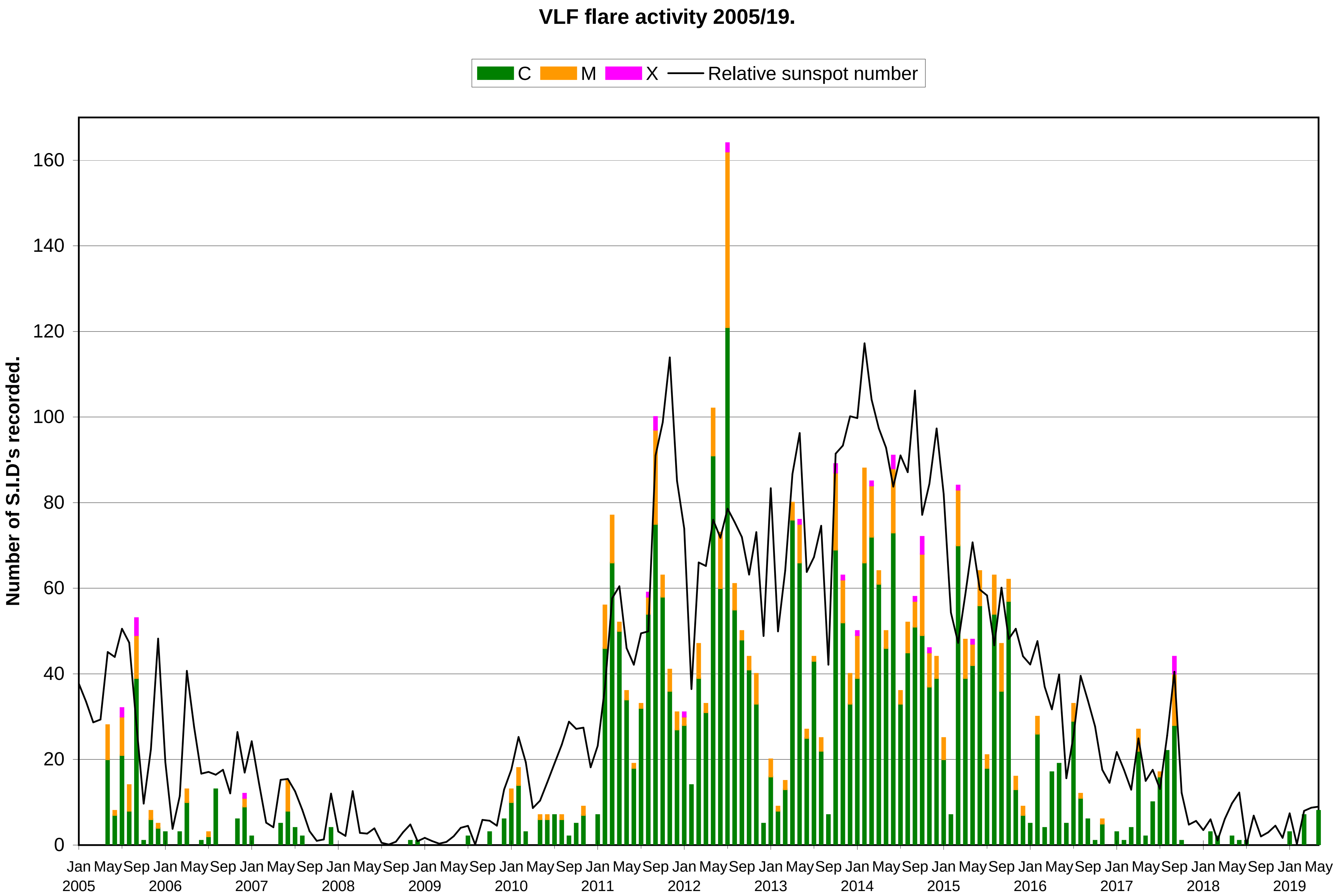
BAA Radio Astronomy Group. **2019 MAY**

	Xray class	Observers	John Cook (23.4kHz/*22.1kHz*)				Roberto Battaiola (21.75kHz)				Paul Hyde (20.9/22.1/37.5kHz)				Mark Edwards (22.1kHz/*37.5kHz*)				Colin Clements (23.4kHz/*18.3kHz*)			
			Tuned radio frequency receiver, 0.58m frame aerial.				Modified AAVSO receiver.				Spectrum Lab / PC 1.5m frame aerial.				Spectrum Lab / PC 2m loop aerial.				Tuned Radio Frequency receivers, 0.76m screened loop aerial.			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
5	B7.5	5									11:47	11:52	12:02	1-	11:48	11:51	12:05	1-				
5	B9.8	4									13:39	13:46	14:17	2	13:41	13:44	14:01	1				
6	C9.9	4	*05:08*	*05:09*	*05:11*	*1-*					05:07	05:11	05:28	1	05:10	05:11	05:16	1-				
6	C1.7	5	*07:30*	*07:44*	*?*	-					07:29	07:50	08:34	2+	07:36	07:48	08:06	1+				
6	C2.0	6	*08:44*	*08:48*	*09:09*	*1*					08:45	08:51	09:26	2	08:44	08:49	09:07	1				
6	C1.5	6	*10:00*	*10:03*	*10:16*	*1-*					09:58	10:04	10:26	1+	10:00	10:04	10:35	2				
6	C7.3	6	*13:50*	*13:55*	*14:04*	*1-*					13:41	13:53	15:01	2+	13:48	13:55	15:03	2+	*13:46*	*13:52*	*14:17*	*1+*
7	B8.0	1													*09:33*	*09:38*	*09:44*	*1-*				
7	C1.2	3									10:30	10:47	11:12	2	10:33	10:48	11:36	2+				
7	C1.4	1													*11:54*	*11:58*	*12:06*	*1-*				
9	C6.7	1													05:49	05:55	06:03	1-				

	Xray class		Steve Parkinson (Various)				Andrew Thomas (23.4/19.6kHz)				Phil Rourke (23.4kHz)				Jim Barber				John Elliott (18.3kHz)			
