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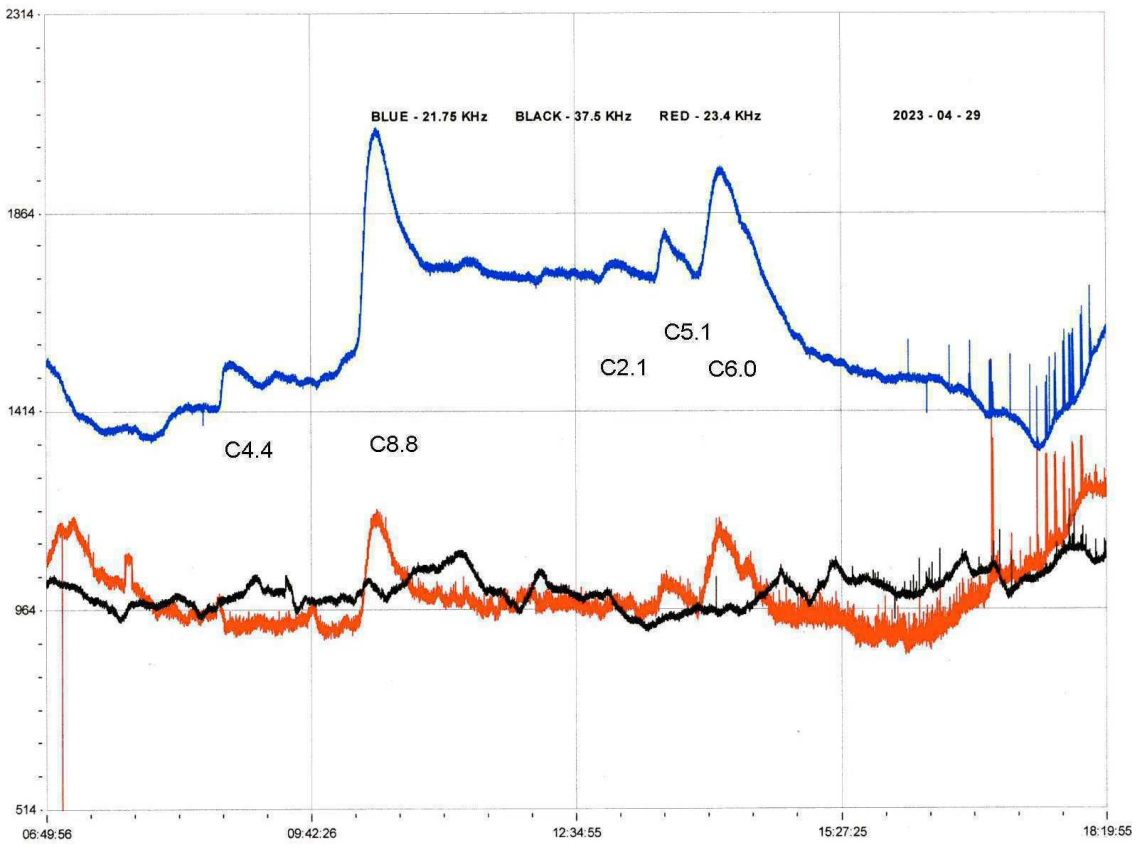
BAA Radio Astronomy Section. Director Paul Hearn.

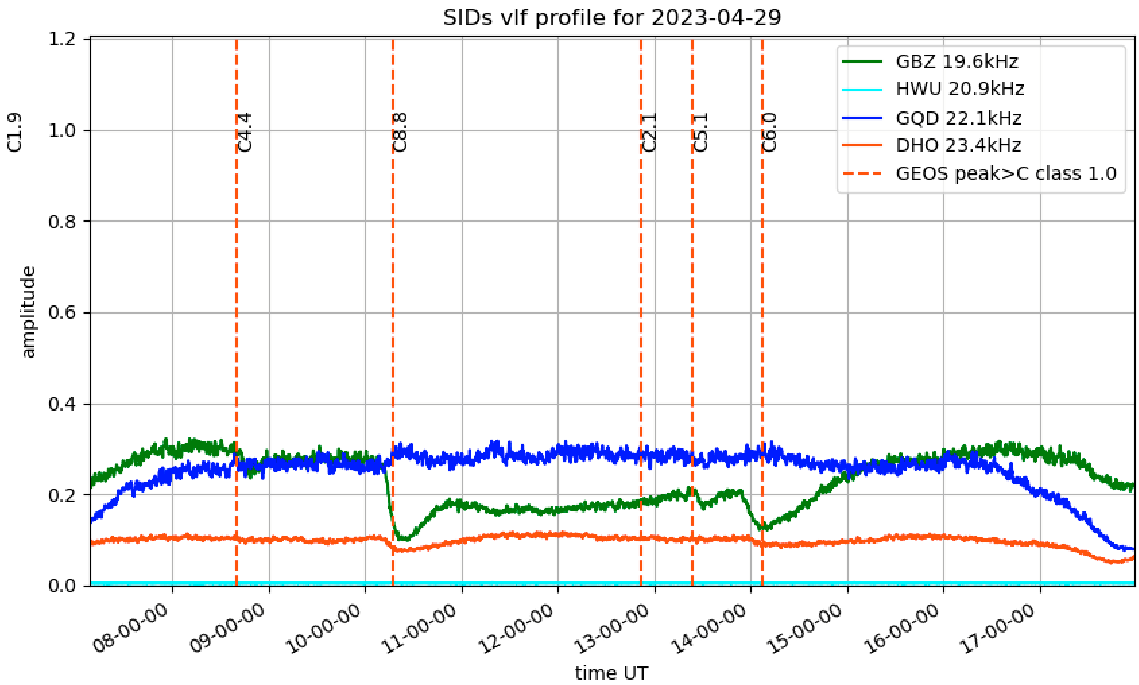
RADIO SKY NEWS 2023 APRIL.

VLF SID OBSERVATIONS.

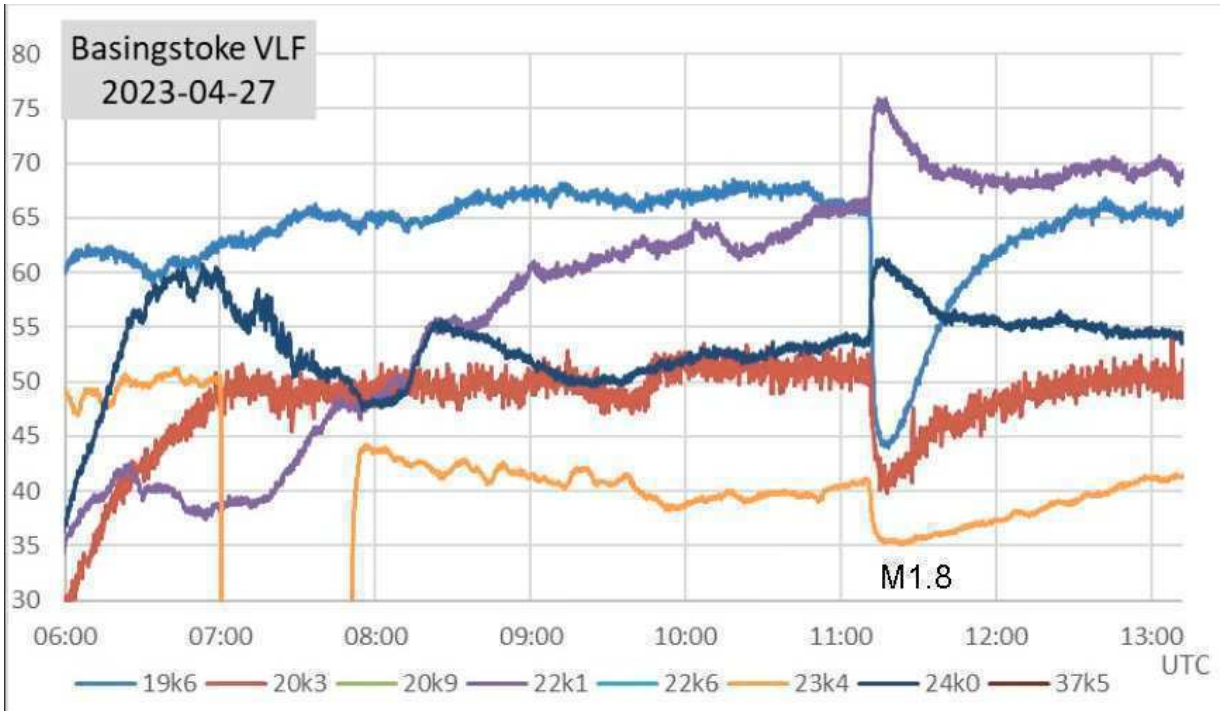
Solar flaring activity in April was at a similar level to last month, with 65 C-class and 7 M-class flares. There were no X-class flares, the strongest recorded being M3.0 peaking at 05:44UT on the 6th. This was quite early for most of our signals. 23.4kHz has again been unreliable, with many breaks in the signal.



