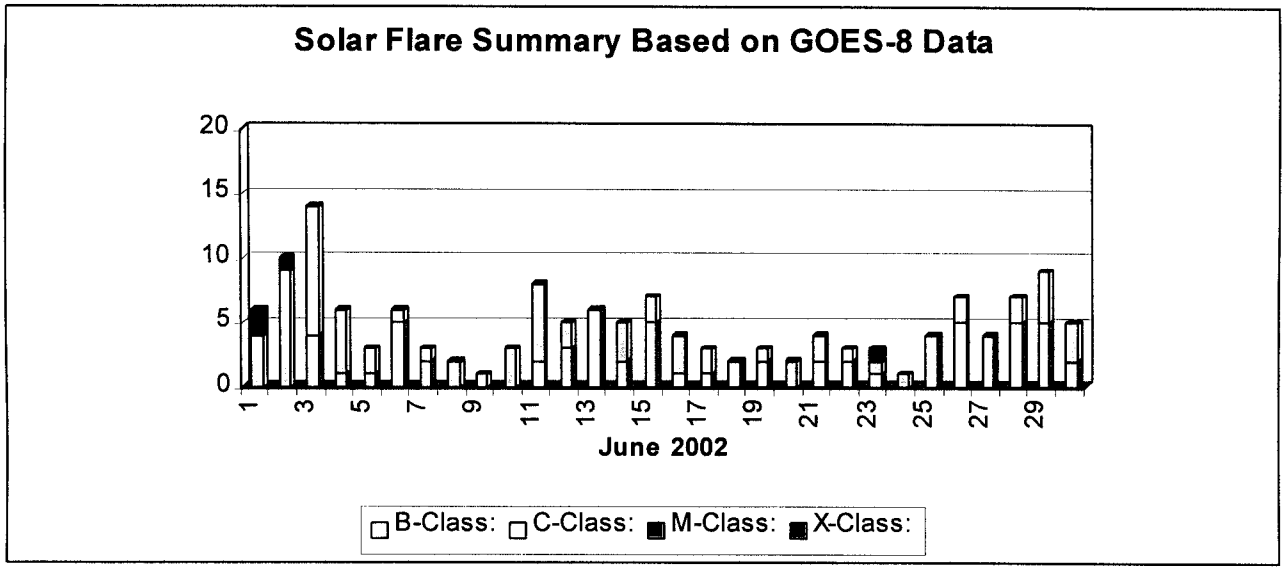


Solar Events

June of 2002 was a very slow month for solar activity as clearly demonstrated by the lack of SID events which most observers recorded. Some of you didn't even record any events. This comes on the heels of what appears to be a second burst of activity the last few months, mimicking the second peak of the past solar maximum. This lull is a sign of the slower activity to be expected as we now begin our approach to solar minimum. It makes for less exitement but allows us to hone our systems to work towards more sensitivity to smaller flare events and, if you should be so inclined, to look for another SID type of event; Those produced by the enigmatic Gamma Ray Bursts or GRBs. If you do pursue this then you should contact Casper Hossfield (capaavso@aol.com) and get involved with the AAVSO GRB program that coordinates such events and activities.

There were only 16 coordinated flare related SID events reported this month. The most active day was on June 1st and 2nd. Interestingly the most active day for GOES-8 XRA events was on the 3rd. This is probably due to a flare-producing region producing a number of large flares when it first formed. Most of these flares we detected relatively easily. This was followed by a period of more numerous flares of lesser intensity as the area of activity on the sun waned in strength. It would be interesting to determine if this is a pattern than is repeated by most active spot groups.

The GOES-8 Satellite data showed a much lower activity level, as well. There were only 145 XRA events recorded, compared to the previous 200-300 events per month. Of these, only four were M-Class events, and there were no X-Class events. Most of these were on the 1st and 2nd of the month.



SOLAR BULLETIN of the American Association of Variable Star Observers. Vol. 58, No 6, June, 2002

SUDDEN IONOSPHERIC DISTURBANCES SUPPLEMENT

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SUDDEN IONOSPHERIC DISTURBANCES
RECORDED DURING JUNE, 2002

THE SUDDEN IONOSPHERIC DISTURBANCE NETWORK.

