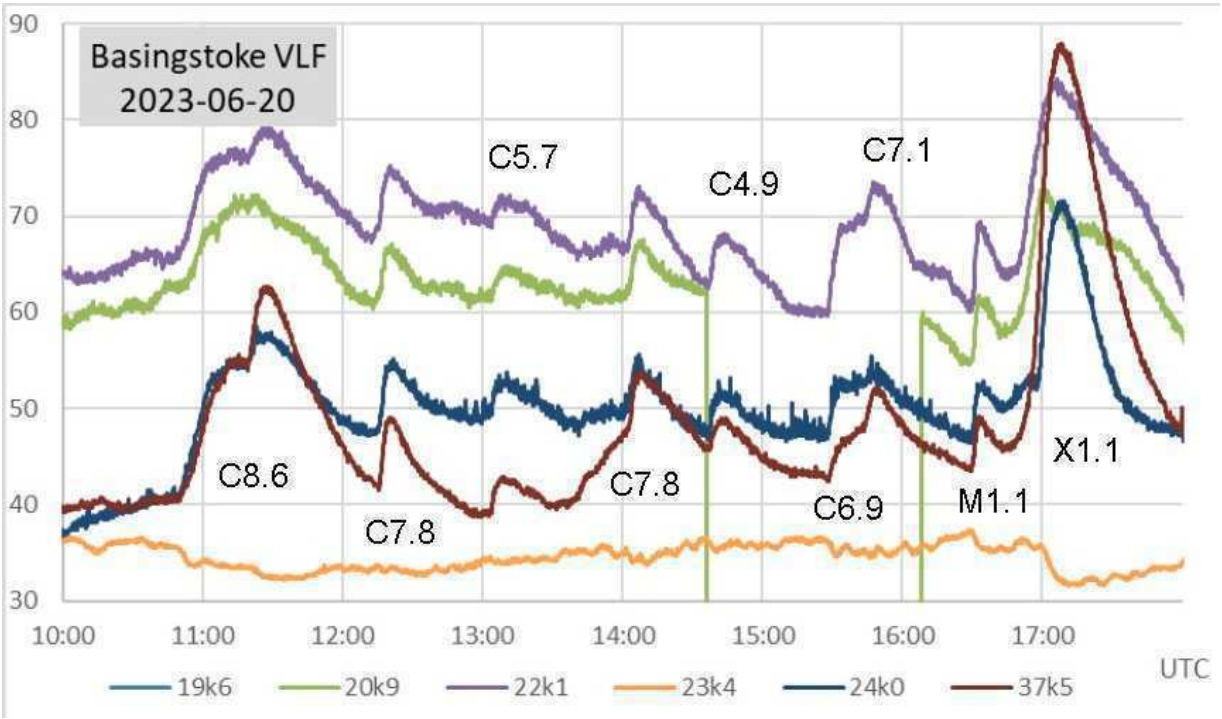
The British Astronomical Association
A company limited by guarantee
Registered Charity No. 210769
Founded in 1890
PO Box 702, Tonbridge, TN9-9TX 020-7734 4145
www.britastro.org

Please send all reports and observations to jacook@jacook.plus.com
BAA Radio Astronomy Section. Director Paul Hearn.

RADIO SKY NEWS 2023 JUNE.

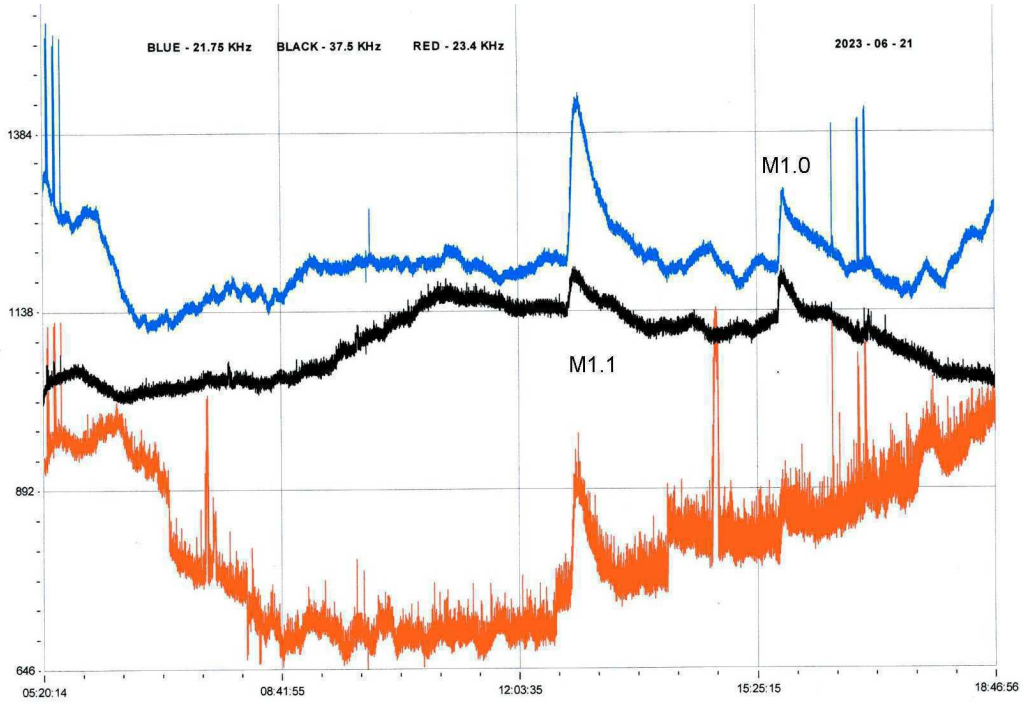
VLF SID OBSERVATIONS.

June has been another very busy month for solar activity, with a total of 124 SIDs recorded from 105 flares. Many flares were again multi-peaked and overlapping, making analysis very tricky. We recorded another X-class flare, the fourth so far in 2023, just in time to be recorded before the mid summer sunset. It was also the only one shown in the GOES X-ray data.

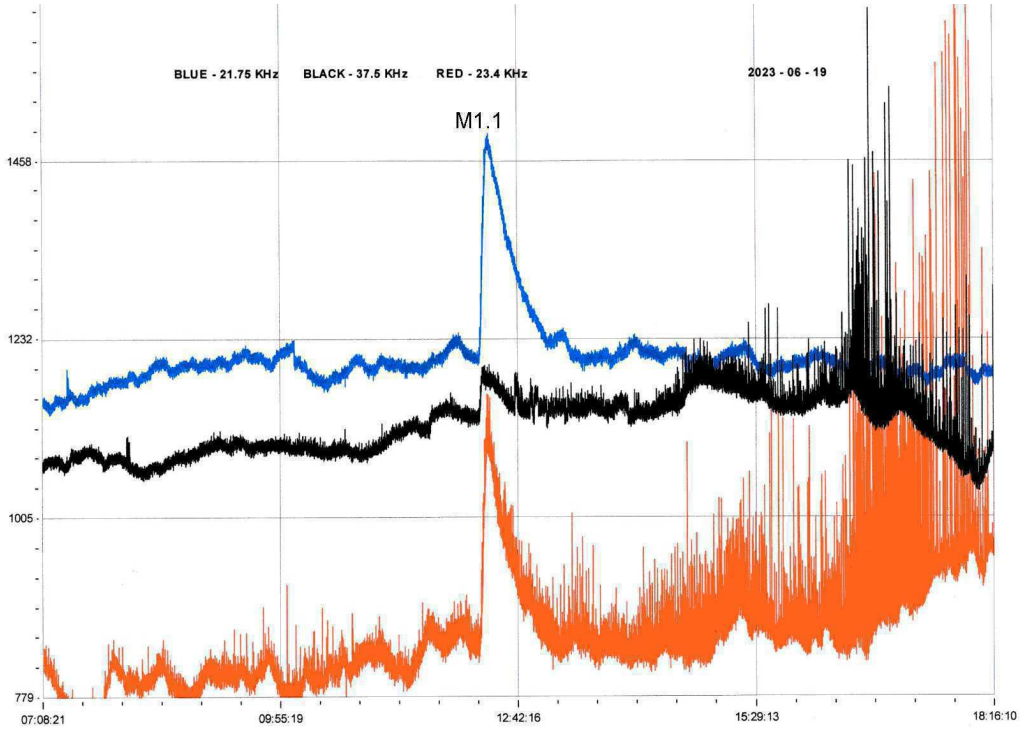


This recording by Paul Hyde shows activity on the 20th, ending with the X1.1flare. The first SID was from two flares, one unclassified, the other listed as C8.6. This has produced different SID shapes on the signals shown, appearing as a single event at 20.9kHz, and clearly twin at 37.5kHz. 23.4kHz has remained unaffected through most of this period. It does show a small dip aligned with the M1.1 flare, and a slightly larger dip for the X1.1. A total of four active regions were responsible for this activity

