Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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Daily Mean Sunspot Numbers, R_a for February 1999

(computational analysis performed by Grant Foster, AAVSO Headquarters)

	simple average		k-corrected	
Day	R_a avg	Std. Dev.	R_a k	Std. Dev.
1	31	2.5	32	1.7
2	29	2.7	23	2.0
3	26	1.5	21	1.0
4	22	1.3	19	1.6
5	15	1.1	14	1.4
6	23	1.3	20	0.9
7	30	2.0	28	1.2
8	53	2.7	49	1.8
9	55	3.5	45	2.2
10	76	3.1	66	1.7
11	94	4.3	80	3.2
12	136	6.1	114	3.9
13	162	6.4	130	4.1
14	168	5.4	144	3.8
15	161	6.1	133	4.4
16	161	5.9	137	3.8
17	151	6.6	127	4.6
18	115	5.5	100	4.8
19	103	4.1	87	2.7
20	99	5.3	82	3.0
21	87	3.3	78	2.8
22	53	3.7	48	2.9
23	46	2.0	38	1.3
24	44	2.1	38	1.3
25	55	4.0	45	2.4
26	56	2.9	45	2.0
27	68	3.7	58	2.4
28	92	5.9	73	4.7
29	-	-	-	-
30	-	-	-	-
31	-	-	-	-

Monthly Mean R_a avg = 79.0
Monthly Mean R_a k = 67.0

Observer	Code	Days Obs.
Abbott, P	AAP	15
Anderson, E	ANDE	7
Atac, T	ATAT	19
Atkinson, G	ATKG	11
Barnes, H	BARH	9
Battaiola, R	BATR	7
Black, B	BLAB	6
Blackwell, J	BLAJ	11
Boschat, M	BMF	14
Bose, B	BOSB	27
Branchett, B	BRAB	25
Branch, R	BRAR	20
Carlson, J	CARJ	15
Morales, G	CHAG	14
Cudnik, B	CKB	12
Clemens, C	CLEC	22
Compton, T	COMT	11
Conlin, G	CONG	5
Cragg, T	CR	24
Dempsey, F	DEMF	9
Dyck, G	DGP	15
Dragesco, J	DRAJ	21
Dubois, F	DUBF	17
Eleizalde, G	ELEG	26
Feehrer, C	FEEC	17
Ruiz, J	FERJ	9
Fleming, A	FLEN	4
Fleming, T	FLET	14
Giovanoni, R	GIOR	19
Gottschalk, S	GOTS	14
Halls, B	HALB	3
Hay, K	HAYK	12
Hrutkay, T	HRUT	7
Imperi, R	IMPR	7
Janssens, J	JANJ	3
Jeffrey, T	JEFT	9
Kaplan, J	KAPJ	17
Knight, J	KNJS	13
Lawrence, J	LAWJ	8
Lerman, M	LERM	12
Leventhal, M	LEVM	17
Lopriore, J	LGN	11
Lizak, T	LIZT	11
Lohvinenko, T	LWT	2
Malde, K	MALK	18
Mariani, E	MARE	7
Maranon, J	MARJ	28
McHenry, L	MCHL	3
Miller, J	MILJ	5
Moeller, M	MMI	15
Mudry, G	MUDG	6
Culgoora Solar Obs	OBSO	17
Parker, N	PARN	6
Randall, T	RANT	8
Richardson, E	RICE	16
Ramsey, J	RMAJ	5
Ramsey, S	RMAS	1
Schott, G	SCGL	18
Simpson, C	SIMC	8
Stefanopoulos, G	STEF	5
Stemmler, G	STEM	11
Suzuki, M	SUZM	22
Teske, D	TESD	20
Thompson, R	THR	12
Vargas, G	VARG	12
Vardaxoglou, P	VARP	14
Vazquez, C	VAZC	20
Wilson, W	WILW	13
Witkowski, L	WITL	23
Watts, K	WKW	11

