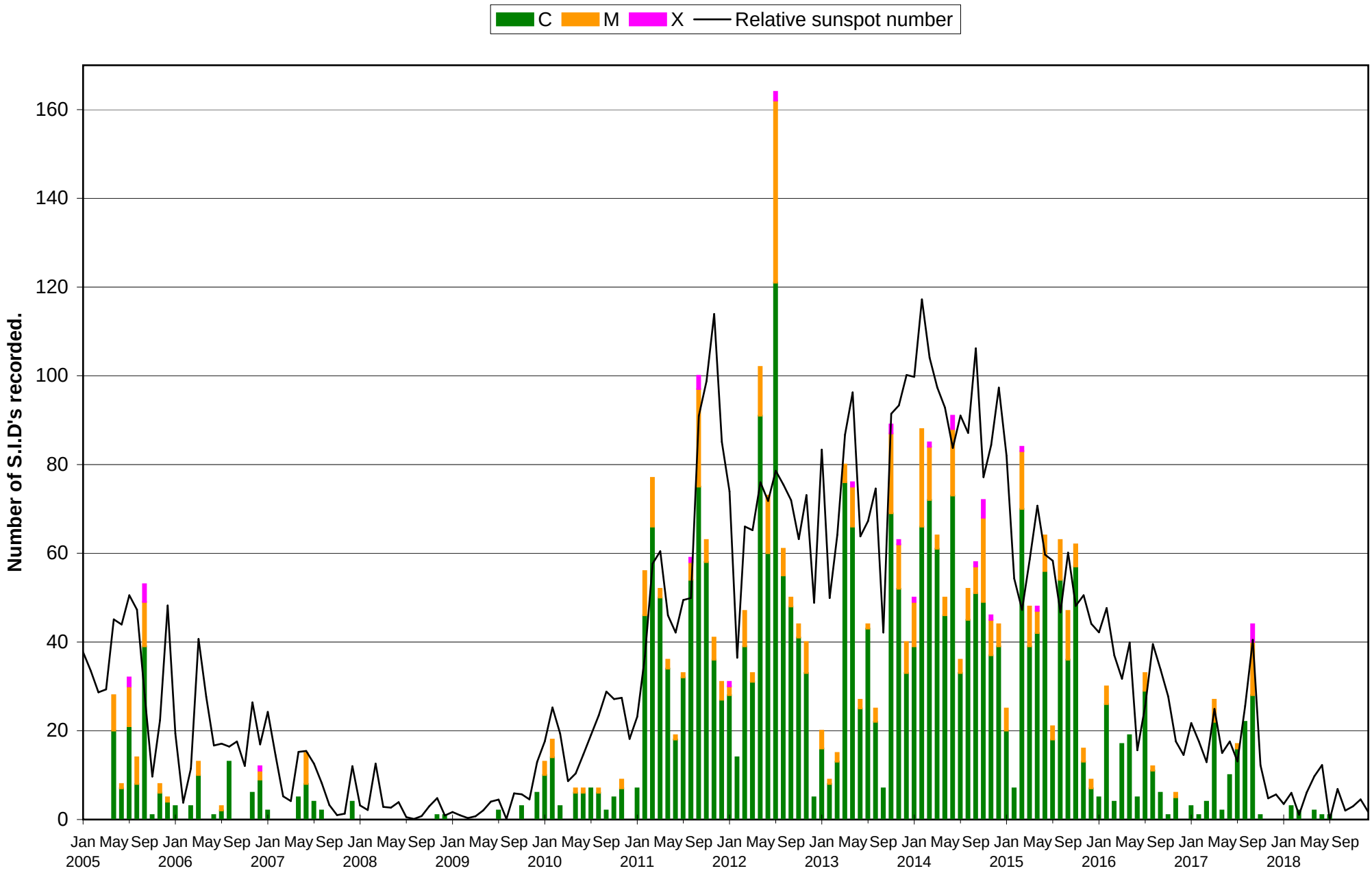
BAA Radio Astronomy Group. **2018 DECEMBER**

