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# The British Astronomical Association

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BAA Radio Astronomy Section.

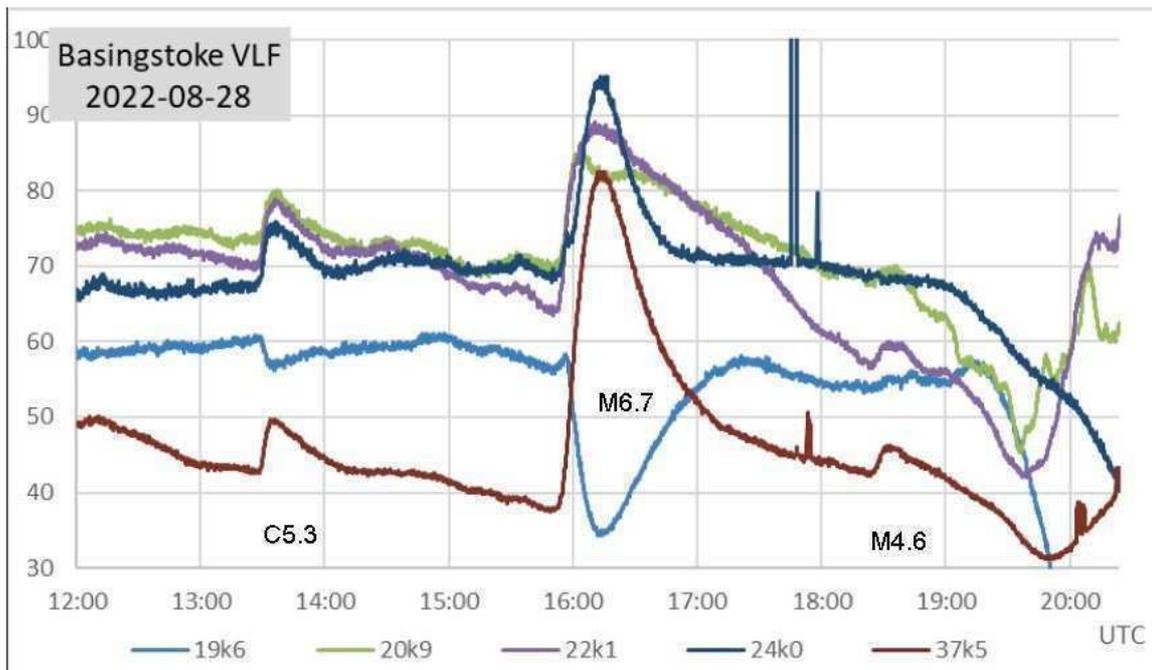
Director Paul Hearn.