			Tuned radio frequency receiver, frame aerials.				Tuned radio frequency receivers, frame aerials, 0.6m 23.4k, 1m 19.6k				Spectrum Lab, 0.6m frame aerial.				Spectrum Lab, 0.6m frame aerial.				Tuned radio frequency receiver, 0.5m frame aerial.			
DAY			START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)		START	PEAK	END (UT)	
5	B7.5		11:47	11:52	12:19	1+	11:47	11:53	12:12	1												
5	B9.8		13:40	13:44	13:58	1-																
6	C9.9						05:08	05:12	05:25	1-												
6	C1.7						07:35	07:42	?	-												
6	C2.0		08:44	08:51	09:09	1	08:44	08:50	09:04	1												
6	C1.5		09:59	10:04	10:27	1+	09:58	10:05	10:17	1												
6	C7.3		13:50	13:55	14:45	2+																
7	B8.0																					
7	C1.2																					
7	C1.4																					
9	C6.7																					

	Xray class		Colin Briden (22.1kHz)																			
			Spectrum Lab / PC, 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)	
5	B7.5		11:47	11:52	12:04	1-																
5	B9.8		13:40	13:45	14:05	1																
6	C9.9																					
6	C1.7		07:35	07:48	08:03	1+																
6	C2.0		08:45	08:51	09:15	1+																
6	C1.5		10:00	10:04	10:27	1+																
6	C7.3		13:41	13:56	14:31	2+																
7	B8.0																					
7	C1.2		10:31	10:37	10:43	1-																
7	C1.4																					
9	C6.7																					



