Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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Daily Mean Sunspot Numbers, R_a for November 1999

(computational analysis performed by Joseph Lawrence)

simple average				k-corrected	
Day	R_a avg	Std. Dev.		R_a k	Std. Dev.
1	147	5.1		133	4.4
2	120	5.3		100	4.2
3	100	4.5		83	2.7
4	117	3.4		99	2.4
5	127	5.1		108	3.4
6	145	3.9		125	3.6
7	169	6.8		156	6.1
8	195	7.5		168	4.7
9	221	10.5		192	7.4
10	266	14.2		218	7.6
11	245	14.4		213	8.9
12	226	13.4		186	9.2
13	209	11.5		179	6.7
14	197	9.7		161	6.0
15	191	8.2		165	5.4
16	211	9.5		175	5.3
17	209	10.7		177	8.0
18	203	9.4		183	8.0
19	204	11.3		179	9.0
20	202	11.7		169	7.0
21	194	8.9		171	7.3
22	160	10.7		135	6.7
23	131	6.8		113	6.3
24	121	6.7		102	4.9
25	119	7.0		100	4.0
26	124	8.7		100	4.7
27	138	9.3		113	6.1
28	122	6.5		108	4.2
29	98	5.2		81	3.4
30	119	5.6		97	3.7
31	-	-		-	-

Monthly Mean R_a avg = 167.6
Monthly Mean R_a k = 143.0

Observer	Code	Country	Days Obs.
Abbott, P	AAP	Canada	9
Anderson, E	ANDE	USA, NY	6
Barnes, H	BARH	New Zealand	11
Battaiola, R	BATR	Italy	5
Berg, R	BEB	USA, IN	11
Blackwell, J	BLAJ	USA, NH	9
Boschat, M	BMF	Canada	13
Bose, B	BOSB	India	28
Branchett, B	BRAB	USA, FL	30
Branchett, D	BRAD	USA, FL	25
Branch, R	BRAR	USA, CA	20
Carlson, J	CARJ	USA, MA	16
Morales, G	CHAG	Bolivia	13
Cudnik, B	CKB	USA, TX	20
Clemens, C	CLEC	USA, PA	16
Corp, L	CLZ	France	5
Collins, B	COLB	USA, OH	7
Compton, T	COMT	USA, MI	14
Conlin, G	CONG	USA, WA	3
Cragg, T	CR	Australia	22
Dempsey, F	DEMF	Canada	2
Dragesco, J	DRAJ	France	20
Dubois, F	DUBF	Belgium	12
Reed, E	ELR	USA, TX	28
Feehrer, C	FEEC	USA. MA	22
Ruiz, J	FERJ	Spain	14
Fleming, T	FLET	USA, TX	27
Fujimori, K	FUJK	Japan	20
Galvez, E	GALE	PERU	9
Gallo, M	GALM	Argentina	1
Giovanoni, R	GIOR	USA. MD	23
Gottschalk, S	GOTS	USA, IA	21
Hay, K	HAYK	Canada	5
Hrutkay, T	HRUT	USA, PA	12
Ibanez, J	IBAJ	Spain	14
Ibrahem, A	IBRA	Egypt	16
Jenner, S	JENS	England	4
Jennings, V	JENV	USA, VA	2
Kaplan, J	KAPJ	USA, MN	24
Knight, J	KNJS	South Africa	16
Lerman, M	LERM	Canada	9
Leventhal, M	LEVM	Australia	20
Lizak, T	LIZT	USA, RI	11
Lohvinenko, T	LWT	Canada	5
Malde, K	MALK	Norway	10
Jarboles, J	MARJ	Spain	23
Mochizuki, E	MCE	Japan	21
McHenry, L	MCHL	USA, PA	1
Miller, J	MILJ	USA, MD	5
Moeller, M	MMI	Germany	14
Mudry, G	MUDG	Canada	2
Nilsson, B	NILB	Denmark	9
Nylander, H	NYLH	Finland	6
Prestage, N	OBSO	Australia	18
Randall, T	RANT	USA,NY	8
Richardson, E	RICE	England	12
Ritchie, A	RITA	USA, MA	24
Ramsey, J	RMAJ	USA, AR	5
Ramsey, S	RMAS	USA, AR	2
Schott, G	SCGL	Germany	15
Simpson, C	SIMC	USA, OH	6
Stemmler, G	STEM	Germany	17
Stoikidis, N	STQ	Greece	16
Suzuki, M	SUZM	Japan	21
Takuma, H	TAKH	Japan	21
Teske, D	TESD	USA, MS	21
Thompson, R	THR	Canada	10
Vargas, G	VARG	Bolivia	15
Wilson, W	WILW	USA, TN	20
Witkowski, L	WITL	USA, FL	23
Watts, K	WKW	USA, CA	3
Yesilyaprak, H	YESH	Turkey	20

