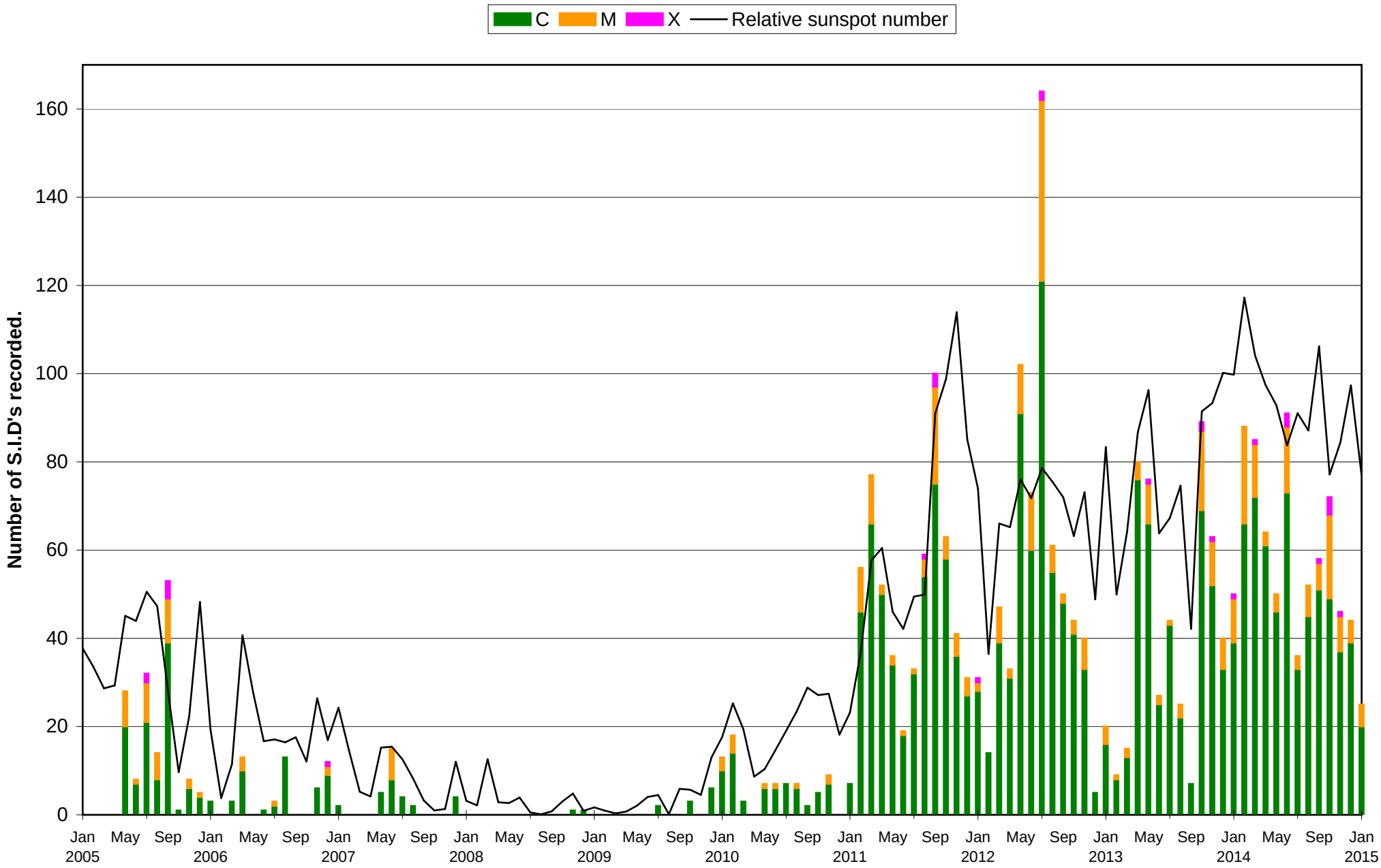
BAA Radio Astronomy Group. **2015 JANUARY**

