Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

Joseph D. Lawrence, Editor
1808 N. Anthony Blvd.
Fort Wayne, IN 46805 USA

email: lawrence@ipfw.edu
phone: 219.422.0230
ISSN 0271-8480

Volume 55 Number 8

August 1999

Daily Mean Sunspot Numbers, R_a for August 1999

(computational analysis performed by Joseph Lawrence)

simple average k-corrected

Day	R_a avg	Std. Dev.		R_a k	Std. Dev.
1	182	6.8		164	5.1
2	199	7.3		175	5.8
3	172	7.2		151	6.1
4	158	5.5		136	4.5
5	147	7.1		126	5.5
6	119	4.8		103	3.7
7	111	5.3		103	4.3
8	111	5.8		98	4.4
9	85	5.2		74	4.3
10	69	3.7		55	2.9
11	71	4.1		62	3.3
12	70	4.5		65	3.1
13	75	5.6		68	4.7
14	71	3.6		63	3.1
15	62	3.4		54	2.6
16	53	2.0		47	1.5
17	36	2.3		31	1.9
18	43	2.1		38	1.1
19	56	4.1		45	2.8
20	65	3.0		55	2.5
21	75	4.1		63	3.2
22	87	4.2		73	3.2
23	93	4.4		85	3.8
24	112	7.5		106	6.4
25	148	7.9		138	6.1
26	170	9.0		149	8.1
27	150	7.5		126	6.6
28	187	10.8		171	9.4
29	175	8.1		161	7.4
30	151	7.5		131	6.5
31	133	5.8		118	5.0

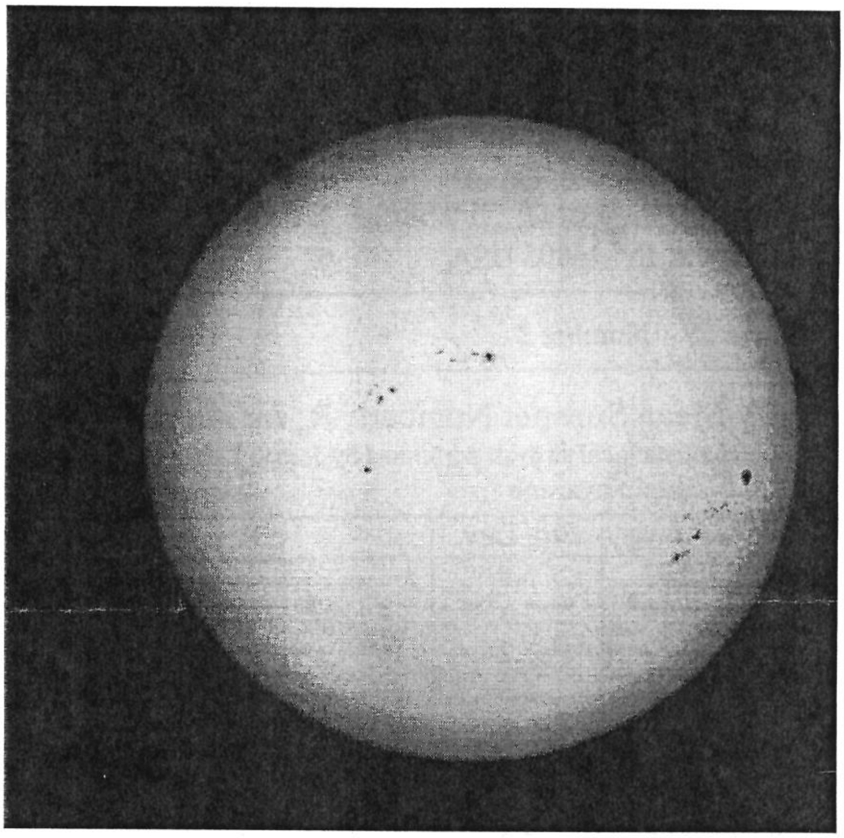
Monthly Mean R_a avg = 110.8
Monthly Mean R_a k = 98.0

