The British Astronomical Association

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Founded in 1890

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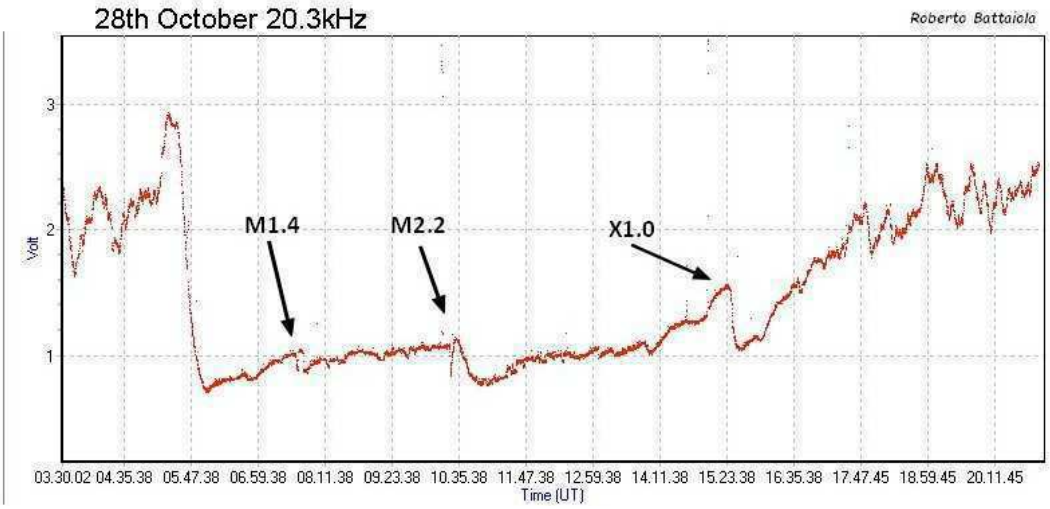
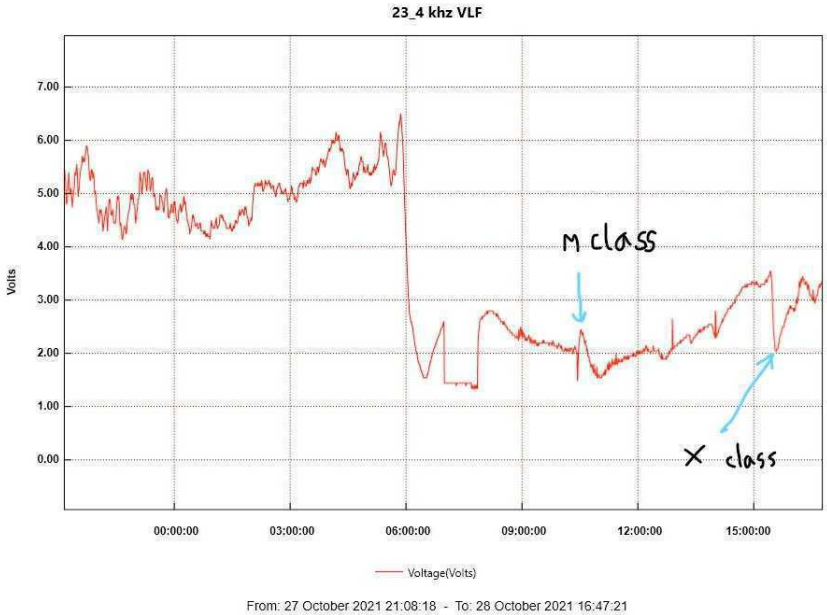
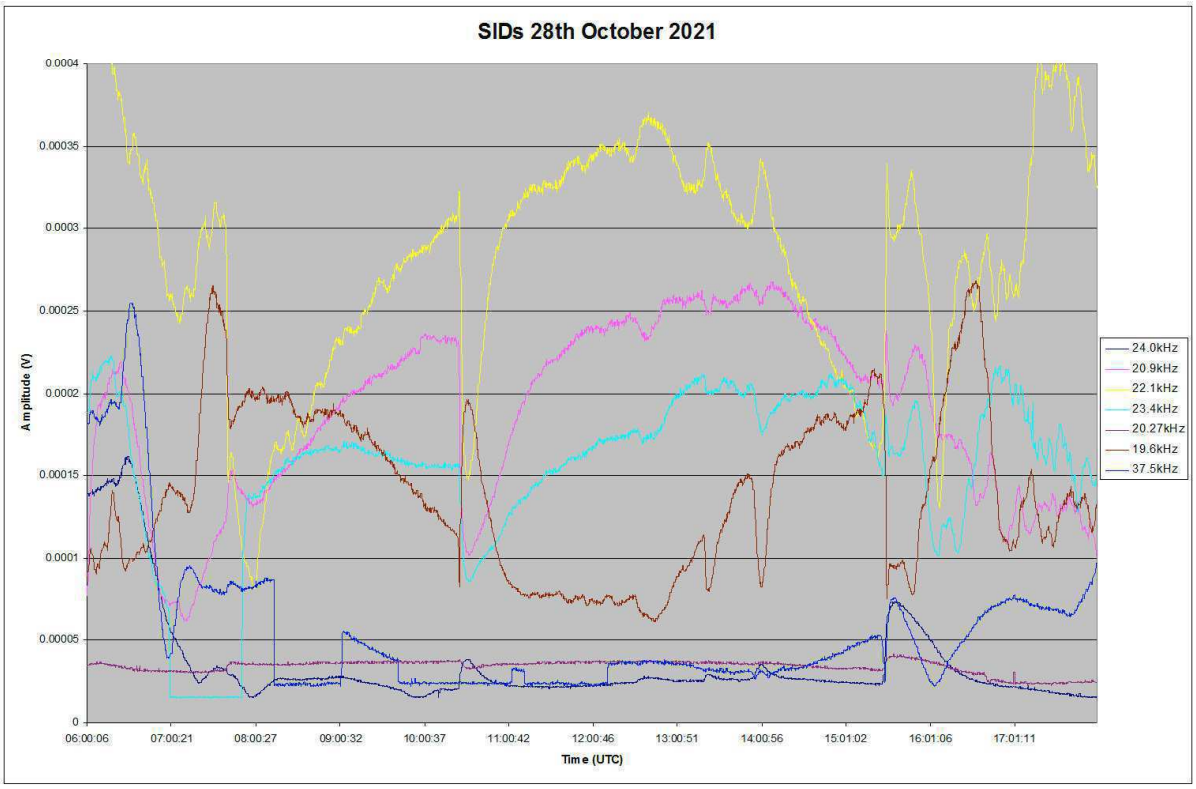
BAA Radio Astronomy Section. 2021 OCTOBER.

The first three weeks of October were very quiet, with mostly B-class class flares and a few small C-class. The M1.6 on the 9th was therefore quite a surprise. Peaking at 06:33UT, it was too early for UK observers, but was recorded by Roberto Battaiola in Milan, Italy. The appearance of AR12887 started a far more active period in the last week of the month, including the second X-class flare recorded so far in solar cycle 25.