	Xray class	Observers	John Cook (23.4kHz/*22.1kHz*)	Roberto Battaiola (20.9kHz)	Paul Hyde (22.1kHz/*24kHz*)	Mark Edwards (24.0kHz)	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		0	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)

	Xray class		Steve Parkinson (Various)	Andrew Thomas (23.4kHz)	Phil Rourke (23.4kHz)	Jim Barber	John Elliott (18.3kHz)
			Tuned radio frequency receiver, frame aerials.	Tuned radio frequency receiver, 0.6m frame aerial.	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)

	Xray class		Colin Briden (22.1kHz)				
			Spectrum Lab / PC, 1.2m frame aerial.				
DAY			START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)


VLF flare activity 2005/18.
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
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

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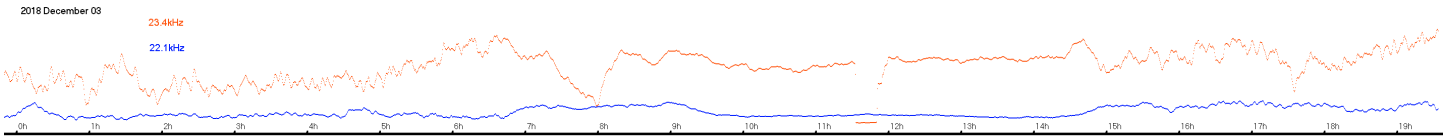
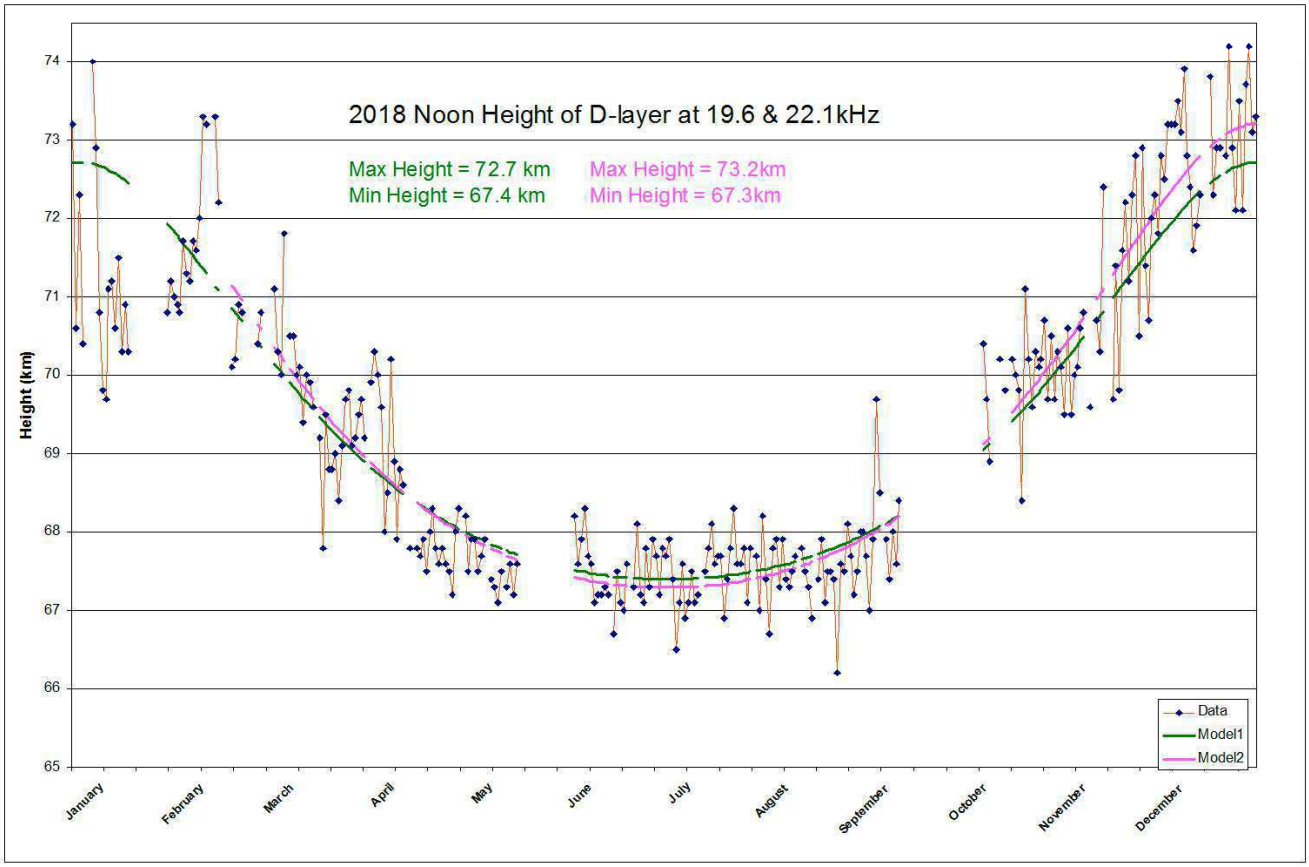
December was another very quiet month on the sun, with just a few small spots visible. The background X-ray flux recorded by GOES15 started the month at A1, rising as high as B1 over the 9th to 12th. After that it returned back to A1 levels for the rest of the month. There were a few A-class flares, as well as a B2.4 flare on the 9th. There were no SIDs recorded.

