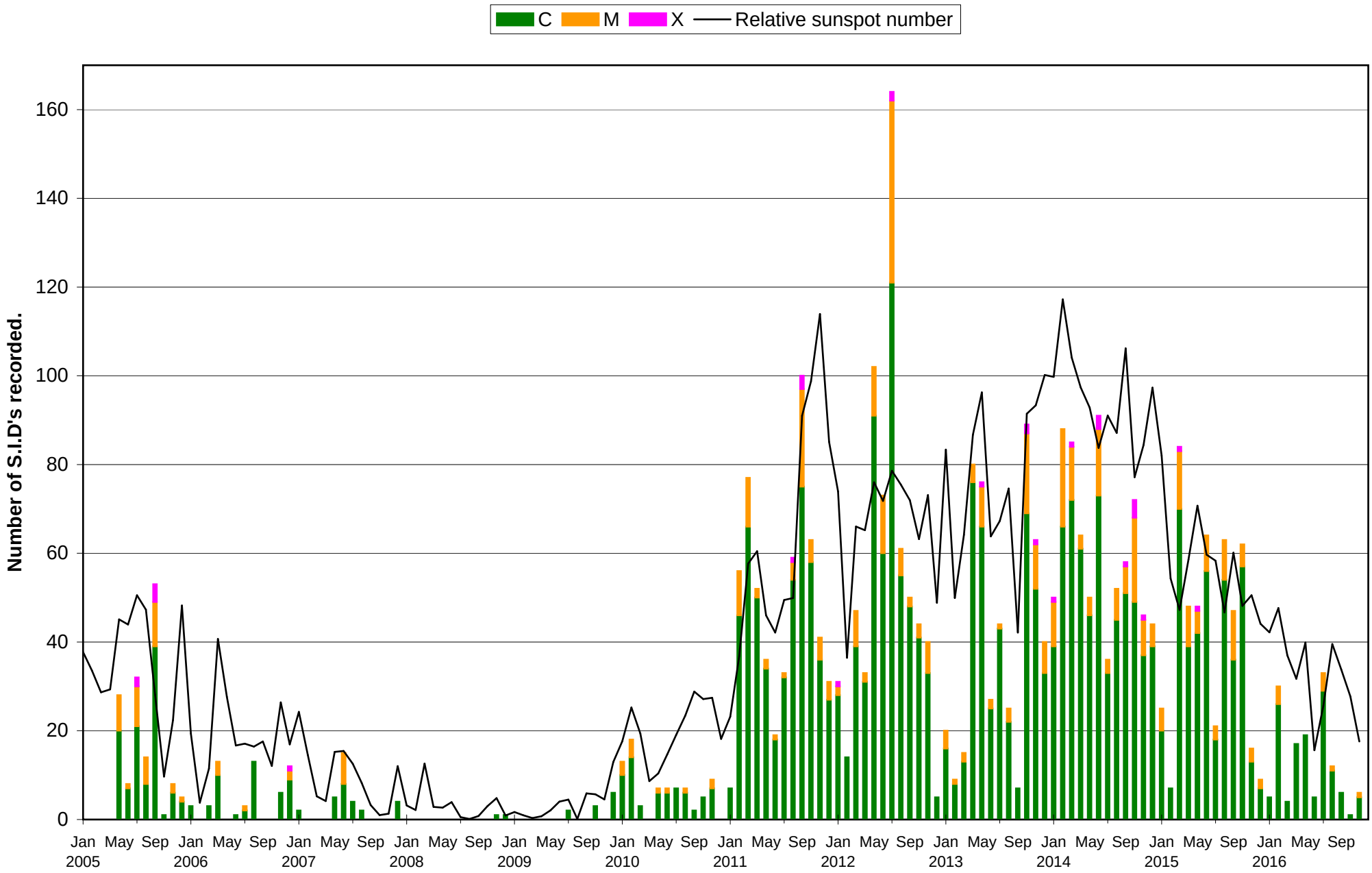
BAA Radio Astronomy Group. **2016 NOVEMBER**

