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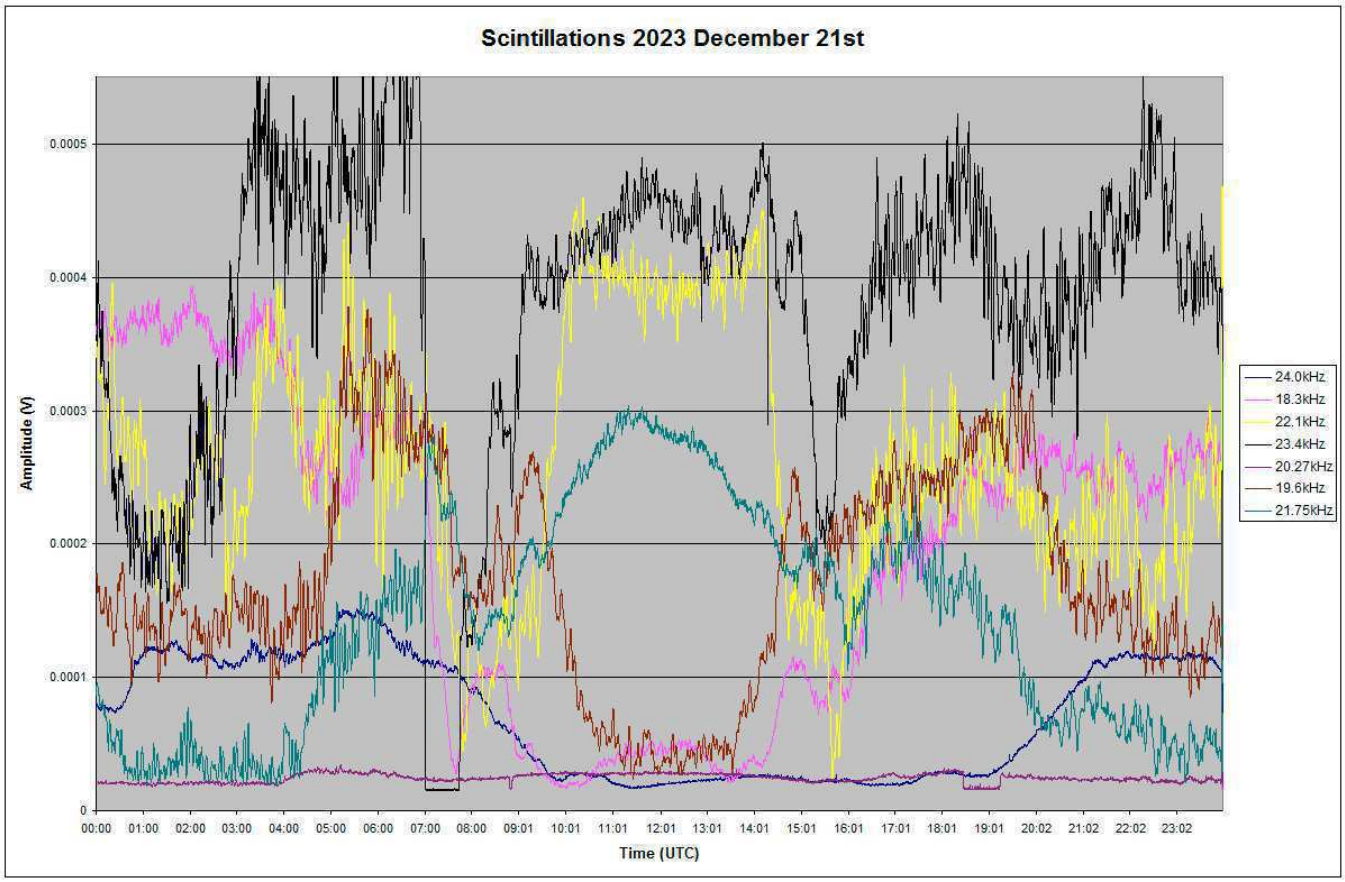
BAA Radio Astronomy Section. Director Paul Hearn.

RADIO SKY NEWS 2023 DECEMBER.

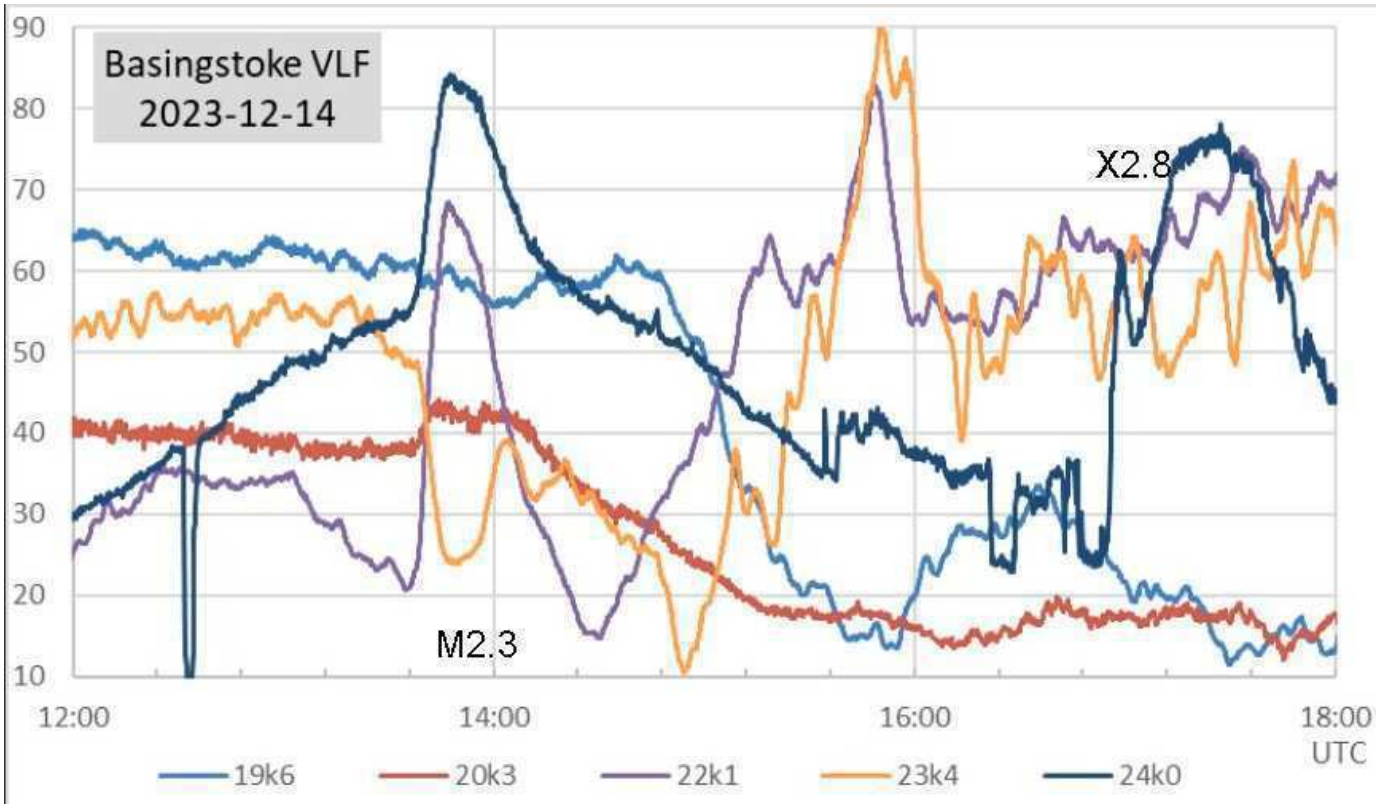
VLF SID OBSERVATIONS.