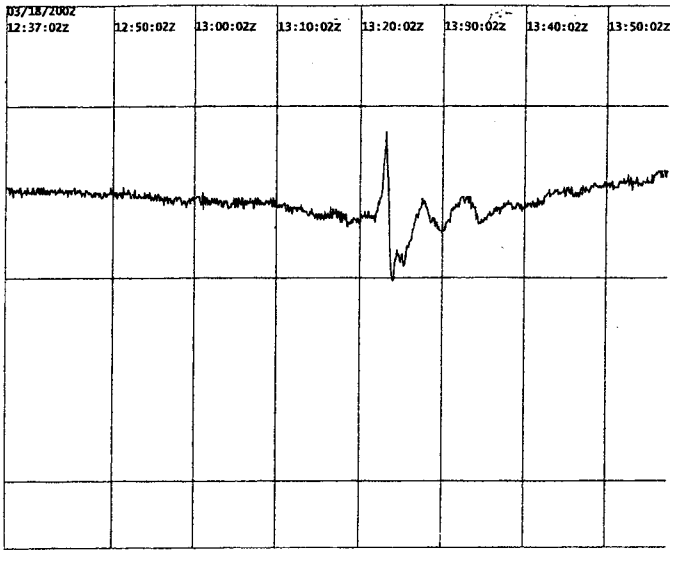
There is good news to report this month. Solar Division SID observers now have a list server network where you can post mail that will go out to all observers who have subscribed to the network. The simple easy to build VLF receiver I described in the April and May SID Supplement of the Solar Bulletin has generated a lot of new interest in detecting solar flares by the SES method. One of those I helped build the hexagonal loop antenna receiver described in the May Supplement is new SID observer Doug Welch, A-104. We are very lucky that Doug became interested in our SID program. He set up the gamma ray burst network for the AAVSO and is its administrator. He has now very kindly set up an SID network for us where we can post questions and answers and discuss SIDs in general. The list server for this network is at McMaster University in Hamilton, Ontario, Canada, where Doug is a professor in the Department of Physics and Astronomy. Please subscribe to the SID network at this URL:

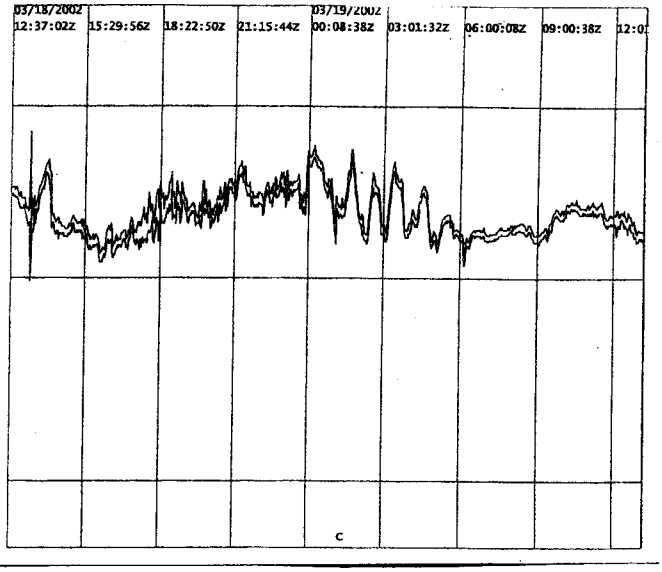
http://mailman.mcmaster.ca/mailman/listinfo/aavso-sid-list

Once you have subscribed you will receive all postings to the list and it will be a way for us to get to know each other better. Please subscribe today and post any questions you may have on the network list where they can be answered by several people who may know the answer. If you are an observer who has some experience please share your knowledge by answering the question on the network so all of us see both the question and the answers given. This way we all learn things we may have wondered about and get to know each other through shared experience. Most SID receivers work pretty much the same way and tend to have the same problems that new observers have to contend with. Now we can share our problems with the network and it will be much easier to get the answers we need from experienced observers who once asked the same questions. So let's all get together and help one another get these SID receivers working and recording all those SIDs as SESs.