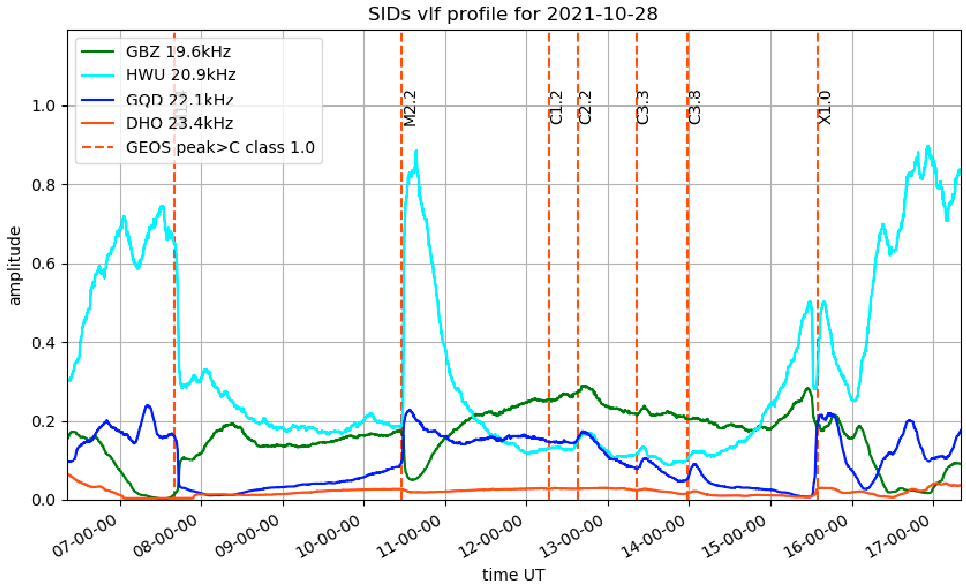




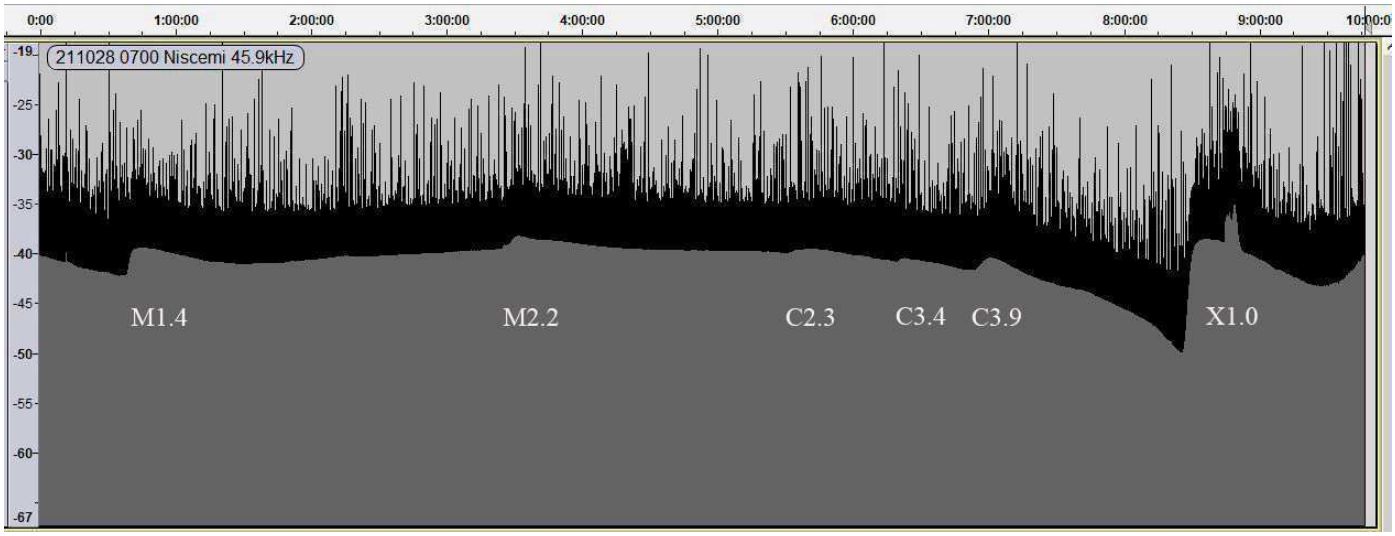
The first recording is from Roberto Battaiola, our most southerly observer, while the second is from Phil Rourke in Dundee, Scotland, our most northerly observer. Both show a clear SID from the M2.2 and X1.0 flares, the X1.0 conveniently timed just before sunset takes over.



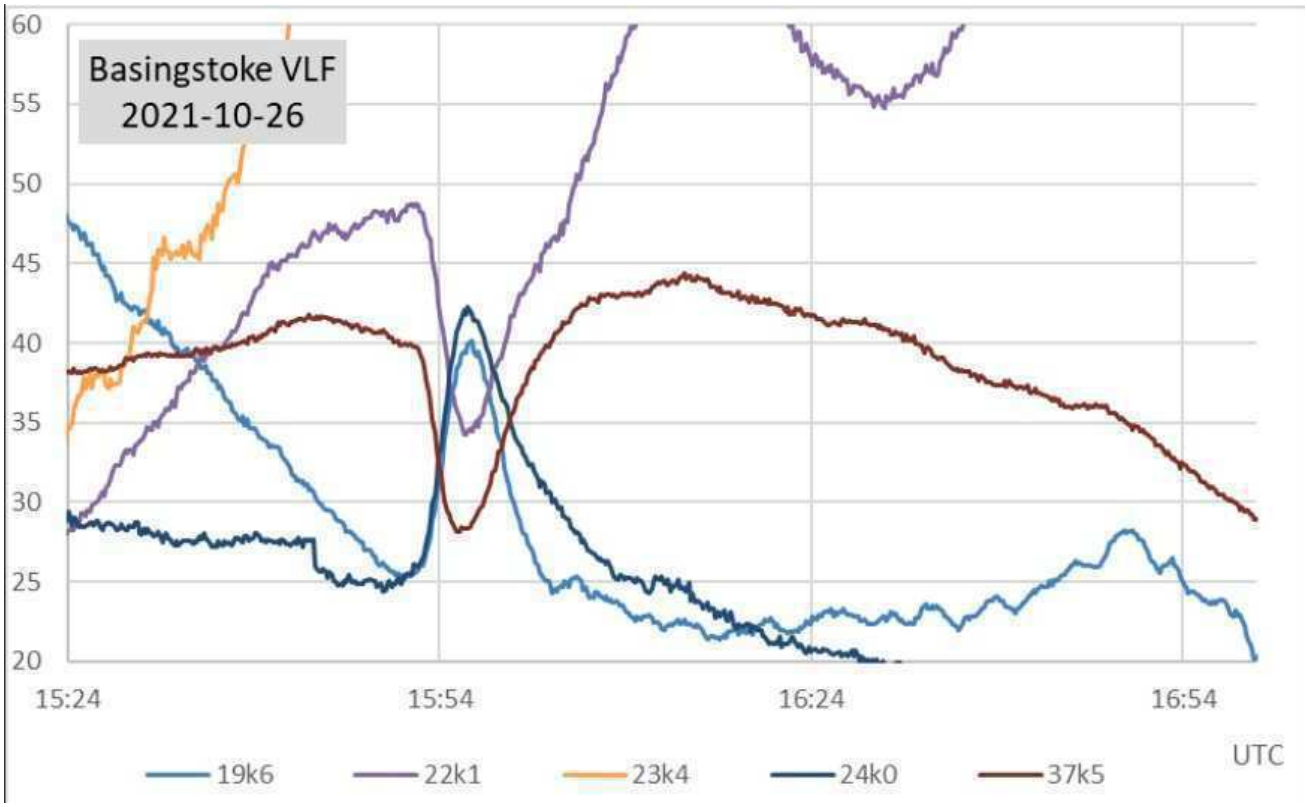
This recording from Mark Edwards (central England) shows a wide range of SID shapes from all of the flares on the 28th. 19.6kHz (brown trace) and 22.1kHz (yellow) show very similar inverted responses to the X1.0 flare.



