Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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Daily Mean Sunspot Numbers, R_a for December 1998

(computational analysis performed by Grant Foster, AAVSO Headquarters)

	simple average			k-corrected	
Day	R_a avg	Std. Dev.		R_a k	Std. Dev.
1	117	10.3		100	6.6
2	116	11.2		99	7.0
3	104	6.6		92	5.9
4	103	5.7		93	3.9
5	83	6.3		75	3.4
6	107	6.9		88	3.6
7	132	7.4		114	4.4
8	142	8.1		128	5.4
9	130	6.9		120	4.3
10	136	8.8		117	5.4
11	123	7.9		105	4.3
12	133	8.2		112	4.1
13	114	6.7		101	4.4
14	104	7.0		90	4.0
15	81	4.5		73	3.6
16	75	6.8		61	4.9
17	77	5.2		64	2.9
18	73	4.2		61	2.4
19	60	5.5		53	3.3
20	63	4.9		53	4.0
21	54	5.9		47	3.3
22	46	4.8		38	2.7
23	49	5.1		44	3.2
24	71	5.8		60	3.9
25	85	6.0		72	3.4
26	112	10.5		93	5.5
27	122	9.8		107	5.1
28	131	13.1		122	8.1
29	108	8.8		99	7.6
30	117	14.0		102	7.6
31	116	12.2		97	7.0

Monthly Mean R_a avg = 99.5
Monthly Mean R_a k = 86.4

(Based on 766 observations contributed by 54 observers)

AAVSO Sunspot Observer Codes

AAP	A. Patrick Abbot
ANDE	Eric Anderson
ATAT	Tamer Atac
ATKG	Gerald Atkinson
BARH	Howard Barnes
BARW	W. Barton
BATR	Roberto Battaiola
BDT	David Branchett
BERA	Alberto Berdejo
BERJ	Jose Alberto Berdett
BLAJ	John A. Blackwell
BMF	Michael Boschat
BOSB	Biswajit Bose
BRAB	Brenda Branchett
BRAR	Robert Branch
BROR	Rodney Brooks
BURS	Scott Burgess
CARJ	James Carlson
CHAG	German Morales Chavez
CHOJ	John Chouinavas
CKB	Brian Cudnik
CLEC	Carl Clemens
COMT	Thomas Compton
CONG	Gregory Conlin
CR	Thomas Cragg
DAVT	Thomas F. Davis
DEMF	Frank Dempsey
DRAJ	Jean Dragesco
DUBF	Franky Dubois
ELEG	Gontran Eleizalde
ELLJ	Jaime Ellerbe
EVAC	Charles Evans
FERJ	Javier Ruiz Fernandez
FLEN	Nicolas Alejandro Fleming
FUJK	K. Fujimori
GIOR	Richard Giovanoni
GOTS	Steve Gottschalk
GUNM	Marcelo Mojica Gundlach
GUTD	David Montes Gutierrez
HALB	Brian Halls
HANS	Stanley Hanna
HAYK	Kim Hay
HRUT	Timothy Hrutkay
HSF	Casper Hossfield
IBAJ	Jose Manuel Oporto Ibanez
ISKJ	Jozsef Iskum
ISLJ	John E. Isles
JANJ	Jan Janssens
JEFT	Thomas Jeffrey
JENJ	James Jenkins
JENV	Vernon Jennings
KAPJ	John Kaplan
KNJS	James & Shirley Knight
KOS	Attila Kosa-Kiss
KUEK	Kevin Kuehl
LAWJ	Joseph D. Lawrence
LERM	Michel Lerman
LEVM	Monty Leventhal
LGN	Gennaro Lopriore
LIZT	Tom Lizak
LUBT	Thomas Lubbers
LUNH	Hugh Lund
LWT	Todd Lohvinenko
MALK	Kjell Inge Malde
MARE	Enrico Mariani
MARJ	Javier Jarboles Maranon
MCE	E. Mochizuki
MCHL	Larry McHenry
MILJ	Jay Miller
MMI	Michael Moeller
MOJH	Hector Mojica
MUDG	George Mudry
PAIM	Marie-Therese Pain
QUAG	George R. Qualley
RANT	Thomas Randall
REYD	Darryl Reynolds
RICE	E. C. Richardson
RMAJ	Jim Ramsey
ROSG	George Rosenberg
SCGL	Gerd-Lutz Schott
SCHG	Gregg Scholl
SIMC	Clyde Simpson
SPEP	Pam Spence
SPER	Robert Spellman
STAB	B. States
STEE	Elizabeth Stephenson
STEF	George Stefanopoulis
STEM	Gerhard Stemmler
SUZM	M. Suzuki
TAKH	H. Takuma
TESD	David Teske
THR	Raymond Thompson
TORM	Marcello Torsoli
VARG	Gonzalo Vargas
VAZC	Carlos Eduardo Angueira Vazquez
WHIM	Matthew Whitehouse
WILW	William M. Wilson
WISM	Michael Wiskirken
WITL	Leonard Witkowski
WKW	Kenneth Watts