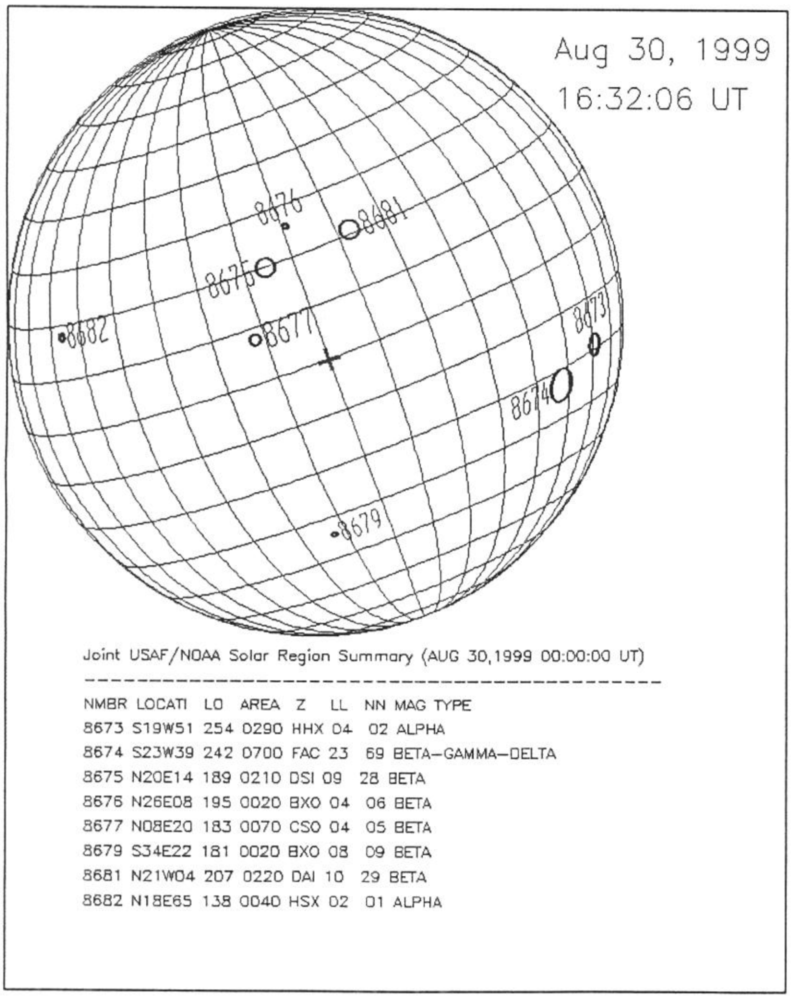
Observer	Code	Country	Days Obs.
Abbott, P	AAP	Canada	10
Anderson, E	ANDE	USA, NY	5
Attanasio, A	ATON	Italy	2
Barnes, H	BARH	New Zealand	17
Barton, W	BARW	England	5
Battaiola, R	BATR	Italy	6
Berg, R	BEB	USA, IN	19
Berdejo, J	BERJ	Spain	16
Blackwell, J	BLAJ	USA, NH	7
Boschat, M	BMF	Canada	22
Branchett, B	BRAB	USA, FL	8
Branch, R	BRAR	USA, CA	31
Carlson, J	CARJ	USA, MA	18
Morales, G	CHAG	Bolivia	26
Cudnik, B	CKB	USA, TX	18
Collins, B	COLB	USA, OH	15
Compton, T	COMT	USA, MI	18
Conlin, G	CONG	USA, WA	12
Cragg, T	CR	Australia	26
Dempsey, F	DEMF	Canada	16
Dubois, F	DUBF	Belgium	30
Reed, E	ELR	USA, TX	30
Feehrer, C	FEEC	USA. MA	25
Ruiz, J	FERJ	Spain	18
Gallo, M	GALM	Argentina	4
Giovanoni, R	GIOR	USA. MD	28
Gottschalk, S	GOTS	USA, IA	15
Hrutkay, T	HRUT	USA, PA	8
Ibanez, J	IBAJ	Spain	4
Imperi, R	IMPR	USA, OH	5
Iskum, J	ISKJ	Hungary	15
Janssens, J	JANJ	USA, TX	2
Jenkins, J	JENJ	USA, IL	14
Jenner, S	JENS	England	5
Kaplan, J	KAPJ	USA, MN	28
Lawrence, J	LAWJ	USA, IN	11
Lerman, M	LERM	Canada	15
Leventhal, M	LEVM	Australia	25
Lubbers, T	LUBT	USA, MN	9
Lohvinenko, T	LWT	Canada	9
Malde, K	MALK	Norway	26
Mariani, E	MARE	Italy	13
Jarboles, J	MARJ	Spain	29
Mochizuki, E	MCE	Japan	24
McHenry, L	MCHL	USA, PA	2
Miller, J	MILJ	USA, MD	5
Moeller, M	MMI	Germany	15
Mudry, G	MUDG	Canada	9
Nylander, H	NYLH	Finland	22
Prestage, N	OBSO	Australia	18
Randall, T	RANT	USA,NY	1
Richardson, E	RICE	England	20
Ritchie, A	RITA	USA, MA	26
Ramsey, J	RMAJ	USA, AR	2
Ramsey, S	RMAS	USA, AR	2
Schott, G	SCGL	Germany	23
Simpson, C	SIMC	USA, OH	12
Gordon-States, B	STAB	England	31
Stemmler, G	STEM	Germany	28
Stoikidis, N	STQ	Greece	29
Teske, D	TESD	USA, MS	29
Thompson, R	THR	Canada	11
Vargas, G	VARG	Bolivia	22
Vardaxoglou, P	VARP	Greece	11
Whitehouse, M	WHIM	USA, MS	5
Wilson, W	WILW	USA, TN	18
Witkowski, L	WITL	USA, FL	24
Watts, K	WKW	USA, CA	3
Wydra, K	WYDK	Poland	14
Yesilyaprak, H	YESH	Turkey	29

Determination of Sunspot Group Number; Practical Guidelines Part I

At least one respected sunspot observer has claimed, "the counting of groups of sunspots is more of an art than a science."[1] Even an art can be mastered with practice and training. This past month presented a variety of sunspot groups which challenged even more experienced observers in properly determining the daily group number. The larger than normal standard deviation in daily Wolf numbers is directly attributed to errors in determining the appropriate group number. In one particularly notable example, two observers using the same telescope at the same location made separate observations within minutes of each other. One estimated 12 groups and the other estimated 19 groups! By comparison, official observers at an USAF observatory recorded only 8 groups for the same day. Discrepancies this large can only be ascribed to a lack of understanding of sunspot group structures and evolution.