This recording by Colin Clements shows activity on the 29th, with a rather unusual response at 21.75kHz (blue). The C8.8 flare was the largest of the day, but the signal seems to have remained at a high level until the C6.0 flare faded away, a period of over four hours. 37.5kHz (black) has remained very unstable throughout the day.

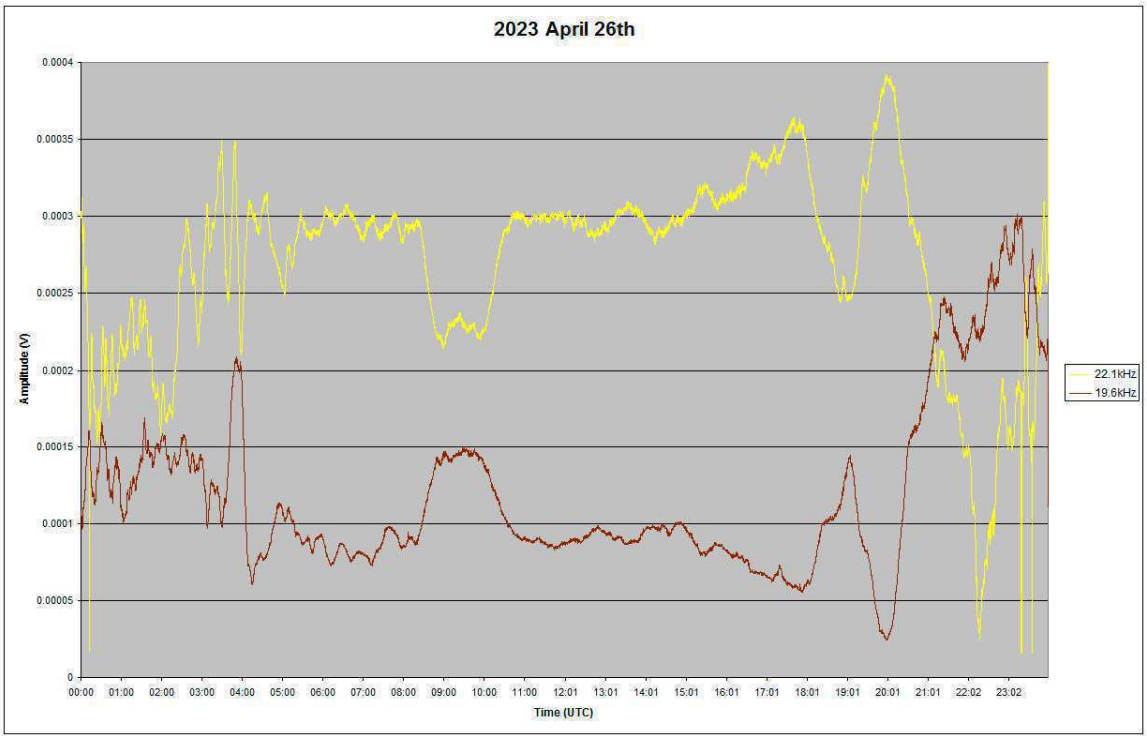


This recording by Mark Prescott does not include these signals, but does show the very weak response at 23.4kHz. 19.6kHz shows clear SIDs for the two larger flares, while 22.1kHz barely shows any effects at all.

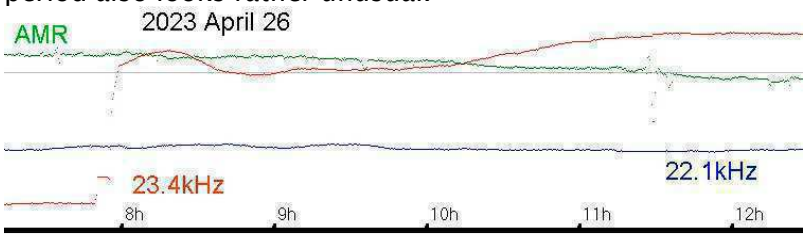


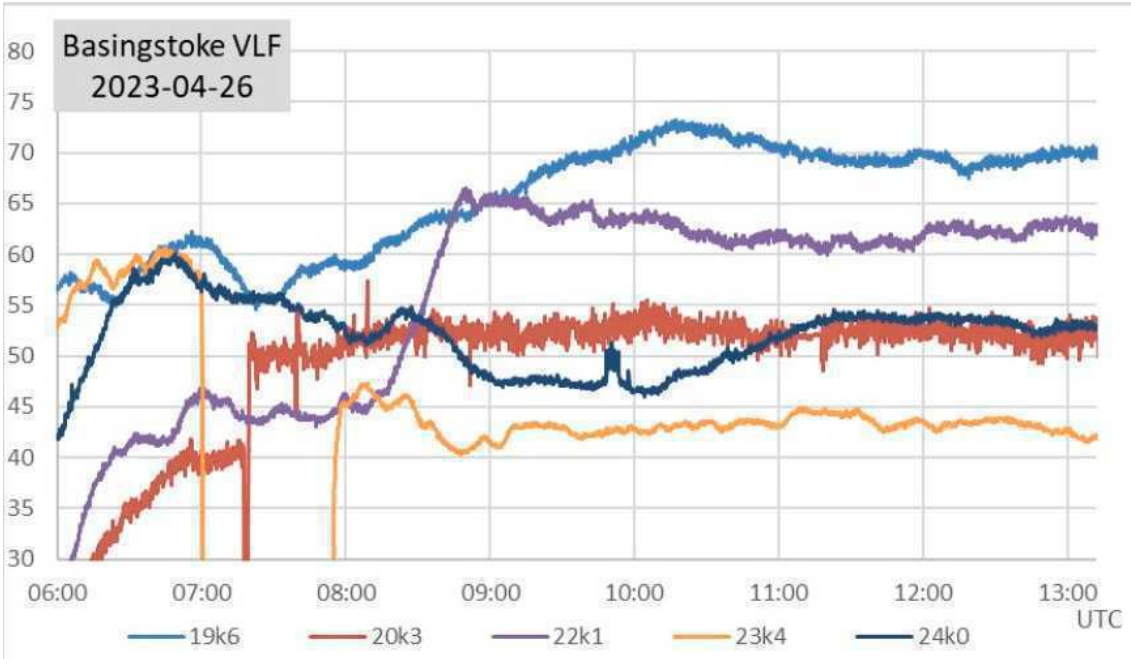
The M1.8 flare peaking at about 11:17UT on the 27th shows well in this recording by Paul Hyde, with a combination of normal and inverted SIDs. The path lengths at 19.6kHz and 22.1kHz only differ by about 27km on a very similar bearing, but enough to produce inverted responses.

There was just a single C2.5 SID recorded on the 26th, peaking at 14:23UT. This was the only classified flare shown in the GOES satellite data. We did however record some strange effects during the morning, shown in the recording by Mark Edwards:



The C2.5 flare is hardly visible in the recording, but the matching pair of 'bumps' from 08:30 to 10:30 are very clear. The matching symmetrical nature suggests that it was not a transmitter effect. The sunrise period also looks rather unusual.