All sunspot observers are requested to include their observer code listed above on monthly reports and all correspondence with the AAVSO Solar Division. All individual observations are referenced by your observer code in the new sunspot database. This will allow for efficient searches of data and recognition of individual contributions.

Sudden Ionospheric Disturbance Report

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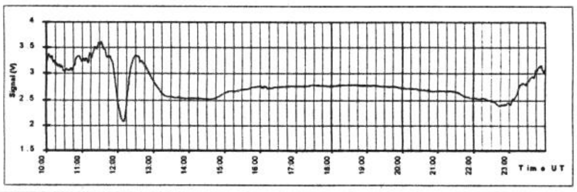

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Sudden Ionospheric Disturbances Recorded During December 1998

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
981201	1120	1-	981213	2049	1-	981218	1540	1-	981227	0558	1-
981201	1320	1-	981214	0944	2	981218	1607	2	981227	1830	2
981201	1814	2	981214	1110	1-	981218	1718	3+	981227	2018	1
981202	0910	1-	981214	1145	1-	981219	0655	1	981228	0518	1+
981204	1105	1-	981214	1220	1-	981219	0950	1-	981228	0546	1+
981206	1445	1-	981214	1924	1-	981219	1435	1+	981228	0854	1-
981207	1000	1-	981214	2231	1+	981220	0515	2	981228	1107	1-
981207	2155	1+	981215	1055	1-	981220	0901	2	981228	1200	1+
981208	1320	2+	981215	2050	1+	981220	1247	1-	981228	1315	1-
981208	1407	1+	981216	0118	1-	981221	1957	1-	981228	1812	1
981208	1619	1	981216	0958	1+	981222	1527	1+	981228	2323	2
981208	1639	2	981216	1200	1-	981222	2352	1-	981229	0735	1
981208	1824	2+	981216	1909	1+	981223	0816	1	981229	1520	2
981208	2018	1	981217	0748	2	981223	1205	1-	981229	1554	1+
981209	1745	1+	981217	1419	1+	981224	0656	1-	981230	0528	1-
981209	1808	1	981217	1754	1	981224	1137	1+	981230	0537	2
981211	1150	1-	981217	1816	2	981224	1928	1-	981230	1227	1+
981211	1752	1+	981217	2119	2	981225	0622	1+	981230	1810	1-
981212	1300	1	981217	2311	1+	981226	0515	1-	981231	0630	1
981213	0516	1-	981218	0530	1-	981226	0601	1	981231	0719	1
981213	0715	1+	981218	0750	2	981226	0928	1	981231	1502	2+
981213	1035	1	981218	0950	1-	981226	1500	2			
981213	1852	1-	981218	1253	1-	981226	1830	2+			

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 following observers submitted reports and/or charts for December:
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-90 Mandaville, Arizona