The low altitude of the sun at this time of year often results in ionospheric instability, and noisy VLF signals. This has been the case again this year, particularly during the first half of the month.



This is my own recording from December 3rd, showing the daytime signal level very similar to the night-time level, and without any clear sunset. As usual this signal was shut down over the holiday period, with just a few short periods of activity.



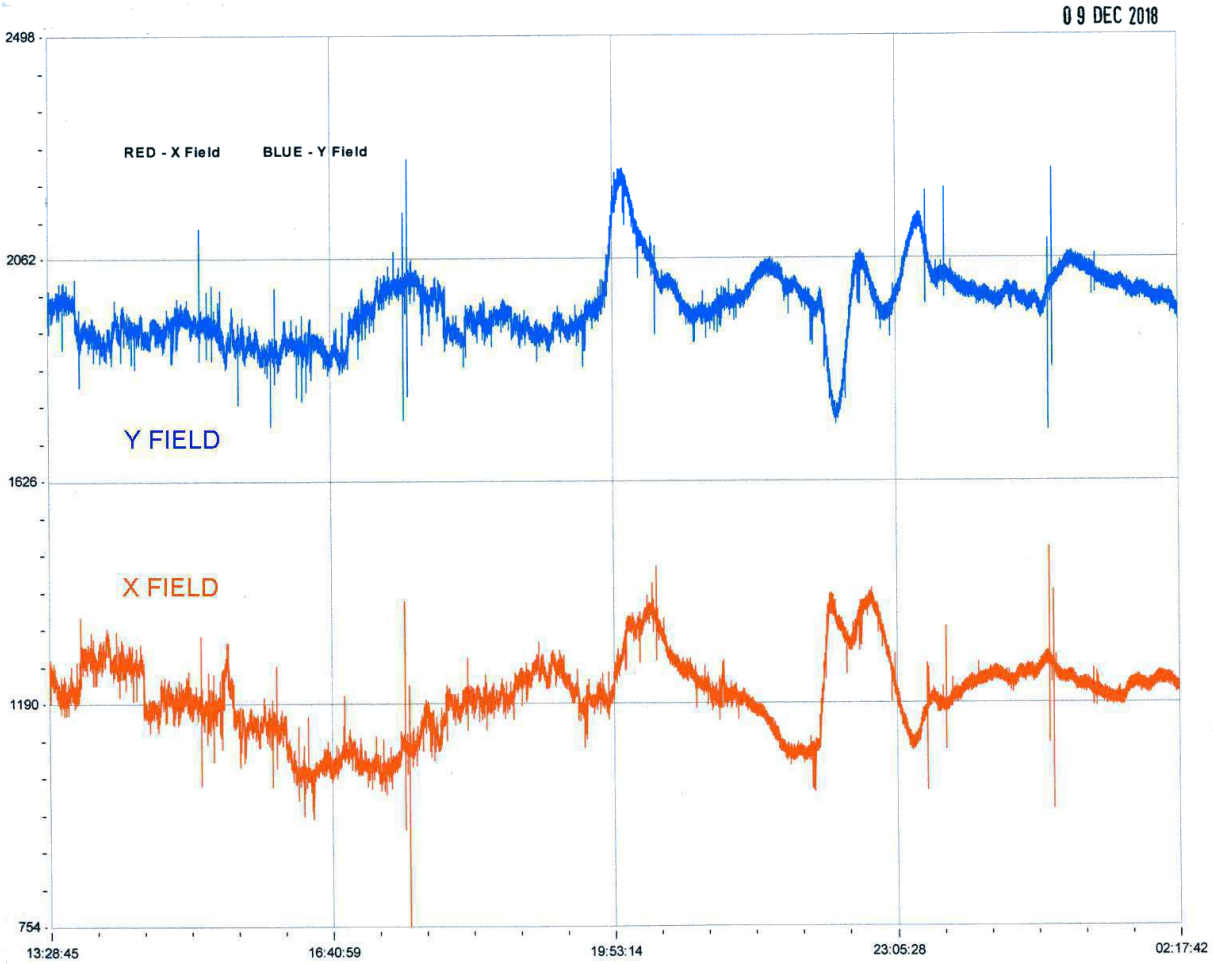