Determination of Sunspot Group Number: Practical Guide Part II

As noted in Part I (August 1999 *Solar Bulletin*), the McIntosh sunspot group classification scheme systematizes the identification of sunspot groups and provides an operational guide for segregating complex sunspot clusters into the appropriate groups. The McIntosh system doesn't assume knowledge of the magnetic structure of the cluster and so is suitable for white-light observations. Patrick McIntosh (Space Environment Center, Boulder, CO) devised his sunspot group classifications to distinguish classes of sunspots most likely to produce flares. The older Zurich (Waldmeier) classification system didn't make fine enough distinctions between sunspot types to make reliable predictions of which sunspots would likely spawn flares. McIntosh extended the Zurich system and subcategorized sunspots with traits that enhanced the likelihood of flare production. The probability of each McIntosh sunspot class to produce flares has been characterized over the past twenty years so that the system provides a reliable and high confidence estimate of expected flare activity. Reports generated by NOAA and the Space Environment Center use the McIntosh system to describe sunspot groups and track their evolution.

The McIntosh classification identifies sunspot clusters along three dimensions and uses letter codes to distinguish the type in each dimension. The first dimension classifies the cluster's structure by describing the size of the cluster (length in heliographic degrees) and the presence of penumbrae. This dimension closely follows the older Zurich classification scheme except the 'G' and 'J' categories were eliminated in the McIntosh redefinition. The second dimension describes the penumbra associated with the largest spot in the cluster. The third dimension describes the distribution of interior spots in the cluster.

McIntosh Sunspot Group Classification

The accompanying diagram on the next page attempts to illustrate the category descriptions.

<u>First Letter: Modified Zurich Class</u> (always capitalized)
A: Unipolar group with no penumbra. Usually seen during the beginning and end of a sunspot's evolution.

B: Bipolar group without penumbra on any spot.

C: Bipolar group with penumbra on one end of the group. Penumbra most likely surrounds umbrae of the largest leader cluster or spot.

D: Bipolar group with penumbrae on spots at both ends. The longitudinal length of the group does not exceed 10°.

E: Bipolar group with penumbrae on spots at both ends. Length measures between 10 – 15°.

F: Bipolar group with penumbrae on spots at both ends. Group length exceeds 15°.

H: Unipolar group with penumbra. Normally an older leader spot whose follower spots have dissolved.

<u>Second Letter: Penumbra Class</u> (lower case)
x: No penumbra (class A or B only).

r: Rudimentary penumbra that partially surrounds largest spot in early or decaying stages of evolution.

s: Small, symmetric penumbra surrounding a single or compact cluster of umbra. Spot is smaller than 2.5° in North-South length.

a: Small, asymmetric penumbra surrounding a single or irregular shape compact cluster. Spot is smaller than 2.5° in North-South length.

h: Large, symmetric penumbra surrounding a single or compact cluster of umbra. Spot is greater than 2.5° in North-South length.

k: Large, asymmetric penumbra surrounding a single or irregular shape compact cluster. Spot is greater than 2.5° in North-South length.

<u>Third Letter: Distribution Class</u> (lower case)
x: Group has no intermediate spots (usually associated with A and H classes).

o: (Open) only a few spots between the leader and follower spots

i: (Intermediate) numerous spots reside between the leader and follower spots.