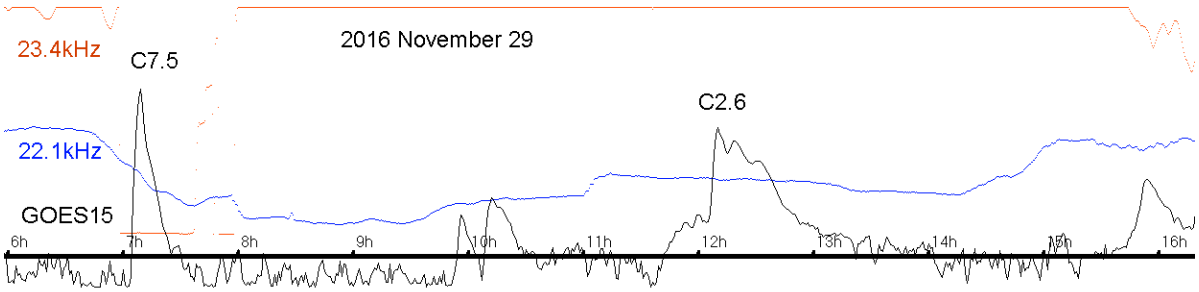
	Xray class	Observers	John Cook (22.1kHz)				Roberto Battaiola (21.75kHz)				Paul Hyde (22.1kHz)				Mark Edwards (24.0kHz)				Colin Clements (23.4kHz/*22.1kHz*)			
			Tuned radio frequency receiver, 0.58m frame aerial.				Modified AAVSO receiver.				Spectrum Lab / PC 1.5m frame aerial.				Spectrum Lab / PC 2m loop aerial.				AAVSO receiver, 0.76m screened loop aerial.			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
28	C1.4	1	08:00	08:08	08:19	1																
29	C7.5	1	07:09	07:17	07:24	1-																
29	C2.6	5	12:08	12:12	12:28	1	12:07	12:14	12:16	1-	12:08	12:14	12:54	2+	12:09	12:12	?	-	12:10	12:17	12:19	1-
29	?	1													12:17	12:22	12:30	1-				
29	**M1.0**	1									17:22	17:26	?	-								
30	C1.0	1									15:06	15:08	15:16	1-								
30	C2.3	2									15:24	15:26	15:38	1-	15:25	15:26	15:30	1-				

	Xray class		Steve Parkinson (Various)			John Wardle (19.6/23.4kHz)			Phil Rourke (23.4kHz)			Jim Barber			John Elliott (18.3kHz)		
			Tuned radio frequency receiver, frame aerials.			PC soundcard, 0.7m frame aerial.			Spectrum Lab, 0.6m frame aerial.			Spectrum Lab, 0.6m frame aerial.			Tuned radio frequency receiver, 0.5m frame aerial.		
DAY			START	PEAK	END (UT)	START	PEAK	END (UT)	START	PEAK	END (UT)	START	PEAK	END (UT)	START	PEAK	END (UT)
28	C1.4																
29	C7.5																
29	C2.6																
29	?																
29	**M1.0**																
30	C1.0																
30	C2.3																

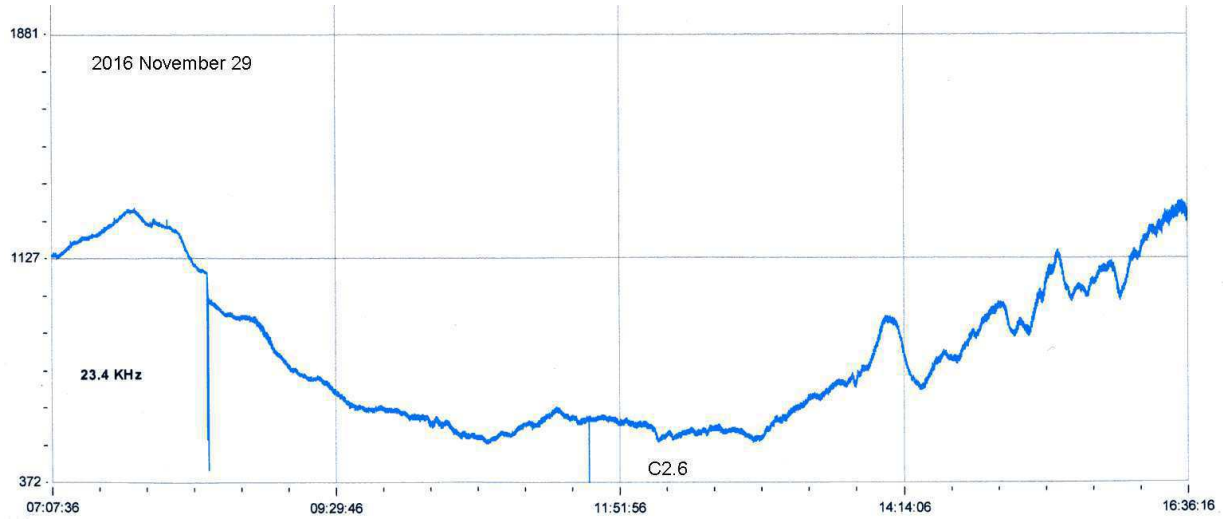

VLF flare activity 2005/16.
C
M
X
Relative sunspot number
Number of S.I.D's recorded.
0
20
40
60
80
100
120
140
160
Jan 2005
May
Sep
Jan 2006
May
Sep
Jan 2007
May
Sep
Jan 2008
May
Sep
Jan 2009
May
Sep
Jan 2010
May
Sep
Jan 2011
May
Sep
Jan 2012
May
Sep
Jan 2013
May
Sep
Jan 2014
May
Sep
Jan 2015
May
Sep
Jan 2016
May
Sep

BAA Radio Astronomy Group. **2016 NOVEMBER.**

GOES15 data shows that the background X-ray flux remained at A8 to B1 levels from the start of November right up until the 28th when active region AR12615 began flaring. A number of its flares were during the night and so not recorded as SIDs. This included the most energetic in the GOES data, an M1.2 flare at 23:38UT on the 29th. We did capture the earlier M1.0 flare though, recorded by Paul Hyde on the 24kHz trans-Atlantic path. I was quite surprised to find SIDs from smaller early morning flares on the 28th and 29th. Unfortunately the 23.4kHz signal was taking its usual morning break at the time, but they are just visible at 22.1kHz.

