Founded in 1890

The British Astronomical Association

A company limited by guarantee

Registered Charity No. 210769

PO Box 702, Tonbridge, TN9-9TX 020-7734 4145

www.britastro.org

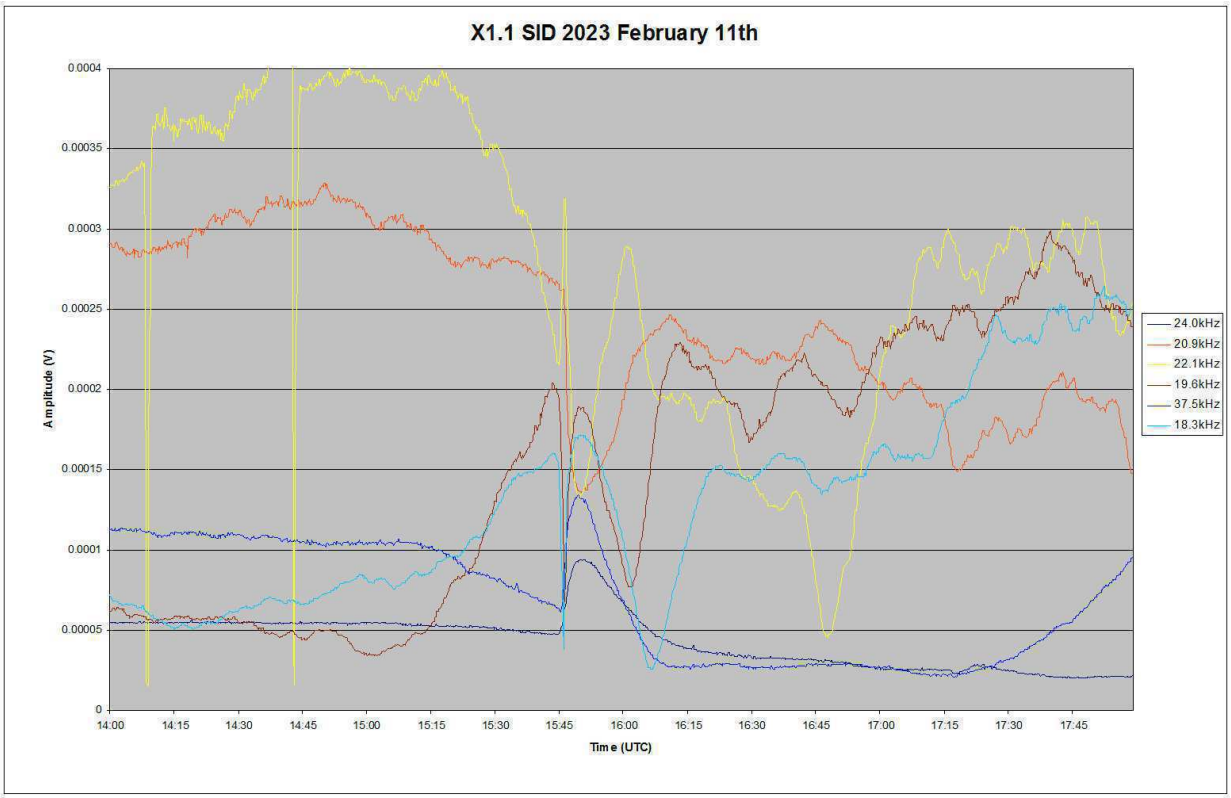
Please send all reports and observations to jacook@jacook.plus.com

BAA Radio Astronomy Section. Director Paul Hearn.

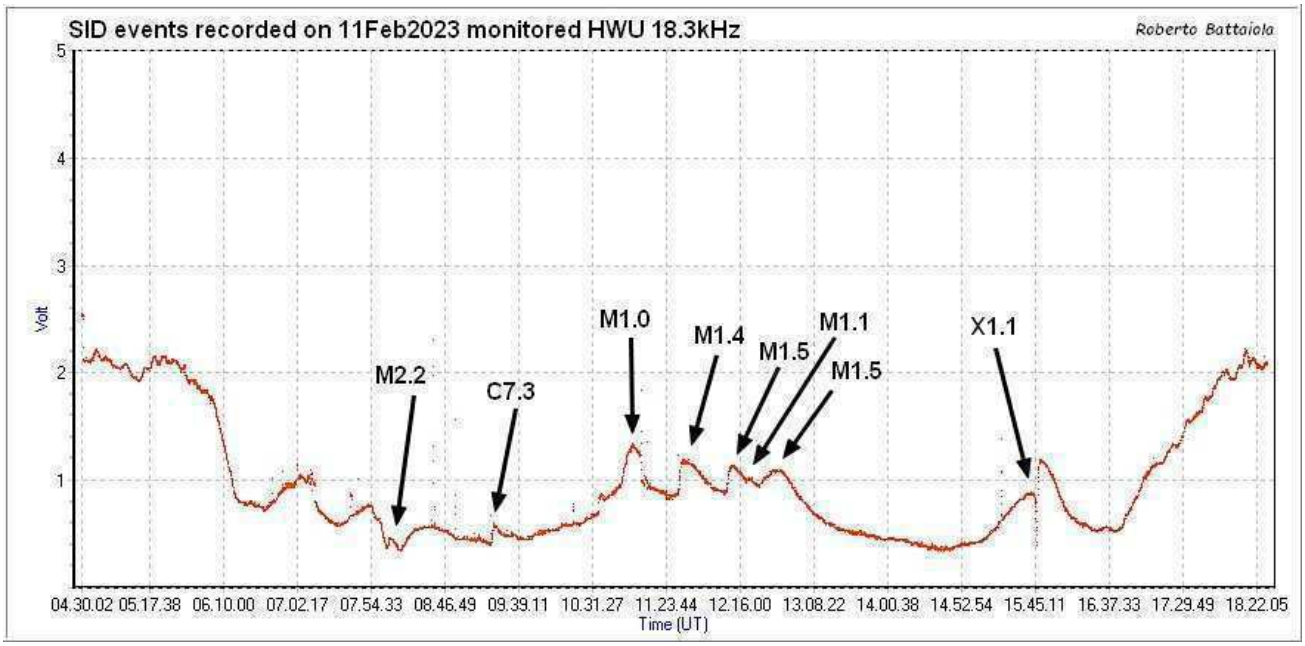
RADIO SKY NEWS 2023 FEBRUARY.

VLF SID OBSERVATIONS.

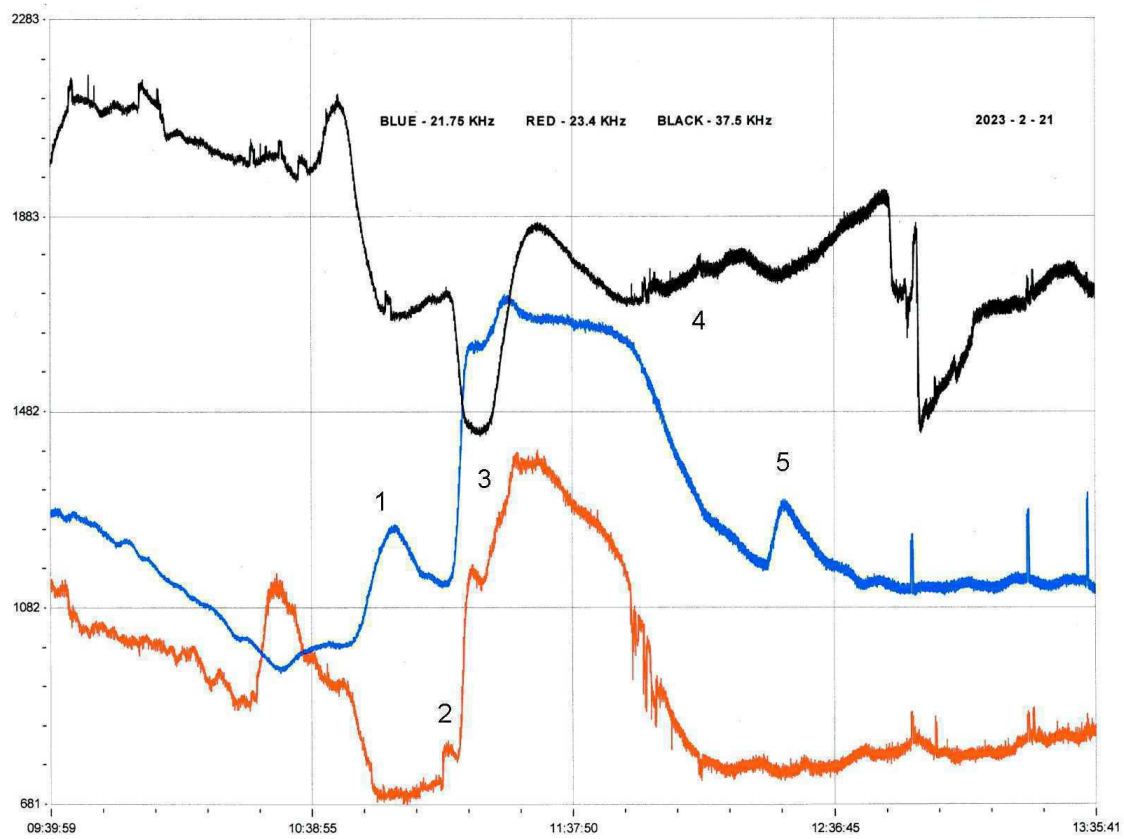
Solar flare activity increased significantly in February, with many M-class flares and two of X-class that were suitably timed for us to record. The general X-ray flux background was very high, and so many of the smaller flares were lost. Many of the larger flares were also quite complex, with multiple peaks. These have shown up on some signal paths, but not all. There were also two simultaneous flares from the same active region, hence showing as just a single SID, but listed in the SWPC independently at C6.2 and C6.1. This was the SID peaking at 17:52UT on the 9th, only recorded on the 24kHz Atlantic path, shown in the timing tables as just 'C'. The X2.2 flare on the 17th was also rather late, just showing on 24kHz, but the X1.1 on the 11th was more widely recorded.



