

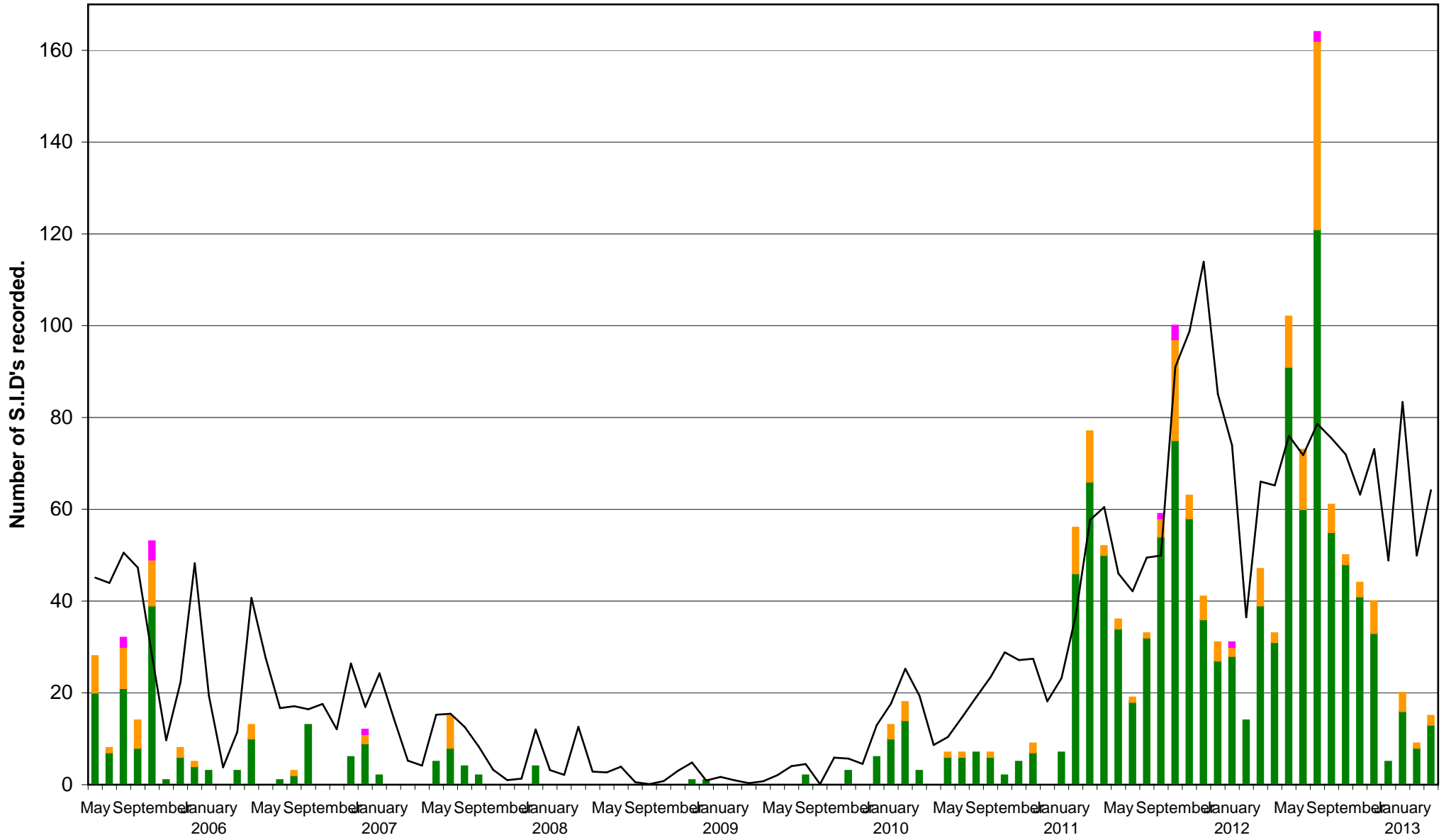
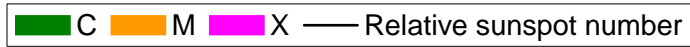
BAA Radio Astronomy Group.