A Simple Easy to Build Homemade Magnetometer

One of the charts below shows a sudden commencement that was part of a magnetic storm that was recorded by Edward Los who lives in Nasua, New Hampshire, USA. Edward built his magnetometer from instructions that were in the October, 2001 issue of the Solar Bulletin that described a magnetometer built by Rebecca Ragar, a high school student in Rudy, Arkansas, USA for a science fair project. Rebecca's magnetometer was one of the winners in the regional fair so it was then entered in the state fair where she won valuable awards from the US Geological Survey and the US Navy. I built an example of Rebecca's magnetometers and set it up as an exhibit by the registration table for the Fall Meeting of the AAVSO in November, 2001. Edward was one of the people who was inspired by the exhibit to build this simple McWilliams magnetometer that requires no electronics and can record magnetic storms on a strip chart recorder or computer. Edward describes here the very nice system he used to make the recordings below. It is a big advantage to be able to use an 8-bit A/D converter and an old 386 PC that you can probably get for nothing and record on a floppy diskette. A similar economical recording system could probably be used to record SIDs instead of dedicating a valuable computer.





My McWilliams magnetometer has been in operation since December 23, 2001. Construction took less than three weeks of spare time. The construction of the magnetomer followed Casper Hossfield's plans with minor modifications. However, the electronics and accompanying software are of my own design. The cost of parts (less electronics and computer) was $125.40.

I found it easier to epoxy the photocells to a piece of Radio Shack perf board with holes drilled on 0.1" centers. A brass screw attaches the perf board to the photocell holder. For fine adjustment, a tab cut from 1/64" Birch plywood epoxied to the photocell holder extends under the wind screen. A millimeter scale taped to the photocell holder helps with adjustment and provided the sensitivity plot shown in Figure 1.

The electronics is based on a Radio Shack TLC-548 8-bit A/D converter. This resolution is adequate because noise in my system limits the data accuracy to about six bits. Since the converter had been in my spare parts box for some time, I do not know if Radio Shack still carries this part in their catalog. Figure 2 shows that the converter requires only two input lines and one output line. I mapped the I/O clock input to the COM port RTS line; the Chip Select input to the COM DTR line and the Data Output to the COM CTS line. Figure 3 shows the complete circuit which operates off a 5V regulator and uses two generic NPN transistors to provide isolation between the +/- 12 Volt COM lines and the 5 Volt A/D converter.

The data collection computer is an old 386 laptop which runs MS-Dos version 3.0. To reduce power and audible noise, I disconnected the hard drive of the laptop and run MS-Dos from the floppy drive. The total power consumption of the system is only 16 watts and should cost me less than $10 per year of electricity. The laptop sits on my kitchen counter while the magnetomer is in a dark corner of my basement to minimize thermal and stray light effects.

The data collection software is written for a Turbo C Version 2.0 compiler that is compatible with MS-Dos version 3.0. This software has a simple character cell display which allows me to monitor the operational status of the magnetometer and to obtain a quick assessment of geomagnetic activity. I chose the sampling period of six seconds to allow a complete hour's worth of raw data to appear on the screen in the form of hexadecimal bytes. Since the vane oscillation period is eighteen seconds, this sampling period satisfies the Nyquist Theorem. Every hour, I display a summary line with contains a timestamp, the maximum and minimum samples, and a geomagnetic index for each of the last twenty-two hours. I use the maximum and minimum samples to make sure that the plot has not gone off-scale.

The geomagnetic index is very loosely based on the K index definition. I first find a running mean with a 128 sample time constant:

(Mean for sample N) = ((Current Sample) + (127 * (Mean for sample N-1)))/128

I then subtract the current sample from the running mean and define my geomagnetic index as the range of the resulting value for an interval of an hour. As a result, the slowly varying Quiet Solar Variation has no effect on my geomagnetic index, but any rapid fluctuations contribute directly to the index. As with the official K index definition, the largest fluctuation during the recording interval defines the index value for that interval.

The data recording software writes all samples directly to a file on the floppy disk. Because there is limited space on this disk, I have devised my own protocol which is loosely based on existing networking protocols. The protocol allows the recording of approximatly 90 days of data on a standard 2.25" floppy diskette. Each eight bit sample becomes a byte except for five special function bytes which are the ASCII numbers "0" through "4". The numbers "1" through "4" are followed by a single byte field indicating the length of the data to follow and then the actual data itself. The number "0" is an escape character meaning that the following byte of raw data has been xor'ed with 0x20 to avoid making it look like one of the special function bytes. The function codes have the following definitions:

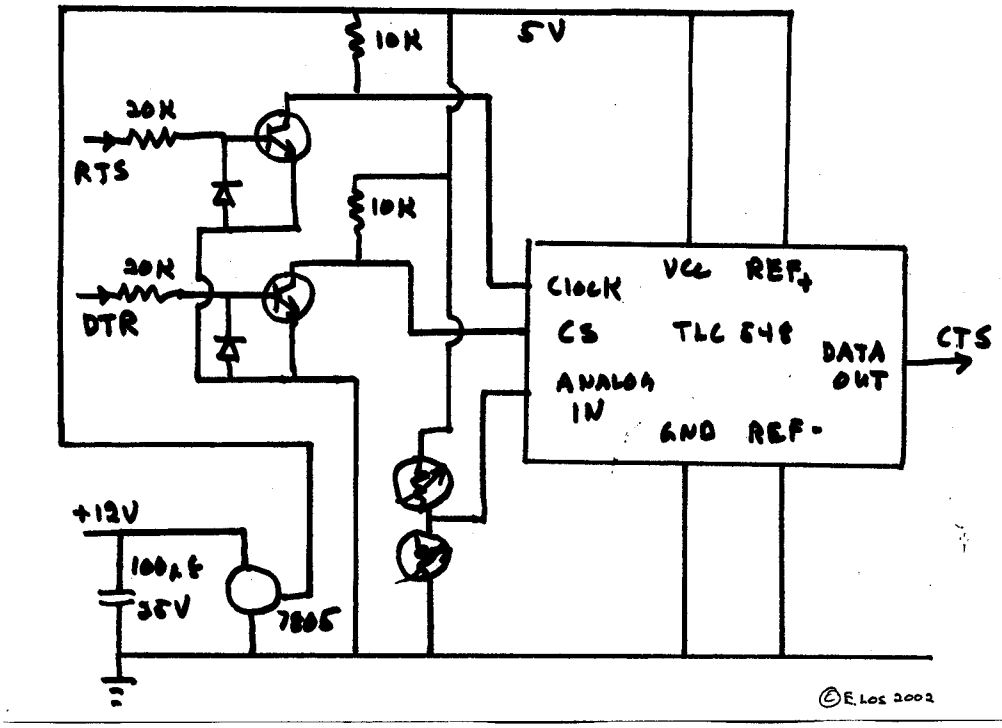
"1" A four-byte UNIX-style timestamp follows.
"2" Start of the file. A one byte version number follows.
"3" End of the file. No parameter.
"4" A variable length comment string follows.

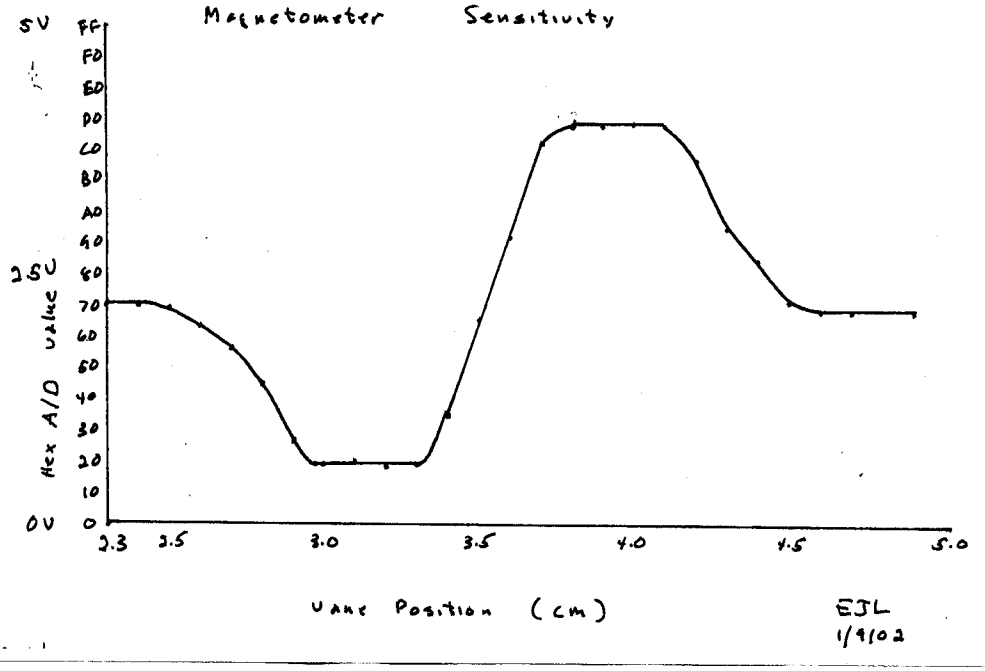
Comments may be entered directly from the keyboard at any time. I use "Z" when I re-zero the magnetometer scale; "C" when I am about to move my car in the driveway; and "S" for any other comment that needs recording (The "S" does not actually appear in the file). Every hour, a timestamp is written to the file and the file is closed and reopened to flush the data to disk in case there is a power failure.