Sudden Ionospheric Disturbance Report

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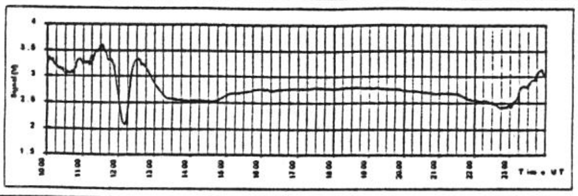

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Sudden Ionospheric Disturbances (SID) Recorded During February 1999

(correlation analysis performed by Joseph Lawrence, SID Analyst)

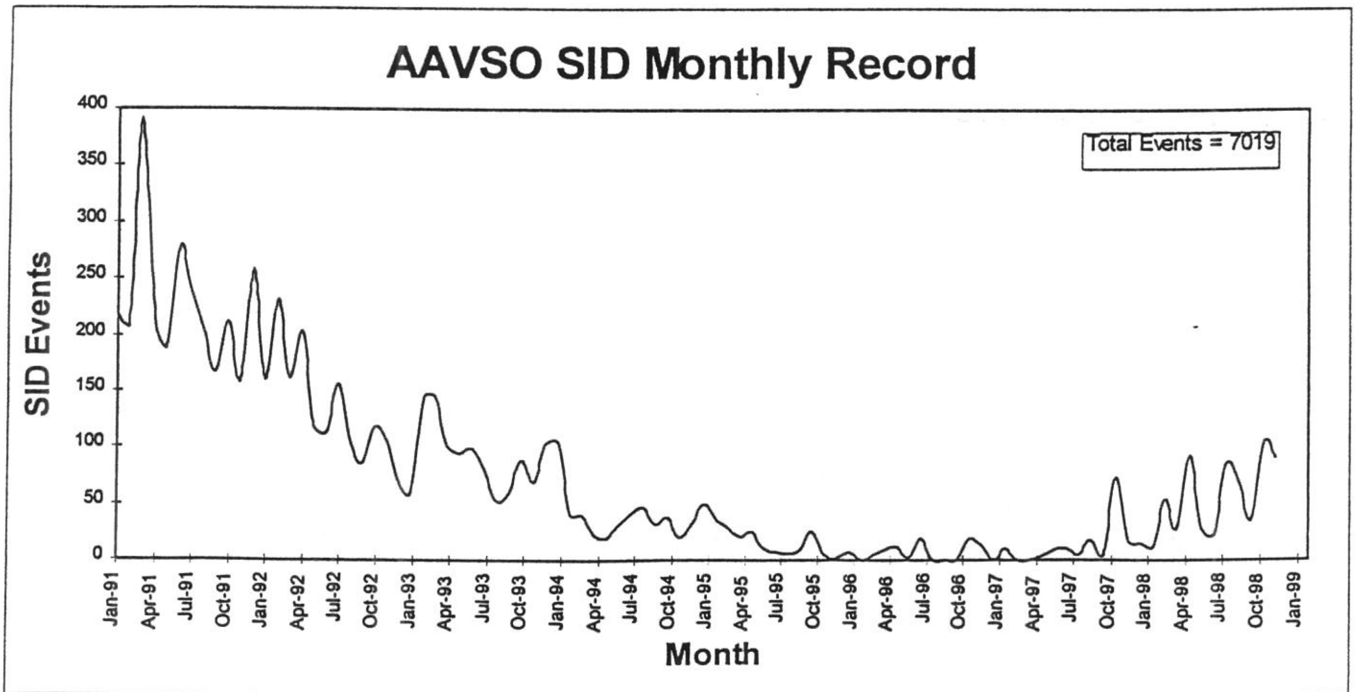
Date	Max	Imp	Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
990201	0841	2	990213	0727	2	990216	0016	1+	990221	0948	2+
990204	0640	2	990213	1215	2	990216	0410	1+	990221	1330	2+
990208	0850	2	990213	1528	1-	990216	1740	2+	990221	2235	1
990208	1615	1-	990213	1615	2+	990216	1934	2	990222	1300	3
990209	0505	1+	990214	0657	1	990216	2124	2	990225	1025	1-
990210	0916	1+	990214	0935	1	990217	2031	2	990225	1046	1-
990212	0720	1	990214	1042	2+	990218	1015	1	990225	1756	1
990212	0823	2	990214	1425	1+	990218	1235	1	990227	0857	1
990212	0955	1+	990215	0927	1+	990218	1718	1-	990228	1641	2+
990212	1050	1-	990215	1641	2	990219	1625	1	990228	1930	1+
990212	1355	2	990215	1839	1	990220	0407	2	990228	2140	1+
990212	1535	1+	990215	1907	1	990220	1522	1+			

