Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS
SOLAR SECTION

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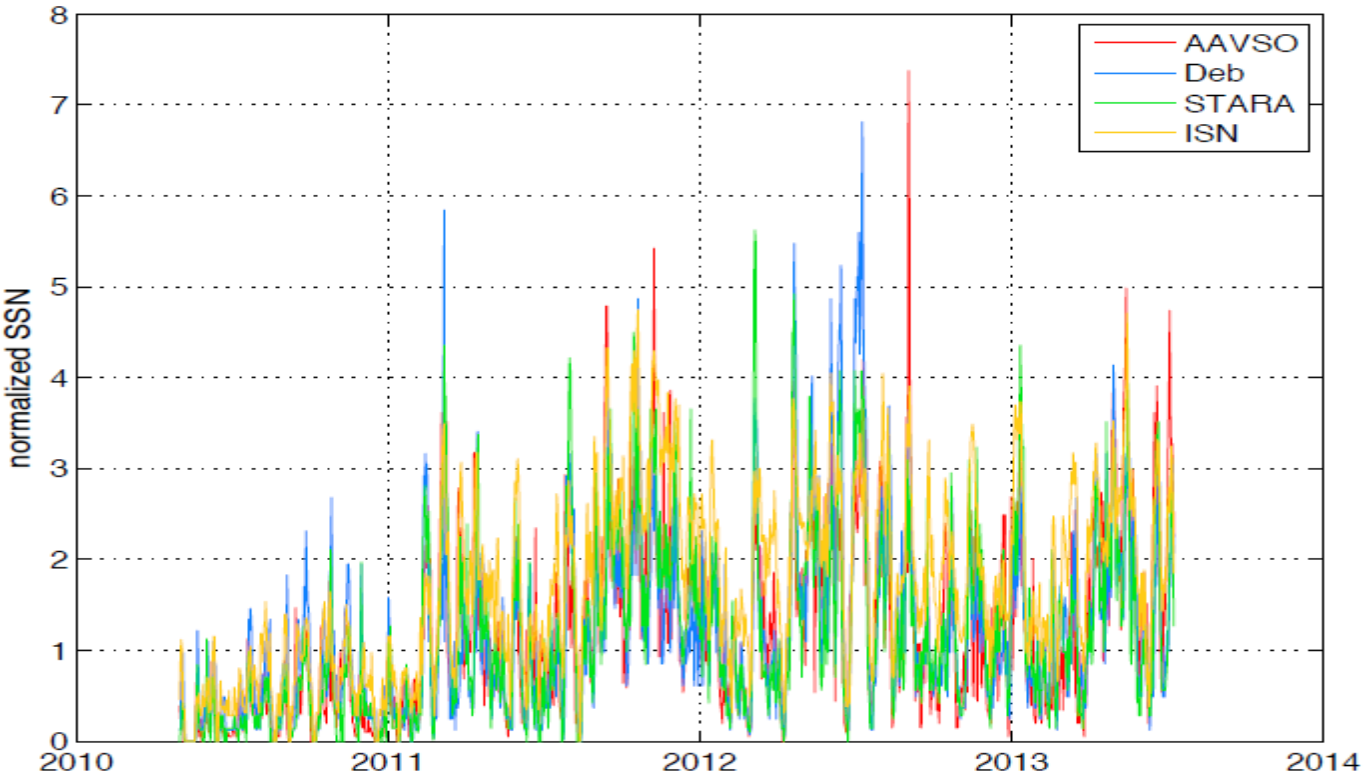
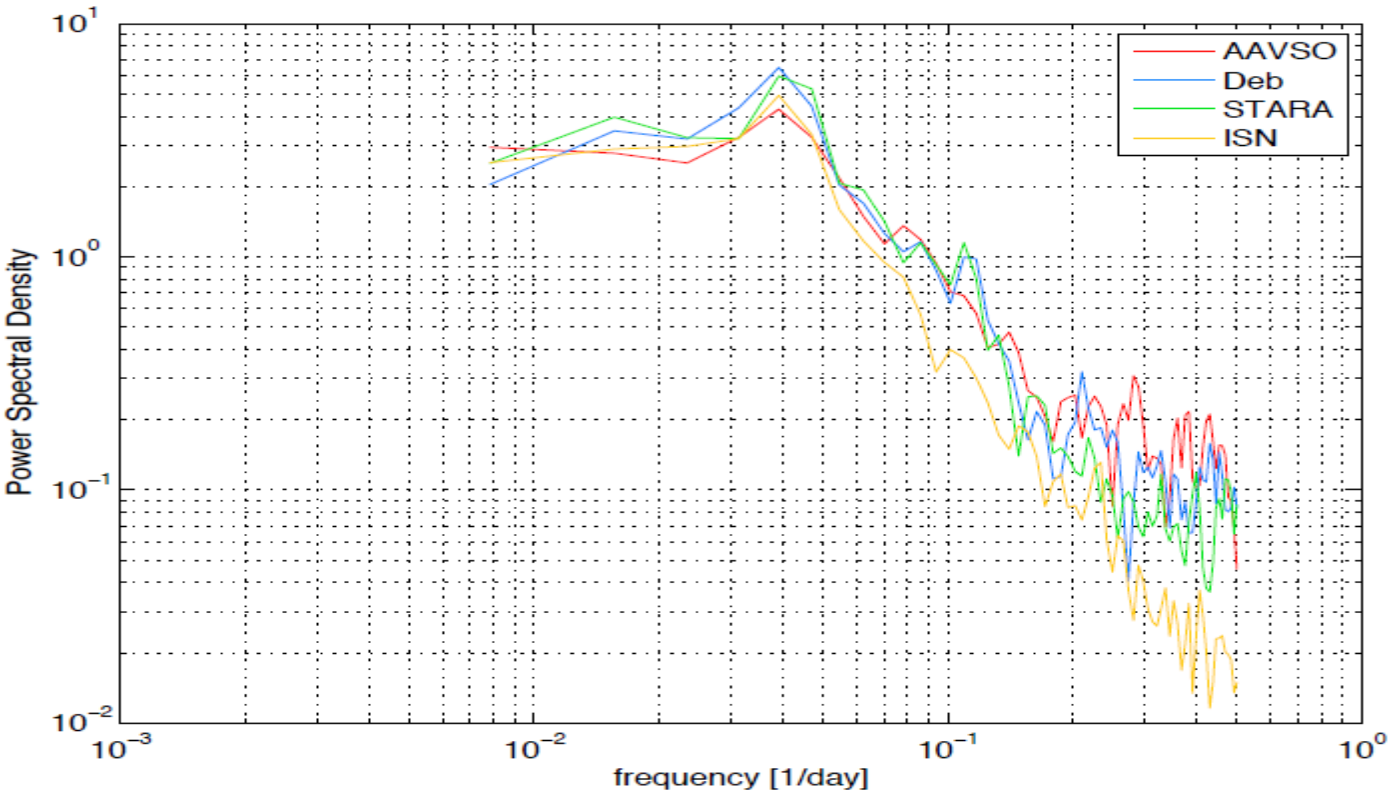
ISSN 0271-8480