## RADIO SKY NEWS

## 2022 AUGUST.

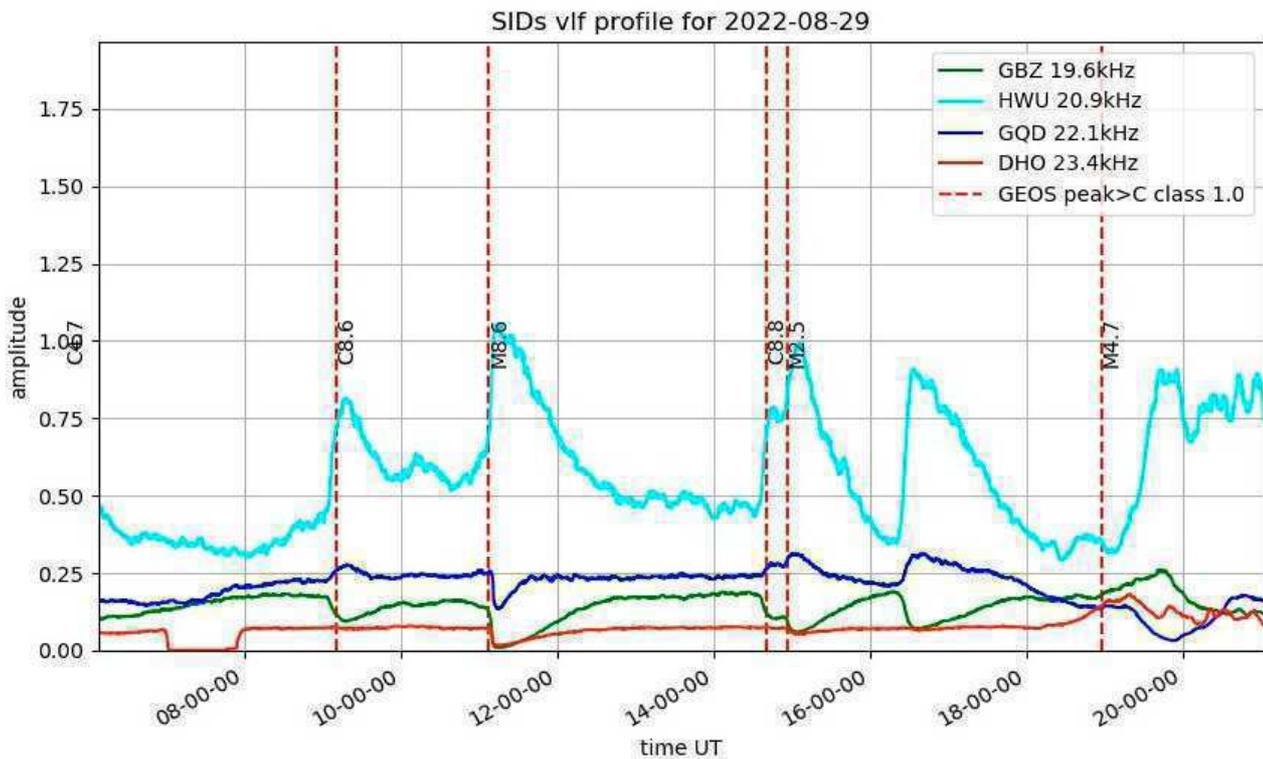
### VLF SID OBSERVATIONS.

Activity predictions for solar cycle 25 suggested that it would be weaker than cycle 24. Our activity chart shows that the first two years of the new cycle were actually much stronger than in cycle 24. We have recorded 23 M-class flares in August, the highest count since 2012 July when we had 41. Most of the stronger activity was in the second half of the month, much of it produced by active region AR13088, an unusual group in that its magnetic orientation was north-south compared to the normal east-west.