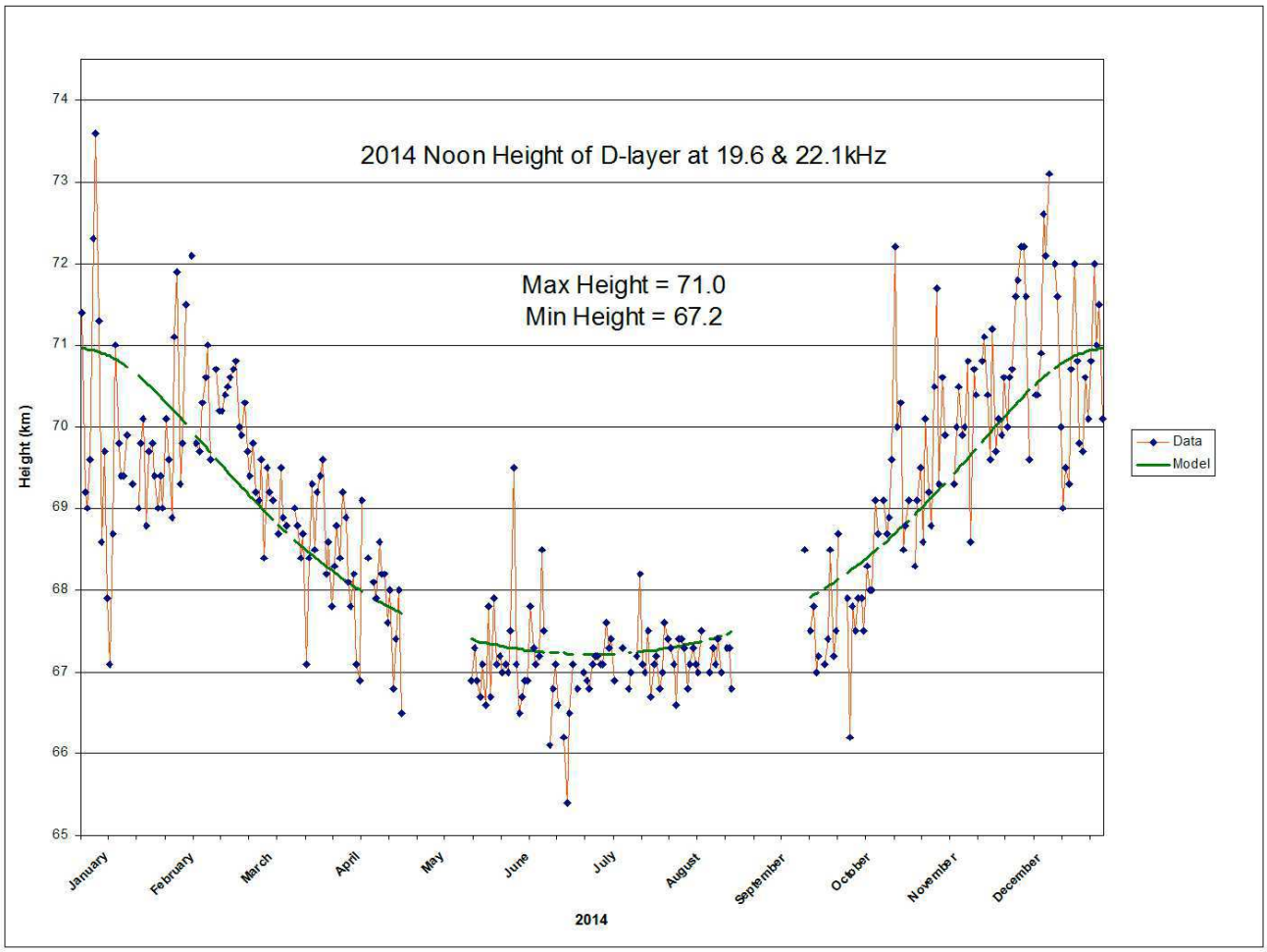
			John Cook (23.4kHz/*22.1kHz*)				Roberto Battaiola (18.3kHz)				Paul Hyde (22.1kHz/*23.4kHz*)				Bob Middlefell (22.1kHz)				Mark Edwards (**21.75**/24.0/*18.3kHz*)			
			Tuned radio frequency receiver, 0.58m frame aerial.				Modified AAVSO receiver.				Tuned radio frequency receiver, 0.96m frame aerial.				Tuned radio frequency receiver, 0.5m frame aerial.				Spectrum Lab / PC 2m loop aerial.			
DAY	Xray class	Observers	START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
3	**M1.1**	5					09:43	09:47	09:50	1-	09:45	09:48	10:01	1-					**09:45**	**09:48**	**09:54**	**1-**
4	**M1.3**	1																	15:23	15:36	16:02	2
5	*	2	11:13	11:16	11:25	1-													*14:55*	*14:58*	*15:07*	*1-*
5	C3.9	1					14:52	14:57	15:14	1												
6	C9.7	6	11:43	11:49	12:15	1+	11:43	11:48	12:03	1	*11:45*	*11:50*	*12:13*	*1+*					11:45	11:48	12:11	1+
7	C4.3	5	11:46	11:52	12:16	1+	11:46	11:52	12:01	1-	11:47	11:53	12:23	2					11:48	11:52	12:05	1-
7	C2.1	1																	15:00	15:02	15:11	1-
8	C2.6	1					15:46	15:50	16:02	1-												
9	C9.6	1																	*08:10*	*08:16*	*08:23*	*1-*
10	C3.3	4	11:18	11:26	11:57	2					11:18	11:27	11:58	2					11:21	11:33	11:48	1+
12	C5.6	5	12:51	12:56	13:08	1-	12:48	12:55	13:04	1-	12:49	12:56	13:17	1+					*12:52*	*12:57*	*13:04*	*1-*
12	C7.1	3	14:26	14:42	14:47	1					14:27	14:41	15:10	2								
13	C2.4	3	13:11	13:14	13:25	1-					13:12	13:17	13:29	1-					**13:13**	**13:15**	**13:20**	**1-**
14	C5.3	2	09:39	09:43	09:50	1-	09:32	09:41	09:52	1												
14	**M2.2**	7	12:50	12:57	13:45	2+	12:48	12:58	13:23	2	12:53	12:57	13:42	2+					*12:51*	*12:59*	*13:41*	*2+*
15	C2.4	2					14:49	14:57	15:04	1-									14:54	15:00	15:05	1-
15	C2.6	1																	16:43	16:47	16:56	1-
21	C4.3	5	10:40	10:49	11:00	1	10:38	10:48	10:59	1	10:40	10:46	11:06	1+					**10:44**	**10:47**	**11:02**	**1-**
21	C9.9	7	11:36	11:43	12:06	1+	11:36	11:42	12:01	1	11:37	11:44	12:05	1+					*11:39*	*11:44*	*12:04*	*1*
21	C5.0	1																	***15:28***	***15:34***	***15:42***	***1-***
23	C1.1	1									12:36	12:38	12:44	1-								
23	C3.7	1																	15:55	16:00	16:14	1
27	?(C1.4)	1									12:00	12:03	12:08	1-								
27	?(C2.0)	1									12:49	12:53	13:02	1-								
28	C2.7	2	10:41	10:43	10:50	1-					10:38	10:43	10:50	1-								
29	**M2.1**	6	11:36	11:43	?	-	11:34	11:37	12:09	2	11:35	11:44	?	-					11:35	11:44	12:00	1
29	C7.6	4	12:22	12:27	12:37	1-	12:21	12:27	12:38	1-	12:22	12:28	12:35	1-					12:23	12:28	12:31	1-
30	**M2.4**	7	12:13	12:17	12:44	1+	12:12	12:14	12:49	2	12:13	12:17	12:37	1					12:14	12:18	12:29	1-

