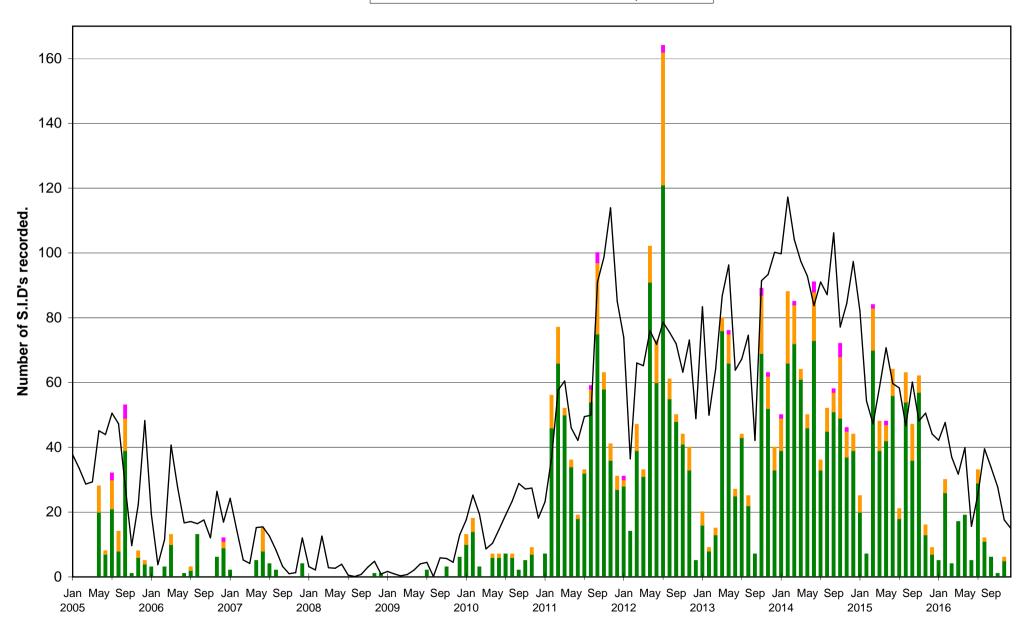
VLF flare activity 2005/16.

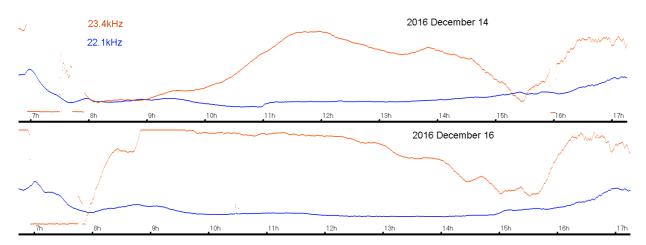
C M X — Relative sunspot number



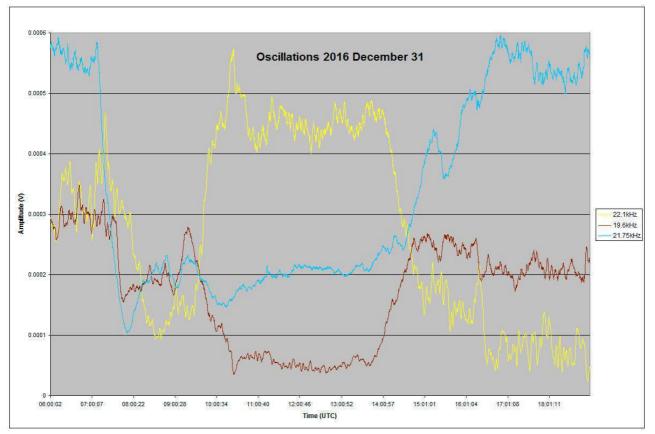
BAA Radio Astronomy Group.