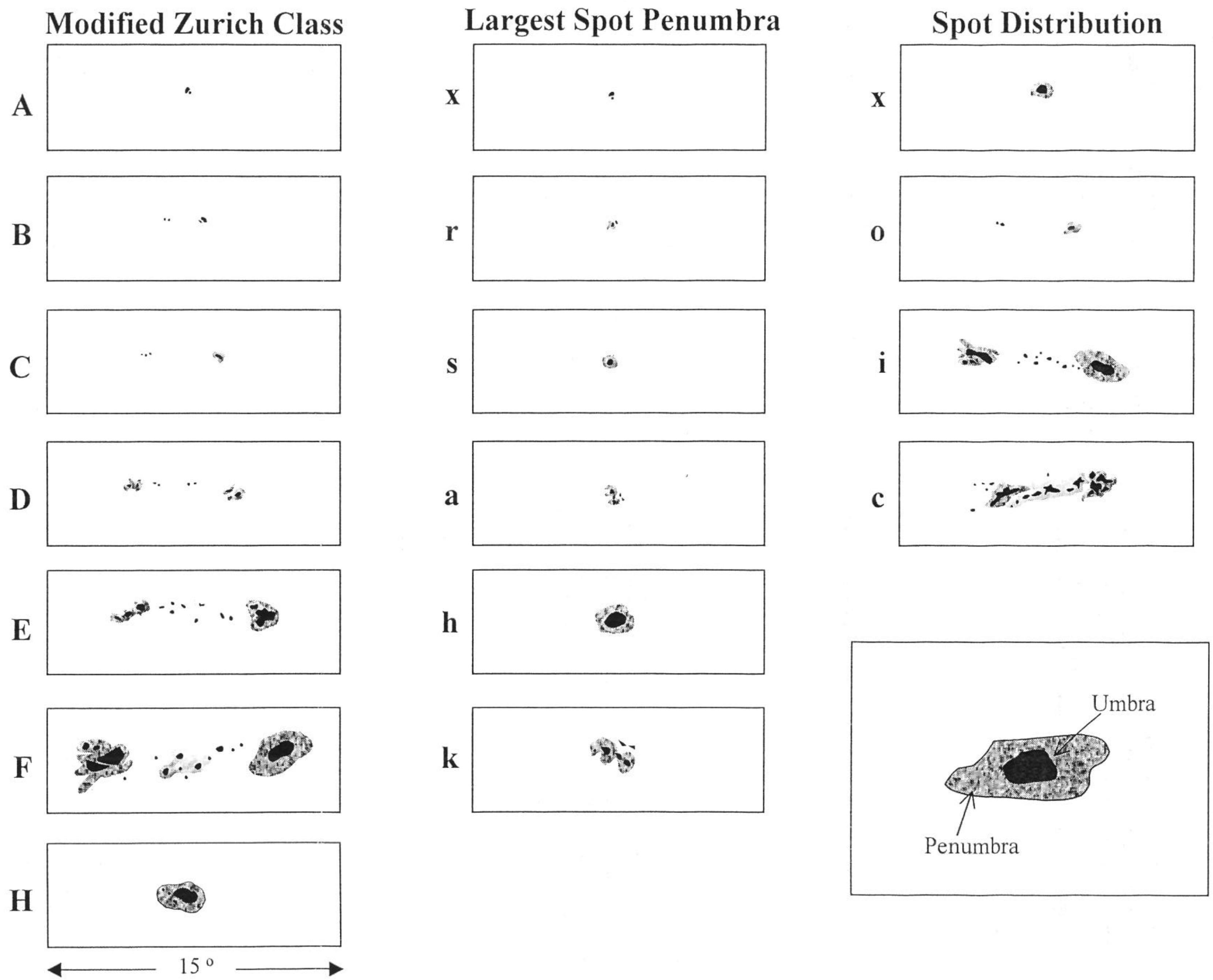
c: (Compact) many large spots between the leader and follower spots with at least one having a penumbra.

Some three letter combinations are not allowed because of obvious incompatible definitions (ie- Cxx cannot have a penumbra at one end and yet not have penumbrae around any spot). Learning the McIntosh classifications and recognizing the prototypes while determining sunspot group count should minimize misidentification of groups and decrease the variation between observer estimates.