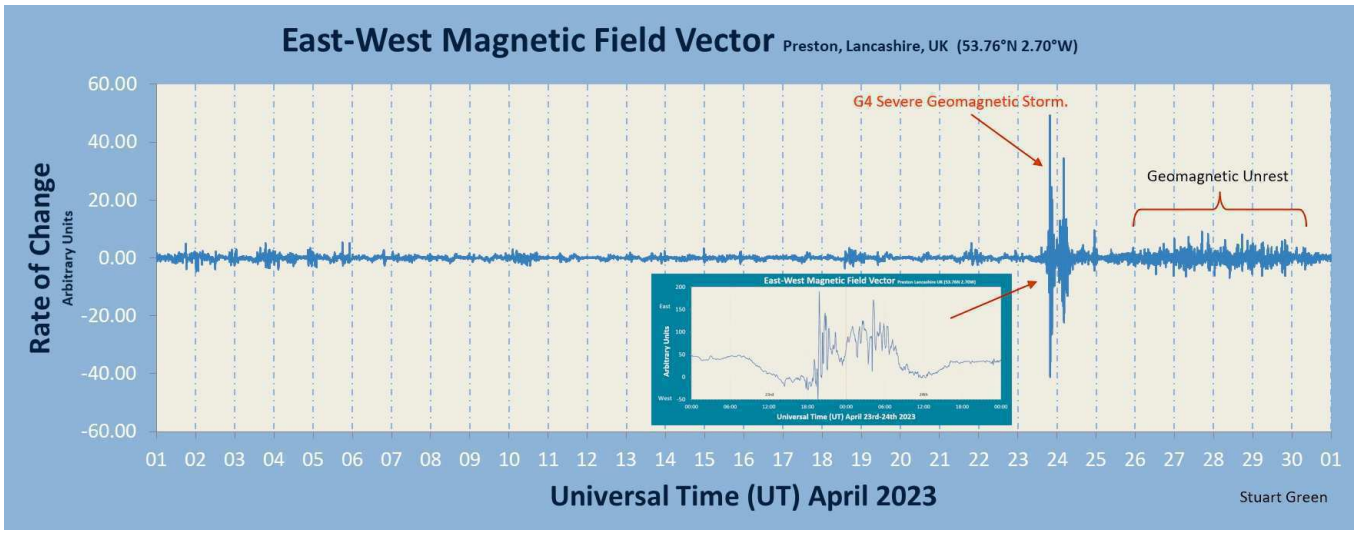




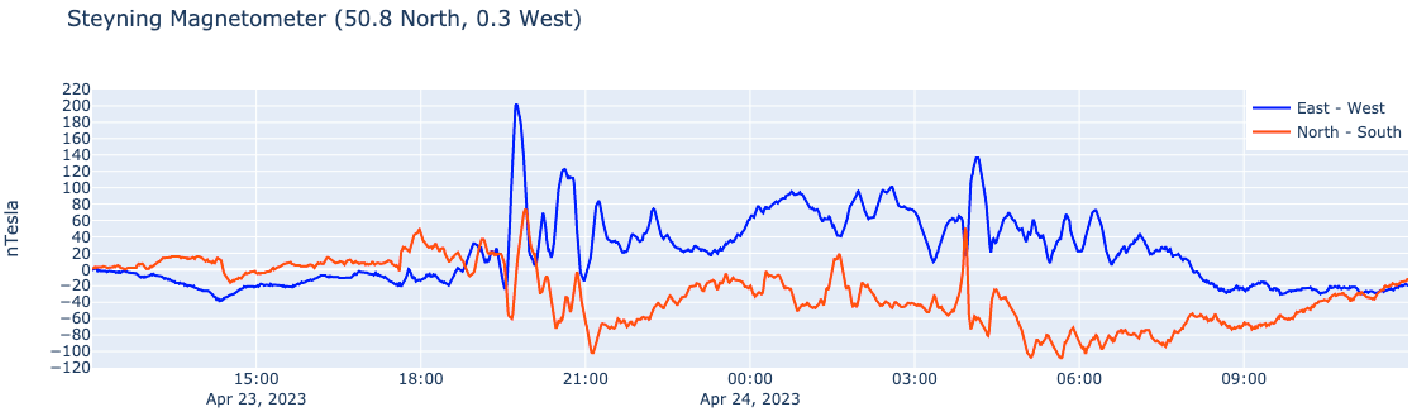
My own recording includes the magnetic signal (AMR), with no disturbance. The pulse at 11:30 is local traffic interference. The chart from Paul Hyde includes other signals, with a similar response at 24kHz. The other

signals being much less clear. The 23.4kHz signal in my own recording has a small downwards bump matching in time, with a much smaller response at 22.1kHz. The source of this effect remains unknown, but was presumably some weather-related effect on the lower ionosphere.

MAGNETIC OBSERVATIONS.

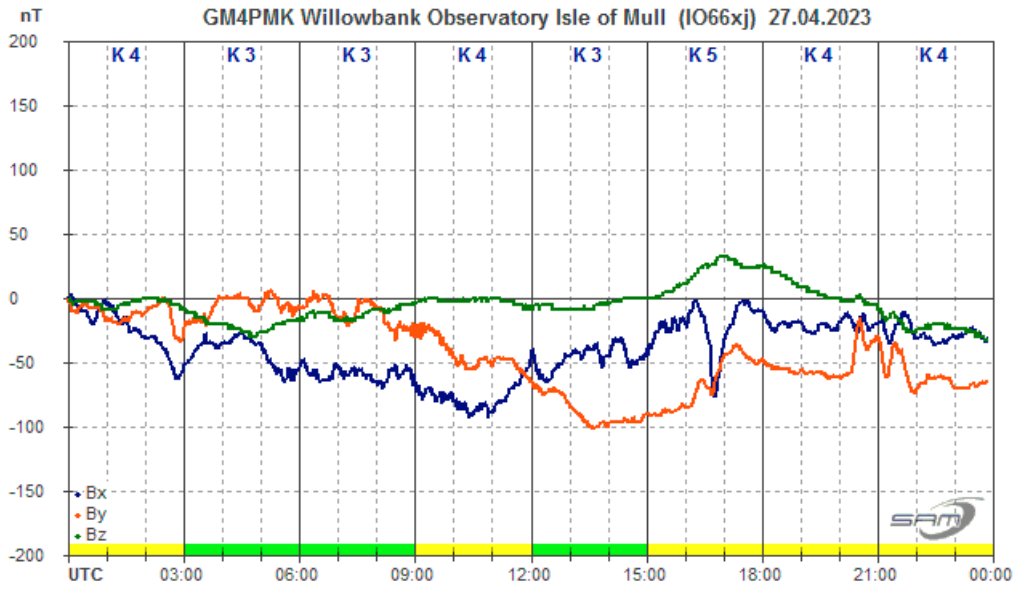


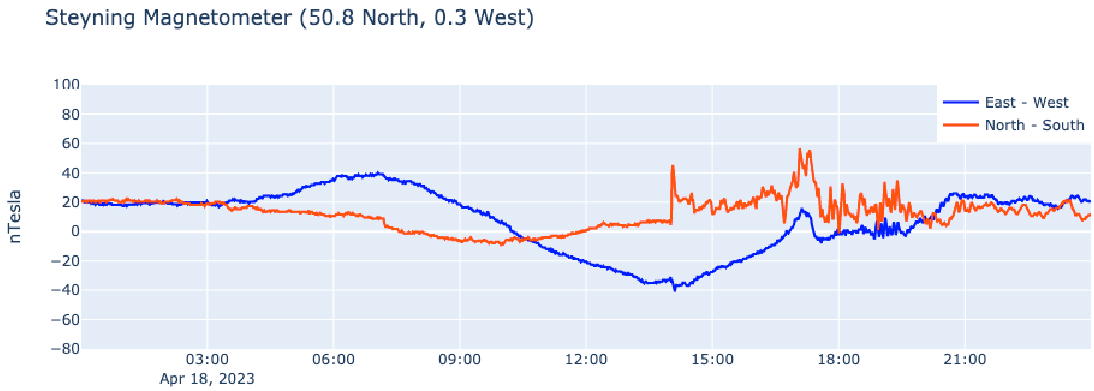
Stuart Green's monthly summary chart shows just a single major disturbance on the 23rd / 24th, following a very calm start to April. The STCE bulletin links this to a CME arrival from the M1.7 flare on the 21st. The SWPC list AR13283 as generating the flare, located near the central meridian of the sun at the time. Paul Hyde's recording gives a peak time of 18:10UT for the SID.



Nick Quinn's magnetic recording shows the very strong disturbance through the evening of the 23rd and into the 24th. The exact impact arrival time is not entirely clear, possibly being at 17:45, other recordings also showing this timing. That gives a CME transit time of about 48 hours, making it the 6th fastest that we have recorded. The fastest was 34h 41m in 2012 March. The peak magnitude of the disturbance is also the highest that I can remember, Roger Blackwell's Mull magnetometer showing +300/-200nT through the night. Aurora were widely reported, even on the local weather forecasts, but sadly nothing visible here. No doubt the Aurora section will have more on that later.