2016 DECEMBER.

For the first time since 2010 December, we have not recorded any SIDs. There have been very few sunspot regions visible, and those that were present have been very small and stable. The strongest flare in the GOES15 X-ray data was C4.0, at 17:15UT on the 10th. The background X-ray flux was about B1 prior to this flare, but then dropped to A7 – A8 levels for the rest of the month. There were a few very small (B1 – B2) flares over this period, but for most of the time the Sun remained very quiet. This has led to some very strange looking diurnal curves, with plenty of instability and general noise, but no sustained oscillations.

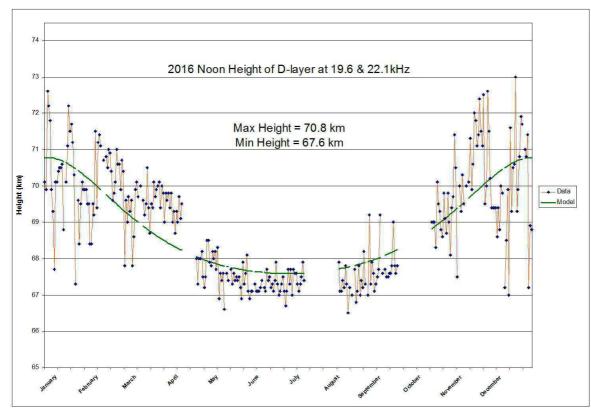


These are just two extreme examples of my own recordings. On both days the 23.4kHz signal level is quite high just before the morning break, but on the 14th the sunrise dip seems to last until nearly midday, while on the 16th there is a rapid rise with the receiver saturating by 09:00.



This recording is from Mark Edwards on the 31st. The 21.75kHz signal (blue) shows a very asymmetric diurnal

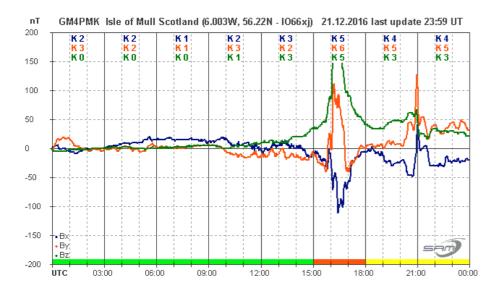
curve, while 22.1kHz (yellow) shows significant noise and instability. 19.6kHz (brown) is also quite noisy, but at a much lower level. Mark has also produced his annual chart of D-region height for 2016:



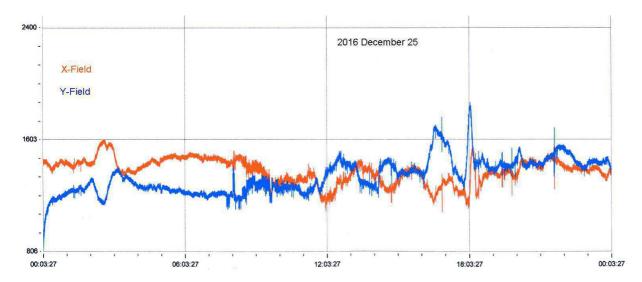
As with previous years, the signal instabilities recorded during the winter months lead to a wide variation in measured height (red trace) compared to that in the summer. The model output (green) will be influenced by this, but does still show similar maximum and minimum values to last year.

MAGNETIC OBSERVATIONS.

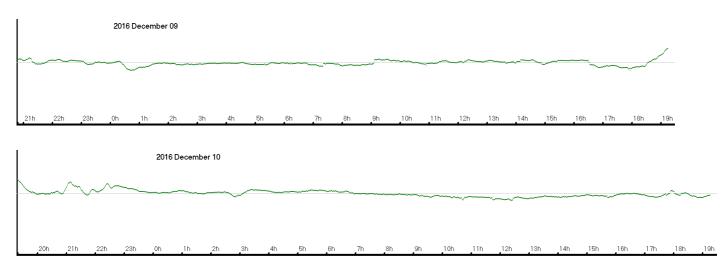
As there were no major flares in December, all of the magnetic activity recorded is from coronal hole effects. The large hole seen in recent months has broken up into several smaller holes, but is still very evident in the Bartels diagram, slowly drifting a few days later each month.