2013 MARCH

DAY	Xray class	Observers	John Cook (23.4kHz/22.1kHz)	Roberto Battaiola (20.3kHz)	Paul Hyde (22.1kHz)	Bob Middlefell (22.1kHz)	Mark Edwards (19.6/24.0kHz)
			Tuned radio frequency receiver, 0.58m frame aerial.	Modified AAVSO receiver.	Tuned radio frequency receiver, 0.96m frame aerial.	Tuned radio frequency receiver, 0.5m frame aerial.	Spectrum Lab / PC 2m loop aerial.
			START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)
2	C1.9	4			15:05 15:10 15:22 1-		15:04 15:10 15:34 1+
5	M1.2	5	07:51 07:56 08:20 1+	07:53 07:56 08:09 1-	07:50 07:53 08:31 2		07:52 07:55 08:05 1-
7	C1.5	1					16:43 16:46 16:53 1-
12	C2.0	1					
12	C1.0	1					
13	C1.4	2	16:19 16:21 16:30 1-				16:19 16:22 16:33 1-
15	M1.1	1					06:47 06:57 07:17 1+
15	C2.2	2			10:41 10:45 10:55 1-		
17	C1.0	1					
18	C1.2	1					
19	C1.5	1					
19	C1.7	4	16:12 16:19 16:30 1-		16:10 16:20 16:48 2		16:12 16:20 16:39 1+
21	C1.0	4			15:28 15:34 15:47 1		15:29 15:32 15:49 1
22	C1.3	5		08:26 08:28 08:30 1-	08:22 08:30 08:37 1-		08:29 08:31 08:34 1-
22	B9.4	1					
22	C1.4	6	12:18 12:23 12:29 1-	12:16 12:23 12:34 1-	12:18 12:24 12:35 1-		12:19 12:24 12:36 1-