Mild magnetic disturbances continued through to the end of the month, with a number of minor CMEs combining. Roger Blackwell's recording from the 27th is a good sample:

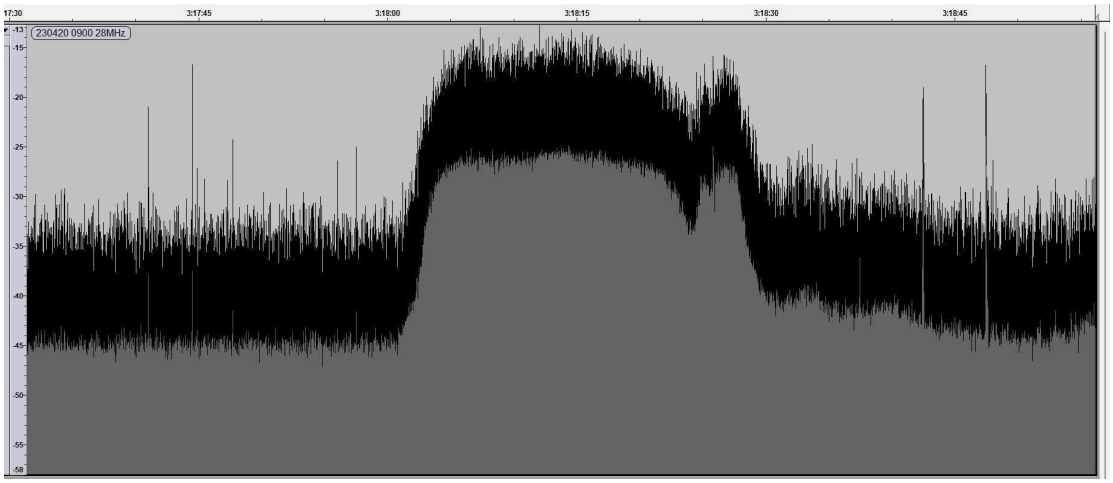




Nick Quinn's recording from the 18th appears to show a shock at about 14:00UT, followed by some rapid turbulence. The source of this is not known, but it does look real and not some local interference.

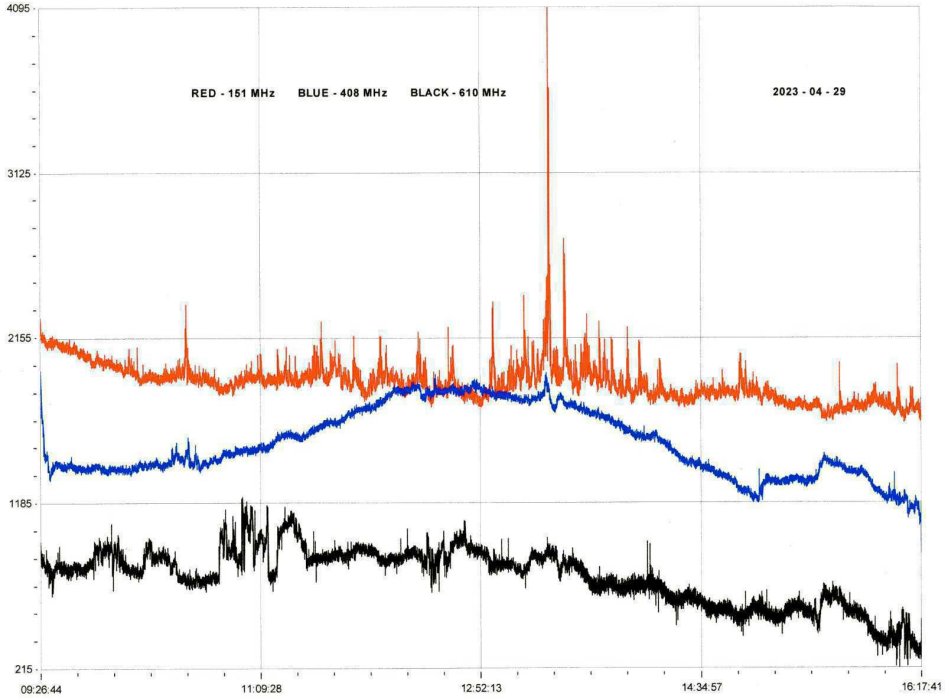
Magnetic observations received from Roger Blackwell, Colin Clements, Stuart Green, Nick Quinn and John Cook.

SOLAR EMISSIONS.

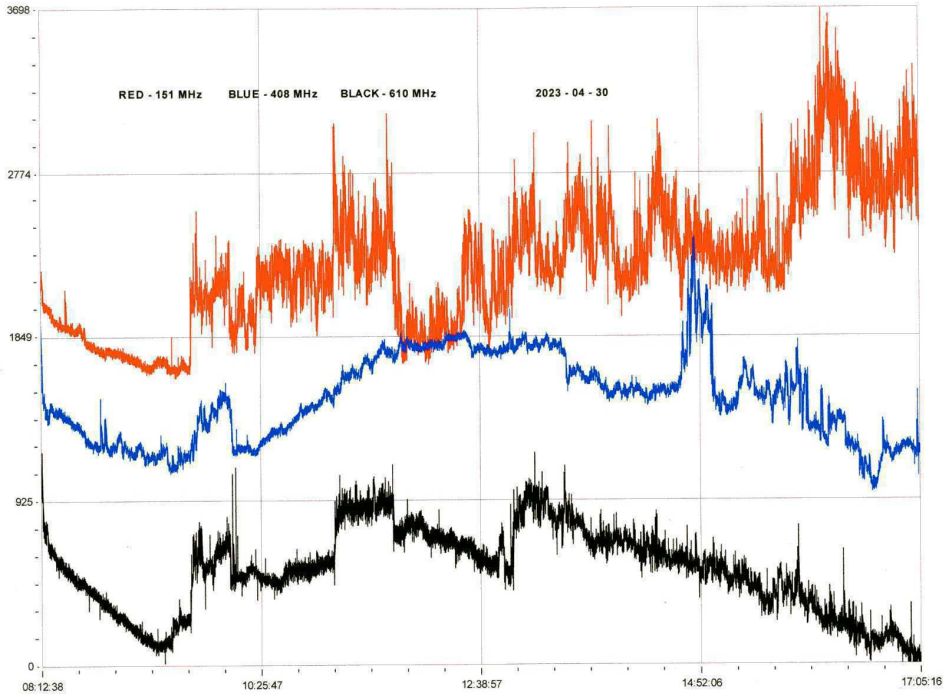


This recording by Colin Briden shows a 28MHz type III noise burst starting at 12:18 on the 20th.

It appears to match the timing of the C2.3 flare that we recorded as a SID. It lasted about 18 seconds, with an average amplitude of about 20dB. Colin notes that it has taken some time to find a clear spot in the radio spectrum to make these observations, the usual 30MHz band having interference. 28MHz seems to be clear at the moment.

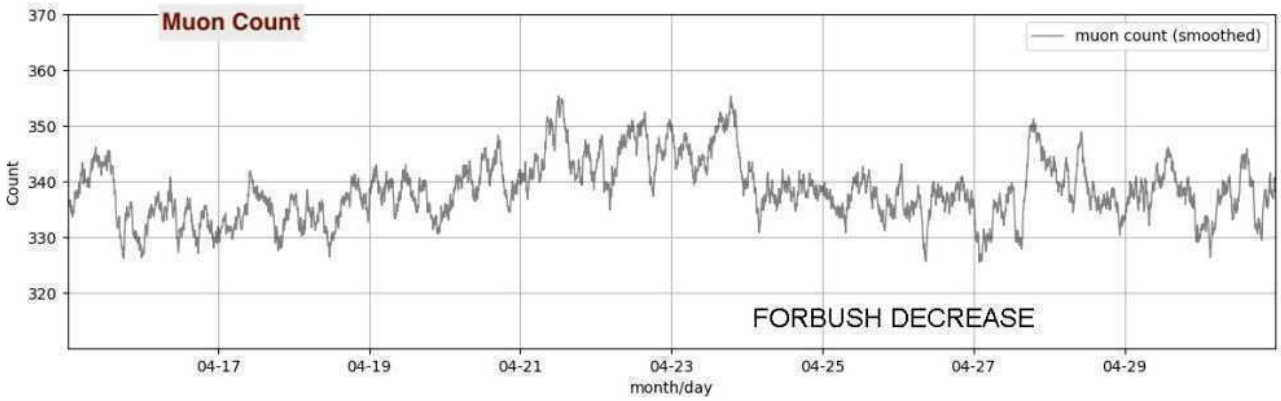


Colin Clements recorded this noise burst on the 29th, with a strong 151MHz (red) signal and much smaller 408MHz (blue) signal. 610MHz (black) is generally noisy, and shows no matching increase in noise. This appears to match the C5.1 flare, with maybe some contribution from the C2.1 and C6.0 flares. The matching SID recording is shown on the first page.