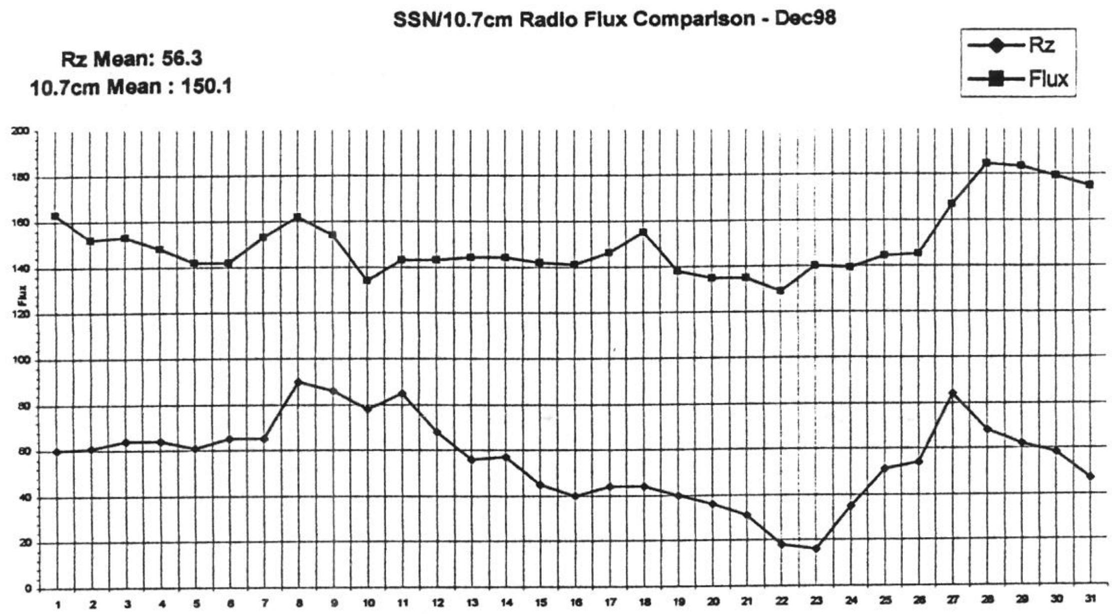
SID Monitoring Station Online

The University of Louisville Physics department has initiated a webpage which continuously displays the output from their SID monitoring receiver. Previously operated by longtime SID program member Dr. Walter Moore (A26), one of his former students, Dr. John Kielkopf has resurrected the station and plans to use the results in his undergraduate physics laboratory courses. Description of the station and its SID plots can be found at: **http://moondog.astro.louisville.edu/flares**