This recording by Roger Blackwell shows the effect of the sudden rise in solar wind speed after 15:00UT on the 21st. My own single-axis magnetometer recorded a peak of 137nT at 16:30, followed by a much smaller peak at 21:00. A less active disturbance continued through to December 27th. This chart from December 25th by Colin Clements is more typical of this period:



The active period over the 9th and 10th was due to a co-rotating interaction region combined with a HSS from a long narrow coronal hole stretching from the south pole to mid northern latitudes.



The peak of the activity on the 9th occurred just at the time when I downloaded the magnetometer data into the PC, measuring about 92nT in my recording. This had faded away by the early morning of the 11th.

While the VLF SID activity in 2016 is considerably lower than in 2015, magnetic activity levels have been similar. The Bartels diagram shows that in 2013, nearer to the sunspot peak, magnetic was activity actually much lower. 2017 will prove to be an interesting year as the minimum of cycle 24 was predicted to be 2018 or 2019.

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

BAA Radio Astronomy Group

BARTELS DIAGRAM

BAA	Radio Astronomy Group BARTELS DIAGRAM																										
ROTATION	KEY: DISTURBED.						ACTIVE SFE					B, C, M, X = FLARE MAGNITUDE.					Synodic rotation start (carrington's).										
2460	19	20	2144 21	22	23	24	25	26	27	28	29	30	2013 De 1	cember 2	3	4	5	6	7	8	9	10	11	12	13	14	15
	FΧ	CC	М	C 2145	CCM	CC							С	С			C 2014 Ja	С		С	CCC		CC	С		CC	сс
2461	16 F C	17	18	19 C	20 CMCC	21 C	22 MMMM	23 M	24	25 C	26	27 CC	28 CC	29 MCCC	30 C	31 C	1 C	2 C	3 CCMC	4 CCMC	5 C	6 C	7 CMCX	8 CCCC	9	10	11 CCC
2462	12	13 CC	14 C	2146 15	16 C	17 CCCC	18 CC	19	20	21	22	23	24	25	26 C	27 C	28 MMMM	29 CCC	30 MCC	31	2014 Fe	2	3	4	5	6	7 CCMC
2463	8	9	10	11	2147 12		14	15	16	17	18	10	20	21	22	23	24	25	26	CM	28	2014 M	arch	3	4	5	6
2100	F CCC	м	CC	СМ	CM 2148	MCCM	СМММ	15	MCC	ccc	CC	С	M	CC	C	CC	MMC	C	CCM		CCC	MC	ccc		cccc	C 2014 Ap	
2464	F 7	8	9 CCMM	10 CCCM	11 CMCC	12 CMC	13 CCM	14 C	15 CCC	16 CC	17 CCC	18 C	19 CCCC	20 CC	21 C	22 MCC	23 CC	24 CC	25	26 CC	27	28 CM	29 CCCX	30 M	31 MC	1	2 CCM
2465	3	4	5	6	2149 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
2466		2014 M			CC	2150		<u>с</u>	CCC	С	C	CCCC			cc	CM	0000	0000	C	0000	CCCC	C	CC 22	C 23		BC	В
2400	30 F B	1	2 CCC	3 CCCC	4 CCCC	5 C 2014 Ju	6 MCC	7 CMC	M	CCCC	CCC	CCCC	12	13 C	14 CCC	15 C	16 CCC	17	18	19	20 B	21 C	C	23	24 M	25 C	26 CCC