Mark Prescott has added the peak timings for each of the flares to his recording. This helps to identify the 'peak and wave' SID from the M2.2 flare, as well as the unusual 20.9kHz SID from the X1.0 flare.



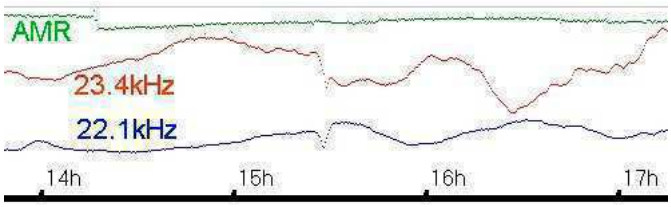
Colin Briden recorded the 45.9kHz signal from Niscemi, Italy, SIDs showing in the grey area, black indicating the raw signal data. Here all of the flares have produced ordinary 'shark fin' SIDs.

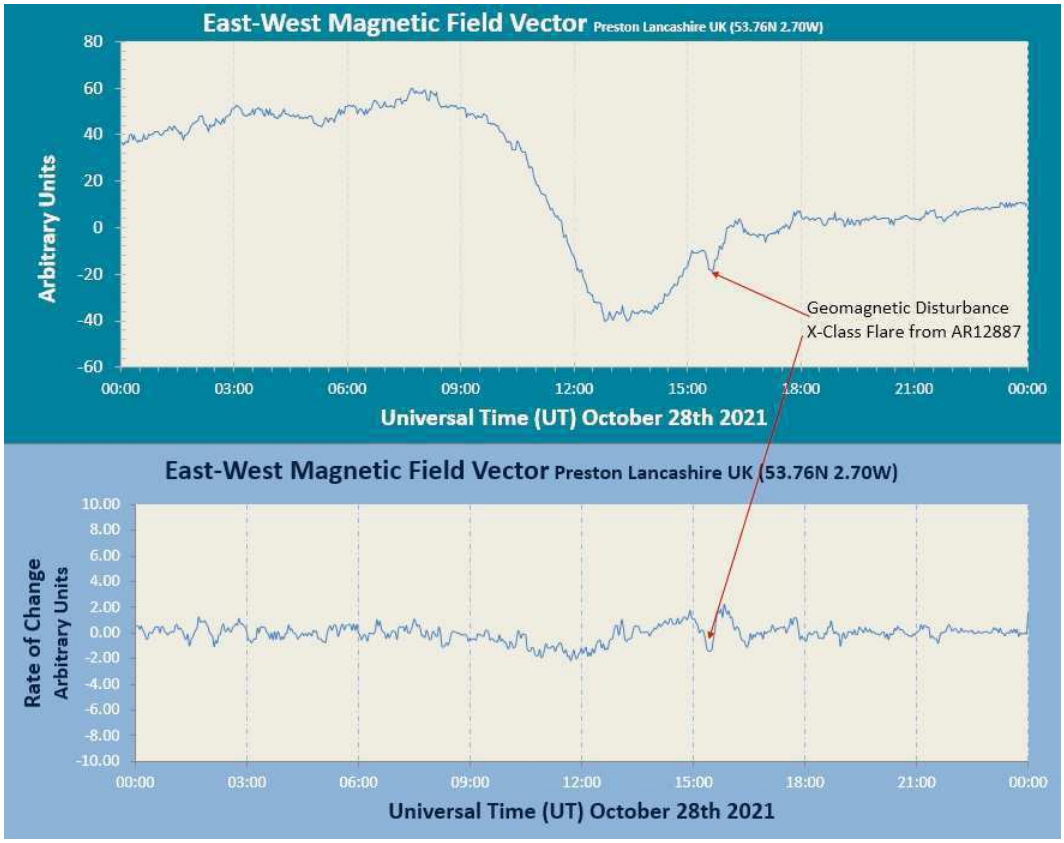


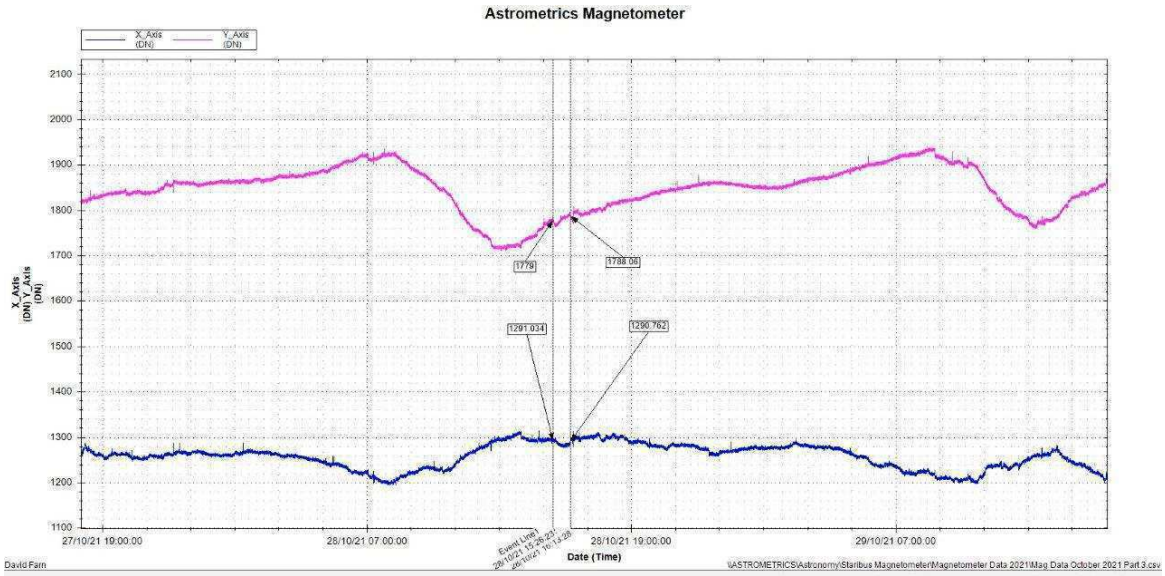
This recording from Paul Hyde shows the M1.0 flare peaking at 15:56UT on the 26th. The 23.4kHz signal is rising steeply into the sunset, but the other signals all show good clean SIDs.

MAGNETIC OBSERVATIONS.