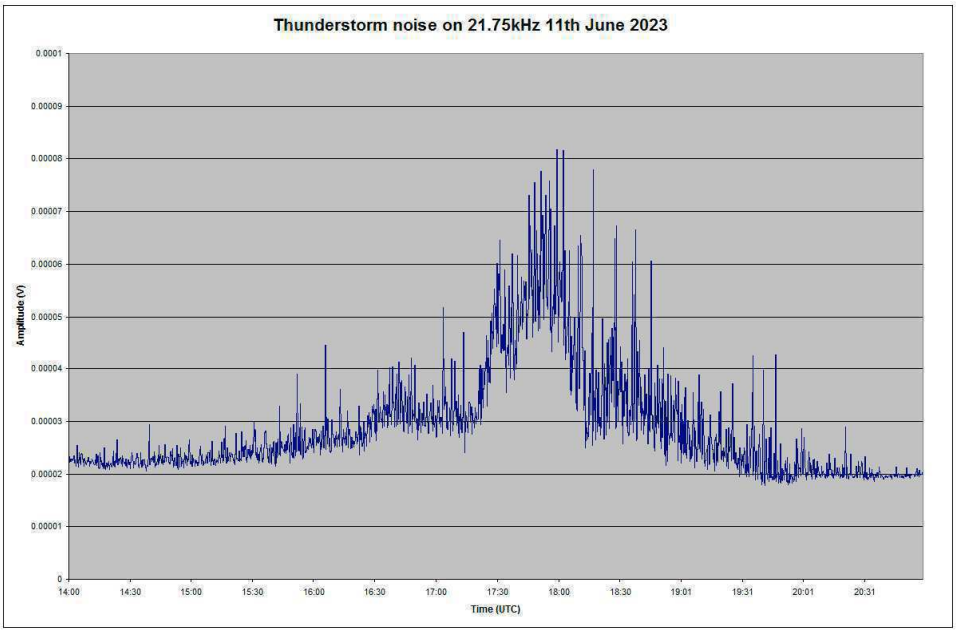
There were two M-class flares widely recorded on the 21st, shown in this chart by Colin Clements:

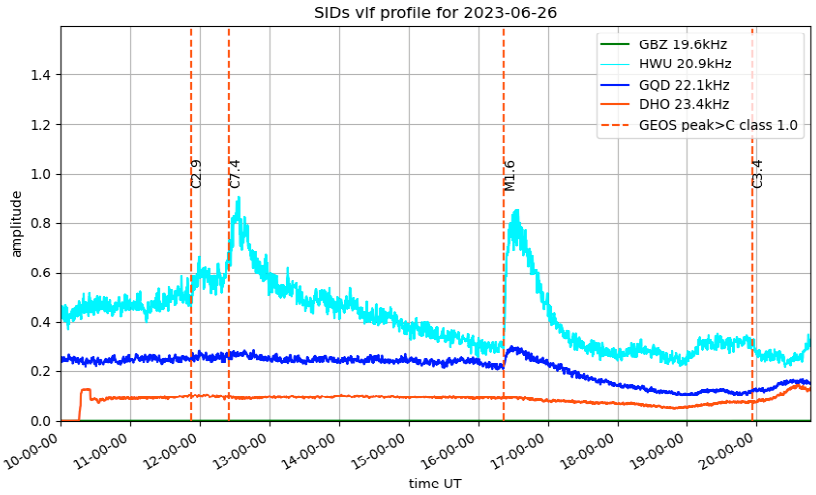


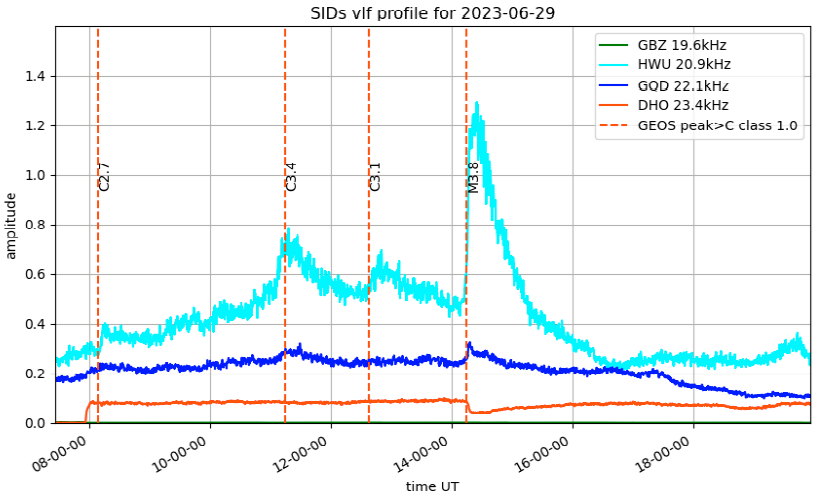
Both flares have produced clear SIDs at 21.75kHz and 37.5kHz, while 23.4kHz has been affected by long lasting thunder storms. These caused interference over several days, although Colin was not aware of them at the time. His recording from the 19th shows much stronger interference:



The M1.1 flare is well clear of the noise, which built up later in the afternoon. 37.5kHz also shows the storm. Colin's recording of the strong activity on the 20th was completely lost on these signals with even stronger interference from the storms. Most of the UK was affected by the storms sometime during this period, so Mark Edwards made a recording at 21.75kHz on the 11th. His recording shows the storm peaking between 17:30 and 18:30. This storm was local to Mark, rattling doors in the house! Lightning discharges around the globe are the classic source of 'spherics' recorded via D-layer propagation.

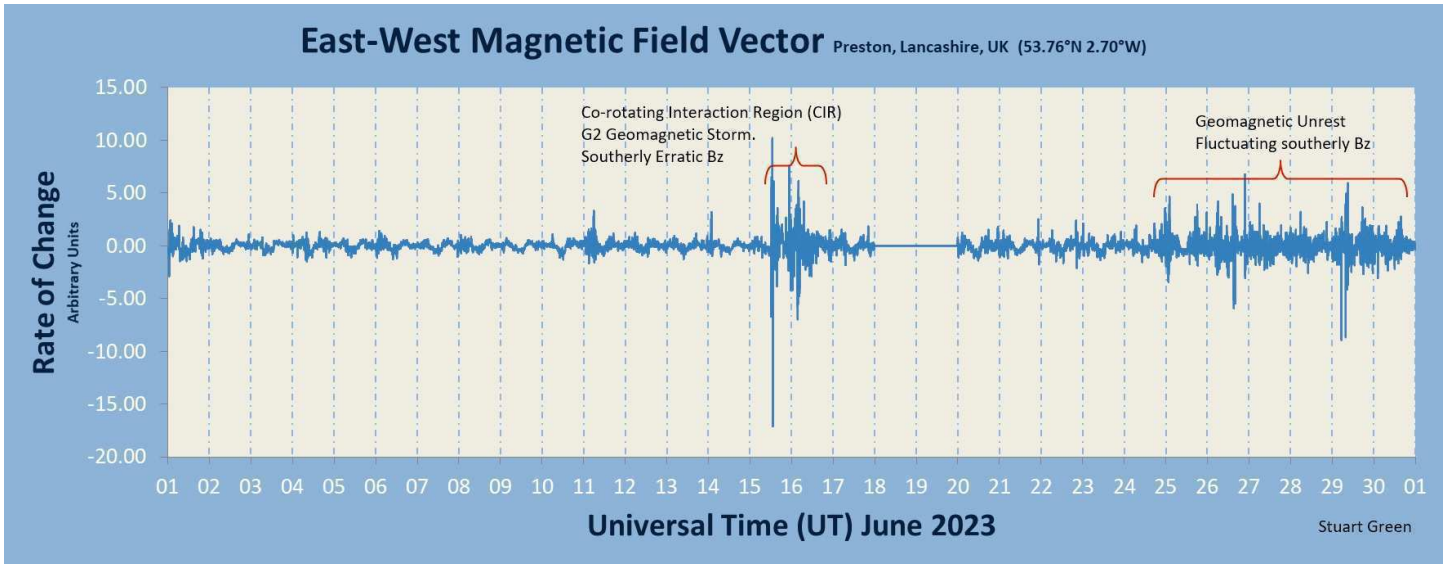




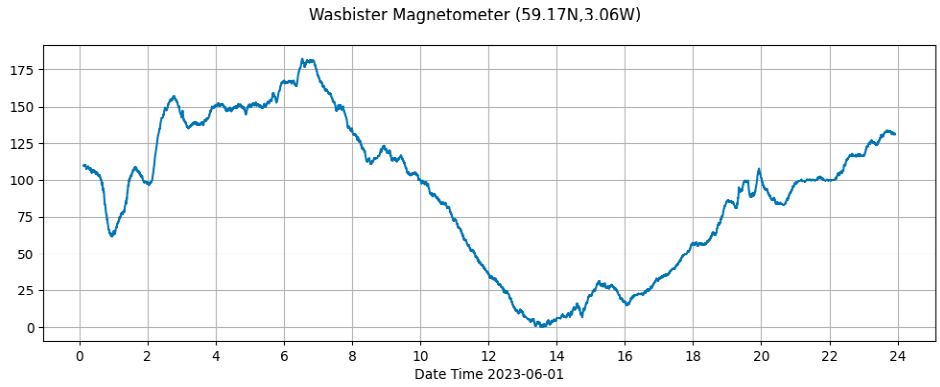


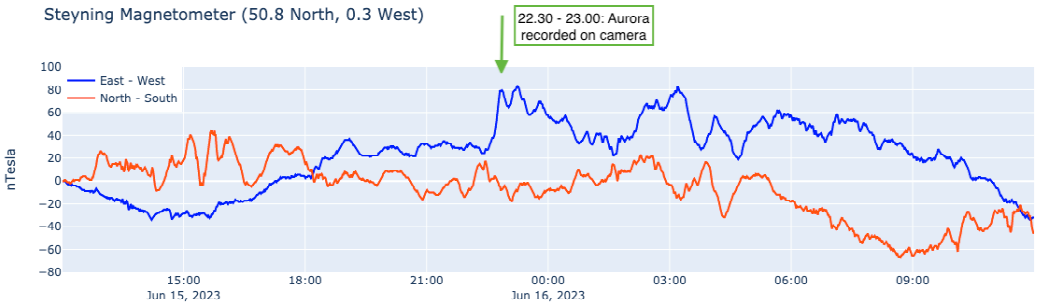
The strong activity continued through to the end of the month, these two charts showing Mark Prescott's recordings from the 26th and 29th. 20.9kHz shows the strongest response to the flares, both of the M-class flares having very rapid rise times.