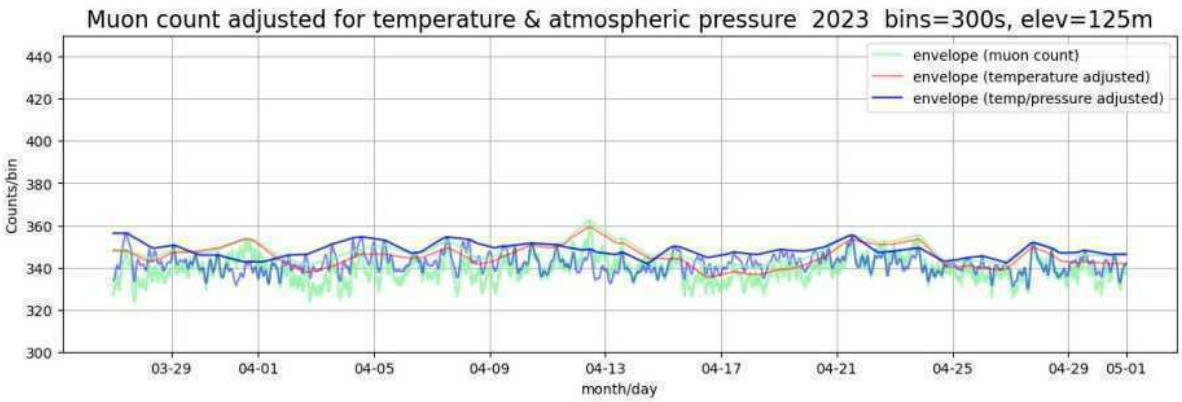


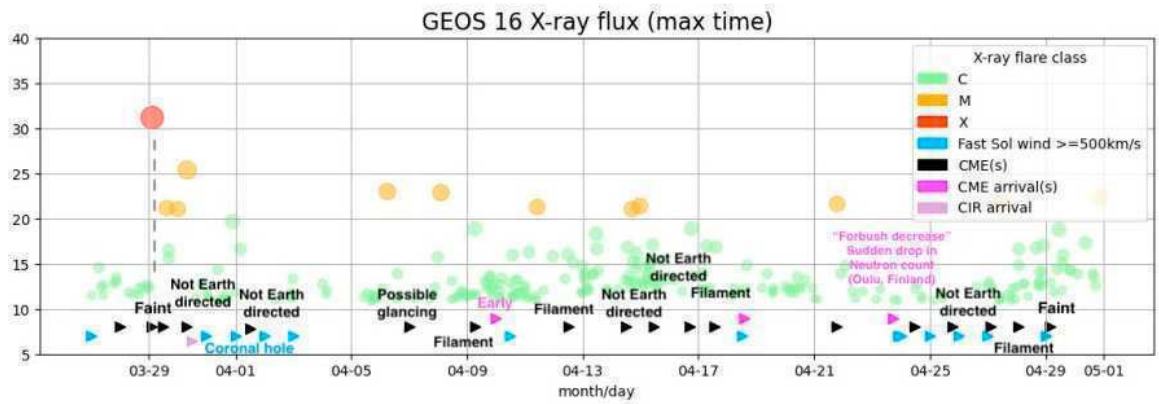
Colin's recording on the 30th shows 151MHz noise lasting all day, with some clearer peaks on the other frequencies. The 408MHz peak starting at 14:40 matches well with the C3.6 flare, but the source of the other peaks is less clear.

MUONS.

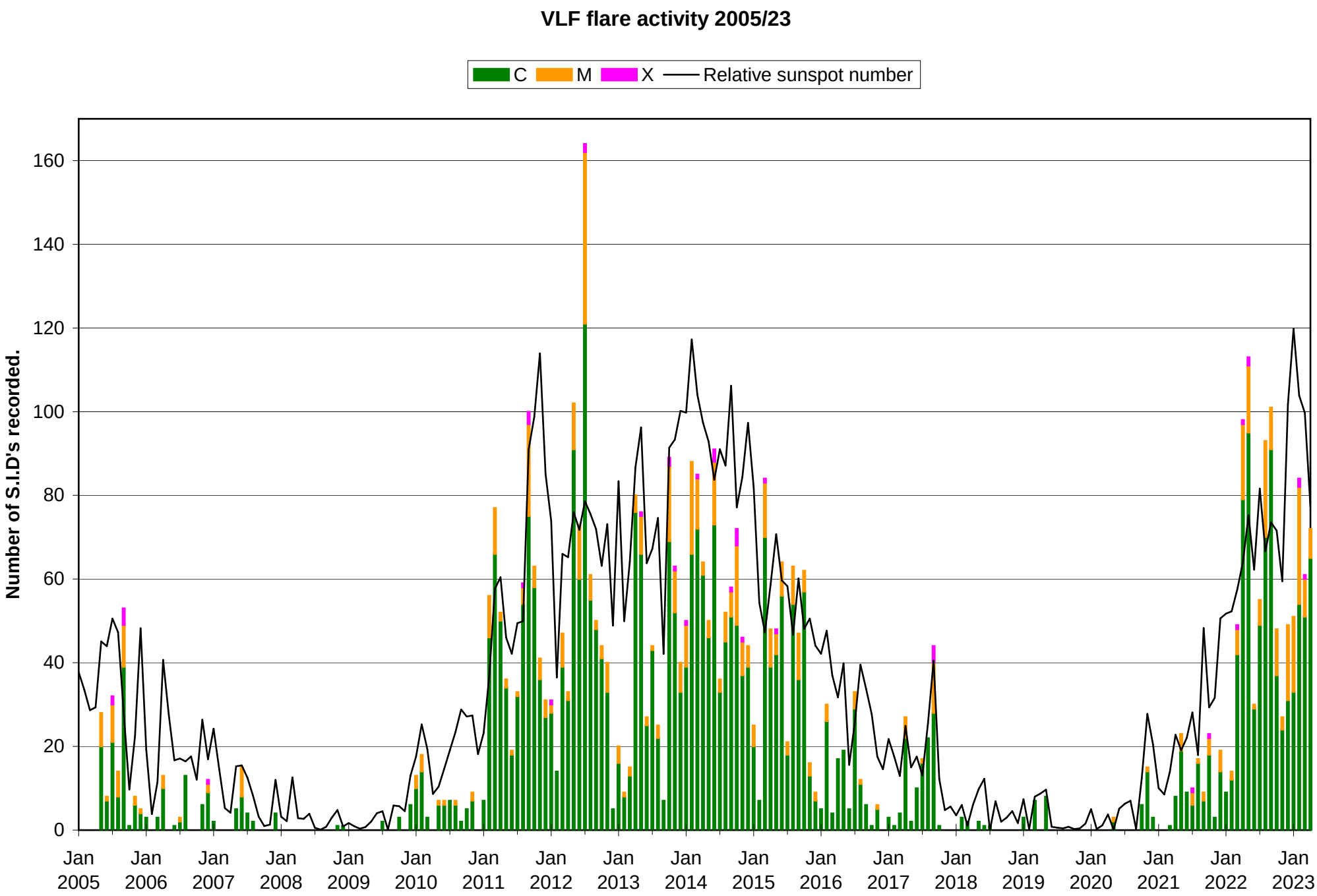


The very strong magnetic disturbance on the 23rd and 24th caused a significant drop in the Muon count recorded by Mark Prescott, as shown in his recording. This effect is called a Forbush Decrease, and is caused by compression of the upper ionosphere / atmosphere increasing its density, and therefore reducing the cosmic ray intensity reaching the lower layers. We see this as a reduction in Muon counts. It also reduces the neutron count, and was recorded by the Oulu cosmic ray monitor in Finland.