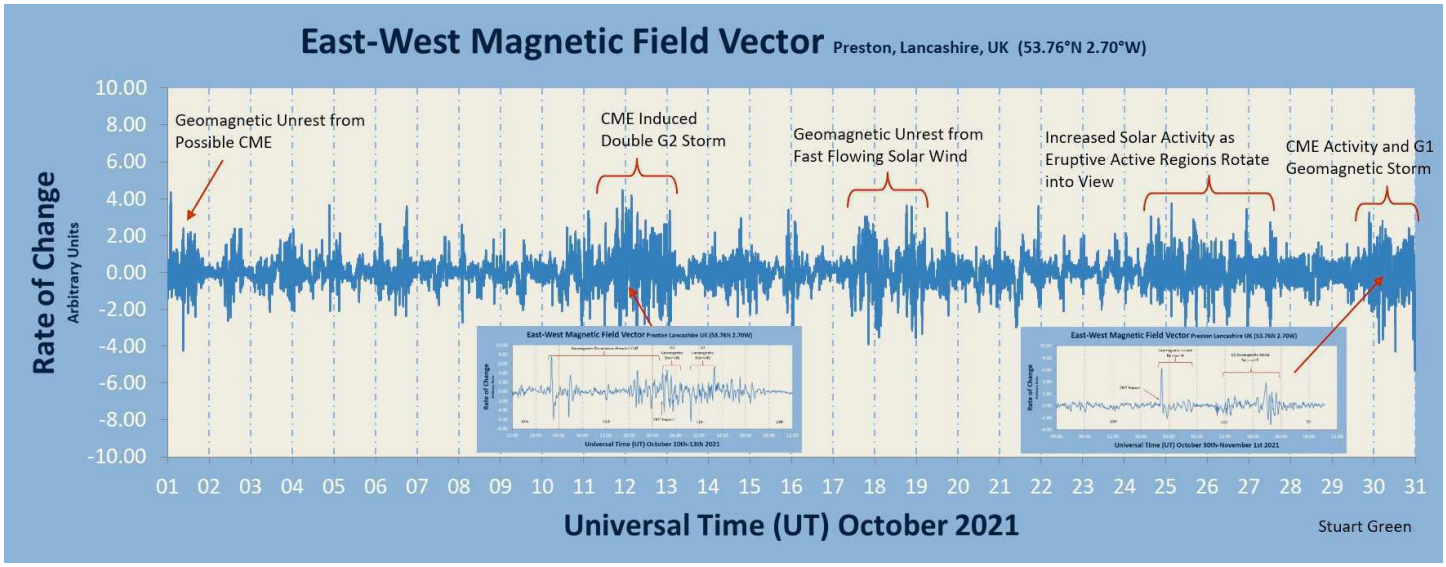
The X1.0 flare also produced a very small SFE, the second recorded so far in solar cycle 25. My own recording on the next page shows a barely visible 'bump' in the green magnetometer trace of about 2nT directly above the peak of the flare. Compare its magnitude with the disturbance from parking the car on my drive at 14:18. It was also barely visible on Roger Blackwell's recording, but does show clearly on the recording from Stuart Green, shown below.







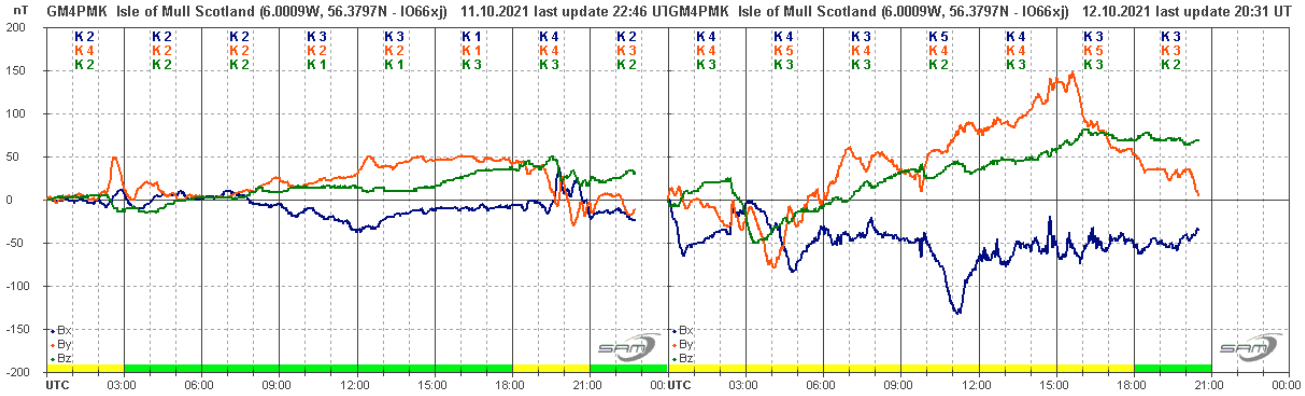
This recording by David Farn also shows a much clearer SFE response.

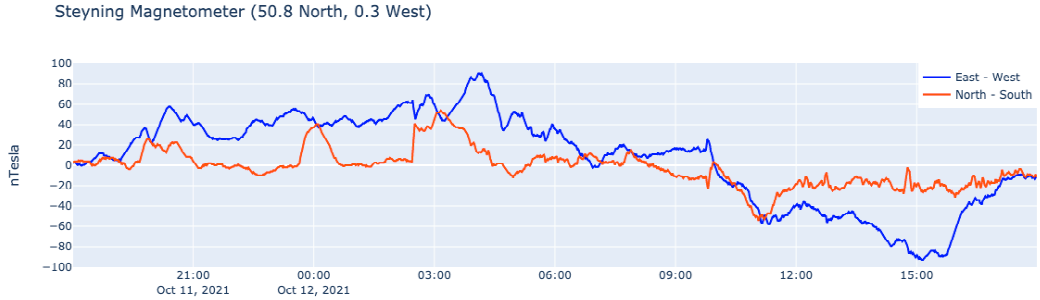


Stuart's chart for October shows that it was a very active month, with a number of CMEs as well as fast solar winds. The period around the equinoxes always show a greater influence from the inter-planetary magnetic field, due to the more favourable alignment with the Earth's field at this time of year.

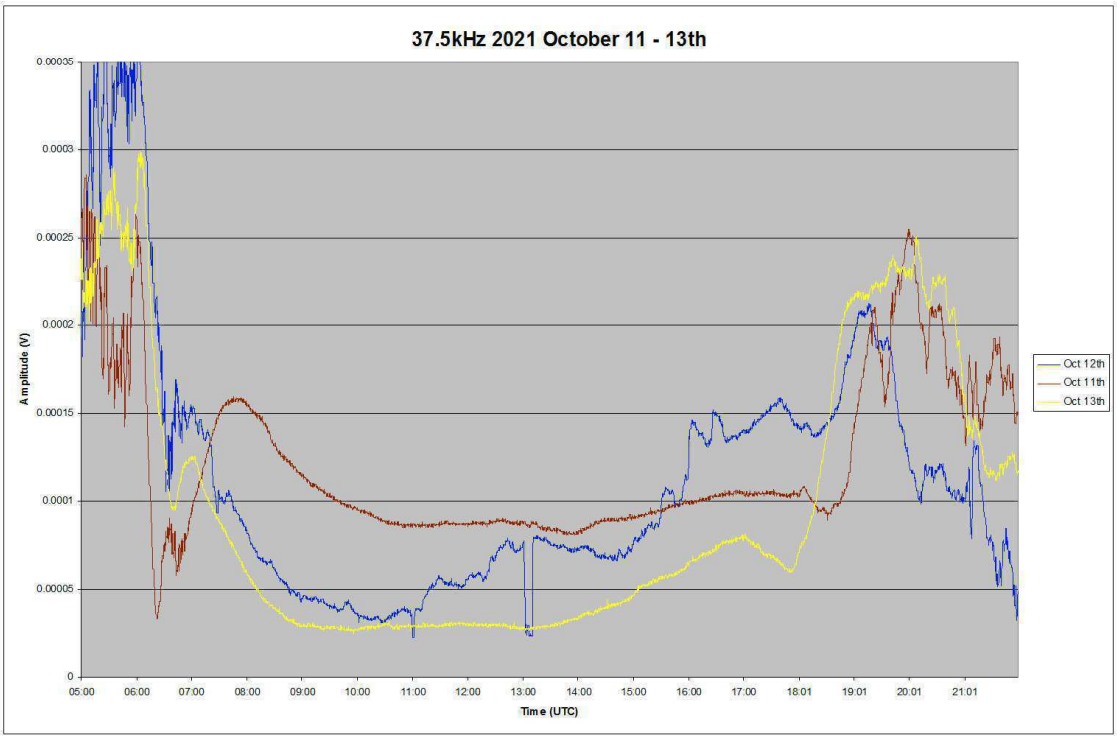
The disturbance on the 1st appears to be from a CME produced by a C1.6 flare early on September 28th. The flare is listed in the September summary, recorded by Roberto Battaiola peaking at 06:30UT. The magnetic disturbance was minor, lasting only an hour or two around 2AM.