To address the problem of inaccurate sunspot group determination, several experienced observers were tasked by former Solar Division Chairperson Betty Stephenson to develop operational guidelines for identifying sunspot groups. Their final report offers suggestions for improving observation technique and practical rule of thumb guides for determining the separation of spots into groups.





```
Joint USAF/NOAA Solar Region Summary (AUG 30,1999 00:00:00 UT)
-------------------------------------------------------
NMBR LOCATI  LO  AREA  Z   LL  NN MAG TYPE
8673 S19W51 254 0290 HHX 04  02 ALPHA
8674 S23W39 242 0700 FAC 23  69 BETA-GAMMA-DELTA
8675 N20E14 189 0210 DSI 09  28 BETA
8676 N26E08 195 0020 BXO 04  06 BETA
8677 N08E20 183 0070 CSO 04  05 BETA
8679 S34E22 181 0020 BXO 08  09 BETA
8681 N21W04 207 0220 DAI 10  29 BETA
8682 N18E65 138 0040 HSX 02  01 ALPHA
```

Images used here from Mees Solar Observatory, University of Hawaii, are produced with the support of NASA grant NAG 5-4941 and NASA contract NAS8-40801

Improving Technique

The key to counting sunspot groups is proficiency in recognizing the established classes of groups. Since the AAVSO Sunspot program is sponsored by and provides results to NOAA, all AAVSO solar observers should adopt and become familiar with the McIntosh group classification[2] scheme presently used by NOAA. With very few exceptions, if a cluster of spots doesn't fit one of the established McIntosh group categories, then it probably isn't a single group and the observer should reconsider his classification of the cluster. References given below describe the McIntosh classification scheme and more details will be provided in Part II of this article next month.

The McIntosh classification identifies clusters of spots by a three character code. Each character identifies a sub-classification of the spot cluster. The first letter of the code describes the structure of the cluster and is determined by the size of the cluster in heliographic degrees and the presence of penumbrae among the spots. The second letter describes the penumbra of the largest spot in the cluster. The third letter in the code describes the compactness of interior spots in the cluster.

Understanding the evolution of a cluster of spots will improve the determination of group count. Plotting the spot clusters on a properly oriented solar disk provides a daily history of the cluster's evolution. A simple software utility program called SPOTPLOT is available from the AAVSO Solar Division URL http://www.aavso.org/solar. This program generates correctly oriented Stonyhurst disks for any day of the year. This will allow the observer to determine spot cluster positions more accurately while at the telescope. When weather and other priorities preclude daily observations, the loss of continuity compromises the observer's ability to distinguish groups from evolutionary clues. Observers who only look at the sun 2 or 3 times per month provide less accurate results because they develop experience more slowly and they cannot make use of evolutionary clues to properly count groups. When long gaps occur between observations, it is recommended that observers make use of internet resources to stay aware of sunspot evolution. Solar images and diagrams are provided by many research institutions on frequently updated webpages. The images accompanying this article were downloaded from the http://www.solar.ifa.hawaii.edu/mees.html Mees Solar Observatory site. Observers are cautioned to never use internet resources to bias an observation and it is not appropriate to make an observation and later change the results due to information gathered from the internet. Use the internet solar images as an education tool to practice sunspot group classification, but never allow these images to influence your independent daily observation.

The patience and diligence of the observer also will affect his group count. The early stages of a developing spot cluster may go unnoticed if the observer only makes a quick sweep over the solar disk. It is recommended that an observation include at least three careful scans of the solar disk using progressively higher magnification. A full disk scan at about 40 – 50x will give an overall perspective of the position of larger sunspot clusters. These clusters can be roughed into a sketch on the Stonyhurst template. A second sweep about 60 –70x will reveal more penumbral detail. A final section by section examination at 80 – 100x will allow determination of individual spots in each cluster. In direct observation, patiently waiting for the moments of best seeing before moving to the next field is preferred over a continuous scan. Jiggling the telescope slightly (sometimes an unavoidable asset) will help discern faint spots. Even a faint isolated spot constitutes a single group and so missing that spot will produce an error of 11 in the Wolf number.

The recommendations for improving group counting technique can be summarized as:

1) Learn the McIntosh sunspot classification system. Identify sunspot clusters that fit one of the established group categories.

2) Observe frequently enough to stay acquainted with current sunspot cluster evolution. Sketch your observation on a Stonyhurst disk to maintain a personal record. If you must miss a few days, then compensate by reviewing solar images online. Never let the internet images influence your at-the-telescope observation.

3) Use patience and close scrutiny to search for faint sunspot clusters. Scan the disk more than once at different magnifications to see the overall pattern of spot clusters on the disk, define penumbral features in the clusters, and discern the faintest spots.

In Part II of this article, the McIntosh sunspot classification scheme will be examined and operational guidelines for identifying groups based on evolutionary clues will be offered.