2467	27 F C	28	29	30	31 B	1 C	2 M	3 CCM	4	5	6	7 CC	8 CC	9 CCC	10 CCXX	11 MMXC	12 MMMM	13 MCCC	14 CCM	15 CMCC	16 CCCC	17 CBCC	18 CC	19 C	20 CC	21 C	22 B
2468	23	24	25	26	27	2152 28		30	2014 Ju 1	ily 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	F	BBB				2153		CC	CCCM	С		С	2014 Au	CC gust	CC	СМ	С	CC			CCCC						
2469	20 F	21 B	22	23	24	25 C	26 CCCB	27 CC	28	29 CC	30 CC	31 CMCC	1 CMM	2 CC	3 C	4	5 CCC	6	7	8 CCCC	9 C	10	11	12	13	14	15 CC
2470	16 F C	17	18 C	19	20 CCCC	21 CMCC	2154 22 MCCC	23 CCCC	24 CMC	25 MM	26 C	27	28 CB	29 C	30 CCB	31 CCCC	1	eptembe 2 CC	3 CCM	4 CCCC	5 CC	6 CCMC	7 CCC	8	9 C	10 CCX	11 CCM
2471	12	13	14	15	16	17	2155	19	20	21	22	23	24	25	26	27	28	29	30	2014 Oc		3	4	5	6	7	8
	F CCCC	CC			CC		CMC 2156	C	CC	CCC			CC	С	CCC	М	ССММ	С			MM	CCC			ovember		С
2472	9 F MCCC	10	11	12	13	14	15	16 CCM	17 CC	18 MCCC	19 CCCC	20 MCMM	21 CCCM	22 CCXM	23 MCC	24 MCC	25 CCCX	26 XCCM	27 CCMX	28 CCM	29 MMMM	30 CCCC	31	1 CCCC	2	3 M	4 MM
2473	5	6	7	8	9	10	2157 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1
2474	F MC 2014 De	C cembe 3	MCCX	5	CCM 6	CC	С 8	C 2158 9	C 10	CC	M 12	13	C 14	15	16	17	18	C 19	C 20	C 21	22	23	24	C 25	26	CC 27	28
24/4		0000		CCM 2015 Ja	C	'	0	CCCC 2159		С	C	CCC	CC	15	CCC	cc	CCC	MC	20 C	M	C	23	24	23 C	C	21	C
2475	29 F C	30	31 C	1	2	3 M	4 M	5 C	6 C	7 CC	8 C	9 C	10 C	11	12 CC	13 C	14 CM	15 CC	16	17	18	19	20	21 CCC	22	23 CC	24
2476	25	26	27	28	29	30	31	2015 Fe	ebruary 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2477	F 21	22	CC 23	C 24	MC 25	M	27	C 28	2015 M	CC arch	C 3	4	5	6	7		9	10	11	10	13	14	15	16	17	10	C 19
2411	F	22	23	24	25	26	21	CC	C 2162	CMCCM		4 CC		MCCC	1	C				12 CMMM	C		15 MCCC	16 CCMC		0000	C
2478	20 F	21	22	23 C	24	25 CC	26 CC	27 CCC	28	29 CCCC	30 CC	31	1	2	3	4	5	6	7	8 M	9 CCCC	10 CCCC	11 C	12 CMCC	13 CCC	14	15 C
2479	16	17	18	19	20	21	22	23	2163 24		26	27	28	29	30	2015 N 1	lay 2	3	4	5	6	7	8	9	10	11	12
	F CCCC	С	CCC				CCMC			C 2164	С							С	CCC	MMMX 2015Jur	ne		CC	CC	CCC		CC
2480	F CCCC	14 CCCC	15	16	17 B	18	19 C	20 C	21	22 2165	23 CC	24	25	26	27	28	29	30	31	1	2 C	3	4 CC 2015 Ju	5 CC	6	7 CC	8
2481	9 F	10 CCC	11 CMCC	12 CC	13 MCCC	14 C	15 CC	16 CC	17 CC	18 CCM	19 CCCC	20 MC	21 MCCM	22 CCCM	23 C	24 C	25 M	26	27	28 C	29 CCCC	30 C	1	2 C	3 СССМ	4	5
2482	6	7	8	9	10	11	12	13	14	2166 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1
	F MCCM 2015 Au				С				С	l	2167		С						cc		С						С