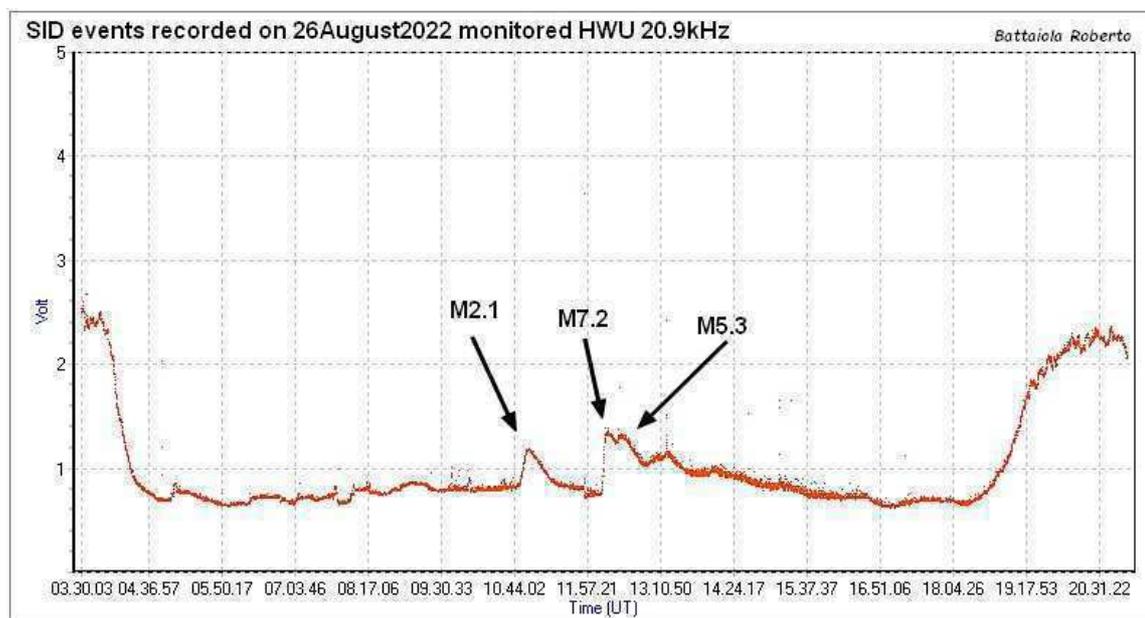


This recording by Paul Hyde shows the activity from AR13088 during the afternoon of the 28<sup>th</sup>. The M6.7 flare has produced a very strong SID at all frequencies, with just a hint of a spike-and-wave SID at 20.9kHz. 19.6kHz shows inverted SIDs for all three of the flares. The M4.6 appears to be much weaker, probably due to its timing just before the sunset dip in signal strength.

Mark Prescott recorded more AR13088 activity on the 29<sup>th</sup>, shown on the next page:

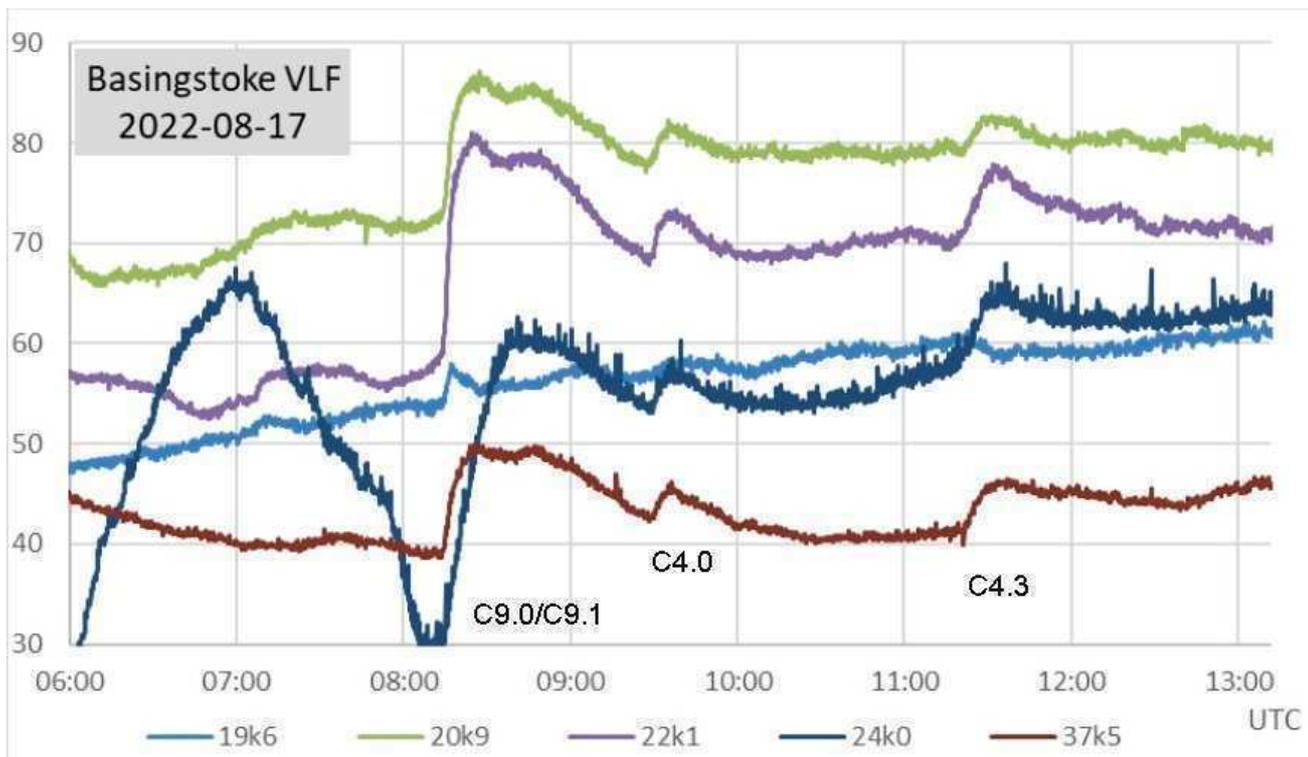
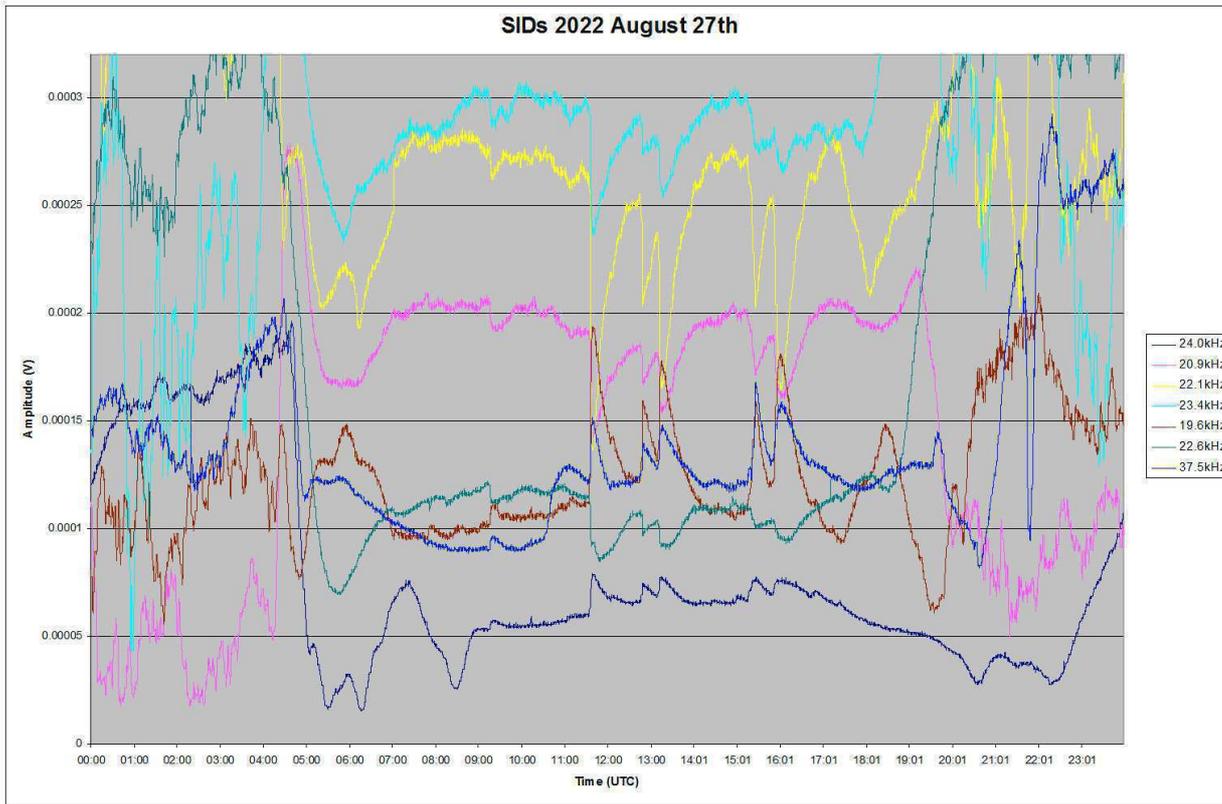


The C8.8 / M2.5 combination appears to be from a multi-peaked flare, but the SWPC tables do not include a source for the C8.8 peak. The strong peak at 16:35 is not listed by the SWPC, but does appear to be from an M-class flare.