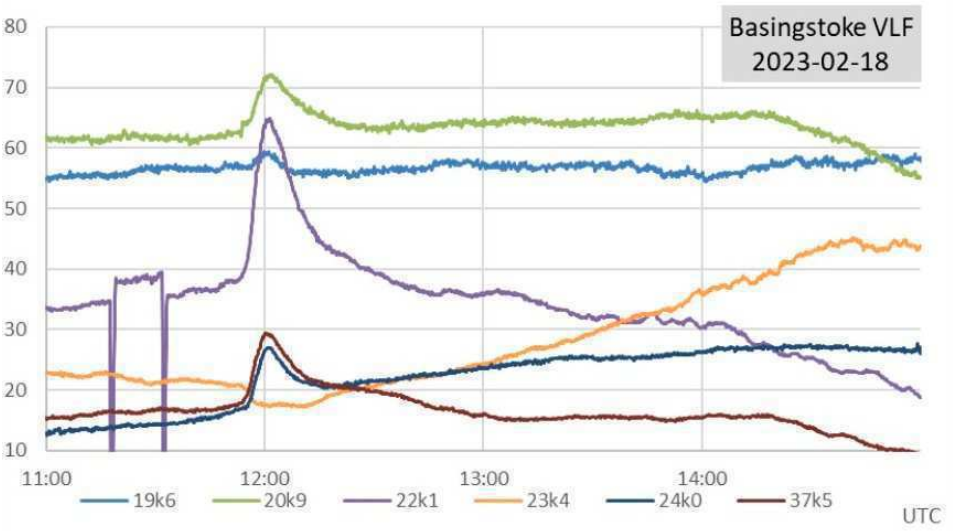
This chart by Mark Edwards shows the X1.1 flare in detail over six signals, just merging into the afternoon sunset on the European signals.



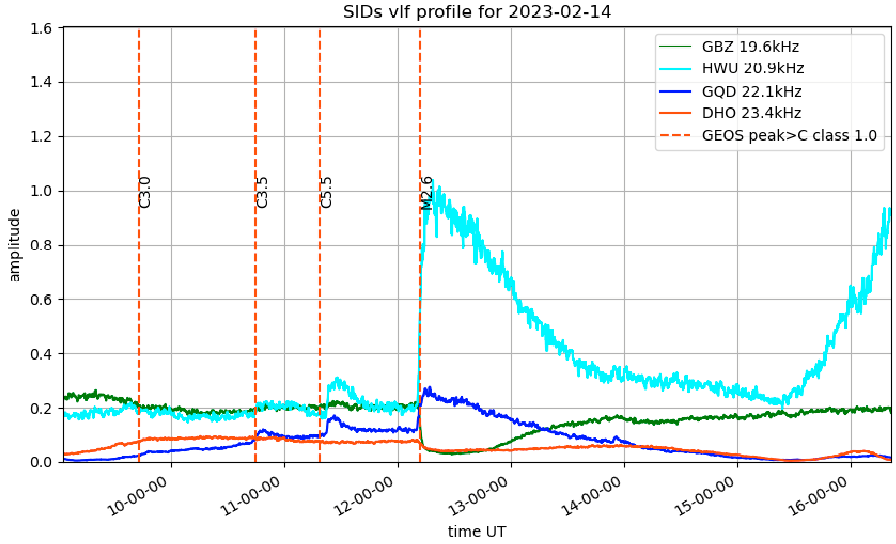
The recording from Roberto Battaiola shows it in context to the rest of the day's activity, including a barrage of M-flares from 11:00 to 13:00UT.

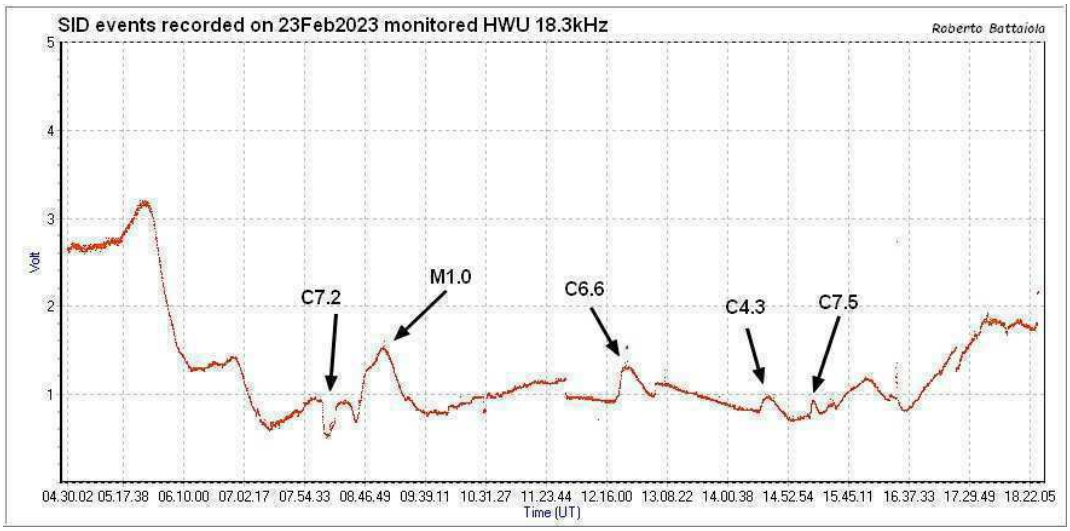


The timing tables show a complex set of flares on the 21st, shown in this recording by Colin Clements. I have labelled the timing entries 1..5, as listed in the tables. Not all of flares show as clear SIDs, with three active regions responsible. Entries 2 and 3 both appear to be from M-class flares, although only 2 is given a magnitude (M4.7). I suspect that both 2 and 3 were fairly slow flares, so merging into a single larger SID. A complex system to analyse.



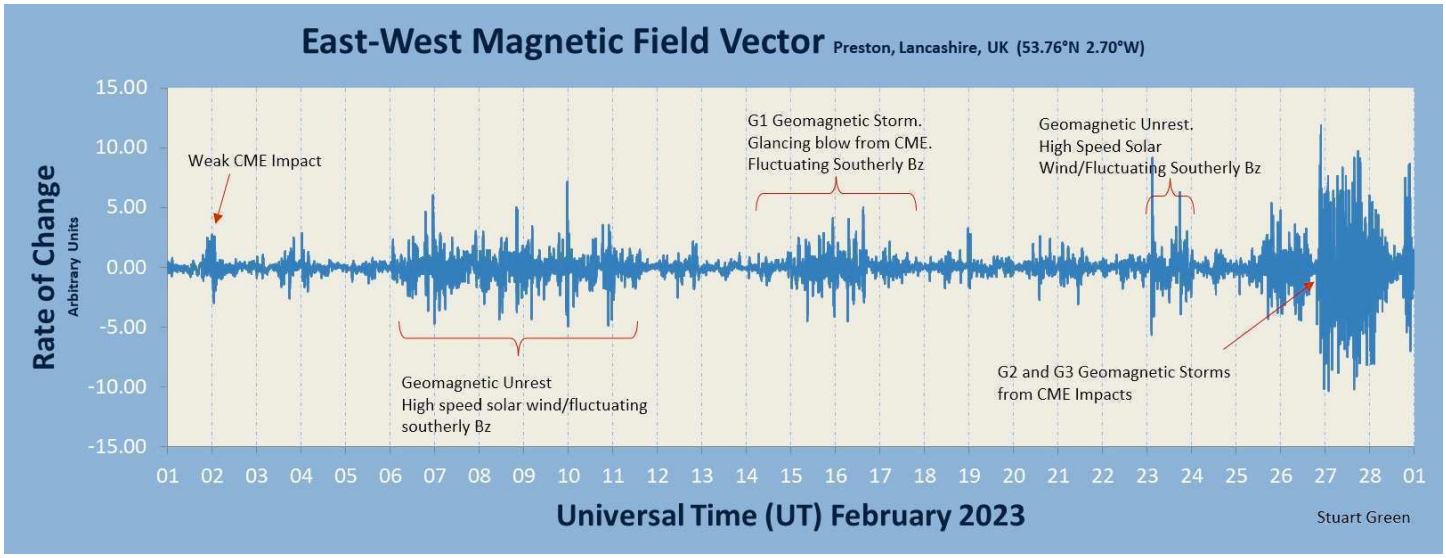
This recording by Paul Hyde shows a much better defined SID from the C7.7 flare at 12:02UT on the 18th. The SWPC bulletin does list a lot more flares on the 18th, but without magnitudes.