Sudden Ionosphere Disturbances Recorded during December

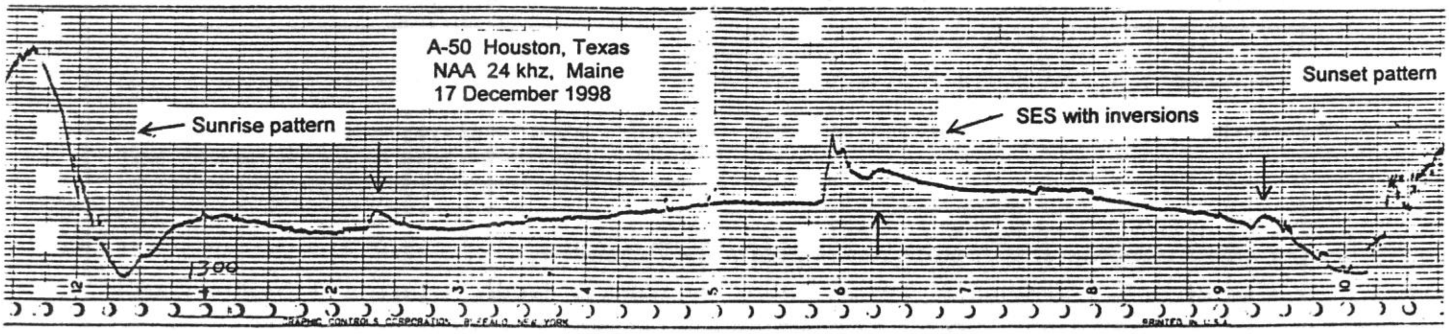
Prepared by

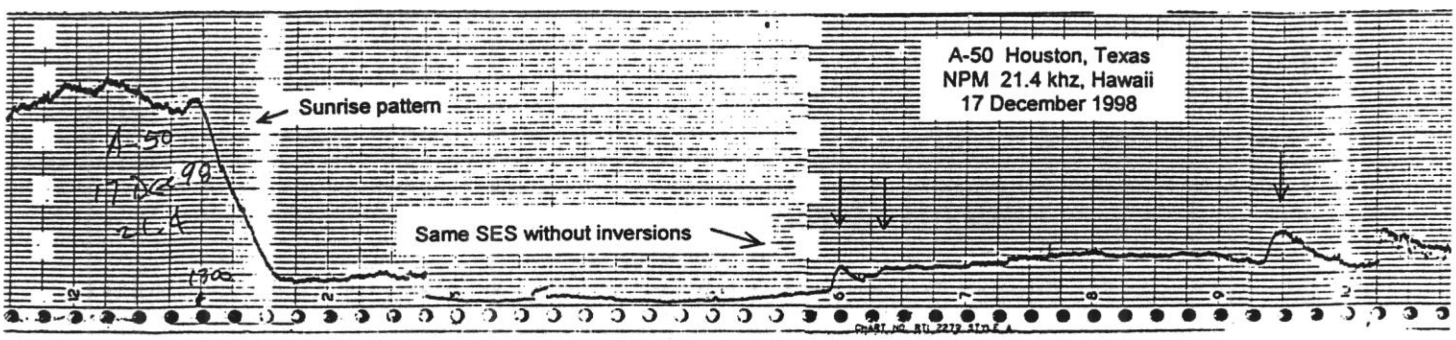
Casper H. Hossfield



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Rz	60	61	64	64	61	65	65	90	86	78	85	68	56	57	45	40	44	44	40	36	31	18	16	35	51	54	84	68	62	58	47
Flux	163	152	153	148	142	142	153	162	154	134	143	143	144	144	142	141	146	155	138	135	135	129	140	139	144	145	167	184	183	179	175

The graph above shows 10.7 cm flux plotted against Zurich sunspot numbers computed from observations of seven AAVSO sunspot observers who count according to the Zurich system. The Zurich reduction formula was used to reduce their counts to true Zurich Relative Sunspot Numbers, RZ. AAVSO Sunspot observer, Tom Lizak, prepared the graph





Jerry Winkler, A-50, made the two charts above. The recording of NAA in Cutler, Maine shows an SES starting at 0552 with an inversion in the rise to maximum that distorts the recording of the event so it is not clear where it reached maximum. It is also not clear where it ends or whether there is a second SES starting at 0613. A chart recording of NPM in Hawaii shows a normal recording of the same SES. It shows clearly where the maximum occurred and that a second SES started when the first one had not quite ended. Without the NPM chart it would not be possible to understand what happened on the NAA chart.

Sudden Ionospheric Disturbance Technical Bulletin

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The Solar Division is pleased to receive for publication a description of geomagnetic disturbance monitoring research from 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 observers are encouraged to submit articles pertaining to solar observing technique, equipment, and data analysis for consideration.

Recording Magnetometer

by Dr. Walter S. Moos

In the *Solar Bulletin* of May 1998 (Vol 54, #5), a simple method for recording geomagnetic storms has been described which had been devised by Al McWilliams at the University of Minnesota. I was very much intrigued by the device and started to build one myself. It soon turned out to be a greater job than I had anticipated. Not that a simple demonstration unit would not work, however the problem I wanted to solve was to build a sturdy unit which, if possible, could be exposed to the open air environment such as a garden. The biggest handicap was to overcome the influence of stray light entering the instrument and causing erroneous signals. The bridge circuit makes the system extremely sensitive. Also I wanted to make sure that no air drafts, temperature changes, etc would cause any deflections of the suspended magnets once their positions were set. On the basis of the encountered problems during construction, I thought that some of my experiences might be of interest to others also attempting a similar project.

All parts had to be made of aluminum, copper, or brass. To start with, I was lucky enough that I had saved an old piece of copper pipe which I had picked up from the disposal bin of a vacuum condenser manufacturer. The pipe had an outer diameter of 132mm, a height of 50mm, and a wall thickness of 2mm. These were just the perfect dimensions. A 1mm copper bottom sheet was soldered on with ordinary solder and so were all the subsequent metal to metal joints, always taking great care that all critical joints were light tight. A 128 x 12 x 3mm piece of brass was soldered across the upper part of the pipe with a 3mm hole in its center. On this crossbar a 200 x 10mm copper pipe was mounted serving as a protective mantel for the suspension wire of the magnets. The wire (0.203 steel) used for musical stringed instruments was threaded though a 0.5mm hole in a brass screw, which in turn was screwed into a nylon plastic stopper on top of the pipe. This allows minute adjustments in height and rotation since the nylon clamps fairly tightly around the screw. Coarse adjustments can be made with the help of an additional piece of 70 x 12.5mm copper pipe slipped over the lower pipe and fixed with a small brass clamp screw on the side. An additional copper ring of the same diameter facilitates to secure the desired height after coarse adjustments. A small piece of brass pipe (2mm outside diameter by 5mm length) must be soldered in the exact center at the bottom of the sheet. This centering provision keeps sideward movements of the rotational magnetic parts of the instrument at a minimum. Three small plastic pieces were glued to the underside of the bottom sheet as feet.