Mark Edwards has again produced a chart of the D-region height variation over the year. As with last year's chart, model 1 (green) includes data from the whole year, while model 2 (pink) excludes the more noisy data recorded in January. Comparing with previous years:

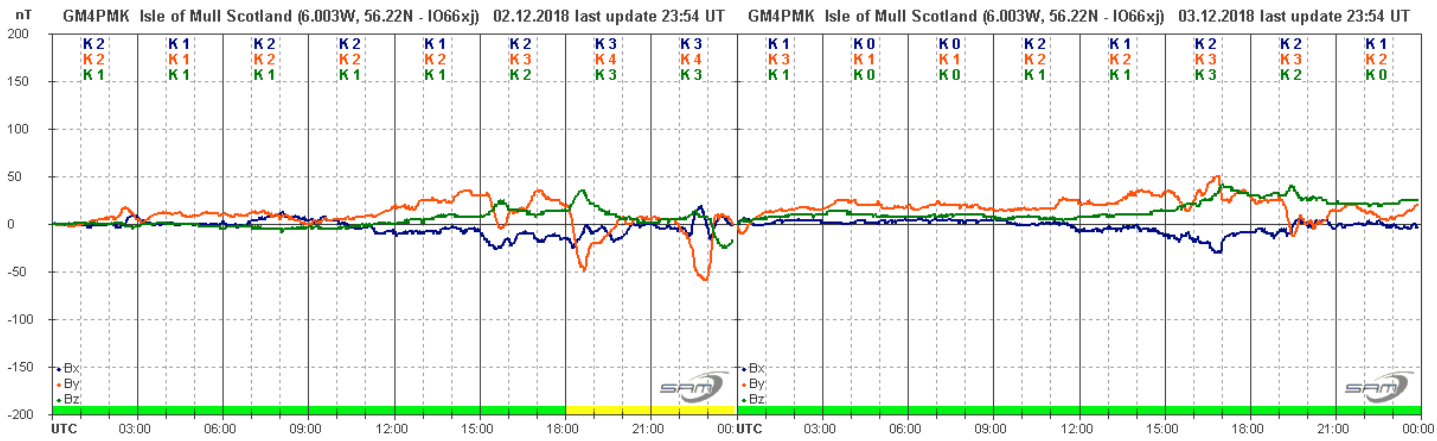
	2011	2012	2013	2014	2015	2016	2017(1)	2017(2)
Maximum	71.6	71.8	71.4	71.0	69.9	70.8	71.0	72.4km
Minimum	67.0	66.8	66.8	67.2	67.3	67.6	67.7	67.3km