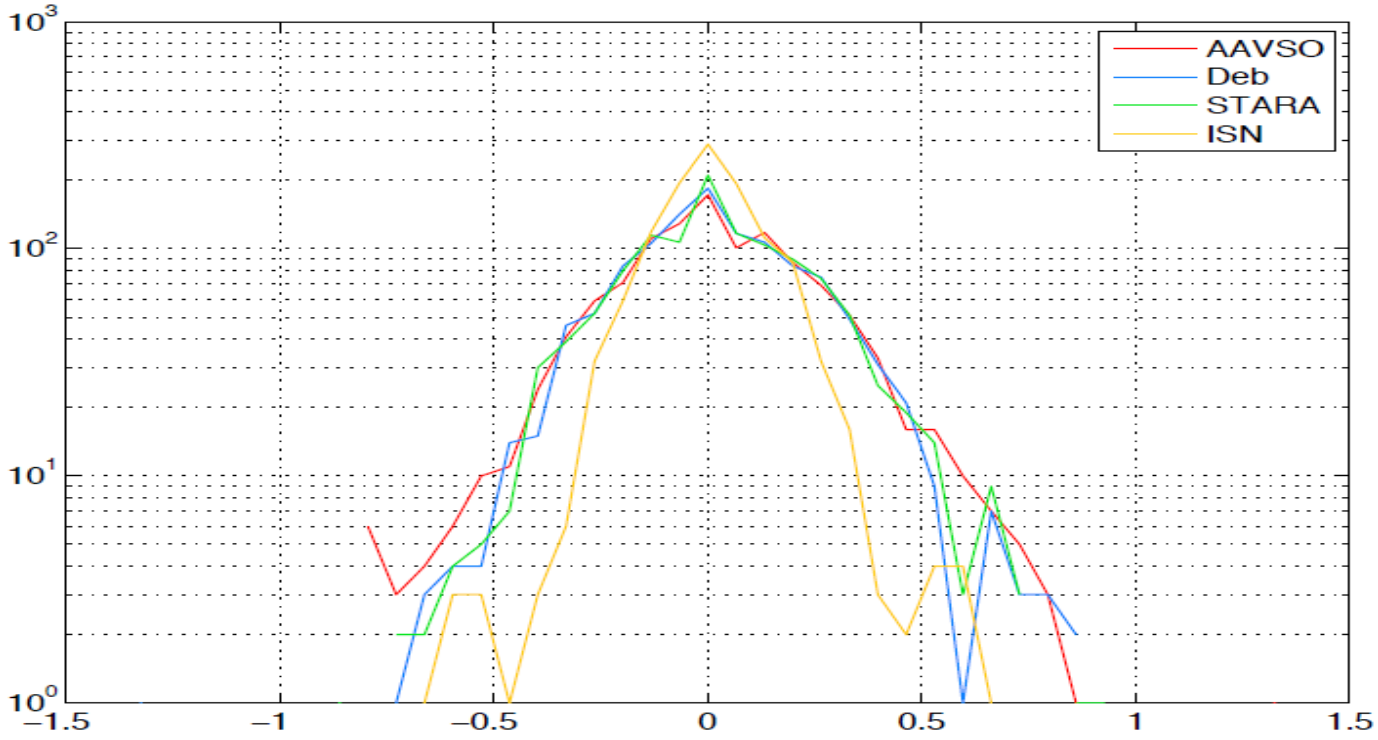
Volume 70 Number 3 March, 2014



These graphs and commentary are courtesy of Thierry Dudok de Wit (Laboratoire de Physique et Chimie de l'Environment et de l'Espace. The above graph covers ~ 3 years of data from: the Royal Observatory Belgium's (ROB) Debrecen Catalog (Laure Lafevre) http://sidc.oma.be/merged-sunspot-catalog/, the National Solar Observatory's (NSO) STARA catalog (Fraser Watson) http://www.nso.edu/staff/fwatson/STARA/catalogue and the AAVSO average visual observer sunspot counts from May, 2010 thru July, 2013. All these data are of sunspot counts only, (except for the SIDC ISN). The NSO data come from the Solar Dynamic Observatory (satellite) SDO HMI white light CCD images and intensity magneto-grams, the Debrecen catalog consist of USAF, SOHO (satellite), Boulder and other European optical observatory's sunspot counts, and the AAVSO visual observers average daily sunspot counts throughout the world. The reason for only showing sunspot counts is that the STARA catalog of SDO HMI CCD images only record sunspot counts and no group counts. (Neither Zurich, McIntosh, or Boulder-Mount Wilson Active Region groupings are in the STARA catalog). A description of these group classifications can be found here: http://sidc.oma.be/educational/classification.php However, the Debrecen catalog does have Boulder, Zurich, and modified McIntosh groupings for some, but not all its network of observatories and the SIDC data uses only Zurich groupings (supposedly) when calculating the ISN index.