The M1.6 flare recorded on the 9th produced a CME that added to an already disturbed magnetic field on the 12th:



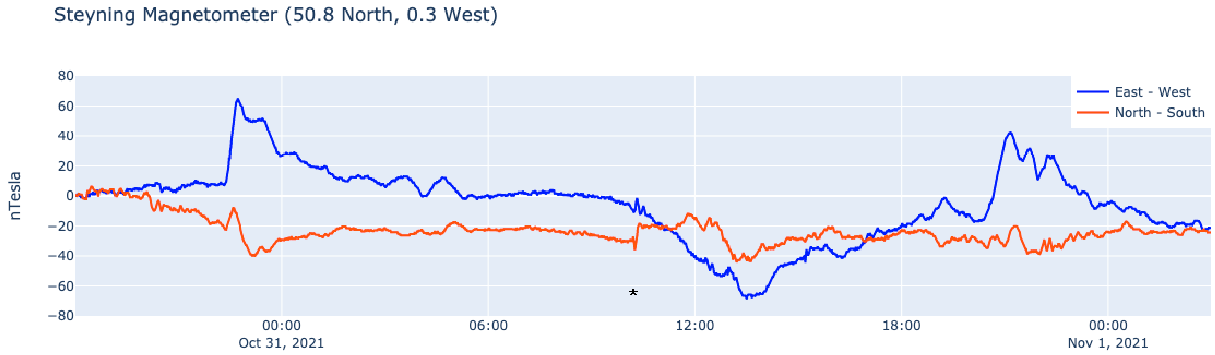


The first chart is from Roger Blackwell, showing the strength of activity over the two days. Some data has been lost around midnight on both days. The second chart is from Nick Quinn, showing the overnight period, and clearly showing the arrival of the CME at about 02:30UT on the 12th



This magnetic activity was also recorded on the 37.5kHz signal by Mark Edwards. The chart shows the 12th in blue, with the 11th and 13th in brown and yellow. There appears to be a signal drop-out just after 13:00 on the 12th, but the rest of the day is clearly very disturbed. Colin Clements also recorded a similar disturbance at 37.5kHz, matching well with Mark's timings.

The X1.0 flare also produced a CME, resulting in disturbances on the 30th and 31st. This shows well in the recording by Nick Quinn:

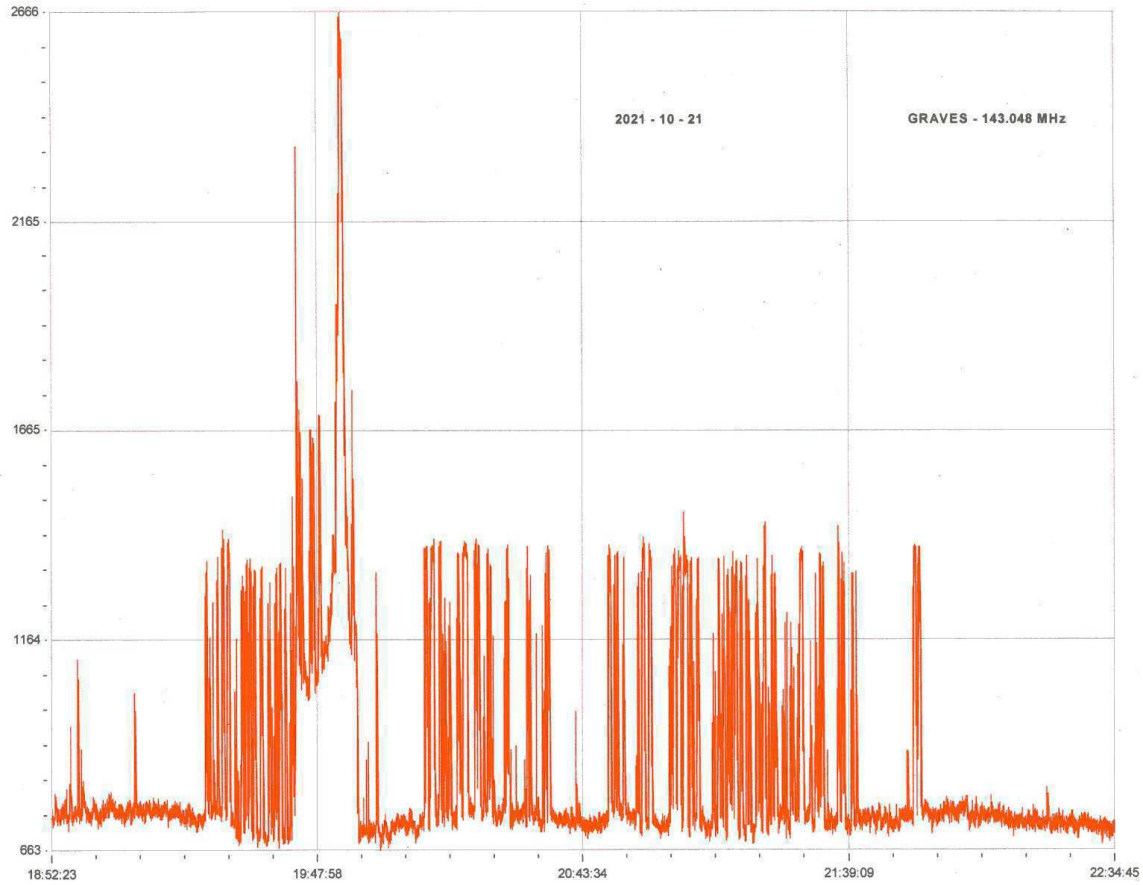


There was already a disturbance present just before midnight on the 30th, with mild conditions continuing into the morning of the 31st. The CME arrival can be seen at about 10:20UT on the 31st, marked by '*' on the chart. With our peak SID timing around 15:30 on the 28th, this gives a CME transit time of 66 hours 50 minutes. It is the 21st fastest that we have recorded since 2005, the fastest being 34h 41m on 2012 March 7th. This was close to the first peak of solar cycle 24 activity. The disturbance continued through the day and into November 1st, but was fairly mild as it was only the very edge of the CME that hit Earth.