The editor wishes to thank the team of solar observers who pooled their years of experience and collaborated to develop the guidelines presented in this series of articles. Many thanks to:

Jim Carlson (USA)
Thomas Cragg (Australia)
Gontran Eleizalde (Venezuela)
Brian Halls (England)
Casper Hossfield (USA)
Michel Lerman (Canada)
George Mudry (Canada)
Ray Thompson (Canada)

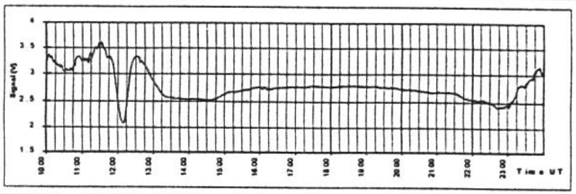
Reference:

1. Hill, R., editor. *The New Observe and Understand the Sun*, Astronomical League, 1990.

2. McIntosh, P., [1984], "Flare Forecasting Based on Sunspot Classification" in *Solar-Terrestrial Predictions: Proceedings of a Workshop at Meudon, France, June 18-22 1984*. Published by NOAA and the Air Force Geophysics Laboratory.

Sudden Ionospheric Disturbance Report

Casper Hossfield, SID Coordinator
PO Box 23
New Milford, NY 10959 USA
capaavso@aol.com
FAX 201.327.5246



Joseph Lawrence, SID Analyst
1808 N. Anthony Blvd.
Fort Wayne, IN 46805 USA
lawrence@ipfw.edu
FAX 219.451.6033

Sudden Ionospheric Disturbances (SID) Recorded During August 1999

(correlation analysis performed by Joseph Lawrence, SID Analyst)

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
990801	0645	2+	990805	1944	2	990814	1330	1	990824	0610	2+
990801	0835	1+	990805	2222	1	990814	1526	1	990824	1552	2
990801	0906	1	990805	2244	2+	990814	1549	1+	990824	1715	3
990801	1256	2	990805	2335	1+	990814	1940	2+	990825	0139	2+
990801	1539	1+	990806	0720	2	990816	2027	2	990825	1330	3+
990801	1620	2	990806	1005	2+	990817	1530	3	990825	1450	2+
990801	1746	2+	990806	1245	1	990818	0646	3	990826	0700	2+
990801	1829	1	990806	1418	2+	990818	1045	3+	990826	1450	1+
990801	2317	2	990806	1635	2+	990819	1205	2	990826	1712	2
990802	0015	1-	990806	1837	3	990819	1558	1+	990826	2125	2+
990802	0029	2+	990807	1547	2+	990820	0723	2+	990827	0135	2+
990802	0900	1-	990807	1912	3	990820	1315	3+	990827	0515	2
990802	0949	1	990807	2049	3	990820	1410	2	990827	0632	1
990802	1155	1-	990808	0652	2+	990820	1830	2+	990827	0905	2
990802	1420	1+	990808	0745	1-	990820	1926	2+	990827	1300	2+
990802	2125	3	990808	1040	2+	990820	2102	2	990827	1636	2+
990803	0440	1-	990808	2121	2+	990820	2307	2	990827	1718	2+
990803	0502	1+	990809	1430	2+	990821	1105	1+	990828	0100	2+
990803	0721	1	990809	1840	3+	990821	1513	2	990828	1505	1+
990803	1142	2	990809	2337	2	990821	1635	2+	990828	1759	2+
990803	1224	1+	990810	0605	2	990821	2215	2+	990828	2216	2
990803	1746	2	990810	0748	1+	990821	2326	1+	990829	0638	2
990803	1857	1	990810	0957	1	990822	1414	2	990829	1646	1
990803	1954	2+	990810	1229	1+	990822	1510	1-	990829	1731	2+
990804	0552	2+	990810	1625	1+	990822	1551	2	990829	1926	1-
990804	0856	1	990812	1040	1+	990822	1805	1+	990830	0119	1
990804	1201	1	990813	0753	1+	990822	2146	2	990830	1730	1+
990804	1606	2+	990813	1512	2	990823	1650	3	990830	1801	2+
990804	1826	3	990813	1600	2	990823	1809	2	990831	0038	2+
990805	1442	2+	990813	1704	1	990823	2028	2	990831	0550	2+
990805	1627	3	990813	1941	2+	990823	2114	1	990831	1300	1
990805	1852	2	990814	1210	2+	990823	2317	2+	990831	1730	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

Observer	Code	Station(s) Monitored
Del Vecchio, P	A-03	NAA
Hossfield, C	A-05	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
Landry, A	A-81	NAA
Panzer, A	A-83	NAA
Moos, W	A-84	FTA, GBZ, ICV
Hill, M	A-87	NAA
Mandaville, J	A-90	NAA, NPM