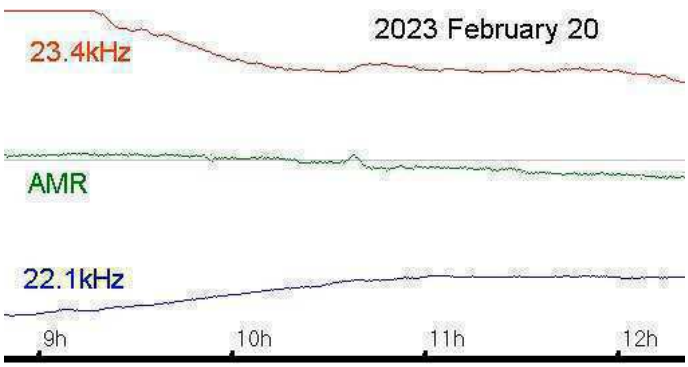
The recording from Mark Prescott shows the M2.6 flare on the 14th with a strong response at 20.9kHz. The recording from Roberto Battaiola shows another busy day on the 23rd, including the M1.0 flare with two peaks at 08:44 and 09:02UT.

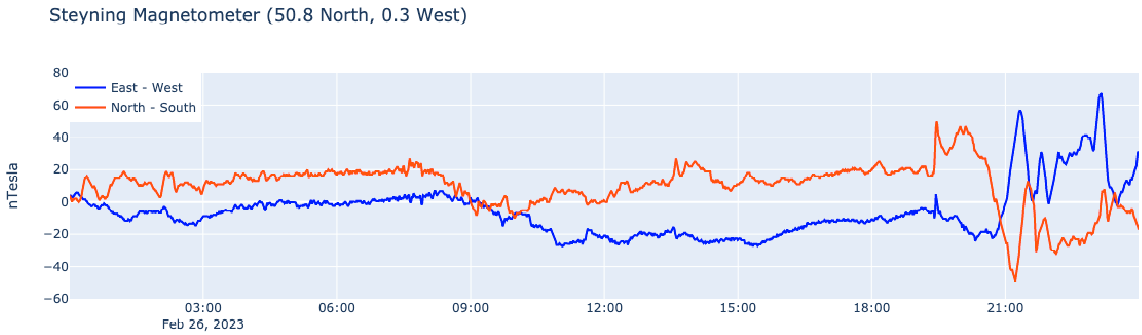
MAGNETIC OBSERVATIONS.



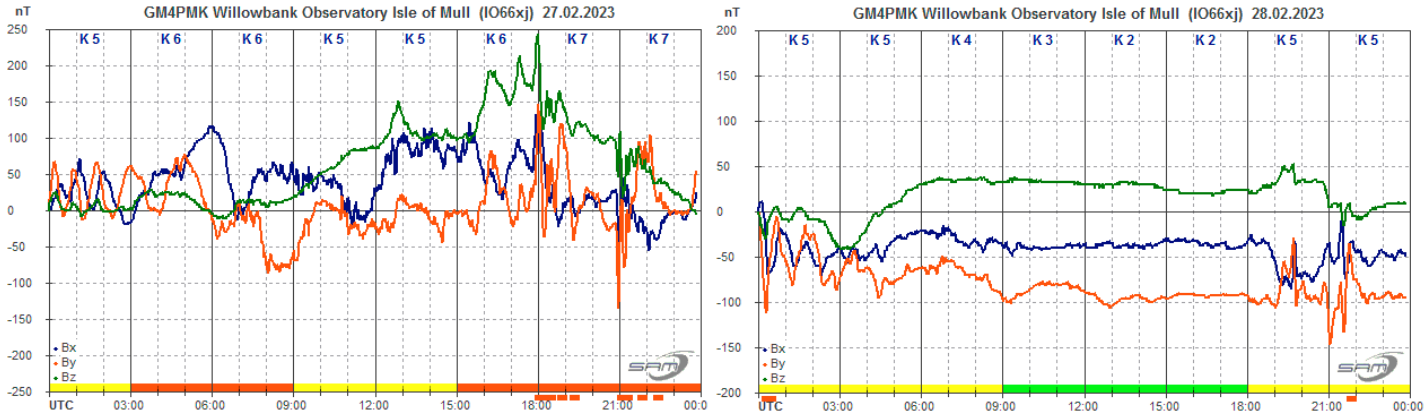
Stuart Green has repaired his leaking sensor, and has it back in operation again. The month's summary shows a fairly quiet start, with a much more active period in the last week.

The X2.2 flare at 20:16UT on the 17th was too late in the evening to be recorded as a SID, but it did produce a CME arriving on the 20th. My own recording shows the sudden impact at 10:38UT on the 20th, with a magnitude of about 14nT. Subsequent magnetic disturbances were very mild lasting into the morning of the 21st.

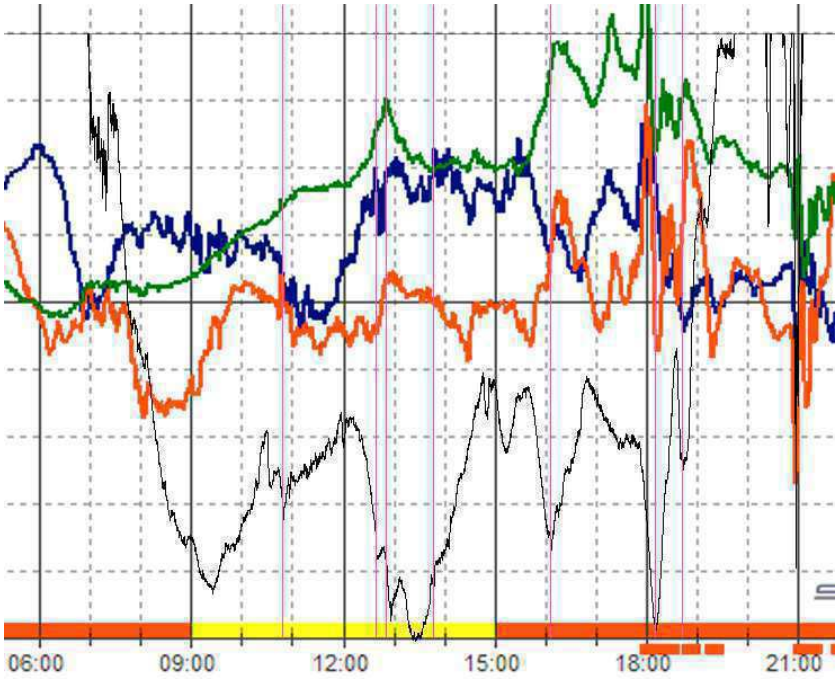




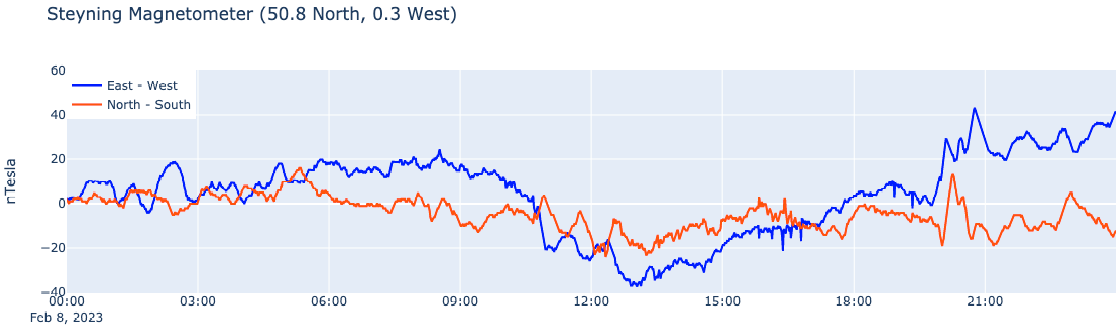
A combination of a high speed solar wind and a number of CMEs produced very active conditions at the end of the month. The recording by Nick Quinn shows the start at about 19:30UT on the 26th with a very sharp shock. The disturbance grew in strength through the following days.