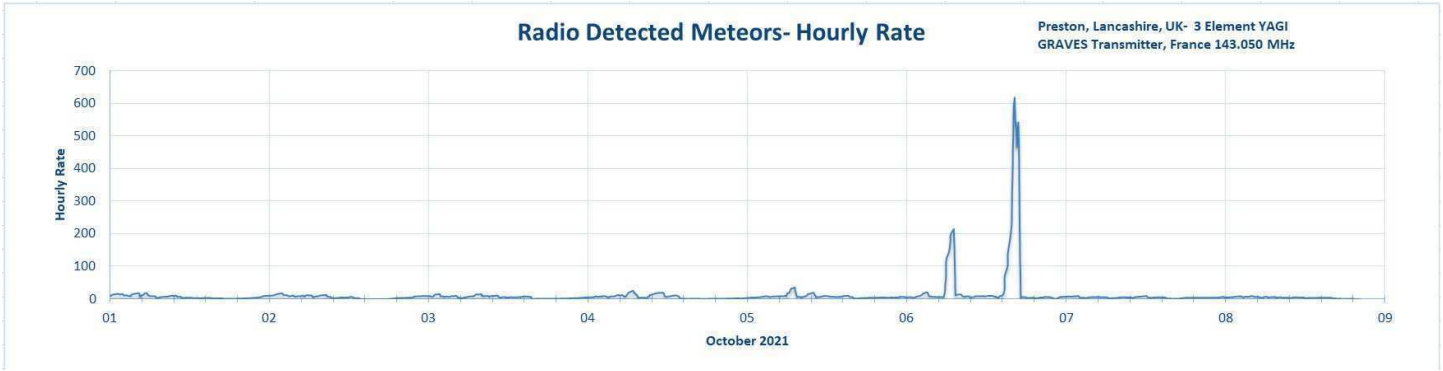
Following the report of a possible magnetic effect at 37.5kHz on September 21st shown in last month's summary, Stuart Green made further analysis of his data, and found that there was indeed a magnetic transient that matched well with the timing on Mark Edward's chart.

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

ORIONID METEORS.



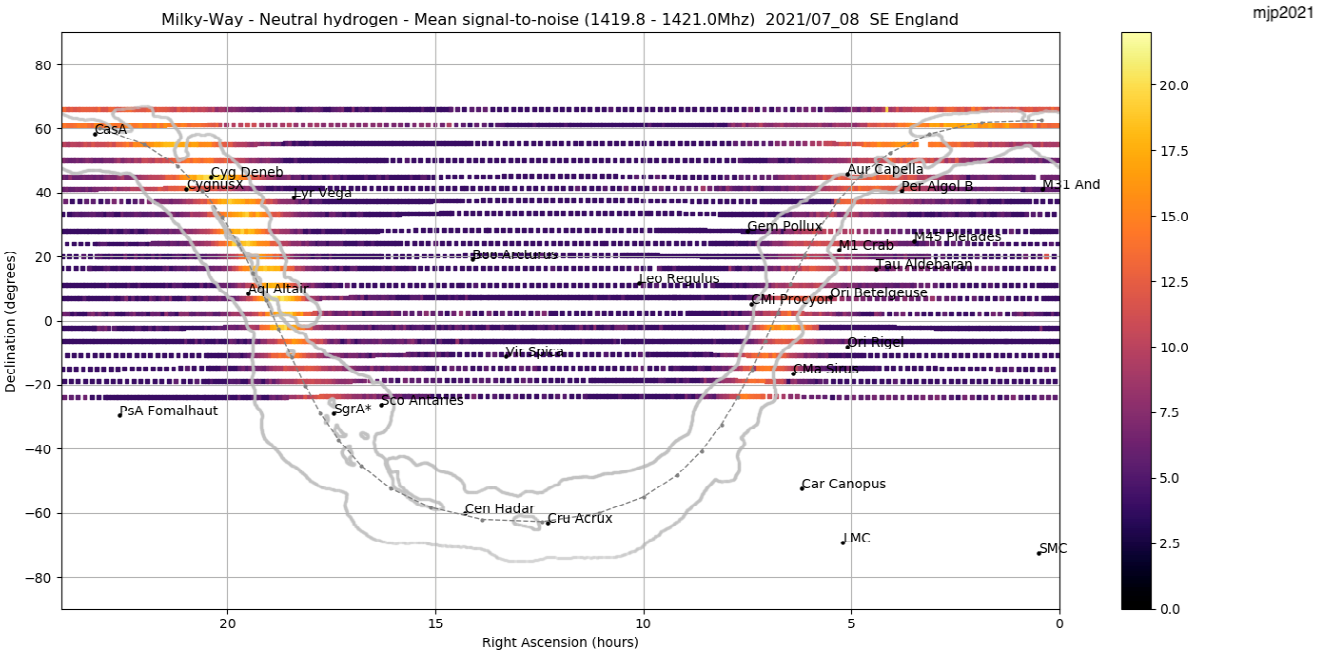
Colin Clements made this recording of echos from the GRAVES 143MHz signal on the 21st. Some very strong echos show around 19:50UT. Peaks in activity show for about 20 minutes starting at 19:24 and at 21:10. This period of activity does seem very short and abrupt for the Orionid meteors, with nothing recorded into the early morning as would normally be expected. We have not received any other recordings, so there is unfortunately no comparison. Stuart Green did catch some echos on the 6th, possibly from the anticipated Arid meteors. These were expected to be below the horizon from the UK, so again the link is uncertain.

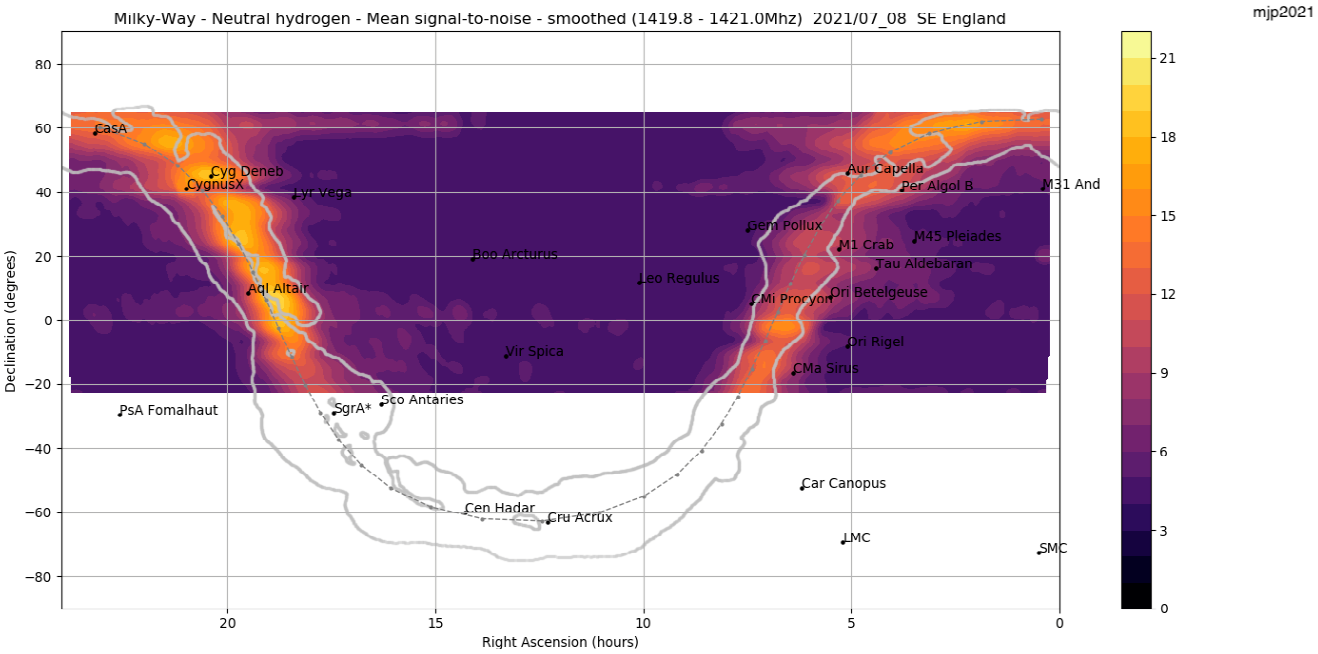


HYDROGEN LINE OBSERVATIONS.