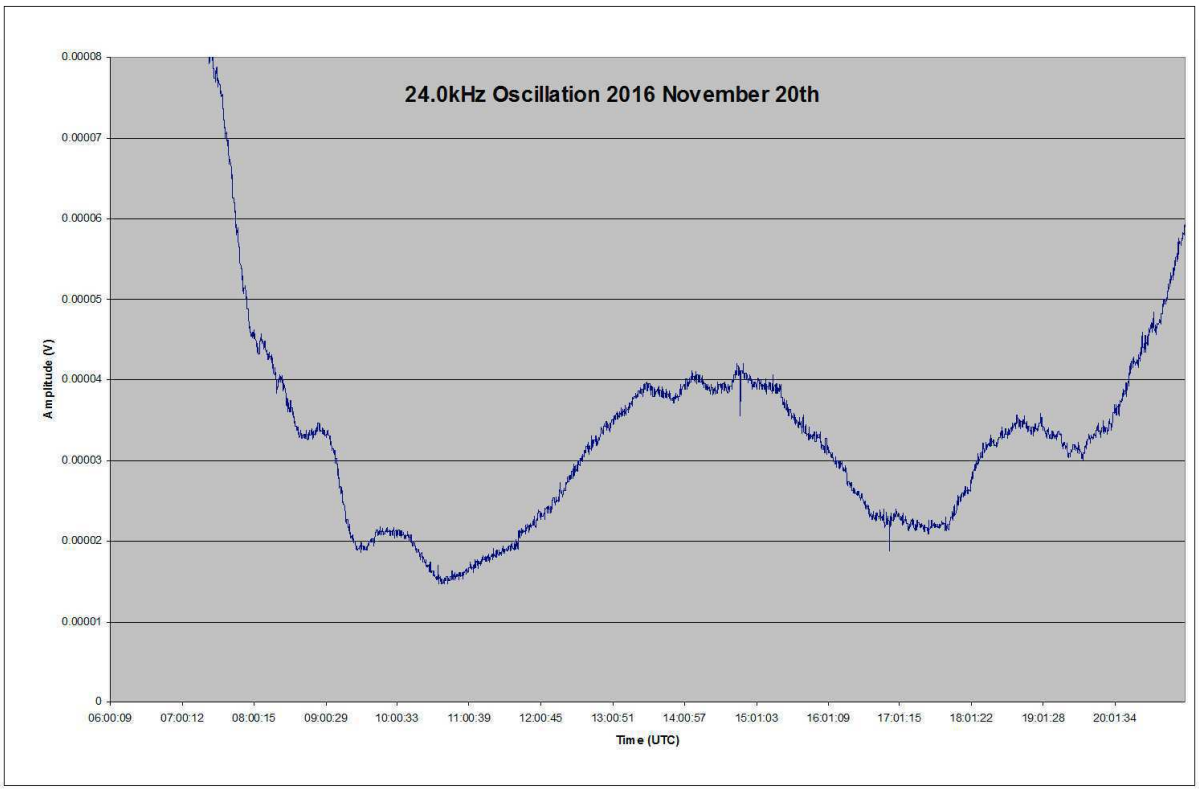


This is my recording from the 29th, showing a distinct dip in the sunrise curve at 22.1kHz matching the C7.5 flare. The later C2.6 flare has left a very small SID, despite being much better timed near midday. The 23.4kHz signal has saturated the receiver, and so shows no details. Colin Clements had a better response at 23.4kHz, shown below, although the SID is well disguised by the general noise on the signal.