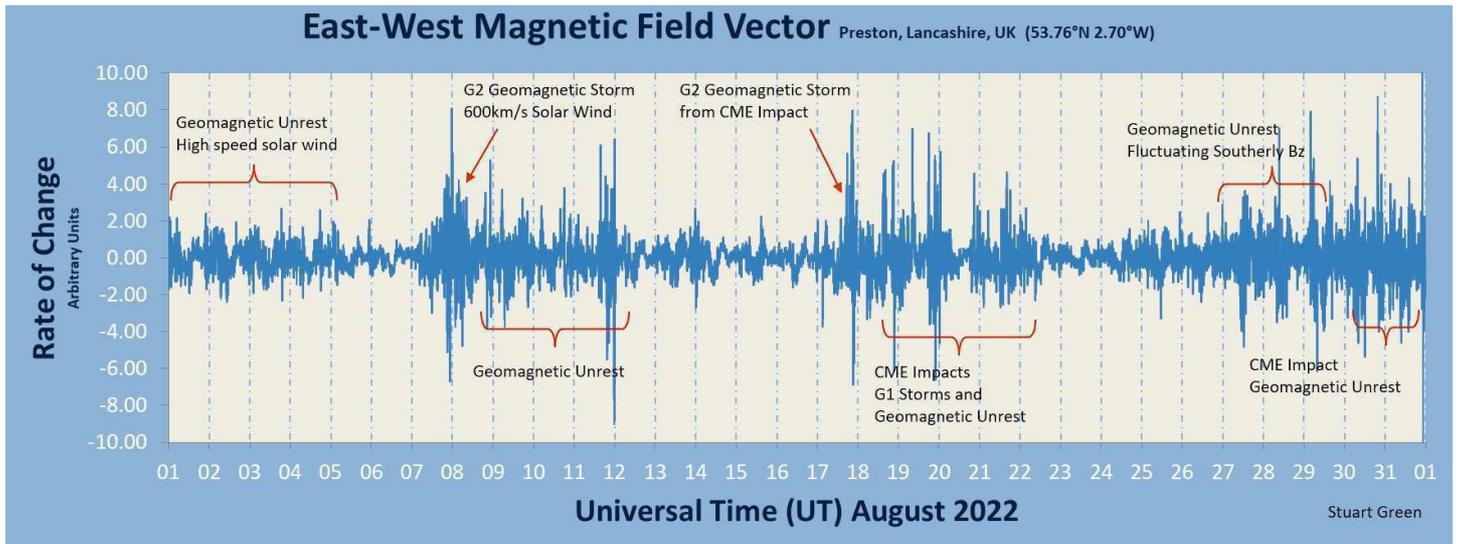
AR13089 was also very active over this period, with three M-class flares on the 26<sup>th</sup> shown here by Roberto Battaiola. The M7.2 and M5.3 flares are listed separately, but have produced overlapping SIDs. The satellite data shows a total of 13 M-class flares over the four days from the 26<sup>th</sup>. It also shows that their activity continued as they rotated onto the far side of the sun.

The chart from Mark Edwards on the 27<sup>th</sup> shows just how chaotic these flares have been when seen at multiple frequencies, and gives an indication of the difficulty in analysing our observations:



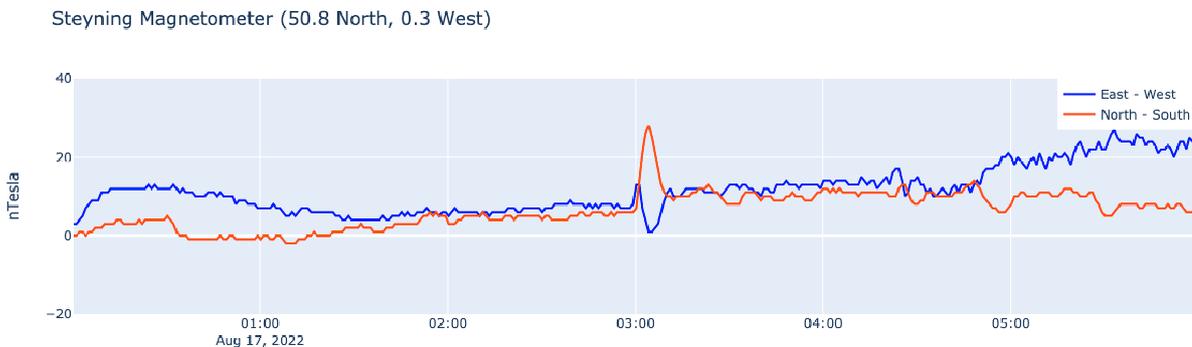
Paul Hyde's recording from the 17<sup>th</sup> shows a pair of simultaneous flares, C9.0 and C9.1 as listed in the SWPC data. They are shown with identical timings, both from AR13078, appearing here as a double peaked SID. The SWPC listing for the 15<sup>th</sup> includes a flare of magnitude M0.9, a very odd number for a logarithmic scale. It was rather late in the day, producing only a minor SID.