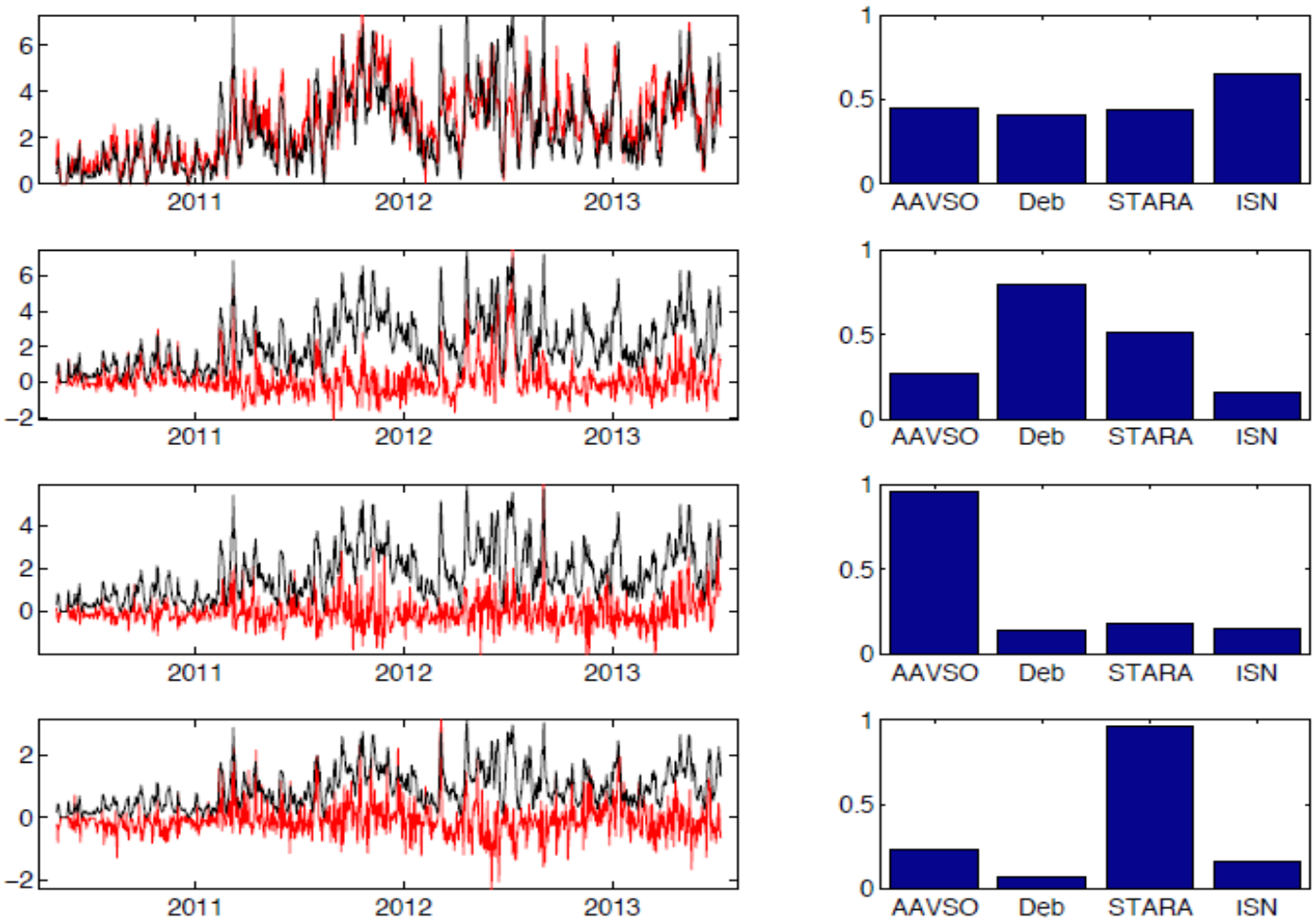
The above graph shows each data stream's spectra. Not much to say. The ISN definitely has lower high-frequency noise, while the other three are comparable within their error bars; the probability density function (pdf) of their high frequency noise is as follows:



The pdf of the ISN is narrower as expected, but none of the pdfs departs much from a Gaussian (given their uncertainty). The cross-coherency, showing that all are strongly correlated on time

scales > 10 days and very little on time scales < 3 days. The surprise comes from the high coherency between Debrecen and STARA, which is really unexpected. The coherency between AAVSO and ISN is rather large, as we would wish, still remains below the former. Note: that the confidence intervals are about +- 0.1 for these plots.

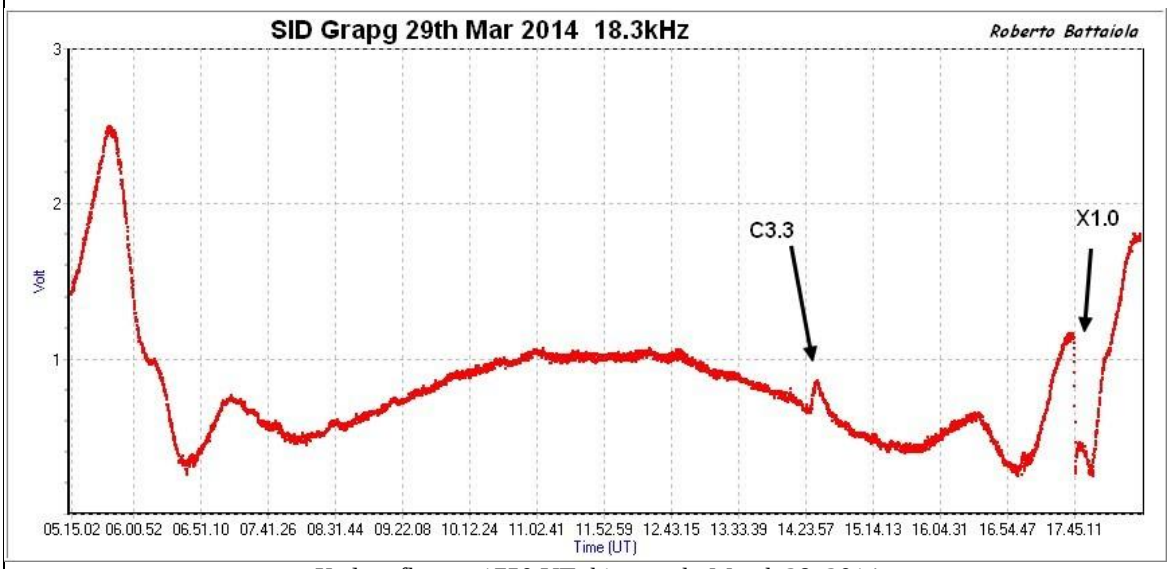
Below, I applied independent component analysis to identify features that may occur in one record only, vs. those that are common to all. With this each record is expressed as a linear combination of 4 time series (in red), each of which is weighted by the values given on the right. The black curve is just the average of the four sunspot records.