The chart by Roger Blackwell for the 27th and 28th shows the very active period in the evening of the 28th. Note the change in scale on the vertical axis between the days, +/-250nT on the 27th and +/-200nT on the 28th. The sensor reset at midnight has also led to the three axes being a little offset on the 28th. As might be expected, this level of activity caused a notable disturbance on the 37.5kHz signal from Iceland.



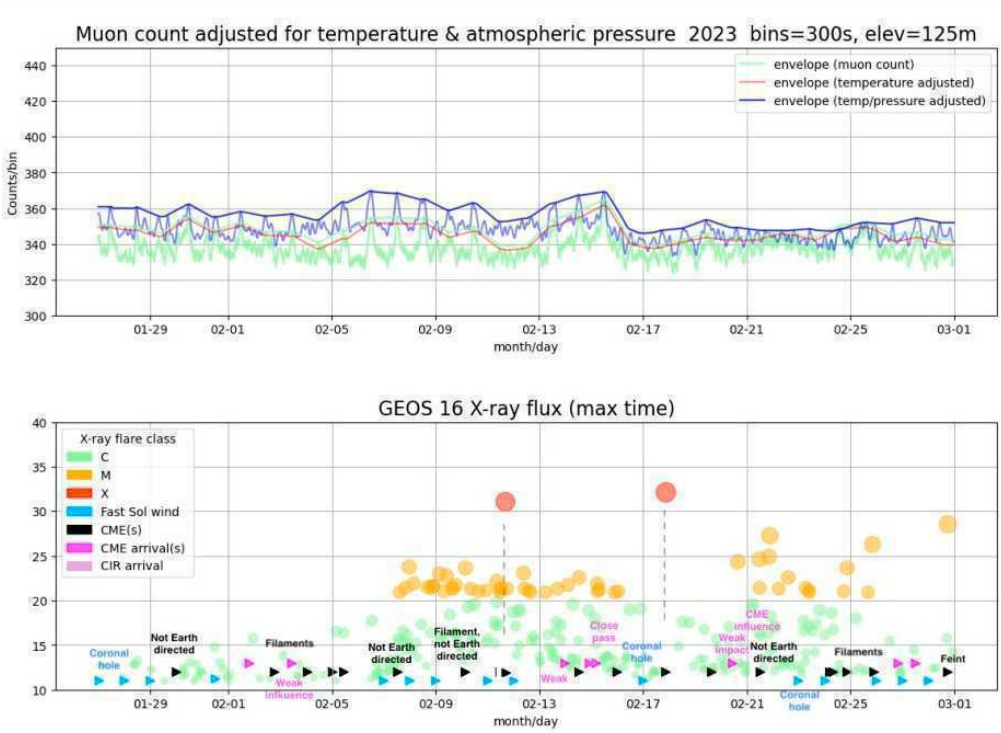
Mark Edwards has overlaid his 37.5kHz trace (black) onto Roger Blackwell's magnetometer. The vertical pink lines highlight some of the matching dips and peaks. The C4.5 flare at 10:27UT is also visible.



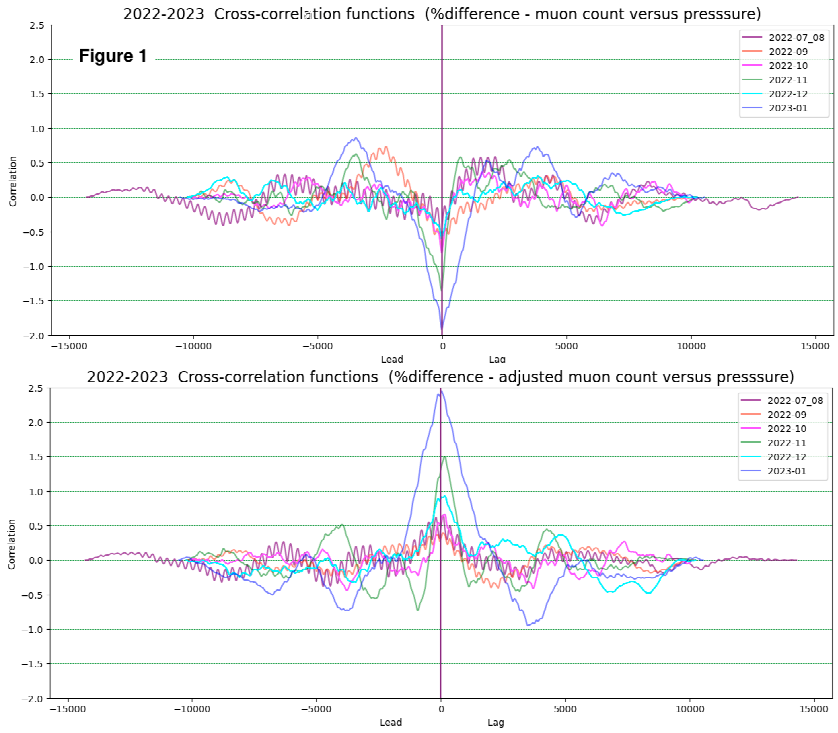
CMEs from flares earlier in the month were mostly not Earth-directed, a stronger solar wind causing short periods of mild magnetic disturbance. The recording of the 8th by Nick Quinn shows just a sample of this activity.

Magnetic observations received from Roger Blackwell, Stuart Green, Andrew Thomas, Nick Quinn and John Cook.

MUONS.



Mark Prescott has provide his Muon counts for February. The two X-class flares are marked in the lower panel. As already noted, the second one produced an Earth-directed CME, which may be reflected in the Muon counts, corrected for pressure and temperature, in the upper panel.



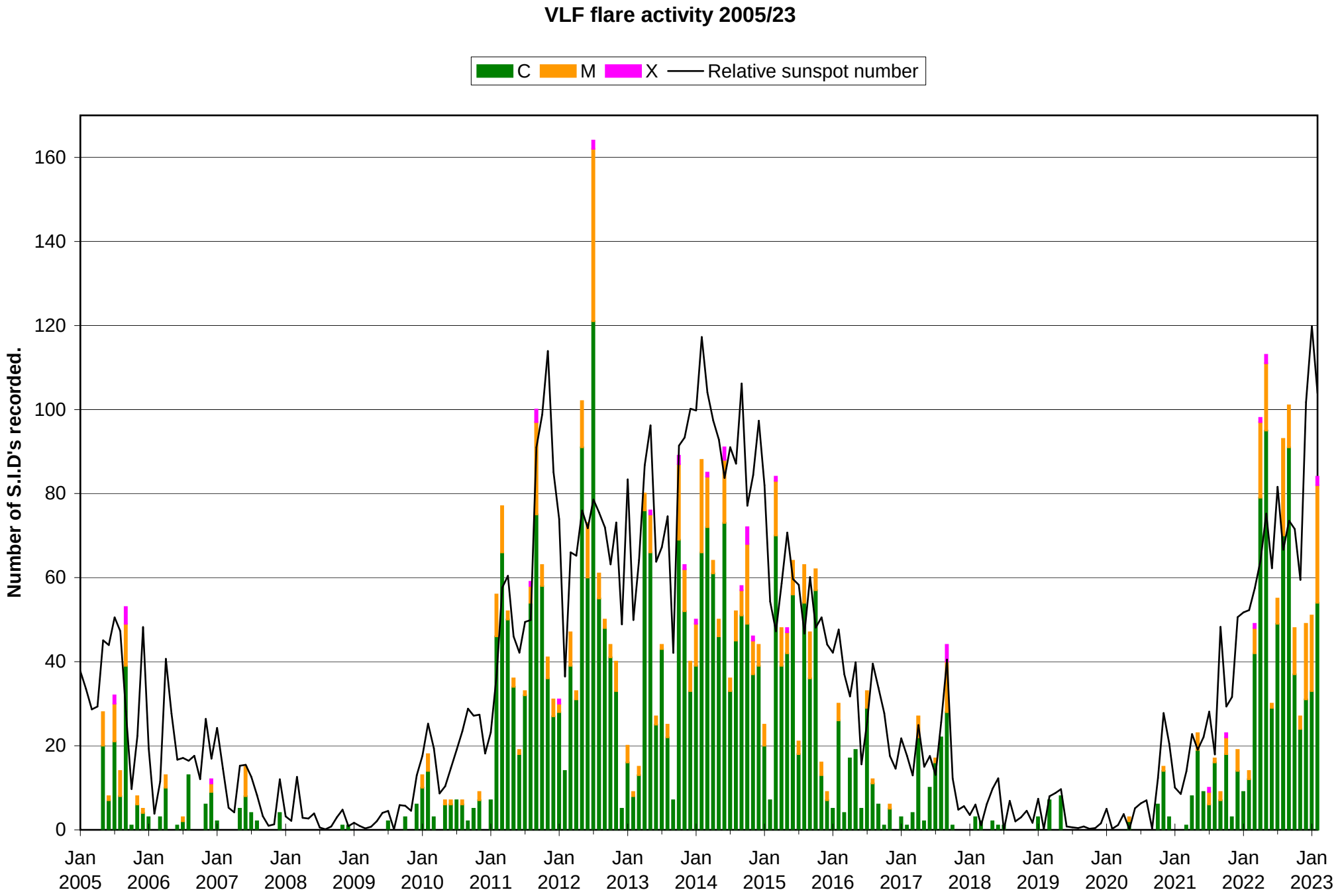
These charts show the cross-correlation of Muon count versus atmospheric pressure. The upper panel

uses the raw Muon counts, giving a negative match. This shows that the Muon trend is mirrored in the long term pressure trend. The lower panel uses the corrected Muon data shown in the first chart. This has a good positive cross-correlation, showing that there is a good match following the corrections applied.