VLF flare activity 2005/19.
C
M
X
Relative sunspot number
Number of S.I.D's recorded.
0
20
40
60
80
100
120
140
160
Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May Sep Jan May
2005
2006
2007
2008
2009
2010
2011
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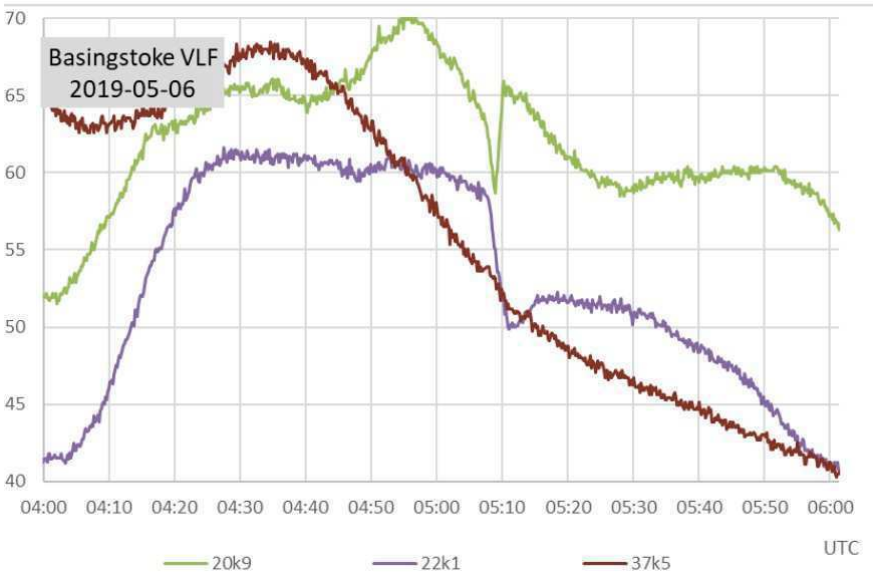
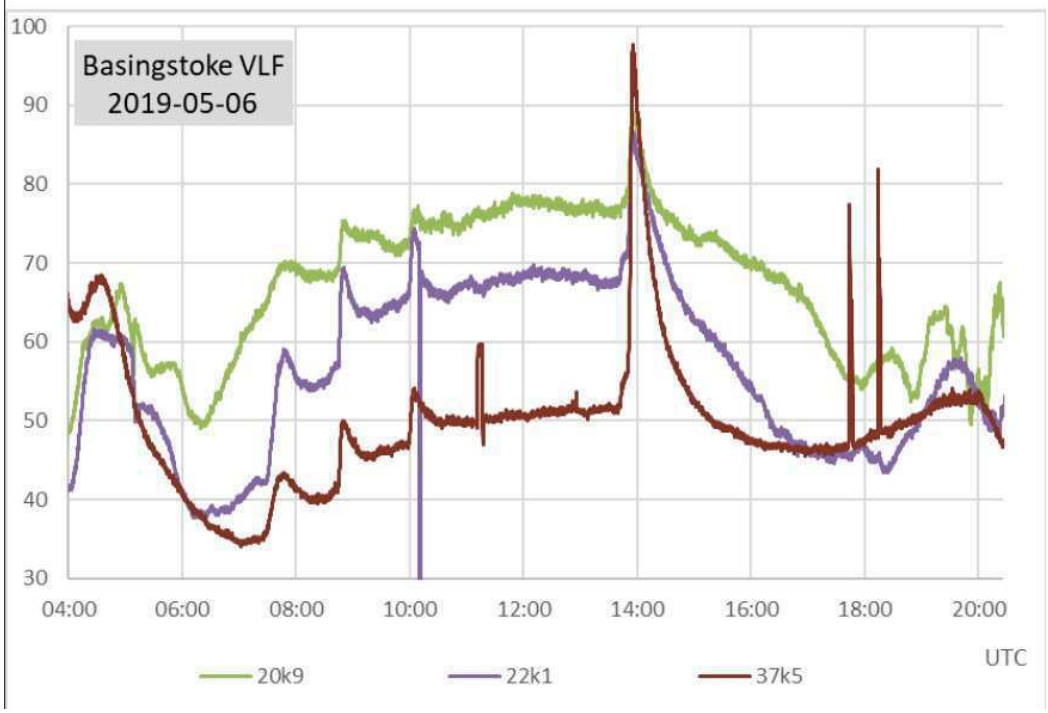
2014
2015
2016
2017
2018
2019

BAA Radio Astronomy Group. **2019 MAY.**

May began with the X-ray background flux at about A6 as recorded in the GOES data. On the third it started to rise above B1 as AR12740 became active. Although it was not a particularly large region, it did generate a good number of flares between the 5th and 15th. We were lucky in recording the largest of these at C9.9 peaking at about 05:11UT on the 6th.