2483	F 2	3	4	5	6 C eptembe	7 CBCC	8 CC	9 C	10	11 2168	12	13	14	15 C	16	17	18	19	20 CC	21 MCM	22 MCCM	23 CCCC	24 MCCM	25 CCCC	26 CC	27 M	28 CMCM
2484	29 F CCC	30 CC	31	1	2	3 C	4	5	6	7	8	9	10	11	12	13	14	15	16 CC	17 CMCC	18 C	19 C	20 CCM	21	22	23 CCC	24
2485	25	26	27	28	29	30	2015 O	ctober 2	3	2169 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	F	С					CCM					ovember							CC	CC	CCCC		CCCC		CCC	С	CCC
2486	22 F	23	24	25	26 C	27	28 C	29 CC	30 CCCC	31 CCCM	1 CCCC 2171	2 CCCC		4 CMM 2015 De	5	6	7	8	9 M	10 CC	11	12	13	14	15	16	17
2487	18 F	19	20	21 C	22	23	24	25	26	27	28	29	30	1	2	3	4	5 C	6	7	8	9	10 C	11	12 CC	13	14
2488	15	16	17	18	19	20	21	22	23	24	2172 25	26	27	28	29	30	31	2016 Ja	inuary 2	3	4	5	6	7	8	9	10
	F						М	С				2173		М	С							2016 F					
2489	11 F	12	13	14	15 C	16	17	18	19	20	21	22	23	24	25	26	27 C	28 C	29 C	30	31	1	2 C	3 CC 2016 M	4 CCC	5	6
2490	F C	8	9	10 C	11	12 MC	13 CMCM	14	15 CMCC	16 CC	17 CCCC	18	19 C	20	21	22	23	24 C	25 C	26	27	28	29	1	2	3	4
2491	5	6	7	8	9	10	11	12	13	14	15	2175 16		18	19	20	21	22	23	24	25	26	27	28	29	30	31
	F 2016 Ap	ril		СВ	С			-			CC		2176				_				В		BB				
2492	F	2	3	4 2016 M	5	6 CC	7 CBCB	8 BC	9 CC	10	11 B	12 C	13 2177	14 CC	15 BC	16 C	17 BC	18	19 BB	20	21	22	23	24	25	26 BC	27
2493	28 F CCC	29	30 C	1 C	2 C	3	4 C	5	6	7 C	8	9	10	11	12	13	14 CCCB	15 CCBC	16 C	17	18	19	20	21 BC	22 B	23	24 BBC
2494	25	26	27	28	29	30	31	2016 Ju 1	ine 2	3	4	5	2178 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	F	CC	CC								2016 Ju	ıly	2179			BCC		В	С	с						С	
2495	21 F	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7 C	8	9 C	10	11	12	13	14	15 C	16 CCCB	17 C
2496	18 F C	19 C	20	21 CBCB	22 CCC	23 MMCC	24 MBCM	25 C	26 BB	27	28	29	30	2180 31	2016 Au 1	yust 2	3	4	5 C	6	7 CCMC	8	9 C	10 B	11 C	12	13
2497	14	15	16	17	18	19	20	21	22	23	24	25	26	2181 27	28	29	30	31		eptember 2		4	5	6	7	8	9
	FC													2182								2016 O	ctober		В		
2498	10 F	11	12	13	14	15	16	17	18	19	20	21 CCB	22 CCCC	23	24	25	26	27	28	29	30	1	2	3	4	5	6
2499	7	8	9	10	11	12	13	14 P	15	16	17	18	19	2183 20	21	22	23	24	25	26	27	28	29	30	31	2016 No 1	ovember 2
2500	F 3	4	5	6	7	<u>с</u> 8	9	B 10	11	B 12	13	14	15	16	2184 17	18	19	20	21	22	23	24	25	26	27	28	29
2000	F	2016 D	5 ecember		'	U		-10		- 12	-13	- 14	-13	10	2185	10	13	20	21	- 22	-23	24	- 23	20	21	28 C	CCM
2501	30 F CC	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
2502	27	28	29	30	31	2017 Ja 1	anuary 2	3	4	5	6	7	8	9	2186 10	11	12	13	14	15	16	17	18	19	20	21	22
	F																									-	