For those interested in particle interactions with the atmosphere, there is an interesting tutorial titled “Capturing cosmic rays with a digital camera.” on the BAA web site (www.britastro.org). The link can be found towards the bottom of the page.

ANY IDEAS ?

One of our members recently made a visit to Esperance in south western Australia, where there is a museum including wreckage from the 1979 skylab that crashed into the sea nearby. The item in the picture is clearly not from that source, but its history is completely unknown to the museum staff. The heading at the top of the cabinet reads: “SOLAR RADIATION MEASUREMENT EQUIPMENT”. Have any of our readers come across this before?


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

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

2543

F 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 2020 February 1 2 2227 3

2544

F 4 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 2228 1

2545

F 2020 March 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 27 2229 28

2546

F 29 30 31 2020 April 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

2547

F 2230 25 26 27 28 29 30 2020 May 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

2548

F 2231 22 23 24 25 26 27 28 29 MCCB 30 31 2020 June 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

2549

F 2032 18 19 20 21 22 23 24 25 26 27 28 29 30 2020 July 1 2 3 4 5 6 7 8 9 10 11 12 13 14

2550

F 2033 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 2020 August 1 2 3 4 5 6 7 8 9 10

2551

F 11 2234 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 2020 September 1 2 3 4 5 6

2552

F 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

2553

F 4 2236 5 6 7 8 9 10 11 12 13 14 15 16 CC 17 18 19 20 21 22 23 24 25 26 27 C 28 29 BCCC 30

2554

F 31 2237 1 B 2020 November 2 3 4 B 5 CBCC 6 CBC 7 B 8 9 10 C 11 C 12 13 14 15 16 17 18 19 20 21 22 CC 23 24 25 26 C

2555

F 27 28 C 2238 29 CM 30 2020 December 1 2 3 4 5 6 C 7 C 8 9 10 11 12 13 14 C 15 16 17 18 19 20 21 22 23

2556

F 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

2557

F 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

2558

F 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 C 10 11 12 13 14

2559

F B 15 16 17 2242 18 19 20 21 22 23 24 25 B 26 27 28 29 30 31 2021 April 1 2 3 4 5 6 7 8 9 10

2560

F 11 12 13 2243 14 15 16 17 B 18 19 20 C 21 22 CCCC 23 24 25 26 27 28 29 30 2021 May 1 2 3 4 5 6 7 M

2561

F CC 8 CC 9 2244 10 11 12 C 13 14 15 16 17 18 19 20 21 C 22 CCMM 23 CCBM 24 25 26 CCCC 27 28 C 29 30 31 2021 June 1 2 3

2562

F 4 5 6 7 8 CCC 9 CCB 2245 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 C 26 27 28 CBC 29 30 CC

2563

F 2021 July 1 2 3 MCXM 4 MC 2246 5 6 7 8 9 CCB 10 11 12 13 14 15 16 C 17 18 C 19 20 21 22 23 24 25 26 27

2564

F 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 CCC 21 22 C 23

2565

F C 24 25 26 27 CCCC 28 MCCC 2248 29 CC 30 C 31 2021 September 1 2 3 4 5 6 7 8 CC 9 C 10 11 12 13 14 15 16 17 18 19

2566

F 20 C 21 22 23 MM 24 2249 25 26 C 27 28 C 29 30 C 2021 October 1 2 3 4 5 6 7 8 9 M 10 11 12 13 14 15 16

2567

F 17 18 19 20 21 2250 22 23 24 25 26 CCCM 27 CCCC 28 CMMX 29 CC 30 CCC 31 2021 November 1 2 3 4 CC 5 6 7 8 9 10 11 12

2568

F C 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 M 5 6 7 8 9

2569

F 10 11 12 13 14 2252 15 CCC 16 CC 17 C 18 19 20 CM 21 M 22 MCC 23 CC 24 CCCM 25 26 27 28 29 30 31 2022 January 1 2 3 4 5

2570

F 6 7 8 9 10 11 2253 12 C 13 C 14 15 16 17 18 19 20 21 22 23 24 25 C 26 CC 27 28 C 29 BCCC 30 31 1 C

2571

F CC 2022 February 2 3 4 CC 5 6 7 2254 8 C 9 C 10 11 12 MCCC 13 14 CCM 15 16 17 18 19 20 21 22 23 24 25 26 27 28 C

2572

F CM 2022 March 1 2 3 4 5 6 C 2255 7 C 8 9 10 11 CCCC 12 C 13 14 M 15 CCMC 16 17 18 19 20 CC 21 22 CC 23 CCCC 24 C 25 26 C 27 C

2573

F CMC 28 MCCC 29 CCCC 30 CCCX 31 2022 April 1 CCCC 2 CCMM 3 CC 2256 4 C 5 6 C 7 8 CC 9 C 10 11 CBCC 12 13 MMCC 14 CCCM 15 CCCM 16 MMCM 17 CCCC 18 CMCC 19 CC 20 CMC 21 C 22 23 C

2574

F 24 25 MCCC 26 CCCC 27 CCC 28 CC 29 MCCM 30 MMXM 2022 May 1 CCCC 2 3 MCX 4 BMCM 5 CMMC 6 CC 7 CC 8 CCC 9 C 10 CCX 11 CCMM 12 CCCM 13 CCCC 14 C 15 CMC 16 CCCC 17 CCCC 18 CMMM 19 CMM 20 CMM

2575

F 21 CCC 22 CC 23 CC 24 CC 25 CCM 26 CC 27 CC 2258 28 CC 29 30 31 2022 June 1 2 3 4 5 6 7 8 CC 9 CCMC 10 C 11 12 C 13 CCCC 14 15 C 16 C

2576

F 17 CCCC 18 CCC 19 C 20 CC 21 C 22 CC 23 CC 2259 24 C 25 C 26 27 28 29 30 2022 July 1 2 BC 3 C 4 C 5 CC 6 7 8 M 9 CCCC 10 CCCC 11 CM 12 CCCC 13 CCC

2577

F 14 CMCM 15 CCC 16 MCM 17 CCCC 18 19 C 20 CCCC 21 2260 22 CCCC 23 C 24 C 25 26 C 27 C 28 29 30 31 2022 August 1 CC 2 CC 3 C 4 5 CC 6 7 8 9

2578

F 10 11 C 12 CC 13 CCCC 14 C 15 CMMM 16 MCC 17 CCMM 2261 18 CMMM 19 MCCC 20 21 C 22 C 23 24 25 CCCM 26 CMMM 27 CMMM 28 CCMM 29 CMMM 30 CCCM 31 C 2022 September 1 CC 2 CCCC 3 CCCC 4 CCCC 5 CCMC

2579

F 6 CC 7 8 9 10 C 11 CCCC 12 CCCC 13 CCCC 2262 14 MCCC 15 16 MM 17 M 18 CC 19 C 20 MCCC 21 M 22 CCCC 23 CCCM 24 CCCC 25 26 CCC 27 CCCC 28 29 CC 30 CCMM 2022 October 1 CC 2 CMMC

2580

F 2022 October 3 CMMM 4 M 5 C 6 7 CM 8 C 9 CCCC 10 CM 2263 11 MMCC 12 CC 13 C 14 C 15 M 16 C C 17 18 C 19 20 CC 21 22 CB 23 24 CC 25 C 26 C 27 28 29

2581

F 30 31 2022 November 1 2 3 4 5 6 C 7 C 2264 8 9 10 C 11 MCCM 12 CC 13 C 14 C 15 CCC 16 CC 17 CC 18 CCC 19 M 20 21 22 CCC 23 24 25

2582

F 26 27 28 29 C 30 2022 December 1 C 2 C 3 M 4 2265 5 6 7 C 8 9 10 11 C 12 13 14 MMMM 15 CMCM 16 MMMC 17 18 CC 19 CCC 20 M 21 C 22 C

2583

F CC 23 C 24 25 CCC 26 CM 27 28 29 CM 30 CCCM 31 C 2023 January 1 2 3 4 5 6 7 CC 8 MCCM 9 MM 10 MCMM 11 MC 12 MCMC 13 MC 14 CCC 15 CM 16 C 17 18 MC