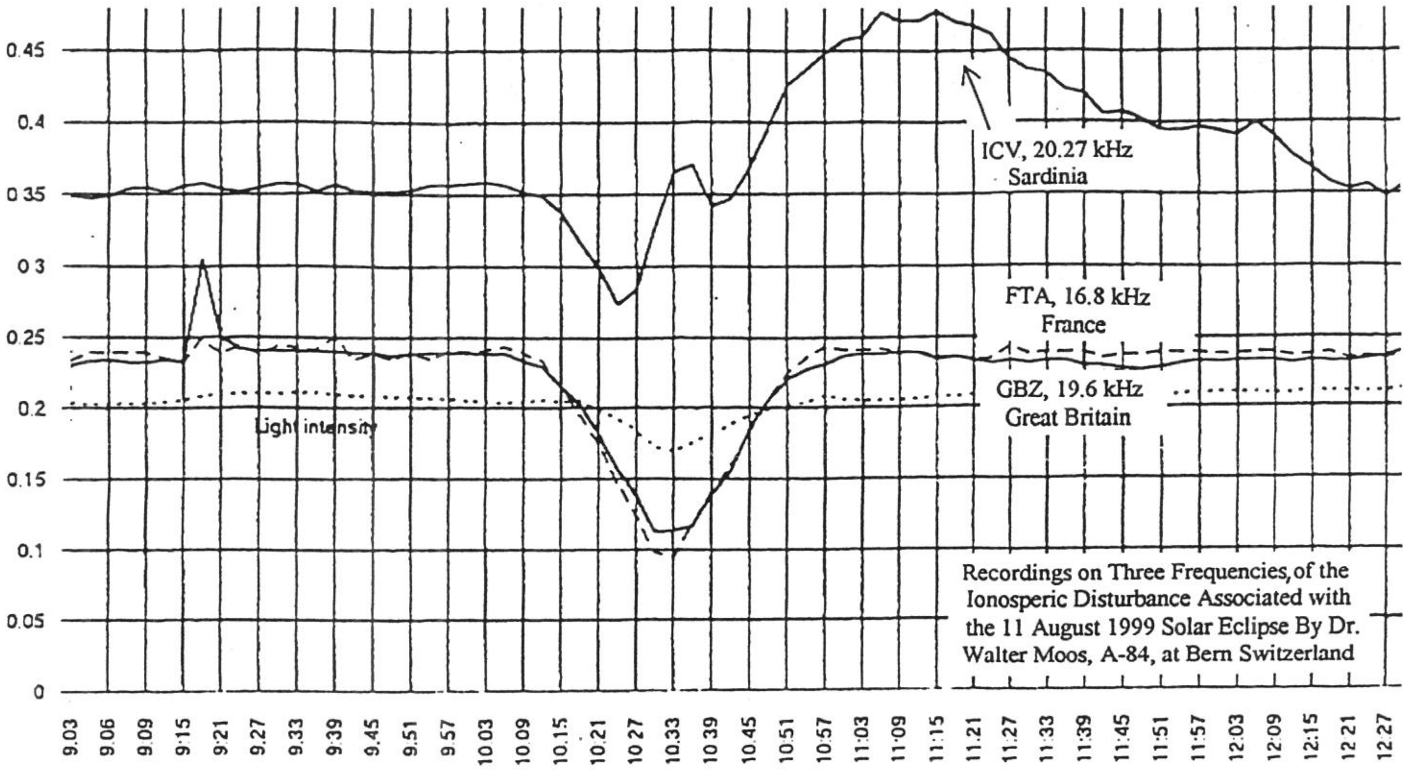
Importance	Duration (min)
1-	< 19
1	19 - 25
1+	26 - 32
2	33 - 45
2+	46 - 85
3	86 - 125
3+	> 125

Editor's Note: It is a great pleasure to receive a monthly SID report from Phil Del Vecchio (A-03), one of the original SID program members from 1958. Cap Hossfield (A-05) visited Phil and helped him get a gyrator II on the air in Pennsylvania.