As a 'lock-down project' last year, Mark Prescott decided to try making Hydrogen line observations. Starting with a horn antenna, a low noise amplifier and software-defined radio, data was recorded onto a Raspberry Pi 4B module. This was able to record some low resolution signals.

Adding a 0.9m x 0.6m parabolic grid antenna, Mark then made a series of 21 24 hour drift scans over a range of 1418.8MHz to 1421.2MHz with the antenna in a fixed position. Observations were then repeated with the antenna pointing at different altitude and azimuth angles. Some home-written python3 code was used to process the spectra, removing noise and smoothing to create maps from the data.





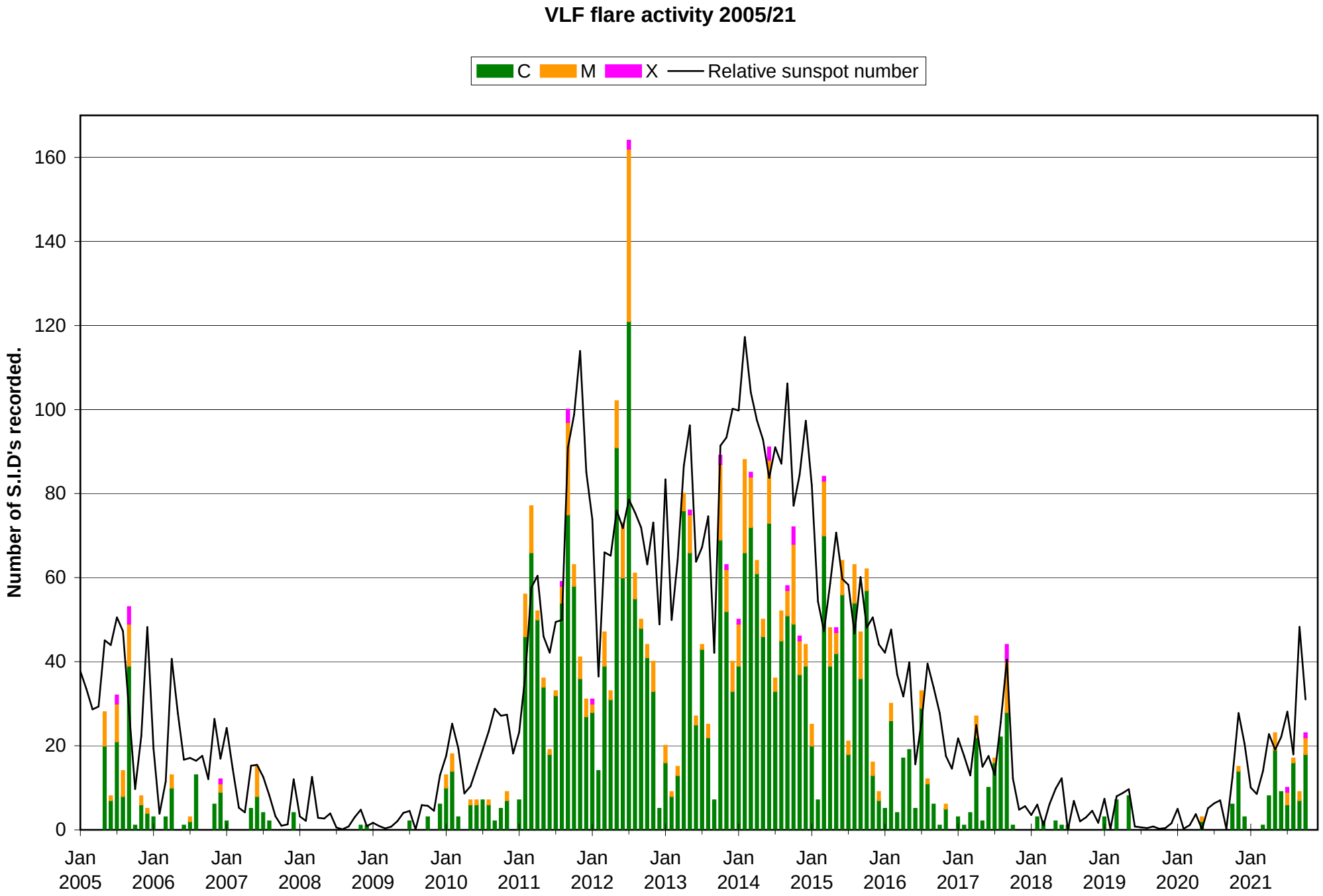
The first chart shows the data from the individual drift scans, overlaid onto a map of the Milky Way. The second chart shows the smoothed data signal-to-noise ratio over the area observed. The strongest signals follow the known position of the galactic arms extremely well. The data was also used to calculate the galactic rotation curve, with results closely matching those derived from the ESA GAIA survey data.