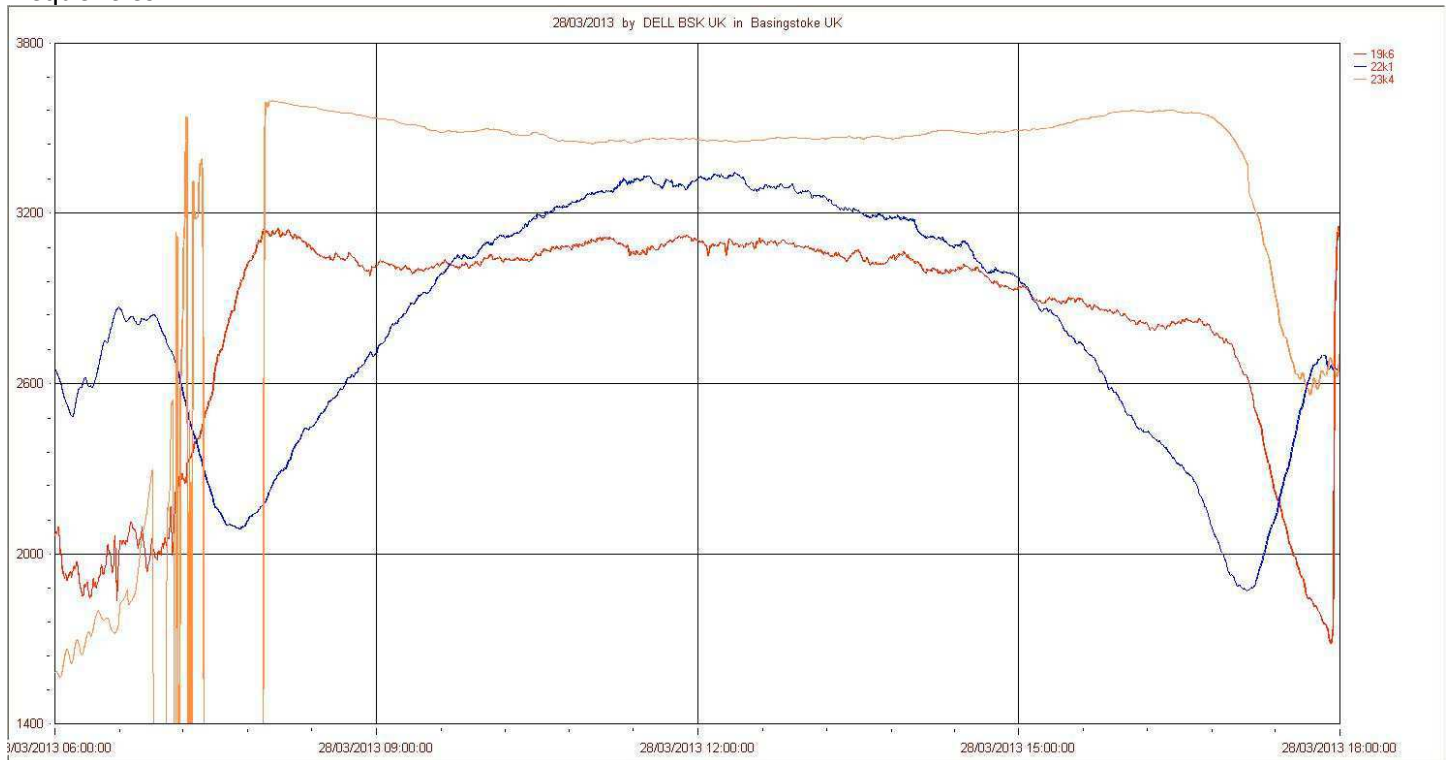
DAY	Xray class	Observers	Colin Clements (23.4kHz)	Peter King (18.3kHz)	Tarif Rashid Santo (19.8kHz)	John Wardle (19.6/23.4kHz)	Steve Parkinson (Various)
			AAVSO receiver, 0.76m screened loop aerial.	Own designed receiver, 1.4m loop aerial.	Spectrum Lab, 15m Half-wave dipole.	PC soundcard, long wire aerial.	Tuned radio frequency receivers, frame aerials.
			START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)	START PEAK END (UT)
2	C1.9		15:00 15:09 15:23 1	15:00 15:10 15:25 1			
5	M1.2					07:51 07:58 08:10 1	
7	C1.5						
12	C2.0			10:19 11:10 12:28 3+			
12	C1.0			14:10 14:15 14:25 1-			
13	C1.4						
15	M1.1						
15	C2.2			10:40 10:45 14:50 3+			
17	C1.0			12:50 12:55 12:58 1-			
18	C1.2			11:30 11:35 11:40 1-			
19	C1.5			13:53 14:25 14:45 2+			
19	C1.7						16:12 16:19 16:30 1-
21	C1.0			15:28 15:33 15:48 1			15:29 15:33 15:45 1-
22	C1.3			08:24 08:30 08:32 1-			08:38 08:49 09:04 1+
22	B9.4						10:24 10:27 ?
22	C1.4		12:14 12:19 12:36 1				12:18 12:24 12:33 1-

### VLF flare activity 2005/13.



Activity in March was slightly higher than in February, although still very low for the current stage of solar cycle 24. NASA have predicted that this could be the smallest sunspot cycle since 1906. We have recorded a good sample of the flares, including two M-class events. The most energetic recorded by GOES was M1.6 at 22:04UT on the 22<sup>nd</sup>.