A circular piece of copper (0.75mm thick and 50mm length) was cut and bent into a U-shaped form with height of 35mm. This part must hold the light source (6V, 40 mA miniature lamp, 15.87 x 5.84mm) on the top and the light sensitive CdS cells (4 cells - 5.2 x 5.2mm) on the bottom. The CdS cells were mouunted on a piece of insulating plastic using a fast curing glue (cyanoacrylate). The cells were connected in such a way that they constituted one side of a bridge circuit. The three ends of the wires were fastened to a connector made from a black plastic rod in which five copper pins were inserted as lead throughs. Again these pins must be fixed to the plastic with cyanoacrylate glue. The remaining two pins serve for connecting the lamp to a two volt power supply. The low

voltage was chosen to prolong lamp life and to avoid heating effects. The connector must be mounted light tight and the lamp holding part is screwed on the main body of the instrument.
The moving part of the magnetometer was built from four rod magnets, each 25 x 6mm, 1600 gauss. The magnets have enough strength that they can support each other for their entire length of 100mm. Between the second and third rod, a sewing needle was inserted together with two halves of a small washer. This split washer allowed the magnets to stay straight in line while the needle was fixed between the two halves. The whole assembly was glued together with a few drops of epoxy glue. On one end of the 100mm rod a 5 x 5mm piece of black paper was fixed with the same type of glue. The lower end of the steel wire protruding from the vertical suspension system is slightly bent to form a hook and then threaded through the opening of the sewing needle. The black paper square blocks about 1/2 of each of the two center CdS cells when hanging properly on the steel wire. The magnet assembly is now free to rotate and easily tries to align itself with the geomagnetic field N/S direction. The entire instrument must therefore be rotated about 90 degrees which causes sufficient torsion on the wire to counteract the geomagnetic field. Small adjustments can be made with the top screw and the upper pipe as indicated before.

Basically the instrument could now be operational with the exception that a light light cover must be placed over the part containing the light sensitive elements. A thin copper or brass disk (cardboard might do also) with about a 20mm rim will do the job if a soft rubber gasket is inserted between the cover and the upper border of the instrument. The light sensors are extremely responsive to the smallest amount of light and therefore a rubber gasket must also be placed around the wire supporting pipe. If exposed to intense sunlight, it is recommended to place a black plastic bucket over the entire unit. Keeping stray light out caused me more trouble than the assembly of the rest of the instrument. Figure 1 shows the constructional details of the instrument.

Magnetometer.