BAA Radio Astronomy Section. **2021 OCTOBER.**

	Xray class	Observers	John Cook (23.4kHz/*22.1kHz*) Tuned radio frequency receiver, 0.58m frame aerial.				Roberto Battaiola 20.3kHz Modified AAVSO receiver.				Paul Hyde (22.1kHz/*24kHz*) Spectrum Lab / PC 1.5m frame aerial.				Mark Edwards (24.0kHz/*37.5kHz*) Spectrum Lab / PC 2m loop aerial.				Colin Clements (23.4kHz) 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)	
9	**M1.6**	1					06:29	06:33	06:42	1-												
26	C5.0	7	*09:49*	*09:53*	*10:07*	*1-*					09:46	09:51	10:16	1+	*09:48*	*09:52*	*10:12*	*1*				
26	*										11:15	11:19	?	-								
26	C4.8	8	11:22	11:26	11:51	1+					11:20	11:25	11:45	1	11:22	11:26	11:40	1-	11:14	11:26	11:50	2
26	C3.1	6	13:20	13:23	13:35	1-					13:31	13:34	13:53	1	13:33	13:38	13:57	1	13:30	13:34	13:35	1-
26	**M1.0**	6	*15:54*	*15:56*	*16:13*	*1*	15:53	16:04	16:10	1-	15:52	15:56	16:08	1-	15:53	15:58	16:14	1				
27	C1.5	1																				
27	C1.7	3									08:44	08:49	08:55	1-	*08:47*	*08:50*	*09:03*	*1-*				
27	C2.8	5									09:50	09:53	10:03	1-	*09:53*	*09:55*	*10:01*	*1-*				
27	C1.5	2													*10:23*	*10:29*	*10:36*	*1-*				
27	C1.6	3									11:53	11:57	12:07	1-	11:56	11:59	12:12	1-				
27	C2.3	4									12:13	12:18	12:32	1	12:16	12:18	12:30	1-				
27	C1.1	2													*13:40*	*13:45*	*13:50*	*1-*				
28	**M1.4**	7	*07:39*	*07:42*	*07:53*	*1-*	07:40	07:43	07:44	1-	07:36	07:40	08:44	2+	*07:39*	*07:44*	*07:50*	*1-*				
28	**M2.2**	11	10:25	10:29	11:18	2+	10:20	10:27	10:40	1	10:23	10:30	11:51	3	10:25	10:33	10:59	2				
28	C2.2	6	*13:19*	*13:21*	*13:30*	*1-*					12:28	12:36	12:49	1	12:31	12:39	12:56	1				
28	C3.3	5									13:17	13:22	13:25	1-	13:20	13:22	13:37	1-				
28	C3.8	7	*13:53*	*13:59*	*14:12*	*1*					13:53	13:59	14:18	1	13:53	13:59	14:23	1+				
28	**X1.0**	11	15:26	15:31	16:02	2	15:23	15:36	15:47	1	15:25	15:32	17:34	3+	15:26	15:35	16:53	3				
29	C1.5	1													*11:23*	*11:24*	*11:33*	*1-*				
29	C2.5	5	*13:24*	*13:30*	*13:48*	*1*					13:23	13:29	13:41	1-	13:24	13:30	13:42	1-				
30	C1.6	1									09:50	09:54	10:08	1-								
30	C0.9	2									13:39	13:44	13:56	1-	13:42	13:44	13:53	1-				
30	C3.1	2									15:18	15:27	15:38	1	15:21	15:31	15:45	1				

	Xray class		Steve Parkinson (Various) Tuned radio frequency receiver, frame aerials.				Andrew Thomas (22.1kHz/*19.6kHz*) Tuned radio frequency receiver, 0.6m frame aerial.				Phil Rourke (23.4kHz) Spectrum Lab, 0.6m frame aerial.				John Wardle SpetrumLab/Starbase, Active mini-whip aerial.				Christopher Bailey Spectrum Lab			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
9	**M1.6**																					
26	C5.0		09:48	09:53	?	-	09:46	09:56	10:15	1+												
26	*																					
26	C4.8		11:22	11:26	11:38	1-	11:22	11:26	11:40	1-												
26	C3.1						13:32	13:38	13:46	1-												
26	**M1.0**																					
27	C1.5																					
27	C1.7																					
27	C2.8		09:52	09:55	10:00	1-																
27	C1.5																					
27	C1.6																					
27	C2.3																					
27	C1.1																					
28	**M1.4**						*07:37*	*07:39*	*07:46*	*1-*									07:40	07:43	08:00	1
28	**M2.2**		10:24	10:32	11:40	2+	10:23	10:28	10:56	2	10:25	10:31	11:14	2+					10:25	10:30	11:15	2+
28	C2.2		12:31	12:35	12:45	1-																
28	C3.3						13:19	13:23	13:32	1-												
28	C3.8		13:54	14:00	14:07	1-	13:52	13:59	14:13	1												
28	**X1.0**		15:28	15:35	15:58	1+	15:24	15:37	16:11	2+	15:26	15:34	16:10	2					15:27	15:30	16:10	2
29	C1.5																					
29	C2.5						13:22	13:28	13:40	1-												
30	C1.6																					
30	C0.9																					
30	C3.1																					

	Xray class		Colin Briden (22.1kHz) Spectrum Lab / PC, 1.2m frame aerial.				Andrew Lutley (23.4kHz) Tuned radio frequency receiver, 0.6m frame aerial.				Peter Meadows (23.4kHz) Tuned radio frequency receiver, 0.6m frame aerial.				John Elliott (22.1kHz) Tuned radio frequency receiver, 0.5m frame aerial.				Mark Prescott (20.9/*19.6* /**22.1kHz**)			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
9	**M1.6**																					
26	C5.0		09:48	09:54	10:15	1+													*09:52*	*09:57*	*10:15*	*1*
26	*																					
26	C4.8		11:21	11:28	11:36	1-													11:21	11:31	11:42	1
26	C3.1		13:33	13:37	13:46	1-																
26	**M1.0**		15:54	15:58	16:02	1-													15:55	16:01	16:10	1-
27	C1.5																		07:00	07:08	07:22	1
27	C1.7																		08:49	08:57	09:16	1+
27	C2.8		09:53	09:55	09:58	1-													09:55	10:00	10:08	1-
27	C1.5																		*10:28*	*10:32*	*10:37*	*1-*
27	C1.6		11:54	11:59	12:03	1-																
27	C2.3		12:12	12:19	12:27	1-													12:08	12:16	12:24	1-
27	C1.1		13:40	13:43	13:46	1-																
28	**M1.4**		07:38	07:43	08:15	2																
28	**M2.2**		10:26	10:31	11:04	2									10:20	10:25	10:45	1	10:27	10:38	11:46	2+
28	C2.2		12:31	12:40	12:54	1													12:35	12:43	13:03	1+
28	C3.3		13:19	13:23	13:29	1-													13:20	13:26	13:31	1-
28	C3.8		13:54	14:01	14:11	1-													**13:57**	**14:03**	**14:17**	**1**
28	**X1.0**		15:27	15:35	?	-									15:10	15:30	16:15	2+	15:28	15:33	15:40	1-
29	C1.5																					
29	C2.5																		**13:26**	**13:35**	**13:57**	**1+**
30	C1.6																					
30	C0.9																					
30	C3.1																					


VLF flare activity 2005/21
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

BAA Radio Astronomy Section.

BARTELS DIAGRAM

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

2529

F 26 27 28 29 30 31 2019 January 1 2 3 4 5 6 C 7 8 9 10 11 12 13 14 15 16 2213 17 18 19 20 21

2530

F 22 23 24 25 26 CB 27 28 29 C 30 31 2019 February 1 2 3 4 5 6 7 8 9 10 11 12 2214 13 14 15 16 17

2531

F 18 19 20 21 22 23 24 25 26 27 28 2019 March 1 2 3 4 5 6 7 8 9 10 11 12 2215 13 14 15 16

2532

F 17 18 19 20 C 21 CCC 22 CCCB 23 B 24 25 26 27 28 29 30 31 2019 April 1 2 3 4 5 6 7 8 B 2216 9 10 11 12 B

2533

F 13 14 15 16 17 18 19 20 B 21 22 23 24 25 26 27 28 29 30 2019 May 1 2 3 4 5 BB 2217 6 CCCC 7 BCC 8 9 C

2534

F 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 2019 June 1 2 2218 3 4 5

2535

F 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 2219 30 2019 July 1 2

2536

F 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 2220 27 28 29

2537

F 30 31 2019 August 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 2221 23 24 25

2538

F 26 27 28 29 30 31 2019 September 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 2222 19 20 21

2539

F 22 23 24 25 26 27 28 29 30 2019 October 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 2223 17 18

2540

F 19 20 21 22 23 24 25 26 27 28 29 30 31 2019 November 1 2 3 4 5 6 7 8 9 10 11 12 2224 13 14

2541

F 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 2019 December 1 2 3 4 5 6 7 8 9 2225 10 11

2542

F 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 2020 January 1 2 3 4 5 2226 6 7

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

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