Mark's paper on SID modeling can be found at www.britastro.org/radio/downloads/ModellingSIDs.pdf

MAGNETIC OBSERVATIONS.

The Bartels diagram clearly shows the presence of a recurrent coronal hole early in December, and again in the last few days of the month. Satellite images show the coronal hole across the solar equator, facing towards Earth on the 2nd. There were numerous periods of fairly mild magnetic disturbance, but nothing particularly active. This recording from Colin Clements shows activity in the afternoon and evening of the 9th:

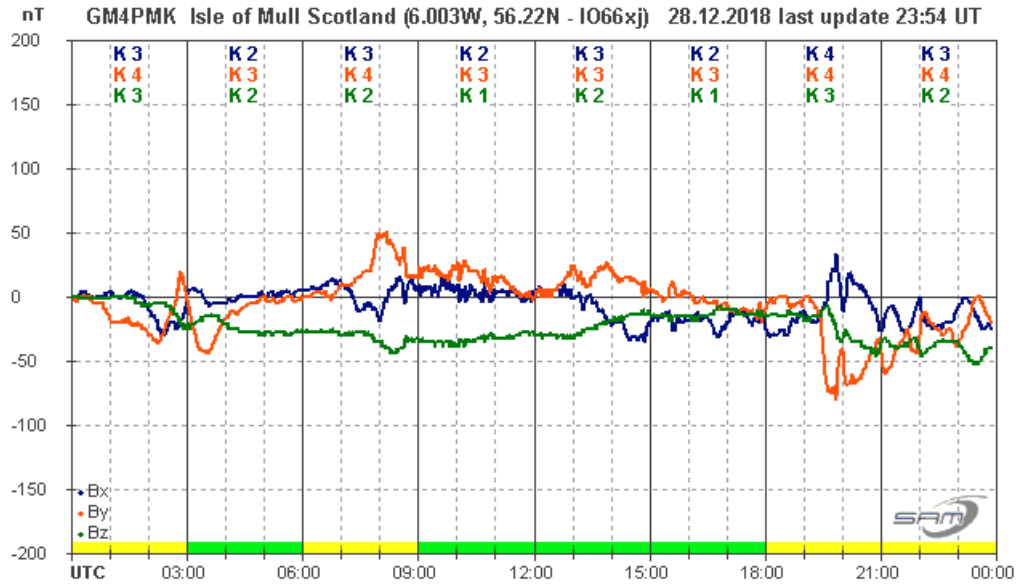




Roger Blackwell's recording from the 2nd and 3rd shows more of the mild disturbance, again mostly present in the afternoon and evenings.