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

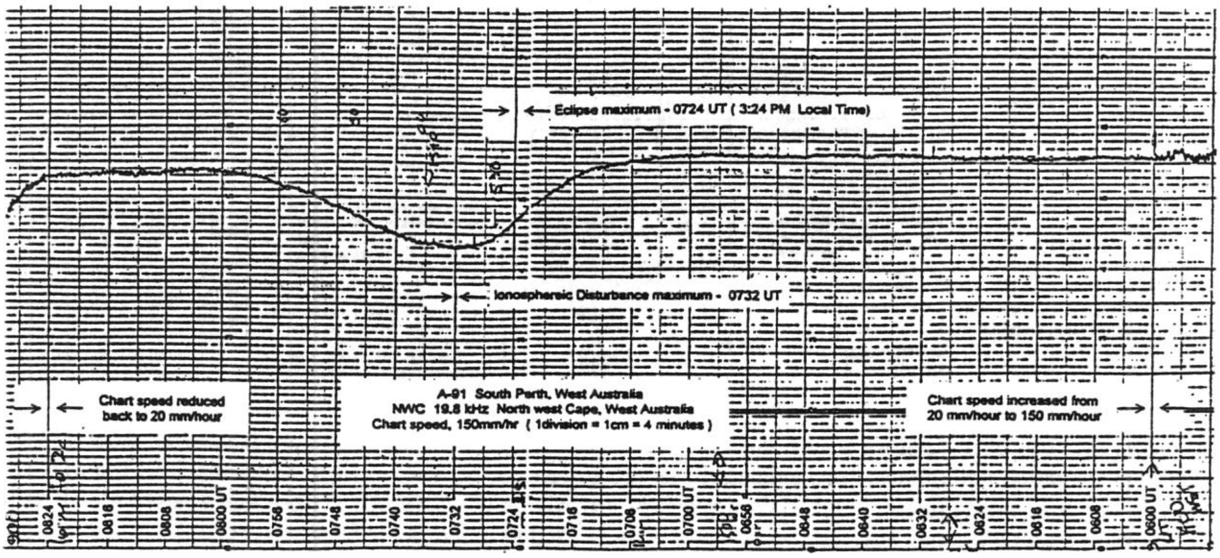
Observer	Code	Station(s) Monitored
Parker, N	A-40	NAA
Winkler, J	A-50	NAA, NPM
Overbeek, D	A-52	NAA, NSW, NPM
Toldo, D	A-52	NAA, NSW, NPM
Stokes, A	A-62	NAA
Witkowski, L	A-72	NAA
King, P	A-80	FTA
Lawrence, J	A-82	NAA
Moos, W	A-84	FTA, GBZ, ICV
Mandaville, J	A-90	NAA, NPM
Anderson, L	A-91	NWC