December has been a difficult month to analyse. 37.5kHz has been off-air due to the Grindavik volcanic activity, and some signals showed only intermittent operation during the holiday period. Day length is at is shortest, and with the low altitude of the sun there has been a high level of general instability on most signals. The GOES satellite data shows that the background solar X-ray flux has also been fairly high for most of the month. This has hidden many of the smaller flares that we might otherwise detect. Mark Edwards shows the problem at its worst on the 21st:

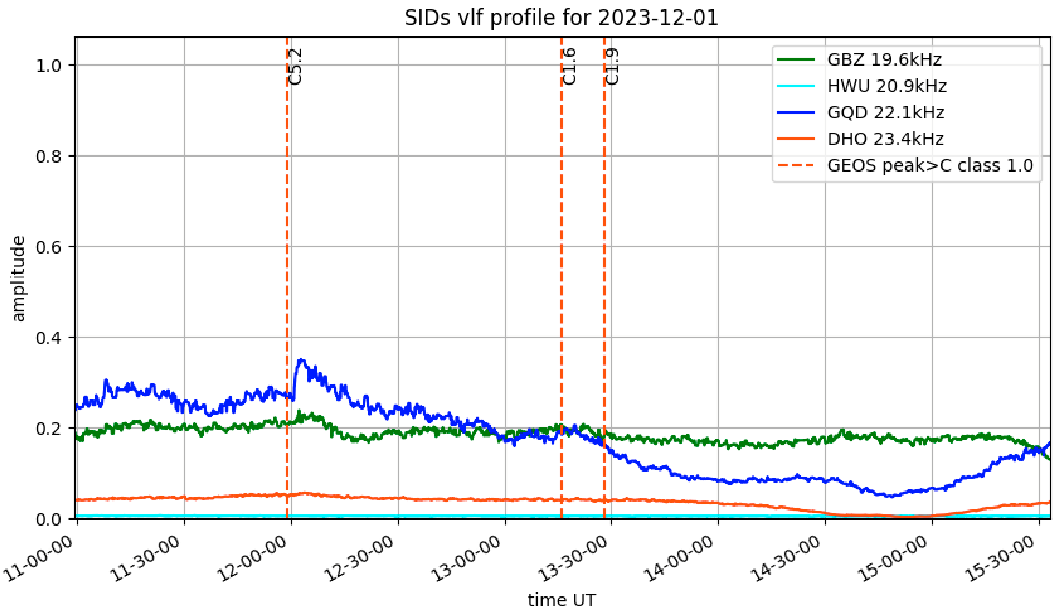


The SWPC bulletin lists four C2 class flares between 10:00 and 17:00UT, all well hidden by the noise.

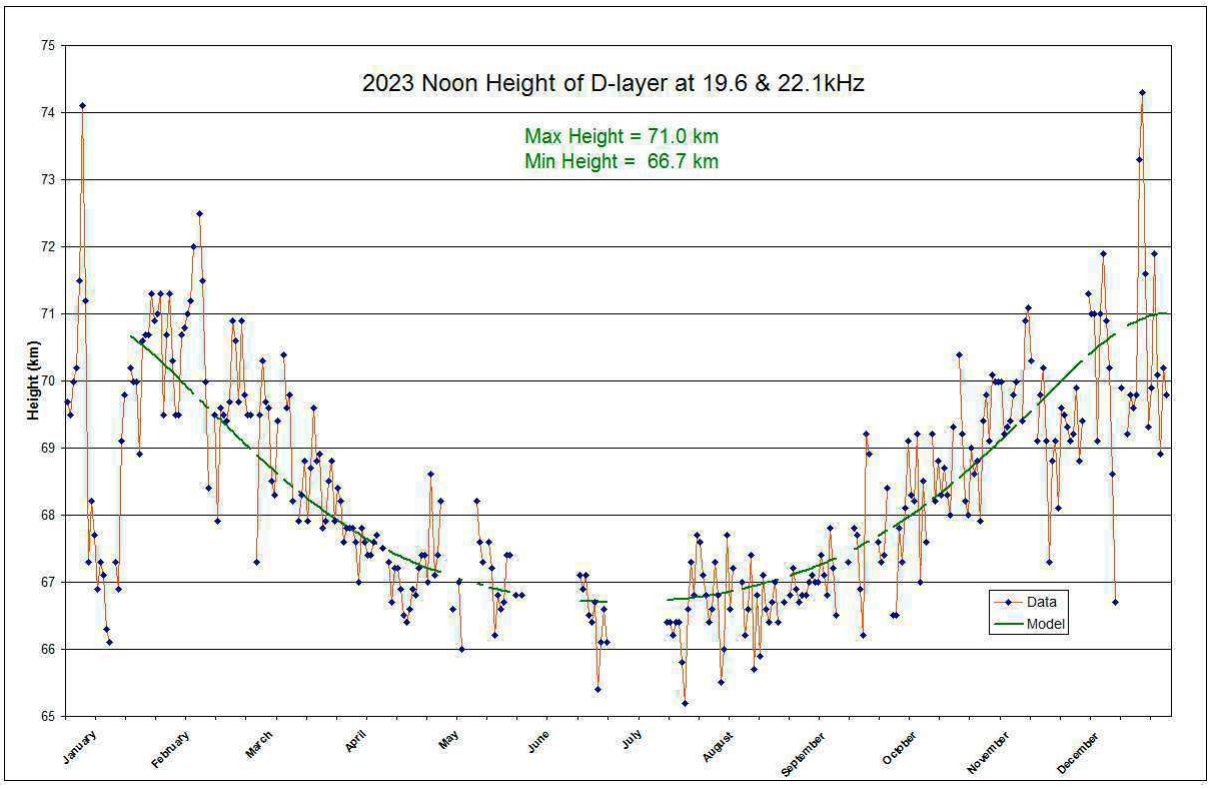
There were two X-class flares in the SWPC bulletins, an X5.0 flare at 22:00 on the 31st, (the strongest so far in this solar cycle), and an X2.8 flare at 17:00 on the 14th. We were lucky to catch this one at 24kHz, shown here by Paul Hyde:

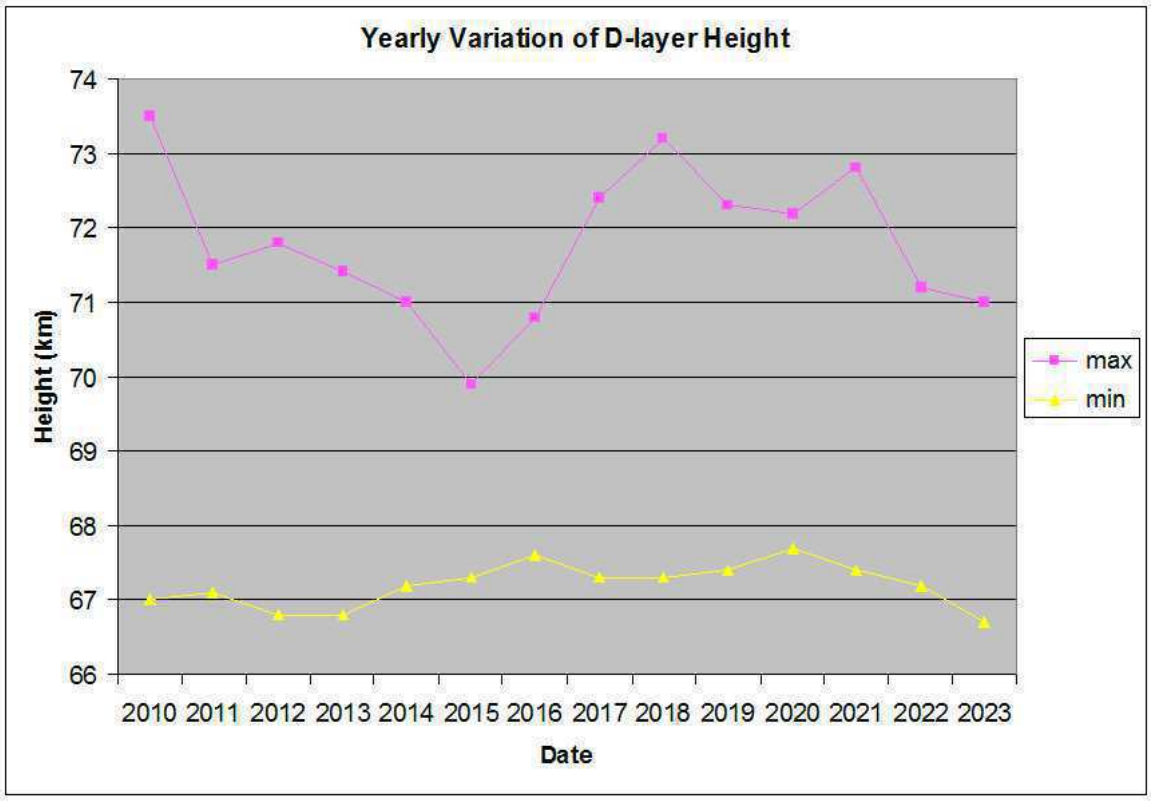


The M2.3 flare peaking at 13:47 is much clearer on most signals, although barely visible at 19.6kHz. The transmitter for 19.6kHz (Skelton) is fairly close to that for 22.1kHz (Anthorn), both near the Solway Firth, so the difference in effect is quite dramatic.



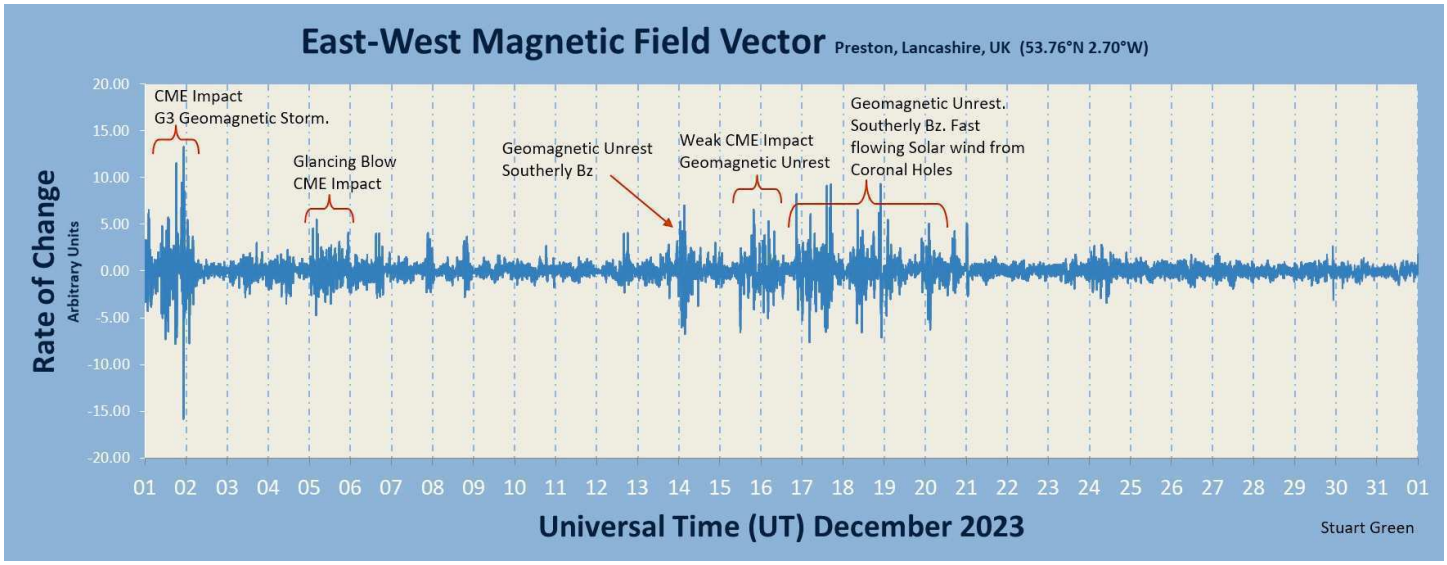
Mark Prescott's recording from the 1st shows a clear 22.1kHz SID for the C5.3 flare, again with a weaker response at 19.6kHz. The two weaker flares around 13:30 have not had much effect.