			Colin Clements (23.4kHz/*22.1kHz*)				Steve Parkinson (Various)				John Elliott (19.6kHz)				John Wardle (19.6/23.4kHz)				Richard Kaye (Various)			
			AAVSO receiver, 0.76m screened loop aerial.				Tuned radio frequency receiver, frame aerials.				Tuned radio frequency receiver, 0.5m frame aerial.				PC soundcard, 0.7m frame aerial.				Pre-amplifier + PC software receiver.			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
3	**M1.1**		09:44	09:48	09:58	1-	09:45	09:47	09:58	1-												
4	**M1.3**																					
5	*																					
5	C3.9																					
6	C9.7						11:45	11:49	12:17	1+	11:45	11:50	12:10	1								
7	C4.3						11:47	11:52	12:10	1												
7	C2.1																					
8	C2.6																					
9	C9.6																					
10	C3.3						11:20	11:27	11:58	2												
12	C5.6						12:51	12:56	13:09	1-												
12	C7.1						14:28	14:40	14:54	1+												
13	C2.4																					
14	C5.3																					
14	**M2.2**		*12:51*	*12:58*	*13:23*	*1+*	12:51	12:58	13:50	2+	12:55	13:15	14:20	2+								
15	C2.4																					
15	C2.6																					
21	C4.3						10:40	10:47	10:58	1-												
21	C9.9		11:37	11:44	12:13	2	11:37	11:45	12:20	2	11:40	11:50	12:17	2								
21	C5.0																					
23	C1.1																					
23	C3.7																					
27																						
27																						
28	C2.7																					
29	**M2.1**		11:35	11:43	12:22	2+					11:33	11:35	12:16	2								
29	C7.6																					
30	**M2.4**		12:13	12:17	12:44	1+	12:13	12:17	12:48	2	12:15	12:30	13:00	2								