The first row basically shows the component which is common to all, since it has almost the same weightings (in blue) for all records. The second row reveals features that are predominantly observed by Debrecen, although the separation is not that clear. The third and fourth ones show outstanding features that clearly belong to AAVSO only and to STARA only. Basically, you recover your original AAVSO record by summing up all 4 red curves, weighted by their values given in the right column.

What you can see, for example, is that the long increase in the sunspot nr observed in mid-2012 is predominantly seen by Debrecen (second graph in the series). AAVSO does not show any outstanding peaks except for what happened near September 2012. There are many more occasions, on the contrary, where STARA counts sunspots that are not seen by the others.

Sudden Ionospheric Disturbance Report



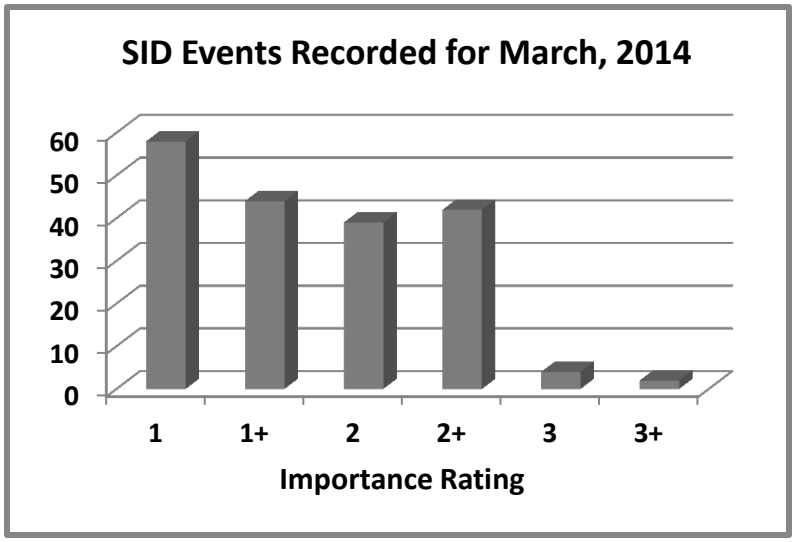
X class flare at 1750 UT this month, March 29, 2014.

Sudden Ionospheric Disturbances (SID) Records During March, 2014

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
140301	801	1	140304	454	2	140309	2027	1+
140301	1602	1	140304	1125	2	140309	215	2+
140301	2219	1	140304	2128	2	140309	703	2+
140301	1323	2	140304	2307	2	140310	29	1
140301	1400	2	140304	11	1+	140310	1142	1
140301	2258	2	140304	1102	1+	140310	1446	1
140301	56	1+	140304	2301	2+	140310	1528	1
140301	1331	1+	140305	207	1+	140310	1750	1
140301	5	2+	140306	850	1	140310	2024	1
140302	1203	1	140306	1250	1	140310	406	2
140302	1251	1+	140307	1000	1	140310	1042	2
140302	2317	1+	140307	900	2+	140310	2242	1+
140302	12	2+	140307	1222	2+	140310	2259	1+
140302	350	2+	140307	1836	2+	140311	2021	1
140302	1434	2+	140308	1759	1	140311	1240	2
140303	1226	1	140308	2340	2	140311	1900	2
140303	1559	1	140308	2143	1+	140311	2140	2
140303	559	2	140309	835	1	140311	2156	2
140303	1440	2	140309	1331	1	140311	908	1+
140303	1200	2+	140309	1359	1	140311	1010	1+
140304	655	1	140309	1441	1	140311	1017	1+
140304	1245	1	140309	2343	1	140311	1207	1+
140304	1348	1	140309	447	2	140311	349	2+
140304	1430	1	140309	1722	1+	140311	1822	2+