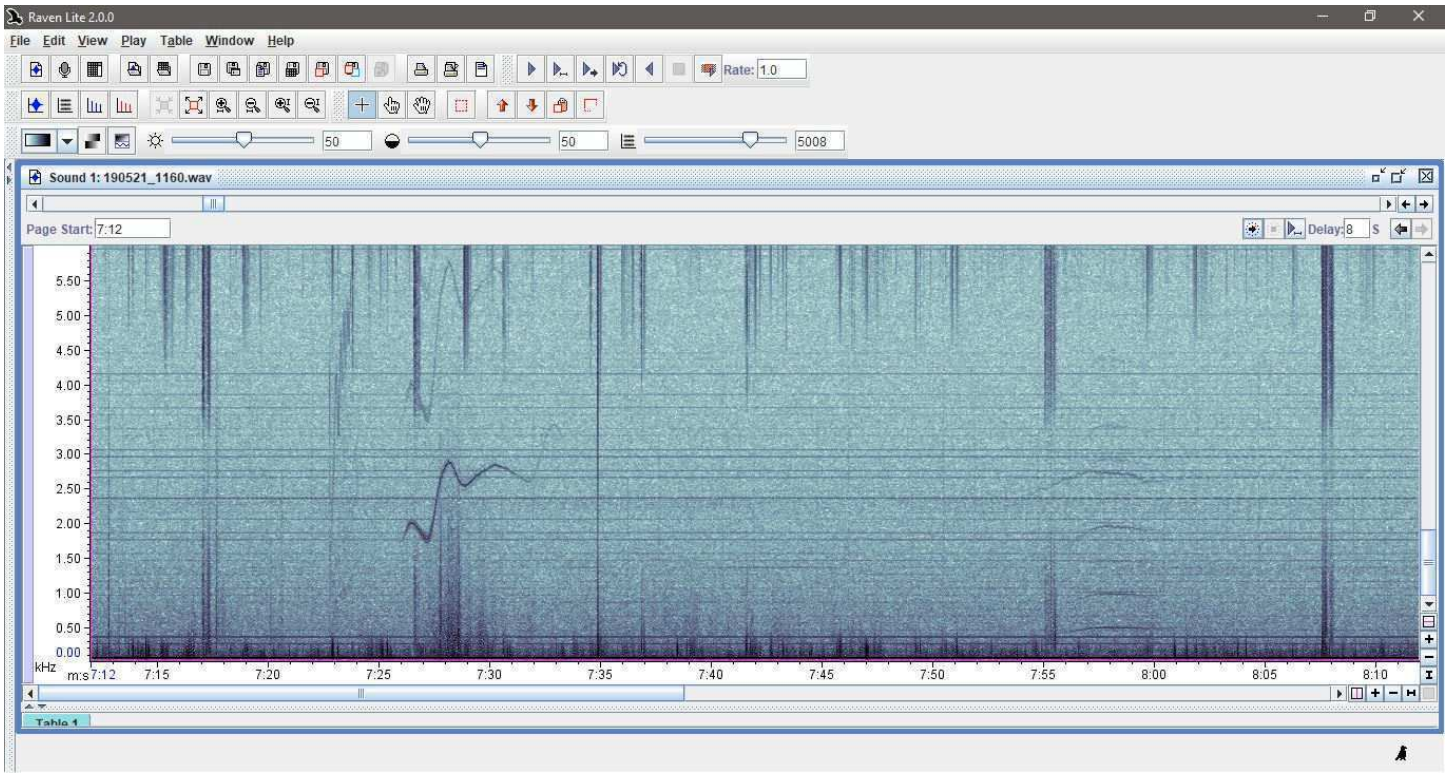
This recording by Paul Hyde shows the flare very clearly at 20.9 and 22.1kHz, but the more westerly path at 37.5kHz has barely responded while still showing sunrise effects.



The full day's recording puts it into context, showing good SIDs at 37.5kHz for the rest of the flares during the day. There are some large glitches around 11UT and either side of 18UT, but the C7.3 flare dominates the chart just before 14UT on all of the signals. These two flares are the strongest so far in 2019, the last time that an M-class flare was seen being back in 2017 October.

Low level flaring continued for the next few days, the last recorded as a SID being the C6.7 at 05:51UT on the 9th. There was a C2 flare at 19:24 on the 15th, but too late in the evening for us to record. The background X-ray flux dropped back to A6 or 7 after that, remaining flat for the rest of the month.