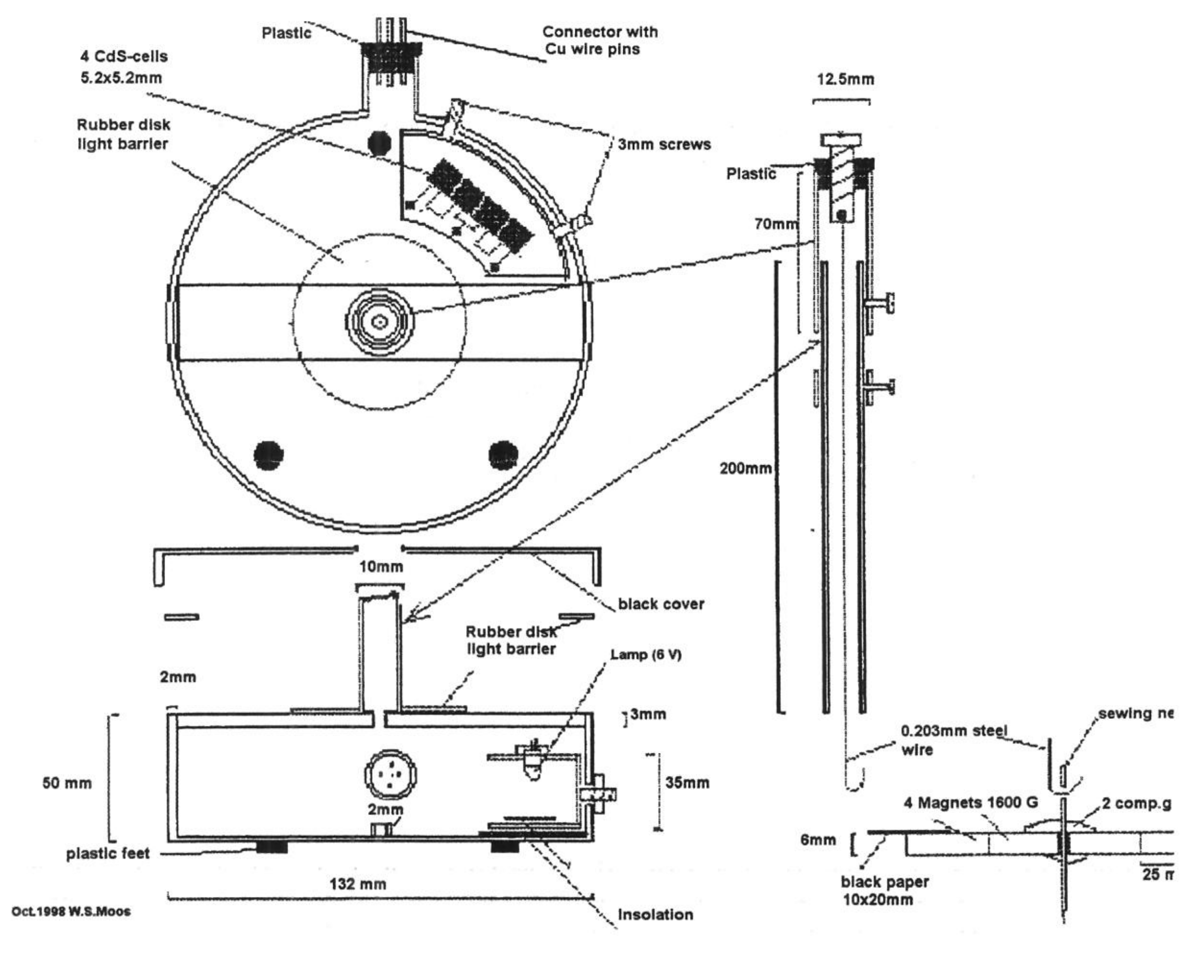

Figure 1

The electrical circuit part has been described by McWilliams and I used the same arrangement housed in a small plastic box. If an ordinary potentiometer with steel housing is used, care must be taken that it is sufficiently remote from the magnetometer and that it remains in a fixed position.

My first experiments confirmed the reported problems with moving cars. Driving my own car from the garage resulted in catastrophic magnetic deflections to the extent that the magnets did not return to their original positions. Therefore the instrument was placed in the garden about 20 meters from any moving vehicle. This seems sufficiently remote to no longer cause any erroneous signals from such sources. The signal from the unit is fed into an analog/digital converter and from there into a computer. However it soon showed that the effect of temperature variations cannot be neglected. In the open environment, temperature changes from 0° (or below) to 25°C must be expected. This causes considerable changes in the magnetometer readings as demonstrated in Fig. 2. The problem could partly be solved by placing the entire unit in a highly temperature insulated box. However this makes adjustments rather complicated and slow daily temperature changes cannot be eliminated entirely unless one compensates temperature changes by additional means. To avoid such steps, I finally decided to place the unit in a room of the house which was seldom used and which had a fairly constant temperature over longer periods of time. This gave good results (Fig. 3). Originally I had intended the construction in such a manner that the entire rotating part would be immersed in an oil bath as a damping mechanism. It turned out to be a messy affair which I gave up, but I believe Jim Mandeville's (SID Report September 1998) method would be a fine solution.