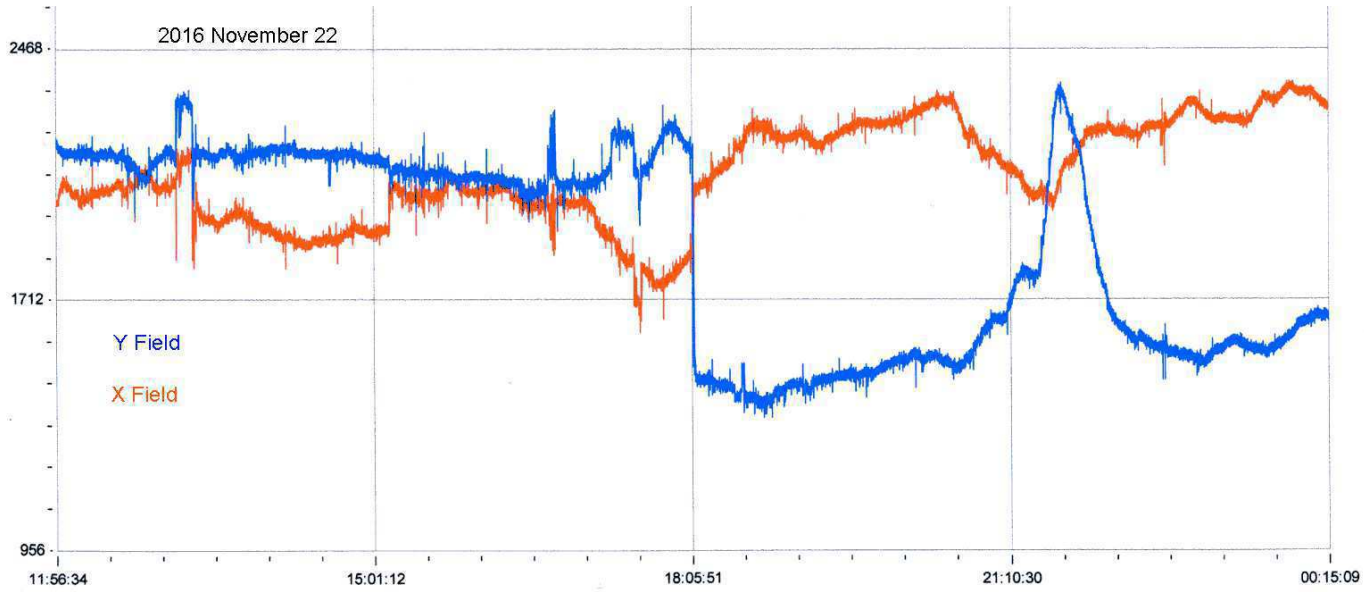
I have found signal levels in general to be very variable this month, with no obvious X-ray source. A gentle rise at 11UT on the 22.1kHz signal can be seen in my recording from the 29th. Similar effects have been seen on several occasions, while the 23.4kHz signal level has been consistently high. Colin noted some mild oscillations particularly on the 21st on both 22.1 and 23.4kHz. Steve Parkinson noted an unusual shape to the diurnal curves at 19.6 and 22.1kHz on the 26th and 27th.

Mark Edwards recorded slow oscillations at 24kHz between 13:15 and 15:00UT on the 20th, period about 30 minutes. There is nothing in either the X-ray or magnetic data over this period, and while the more local signals have suffered significant fluctuations for most of the month the longer 24khz path is usually much more stable. It may be a result of gravity waves in the ionosphere set off by movement of the jet stream. See chart on the next page:

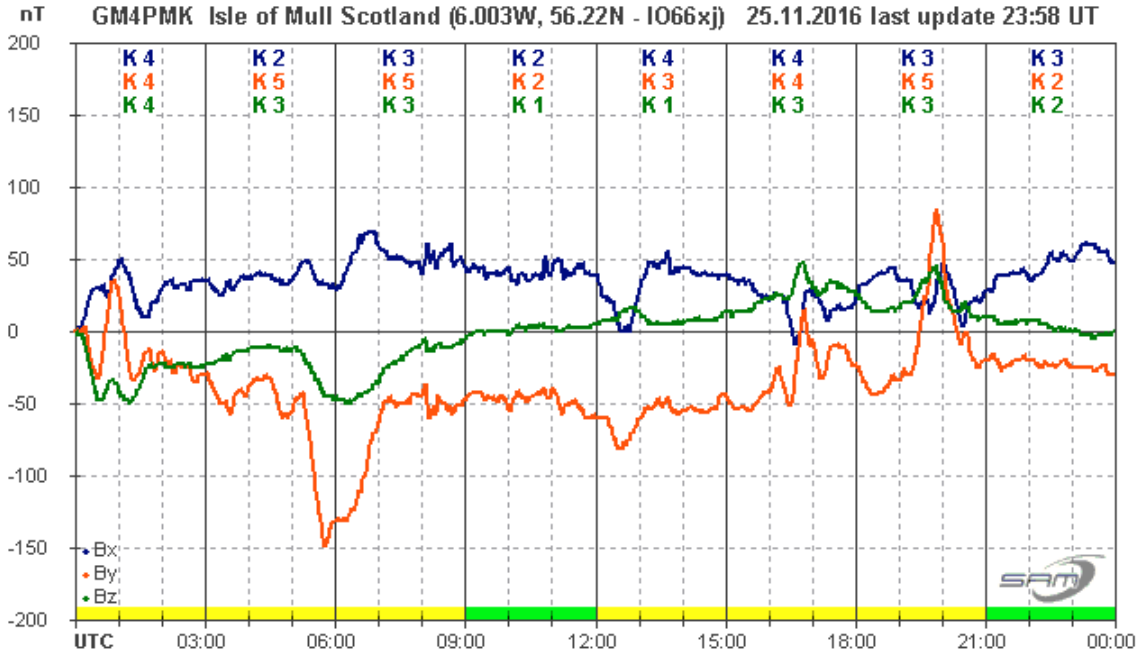


MAGNETIC OBSERVATIONS.