2584

F MMC 19 CC 20 CC 21 CMCM 22 C 23 CCC 24 MCM 25 CMCC 26 27 C 28 2267 29 C 30 31 CC 2023 February 1 2 C 3 4 C 5 C 6 C 7 CC 8 CM 9 MMMM 10 MCCM 11 MMXM 12 MMMM 13 CCCM 14 CCM

2585

F CCCC 15 C 16 CX 17 18 C 19 CC 20 CMCC 21 MCCM 22 CCCM 23 CMCC 24 CCM 2268 25 CCMM 26 CC 27 CC 28 2023 March 1 2 3 4 5 6 7 8 9 10 11 12 13

BAA Radio Astronomy Section. **2023 FEBRUARY.**

	Xray class	Observers	John Cook (23.4kHz/*22.1kHz*) Tuned radio frequency receiver, 0.58m frame aerial.				Roberto Battaiola 18.3kHz Modified AAVSO receiver.				Paul Hyde (22.1kHz/*24kHz*) Spectrum Lab / PC 1.5m frame aerial.				Mark Edwards (24.0/*18.3*/**19.6kHz**) Spectrum Lab / PC 2m loop aerial.				Colin Clements (21.75/*23.4*/**37.5k**) 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)	
2	C1.3	1													14:07	14:12	14:18	1-				
4	C1.7	1													15:24	15:26	15:34	1-				
5	C6.4	9	*10:44*	*10:51*	*11:06*	*1*	10:43	10:51	11:07	1	10:45	10:54	11:23	2	*10:47*	*10:52*	*11:03*	*1-*				
6	C7.8	9	12:05	12:12	12:52	2+	12:01	12:12	12:46	2	12:03	12:14	12:58	2+	*12:04*	*12:14*	*12:44*	*2*	12:04	12:15	12:43	2
7	?	1													*12:29*	*12:34*	*12:49*	*1*				
7	C5.5	4	13:36	13:44	14:32	2+	13:12	13:24	13:34	1					13:15	13:24	?	-				
7	?	2													***13:35***	***13:44***	***?***	**-**				
7	?	8					13:35	13:52	14:35	2+	13:34	13:55	14:39	2+	13:35	13:56	14:33	2+	13:38	13:55	14:18	2
7	C6.7	1													17:13	17:18	17:29	1-				
8	C7.4	8	10:21	10:32	10:52	1+	10:04	10:32	10:59	2+	10:21	10:35	10:58	2	*10:19*	*10:34*	*10:55*	*2*				
8	?	1													*11:09*	*11:39*	*11:53*	*2*				
8	?	2													*12:33*	*12:37*	*12:46*	*1-*	**11:50**	**12:27**	**13:37**	**3**
8	?	2									15:36	15:42	16:21	2	15:34	15:44	?	-				
8	**M1.6**	3					15:31	15:57	16:17	2+					15:49	16:00	16:27	2	*16:07*	*16:17*	*16:23*	*1-*
9	**M2.8**	5	08:54	09:05	09:32	2	08:52	09:07	09:43	2+					*08:54*	*09:07*	*09:28*	*2*				
9	C8.4	6	12:09	12:20	12:54	2	12:03	12:22	12:55	2+	12:06	12:18	13:28	2+	12:08	12:21	12:44	2				
9	**M1.5**	7	*14:51*	*14:56*	*?*	-	14:49	14:56	15:15	1+	14:51	14:57	15:17	1+	14:51	14:57	?	-	14:53	14:59	15:16	1
9	**M1.4**	4	*15:18*	*15:23*	*15:43*	*1*	15:18	15:22	15:31	1-					15:17	15:25	15:36	1				
9	C	1													17:48	17:52	18:06	1-				
9	C6.5	1													18:21	18:34	?	-				
9	**M1.8**	1													18:39	18:42	19:09	1+				
10	**M1.4**	1					08:02	08:06	08:18	1-												
10	C5.5	3	08:51	08:53	08:55	1-	08:49	08:55	08:59	1-					*09:02*	*09:06*	*09:12*	*1-*				
10	C4.1	1													*10:24*	*10:30*	*10:33*	*1-*				
10	C9.6	6	10:47	10:51	11:05	1-	10:43	10:50	11:01	1-	10:46	10:50	11:08	1	10:47	10:51	10:55	1-	10:51	10:53	10:57	1-
10	?	1													11:07	11:11	11:22	1-				
10	**M1.1**	3	14:40	14:55	15:16	2	14:47	14:59	15:04	1-					14:39	14:55	?	-				
10	?	1													15:16	15:19	15:23	1-				
10	?	1													15:32	15:39	?	-				
10	?	2					15:53	16:06	16:15	1					15:48	15:59	16:18	1+				
11	**M2.2**	3	07:55	08:08	08:17	1	08:05	08:08	08:19	1-												
11	?	0																				
11	C7.3	5	09:18	09:21	09:29	1-	09:15	09:21	09:30	1-	09:18	09:21	09:31	1-	09:19	09:23	09:26	1-				
11	?	1													*09:34*	*09:38*	*09:44*	*1-*				
11	**M1.0**	7	10:52	10:58	11:17	1	10:38	10:59	11:24	2+	10:51	10:55	11:02	1-	10:55	10:58	11:09	1-				
11	**M1.4**	8	11:33	11:36	11:50	1-	11:30	11:35	11:58	1+	11:30	11:35	11:51	1	11:33	11:35	11:43	1-	11:36	11:37	11:47	1-
11	**M1.5**	7	12:06	12:12	12:20	1-	12:04	12:09	12:19	1-					12:07	12:12	?	-	12:08	12:14	12:22	1-
11	**M1.1**	2					12:19	12:21	12:26	1-					**12:20**	**12:23**	**?**	**-**				
11	**M1.5**	6	12:29	12:40	13:00	1+	12:28	12:42	13:10	2					**12:29**	**12:41**	**13:11**	**2**	12:31	12:43	13:10	2
11	**X1.1**	8					15:44	15:46	15:48	1-	15:43	15:47	16:28	2	15:45	15:51	16:21	2	15:48	15:53	16:03	1-
11	**M1.4**	1													17:17	17:23	17:50	2				
12	**M3.1**	7	08:44	08:48	08:56	1-	08:37	08:48	09:03	1+	08:42	08:48	?	-	*08:41*	*08:48*	*?*	-				
12	?	2									09:00	09:02	09:14	1-	*09:10*	*09:03*	*09:10*	*1-*				
12	**M1.4**	6	*09:14*	*09:24*	*09:40*	*1+*	09:12	09:27	09:44	1+					*09:14*	*09:29*	*10:00*	*2+*	*08:50*	*09:14*	*09:25*	*2*
12	?	1													***11:11***	***11:14***	***11:21***	***1-***				
12	?	1													***13:04***	***13:06***	***13:12***	***1-***				
12	**M1.2**	10	13:28	13:35	13:50	1	13:27	13:36	14:05	2	13:27	13:36	14:25	2+	13:28	13:36	14:03	2	13:32	13:37	13:59	1+
12	?	1													14:31	14:38	14:49	1-				
12	C5.5	3	15:07	15:10	15:16	1-					15:08	15:11	15:25	1-	15:08	15:14	15:24	1-				
12	**M1.0**	9	*15:36*	*15:39*	*15:50*	*1-*	15:32	15:39	15:59	1+	15:34	15:41	16:35	2+	15:36	15:41	16:16	2	15:38	15:42	15:53	1-
12	C6.1	2									17:20	17:27	17:44	1	17:21	17:26	17:45	1				
13	C3.7	2									10:31	10:37	?	-	**10:30**	**10:37**	**10:43**	**1-**				
13	C4.5	4	10:45	10:49	10:56	1-					10:42	10:51	10:55	1-	**10:45**	**10:51**	**10:57**	**1-**				
13	?	2													*11:28*	*11:44*	*11:54*	*1+*				
13	?	3									12:08	12:13	12:22	1-	*12:08*	*12:12*	*12:22*	*1-*				
13	C3.7	3	13:00	13:03	13:12	1-					12:59	13:08	?	-	*12:59*	*13:06*	*?*	-				
13	?	2									13:19	13:24	13:36	1-	*13:18*	*13:24*	*?*	-				