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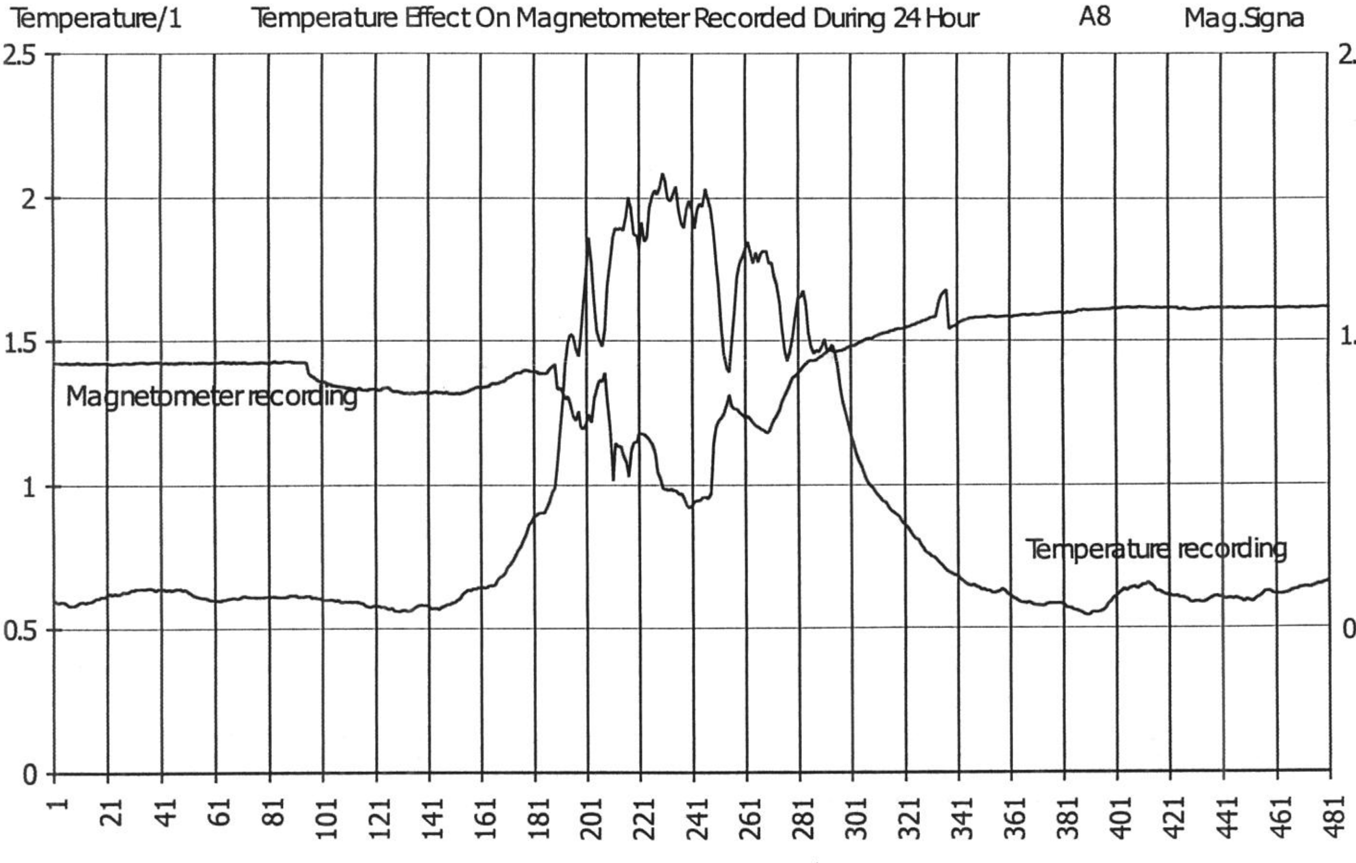