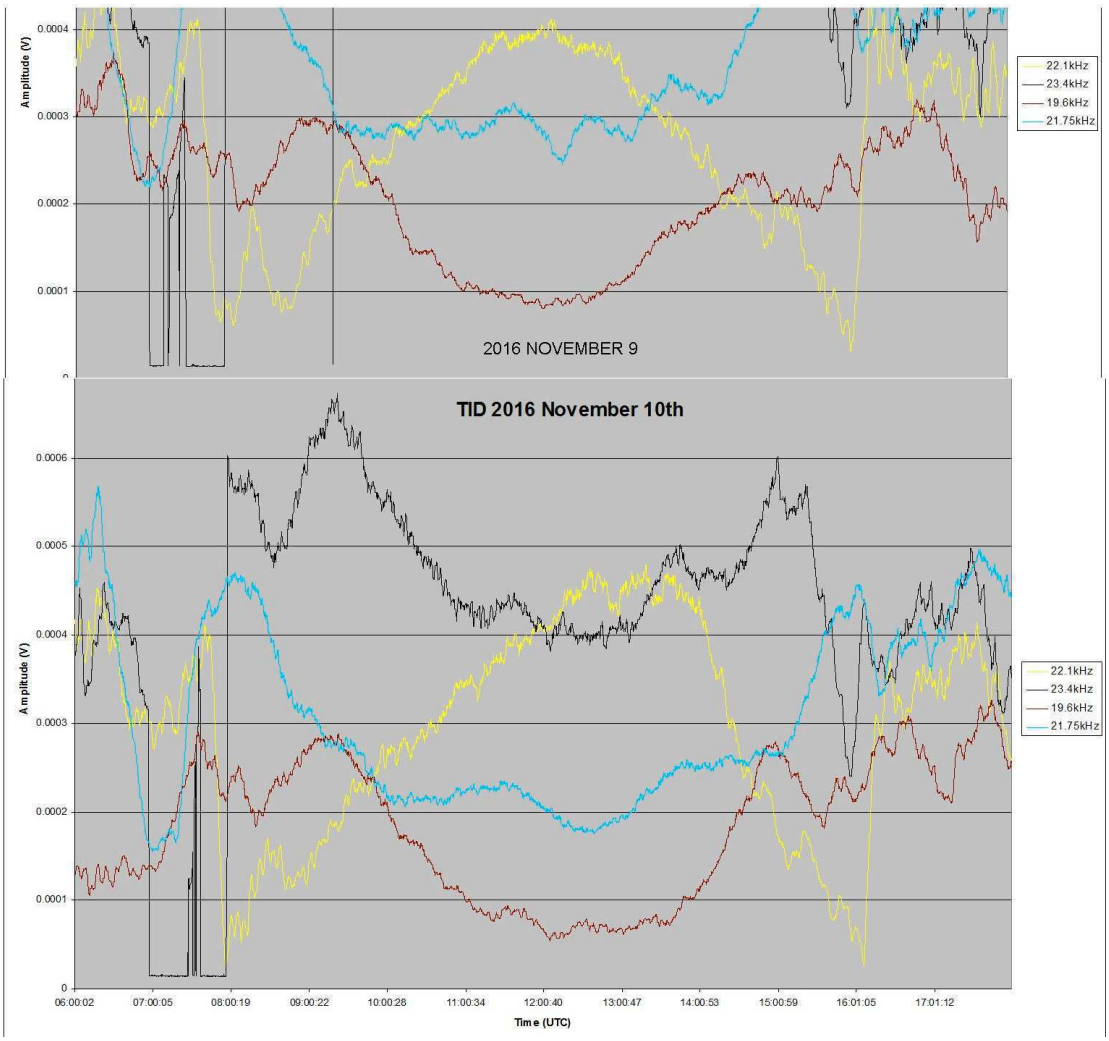
The large coronal hole that has been a major feature over recent months has again been present, although now much reduced in size. The CHHSS on the 22nd is shown in this recording by Colin Clements:



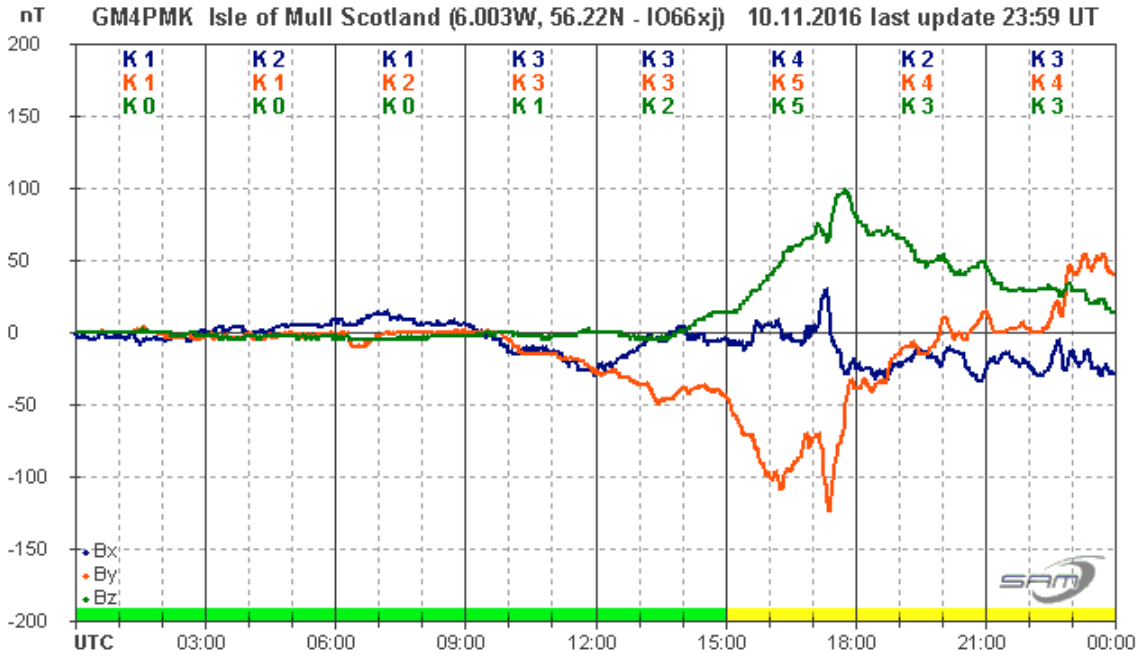
There is a large local disturbance at 18:00, but the CHHSS is very clear from 20:30UT to the end of the recording. It lasted until about 03:30 in the morning of the 23rd, with some further minor disturbances overnight and through the 24th. The storm increased on the 25th , shown in the Recording by Roger Blackwell:



A filament eruption seen in satellite images on November 5th caused magnetic disturbances on the 9th and 10th. This seems to have had an effect at VLF as shown in Mark Edwards recordings:

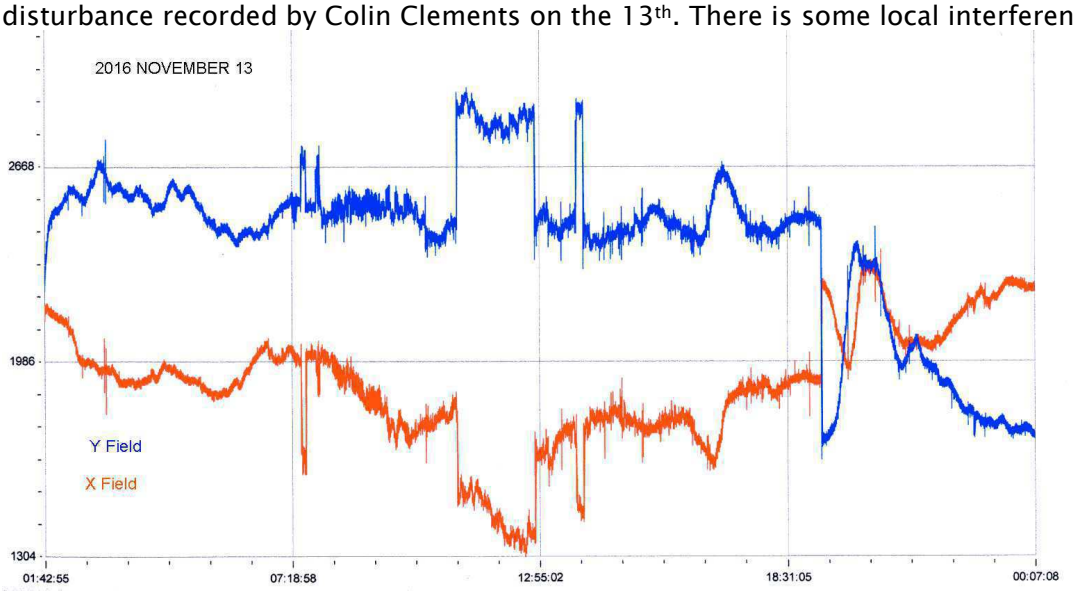


The top panel shows the 9th, with a symmetrical diurnal curve at 22.1kHz (yellow). The 21.75kHz signal (blue) is quite noisy with random variations. The lower panel is from the 10th, and shows a very non-symmetrical curve at 22.1kHz, the signal level remaining high from 12UT until 14UT before falling rapidly towards sunset. While 21.75kHz is generally less noisy than on the 9th, it does show a strong depression from about 11:30 to 13:30UT. Roger blackwell's magnetic recording from the 10th is shown below:



This shows the magnetic disturbance building from 11UT to its peak at 17-18UT, after local sunset. The SOHO solar wind monitor recorded a jump in wind density at the same time, with a change in direction to southward-pointing making it far more effective. These magnetic changes are much slower than ones that we have previously seen connected to VLF disturbances, so the connection may be coincidental or genuine….