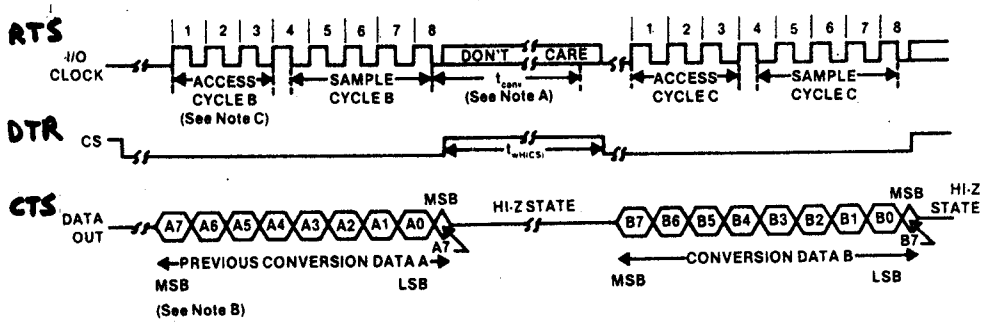
I periodically shut the magnetometer down long enough to transfer the files to my Pentium computer which runs Windows 98. I modified software from the Microsoft Developer Network library to provide the graphs which accompany this article. The graphing program displays the time in either UTC or Eastern and has the ability to zoom in on segments of interest. The two plots which accompany this article are from an official "minor storm" of March 18-19 2002. The sudden storm commencement began at 13:30Z

on March 18 and the storm lasted for about 18 hours. There are two car-motion detections at 14:11Z of March 18 and 1:15Z of March 19 which should be ignored. The overview plot shows the maximum and minimum range for each pixel and two detailed plots show all of the individual samples for about an hour.

The car motions mentioned in the previous paragraph are an important sign that the magnetometer is working correctly. The magnetometer is very sensitive to movement of metal around my house, but is sufficiently far from the road to respond noticeably to passing cars. To maintain sensitivity, I have to add a humidifier anti-bacterial agent to the damping pool and I have to make sure that the water level does not get too low. As the warm weather approaches, I am having an increasing problem with spiders and may have to seal up the wind screen more thoroughly. I am still looking forward to fulfilling my original goal of having the magnetometer alert me to an ongoing auroral display.







TLC 548 8-BIT A/D

Edward has the software for his recording system described above on a CD. If you would like to have one of these CDs please write to: Edward Los, 7 Cheyenne Drive, Nashau, NH 03063 USA. His phone number is 603 880 6219. A 10 bit A/D converter is now available from Dataq for only $24.95. With Edwards software this is a very economical way to record the output of a magnetometer or an SES receiver on a computer. The URL to order the $24.95 A/D converter is:

http://www.dataq.com/products/startkit/di194rs.htm

You can find plans for building the magnetometer Edward built in the AAVSO Solar Bulletin for October 2001. At:

http://www.aavso.org/committees/solar/oct01.stm

Scroll down to the end of the October Solar Bulletin and you will find the plans in the Sudden Ionospheric Disturbance supplement. If you decide you would like to build this magnetometer send me an email and I will send you drawings of the individual parts and how to assemble them and set up the magnetometer and get it working. The kit is no longer available.

Below is a stack of traces for the month of May made by Doug Welch, A-104, who records NAA in Cutler ,Maine, USA transmitting on 24 kHz. It shows how the sunrise and sunset patterns repeat each day and all the SESs for the month show in between. Notice how the stack shows the SIDs were most plentiful during the middle of the month. Doug will be glad to tell you how to make a stack of your recordings for a whole month. Please ask him how to do it by posting your questions to the SID Network List so we can all learn how he made this interesting chart.