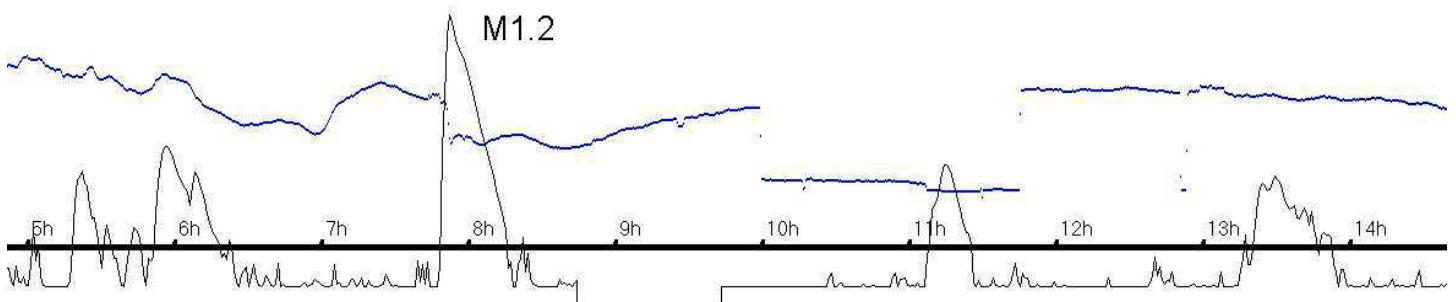
Paul Hyde has taken the opportunity of a quiet period to compare diurnal curves at different frequencies:



22.1kHz (blue, estimated distance 412km) shows a nearly symmetrical shape, the sunset dip being slightly deeper than the dip at sunrise. 23.4kHz (orange, 640km) is also symmetrical, but showing a saddle shape rather than a hump. The early morning signal break has hidden the sunrise response. 22.1kHz (red, 438km) is by contrast asymmetrical, with a slow drop in signal from noon towards sunset, but with small peaks at sunset and sunrise. The paths at 19.6 and 22.1kHz are very similar, 350 degrees and 344 degrees respectively, whilst the path at 23.4kHz is 66 degrees.

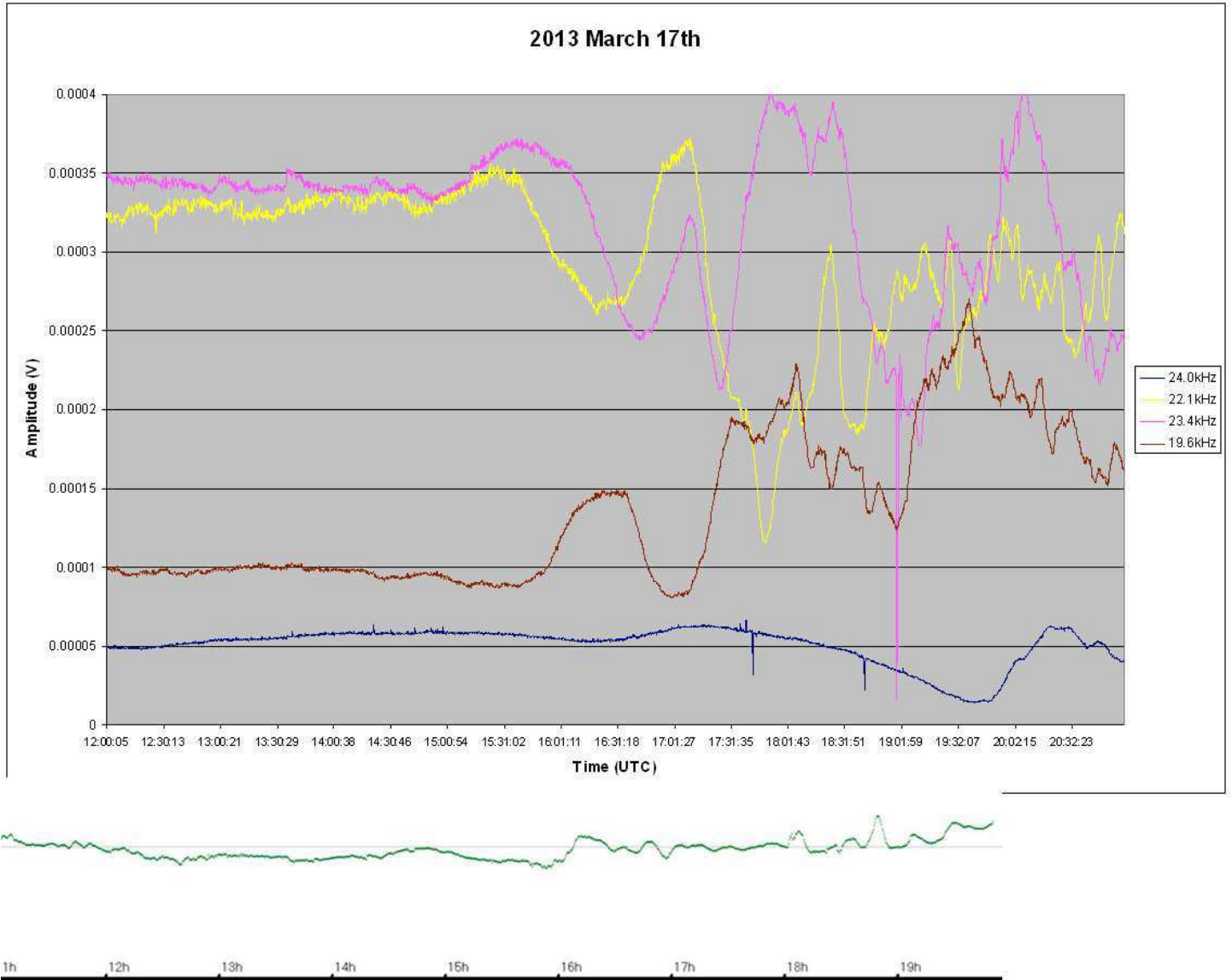
The M1.2 flare in the morning of the 5<sup>th</sup>. produced a good SID:-