A large southern hemisphere hole was present through the middle of the month, with a strong disturbance recorded by Colin Clements on the 13th. There is some local interference around 11 to 13UT.



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

BAA Radio Astronomy Group

BARTELS DIAGRAM

ROTATION	KEY:	DISTURBED.	ACTIVE	SFE	B, C, M, X = FLARE MAGNITUDE.	Synodic rotation start (carrington's).

2460

	19	20	2144 21	22	23	24	25	26	27	28	29	30	2013 December 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F	X	CC	M	C	CCM	CC							C	C			C	C		C	CCC		CC	C		CC	CC

2461

	16	17	18	2145 19	20	21	22	23	24	25	26	27	28	29	30	31	2014 January 1	2	3	4	5	6	7	8	9	10	11
F	C			C	CMCC	C	MMMM	M		C		CC	CC	MCCC	C	C	C	C	CCMC	CCMC	C	C	CMCX	CCCC			CCC

2462

	12	13	14	2146 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2014 February 1	2	3	4	5	6	7
F		CC	C		C	CCCC	CC								C	C	MMMM	CCC	MCC		CCCC	MMMM	CCCC	MCCM	CCCM	CCC	CCMC

2463

	8	9	10	11	2147 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	2014 March 1	2	3	4	5	6
F	CCC	M	CC	CM	CM	MCCM	CMMM		MCC	CCC	CC	C	M	CC	C	CC	MMC	C	CCM	CCCC	CCC	MC	CCC	CCCM	CCCC	C	

2464

	7	8	9	10	2148 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2014 April 1	2
F			CCMM	CCCM	CMCC	CMC	CCM	C	CCC	CC	CCC	C	CCCC	CC	C	MCC	CC	CC		CC		CM	CCCX	M	MC		CCM

2465

	3	4	5	6	2149 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
F	CC	CCC	CCC		CC			C	CCC	C	C	CCCC	CCCC	CCCM	CC	CM	CCCC	CCCC	C	CCCC	CCCC	C	CC	C		BC	B

2466

	30	2014 May 1	2	3	4	2150 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
F	B		CCC	CCCC	CCCC	C	MCC	CMC	M	CCCC	CCC	CCCC		C	CCC	C	CCC				B	C	C		M	C	CCC

2467

	27	28	29	30	31	2014 June 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
F	C				B	C	M	CCM				CC	CC	CCC	CCXX	MMXC	MMMM	MCCC	CCM	CMCC	CCCC	CBCC	CC	C	CC	C	B

2468

	23	24	25	26	27	28	29	30	2014 July 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
F		BBB				CCCC	CCCC	CC	CCCM	C		C		CC	CC	CM	C	CC		CCC	CCCC						

2469

	20	21	22	23	24	25	26	27	28	29	30	31	2014 August 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F		B				C	CCCB	CC		CC	CC	CMCC	CMM	CC	C		CCC			CCCC	C							CC

2470

	16	17	18	19	20	21	2154 22	23	24	25	26	27	28	29	30	31	2014 September 1	2	3	4	5	6	7	8	9	10	11
F	C		C		CCCC	CMCC	MCCC	CCCC	CMC	MM	C		CB	C	CCB	CCCC	CC	CC	CCM	CCCC	CC	CCMC	CCC	C	C	CCX	CCM

2471

	12	13	14	15	16	17	2155 18	19	20	21	22	23	24	25	26	27	28	29	30	2014 October 1	2	3	4	5	6	7	8
F	CCCC	CC			CC		CMC	C	CC	CCC			CC	C	CCC	M	CCMM	C			MM	CCC					C

2472

	9	10	11	12	13	14	2156 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2014 November 1	2	3	4
F	MCCC							CCM	CC	MCCC	CCCC	MCMM	CCCM	CCXM	MCC	MCC	CCCX	XCCM	CCMX	CCM	MMMM	CCCC		CCCC		M	MM

2473

	5	6	7	8	9	10	2157 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1
F	MC	C	MCCX		CCM	CC	C	C	C	CC	M	CCCM	C					C	C	C			CCC	C	CCCC	CC	

2474

	2014 December 2	3	4	5	6	7	8	2158 9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
F	CCC	CCCC	MCM	CCM	C			CCCC		C	C	CCC	CC		CCC	CC	CCC	MC	C	M	C			C	C		C

2475

	29	30	31	2015 January 1	2	3	4	2159 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
F	C		C			M	M	C	C	CC	C	C	C			CC	C	CM	CC					CCC		CC	

2476

	25	26	27	28	29	30	31	2015 February 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
F			CC	C	MC	M		C		CC	C																C

2477

	21	22	23	24	25	26	27	28	2015 March 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
F								CC	C	CMCCM	CC	CC	CM	MCCC		C	CCMC	CCCC	MMCX	CMMM	C	CCCC	MCCC	CCMC		CCCC	C