Sudden Ionospheric Disturbances Recorded During August

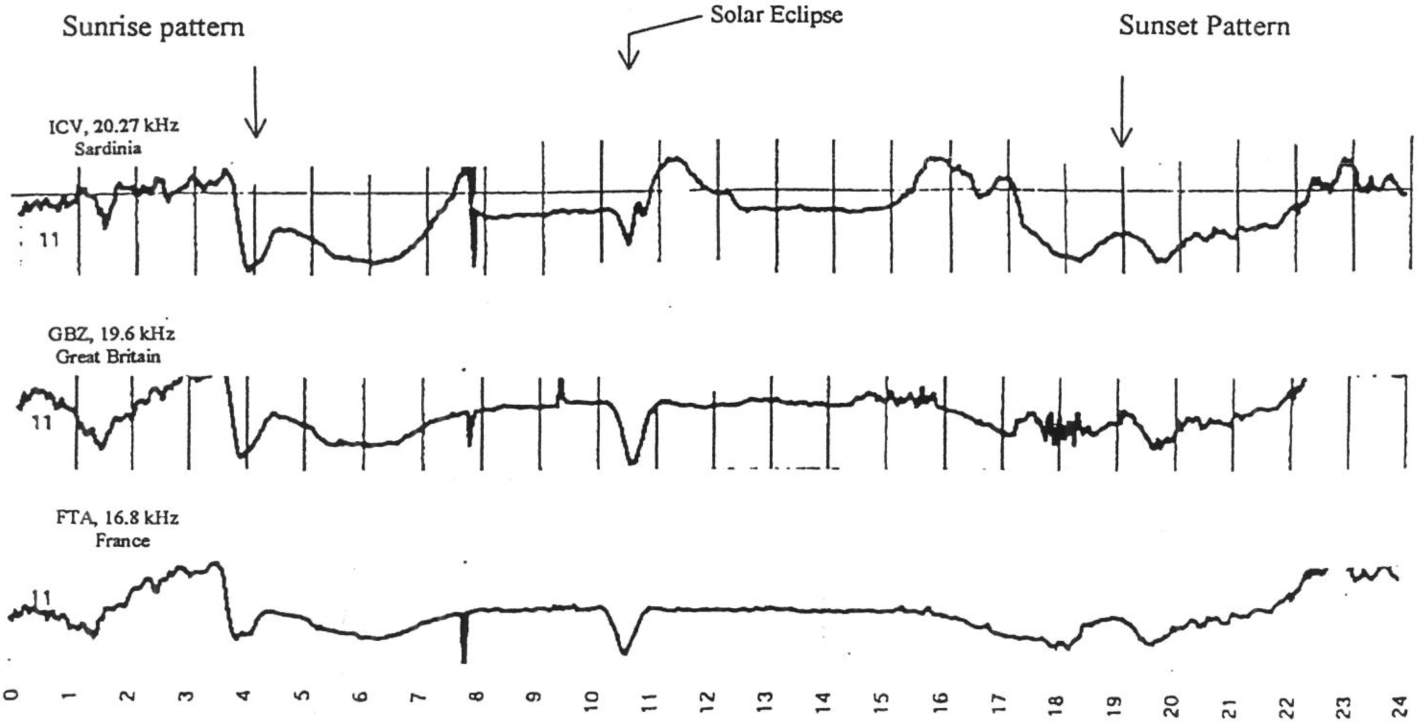
Prepared by

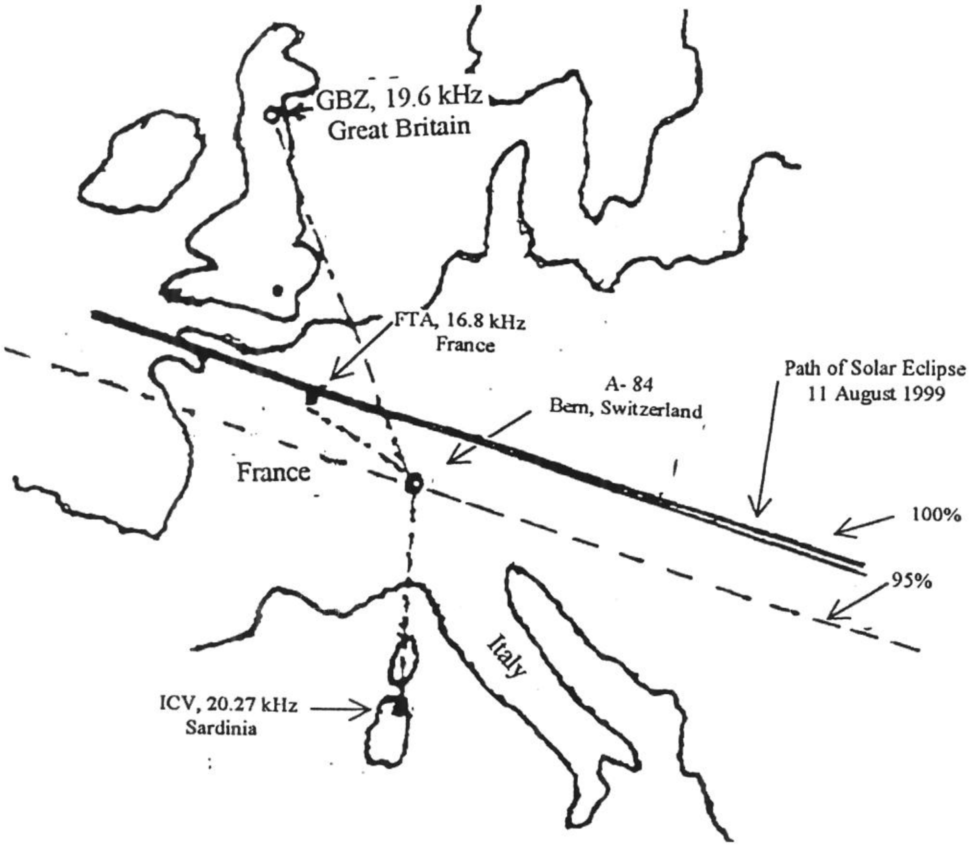
Casper H. Hossfield



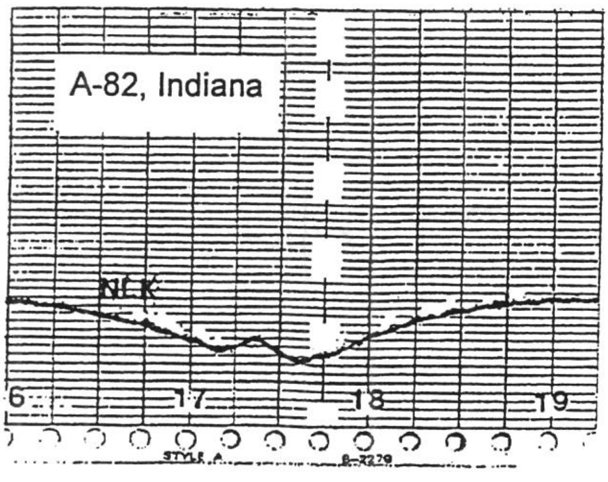
Recordings on Three Frequencies, of the Ionosperic Disturbance Associated with the 11 August 1999 Solar Eclipse By Dr. Walter Moos, A-84, at Bern Switzerland