VLF flare activity 2005/15.
C
M
X
Relative sunspot number
Number of S.I.D's recorded.
0
20
40
60
80
100
120
140
160
Jan 2005
May
Sep
Jan 2006
May
Sep
Jan 2007
May
Sep
Jan 2008
May
Sep
Jan 2009
May
Sep
Jan 2010
May
Sep
Jan 2011
May
Sep
Jan 2012
May
Sep
Jan 2013
May
Sep
Jan 2014
May
Sep
Jan 2015

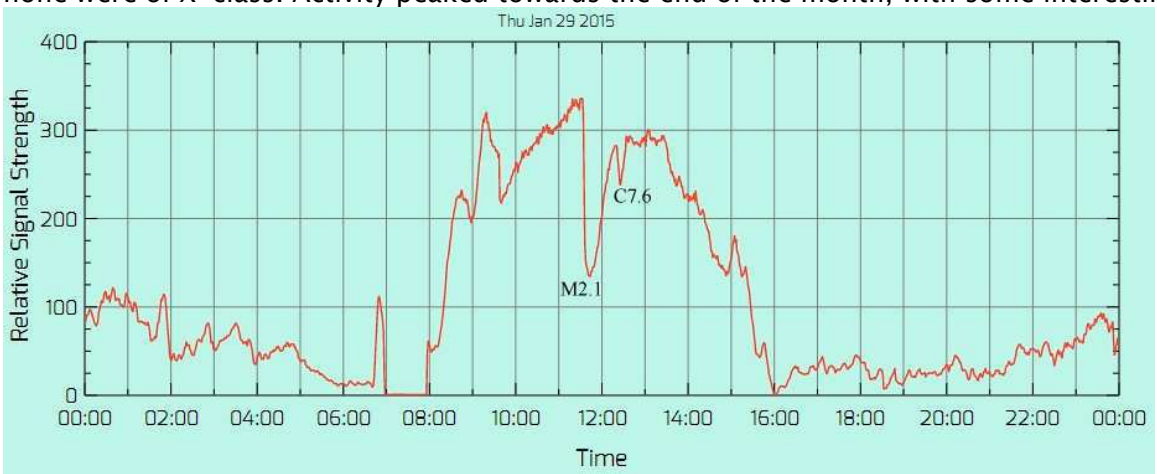
BAA Radio Astronomy Group. **2015 JANUARY.**

To complete 2014, Mark Edwards has again produced a chart of the D-region height from his 19.6 and 22.1kHz observations:



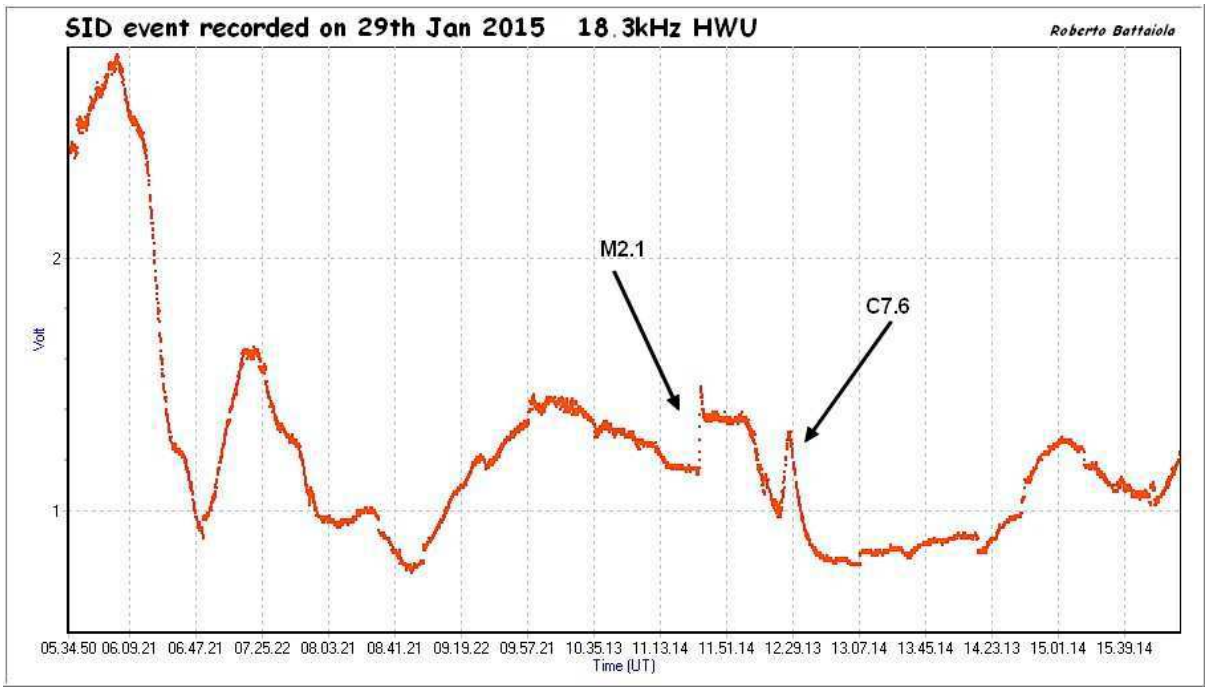
The data points are in red, with the model result in green. Results are similar to those from previous years, although the large spread in the data makes interpretation quite difficult.