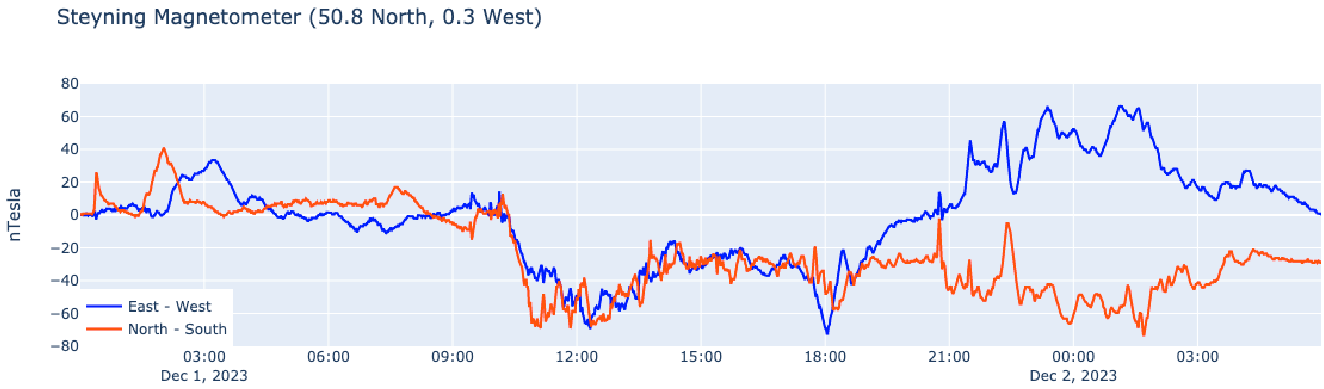


Mark Edwards has again provided his chart of D-region heights through the year, determined from the propagation at 19.6 and 22.1kHz. The winter months have less precise values due to the effects already mentioned. The lower chart shows how these values have changed over the last 14 years. Solar cycle 24 had two activity peaks, early 2012 and early 2014. Minimum was through 2018 – 2020. Cycle 25 peak had been predicted for 2025, but new predictions suggest that it is more likely in 2024.

MAGNETIC OBSERVATIONS.

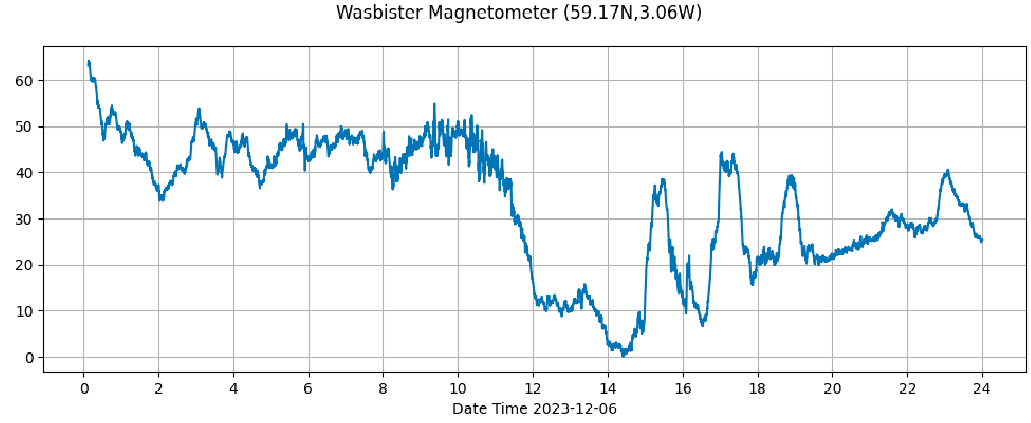


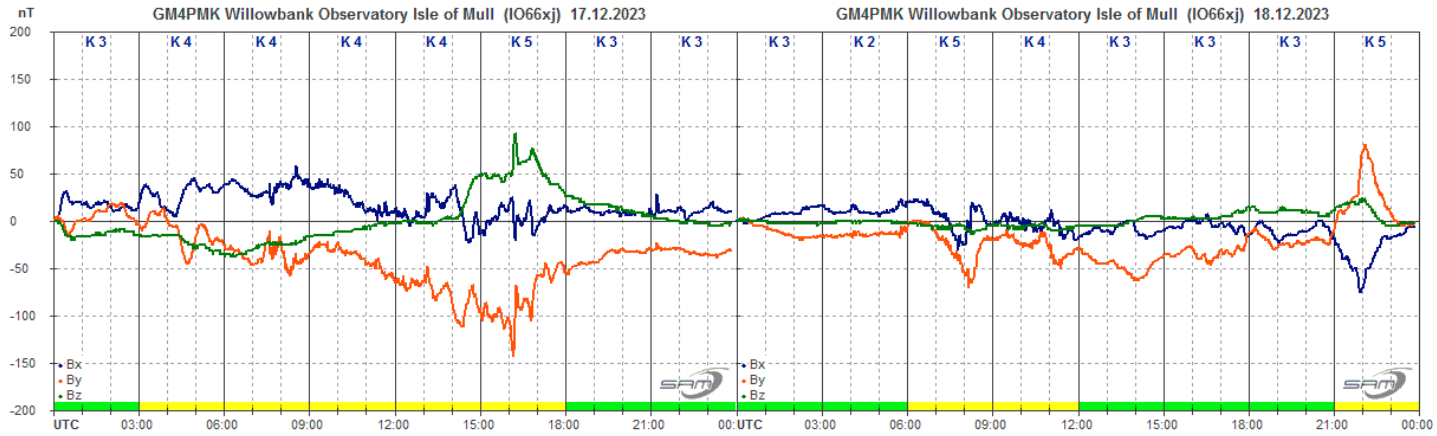
Stuart Green's chart of magnetic activity in December shows a very quiet end to the month, with just a few CME impacts in the first half.



The first of the CMEs arrived in the morning of December 1st, all of our recordings showing a small impact at about 09:30UT with a mild disturbance through the afternoon. It became much more active after 21:00, but then faded the following morning.

The glancing CME on the 5th produced some magnetic turbulence over several days, this recording by Callum Potter is from the 6th:

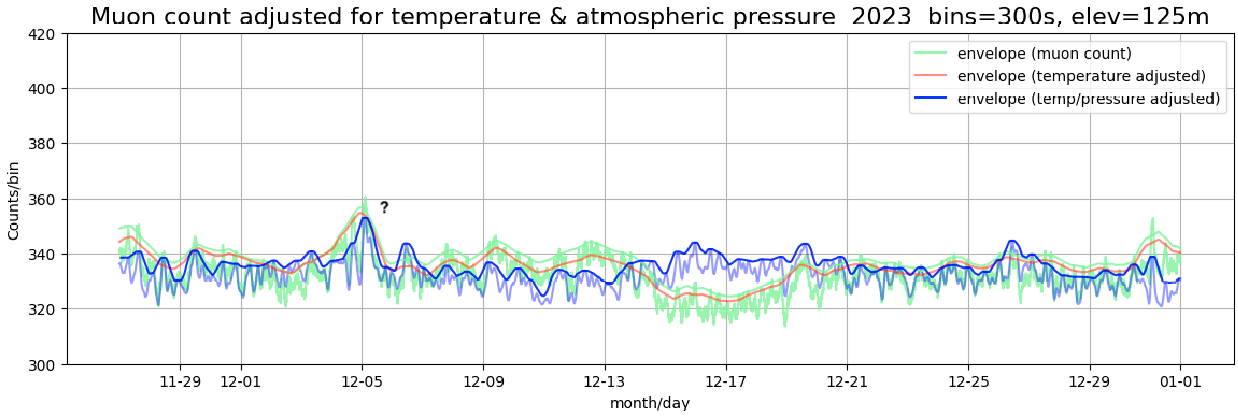


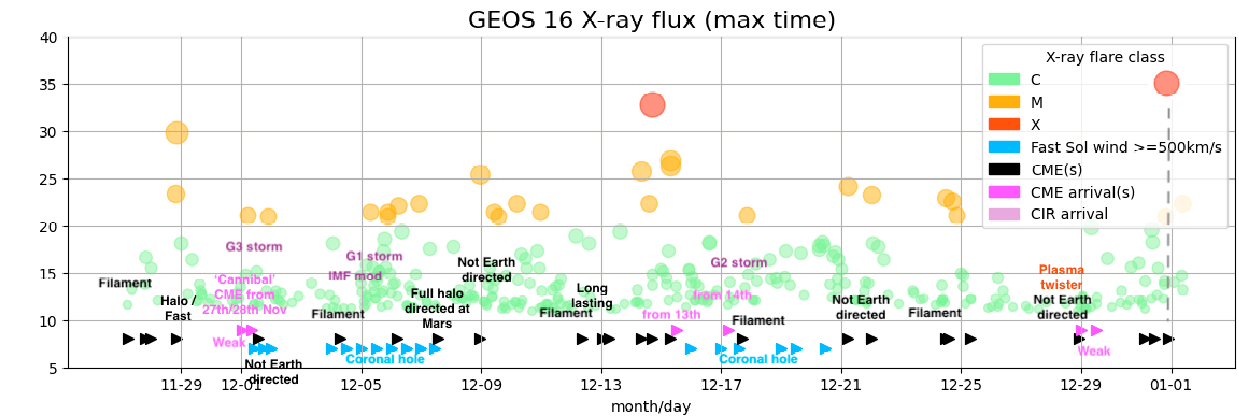


A combination of Solar wind and a mild CME produced a slightly stronger disturbance on the 17th and 18th, shown here by Roger Blackwell. This was preceded by a mild disturbance on the 16th, and then faded out over the next few days.

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

MUONS.