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



Sudden Ionosphere Disturbances Recorded during February

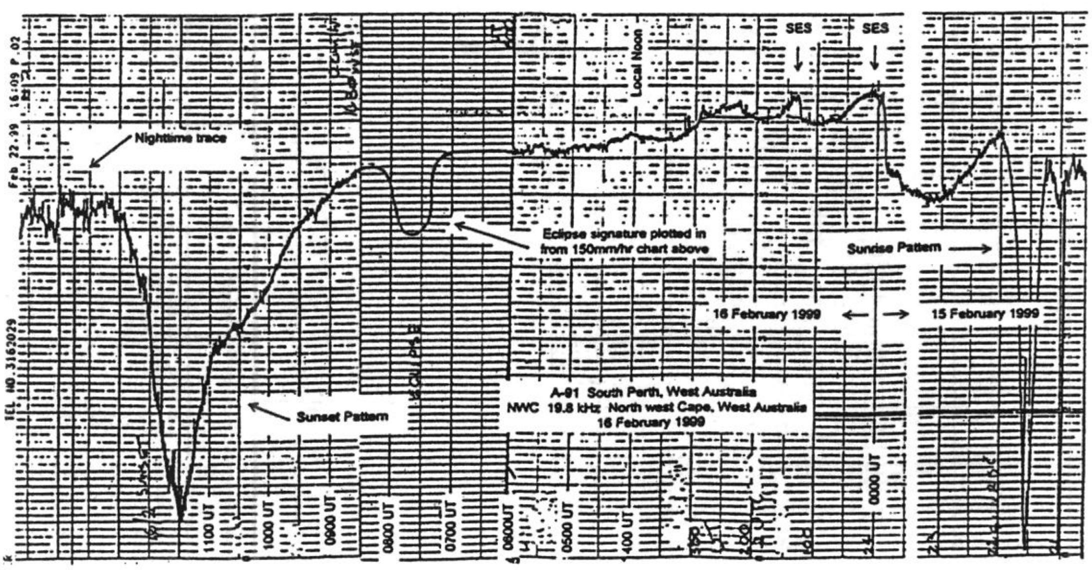
Prepared by
Casper H. Hossfield



The solar eclipse of 16 February has been recorded above as a disturbance in the Earth's ionosphere. The path of this eclipse across Australia is shown in the map on the next page. The eclipse was annular and visible only in Australia. Len Anderson, A-91, lives in South Perth on the west coast of Australia near the centerline of the eclipse, an ideal spot to record its effect on the ionosphere. Len normally monitors the ionosphere to detect Solar flares but made special preparations to record the eclipse. He speeded up his strip chart recorder to show more detail during the eclipse. Normally it runs at 20 millimeters per hour but starting at 0600 Universal time he increased the speed over seven times to 150 millimeters per hour to catch the eclipse and make the chart above. After the eclipse the recording reverts to its normal 20 mm / hr speed at 0824 UT

The eclipse's signature was made by recording the signal strength of very-low-frequency radio station, NWC, 1000 kilometers northwest along the coast of West Australia. NWC's powerful 1-megawatt VLF transmitter is a communication link to submerged submarines. The 1000-mile radio propagation path between South Perth and the transmitter at Northwest Cape is maintained by the Sun during daylight and any disturbance of sunlight such as an eclipse or a solar flare is easily recorded on Len's strip-chart recorder.

The chart below shows the speeded-up eclipse recording plotted into the day - long recording to show how it would have looked if it had not been speeded up. This chart, which covers the whole day, also shows two solar flares recorded as "Sudden Enhancements of the Signal", SES. Arrows point to two SESs in the morning hours of the chart to the right of the afternoon eclipse. The signal is enhanced to produce the sudden rise in the trace, the SESs, by x-rays from the flare that increase the ionization in the lower D-layer of the ionosphere. The increased ionization provides a better propagation path that propagates a stronger NWC signal from Northwest Cape to South Perth. The stronger signal produces the SES. The normal daytime D-layer ionization is provided by the Sun's far-ultraviolet radiation. The less energetic near-ultraviolet cannot ionize the thin upper atmosphere so it passes right through the D-layer and dissipates its energy by converting oxygen into ozone in the ozone layer just below the D-layer. The even-less-energetic ultraviolet and visible part of the spectrum passes through the Ozone layer to reach the Earth's surface and is the sunlight that is the chief source of energy for all life on Earth.