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
140311	1925	2+	140317	1720	2	140324	1100	2+
140312	1105	2	140317	1108	2+	140324	1140	2+
140312	1500	2	140317	1500	2+	140325	1712	1+
140312	1730	2	140318	756	1	140326	1338	1
140312	2234	2	140318	506	2	140326	650	2
140312	754	1+	140318	1534	1+	140326	1300	1+
140312	2240	2+	140318	1726	1+	140327	906	1
140312	2018	3+	140318	1816	1+	140327	1550	2
140313	1516	1	140318	2252	1+	140327	2030	2
140313	1657	1	140319	732	1	140327	1800	3
140313	1715	1	140319	1129	1+	140327	1043	2+
140313	1737	1	140319	1253	1+	140328	1045	2
140313	1919	2	140320	900	1	140328	1200	3
140313	1023	3	140320	202	2	140328	2351	1+
140313	1809	1+	140320	947	1+	140328	1916	2+
140313	712	2+	140320	356	2+	140328	1921	2+
140314	1009	1	140320	1626	2+	140329	752	1
140314	1015	1	140320	1835	2+	140329	1748	1
140314	316	1+	140322	308	2	140330	2057	1
140314	552	1+	140322	916	2	140330	2220	1
140314	1100	1+	140323	237	2	140330	1153	2
140314	810	2+	140323	848	1+	140330	1159	1+
140314	921	2+	140323	859	1+	140330	2118	1+
140315	410	2	140323	348	2+	140331	811	2
140315	936	1+	140324	250	1	140331	1415	1+
140315	1712	1+	140324	950	1	140331	732	2+
140315	1720	2+	140324	1240	1	140331	803	2+
140316	939	1	140324	902	2			
140316	1430	3	140324	1600	1+			
140316	1301	2+						
140317	836	1						
140317	952	1						