2013 MARCH 5th



My chart (above) is at 22.1kHz, and shows the SID disrupting the normal sunrise dip at this time. It was the most energetic event recorded by the group.

A similar M1.1 flare at 06:58UT on the 15<sup>th</sup> was too early to be recorded. It was associated with a long lasting proton event, and a CME. The CME produced a period of magnetic activity on the 17<sup>th</sup> (see later). Mark Edwards also reported some VLF disturbance on the 17<sup>th</sup>, starting around 16:30UT. He has added my magnetic recording to his chart:



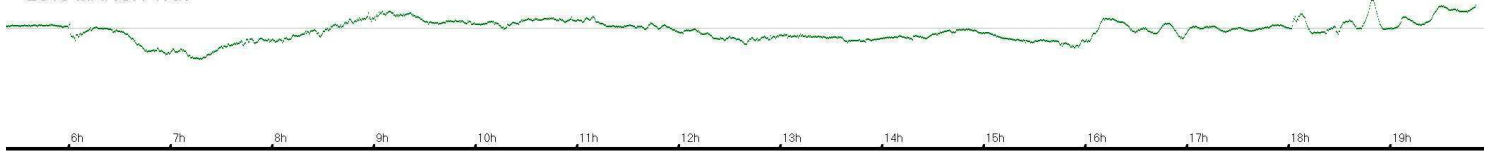
GOES data for the period shows no significant X-ray activity at the time, and the proton flux was beginning to return to normal levels. Whether there is a connection with the magnetic activity is not clear, but there is certainly a clear VLF disturbance before sunset.