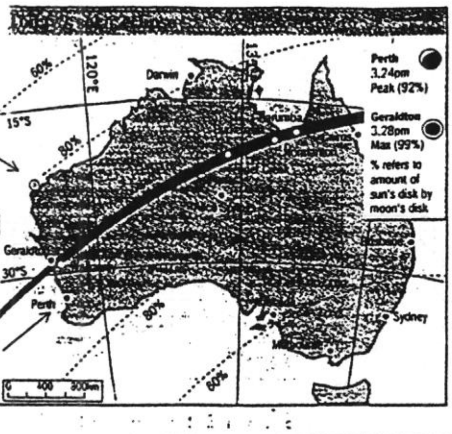


Map from the "WEST AUSTRALIAN"
16 February 1999

NWC Transmitter,19.8 kHz
Northwest Cape, Australia

VLF monitor station, A-91
South Perth, Australia

Lights to dim as solar eclipse dawns



■ By Carmelo Amalfi

THE lights will dim in WA this afternoon when the Moon shuts out the Sun's light in an eclipse visible only in Australia.

But people, particularly schoolchildren who will be heading home during the solar crossing from about 2pm to 4pm, are urged not to look up when the sky begins to darken.

Prolonged viewing can cause serious eye damage, so the safest way to watch the eclipse is by projecting it on to a screen or by using special glasses.

The best spot to watch the eclipse will be from inside the 30km-wide path of annularity — the path along which the eclipse appears as a bright ring when the Moon appears to sit inside the Sun's disc without covering it completely.

The annular phase will be visible along a line that extends from Greenough and Cue in WA to Tennant Creek in the Northern Territory and 100km north of Cairns in Queensland.

Between Greenough and Dongara, 99 per cent of the Sun's disc will be covered by the Moon. In Perth, maximum eclipse will be at 3.24pm.

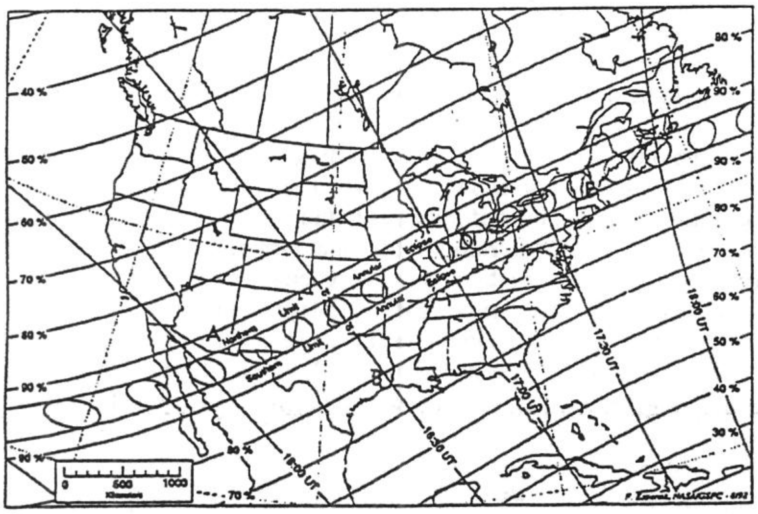
Primary school students at Walkaway, which sits at the centre of the eclipse path, will be allowed to view the event when they leave school at 3.05pm.

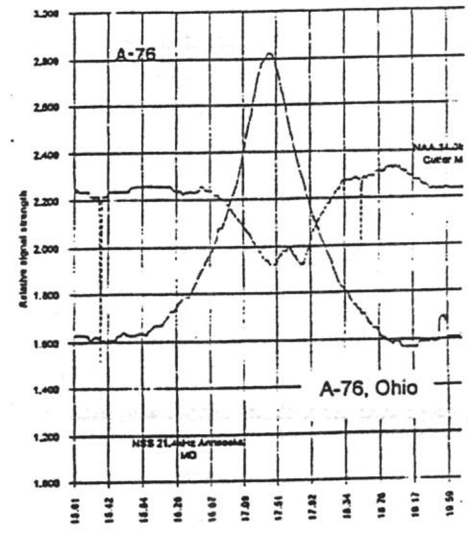
Walkaway Primary School principal Peter Bright said the school had promoted the event in science lessons that emphasised health and safety aspects.