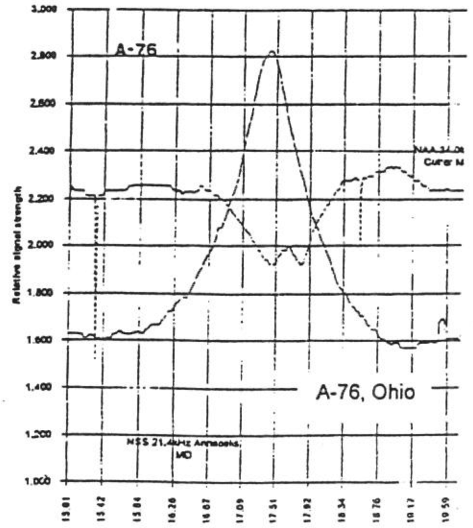
Dr. Walter Moos, A-84, in Switzerland made the excellent recording above of the 11 August 1999 solar eclipse. It records the signal strength of three very low frequency, VLF, radio transmitters in France, Sardinia and Great Britain. VLF signals are propagated by the D-layer of the ionosphere that is kept ionized by far ultraviolet light from the sun so it is not surprising that an eclipse of the sun would diminish the ionization in the D-layer and therefore weaken the signals from VLF radio stations and this is exactly what the above chart shows. The charts below shows the same eclipse signature on individual 24-hour recordings of the three VLF radio stations. The signals from GBZ and FTA show the normal drop in signal strength that is expected but ICV shows a complicated signature that is further explained on the next page where there is also a map that shows the propagation paths of the signals from the three transmitters.

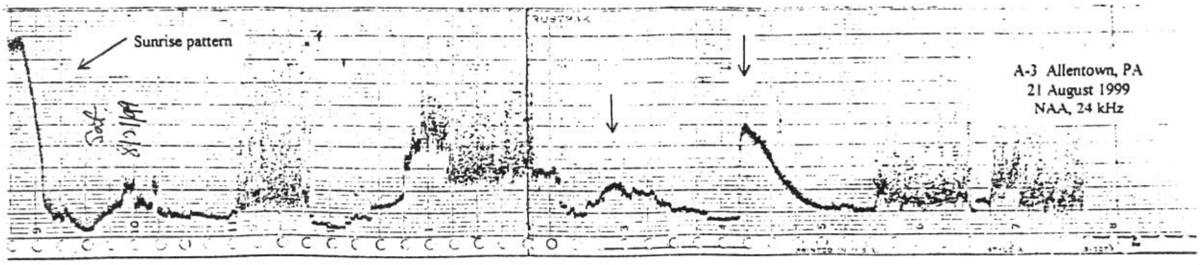


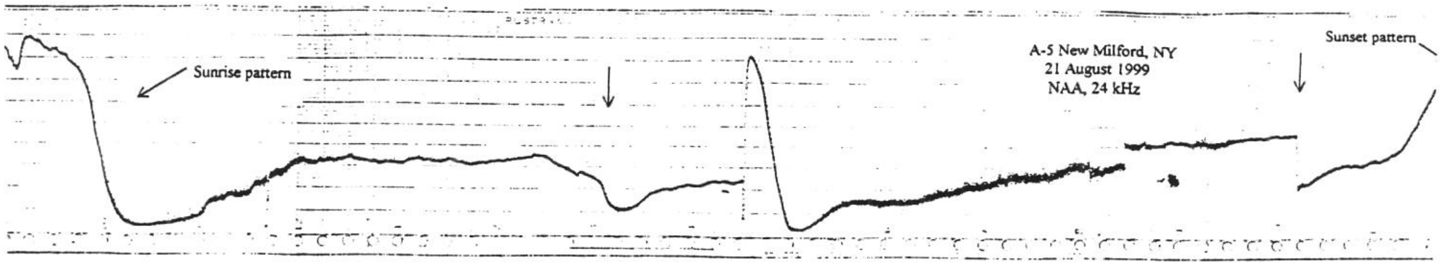


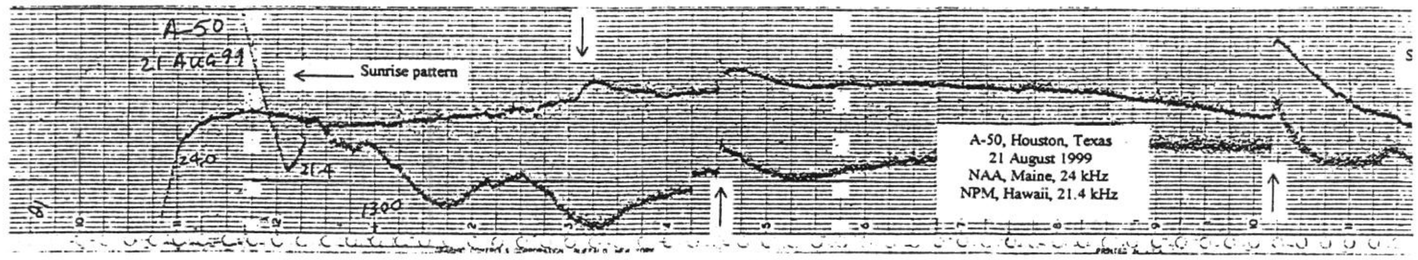
The signature of ICV in Sardinia looks more complicated than the signatures of FTA and GBZ because it is partly inverted. Inversions like this are not rare. Below are recordings of the 10 May 1994 annular eclipse that show similar inversions. The recording made by Solar Division Chairman Joseph Lawrence, A-82, shows an inversion in the shallow signature of NLK in Jim Creek, Washington. The signature is shallow because the NLK propagation path was far from the eclipse path. Dianne Lucas, A-76, made the multiplexed recording of NSS in Annapolis, Maryland and NAA in Cutler, Maine. The propagation path to Maine was closer to the eclipse path so the NAA signature is much deeper than Lawrence's NLK signature but it has a very similar inversion at the bottom of the curve. Both of these curves are symmetrical whereas Dr. Moos's ICV curve is distorted with the curve rising higher after the eclipse than it was before the eclipse began. Some AAVSO observers of SIDs belong to the Longwave Club of America and receive their monthly publication, The Lowdown, which often has interesting articles about the VLF frequencies below 100 kHz. The current issue (September) has a recording of HBG in Germany that was made by Peter Schnoor to record the effect of the eclipse on ionospheric propagation. His eclipse signature of the 75 kHz HBG signal has a distorted inversion that is very similar to Walter's signature of ICV in Sardinia. The inversions are thought to be an interference pattern between two components of the transmitted VLF radio wave. It is not unusual to find them in the recordings of sudden ionosperic disturbances due to Solar flares. Typical inversions can be seen in the 21 August chart on the next page.