### MAGNETIC OBSERVATIONS.

The CME associated with the March 15<sup>th</sup> flare produced one of the best magnetometer responses that I have recorded. Luckily there was no significant local interference during the period. The initial shock produced a 14nT shift at 06:01UT in my recording, followed by a drop of 40nT at 06:04. By 07:15 the field had fallen by

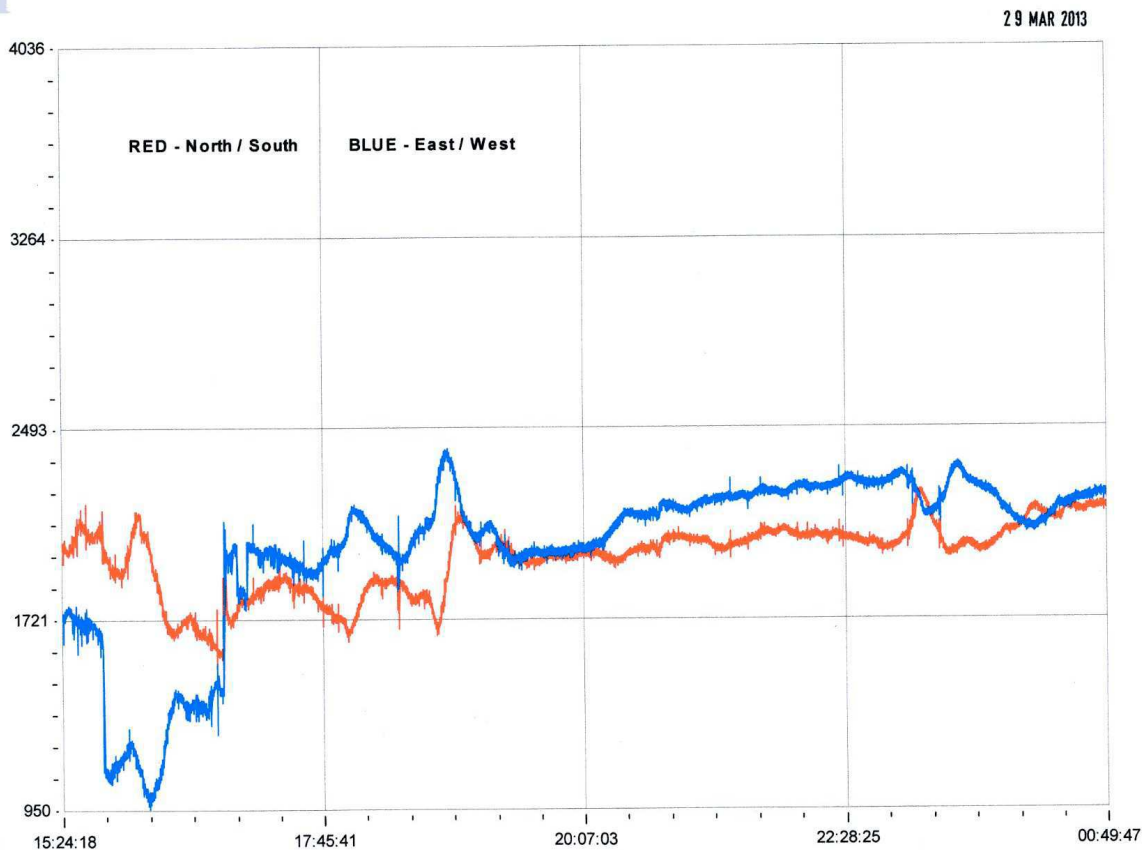
86nT. There followed a period of gentle disturbance until about 16:00, when the field became very active before fading back to normal levels by 01:00 on the 18<sup>th</sup>.

2013 MARCH 17th



My chart, above, shows the disturbance until 20:00 on the 17<sup>th</sup>. SWPC list the peak of the flare at 06:58 on the 15<sup>th</sup>, giving a CME transit time of 47 hours 3 minutes.

Coronal hole high speed streams were responsible for the disturbed periods from the 27<sup>th</sup> to the 30<sup>th</sup>. Colin Clements has provided a good recording from the afternoon of the 29<sup>th</sup>:



Similar effects were recorded from the High speed stream present at the end of February, and lasting through March 1<sup>st</sup> and into the early hours of the 2<sup>nd</sup>.

A filament eruption was associated with the C2.0 flare recorded as a SID at 11:07UT in the 12<sup>th</sup>. A SSC is listed by BGS at 05:25 on the 15<sup>th</sup> from this event, but has not been recorded as a clear disturbance in any of the reports received.