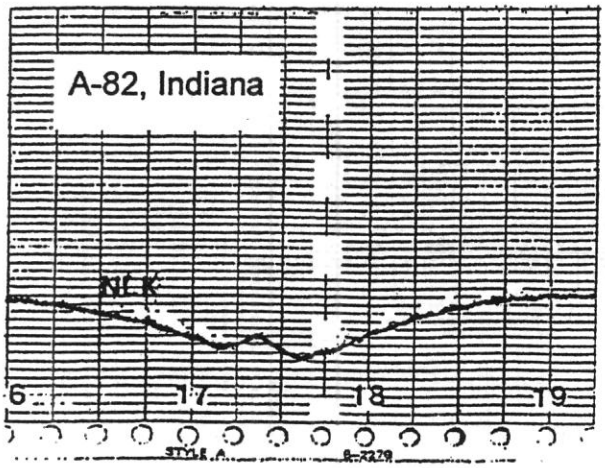
"We've decided that the best policy is not to be part of it," he said. "There would just be too many students around to risk holding viewing sessions."

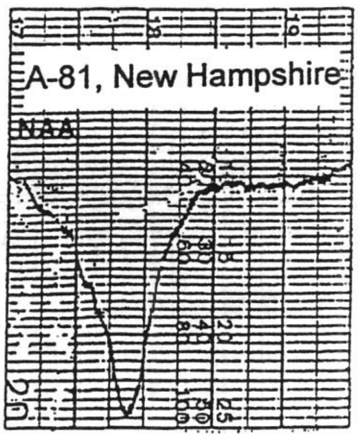
▶ Internet eclipse sites, page 38

The map above shows the path of the eclipse across Australia. Northwest Cape and South Perth are labeled to show how the Moon's shadow crossed the propagation path almost perpendicularly so the difference between eclipse maximum and the maximum of the propagation anomaly are only eight minutes apart. Below are three recordings of an annular eclipse that crossed the United States on 10 May 1994. They were made the same way. SES receivers normally used to detect solar flares recorded the eclipse anomalies. The chart marked Indiana was made by Solar Division Chairman, Joseph Lawrence, A-82. It shows an inversion at the bottom of the anomaly. The Ohio chart was made by Diane Lucas, A-76. She recorded two signals, NAA and NSS, on a computer. Her recording of NAA shows the same inversion at the bottom of the NAA trace. Her recording of NSS is completely inverted. These increases of the signal strength when it seems like the eclipse should cause it to decrease can be explained as phase anomalies, an interference effect between the ground wave and sky wave radiated by the VLF antenna. The same thing accounts for inversions in the SES recordings published recently in the Solar Bulletin. The New Hampshire chart was made by Meddy Landry, A-81. It is a normal recording without inversions like A-91's eclipse recording of NWC during the recent Australian eclipse