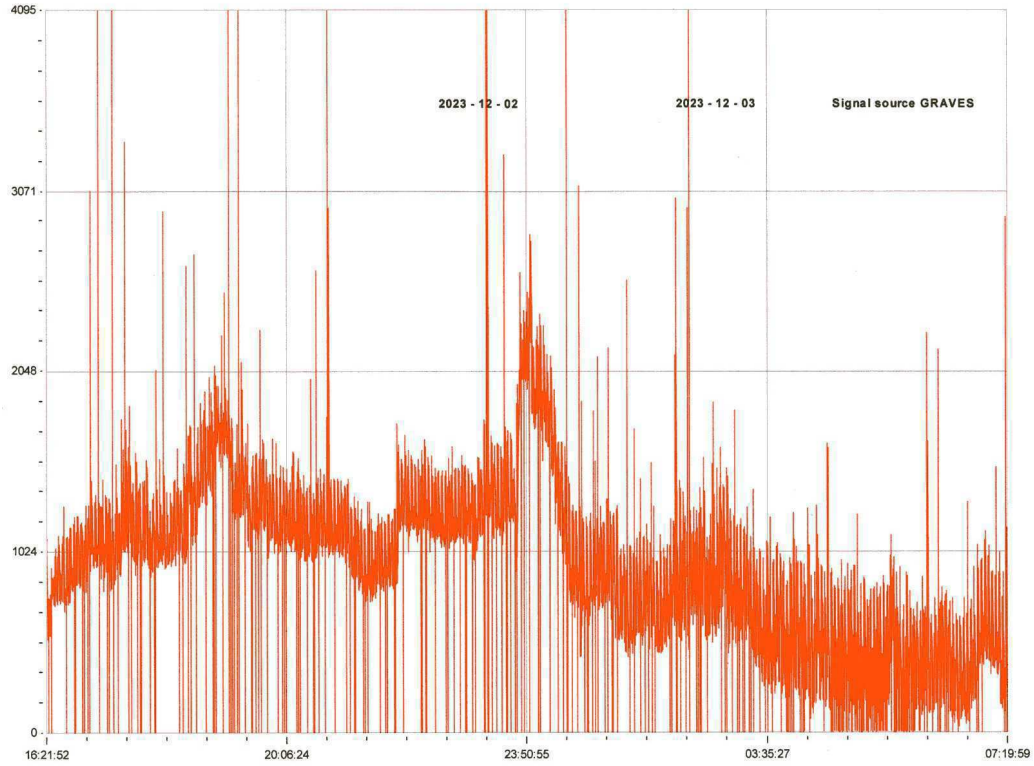


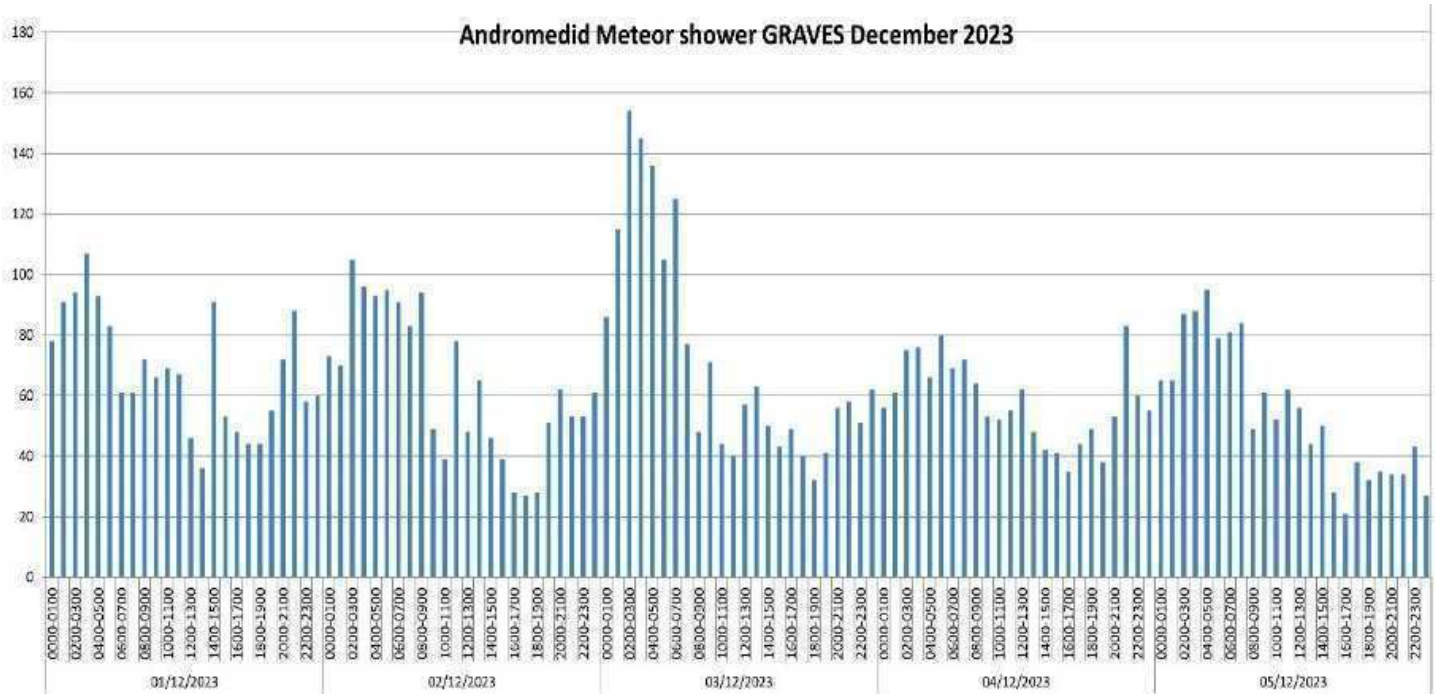


The pressure / temperature adjusted Muon chart from Mark Prescott shows a fairly quiet month, except for a small increase on the 5th. This may be due to the magnetic storm illustrated above although the stronger storm on the 1st has left no trace.

METEORS.

We have two showers to report this month, starting with the anticipated Bielid / Andromedid meteors mentioned last month.

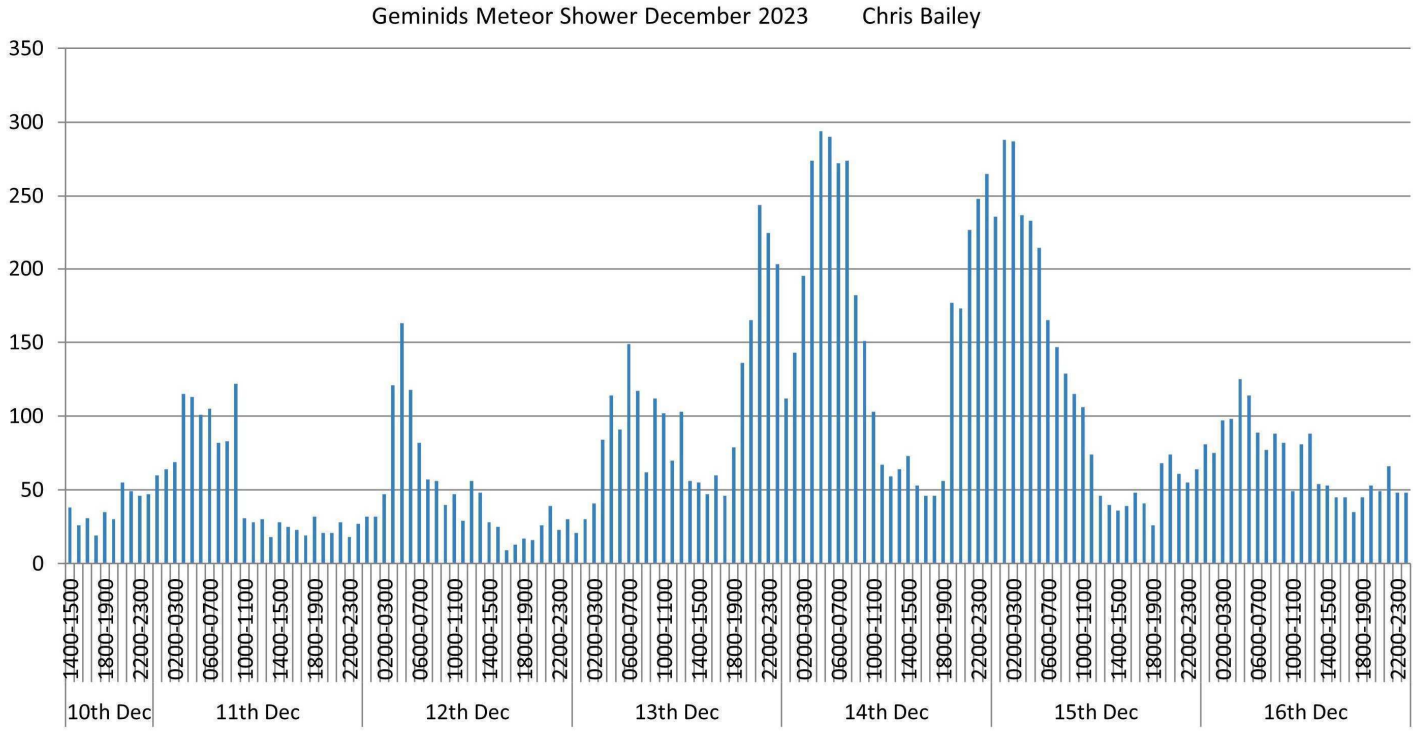




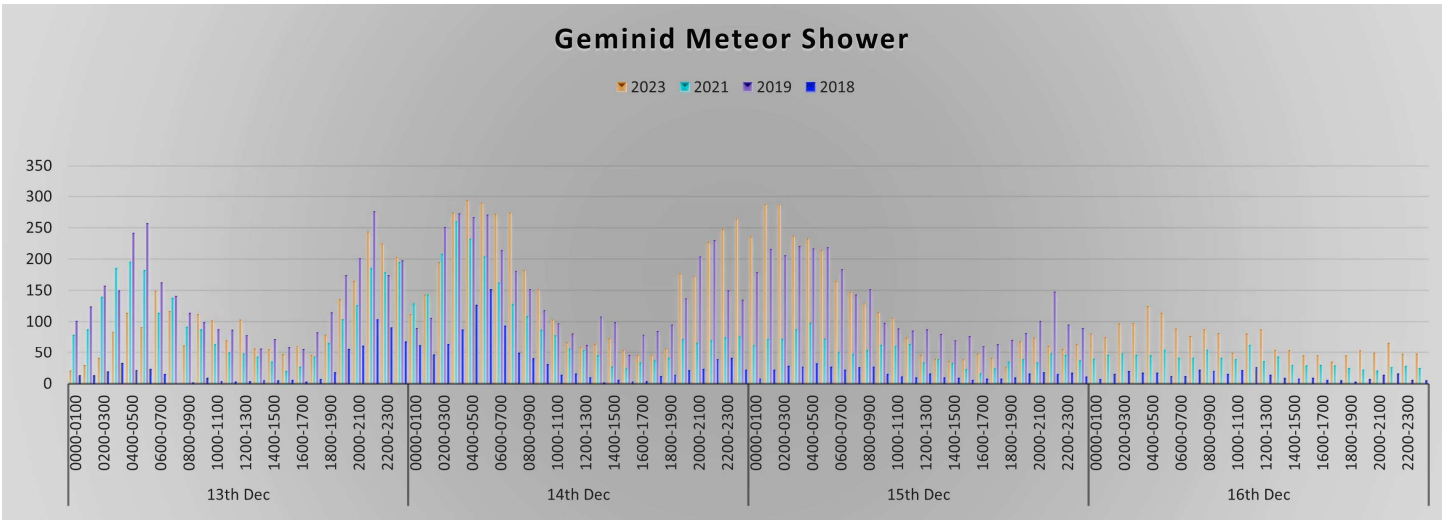
The first chart shows GRAVES echo counts between 16:22 on the 2nd and 07:20 on the 3rd, recorded by Colin Clements. Chris Bailey's chart shows counts from the 1st to the 5th. Both charts show a peak in activity, Colin's at around midnight, and Chris's a little later at 3AM on the 3rd. Chris also analysed shower activity by averaging the counts over the 5 days, and then subtracting this from the totals in each 2 hour period in the