This effect is reduced slightly when the data is temperature / pressure corrected, shown above. The drop in count was very rapid at the time of the CME impact, but slower and smaller drops in counts are also present during periods of a faster solar wind.


VLF flare activity 2005/23
C
M
X
Relative sunspot number
Number of S.I.D's recorded.
0
20
40
60
80
100
120
140
160
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023

BAA Radio Astronomy Section.

BARTELS DIAGRAM

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

ROTATION																													
2552	7	2235 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2020 October 1	2	3		
	F																												
2553	4	2236 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
	F												CC											C		BCCC			
2554	31	2237 1	2020 November 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	F		B		B	CBCC	CBC	B			C	C											CC				C		
2555	27	28	2238 29	30	2020 December 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	F		C	CM						C	C							C											
2556	24	25	2239 26	27	28	29	30	31	2021 January 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
	F																												
2557	20	21	22	2240 23	24	25	26	27	28	29	30	31	2021 February 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
	F																												
2558	16	17	18	2241 19	20	21	22	23	24	25	26	27	28	2021 March 1	2	3	4	5	6	7	8	9	10	11	12	13	14		
	F																					C							
2559	15	16	17	2242 18	19	20	21	22	23	24	25	26	27	28	29	30	31	2021 April 1	2	3	4	5	6	7	8	9	10		
	F	B									B																		
2560	11	12	13	2243 14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2021 May 1	2	3	4	5	6	7		
	F						B			C		CCCC															M		
2561	8	9	10	2244 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2021 June 1	2	3		
	F	CC	CC		C									C	CCMM	CCBM			CCCC		C								
2562	4	5	6	7	2245 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
	F				CCC	CCB																C			CBC		CC		
2563	2021 July 1	2	3	4	2246 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
	F		MCXM	MC					CCB							C		C											
2564	28	29	30	31	2021 August 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	F																							CCC		C			
2565	24	25	26	27	2248 28	29	30	31	2021 September 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
	F	C		CCCC	MCCC	CC	C									CC	C												
2566	20	21	22	23	24	2249 25	26	27	28	29	30	2021 October 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
	F		C	MM			C		C		C									M									
2567	17	18	19	20	21	2250 22	23	24	25	26	27	28	29	30	31	2021 November 1	2	3	4	5	6	7	8	9	10	11	12		
	F									CCCM	CCCC	CMMX	CC	CCC					CC										
2568	13	14	15	16	17	2251 18	19	20	21	22	23	24	25	26	27	28	29	30	2021 December 1	2	3	4	5	6	7	8	9		
	F	C																					M						
2569	10	11	12	13	14	2252 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2022 January 1	2	3	4	5		
	F					CCC	CC	C			CM	M	MCC		CC	CCCM													
2570	6	7	8	9	10	11	2253 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1		
	F							C	C											C	CC		C	BCCC			C		
2571	2022 February 2	3	4	5	6	7	2254 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		
	F	CC	CC					C			MCCC		CCM														C		
2572	2022 March 1	2	3	4	5	6	2255 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
	F	CM				C	C				CCCC	C		M	CCMC					CC		CC	CCCC	C		C	C		
2573	28	29	30	31	2022 April 1	2	3	2256 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	F	CMC	MCCC	CCCC	CCCX	CCCC	CCMM	CC	C		C		CC	C		CBCC			MMCC	CCCM	CCCM	MMCM	CCCC	CMCC	CC	CMC	C		
2574	24	25	26	27	28	29	30	2022 May 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	F		MCCC	CCCC	CCC	CC	MCCM	MMXM	CCCC		MCX	BMCM	CMMC	CC	CC	CCC	C	CCX	CCMM	CCCM	CCCC	CCCC	C	CMC	CCCC	CCCC	CMMM	CMM		
2575	21	22	23	24	25	26	27	2258 28	29	30	31	2022 June 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
	F	CCC	CC	CC	CC	CCM	CC	CC	CC											CC	CCMC	C		C	CCCC		C		
2576	17	18	19	20	21	22	23	2259 24	25	26	27	28	29	30	2022 July 1	2	3	4	5	6	7	8	9	10	11	12	13		
	F	CCCC	CCC	C	CC	C	CC	CC	C								BC	C	CC			M	CCCC	CCCC	CM	CCCC	CCC		
2577	14	15	16	17	18	19	20	21	2260 22	23	24	25	26	27	28	29	30	31	2022 August 1	2	3	4	5	6	7	8	9		
	F	CMCM	CCC	MCM	CCCC		C	CCCC		CCCC	C		C	C						CC	C		CC						
2578	10	11	12	13	14	15	16	17	2261 18	19	20	21	22	23	24	25	26	27	28	29	30	31	2022 September 1	2	3	4	5		
	F		C	CC	CCCC	C	CMMM	MCC	CCMM	CMMM	MCCC		C	C		CCCM	CMMM	CMMM	CCMM	CMMM	CCCM	C	CC	CCCC	CCCC	CCCC	CCMC		
2579	6	7	8	9	10	11	12	13	2262 14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2022 October 1	2		
	F	CC			C	CCCC	CCCC	CCCC	MCCC		MM	M	CC	C	MCCC	M	CCCC	CCCM	CCCC		CCC	CCCC		CC	CCMM	CC	CMMC		
2580	2022 October 3	4	5	6	7	8	9	10	2263 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	F	CMMM	M	C		CM	C	CCCC	CM	MMCC	CC	C	M	C	C		C		CC		CB		CC	C	C				
2581	30	31	2022 November 1	2	3	4	5	6	7	2264 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
	F							C	C			C	MCCM	CC	C	C	CCC	CC	CC	CCC	M			CCC					
2582	26	27	28	29	30	2022 December 1	2	3	4	2265 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
	F			C			C	M				C				C			MMMM	CMCM	MMMC		CC	CCC	M	C	C		
2583	23	24	25	26	27	28	29	30	31	2023 January 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
	F	CC	C	CCC	CM		CM	CCCM	C							CC	MCCM	MM	MCMM	MC	MCMC	MC	CCC	CM	C		MC		
2584	19	20	21	22	23	24	25	26	27	28	2267 29	30	31	2023 February 1	2	3	4	5	6	7	8	9	10	11	12	13	14		
	F	MMC	CC	CC	CMCM	C	CCC	MCM	CMCC		C	C	CC		C		C	C	C	CC	CM	MMMM	MCCM	MMXM	MMMM	CCCM	CCM		
2585	15	16	17	18	19	20	21	22	23	24	2268 25	26	27	28	2023 March 1	2	3	4	5	6	7	8	9	10	11	12	13		
	F	CCCC	C	CX	C	CC	CMCC	MCCM	CCCM	CMCC	CCM	CCMM	CC	CC	CC	CCCC	MCCX	CMMC	CCMC	MCCC	C	MC	CCC	CCCC	C				
2586	14	15	16	17	18	19	20	21	22	23	2269 24	25	26	27	28	29	30	31	2023 April 1	2	3	4	5	6	7	8	9		
	F	C		C	CCCM	C	CCC	C	C		C		CC	CCC	CC	MC	M	CC					CCC	MC		CC	CCCC		
2587	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	2023 May 1	2	3	4	5	6		
	F	MCCC	MC	CCC	CCCC	CCMC	CCCC	C	CC	CCC	CCC	CCCC	M	CC	CC		C	M	CC	CCCC	CCM								