Solar Events

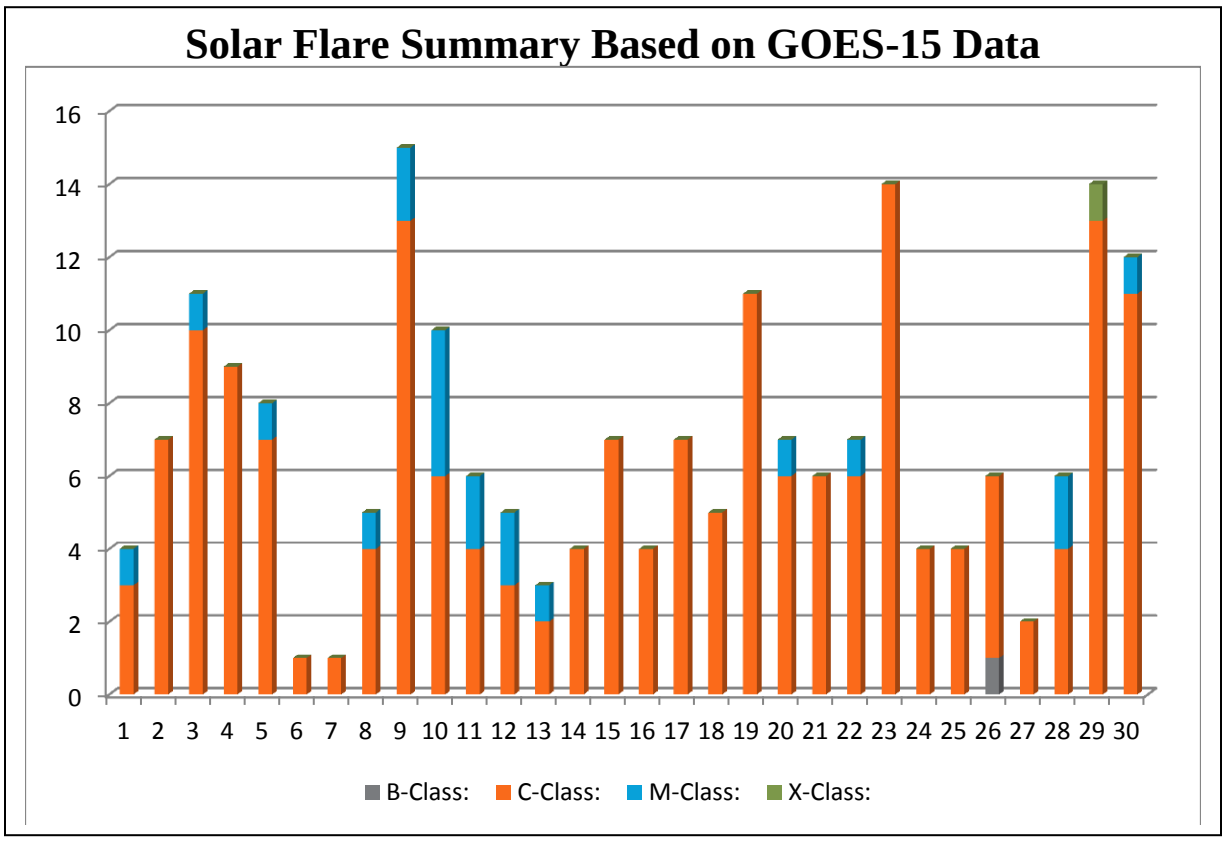


Importance rating: Duration (min)	1-: <19	1: 19-25	1+: 26-32	2: 33-45	2+: 46-85	3: 86-125	3+: >125

Sudden Ionospheric Disturbances (SID) Observers During March, 2014

Observer	Code	Station(s) monitored	Observer	Code	Station(s) monitored
A McWilliams	A94	NML	R Green	A134	JJI NWC
R Battaiola	A96	HWU	R Mrllak	A136	GQD NSY
J Wallace	A97	NAA	D Koawl	A137	DHO NPM NWC
L Loudet	A118	DCF GBZ NAA	S Aguirre	A138	NLK
B Terrill	A120	NWC	F Francione C Re	A139	HWU NAA NSY