2015 made a slow start with just 27 flares recorded as SIDs. Many of these were quite energetic, although none were of X-class. Activity peaked towards the end of the month, with some interesting SIDs on the 29th:



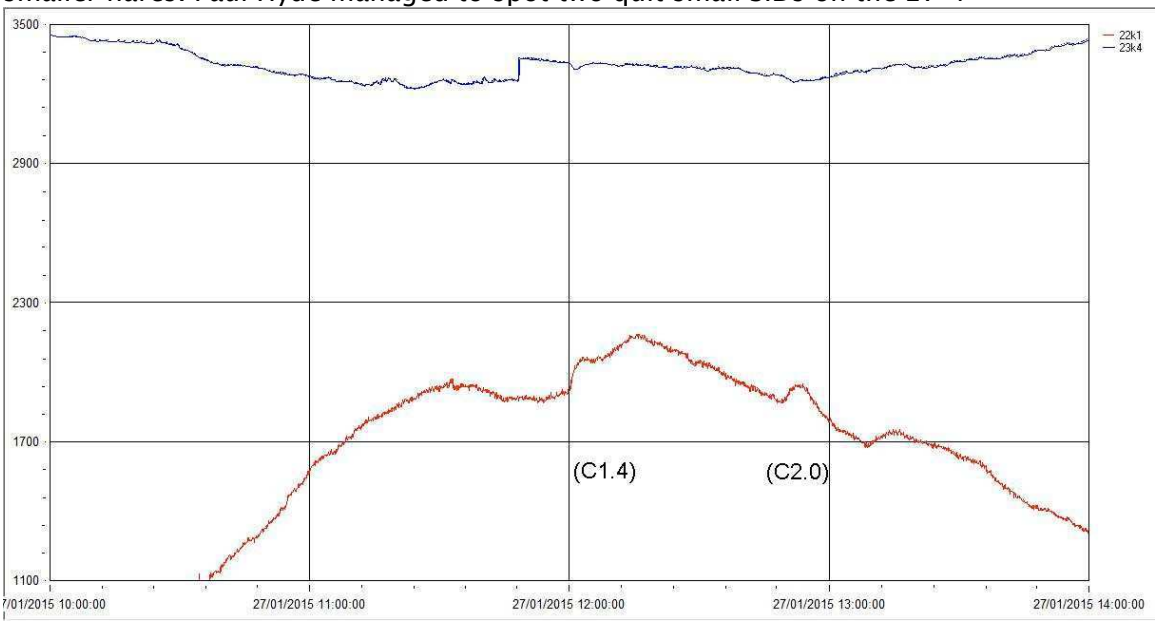
This chart from Peter Meadows shows the M2.1 and C7.6 flares, as well as evidence of an earlier complex of flares around 09:40.