## MAGNETIC OBSERVATIONS.

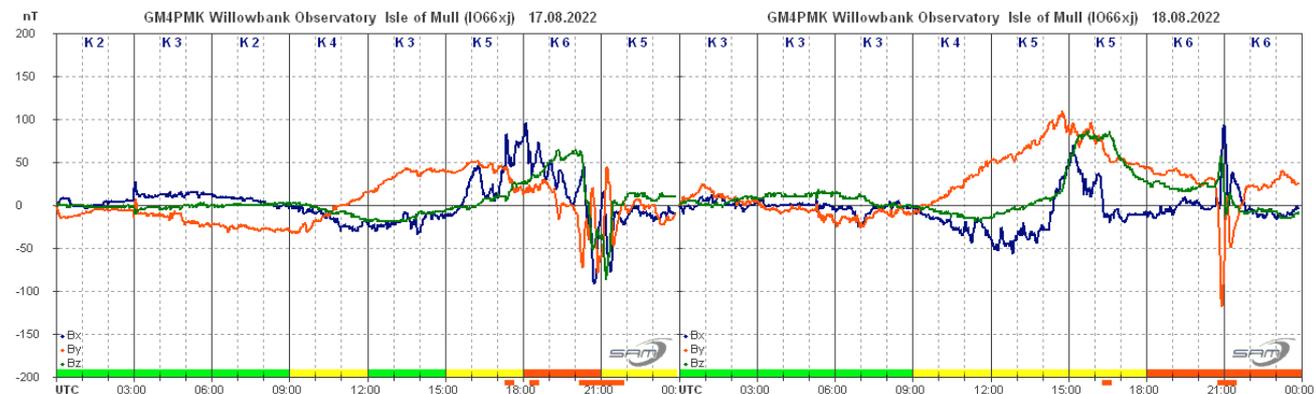


Stuart Green's summary chart of the month's activity shows three distinct periods of very strong activity. With the number of M-class flares recorded it is not surprising that there were a number of CMEs, although many were not geo-effective. There were also several filament eruptions as well as some coronal hole high speed winds to start the month.

Satellite images show a filament eruption at 12:48UT on the 14<sup>th</sup>, producing a CME. Its arrival time was predicted for the 17<sup>th</sup>. Nick Quinn recorded the magnetic impact shortly after 03UT on the morning of the 17<sup>th</sup>:

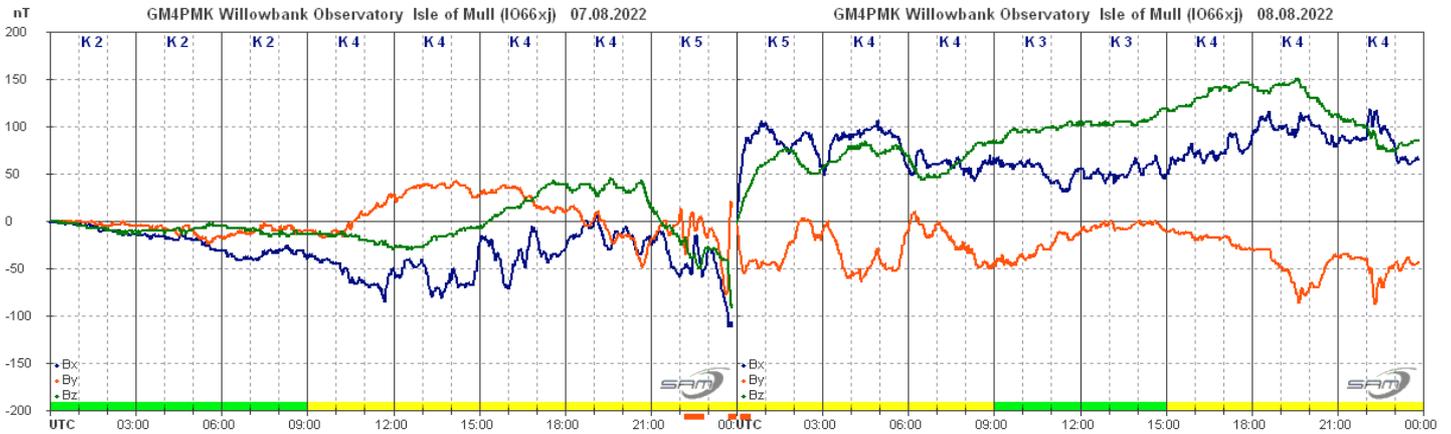


The filament eruption did not produce a flare that we recorded, although the SWPC data does include a number of small flares on the 14<sup>th</sup>.



Roger Blackwell's recording shows the strong increase in magnetic activity in the evening of the 17<sup>th</sup>, with some very rapid oscillations in the field around 21:00. A similar disturbance continued through the 18<sup>th</sup>.

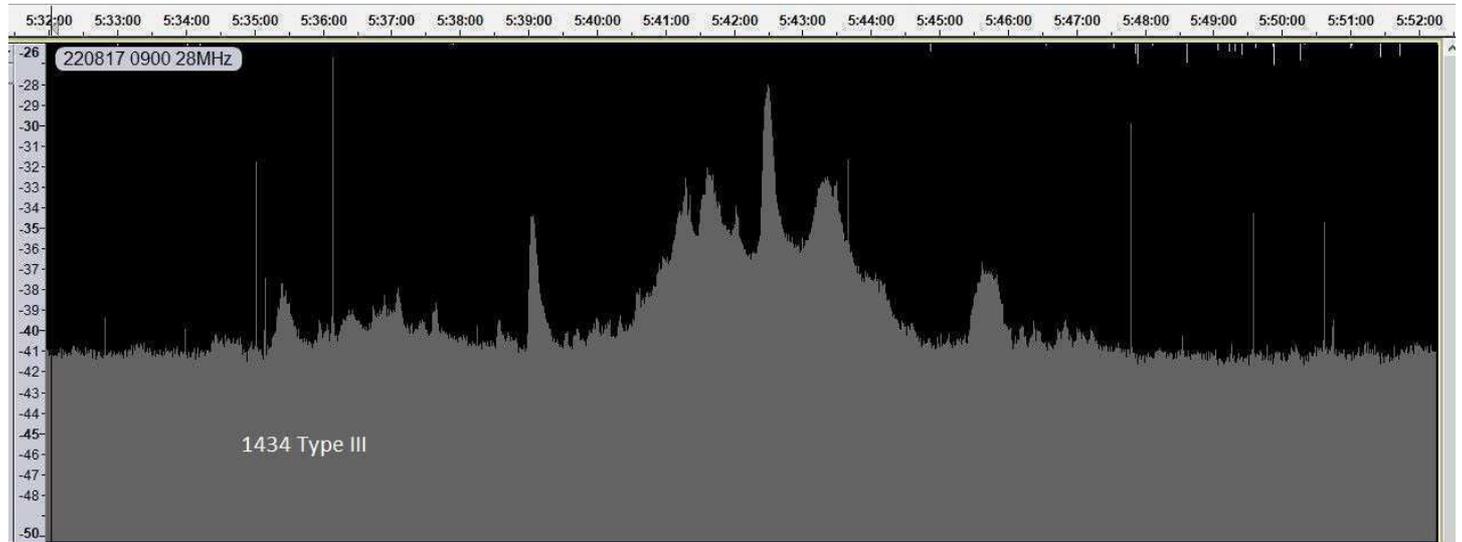
The sharp spike at 21:00 may well be from another CME impact, although I have not been able to determine a source. There were a number of CMEs active over this period. A similar spike was reported by Nick Quinn and John Cook.