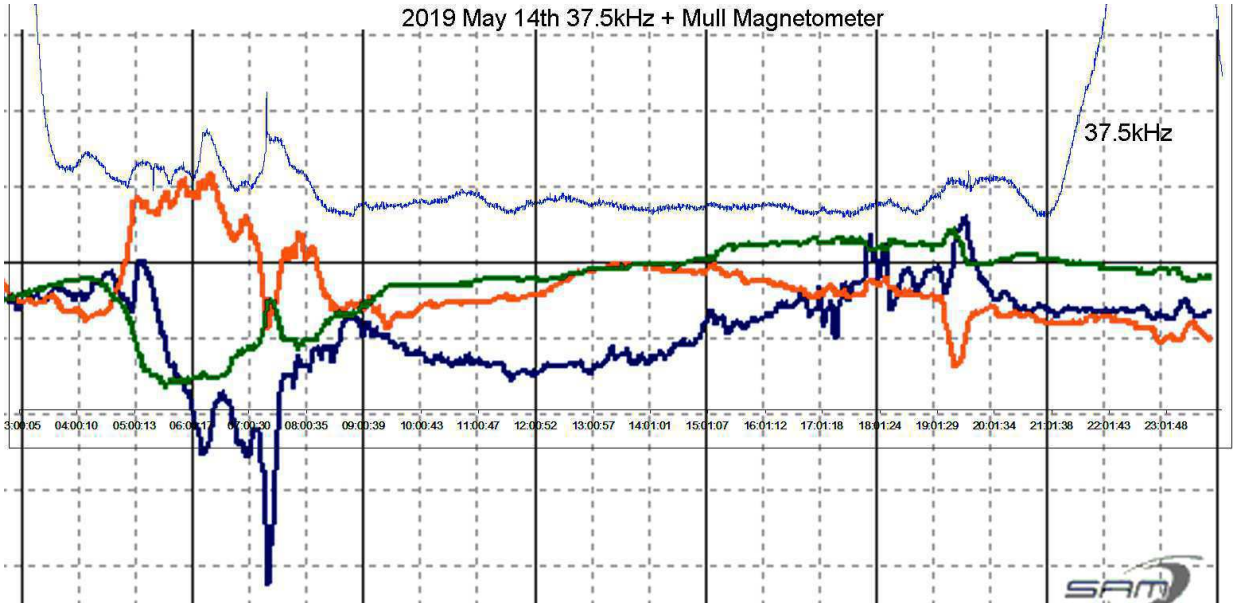
The recording of 'atmospherics' is something that BAA members were doing back in the 1960s along with satellite tracking, but has not been reported for a long time. Colin Briden has recently been experimenting with a portable E-field receiver at a very radio-quiet location between York and Bridlington with some interesting results. He does question whether it is radio astronomy or geophysics, but that probably does not matter because it does involve the Earth's ionosphere, and that is what we monitor as an indicator of solar activity. This is one of the recordings that he made:-



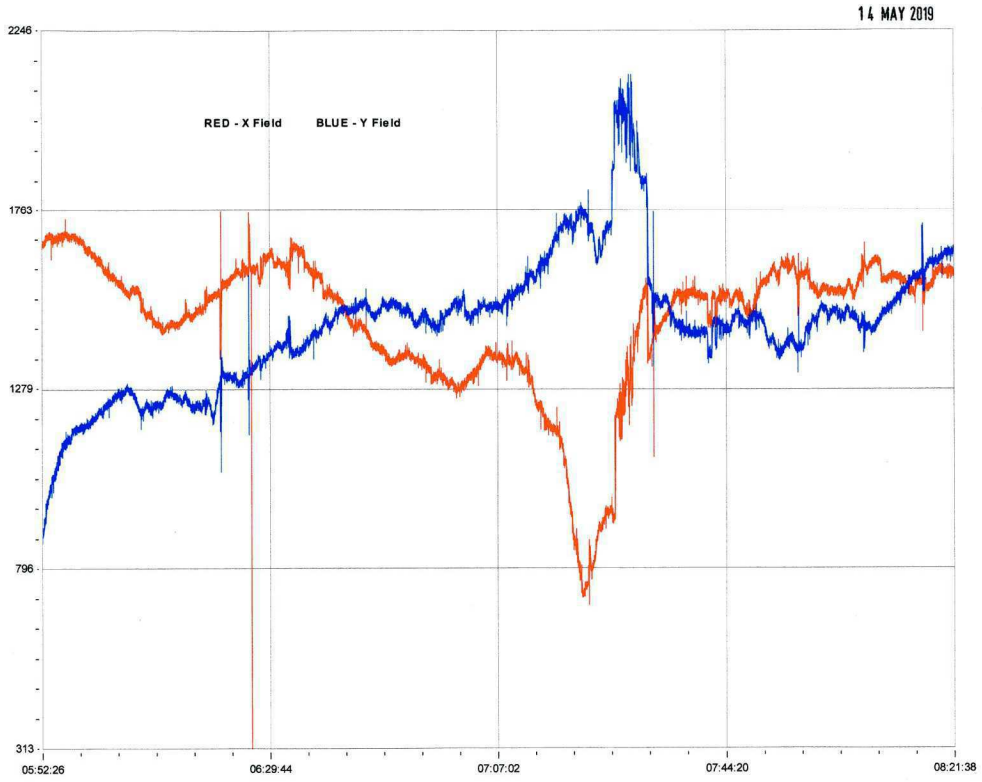
Frequency range (vertical axis) is from 0 to 6kHz, with time in minutes and seconds along the horizontal axis starting at 09:07:18UT. There is a little local noise present, but there are also some natural radio signals to be seen. Starting just after the 7m25s marker is a fast rising 'chirp' with its second harmonic just visible above it. From the 7m55s mark there is another set of weaker signals present, gently rising and falling in frequency. Another similar set of weaker signals was recorded after 56m20s. Some interesting recordings, and Colin is planning to make some more.