Roberto Battaiola also included a chart for the 29th:



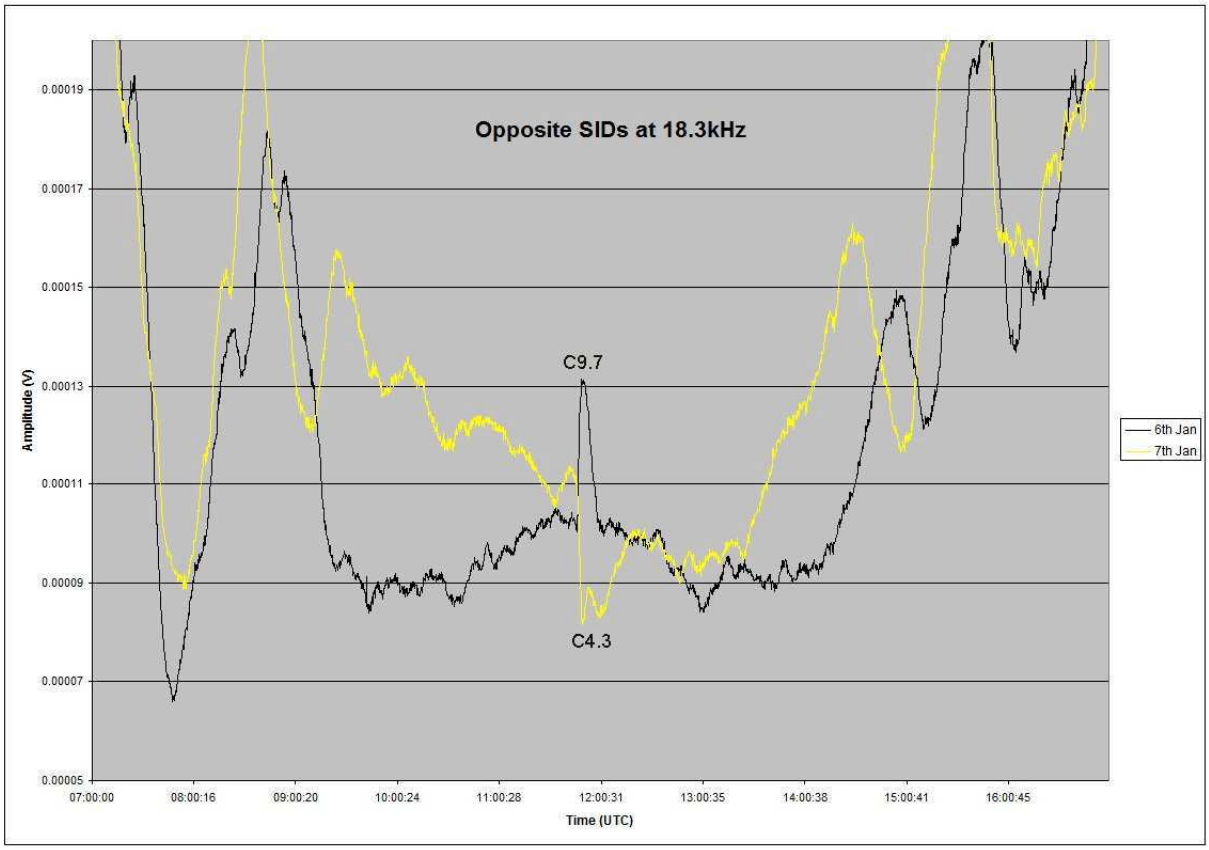
This shows an unusual shaped SID for the M2.1 flare. The flare itself had a long decay time (about 3 hours) with the C7.6 flare from a different active region superimposed on the decay.

As is often the case in the winter, there was a high level of non-solar disturbance to mask some of the smaller flares. Paul Hyde managed to spot two quit small SIDs on the 27th:

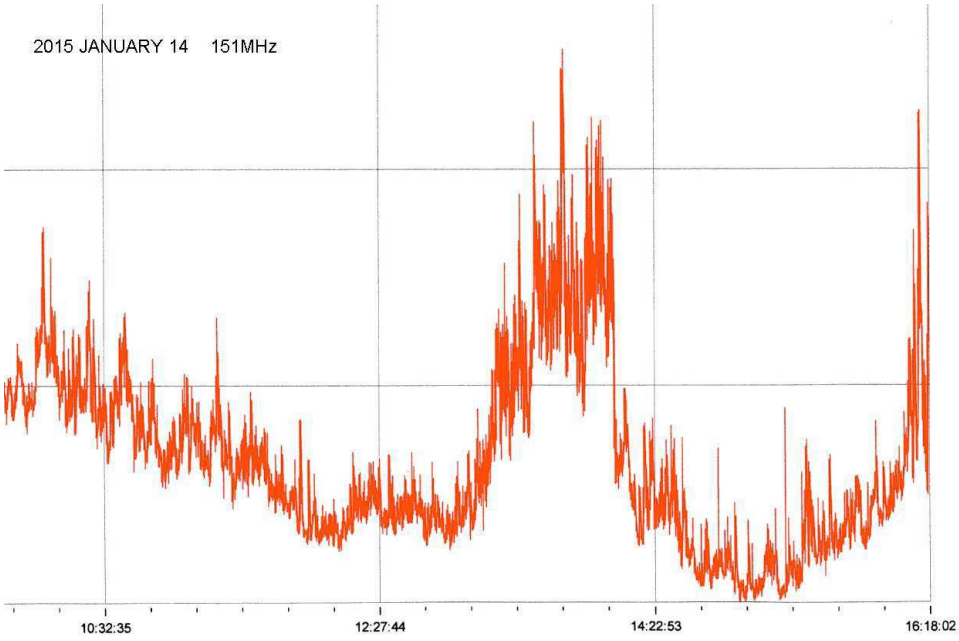


The secondary GOES13 satellite was in use at the time, and the SWPC bulletin does not list either of these flares. I have added the flare magnitudes from the X-ray data file. Both flares show at 23.4kHz (red), with slightly smaller SIDs visible at 22.1kHz (blue).

I have received complaints that some of the best flares have been occurring at 24 hour intervals, close to midnight, and so unobservable in Europe. To compensate, there have been a number of good flares through January much closer to midday. A good pair were recorded on the 6th and 7th within minutes of 12:00UT, and also demonstrating the wide D-region altitude variations at this time of year.



This recording from Mark Edwards shows the two day's SIDs overlaid, both at 18.3kHz. The SIDs are inverted on the two days, as is the shape of the diurnal curve. The reflection point of the D-region was already quite low on the 6th (black trace) allowing an in-phase SID, increasing the signal strength. Conversely on the 7th the reflection point was much higher, initially producing an out-of-phase SID reducing the signal strength. At its peak the reflection point has shifted even further, producing a short period of in-phase reception increasing the signal strength again.



Colin Clements noted just one significant 151MHz burst, shown above. This coincided with the M2.2 flare, widely recorded around 13 to 14UT in the 14th.

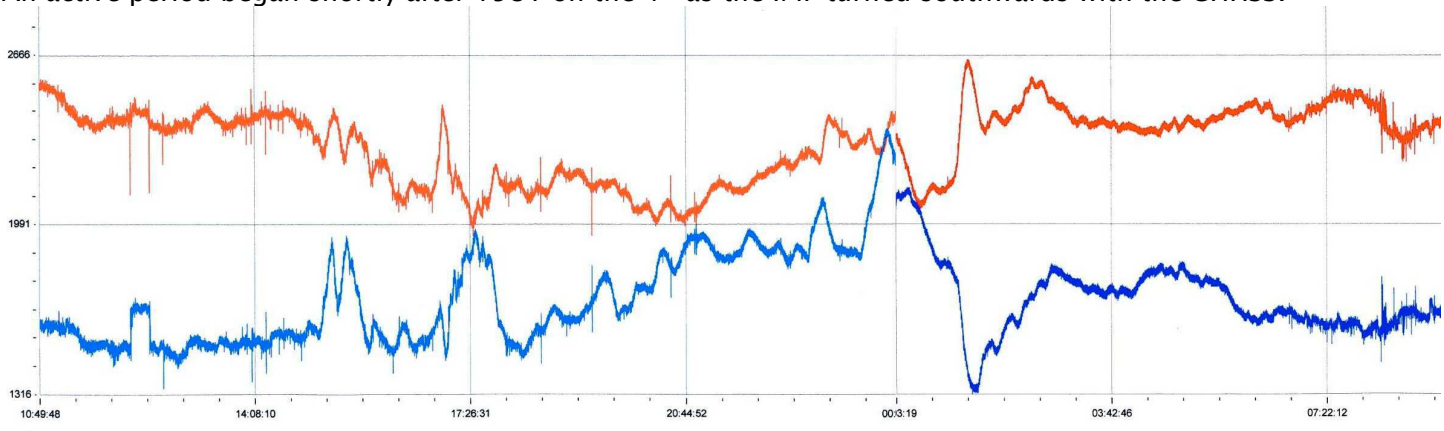
Solar observers are in for treat on March 20th with a Solar Eclipse. Greatest eclipse occurs over the sea between Iceland and the Hebrides, near the Faeroe islands 64° 25'N, 6° 34'W). Throughout the UK there will be a good partial eclipse ranging from 85% in the south-east to 95% in the north of Scotland and Northern Ireland. This also presents an excellent opportunity for radio observers to record the event. Even better, the radio monitoring can be going on while eclipse progress is being watched (weather permitting!) through an eclipse viewer or projected by telescope. Do remember to take care however, remembering that even a 95% eclipse is too bright to watch with the unprotected eye. If in doubt about solar observing safety, contact the Solar Section for advice. Full details of eclipse magnitude throughout the UK can be found in an article by John Mason at www.britastro.org/article_render/6232, as well as in the BAA 2015 handbook.