In Part III of this series, the evolution of sunspot groups will be discussed and operational guidelines for distinguishing individual spots from pores and other granular structures will be considered.

Reference:
McIntosh; P.S. 1981, *The Physics of Sunspots*, Sacramento Peak Observatory, Sunspot, NM

McIntosh Sunspot Classification System



Sudden Ionospheric Disturbance Report

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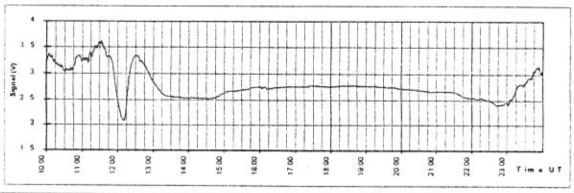

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Sudden Ionospheric Disturbances (SID) Recorded During November 1999

(correlation analysis performed by Joseph Lawrence, SID Analyst)

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
991101	1150	1	991110	1548	1+	991115	0830	2+	991124	0924	1+
991102	0950	1-	991110	1946	2	991115	1315	1	991124	1045	2
991102	1320	1-	991110	2145	2	991116	0238	2+	991124	1220	2
991104	0502	2+	991111	0150	1-	991116	0407	1+	991124	1930	1-
991105	0633	2	991111	0327	1+	991116	0736	2+	991125	0646	1+
991105	1715	2	991111	0453	1	991116	0917	2	991125	0825	1
991105	1806	3+	991111	0940	1+	991116	1035	2+	991125	1030	2
991106	0635	2	991111	1325	1+	991116	1406	2+	991125	1715	2+
991106	1100	1-	991111	1445	2	991116	1552	2+	991125	1910	2+
991106	1705	2+	991112	0827	1+	991116	1645	2+	991126	0120	2
991107	0436	1-	991112	0908	2+	991117	0847	1-	991126	0400	2+
991107	0735	1	991112	0953	2	991117	0935	1	991126	0705	1+
991108	0605	1+	991112	1155	1	991117	0953	2+	991126	0910	2+
991108	1609	1	991112	1725	1+	991117	1204	1	991126	1345	2+
991108	1703	1-	991113	1245	1+	991117	1603	1+	991127	0250	2
991108	1846	2+	991113	1525	1-	991117	1741	2	991127	0455	1+
991108	1953	2+	991113	1610	2	991118	0148	1	991127	0550	1+
991109	0420	1	991113	1919	1-	991118	0804	1+	991127	1010	1+
991109	0508	1-	991114	0352	1-	991118	1901	1+	991127	1130	2
991109	0530	1+	991114	0442	1	991119	1050	1-	991127	1210	2
991109	0837	1+	991114	0618	1	991119	1505	1-	991128	0555	2
991109	1255	1	991114	0800	2+	991120	1150	1	991128	1040	1-
991109	1535	1	991114	0923	2	991120	1235	1-	991128	1155	1
991109	1600	1	991114	1312	1-	991120	1929	1+	991129	1400	1-
991109	1622	1	991114	1450	2+	991121	0828	1+	991128	1820	3+
991109	1746	2+	991114	1607	1	991121	1015	2	991129	0854	1+
991109	1955	2+	991114	1628	1+	991121	1820	2+	991130	0830	1-
221110	0604	1	991114	1706	2	991122	1218	1+	991130	1607	1-
991110	0713	1+	991114	1810	2	991123	1410	1-	991130	1740	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
Scharlach, W	A-09	NAA
Parker, N	A-40	NPM
Winkler, J	A-50	NAA, NPM
Overbeek, D	A-52	NAA, NPM, NSW
Toldo, D	A-52	NAA, NPM, NSW
Stokes, A	A-62	NAA
Ellerbe, J	A-63	ICV
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

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 November

Prepared by
Casper H. Hossfield

Multiplexed recordings of Very Low Frequency VLF radio stations, NAA in Cutler, Maine and NPM in Lualualei, Hawaii, are shown below. Jerry Winkler, A-50, made the recordings. Having the two signals recorded on the same chart makes it easier to find the sudden ionspheric disturbances, SIDs, and it increases the certainty when both signals show a sudden enhancement of their signal, SES, in response to the SID.