MAGNETIC OBSERVATIONS.

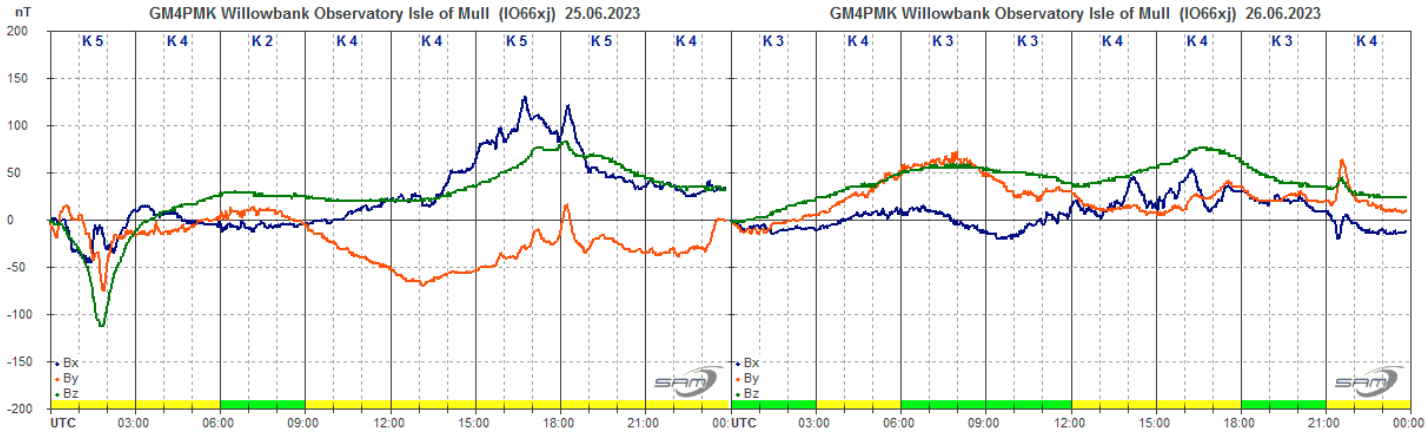


Stuart Green's monthly summary of magnetic activity is in great contrast to our list of energetic flares. Many of these, as well as some filament eruptions, did produce CMEs, but mostly directed well away from Earth. Stuart's chart shows the rate of change of the magnetic field over time, while our magnetometer recordings show the actual field over time. Looking at the Bartels diagram shows that there were periods of disturbance through most of the month, but fairly weak and not very turbulent. Callum Potter's recording from the 1st shows a sample:

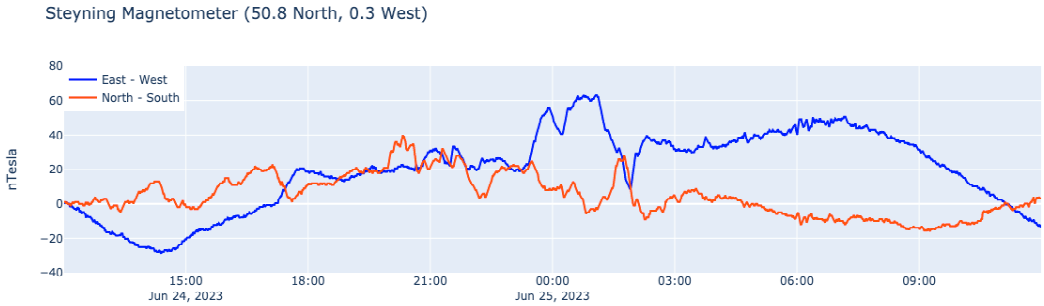




Nick Quinn's recording from the 15th shows a more active period, produced by a high speed wind rather than a CME. Nick also caught some aurora on a newly installed meteor / NLC camera. I suspect that this could have been seen elsewhere in the UK, given that Nick is located near the south coast. Sadly, light pollution probably prevents most of us from noticing it by eye.

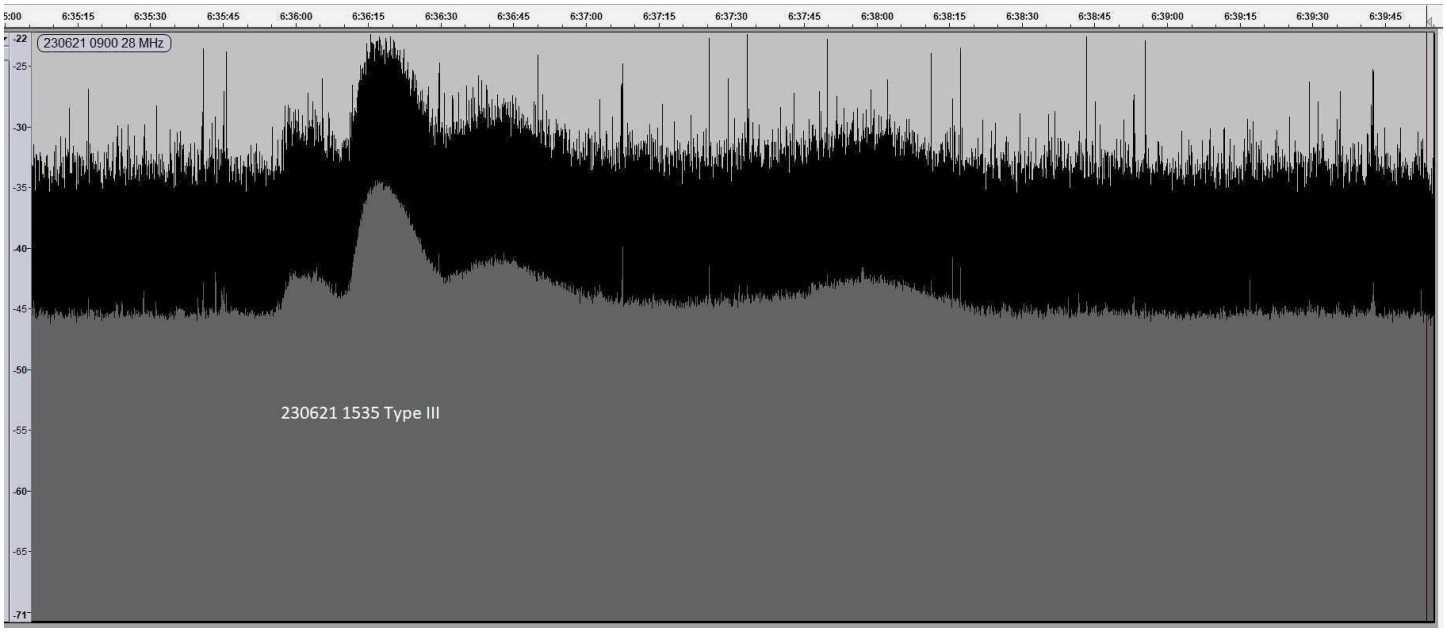


Roger Blackwell's recording from the 25th and 26th shows further disturbance from a combination of high speed winds and glancing CMEs. The SID timing tables show many stronger flares around this time, including the X1.1 on the 20th. Nick Quinn's recording from the 24th / 25th also shows this activity:

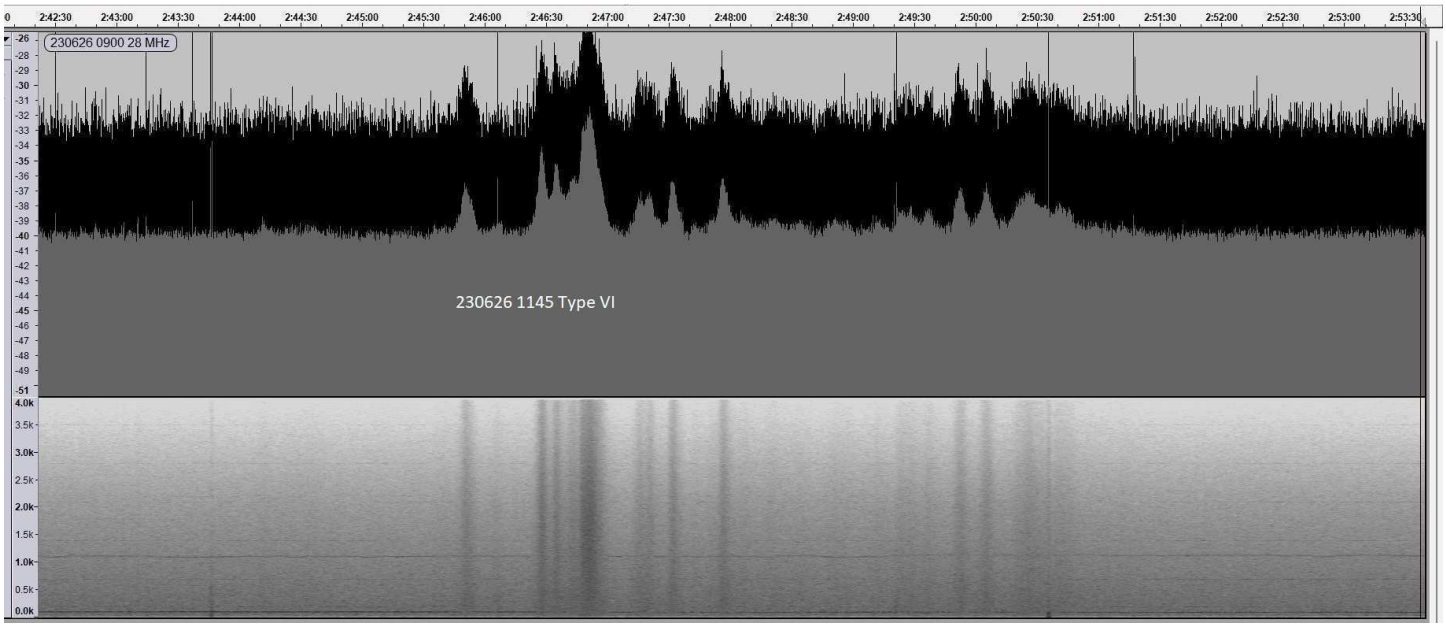


Magnetic observations received from Roger Blackwell, Stuart Green, Callum Potter, Nick Quinn and John Cook.