MAGNETIC OBSERVATIONS.

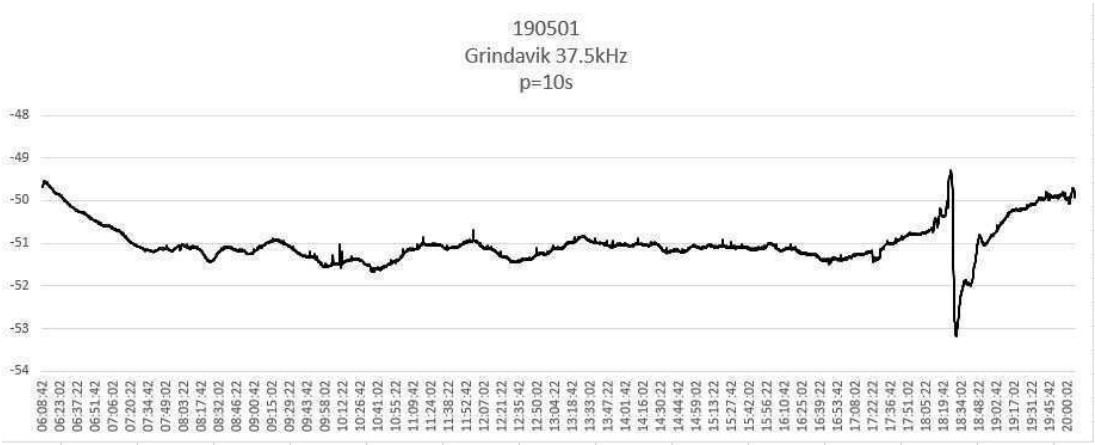
With the burst of flare activity there were a number of CMEs recorded in satellite images, including some at the start of May while AR12740 was still on the far-side of the sun. A number of small CMEs from the 11th, 12th and 13th seem to be responsible for the most active magnetic disturbance, recorded on May 14th. This was also seen on the 37.5kHz signal as shown in Mark Edwards' recording shown on the next page. 37.5kHz is the light blue trace at the top of the chart, superimposed on the three-axis magnetometer recording by Roger Blackwell.



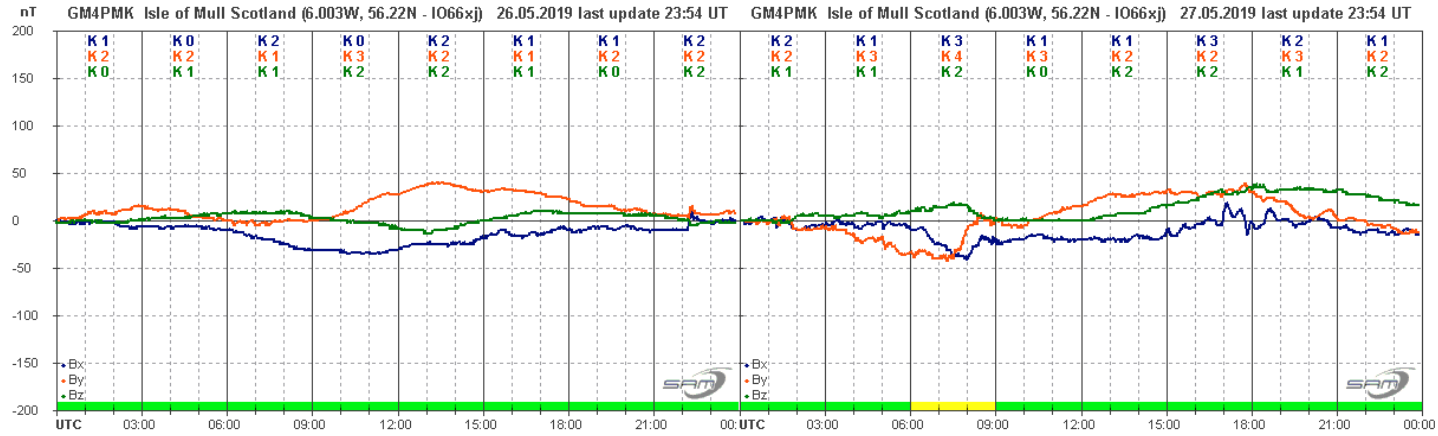
The strongest activity is from 05UT to about 08UT, with a very good match between VLF and magnetic signal. A further disturbance begins just before 17UT, continuing into the sunset. The disturbance was also recorded by Colin Clements, shown in this recording:

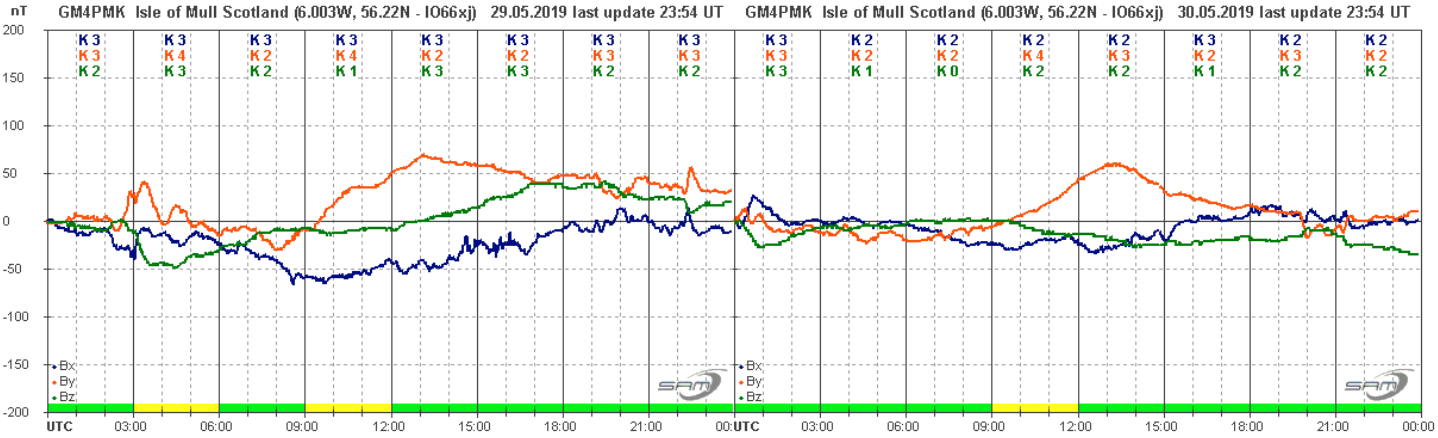


The large coronal holes from earlier in the year have broken up into numerous much smaller holes, resulting in less rapid changes in solar wind speed and less effect on the 37.5kHz signal from Grindavik. Colin Briden and Mark Edwards did record one strong 37.5kHz transient at about 18:20UT on May 1st, shown in Colin's recording on the next page.



A combination of more small CMEs and coronal hole effects produced disturbances over the 26th to 30th of May, as shown in Roger Blackwell's recordings:





The initial impact of a slow CME can be seen just after 22UT on the 26th, followed by some mild disturbance over the next 24 hours. The 28th was quiet, but the faster solar wind became effective on the 29th, fading away on the 30th.

Magnetic observations received from Colin Clements, Roger Blackwell and John Cook.

BAA Radio Astronomy Group

BARTELS DIAGRAM

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

2493

F 28 CCC | 29 | 30 C | 2016 May 1 C | 2 C | 3 | 4 C | 5 | 6 | 7 C | 8 | 9 | 2177 10 | 11 | 12 | 13 | 14 CCCB | 15 CCBC | 16 C | 17 | 18 | 19 | 20 | 21 BC | 22 B | 23 | 24 BBC

2494

F 25 | 26 CC | 27 CC | 28 | 29 | 30 | 31 | 2016 June 1 | 2 | 3 | 4 | 5 | 2178 6 | 7 | 8 | 9 BCC | 10 | 11 B | 12 C | 13 C | 14 | 15 | 16 | 17 | 18 | 19 C | 20

2495

F 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2016 July 1 | 2 | 2179 3 | 4 | 5 | 6 | 7 C | 8 | 9 C | 10 | 11 | 12 | 13 | 14 | 15 C | 16 CCCB | 17 C

2496

F 18 C | 19 C | 20 | 21 CBCB | 22 CCC | 23 MMCC | 24 MBCM | 25 C | 26 BB | 27 | 28 | 29 | 30 | 2180 31 | 2016 August 1 | 2 | 3 | 4 | 5 C | 6 | 7 CCMC | 8 CCCC | 9 C | 10 B | 11 C | 12 | 13