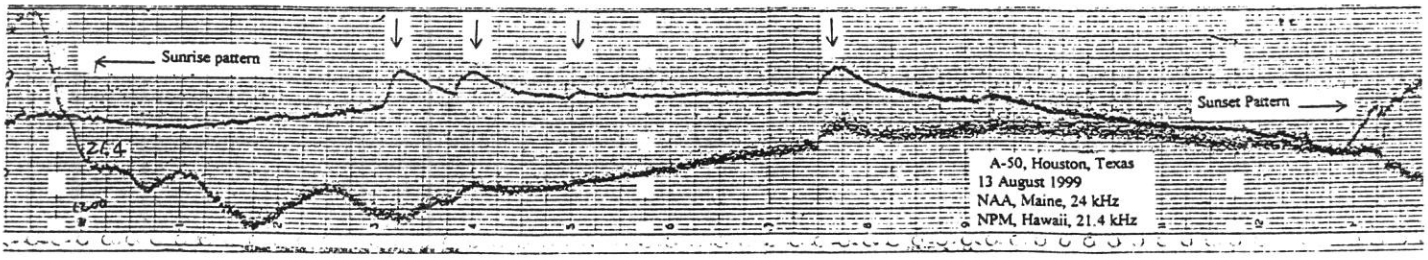


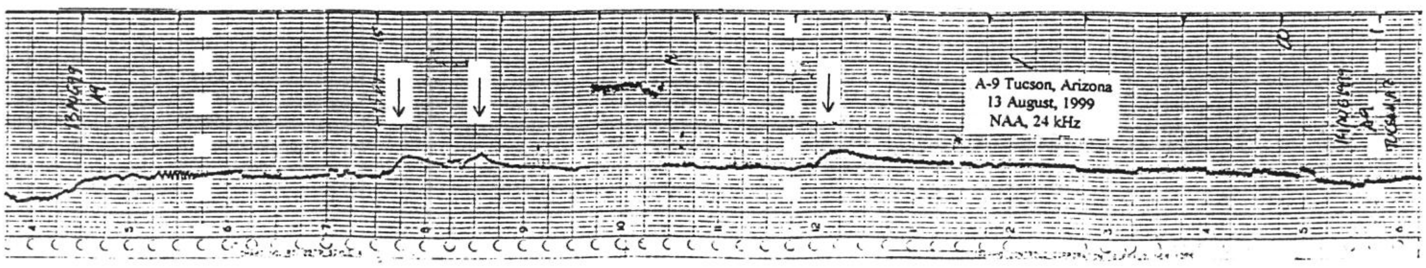






The first chart above was made by Phil DelVecchio, A-3, who is the only one left of the four original SID observers that the National Bureau of Standards, NBS, set up to detect solar flares by the sudden enhancement of atmospherics, SEA, method. NBS loaned the AAVSO four Brown strip chart recorders in 1956 so the AAVSO could participate in the International Geophysical Year in 1959. Harry Bondy who was then Chairman of the Solar Division found David Warshaw, A-1, who was a technician at IT&T to design and build a simple SEA receiver using the early Germanium NPN transistors that were the first transistors and only then becoming available. The Warshaw SEA receiver was soon detecting solar flares on the rise of cycle 19 and NBS was very pleased because there were no satellites to detect them in those days. Phil was one of the most successful of the AAVSO's SID observers until his receiver stopped working about 5 years ago. At that time he had become a very successful amateur seismologist so he didn't bother to fix his SES receiver. Phil is now 94 years old and living in a nursing home that doesn't allow its residents to have seismographs but they did allow him bring his computer. Phil also managed to persuade them to let him have his SES receiver which I fixed and set up for him. The SES above is his first since getting back on the air. He recorded the other SIDs at the end of August as well. As you can see the nursing home is far from being an interference free location but Phil is much happier watching for solar flares than he was watching TV and other entertainment this Hilton-like nursing home provides. Phil's e-mail address is < 75713.3271@compuserve.com>





Two charts above show SIDs recorded on 13 August by Jerry Winkler, A-50, and Werner Scharlach, A-9. Werner is also a longtime SID observer who joined the program in the early 60s and has kept his receiver on the air and has been sending his charts each month for over 30 years