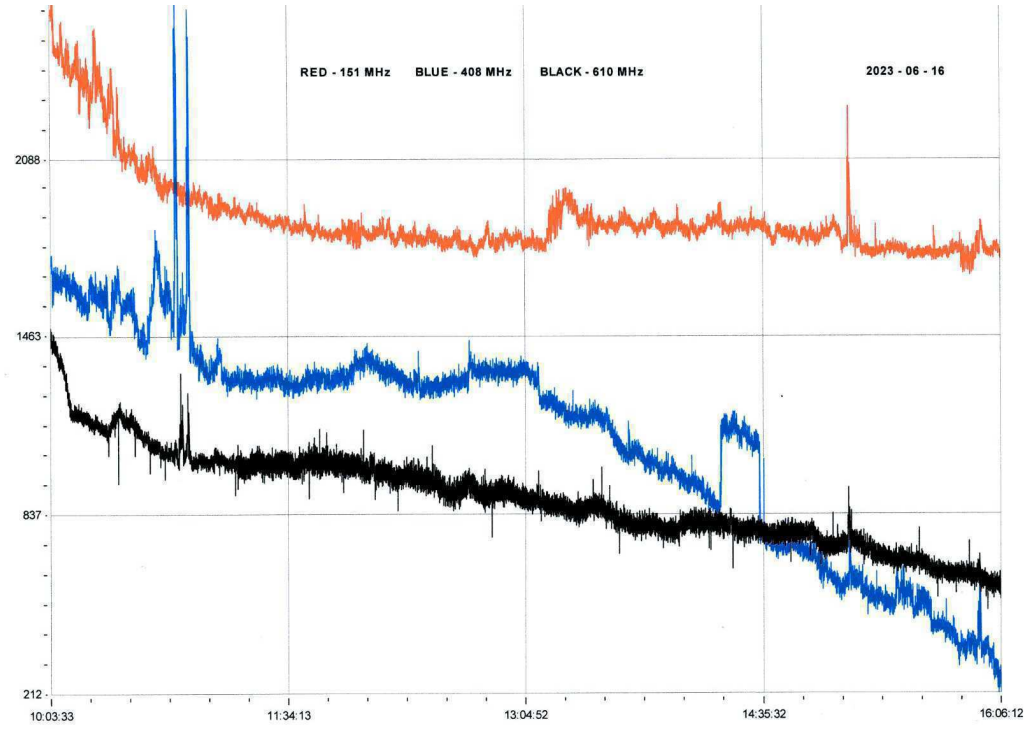
SOLAR EMISSIONS.



First I must apologise for incorrectly attributing last month's solar emission charts. They are of course from Colin Briden. This chart from Colin shows a 28MHz type III burst matching the M1.1 flare recorded at 15:35 on the 21st. This lasts for about 1 minute, with an amplitude rise of about 10dB.

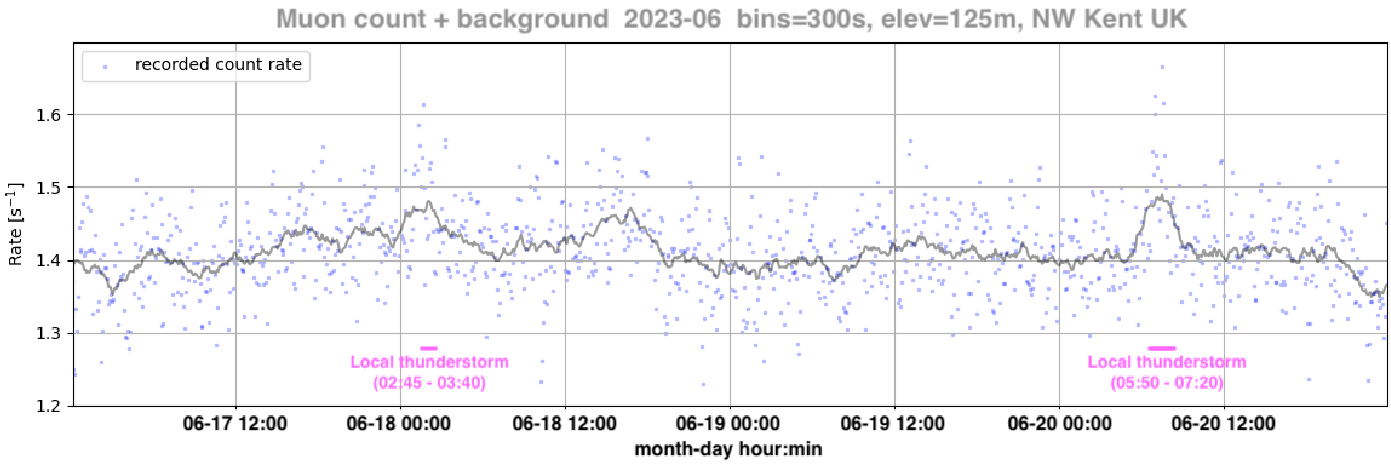


This recording shows a more complex type VI burst associated with the C2.9 flare at 11:45 on the 26th. Its multiple peaks last about 5 minutes, with an amplitude of about 8dB. The lower panel shows the spectrum recorded. The 28MHz data sampling rate gives a very large data file with a bandwidth of 24kHz. This is decimated down to 4kHz, enough to eliminate any non solar interference and save some memory space. This 4kHz bandwidth spectrum is shown in the chart, clearly identifying the individual spikes in the signal.

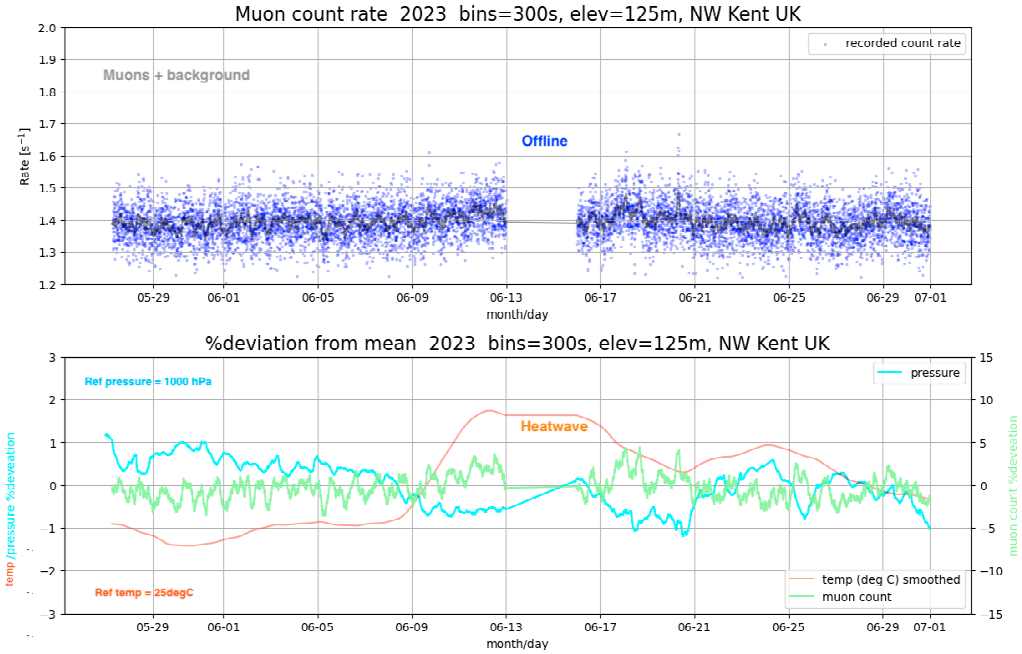


Colin Clement's VHF recording from the 16th shows a fairly small noise signal at 408MHz (blue) and 610MHz (black) possibly associated with the M1.0 flare peaking around 10:40. There is also a small time difference between these signals. 151MHz (red) has not been affected, but does show a small signal at 13:20, matching the smaller C2.7 flare. The source of the 408MHz burst between 12 and 14UT is not clear. He also recorded a stronger 610MHz burst matching the C4.8 flare at 10:25 on the 8th.