BAA Radio Astronomy Section. **2023 APRIL.**

	Xray class	Observers	John Cook (23.4kHz/*22.1kHz*)				Roberto Battaiola 23.4kHz				Paul Hyde (22.1kHz/*24kHz*)				Mark Edwards (24.0/*19.6*/**37.5kHz**)				Colin Clements (21.75kHz/*37.5kHz*)			
			Tuned radio frequency receiver, 0.58m frame aerial.				Modified AAVSO receiver.				Spectrum Lab / PC 1.5m frame aerial.				Spectrum Lab / PC 2m loop aerial.				Tuned Radio Frequency receivers, 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)	
5	C1.3	1													***10:15***	***10:21***	***10:41***	***1+***				
5	C1.8	2													12:08	12:20	12:31	1	12:04	12:21	13:22	2+
5	C1.7	1													17:50	17:52	17:58	1-				
6	**M3.0**	2					05:41	05:44	05:46	1-					***05:41***	***05:54***	***06:06***	***1***				
6	?	1					06:12	06:19	06:23	1-												
6	C3.9	5									13:46	13:57	14:11	1	**13:45**	**13:57**	**14:08**	**1**	13:43	14:02	15:36	3
8	C3.2	5	11:18	11:20	11:38	1	11:16	11:20	11:27	1-					11:17	11:20	11:34	1-	11:22	11:24	11:48	1+
8	C1.2	1													*13:24*	*13:27*	*13:34*	*1-*				
9	C9.0	3	05:58	06:06	06:09	1-	05:58	06:03	06:08	1-					*05:58*	*06:06*	*06:11*	*1-*				
9	C3.2	4									14:39	14:56	15:08	1+	14:53	14:57	15:08	1-	14:42	14:59	15:13	1+
9	?	1													15:10	15:14	15:18	1-				
9	C2.4	2									16:20	16:26	16:53	2	16:22	16:28	?	-				
9	C2.8	1													16:34	16:37	16:44	1-				
9	C3.7	2									18:16	18:27	18:45	1+	18:20	18:28	18:38	1-				
10	**M2.8**	1					05:15	05:16	05:19	1-												
10	C2.9	5	09:42	09:46	10:00	1-					09:36	09:47	10:04	1+	09:43	09:46	09:54	1-				
10	C1.3	3	11:28	11:31	11:42	1-									11:28	11:32	11:52	1				
10	C1.6	1													***13:29***	***13:40***	***13:46***	***1-***				
10	C6.0	8	13:49	13:52	14:21	1+	13:47	13:51	14:00	1-	13:47	13:55	14:29	2	*13:49*	*13:53*	*14:14*	*1*	13:52	13:57	14:33	2
10	C2.1	1													*14:46*	*14:50*	*14:57*	*1-*				
10	C3.3	5	15:41	15:48	16:00	1					15:39	15:49	16:09	1+	*15:41*	*15:47*	*15:59*	*1-*				
10	?	1													*16:00*	*16:02*	*16:08*	*1-*				
11	C1.6	1																				
11	**M1.3**	8	*10:10*	*10:17*	*10:35*	*1*	10:08	10:14	10:40	1+	10:07	10:18	11:22	2+	10:09	10:18	10:46	2	10:13	10:26	11:17	2+
11	?	1													***10:49***	***10:52***	***11:00***	***1-***				
11	C2.1	3									14:35	14:43	14:53	1-	14:37	14:42	15:01	1				
12	C3.4	4									08:38	08:45	08:55	1-	*08:39*	*08:42*	*08:48*	*1-*				
12	C6.1	7					11:40	11:59	12:22	2	11:46	11:54	12:20	2	11:49	11:56	12:20	1+	11:52	11:59	12:47	2+
12	C5.2	6	15:43	15:45	16:00	1-					15:39	15:46	16:44	2+	15:43	15:45	16:01	1-				
13	C3.9	2													***07:59***	***08:01***	***08:08***	***1-***				
13	C3.8	3									08:14	08:25	08:38	1	*08:18*	*08:23*	*08:42*	*1*				
13	C8.4	6									10:37	10:48	11:34	2+	10:39	10:52	11:22	2	10:40	10:55	11:57	2+
13	C4.3	5									11:53	11:59	12:15	1	11:55	12:01	12:06	1-	11:57	12:04	12:28	1+
14	C3.3	2													10:51	10:54	10:57	1-				
14	?	1													*10:59*	*11:07*	*11:09*	*1-*				
14	C6.9	7	12:52	12:57	13:42	2+	12:47	12:56	13:14	1+	12:51	12:59	?	-	12:52	12:57	?	-	12:56	13:03	13:49	2+
14	C3.7	2									13:18	13:25	13:35	1-	13:20	13:24	13:34	1-				
14	C3.2	1													13:43	13:48	14:07	1				
14	?	1													**14:42**	**14:50**	**15:05**	**1**				
14	C2.3	1													15:48	15:51	15:58	1-				
14	**M1.1**	7	*16:13*	*16:19*	*16:44*	*1+*	16:10	16:17	16:21	1-	16:11	16:22	16:47	2	16:14	16:21	16:47	2				
14	C5.3	3									16:50	16:59	17:08	1-	16:52	16:59	17:11	1				
15	C5.3	7	*08:46*	*08:52*	*09:05*	*1*					08:44	08:53	09:07	1	*08:46*	*08:56*	*?*	-	08:49	08:59	09:14	1
15	C7.1	7	*09:12*	*09:16*	*09:29*	*1-*					09:10	09:15	09:42	1+	*09:13*	*09:16*	*?*	-	09:14	09:21	09:47	2
15	?	2									09:46	09:51	10:11	1	*09:48*	*09:51*	*10:23*	*2*				
15	C2.4	1													12:54	12:59	13:09	1-				
15	C2.6	2									13:19	13:24	13:39	1	13:22	13:30	13:44	1				
15	?	3									14:22	14:28	14:56	2	14:23	14:28	14:43	1				
15	C3.3	3									16:14	16:20	16:35	1	16:16	16:21	16:37	1				
15	C5.4	2									17:17	17:28	18:03	2+	17:20	17:27	17:51	1+				
16	C9.0	3									17:32	17:34	18:19	2+	17:35	17:46	18:32	2+				
17	C7.0	2					06:29	06:36	06:43	1-					***06:27***	***06:34***	***06:59***	***1+***				
17	C2.3	1													**08:35**	**08:45**	**08:54**	**1**				
17	?	1													*09:04*	*09:12*	*09:43*	*2*				
17	C6.9	6					14:28	14:32	14:36	1-	14:26	14:32	15:11	2	14:29	14:36	15:22	2+	14:31	14:39	16:48	3+
18	C2.4	3									14:28	14:38	15:21	2+	14:30	14:37	15:22	2+				
18	C4.8	3									15:23	15:32	16:12	2+	15:26	15:33	16:00	2				
18	C3.2	1													18:12	18:18	18:26	1-				
19	C3.9	5	08:22	08:39	09:05	2	08:13	08:35	09:12	2+	08:13	08:44	09:25	2+	**08:25**	**08:40**	**09:25**	**2+**				
19	?	4									11:00	11:14	11:31	1+	*11:07*	*11:16*	*11:32*	*1*	*10:45*	*11:14*	*12:25*	*3*
19	C2.3	1													*13:14*	*13:23*	*?*	-				
19	?	1													*13:35*	*13:42*	*14:05*	*1+*				
19	C2.7	2									15:56	16:09	16:23	1+	**16:01**	**16:09**	**16:16**	**1-**				
20	C3.6	3									09:18	09:26	09:42	1	09:20	09:23	09:37	1-				
20	C2.4	4					10:46	10:57	11:10	1	10:47	10:57	11:16	1+	10:53	10:57	11:15	1				
20	C2.3	3									12:18	12:26	12:46	1+	12:21	12:29	12:50	1+				
20	?	1													*14:10*	*14:20*	*14:46*	*2*				
20	C3.3	3									16:12	16:21	16:44	1+	16:14	16:23	17:08	2+				
21	**M1.7**	1									17:53	18:10	19:11	2+								
22	C1.2	1									10:03	10:11	10:34	1+								
22	C2.0	2									15:56	16:07	16:40	2	16:00	16:04	16:22	1				
24	C2.2	5					11:11	11:22	11:32	1	11:11	11:17	11:34	1	*11:14*	*11:17*	*11:39*	*1*	11:18	11:20	11:58	2
24	C2.8	7	13:03	13:08	13:18	1-	13:01	13:07	13:14	1-	13:02	13:08	13:29	1+	13:05	13:09	13:14	1-	13:06	13:13	13:58	2+
26	C2.5	2	14:21	14:23	14:28	1-	14:12	14:21	14:27	1-												
27	**M1.8**	7	11:12	11:17	12:23	2+	11:14	11:18	11:44	1+	11:10	11:19	12:27	2+	11:12	11:27	11:41	1+	11:17	11:22	12:15	2+
28	C1.5	1													*09:14*	*09:18*	*09:33*	*1*				
28	C6.8	1													15:52	16:02	16:19	1+				
29	C4.4	6	08:38	08:42	09:00	1	08:37	08:41	08:47	1-	08:38	08:42	08:58	1	08:39	08:43	08:54	1-	08:42	08:51	09:11	1+
29	C8.8	7	10:07	10:18	11:12	2+	10:04	10:13	10:20	1-	10:05	10:18	10:38	2	10:09	10:21	10:58	2+	10:10	10:25	11:58	3
29	C2.1	3					12:44	12:50	12:57	1-					*12:49*	*12:53*	*13:04*	*1-*	12:49	12:58	13:25	2
29	C5.1	5	13:22	13:27	13:44	1	13:22	13:28	13:35	1-					13:24	13:28	13:45	1	13:25	13:31	13:53	1+
29	C6.0	6	13:54	14:02	14:55	2+	13:48	14:07	14:26	2					13:52	14:05	14:36	2	13:53	14:08	15:58	3
30	C7.3	7	08:40	08:54	09:48	2+	08:37	08:49	09:55	2+	08:41	08:55	10:05	2+	08:42	08:54	09:38	2+	08:44	09:01	10:14	3
30	C3.6	2													14:11	14:59	15:46	3	14:17	15:07	16:39	3+
30	?	1													**14:23**	**15:16**	**15:53**	**3**				
30	**M2.4**	1													20:07	20:20	20:48	2				
		0																				