Magnetic reports received from: Colin Clements, Gonzalo Vargas and John Cook.

Reports and observations to [jacook@jacook.plus.com](mailto:jacook@jacook.plus.com)

ROTATION	KEY	DISTURBED	ACTIVE	SFE	B, C, M, X = FLARE MAGNITUDE	Synodic rotation start (amington's)
2407	F	18 19 20 21 22 23 24 25 26 27 28 29 30 31			2010 January 1 2 3 4 5 6 7 8 9 10 11 12 13	
2408	F	14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2010 February 1 2 3 4 5 6 7 8 9 CCMC MCMCC	
2409	F	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27			2010 March 1 2 3 4 5 6 7 8 CC CBB	
2410	F	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26			2010 April 1 2 3 4 CC BB	
2411	F	5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22			2010 May 1 CC	
2412	F	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			2010 June 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	
2413	F	29 30 31			2010 July 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	
2414	F	25 26 27 28 29 30			2010 August 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	
2415	F	22 23 24 25 26 27 28 29 30			2010 September 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 27 28 29 30 31	
2416	F	19 20 21 22 23 24 25 26 27 28 29 30 31			2010 October 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 27 28 29 30 31	
2417	F	15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			2010 November 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 27 28 29 30 31	
2418	F	12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			2010 December 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 27 28 29 30 31	
2419	F	8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26			2011 January 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 27 28 29 30 31	
2420	F	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 30 31			2011 February 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 27 28 29 30 31	
2421	F	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19			2011 March 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 27 28 29 30 31	
2422	F	28 29 30 31			2011 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 25 26 27 28 29 30 31	
2423	F	24 25 26 27 28 29 30 31			2011 May 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 27 28 29 30 31	
2424	F	23 24 25 26 27 28 29 30 31			2011 June 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 27 28 29 30 31	
2425	F	19 20 21 22 23 24 25 26 27 28 29 30 31			2011 July 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 27 28 29 30 31	
2426	F	16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2011 August 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 27 28 29 30 31	
2427	F	12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			2011 September 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 27 28 29 30 31	
2428	F	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2011 October 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 27 28 29 30 31	
2429	F	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 30 31			2011 November 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 27 28 29 30 31	
2430	F	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 27 28 29 30 31			2011 December 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 27 28 29 30 31	
2431	F	28 29 30 31			2012 January 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 27 28 29 30 31	
2432	F	25 26 27 28 29 30 31			2012 February 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 27 28 29 30 31	
2433	F	21 22 23 24 25 26 27 28 29 30 31			2012 March 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 27 28 29 30 31	
2434	F	18 19 20 21 22 23 24 25 26 27 28 29 30 31			2012 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 25 26 27 28 29 30 31	
2435	F	14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2012 May 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 27 28 29 30 31	
2436	F	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29			2012 June 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 27 28 29 30 31	
2437	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			2012 July 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 27 28 29 30 31	
2438	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 30			2012 August 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 27 28 29 30 31	
2439	F	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 27			2012 September 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 27 28 29 30 31	
2440	F	28 29 30 31			2012 October 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 27 28 29 30 31	
2441	F	24 25 26 27 28 29 30 31			2012 November 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 27 28 29 30 31	
2442	F	21 22 23 24 25 26 27 28 29 30 31			2012 December 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 27 28 29 30 31	
2443	F	17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2013 January 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 27 28 29 30 31	
2444	F	13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2013 February 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 27 28 29 30 31	
2445	F	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			2013 March 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 27 28 29 30 31	
2446	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 30 31			2013 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 25 26 27 28 29 30 31	
2447	F	2131 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 28 29				
2448	F	2132 30 31				
2449	F	2133 26 27 28 29 30 31				
2450	F	2134 22 23 24 25 26 27 28 29 30 31				
2451	F	2135 21 22 23 24 25 26 27 28 29 30 31				