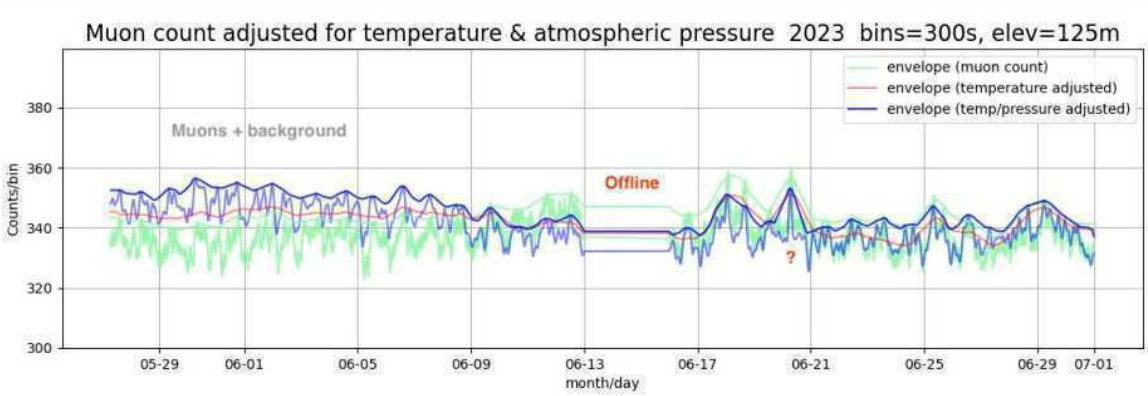
MUONS.

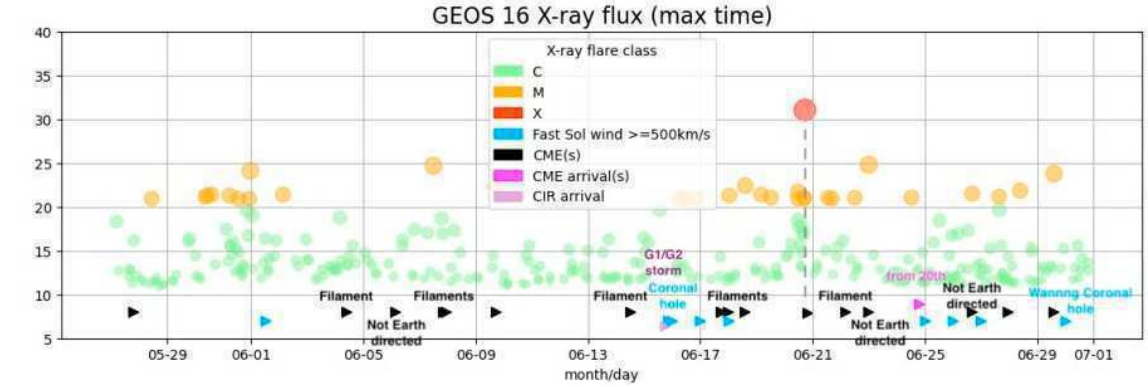


Thunderstorms have already been mentioned as a source of interference to our VLF recordings, but Mark Prescott has also noticed an effect in his Muon counts. A fairly strong local storm on the 20th produced a big increase in the muon count that initially caught his attention. A smaller increase was also noticed in the early morning of the 18th matching a local storm. Investigating, Mark has found work that shows that an increase or a decrease in muon counts can be associated with thunderstorms.



There was also a strong heatwave in the South East of the UK in mid June, marked in red on the lower panel, above. There was also a power failure that led to a loss of three day's data from the 13th. The thunderstorms followed the heatwave, seen as sharper spikes in the count data. The second half of the month was also magnetically more active, the 25th / 26th showing a small rise in muon counts.





The temperature and pressure adjusted chart shows just gentle variations up to the 13th, with much more activity from the 17th. The thunderstorms are clear, with the addition of the X1.1 flare just a few hours later on the 20th. The high speed solar wind and glancing CMEs have created a little more variation through to the end of the month.