13	?	1													*13:37*	*13:42*	*13:51*	*1-*				
13	C6.5	4	*14:29*	*14:32*	*14:44*	*1-*					14:27	14:32	14:48	1	*14:28*	*14:36*	*14:44*	*1-*				
13	?	1													***14:45***	***14:51***	***14:56***	***1-***				
13	C7.7	4					15:32	15:39	15:47	1-	15:31	15:41	15:51	1	*15:35*	*15:40*	*?*	-				
13	**M1.4**	4					15:49	15:55	16:05	1-	15:53	16:00	16:16	1	*15:51*	*15:57*	*16:16*	*1*				
14	C3.5	3	10:40	10:43	10:51	1-									**10:39**	**10:45**	**10:58**	**1**				
14	C5.5	6	11:19	11:22	11:34	1-					11:17	11:24	11:38	1	11:18	11:24	11:31	1-	*11:20*	*11:25*	*11:41*	*1*
14	**M2.6**	6	12:07	12:21	13:49	3					12:07	12:12	13:37	3	12:07	12:24	?	-	12:10	12:23	13:27	2+
14	?	1													13:05	13:07	13:40	2				
14	?	1													*13:45*	*13:46*	*?*	-				
14	?	2									13:48	13:49	13:58	1-	*13:49*	*13:52*	*14:29*	*2*				
14	?	1													15:05	15:06	15:11	1-				
14	?	2													15:58	16:00	16:02	1-				
15	C3.2	1													***08:46***	***08:51***	***08:59***	***1-***				
15	C7.1	4	09:11	09:16	09:32	1	09:11	09:20	09:31	1	09:09	09:22	09:47	2	**09:12**	**09:22**	**09:34**	**1**				
15	C3.3	2									10:07	10:12	10:20	1-	**10:05**	**10:13**	**10:18**	**1-**				
15	?	2									10:23	10:28	10:31	1-	*10:25*	*10:27*	*10:35*	*1-*				
15	?	2									10:41	10:48	10:53	1-	*10:40*	*10:44*	*10:53*	*1-*				
15	?	1													*11:20*	*11:25*	*11:30*	*1-*				
15	?	1													*11:45*	*11:56*	*12:02*	*1-*				
15	C2.4	1													*12:49*	*12:52*	*13:12*	*1*				
15	C3.9	3					13:26	13:36	13:41	1-	13:24	13:37	14:09	2	13:27	13:34	?	-				
15	C3.9	1													13:42	13:43	?	-				
15	?	1													13:49	13:52	14:38	2+				
15	?	1													15:44	15:45	15:53	1-				
15	C3.7	1													15:58	16:02	16:25	1+				
16	C9.0	4					10:15	10:55	11:55	3					*10:16*	*11:03*	*14:47*	*3+*				
17	C2.0	1													*11:47*	*11:52*	*11:59*	*1-*				
17	?	1													*12:35*	*12:49*	*13:15*	*2*				
17	**X2.2**	1													19:52	20:21	21:09	2+				
18	?	1													**09:57**	**10:03**	**10:04**	**1-**				
18	C7.7	9	11:54	12:02	13:13	2+	11:49	12:00	12:18	1+	11:52	12:02	12:48	2+	11:55	12:01	12:27	1+	11:58	12:04	12:14	1-
19	?	1													13:53	13:57	14:05	1-				
19	C2.6	2									14:54	15:04	15:16	1	14:57	15:03	15:23	1+				
19	C2.1	1													15:49	15:53	15:56	1-				
20	C2.5	1	10:36	10:41	10:59	1																
20	**M4.4**	11	14:55	15:01	15:52	2+	14:55	14:57	15:21	1+	14:54	15:00	15:38	2	14:55	15:00	15:33	2	14:57	15:04	15:31	2
20	C3.1	2									16:24	16:28	16:30	1-	16:26	16:28	16:33	1-				
20	C5.4	1													17:42	17:44	17:54	1-				
21	?	6	10:44	10:54	?	-					10:45	10:54	?	-	10:42	10:54	?	-				
21	**M4.7**	7	11:06	11:25	?	-	11:08	11:23	11:33	1	11:06	11:12	?	-	11:08	11:12	?	-				
21	?	6									11:14	11:26	12:07	2+	11:15	11:24	12:02	2+	11:09	11:23	12:21	2+
21	?	2																				
21	C6.1	6	12:18	12:22	13:02	2	12:17	12:22	12:35	1-	12:17	12:25	12:35	1-	12:18	12:24	12:30	1-	12:21	12:25	12:43	1
21	C4.0	1													18:34	18:39	18:54	1				
21	**M5.0**	1													20:10	20:18	20:51	2				
22	C3.2	3					10:21	10:27	10:41	1					*10:23*	*10:25*	*10:30*	*1-*				
22	C3.0	4	12:34	12:38	12:44	1-	12:28	12:37	12:46	1-					*12:33*	*12:39*	*12:49*	*1-*				
22	C3.2	3	12:50	12:54	13:08	1-	12:47	12:53	13:02	1-					*12:49*	*12:54*	*12:59*	*1-*				
22	?	1													***13:17***	***13:19***	***13:23***	***1-***				
22	**M2.6**	11	13:42	13:51	14:33	2+	13:40	13:50	14:36	2+	13:44	13:53	14:16	1+	*13:44*	*13:53*	*14:35*	*2+*	13:47	13:56	14:35	2+
22	?	2													***14:38***	***14:41***	***14:45***	***1-***				
22	?	1													*14:58*	*15:00*	*15:07*	*1-*				
22	?	0																				
23	C7.2	3					08:04	08:12	08:26	1					*08:09*	*08:13*	*08:21*	*1-*				
23	**M1.0**	2					08:32	09:02	09:22	2+					***08:38***	***08:44***	***08:48***	***1-***				
23	?	2													*08:52*	*09:02*	*09:20*	*1+*				
23	C6.6	9	12:25	12:29	12:51	1+	12:19	12:31	12:54	2	12:22	12:32	12:56	2	12:24	12:31	12:54	1+	12:23	12:33	13:02	2
23	C4.3	8	14:27	14:31	14:44	1-	14:24	14:34	14:50	1+	14:27	14:34	14:58	1+	14:27	14:34	14:56	1+				
23	C7.5	9	15:10	15:14	15:27	1-	15:07	15:14	15:19	1-	15:09	15:15	15:32	1	15:11	15:14	15:28	1-	15:13	15:17	15:29	1-
23	?	1													15:30	15:31	15:44	1-				
23	C8.9	1													18:15	18:20	18:31	1-				
24	C1.9	1													11:31	11:34	11:37	1-				
24	C2.9	6	13:03	13:10	13:19	1-	12:59	13:09	13:22	1	13:02	13:11	13:25	1	13:04	13:14	13:27	1				
24	?	1													*13:51*	*13:54*	*14:00*	*1-*				
24	**M1.1**	2									17:13	17:15	17:29	1-	17:13	17:16	17:30	1-				
25	C2.1	4					11:46	11:49	11:56	1-	11:43	11:51	12:00	1-	11:47	11:48	12:01	1-				
25	C2.2	3									15:07	15:10	15:23	1-	15:08	15:11	15:15	1-				
25	**M1.0**	7	15:38	15:42	16:06	1+	15:37	15:41	15:46	1-	15:39	15:43	16:06	1+	15:38	15:42	16:07	1+	15:38	15:46	16:08	1+
25	**M6.3**	1													19:18	19:40	20:03	2				
26	C5.5	6	11:56	11:59	12:12	1-	11:53	12:00	12:11	1-	11:53	12:02	12:27	2	11:55	12:02	12:10	1-				
26	C2.8	1													19:24	19:29	19:33	1-				
27	C4.5	6	10:18	10:23	10:30	1-	10:15	10:22	10:39	1	10:17	10:26	10:39	1	*10:19*	*10:24*	*10:41*	*1*				