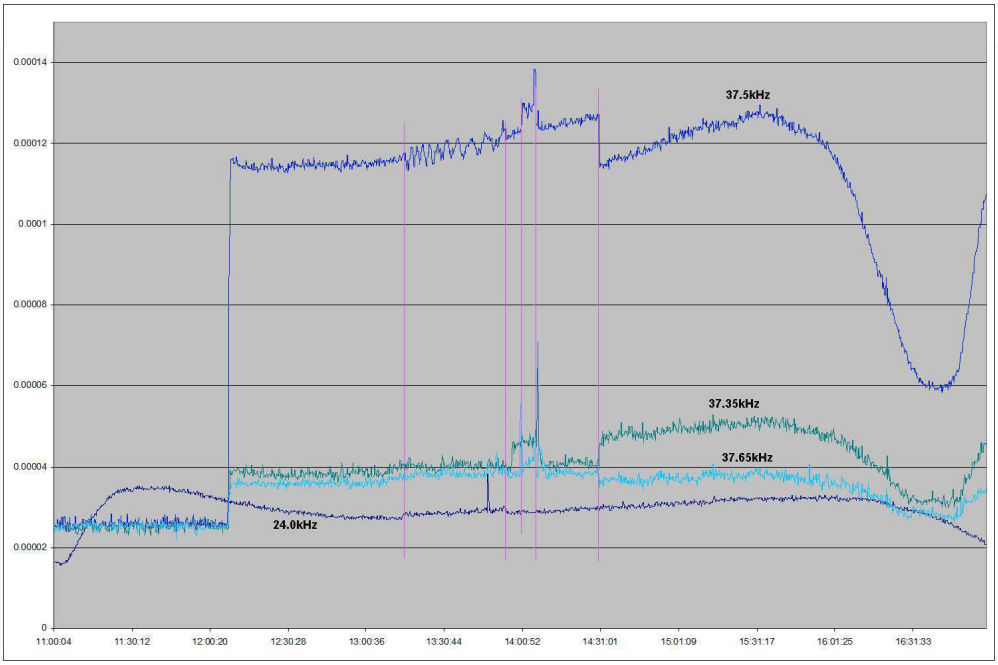
A gentle increase in wind speed over the 19th and 20th lead to another minor disturbance overnight.

The second appearance of the earlier coronal hole produced a slightly more active period on the 28th, shown in Roger's recording:



This faded out in the early-hours of the 29th, but was active again in the afternoon and evening of the 30th, and early morning of the 31st.

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



Another 'chirp' recorded by Mark Edwards on the 27th has enabled a little more detective work on this effect. By recording additional data at 37.35kHz and 37.65kHz, and checking the modulation, it appears that the chirp occurs when there is a 50Hz test modulation present. The signal level drop at 14:31 (right-hand vertical line) marks the change to active data modulation. Each of these three frequencies are recorded with a +/- 75Hz bandwidth. On this occasion the chirp is also accompanied by a very small increase in signal level at 24kHz (dark blue, at the bottom of the chart). Spectrum Lab uses a Fast Fourier Transform algorithm to create its data from the incoming signals. This can lead to artefacts in the resulting charts, and may be playing a part here. The digital FFT is of course essential to such software.

BAA Radio Astronomy Group

BARTELS DIAGRAM

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

2488
F 15 16 17 18 19 20 21 M 22 C 23 24 2172 25 26 27 28 M 29 C 30 31 2016 January 1 2 3 4 5 6 C 7 8 9 10

2489
F 11 12 13 14 15 C 16 17 18 19 20 21 2173 22 23 24 25 26 27 C 28 C 29 C 30 31 2016 February 1 2 C 3 CC 4 CCC 5 6

2490
F 7 C 8 9 10 C 11 12 MC 13 CMCM 14 15 CMCC 16 CC 17 CCCC 2174 18 19 C 20 21 22 23 24 C 25 C 26 27 28 29 2016 March 1 2 3 4

2491
F 5 6 7 8 CB 9 C 10 11 12 13 14 15 CC 2175 16 17 18 19 20 21 22 23 24 25 B 26 27 BB 28 29 30 31

2492
F 2016 April 1 2 3 4 5 6 CC 7 CBCB 8 BC 9 CC 10 11 B 12 C 2176 13 14 CC 15 BC 16 C 17 BC 18 19 BB 20 21 22 23 24 25 26 BC 27

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

2503
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

2504
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 2 MMM 2189 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

2507
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

2508
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

2509
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

2512
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

2513
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

2514
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

2515
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

2516
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

2517
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

2518
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

2519
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

2520
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

2521
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

2522
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

2523
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

2524
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

2525
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

2526
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

2527
F 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

2528
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

2529
F 26 27 28 29 30 31 2019 January 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21