BAA Radio Astronomy Section. **2023 JUNE.**

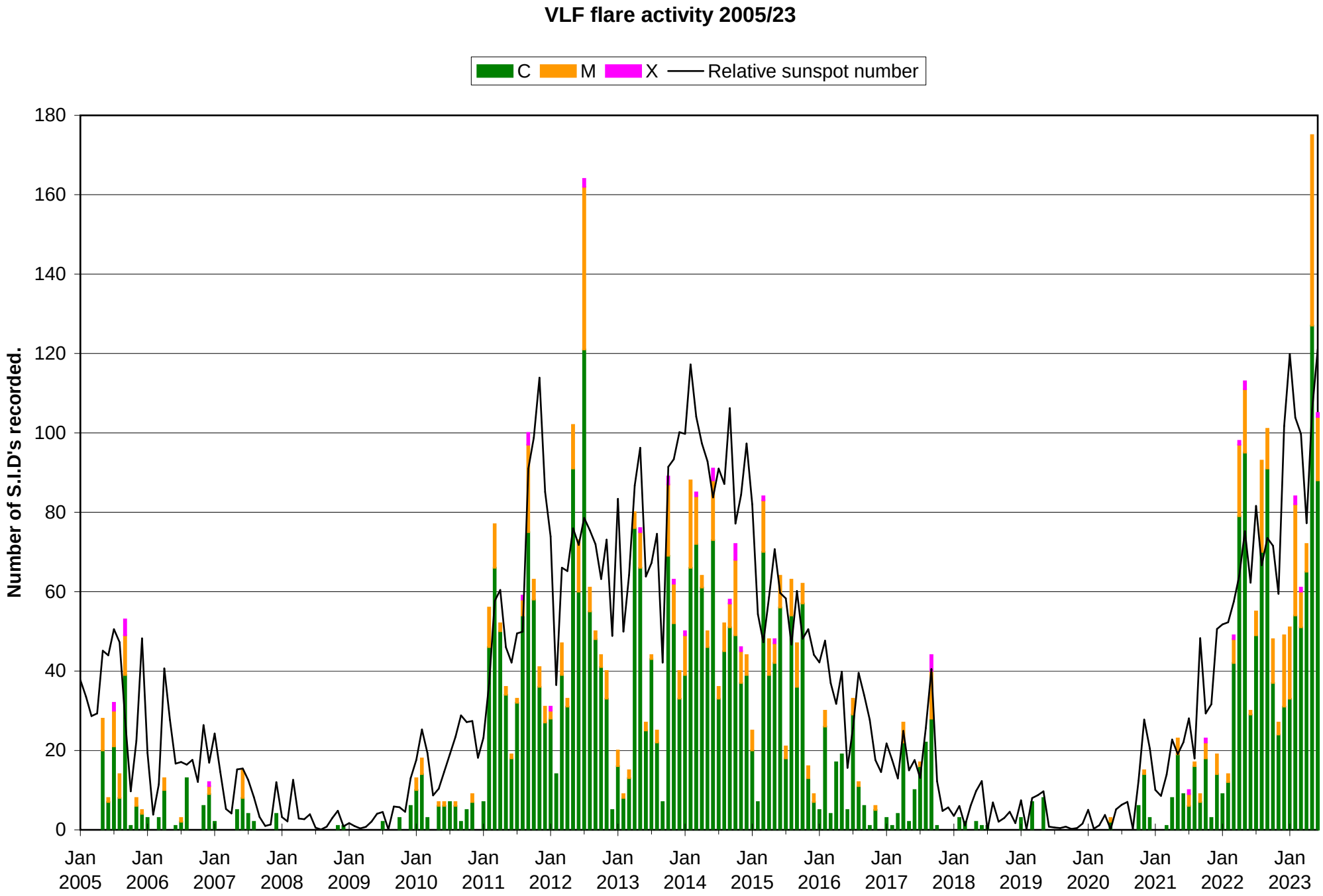
			John Cook (23.4kHz/*22.1kHz*)				Roberto Battaiola 20.9kHz				Paul Hyde (22.1kHz/*24kHz*)				Mark Edwards (24.0/*19.6*/**37.5kHz**)				Colin Clements (21.75kHz/*37.5kHz*)			
	Xray class	Observers	Tuned radio frequency receiver, 0.58m frame aerial.				Modified AAVSO receiver.				Spectrum Lab / PC 1.5m 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)	
1	C3.7	4													09:10	09:31	10:04	2+	09:10	09:40	10:44	3
1	C6.5	10	11:20	11:26	12:04	2	11:20	11:27	11:47	1+	11:17	11:24	12:00	2	11:20	11:28	12:06	2+	11:24	11:33	12:26	2+
1	?	1													12:22	12:27	12:46	1				
1	?	1													13:04	13:13	13:24	1				
1	C2.9	2													***13:32***	***13:40***	***14:38***	***2+***				
1	?	1													13:31	13:54	?	-				
1	C4.2	6	14:44	14:51	15:05	1					14:39	14:52	15:26	2+	14:44	14:53	15:33	2+	14:46	15:04	16:11	2+
1	C4.4	1													18:58	19:03	19:39	2				
1	C6.2	1													20:24	20:35	21:01	2				
2	C3.9	4	14:07	14:12	14:30	1					14:06	14:11	14:39	2	14:09	14:14	14:27	1-				
2	C3.3	1									15:18	15:25	15:46	1+								
3	?	1													*13:15*	*13:31*	*14:00*	*2*				
3	C2.2	2													14:07	14:07	14:25	1-	*14:12*	*14:18*	*14:39*	*1+*
3	C3.4	1													18:39	18:44	18:55	1-				
4	C3.4	6	09:47	09:50	10:05	1-					09:43	09:50	10:19	2	09:46	09:52	10:03	1-	09:47	10:00	10:19	1+
4	C4.5	7	12:03	12:07	12:30	1+					12:01	12:08	12:37	2	12:03	12:10	12:26	1	12:04	12:19	12:39	2
4	C5.7	7	14:29	14:31	14:53	1					14:26	14:32	14:57	1+	14:28	14:32	14:59	1+	14:32	14:44	15:20	2+
4	?	1													*14:39*	*14:40*	*15:00*	*1*				
4	C3.6	2									16:59	17:03	17:18	1	17:01	17:04	17:14	1-				
5	C2.5	1													11:15	11:21	11:38	1				
6	C5.6	7	08:31	08:39	08:51	1					08:32	08:41	?	-	08:34	08:44	?	-	08:36	08:51	09:14	2
6	C6.3	7	09:10	09:14	09:23	1-					09:12	09:16	09:32	1	09:10	09:18	?	-	09:14	09:22	09:41	1+
6	?	1													09:38	09:53	10:04	1+				
6	C2.4	1													17:16	17:24	17:35	1				
6	C2.1	1													18:28	18:28	18:40	1-				
6	C7.5	2									18:53	19:04	19:58	2+	18:58	19:02	19:39	2				
7	C7.1	1													*06:32*	*06:43*	*06:52*	*1*				
7	**M4.7**	11	11:26	11:46	13:33	3+	11:26	11:46	12:34	2+	11:21	11:48	13:44	3+	11:26	11:44	12:30	2+	11:32	11:53	13:02	3
7	?	1													14:16	14:22	14:30	1-				
7	?	1													14:43	14:47	14:56	1-				
7	C2.1	1													**15:49**	**15:58**	**16:11**	**1**				
7	C8.7	4									18:23	18:41	19:37	2+	18:28	18:41	19:37	2+				
8	C4.8	8	10:15	10:25	11:16	2+					10:11	10:25	11:17	2+	10:15	10:26	11:01	2+	10:17	10:33	11:08	2+
8	C1.8	1													16:57	17:02	17:05	1-				
9	C3.1	4	13:42	13:44	14:04	1					13:35	13:47	14:16	2	13:41	13:47	14:28	2+				
9	C4.5	5	14:37	14:41	15:24	2+					14:33	14:38	15:19	2+	14:37	14:41	15:10	2				
9	**M2.5**	10	*16:58*	*17:05*	*18:00*	*2+*	16:57	17:14	17:42	2	16:52	17:00	18:38	3	16:58	17:06	18:18	2+	16:58	17:19	18:12	2+
10	C4.5	1													18:51	18:55	19:08	1-				
12	C5.2	1													***06:57***	***07:02***	***07:13***	***1-***				
12	C2.6	1													08:53	09:00	09:28	2				
12	C2.9	7	09:58	10:05	10:47	2+					09:55	10:09	11:07	2+	09:57	10:11	11:06	2+	10:05	10:15	11:33	3
12	C2.7	1													*13:15*	*13:21*	*13:49*	*2*				
13	C4.9	6	12:01	12:09	12:33	1+					11:53	12:09	12:42	2+	12:02	12:10	12:31	1+	11:56	12:19	12:51	2+
13	C2.0	1													14:31	14:40	14:45	1-				
13	C6.8	2									17:33	17:44	18:21	2+	17:37	17:43	18:12	2				
13	C1.8	1													19:36	19:37	19:44	1-				
13	C2.1	1													20:33	20:36	20:39	1-				
14	C3.7	4	15:07	15:17	15:41	2					15:07	15:16	15:45	2	15:09	15:18	15:35	1+	*15:10*	*15:22*	*15:59*	*2+*
14	C3.6	1													20:37	20:41	20:49	1-				
15	?	1													09:12	09:13	09:20	1-				
15	C9.7	7	12:41	12:53	14:26	3					12:38	12:58	14:52	3+	12:41	12:55	14:47	3+	12:46	13:03	15:23	3+
15	C2.8	1													17:16	17:21	17:42	1+				
15	?	1													18:23	18:27	18:31	1-				
16	**M1.0**	1	05:27	05:34	05:52	1																
16	C3.5	5	09:01	09:05	09:18	1-					08:58	09:08	09:23	1	09:02	09:06	09:28	1+	*08:53*	*09:16*	*10:11*	*2+*
16	**M1.0**	9	10:27	10:40	12:09	3	10:22	10:38	11:00	2	10:23	10:41	12:05	3	10:26	10:43	12:07	3	10:30	10:46	12:11	3
16	C2.7	2	13:19	13:24	13:35	1-									13:20	13:26	13:35	1-				
16	?	1													13:42	13:44	13:53	1-				
16	**M1.0**	2									19:54	20:05	20:54	2+	19:58	20:02	20:42	2				
17	?	1													15:15	15:22	15:34	1				
17	C2.2	1													16:11	16:15	16:23	1-				
17	C4.4	3	*16:56*	*16:58*	*17:27*	*1+*					16:52	17:01	17:28	2	16:56	16:59	17:28	1+				
18	**M2.5**	10	13:33	13:57	14:47	2+	13:29	13:51	14:27	2+	13:29	13:46	15:17	3	13:34	13:48	14:22	2+	13:32	14:00	17:45	3+
19	**M1.1**	10	12:08	12:16	13:20	2+	12:07	12:15	12:28	1	12:06	12:14	12:53	2+	12:09	12:15	13:11	2+	12:14	12:21	13:28	2+
19	?	1													15:02	15:06	15:17	1-				
19	C3.2	1													16:23	16:30	16:36	1-				
20	C5.9	1	*04:52*	*04:57*	*05:07*	*1-*																
20	C8.6	5	10:52	11:09	?	-					10:49	11:13	?	-	10:55	11:15	?	-	*10:50*	*11:16*	*12:24*	*3*
20	?	8					10:47	11:28	11:52	2+	11:19	11:29	12:09	2+	11:22	11:30	12:11	2+	10:58	11:35	12:22	2+
20	C7.8	8	12:17	12:21	12:55	2	12:15	12:19	12:21	1-	12:14	12:24	12:58	2	12:18	12:23	12:59	2	12:22	12:29	13:09	2+
20	C5.7	7	13:05	13:08	13:40	2	13:05	13:11	13:25	1	13:04	13:10	13:40	2	13:05	13:13	13:40	2	13:09	13:16	13:47	2
20	C7.8	6	14:05	14:07	14:32	1+	14:04	14:07	14:18	1-	14:02	14:08	?	-	14:05	14:10	14:34	1+				
20	C4.9	4	*14:39*	*14:43*	*14:58*	*1*	14:39	14:45	14:54	1-	14:37	14:44	15:12	2	14:40	14:46	15:03	1				
20	C6.9	2	15:30	15:34	?	-									15:31	15:38	?	-				
20	C7.1	4	15:45	15:51	16:20	2	15:24	15:49	15:59	2	15:27	15:49	?	-	15:45	15:46	16:28	2				
20	**M1.1**	7	16:31	16:35	?	-					16:29	16:35	?	-	16:31	16:37	?	-	16:34	16:47	16:54	1
20	**X1.1**	10	16:56	17:10	?	-	16:55	17:10	17:32	2	16:49	17:03	18:12	2+	16:45	17:10	17:38	2+	16:54	17:14	18:49	3
21	C5.1	4	10:45	10:49	11:01	1-					10:39	10:51	11:07	1+	10:46	10:54	11:11	1				
21	**M1.1**	11	12:38	12:45	13:41	2+	12:37	12:45	12:57	1	12:35	12:47	13:36	2+	**12:38**	**12:47**	**13:43**	**2+**	12:42	12:54	14:09	3
21	**M1.0**	10	15:37	15:40	16:05	1+	15:36	15:41	15:53	1-	15:34	15:42	16:32	2+	**15:37**	**15:41**	**16:07**	**1+**	15:42	15:47	17:28	3
21	?	1													20:17	20:28	20:38	1				
21	C5.5	1													20:47	20:51	20:57	1-				
22	C4.1	3	08:20	08:26	09:02	2					08:20	08:27	08:45	1	08:24	08:25	08:39	1-				
22	**M1.1**	10	11:06	11:21	12:31	2+	10:57	11:21	11:41	2	11:01	11:20	12:04	2+	11:03	11:22	12:08	2+	11:06	11:29	13:11	3
22	C2.9	1													13:30	13:32	13:42	1-				
22	C3.3	1													13:44	13:48	14:02	1-				
23	C2.9	4	10:02	10:05	10:28	1+	09:58	10:04	10:13	1-	09:59	10:05	10:26	1+	10:02	10:08	10:34	1+				
24	C1.7	2	08:29	09:31	?	-									08:28	08:37	08:50	1				
24	C4.1	8	09:17	09:20	09:42	1					09:14	09:21	09:51	2	09:16	09:22	09:45	1+				
24	**M1.1**	8	12:15	12:20	13:19	2+	12:13	12:21	12:35	1					12:15	12:21	13:18	2+				
24	C2.7	1													16:05	16:14	16:38	2				
24	C3.0	1													17:49	17:59	?	-				
24	?	1													18:16	18:22	18:29	1-				
24	C4.9	1													21:17	21:17	21:26	1-				
25	C6.0	6	07:03	07:07	07:16	1-					06:58	07:09	07:43	2	**07:02**	**07:10**	**?**	**-**				
25	?	1													**07:18**	**07:25**	**07:43**	**1**				
25	C8.5	9	12:15	12:19	13:24	2+					12:11	12:21	12:53	2	12:13	12:21	13:04	2+				
25	C2.1	1													17:24	17:43	17:48	1				
25	C4.5	1													20:22	20:30	20:43	1				
25	C6.8	1													21:59	22:05	22:11	1-				
26	C3.0	1	*06:27*	*06:33*	*06:46*	*1*																
26	C2.9	4	11:49	11:52	12:10	1									**11:49**	**12:00**	**?**	**-**				
26	C7.4	8	12:18	12:26	13:01	2					12:13	12:26	13:00	2+	**12:15**	**12:28**	**12:56**	**2**				
26	**M1.6**	10	16:17	16:22	17:05	2+	16:10	16:23	17:07	2+	16:13	16:22	17:44	3	**16:17**	**16:29**	**17:02**	**2**				
26	C3.4	1													19:54	19:58	20:01	1-				
27	C1.8	2	09:15	09:20	09:44	1+									09:21	09:22	09:27	1-				
27	**M1.2**	9	15:12	15:15	16:00	2+	15:07	15:15	15:54	2+	15:08	15:15	16:24	2+	15:12	15:21	?	-				
27	C2.0	1													16:01	16:06	16:36	2				
27	C5.6	3	16:45	16:51	17:24	2					16:41	16:50	17:22	2	16:44	16:54	17:43	2+				
28	**M1.9**	9	08:37	08:45	09:56	2+	08:35	08:48	09:13	2	08:30	08:46	09:39	2+	08:35	08:48	09:51	2+				
28	?	1													13:32	13:35	13:39	1-				
28	C5.4	4									18:35	18:41	?	-	18:39	18:43	?	-				
28	C5.0	2									18:54	19:02	19:45	2+	18:55	19:01	19:24	1+				
29	C2.7	3	*08:07*	*08:11*	*08:19*	*1-*					08:05	08:12	08:51	2+	08:08	08:13	08:49	2				
29	C3.4	5	11:01	11:08	11:36	2					10:57	11:14	?	-	10:59	11:15	11:55	2+				
29	C3.1	4									12:30	12:53	13:05	2	12:34	12:49	13:21	2+				
29	**M3.8**	9	14:09	14:17	15:41	3	14:10	14:18	14:43	2	14:05	14:14	15:38	3	14:07	14:16	15:10	2+				
30	C5.7	8	09:58	10:08	10:45	2+					09:55	10:11	10:53	2+	09:58	10:11	11:04	2+	09:52	10:13	11:10	2+
30	C1.9	1													11:20	11:23	11:54	2				
30	C2.9	1													12:45	12:49	13:08	1				
30	C4.2	4	13:52	13:54	14:08	1-					13:48	13:55	14:36	2+	13:46	13:57	14:41	2+				
30	?	1													***14:14***	***14:15***	***14:25***	***1-***				
30	C3.7	2									18:54	18:57	19:12	1-	18:57	18:58	?	-				
30	C2.8	1													19:05	19:08	19:30	1				