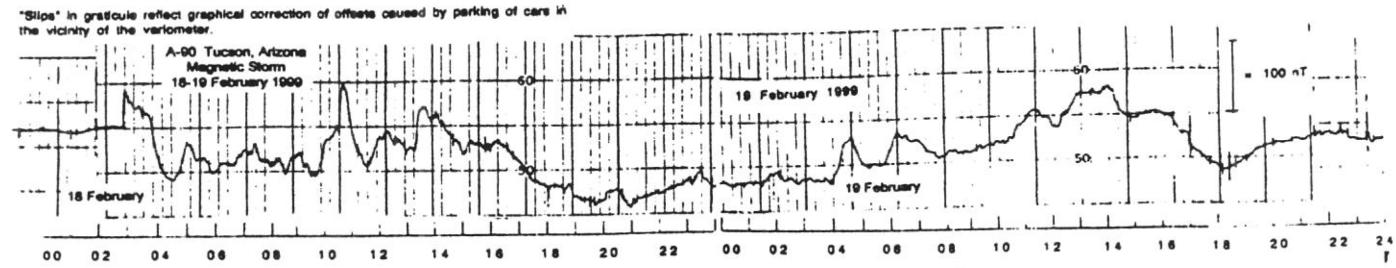


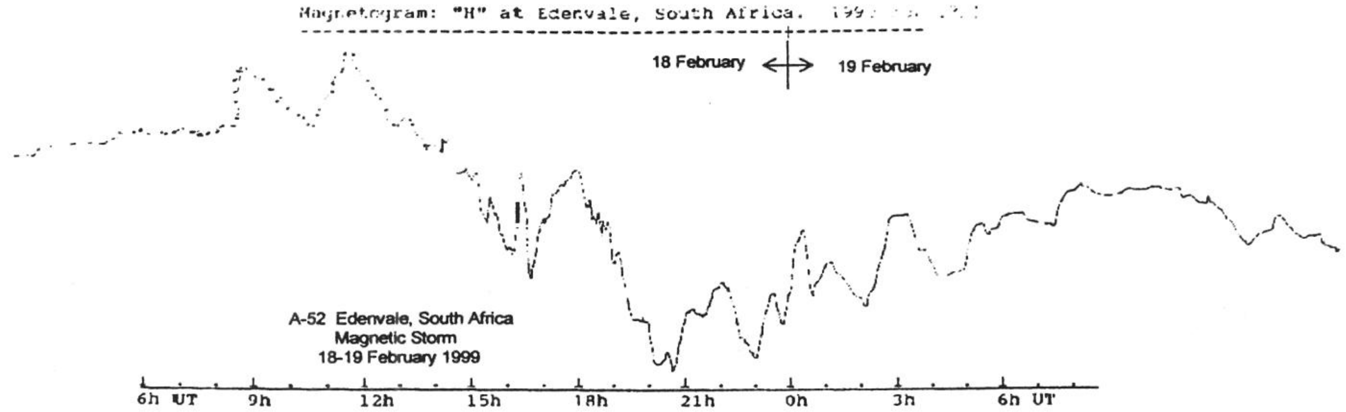
Horizontal component (H) at Oro Valley, Arizona (geographic 32° 23.4'N, 110° 56.8'W; magnetic latitude 40° N), 18-20 February 1999 Torsion variometer; observer J Mandeville Time scale in hours UTC.

Event begins at approx. 0248 UTC, 18 Feb. 99, with a sharp sudden commencement spike of 50 nT.

Original vertical scale 1 mm = 5 nT. Calibration checked 21 Feb 99.

"Slips" in graticule reflect graphical correction of offsets caused by parking of cars in the vicinity of the variometer.





A major magnetic storm started with a sudden commencement at 0248 UT on 18 February and lasted through 19 February. Jim Mandaville, A-91, measured the sudden commencement at 50 nanoTeslas. Danie Overbeek, A-52, also recorded the storm in South Africa. There is considerable similarity between the traces despite the great distance between these stations and their difference in latitude. Both recordings were made with McWilliams magnetometers. A complete description of Jim's magnetometer appeared in the September 1998 Bulletin. There are detailed drawings and a schematic for the sensor electronics, everything you need to know to build one. If you are interested I can supply a copy of this article. Contact me at <casper@carroll.com>. If you have built the magnetometer Jim can help with any questions. Contact him at <zygo@azstarnet.com>. I can supply a kit to build the magnetometer. Despite its simplicity and ease of construction the McWilliams magnetometer makes excellent recordings of magnetic storms as can be seen above. The Boulder USGS magnetometer recorded the sudden commencement at 43 nT so Jim's magnetometer produced a quantitatively comparable result.

The magnetometer trace can be recorded on a computer using Solar Division Chairman, Joseph Lawrence's A/D converter kit and his LOGGER software which is free. The LOGGER data can be plotted in Excel and sent to me as a Word Doc ready for publication in the Solar Bulletin. LOGGER has four channels so you can record your SID receiver on it too and send charts the same way. It will run on a dedicated computer as old as a 386 PC.

CHH