BAA Radio Astronomy Section. **2023 FEBRUARY.**

	Xray class		Steve Parkinson (Various) Tuned radio frequency receiver, frame aerials.				Andrew Thomas (18.3kHz/*19.6kHz*) Tuned radio frequency receiver, 0.6m frame aerial.				Phil Rourke (23.4kHz) Spectrum Lab, 0.6m frame aerial.				Mark Prescott (20.9kHz/*22/1kHz*)) SpetrumLab/Starbase, mini-whip aerial. Active				John Elliott (18.3kHz) 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)	
2	C1.3																					
4	C1.7																					
5	C6.4		10:45	10:52	11:07	1	10:44	10:53	11:04	1	10:44	10:52	11:07	1	10:50	10:56	11:05	1-				
6	C7.8		12:03	12:14	12:43	2	12:05	12:13	12:48	2					12:08	12:14	12:43	2				
7	?																					
7	C5.5														12:30	12:37	12:42	1-				
7	?														13:19	13:27	13:36	1-				
7	?		13:36	13:53	14:22	2+					13:36	13:54	15:06	3	13:39	14:02	14:49	2+				
7	C6.7																					
8	C7.4		10:21	10:34	10:52	1+					10:15	10:33	10:53	2	10:23	10:37	10:57	2				
8	?																					
8	?																					
8	?																					
8	**M1.6**																					
9	**M2.8**										08:54	09:05	09:38	2								
9	C8.4										12:06	12:19	13:00	2+	12:13	12:19	?	-				
9	**M1.5**										14:50	14:57	15:37	2+	14:55	15:01	15:16	1				
9	**M1.4**										?	15:52	16:25	-								
9	C																					
9	C6.5																					
9	**M1.8**																					
10	**M1.4**																					
10	C5.5																					
10	C4.1																					
10	C9.6														10:51	10:54	11:09	1-				
10	?																					
10	**M1.1**																					
10	?																					
10	?																					
10	?																					
11	**M2.2**										08:00	08:09	08:28	1+								
11	?																					
11	C7.3										09:19	09:22	09:34	1-								
11	?																					
11	**M1.0**						10:53	10:59	11:13	1	10:42	10:58	11:15	2	10:55	11:01	?	-				
11	**M1.4**						11:33	11:36	12:03	1+	11:31	11:37	12:00	1+	11:35	11:41	?	-				
11	**M1.5**						12:07	12:11	13:01	2+	12:05	12:11	?	-	12:07	12:18	?	-				
11	**M1.1**																					
11	**M1.5**										?	12:42	13:02	-	?	12:45	?	-				
11	**X1.1**						15:44	15:50	16:22	2	15:43	15:51	16:12	1+	15:48	15:53	16:13	1				
11	**M1.4**																					
12	**M3.1**						08:44	08:48	09:10	1+	08:35	08:48	09:01	1+								
12	?																					
12	**M1.4**						09:12	09:29	09:44	1+	09:15	09:26	09:44	1+								
12	?																					
12	?																					
12	**M1.2**						13:29	13:35	13:59	1+	13:27	13:36	13:56	1+	13:33	13:39	13:54	1	13:30	13:35	13:45	1-
12	?																					
12	C5.5																					
12	**M1.0**						15:36	15:39	15:59	1	15:35	15:40	16:04	1+	*15:40*	*15:44*	*?*	-				
12	C6.1																					
13	C3.7																					
13	C4.5										10:42	10:49	10:58	1-								
13	?										11:29	11:43	12:01	1+								
13	?										12:07	12:12	12:19	1-								
13	C3.7																					
13	?																					
13	?																					
13	C6.5						14:28	14:32	14:47	1												
13	?																					
13	C7.7										15:35	15:40	15:50	1-								
13	**M1.4**						15:34	15:56	16:10	2												
14	C3.5														*10:43*	*10:49*	*11:03*	*1*				
14	C5.5						*11:14*	*11:22*	*11:27*	*1-*					11:21	11:27	11:43	1				
14	**M2.6**						12:07	12:19	13:40	3					12:10	12:19	13:53	3				
14	?																					
14	?																					
14	?																					
14	?																					
14	?																					
15	C3.2																					
15	C7.1																					
15	C3.3																					
15	?																					
15	?																					
15	?																					
15	?																					
15	C2.4																					
15	C3.9																					
15	C3.9																					
15	?																					
15	?																					
15	C3.7																					
16	C9.0										10:14	11:02	15:08	3+								
17	C2.0																					
17	?																					
17	**X2.2**																					
18	?																					
18	C7.7		11:55	12:02	12:30	2	11:55	12:01	12:33	2	11:49	12:02	12:57	2+					11:55	12:00	12:15	1
19	?																					
19	C2.6																					
19	C2.1																					
20	C2.5																					
20	**M4.4**		14:55	15:00	15:35	2	14:54	15:01	15:31	2	14:54	15:12	15:35	2	14:58	15:04	15:28	1+	14:50	14:55	15:30	2
20	C3.1																					
20	C5.4																					
21	?		10:43	10:54	?	-					10:44	10:54	?	-	10:49	10:56	11:09	1				
21	**M4.7**										?	11:09	11:22	-	?	11:15	?	-				
21	?		11:07	11:26	12:30	2+	10:44	11:25	12:42	3					11:19	11:25	12:21	2+				
21	?										11:38	12:04	?	-	12:22	12:27	?	-				
21	C6.1										?	12:23	13:36	-								
21	C4.0																					
21	**M5.0**																					
22	C3.2										10:23	10:28	10:41	1-								
22	C3.0														12:36	12:40	12:49	1-				
22	C3.2																					
22	?																					
22	**M2.6**		13:43	13:52	14:35	2+	13:40	13:51	14:55	2+	13:42	13:46	?	-	13:45	13:55	14:39	2+	13:43	13:50	14:30	2+
22	?										?	14:03	14:38	-								
22	?																					
22	?																					
23	C7.2						08:09	08:13	08:22	1-												
23	**M1.0**																					
23	?										08:36	09:01	09:36	2+								
23	C6.6		12:25	12:30	12:50	1	12:24	12:29	13:20	2+	12:20	12:30	13:01	2	12:27	12:37	12:51	1				
23	C4.3		14:28	14:32	14:44	1-	14:27	14:33	14:46	1	14:27	14:33	14:51	1	*14:31*	*14:37*	*14:53*	*1*				
23	C7.5		15:11	15:13	15:22	1-	15:10	15:13	15:28	1-	15:08	15:14	15:24	1-	*15:13*	*15:18*	*15:31*	*1-*				
23	?																					
23	C8.9																					
24	C1.9																					
24	C2.9		13:03	13:11	13:25	1					13:04	13:09	13:29	1								
24	?																					
24	**M1.1**																					
25	C2.1										11:43	11:49	12:08	1								
25	C2.2										15:37	15:42	16:07	1+								
25	**M1.0**						15:37	15:42	16:09	1+					*15:42*	*15:46*	*15:58*	*1-*				
25	**M6.3**																					
26	C5.5		11:55	12:00	12:28	2					11:54	12:00	12:40	2+								
26	C2.8																					
27	C4.5		10:18	10:23	10:40	1					10:14	10:24	10:44	1+								

BAA Radio Astronomy Section. **2023 FEBRUARY.**

	Xray class		Chris Bailey Spectrum Lab.				Andrew Lutley (23.4kHz) Tuned radio frequency receiver, 0.6m frame aerial.			Peter Meadows (23.4kHz) 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)
2	C1.3																	
4	C1.7																	
5	C6.4		10:44	10:50	11:10	1+												
6	C7.8		12:04	12:12	12:50	2+												
7	?																	
7	C5.5																	
7	?																	
7	?		13:35	13:52	14:40	2+												
7	C6.7																	
8	C7.4		10:20	10:28	11:00	2												
8	?																	
8	?																	
8	?																	
8	**M1.6**																	
9	**M2.8**		08:55	09:06	09:30	2												
9	C8.4																	
9	**M1.5**																	
9	**M1.4**																	
9	C																	
9	C6.5																	
9	**M1.8**																	
10	**M1.4**																	
10	C5.5																	
10	C4.1																	
10	C9.6																	
10	?																	
10	**M1.1**																	
10	?																	
10	?																	
10	?																	
11	**M2.2**																	
11	?																	
11	C7.3																	
11	?																	
11	**M1.0**																	
11	**M1.4**																	
11	**M1.5**																	
11	**M1.1**																	
11	**M1.5**																	
11	**X1.1**		15:44	15:50	16:13	1+												
11	**M1.4**																	
12	**M3.1**		08:41	08:48	09:15	2												
12	?																	
12	**M1.4**																	
12	?																	
12	?																	
12	**M1.2**		13:28	13:34	14:00	1+												
12	?																	
12	C5.5																	
12	**M1.0**		15:35	15:38	15:55	1												
12	C6.1																	
13	C3.7																	
13	C4.5																	
13	?																	
13	?																	
13	C3.7																	
13	?																	
13	?																	
13	C6.5																	
13	?																	
13	C7.7																	
13	**M1.4**																	
14	C3.5																	
14	C5.5																	
14	**M2.6**																	
14	?																	
14	?																	
14	?																	
14	?																	
14	?		15:34	15:40	16:10	2												
15	C3.2																	
15	C7.1																	
15	C3.3																	
15	?																	
15	?																	
15	?																	
15	?																	
15	C2.4																	
15	C3.9																	
15	C3.9																	
15	?																	
15	?																	
15	C3.7																	
16	C9.0		10:15	11:00	12:30	3+												
17	C2.0																	
17	?																	
17	**X2.2**																	
18	?																	
18	C7.7																	
19	?																	
19	C2.6																	
19	C2.1																	
20	C2.5																	
20	**M4.4**		14:38	15:01	15:25	2+												
20	C3.1																	
20	C5.4																	
21	?																	
21	**M4.7**		10:47	11:15	12:00	2+												
21	?																	
21	?																	
21	C6.1																	
21	C4.0																	
21	**M5.0**																	
22	C3.2																	
22	C3.0																	
22	C3.2																	
22	?																	
22	**M2.6**		13:35	13:48	14:00	1												
22	?																	
22	?																	
22	?																	
23	C7.2																	
23	**M1.0**																	
23	?																	
23	C6.6																	
23	C4.3																	
23	C7.5																	
23	?																	
23	C8.9																	
24	C1.9																	
24	C2.9																	
24	?																	
24	**M1.1**																	
25	C2.1																	
25	C2.2																	
25	**M1.0**																	
25	**M6.3**																	
26	C5.5																	
26	C2.8																	
27	C4.5																	