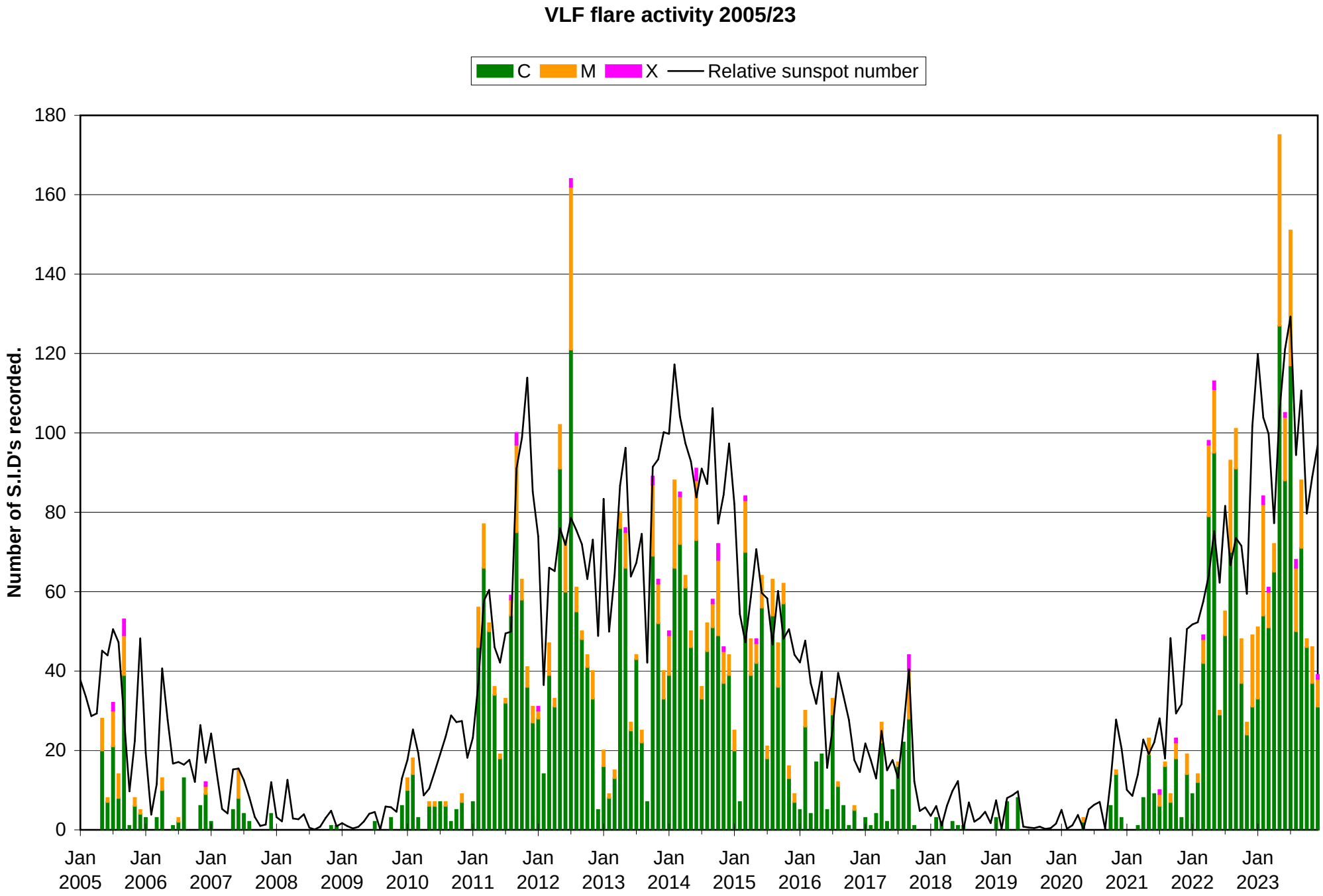
chart in an effort to remove the effects of sporadics. This also showed an excess count in the early hours of the 3rd. I hope that these results will help with future analysis of this shower.

The Geminids are more well known, and again produced some good results.



Chris Bailey's recording shows strong activity peaks overnight 13th / 14th and 14th / 15th, with counts double those seen in the Andromedids. Smaller peaks are seen on the 11th, 12th and 15th. Chris has also produced a chart comparing his observations in 2018, 2019, 2021 and 2023. Recordings in 2018 were made with less sensitive equipment, and so are generally lower.




VLF flare activity 2005/23
C
M
X
Relative sunspot number
Number of S.I.D's recorded.
180
160
140
120
100
80
60
40
20
0
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. **2023 DECEMBER.**