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	Xray class		Steve Parkinson (Various)				Andrew Thomas (18.3kHz)				Phil Rourke (23.4kHz)				Mark Prescott (19.6kHz/*20.9kHz*)				John Elliott (18.3kHz)			
			Tuned radio frequency receiver, frame aerials.				Tuned radio frequency receiver, 0.6m frame aerial.				Spectrum Lab, 0.6m frame aerial.				SpetrumLab/Starbase, Active mini-whip 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)	
5	C1.3																					
5	C1.8																					
5	C1.7																					
6	**M3.0**																					
6	?																					
6	C3.9		13:48	13:58	14:12	1																
8	C3.2		11:18	11:20	11:30	1-																
8	C1.2																					
9	C9.0																					
9	C3.2		14:51	14:54	15:03	1-																
9	?																					
9	C2.4																					
9	C2.8																					
9	C3.7																					
10	**M2.8**																					
10	C2.9		09:41	09:46	10:02	1									09:44	09:51	10:13	1+				
10	C1.3		11:28	11:32	11:40	1-																
10	C1.6																					
10	C6.0		13:49	13:52	14:10	1									13:52	13:57	14:21	1+				
10	C2.1																					
10	C3.3		15:42	15:48	15:55	1-																
10	?																					
11	C1.6																					
11	**M1.3**		10:07	10:11	10:20	1-									10:13	10:22	10:46	2				
11	?																					
11	C2.1		14:37	14:42	14:50	1-																
12	C3.4		08:40	08:44	08:52	1-									08:44	08:48	?	-				
12	C6.1		11:49	11:53	12:10	1									11:52	12:00	12:45	2+				
12	C5.2		15:43	15:45	16:05	1									15:47	15:49	16:11	1				
13	C3.9																					
13	C3.8																					
13	C8.4		10:39	10:48	11:20	2									10:43	10:54	11:58	2+				
13	C4.3		11:55	12:00	12:20	1																
14	C3.3		10:50	10:57	11:20	1+																
14	?																					
14	C6.9		12:52	12:57	13:32	2									12:56	13:02	14:10	2+				
14	C3.7																					
14	C3.2																					
14	?																					
14	C2.3																					
14	**M1.1**		16:14	16:21	17:07	2+									16:21	16:29	16:41	1				
14	C5.3																					
15	C5.3		08:46	08:56	?	-									08:51	09:00	?					
15	C7.1		09:12	09:17	09:38	1+									09:16	09:21	09:55	2				
15	?																					
15	C2.4																					
15	C2.6																					
15	?																					
15	C3.3																					
15	C5.4																					
16	C9.0		17:36	17:46	17:57	1																
17	C7.0																					
17	C2.3																					
17	?																					
17	C6.9		14:29	14:34	15:07	2									14:33	14:43	15:32	2+				
18	C2.4		14:32	14:37	14:53	1																
18	C4.8		15:25	15:32	15:55	1+																
18	C3.2																					
19	C3.9		08:17	08:42	09:20	2+																
19	?		11:09	11:12	11:30	1																
19	C2.3																					
19	?																					
19	C2.7																					
20	C3.6		09:19	09:25	09:50	1+																
20	C2.4		10:50	10:57	11:05	1-																
20	C2.3		12:18	12:27	12:50	1+																
20	?																					
20	C3.3		16:14	16:21	16:40	1+																
21	**M1.7**																					
22	C1.2																					
22	C2.0																					
24	C2.2		11:13	11:17	11:30	1-																
24	C2.8		13:04	13:08	13:25	1																
26	C2.5																					
27	**M1.8**		11:11	11:18	12:10	2+									11:16	11:22	?	-				
28	C1.5																					
28	C6.8																					
29	C4.4		08:38	08:42	09:00	1																
29	C8.8		10:08	10:18	10:50	2									10:10	10:25	10:54	2				
29	C2.1																					
29	C5.1														13:25	13:31	?	-				
29	C6.0		13:54	14:06	14:50	2+									13:54	14:46	15:02	2+				
30	C7.3		08:43	08:58	10:20	3									08:48	08:58	09:59	2+				
30	C3.6																					
30	?																					
30	**M2.4**																					

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	Xray class		Chris Bailey			Colin Briden (22.1kHz)				Martyn Kinder			Andrew Lutley (23.4kHz)			Peter Meadows (23.4kHz)		
			Spectrum Lab.			Spectrum Lab. frame aerial.			1.2m	Tuned radio frequency receivers, Frane aerials.			Tuned radio frequency receiver, 0.6m frame aerial.			Tuned radio frequency receiver, 0.6m frame aerial.		
DAY			START	PEAK	END (UT)	START	PEAK	END (UT)		START	PEAK	END (UT)	START	PEAK	END (UT)	START	PEAK	END (UT)
5	C1.3																	
5	C1.8																	
5	C1.7																	
6	**M3.0**																	
6	?																	
6	C3.9					13:22	13:59	14:35	2+									
8	C3.2																	
8	C1.2																	
9	C9.0																	
9	C3.2																	
9	?																	
9	C2.4																	
9	C2.8																	
9	C3.7																	
10	**M2.8**																	
10	C2.9																	
10	C1.3																	
10	C1.6																	
10	C6.0					13:49	13:51	14:20	1+									
10	C2.1																	
10	C3.3					15:40	15:46	?	-									
10	?																	
11	C1.6					08:07	08:13	08:24	1-									
11	**M1.3**					10:08	10:16	11:12	2+									
11	?																	
11	C2.1																	
12	C3.4																	
12	C6.1					11:49	11:52	12:15	1+									
12	C5.2					15:42	15:44	15:48	1-									
13	C3.9					07:57	08:00	08:03	1-									
13	C3.8					08:17	08:19	08:20	1-									
13	C8.4					10:39	10:51	11:27	2+									
13	C4.3					11:55	11:59	12:05	1-									
14	C3.3																	
14	?																	
14	C6.9																	
14	C3.7																	
14	C3.2																	
14	?																	
14	C2.3																	
14	**M1.1**					16:13	16:20	16:37	1									
14	C5.3					16:52	16:56	17:03	1-									
15	C5.3					08:49	08:53	09:01	1-									
15	C7.1					09:13	09:16	09:36	1									
15	?																	
15	C2.4																	
15	C2.6																	
15	?					14:23	14:28	14:32	1-									
15	C3.3					16:16	16:18	16:20	1-									
15	C5.4																	
16	C9.0																	
17	C7.0																	
17	C2.3																	
17	?																	
17	C6.9																	
18	C2.4																	
18	C4.8																	
18	C3.2																	
19	C3.9																	
19	?																	
19	C2.3																	
19	?																	
19	C2.7																	
20	C3.6																	
20	C2.4																	
20	C2.3																	
20	?																	
20	C3.3																	
21	**M1.7**																	
22	C1.2																	
22	C2.0																	
24	C2.2																	
24	C2.8					13:03	13:23	13:42	2									
26	C2.5																	
27	**M1.8**																	
28	C1.5																	
28	C6.8																	
29	C4.4																	
29	C8.8																	
29	C2.1																	
29	C5.1																	
29	C6.0																	
30	C7.3																	
30	C3.6																	
30	?																	
30	**M2.4**																	