2478

	20	21	22	23	24	25	26	27	2162 28	29	30	31	2015 April 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F				C		CC	CC	CCC	CC	CCCC	CC									M	CCCC	CCCC	C	CMCC	CCC		C

2479

	16	17	18	19	20	21	22	23	2163 24	25	26	27	28	29	30	2015 May 1	2	3	4	5	6	7	8	9	10	11	12
F	CCCC	C	CCC			MMMM	CCMC	CMCC	C	C	C							C	CCC	MMMX	CCMC	CCCC	CC	CC	CCC		CC

2480

	13	14	15	16	17	18	19	20	21	2164 22	23	24	25	26	27	28	29	30	31	2015June 1	2	3	4	5	6	7	8
F	CCCC	CCCC			B		C	C		CCM	CC										C		CC	CC		CC	

2481

	9	10	11	12	13	14	15	16	17	2165 18	19	20	21	22	23	24	25	26	27	28	29	30	2015 July 1	2	3	4	5
F		CCC	CMCC	CC	MCCC	C	CC	CC	CC	CCM	CCCC	MC	MCCM	CCCM	C	C	M			C	CCCC	C		C	CCCM		

2482

	6	7	8	9	10	11	12	13	14	2166 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1
F	MCCM	C			C				C				C						CC		C						C

2483

	2015 August 2	3	4	5	6	7	8	9	10	11	2167 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
F					C	CBCC	CC	C						C						CC	MCM	MCCC	CCCC	MCCM	CCCC	CC	M	CMCM

2484

	29	30	31	2015 September 1	2	3	4	5	6	2168 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
F	CCC	CC				C													CC	CMCC	C	C	CCM			CCC	

2485

	25	26	27	28	29	30	2015 October 1	2	3	2169 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
F		C	CMCC	MCMM	MMCM	CMCM	CCM	CCMM	CCCC										CC	CC	CCCC	MCCC	CCCC		CCC	C	CCC

2486

	22	23	24	25	26	27	28	29	30	31	2015 November 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
F					C		C	CC	CCCC	CCCM	CCCC	CCCC		CMM					M	CC								

2487

	18	19	20	21	22	23	24	25	26	27	28	29	30	2171 1	2015 December 2	3	4	5	6	7	8	9	10	11	12	13	14
F				C														C					C		CC		

2488

	15	16	17	18	19	20	21	22	23	24	25	2172 26	27	28	29	30	31	2016 January 1	2	3	4	5	6	7	8	9	10
F							M	C							M	C							C				

2489

	11	12	13	14	15	16	17	18	19	20	21	2173 22	23	24	25	26	27	28	29	30	31	2016 February 1	2	3	4	5	6
F					C												C	C	C				C	CC	CCC		

2490

	7	8	9	10	11	12	13	14	15	16	17	2174 18	19	20	21	22	23	24	25	26	27	28	29	2016 March 1	2	3	4
F	C			C		MC	CMCM		CMCC	CC	CCCC		C					C	C								

2491

	5	6	7	8	9	10	11	12	13	14	15	2175 16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
F				CB	C						CC										B		BB				

2492

	2016 April 1	2	3	4	5	6	7	8	9	10	11	12	2176 13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
F						CC	CBCB	BC	CC			B	C		CC	BC	C	BC		BB						BC	

2493

	28	29	30	2016 May 1	2	3	4	5	6	7	8	9	2177 10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
F	CCC		C	C	C		C			C							CCCB	CCBC	C					BC	B		BBC

2494

	25	26	27	28	29	30	31	2016 June 1	2	3	4	5	2178 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
F		CC	CC													BCC		B	C	C						C	

2495

	21	22	23	24	25	26	27	28	29	30	2016 July 1	2	2179 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
F																	C		C						C	CCCB	C

2496

	18	19	20	21	22	23	24	25	26	27	28	29	30	2180 31	2016 August 1	2	3	4	5	6	7	8	9	10	11	12	13
F	C	C		CBCB	CCC	MMCC	MBCM	C	BB										C		CCMC	CCCC	C	B	C		

2497

	14	15	16	17	18	19	20	21	22	23	24	25	26	2181 27	28	29	30	31	2016 September 1	2	3	4	5	6	7	8	9
F	C																								B		

2498

	10	11	12	13	14	15	16	17	18	19	20	21	22	2182 23	24	25	26	27	28	29	30	2016 October 1	2	3	4	5	6
F												CCB	CCCC														

2499

	7	8	9	10	11	12	13	14	15	16	17	18	19	2183 20	21	22	23	24	25	26	27	28	29	30	31	2016 November 1	2
F						C		B		B																	

2500

	3	4	5	6	7	8	9	10	11	12	13	14	15	16	2184 17	18	19	20	21	22	23	24	25	26	27	28	29
F																										C	CCM

2501

	2016 December 30	1	2	3	4	5	6	7	8	9	10	11	12	13	2185 14	15	16	17	18	19	20	21	22	23	24	25	26
F	CC																										