Figure 2

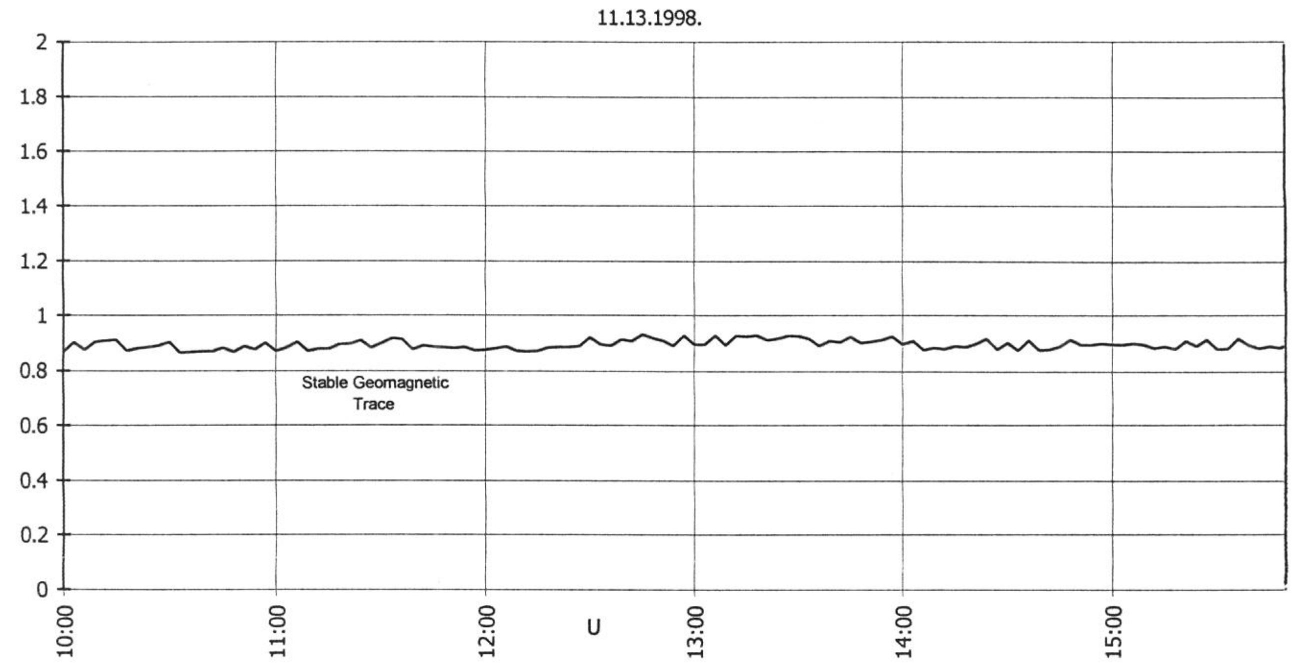
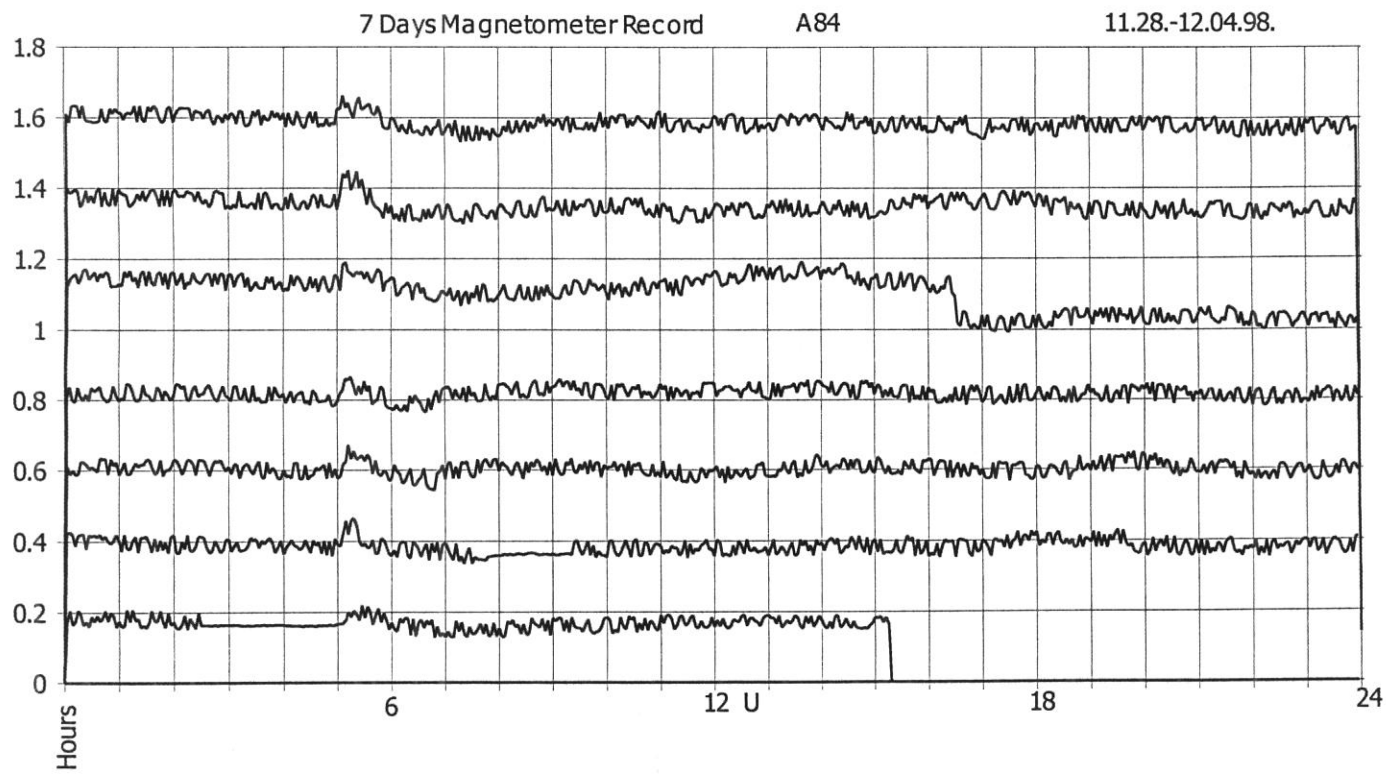


Figure 3



Results provided by Dr. Moos