	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 (24.0/*19.6*/**21.75k**) Spectrum Lab / PC 2m loop aerial.				Colin Clements (23.4kHz/*18.3kHz*) 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	C5.2	7	11:57	12:00	12:08	1-					11:55	12:00	12:15	1	11:50	12:01	12:47	2+	11:52	12:01	12:32	2
1	C1.6	1													13:15	13:16	13:23	1-				
5	C4.7	1													11:55	12:17	12:42	2+				
5	C5.2	1													13:34	13:53	14:31	2+				
5	C2.9	1													15:35	15:38	15:45	1-				
6	C3.6	1																				
9	**M1.5**	8	09:49	09:56	10:24	2	09:44	09:56	10:19	2	09:50	09:57	10:06	1-	09:49	09:56	10:05	1-				
9	C4.3	2	10:43	10:49	10:54	1-																
9	?	1													*13:08*	*13:13*	*?*	-				
9	**M1.0**	8	13:07	13:13	13:34	1+	13:06	13:16	13:28	1	13:06	13:16	13:34	1+	*13:15*	*13:17*	*13:22*	*1-*				
10	C6.6	6	10:39	10:43	10:56	1-	10:37	10:43	11:05	1+	10:37	10:43	10:50	1-	*10:37*	*10:45*	*10:59*	*1*				
10	?	1									11:49	11:52	?	-								
10	C5.5	5	11:49	11:55	12:02	1-	11:47	11:55	12:17	1+	11:53	11:56	12:03	1-	**11:54**	**11:56**	**12:02**	**1-**				
10	C3.9	2													14:27	14:29	14:45	1-				
11	C3.3	1													**08:44**	**08:47**	**09:00**	**1-**				
11	C3.6	2	11:01	11:05	11:15	1-									**11:03**	**11:08**	**11:12**	**1-**				
11	C3.7	2													**13:43**	**13:45**	**13:53**	**1-**				
11	C2.2	1																				
11	C2.5	1																				
12	C3.0	1																				
12	C8.2	8	13:38	13:42	13:58	1					13:36	13:42	13:54	1-	13:37	13:44	14:05	1+				
12	C2.6	1													14:28	14:30	14:42	1-				
13	C9.3	1													14:51	15:15	?	-				
14	**M5.8**	1																				
14	**M2.3**	8	13:38	13:47	?	-					13:35	13:47	14:26	2+	13:36	13:48	14:31	2+				
14	**X2.8**	3									16:53	16:58	?	-	16:55	17:00	17:10	1-				
15	**M6.9**	1																				
15	C3.6	1																				
16	C2.6	1																				
16	C1.9	1																				
16	C8.3	2													13:52	13:55	14:14	1				
16	C8.1	1													14:35	14:38	14:45	1-				
16	?	1													15:11	15:16	?	-				
16	?	1													15:20	15:21	15:29	1-				
17	C2.1	1																				
18	C6.5	2													**14:20**	**14:21**	**14:27**	**1-**				
24	**M2.9**	8	*11:14*	*11:16*	*11:31*	*1-*					11:10	11:20	12:05	2+	11:14	11:19	11:30	1-				
24	**M2.6**	3									16:41	16:51	17:13	1+	16:42	16:50	17:06	1				
30	C5.7	1													15:19	15:21	15:32	1-				
31	C9.6	1													***08:15***	***08:18***	***08:36***	***1***				
31	C8.3	4	*09:09*	*09:12*	*09:22*	*1-*					09:07	09:12	09:23	1-	***09:10***	***09:12***	***09:22***	***1-***				
31	C2.7	1													***12:01***	***12:06***	***12:13***	***1-***				
31	C5.5	1													***12:43***	***12:51***	***13:12***	***1+***				
31	?	1													***13:59***	***14:01***	***14:09***	***1-***				

	Xray class		Steve Parkinson (Various) Tuned radio frequency receiver, frame aerials.				Andrew Thomas (21.7kHz/*19.6kHz*) Tuned radio frequency receiver, 0.6m frame aerial.				Phil Rourke (23.4kHz) Spectrum Lab, 0.6m frame aerial.				Mark Prescott (22.1kHz) 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	C5.2		11:56	11:59	12:06	1-									12:00	12:03	12:26	1+				
1	C1.6																					
5	C4.7																					
5	C5.2																					
5	C2.9																					
6	C3.6																					
9	**M1.5**		09:50	09:55	10:05	1-	09:42	09:55	09:57	1-												
9	C4.3																					
9	?																					
9	**M1.0**		13:08	13:15	13:29	1	*13:08*	*13:13*	*13:33*	*1*												
10	C6.6		10:39	10:43	10:53	1-																
10	?																					
10	C5.5		11:49	11:57	12:20	1+																
10	C3.9																					
11	C3.3																					
11	C3.6																					
11	C3.7																					
11	C2.2																					
11	C2.5																					
12	C3.0																					
12	C8.2		13:37	13:42	13:55	1-	13:37	13:42	14:01	1					13:41	13:46	14:08	1+				
12	C2.6																					
13	C9.3																					
14	**M5.8**																					
14	**M2.3**		13:39	13:48	14:15	2	13:42	13:48	13:56	1-					13:41	13:52	14:28	2+				
14	**X2.8**																					
15	**M6.9**																					
15	C3.6																					
16	C2.6																					
16	C1.9																					
16	C8.3																					
16	C8.1																					
16	?																					
16	?																					
17	C2.1																					
18	C6.5																					
24	**M2.9**		11:11	11:18	11:50	2	11:13	11:19	12:09	2+					11:16	11:19	11:40	1				
24	**M2.6**																					
30	C5.7																					
31	C9.6																					
31	C8.3						09:07	09:12	09:23	1-												
31	C2.7																					
31	C5.5																					
31	?																					

BAA Radio Astronomy Section. **2023 DECEMBER.**

	Xray class		Chris Bailey			Colin Briden				Richard Coffey (19.6kHz/*24kHz*)							
			Spectrum Lab.			Spectrum Lab frame Aerial.			1.2m	Spectrum Lab Frame aerial.			0.55m				
DAY			START	PEAK	END (UT)	START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
1	C5.2					11:57	12:02	12:08	1-								
1	C1.6																
5	C4.7																
5	C5.2																
5	C2.9																
6	C3.6									13:56	14:01	14:06	1-				
9	**M1.5**					09:47	09:55	10:13	1+	09:54	09:55	09:59	1-				
9	C4.3					10:46	10:49	10:53	1-								
9	?																
9	**M1.0**					13:06	13:13	13:44	2	13:11	12:22	13:29	1-				
10	C6.6					10:38	10:43	11:09	1+								
10	?																
10	C5.5																
10	C3.9					14:27	14:29	14:31	1-								
11	C3.3																
11	C3.6																
11	C3.7					11:02	11:04	11:10	1-								
11	C2.2					12:47	12:50	12:52	1-								
11	C2.5					13:07	13:08	13:12	1-								
12	C3.0					09:53	09:57	10:04	1-								
12	C8.2					13:37	13:41	14:00	1	13:35	13:42	13:55	1				
12	C2.6																
13	C9.3																
14	**M5.8**									07:28	07:33	07:50	1				
14	**M2.3**					13:39	13:43	13:53	1-	13:41	13:52	14:12	1+				
14	**X2.8**									*16:55*	*17:00*	*17:05*	*1-*				
15	**M6.9**									07:20	07:24	07:33	1-				
15	C3.6					11:33	11:36	11:41	1-								
16	C2.6					11:03	11:07	11:13	1-								
16	C1.9					12:28	12:32	12:35	1-								
16	C8.3					13:50	13:54	13:58	1-								
16	C8.1																
16	?																
16	?																
17	C2.1					10:23	10:25	10:28	1-								
18	C6.5					14:19	14:21	14:25	1-								
24	**M2.9**					11:12	11:19	11:32	1	11:14	11:16	11:25	1-				
24	**M2.6**									*16:44*	*16:48*	*16:57*	*1-*				
30	C5.7																
31	C9.6																
31	C8.3																
31	C2.7																
31	C5.5																
31	?																