Our normal VLF monitoring techniques should produce some interesting curves during the eclipse as the D-region begins to return to night-time conditions and back to day-time after maximum eclipse. First contact is about 07:40UT, maximum at 09:45, and final contact about 11:50UT (from Fred Espenak's fifty year eclipse cannon). Sunrise at the point of greatest eclipse is 05:37UT. Great circle paths from the UK to NAA, maine (24kHz) and NRK, Keflavic (37.5kHz) pass close to the path of totality to the west of maximum eclipse and should show a very strong response to the eclipse. Paths to Skelton and Anthorn are entirely within the partial eclipse area, as is the easterly path at 23.4kHz (but note that its usual morning break occurs during the period of interest). From northern Italy the eclipse will be about 70%, and should still produce a noticeable change in the diurnal curve.

The activity level of the sun at eclipse time is unknown of course, but a comparison of charts from the days before and after the 20th should provide a good base from which to judge its effect. Each of us has a different path for the various signals, and so as many observations as possible would be welcome for this event.

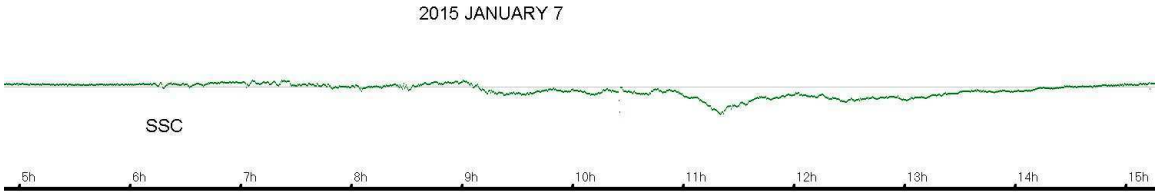
MAGNETIC OBSERVATIONS.

Despite the number of energetic flares in January, there were no CMEs recorded in satellite imagery. Most of the magnetic activity shown in the Bartels chart seems to be from coronal hole effects. A large coronal hole was present close to the Sun's south pole, extending over quite a large area early in the month. An active period began shortly after 15UT on the 4th as the IMF turned southwards with the CHHSS.



This chart from Colin Clements shows the 4th and 5th of January. There is some local interference mid-morning on the 4th, but the CHHSS is quite clear from 15:07UT. Calmer conditions return after 03UT on the 5th. My own recordings show a maximum disturbance of +70/-40nT over this period.

A sudden storm commencement (SSC) was recorded at 06:14UT on the 7th, followed by some fairly rapid variations in the magnetic field. Quiet conditions returned after 14:00, as shown in my recording:



The peak deviation is about 75nT in my horizontally mounted sensor. A Kp of 7 was recorded in the Boulder (USA) magnetometer, despite the strong CHHSS having already slowed down since the 4th / 5th disturbance. The source of the SSC was initially unclear, as no earth-directed CMEs had been seen in satellite data. The ACE sensors had not detected the usual CME shock, and only a very small wind speed increase was seen. The IMF had however turned strongly southwards. LASCO images did show a very weak diffuse CME directed well to the south east at around 07UT on the 3rd. SDO images at this time also showed a rapid change in the shape of the northern edge of the large coronal hole, indicating that some hidden event had occurred. It is suspected that the magnetic field from this event had become entangled with the existing CHHSS to produce the very rapid change in IMF orientation, but without the usual CME shock.

The above details are from the Solar-Terrestrial Centre of Excellence in Belgium. Their bulletin can be found at www.stce.be/newsletter/pdf/2015/STCEnews20150116.pdf. My thanks to Roberto Battaiola for directing me to this information. It is well worth reading.

Short periods of minor disturbance from the CHHSS were also recorded in mid-January. The disturbance increased in strength again mid-afternoon on the 21st, lasting through most of the 22nd. Further short periods of activity were recorded on the 29th and 30th, also from CHHSS effects, as the southern polar coronal hole was joined by another in the northern hemisphere.

Magnetic observations received from Colin Clements, Gonzalo Vargas, Roger Blackwell and John Cook.

BARTELS CHART.