F Adamson	A122	NWC	L Corp	A140	DHO
S Oatney	A125	NLK NML	I Ryumshin	A142	DHO GQD HWU
J Karlovsky	A131	DHO NSY	R Rogge	A143	DHO GQD ICV

There were 205 solar flares measured by GOES-15 for March, 2014: 1 X class, 20 M class, 183 C class and one B class flare. About the same this month as compared to last, with many C and M class flares. There were 16 AAVSO SID observers who submitted reports this month.



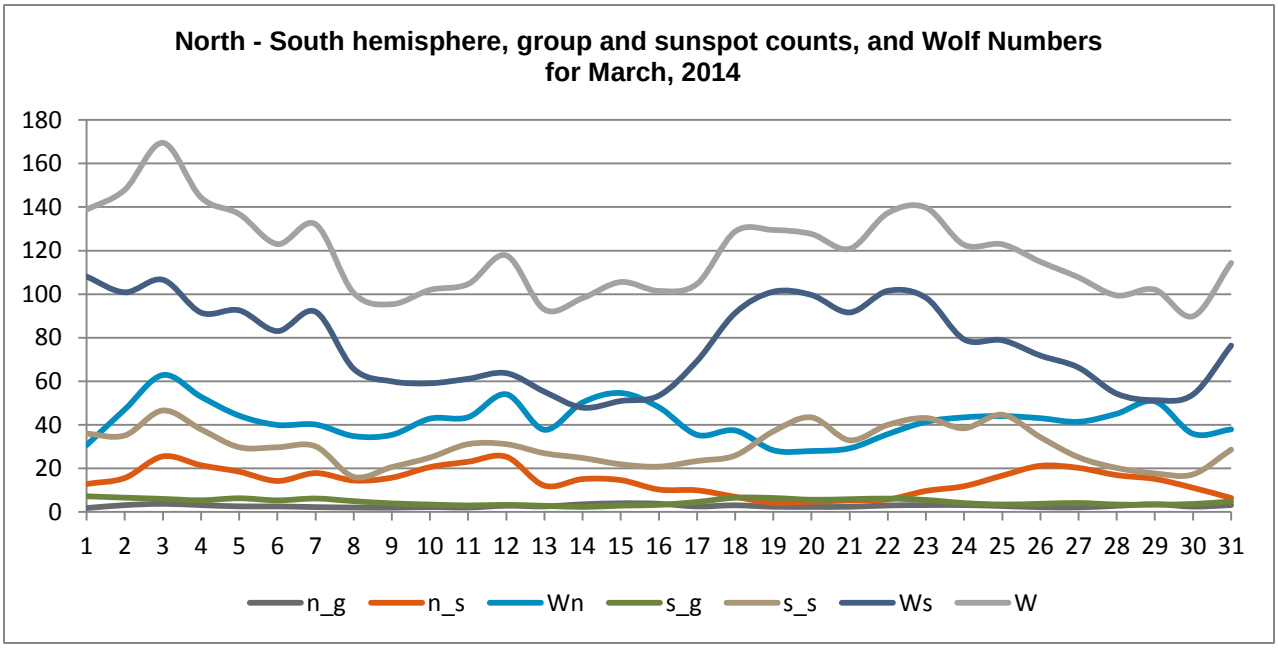
American Relative Sunspot Numbers (Ra) for March, 2014 [**boldface = maximum, minimum**]