2497

F 14 C | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 2181 27 | 28 | 29 | 30 | 31 | 2016 September 1 | 2 | 3 | 4 | 5 | 6 | 7 B | 8 | 9

2498

F 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 CCB | 22 CCCC | 2182 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2016 October 1 | 2 | 3 | 4 | 5 | 6

2499

F 7 | 8 | 9 | 10 | 11 | 12 C | 13 | 14 B | 15 | 16 B | 17 | 18 | 19 | 2183 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 2016 November 1 | 2

2500

F 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 2184 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 C | 29 CCM

2501

F 30 CC | 2016 December 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 2185 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26

2502

F 27 | 28 | 29 | 30 | 31 | 2017 January 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 2186 10 | 11 | 12 C | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 CC | 22

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F 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 2017 February 1 | 2 | 3 | 4 | 5 | 6 | 2187 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18

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F 19 | 20 BB | 21 | 22 C | 23 | 24 | 25 | 26 | 27 | 28 B | 2017 March 1 | 2 | 3 | 4 | 5 | 2188 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17

2505

F 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 BCC | 28 BC | 29 | 30 | 31 C | 2017 Ap 1 BB | 2189 2 MMMM | 3 CCCM | 4 CBCC | 5 CBB | 6 CC | 7 BC | 8 C | 9 | 10 | 11 | 12 | 13

2506

F 14 | 15 | 16 | 17 | 18 C | 19 B | 20 | 21 B | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 2190 30 | 2017 May 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10

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F 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 2191 27 BB | 28 BC | 29 | 30 | 31 C | 2017 June 1 CCC | 2 CBC | 3 CCC | 4 | 5 C | 6

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F 7 CB | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 2192 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2107 July 1 | 2 | 3 M

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F 4 | 5 | 6 | 7 CB | 8 | 9 CCBB | 10 | 11 BBC | 12 | 13 C | 14 C | 15 CCC | 16 CCBB | 17 | 18 C | 19 | 2193 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30

2510

F 31 B | 2017 August 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 CC | 15 CB | 2194 16 | 17 | 18 BBC | 19 CCCC | 20 CCC | 21 BC | 22 CBCC | 23 CCC | 24 B | 25 C | 26

2511

F 27 C | 28 | 29 | 30 BBC | 31 | 2017 September 1 CC | 2 BC | 3 | 4 CMMM | 5 MCCM | 6 XXMM | 7 MMXC | 8 MCCM | 9 CMC | 10 CX | 11 C | 12 | 2195 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22

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F 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2017 October 1 | 2 | 3 | 4 | 5 C | 6 B | 7 | 8 | 9 | 2196 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19

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F 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 2017 November 1 | 2 | 3 | 4 | 5 | 2197 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15

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F 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2017 December 1 | 2 | 3 | 2198 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

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F 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2199 31 | 2018 January 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8

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F 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 B | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 2200 27 | 28 | 29 | 30 | 31 | 2018 February 1 | 2 | 3 | 4

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F 5 | 6 | 7 CC | 8 | 9 BB | 10 C | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 2201 24 | 25 | 26 | 27 | 28 | 2018 March 1 | 2 C | 3

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F 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 2202 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 C

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F 31 | 2018 April 1 B | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 2203 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26

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F 27 | 28 | 29 | 30 | 2018 May 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 2204 16 | 17 | 18 | 19 | 20 | 21 | 22 B | 23 C

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F 24 B | 25 | 26 | 27 | 28 BC | 29 | 30 | 31 | 2018 June 1 | 2 | 3 | 4 | 5 | 6 C | 7 | 8 | 9 | 10 | 11 | 12 | 2205 13 | 14 | 15 | 16 | 17 | 18 | 19

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F 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 2018 July 1 | 2 | 3 | 4 | 5 | 6 C | 7 | 8 | 9 | 2206 10 | 11 | 12 | 13 | 14 | 15 | 16

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F 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 2018 August 1 | 2 | 3 | 4 | 5 | 2207 6 | 7 | 8 | 9 | 10 | 11 | 12

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F 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 2018 September 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8

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F 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 2209 30 | 2018 October 1 | 2 | 3 | 4 | 5

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F 6 | 7 | 8 | 9 | 10 | 11 | 12 B | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 2210 27 | 28 | 29 | 30 | 31 | 1

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2018 November 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 2211 23 | 24 | 25 | 26 | 27 | 28

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F 29 | 30 | 2018 December 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 2212 20 | 21 | 22 | 23 | 24 | 25

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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

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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

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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

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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

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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