BAA Radio Astronomy Section. **2023 JUNE.**

	Xray class		Steve Parkinson (Various) Tuned radio frequency receiver, frame aerials.				Andrew Thomas (19.6/*20.9*/**22.1kHz**) Tuned radio frequency receiver, 0.6m frame aerial.				Phil Rourke (23.4kHz) Spectrum Lab, 0.6m frame aerial.				Mark Prescott (20.9kHz) SpectrumLab/Starbase, Active mini-whip aerial.				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)	
1	C3.7						09:10	09:29	09:55	2					09:14	09:43	?					
1	C6.5		11:20	11:26	12:05	2	11:18	11:28	12:16	2+					11:22	11:32	12:03	2	11:20	11:25	12:00	2
1	?																					
1	?																					
1	C2.9																					
1	?																					
1	C4.2														14:46	15:00	15:18	1+				
1	C4.4																					
1	C6.2																					
2	C3.9						14:06	14:12	14:40	2												
2	C3.3																					
3	?																					
3	C2.2																					
3	C3.4																					
4	C3.4		09:46	09:53	10:04	1-	09:46	09:50	10:08	1												
4	C4.5		12:02	12:10	12:45	2	12:03	12:11	13:00	2+					12:06	12:16	12:41	2				
4	C5.7		14:28	14:34	14:56	1+	14:28	14:33	14:50	1					14:31	14:39	14:59	1+				
4	?																					
4	C3.6																					
5	C2.5																					
6	C5.6						08:31	08:43	09:09	2					08:36	?	?	-				
6	C6.3						09:09	09:17	10:23	2+					09:14	09:21	09:38	1				
6	?																					
6	C2.4																					
6	C2.1																					
6	C7.5																					
7	C7.1																					
7	**M4.7**		11:28	11:45	13:55	3+	11:25	11:47	13:40	3+	11:28	11:41	12:46	2+	11:29	11:49	12:40	2+	11:30	11:45	12:10	2
7	?																					
7	?																					
7	C2.1																					
7	C8.7						18:28	18:37	19:08	2												
8	C4.8		10:14	10:26	10:55	2	10:12	10:26	10:53	2					10:18	10:32	11:01	2	10:15	10:25	11:15	2+
8	C1.8																					
9	C3.1						13:38	13:46	14:27	2+												
9	C4.5						14:37	14:41	15:33	2+					14:39	14:45	?	-				
9	**M2.5**		16:57	17:09	18:08	2+	16:57	17:12	18:06	2+	17:03	17:10	17:39	2	17:02	17:13	18:34	3				
10	C4.5																					
12	C5.2																					
12	C2.6																					
12	C2.9		09:56	10:05	10:40	2	09:56	10:07	10:36	2					10:01	10:10	?	-				
12	C2.7																					
13	C4.9		11:59	12:08	12:55	2+	12:00	12:10	12:43	2												
13	C2.0																					
13	C6.8																					
13	C1.8																					
13	C2.1																					
14	C3.7																					
14	C3.6																					
15	?																					
15	C9.7		12:43	12:56	14:15	3	12:43	12:57	15:28	3+	12:46	12:57	14:24	3								
15	C2.8																					
15	?																					
16	**M1.0**																					
16	C3.5						09:00	09:07	09:14	1-												
16	**M1.0**		10:26	10:39	11:35	2+	10:24	10:41	12:27	3	10:28	10:42	11:43	2+	10:29	10:45	12:21	3				
16	C2.7																					
16	?																					
16	**M1.0**																					
17	?																					
17	C2.2																					
17	C4.4																					
18	**M2.5**		13:33	13:55	15:15	3	**13:32**	**13:42**	**14:01**	**1+**	13:35	13:54	15:30	3	13:36	14:01	15:36	3				
19	**M1.1**		12:09	12:16	13:30	2+	12:07	12:16	12:50	2	12:10	12:15	14:00	3	12:12	12:18	13:57	3				
19	?																					
19	C3.2																					
20	C5.9																					
20	C8.6														10:59	11:10	?	-				
20	?		10:53	11:30	?	-	*10:51*	*11:20*	*12:17*	*3*	10:59	11:30	12:20	2+	?	11:19	?	-				
20	C7.8		12:18	12:23	12:42	1	*12:17*	*12:23*	*12:40*	*1*					12:21	12:27	12:40	1				
20	C5.7						*13:06*	*13:11*	*13:20*	*1-*					13:08	13:12	13:36	1+				
20	C7.8						14:03	14:09	14:25	1					14:08	14:14	14:37	1+				
20	C4.9																					
20	C6.9																					
20	C7.1																					
20	**M1.1**						*16:33*	*16:37*	*16:53*	*1*					16:35	16:41	16:49	1-				
20	**X1.1**		16:58	17:10	18:00	2+	*16:53*	*17:11*	*18:35*	*3*	16:52	17:11	18:39	3	16:56	17:15	18:14	2+				
21	C5.1						*10:45*	*10:52*	*11:04*	*1*												
21	**M1.1**		12:38	12:48	13:50	2+	*12:37*	*12:48*	*14:15*	*3*	12:40	12:46	13:58	2+	12:42	12:51	13:51	2+				
21	**M1.0**		15:36	15:40	16:17	2	15:36	15:41	15:59	1					15:39	15:44	16:51	2+				
21	?																					
21	C5.5																					
22	C4.1																					
22	**M1.1**		11:05	11:23	12:30	2+	*11:01*	*11:23*	*12:29*	*3*	11:05	11:24	12:29	2+	11:08	11:25	12:20	2+				
22	C2.9																					
22	C3.3																					
23	C2.9																					
24	C1.7																					
24	C4.1		09:17	09:24	09:45	1+	*09:16*	*09:22*	*09:53*	*2*					09:20	09:27	10:07	2+				
24	**M1.1**		12:14	12:22	13:07	2+	*12:14*	*12:21*	*13:26*	*2+*					12:16	12:23	13:24	2+				
24	C2.7																					
24	C3.0																					
24	?																					
24	C4.9																					
25	C6.0						**07:03**	**07:07**	**07:28**	**1**					07:06	07:14	07:45	2				
25	?																					
25	C8.5		12:15	12:24	13:10	2+	*12:15*	*12:20*	*13:32*	*2+*	12:15	12:21	13:27	2+	12:18	12:26	13:19	2+				
25	C2.1																					
25	C4.5																					
25	C6.8																					
26	C3.0																					
26	C2.9						*11:48*	*11:54*	*12:17*	*1+*												
26	C7.4		12:18	12:27	13:00	2	*12:17*	*12:27*	*14:05*	*3*	12:21	12:30	13:25	2+	12:24	12:33	12:55	1+				
26	**M1.6**		16:18	16:21	17:12	2+	*16:17*	*16:28*	*17:43*	*3*	16:16	16:29	17:49	3	16:22	16:33	17:21	2+				
26	C3.4																					
27	C1.8																					
27	**M1.2**		15:12	15:27	16:13	2+	*15:11*	*15:25*	*16:34*	*2+*	15:13	15:24	16:04	2+	15:15	15:22	?	-				
27	C2.0																					
27	C5.6																					
28	**M1.9**		08:38	08:46	10:06	3	*08:35*	*08:48*	*09:46*	*2+*	08:38	08:50	09:51	2+	08:39	08:49	09:41	2+				
28	?																					
28	C5.4						*18:39*	*18:40*	*18:48*	*1-*												
28	C5.0																					
29	C2.7																					
29	C3.4						*10:59*	*11:16*	*11:47*	*2+*					11:06	11:18	12:24	2+				
29	C3.1						*12:34*	*12:42*	*13:08*	*2*					12:37	12:50	?	-				
29	**M3.8**		14:09	14:18	16:00	3	14:06	14:18	14:28	1	14:10	14:18	16:22	3+	14:13	14:25	15:21	2+				
30	C5.7		09:58	10:12	10:45	2+	*09:57*	*10:12*	*10:58*	*2+*					10:01	10:12	11:01	2+				
30	C1.9																					
30	C2.9																					
30	C4.2						13:52	13:56	14:09	1-												
30	?																					
30	C3.7																					
30	C2.8																					