DAY	NumObs	RAW	Ra
1	19	140	105
2	29	141	**105**
3	21	147	104
4	23	124	93
5	21	117	89
6	34	113	84
7	31	126	87
8	42	96	75
9	52	84	66
10	34	100	72
11	37	99	75
12	39	107	81
13	37	87	66
14	47	94	70
15	35	100	77
16	42	88	67
17	30	94	67
18	37	113	86
19	29	121	90
20	32	123	93
21	35	112	85
22	29	133	96
23	32	131	94
24	38	112	83
25	29	115	81
26	25	98	73
27	29	92	66
28	28	94	72
29	36	94	67
30	38	87	**64**
31	35	106	75
Average	**33.1**	**109.3**	**81**

Obs	#Obs	Name
AAP	3	A. Patrick Abbott
AAX	17	Alexandre Amorim
AJV	18	J. Alonso
ARAG	29	Gema Araujo
ASA	25	Salvador Aguirre
BARH	12	Howard Barnes
BATR	4	Roberto Battaiola
BDDA	13	Diego Bastiani
BERJ	21	Jose Alberto Berdejo
BMF	18	Michael Boschat
BRAB	28	Brenda Branchett
BRAF	19	Raffaello Braga
BROB	14	Robert Brown
BSAB	31	Santanu Basu
BXD	16	Alexandru Burda
CFO	7	Jean F. Coliac
CHAG	28	German Morales Chavez
CIOA	8	Ioannis Chouinavas
CKB	13	Brian Cudnik
CLZ	2	Laurent Corp
CNT	9	Dean Chantiles
CVJ	6	Jose Carvajal
DEMF	4	Frank Dempsey
DGP	16	Gerald Dyck
DJOB	14	Jorge del Rosario
DUBF	29	Franky Dubois
FAM	8	Fabio Mariuzza
FERJ	15	Javier Ruiz Fernandez
FLET	23	Tom Fleming
FLF	9	Fredirico Luiz Funari
FTAA	9	Tadeusz Figiel
FUJK	19	K. Fujimori
HALB	4	Brian Halls
HAYK	18	Kim Hay
HOWR	26	Rodney Howe
JASK	17	Krystyna Wirkus
JENJ	12	Jamey Jenkins
JGE	7	Gerardo Jimenez Lopez
JJMA	9	Jessica M.Johnson
KAND	19	Kandilli Observatory
KAPJ	16	John Kaplan
KNJS	20	James & Shirley Knight
KROL	21	Larry Krozel
LEVM	21	Monty Leventhal
LKR	9	Kristine Larsen
MARE	9	Enrico Mariani
MCE	21	Etsuiku Mochizuki
MGAA	5	Gael Mariani
MILJ	6	Jay Miller
MJHA	23	John McCammon
MMI	18	Michael Moeller
MUDG	11	George Mudry
OATS	12	Susan Oatney
OBSO	15	IPS Observatory
ONJ	10	John O'Neill

RICE	2	E. C. Richardson	VIDD	5	Dan Vidican
RLM	12	Mat Raymonde	WAU	4	Artur Wargin
RRO	4	Ralph Rogge	WILW	16	William M. Wilson
SDOH	31	SDO-Jan Alvestad	WKM	4	Michael Wiskirken
SDP	1	Dolores Sharples	WRP	2	Russell Wheeler
SIMC	8	Clyde Simpson			
SMNA	8	Michael Stephanou			
SONA	21	Andries Son			
SPIA	10	Piotr Skorupski	**Total**	**Observers:**	**74**
STAB	31	Brian Gordon-States	**Total**	**Observations:**	**1056**
SUZM	21	Miyoshi Suzuki			
TESD	21	David Teske			
URBP	20	Piotr Urbanski			
VARG	19	A. Gonzalo Vargas			

41 of our 74 observers submitted data on the sunspot and group counts for the Sun's north and south hemispheres. It is interesting to note how the Wolf numbers of group and sunspot counts cross over on the 14th and 16th this month; the southern hemisphere is predominant.



Reporting Addresses:
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SID Solar Flare Reports – Rodney Howe

ahowe@frii.com

If you are a new VLF observer, please add your name to the SID list!!
http://www.aavso.org/aavso-sudden-ionospheric-disturbance-program-observers