BAA Radio Astronomy Section. **2023 JUNE.**

	Xray class		Chris Bailey				Colin Briden											
			Spectrum Lab.				Spectrum Lab frame aerial. 1.2m											
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	START	PEAK	END (UT)	START	PEAK	END (UT)
1	C3.7																	
1	C6.5						11:20	11:28	11:47	1+								
1	?																	
1	?																	
1	C2.9						13:32	13:45	14:02	1+								
1	?																	
1	C4.2						14:44	14:53	15:01	1-								
1	C4.4																	
1	C6.2																	
2	C3.9																	
2	C3.3																	
3	?																	
3	C2.2																	
3	C3.4																	
4	C3.4																	
4	C4.5																	
4	C5.7																	
4	?																	
4	C3.6																	
5	C2.5																	
6	C5.6						08:34	08:41	09:00	1+								
6	C6.3						09:13	09:20	09:27	1-								
6	?																	
6	C2.4																	
6	C2.1																	
6	C7.5																	
7	C7.1																	
7	**M4.7**		11:30	11:46	12:45	2+												
7	?																	
7	?																	
7	C2.1																	
7	C8.7		18:27	18:37	19:00	2												
8	C4.8																	
8	C1.8																	
9	C3.1																	
9	C4.5																	
9	**M2.5**		16:55	17:15	18:40	3												
10	C4.5																	
12	C5.2																	
12	C2.6																	
12	C2.9																	
12	C2.7																	
13	C4.9																	
13	C2.0																	
13	C6.8																	
13	C1.8																	
13	C2.1																	
14	C3.7																	
14	C3.6																	
15	?																	
15	C9.7																	
15	C2.8																	
15	?																	
16	**M1.0**																	
16	C3.5																	
16	**M1.0**																	
16	C2.7																	
16	?																	
16	**M1.0**																	
17	?																	
17	C2.2																	
17	C4.4																	
18	**M2.5**		13:34	13:47	15:00	3												
19	**M1.1**		12:08	12:15	12:45	2												
19	?																	
19	C3.2																	
20	C5.9																	
20	C8.6																	
20	?																	
20	C7.8																	
20	C5.7																	
20	C7.8																	
20	C4.9																	
20	C6.9																	
20	C7.1																	
20	**M1.1**		16:31	16:34	16:50	1												
20	**X1.1**		16:54	17:04	18:20	3												
21	C5.1																	
21	**M1.1**		12:37	12:45	13:15	2	12:38	12:46	13:13	2								
21	**M1.0**		15:35	15:39	16:12	2	15:36	15:40	15:48	1-								
21	?																	
21	C5.5																	
22	C4.1																	
22	**M1.1**		11:05	11:23	12:00	2+												
22	C2.9																	
22	C3.3																	
23	C2.9																	
24	C1.7																	
24	C4.1		09:15	09:21	10:00	2	09:16	09:21	09:35	1								
24	**M1.1**		12:13	12:20	12:50	2	12:14	12:21	12:36	1								
24	C2.7																	
24	C3.0																	
24	?																	
24	C4.9																	
25	C6.0		07:02	07:07	07:45	2												
25	?																	
25	C8.5		12:14	12:20	12:50	2	12:15	12:20	12:44	1+								
25	C2.1																	
25	C4.5																	
25	C6.8																	
26	C3.0																	
26	C2.9						11:49	11:53	12:07	1-								
26	C7.4						12:17	12:28	13:17	2+								
26	**M1.6**		16:17	16:20	18:00	3	16:17	16:21	16:53	2								
26	C3.4																	
27	C1.8																	
27	**M1.2**		15:12	15:24	15:52	2												
27	C2.0																	
27	C5.6																	
28	**M1.9**		08:35	08:44	08:55	1												
28	?																	
28	C5.4		18:38	18:40	19:00	1												
28	C5.0																	
29	C2.7																	
29	C3.4																	
29	C3.1																	
29	**M3.8**		14:13	14:16	15:05	2+												
30	C5.7		09:57	10:05	10:33	2												
30	C1.9																	
30	C2.9																	
30	C4.2																	
30	?																	
30	C3.7																	
30	C2.8																	


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
180
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).

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 17 18 19 20 21 22 23 24 25 26 27 28 29 30

CC C BCCC

2554

F 31 | 2237 1 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 | 2020 November

B B CBCC CBC B C C CC C

2555

F 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

C CM C C C

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 10 11 12 13 14

C

2559

F 15 | 2242 16 17 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

B B

2560

F 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

B C CCCC M

2561

F 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

CC CC C C CCM CCBM CCCC C

2562

F 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

CCC CCB C CBC CC

2563

F 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

2021 July MCXM MC CCB C C

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 21 22 23

CCC C C

2565

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

CCCC MCCC CC C CC C C

2566

F 20 21 C 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 31 CCC | 2021 November 1 2 3 4 CC 5 6 7 8 9 10 11 12

2568

F 13 C 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 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 | 2022 January 1 2 3 4 5

CCC CC C CM M MCC CC CCCM

2570

F 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

C C C CC C BCCC C

2571

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

2572

F 2022 March 1 CM 2 3 4 5 C 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 28 CMC 29 MCCC 30 CCCC 31 CCCX | 2022 April 1 CCCC 2 CCMM 3 CC | 2256 4 C 5 6 C 7 8 CC 9 C 10 11 CBCC 12 13 14 15 MMCC 16 CCCM 17 CCCM 18 MMCM 19 CCCC 20 CMCC 21 CC 22 CMC 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 CCCC 15 C 16 CMC 17 CCCC 18 CCCC 19 CMMM 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 9 CC 10 CCMC 11 C 12 13 C 14 CCCC 15 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 BC 2 3 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 | 2260 21 22 CCCC 23 C 24 25 C 26 C 27 C 28 29 30 31 | 2022 August 1 CC 2 C 3 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 M 15 C 16 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 C 6 C 7 C | 2264 8 9 C 10 MCCM 11 CC 12 C 13 C 14 CCC 15 CC 16 CC 17 CCC 18 M 19 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 23 CC 24 C 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 19 MMC 20 CC 21 CC 22 CMCM 23 C 24 CCC 25 MCM 26 CMCC 27 28 C | 2267 29 | 2023 February 30 C 31 CC 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 15 CCCC 16 C 17 CX 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 CC 2 CCCC 3 MCCX 4 CMMC 5 CCMC 6 MCCC 7 C 8 MC 9 CCC 10 CCCC 11 C 12 13

2586

F 14 C 15 16 C 17 CCCM 18 C 19 CCC 20 C 21 C 22 23 | 2269 24 C 25 26 CC 27 CCC 28 CC 29 MC 30 M 31 CC | 2023 April 1 2 3 4 5 CCC 6 MC 7 8 CC 9 CCCC

2587

F 10 MCCC 11 MC 12 CCC 13 CCCC 14 CCMC 15 CCCC 16 C 17 CC 18 CCC 19 CCC 20 CCCC | 2270 21 M 22 CC 23 24 CC 25 26 C 27 M 28 CC 29 CCCC 30 CCM | 2023 May 1 CCMC 2 CCCC 3 MMMM 4 MCCC 5 CMM 6 CC

2588

F 7 C 8 CCCM 9 MCMM 10 MCCC 11 MCCM 12 CCCC 13 CCCC 14 C 15 C 16 CCCM 17 CCCC | 2271 18 MMMM 19 MCCM 20 MMMM 21 CCCM 22 CCMC 23 CCMC 24 MCCM 25 CCMC 26 CCC 27 CCC 28 MC 29 C 30 MMMC 31 CMCM | 2023 June 1 CCCC 2 CC

2589

F 3 CC 4 CCCC 5 C 6 CCCC 7 CMCC 8 CC 9 CM 10 C 11 12 CCCC 13 CCCC | 2272 14 CC 15 CC 16 MCMM 17 CC 18 M 19 MC 20 CCMX 21 CMMC 22 CMCC 23 C 24 CCMC 25 CCCC 26 CCMC 27 CMCC 28 MCC 29 CCCM

2590

F 30 CCCC | 2023 July 1 2 3 4 5 6 7 8 9 10 | 2273 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26