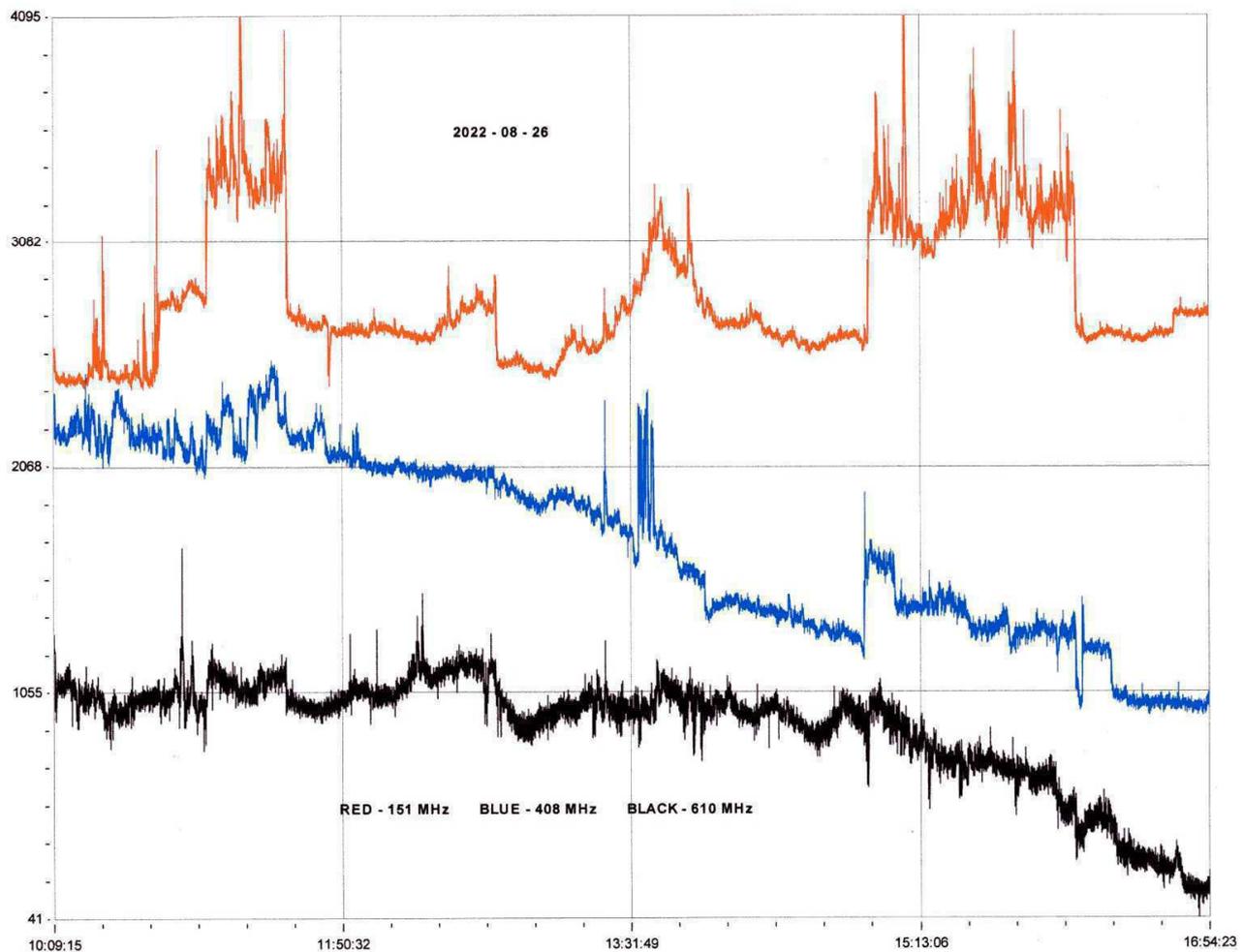
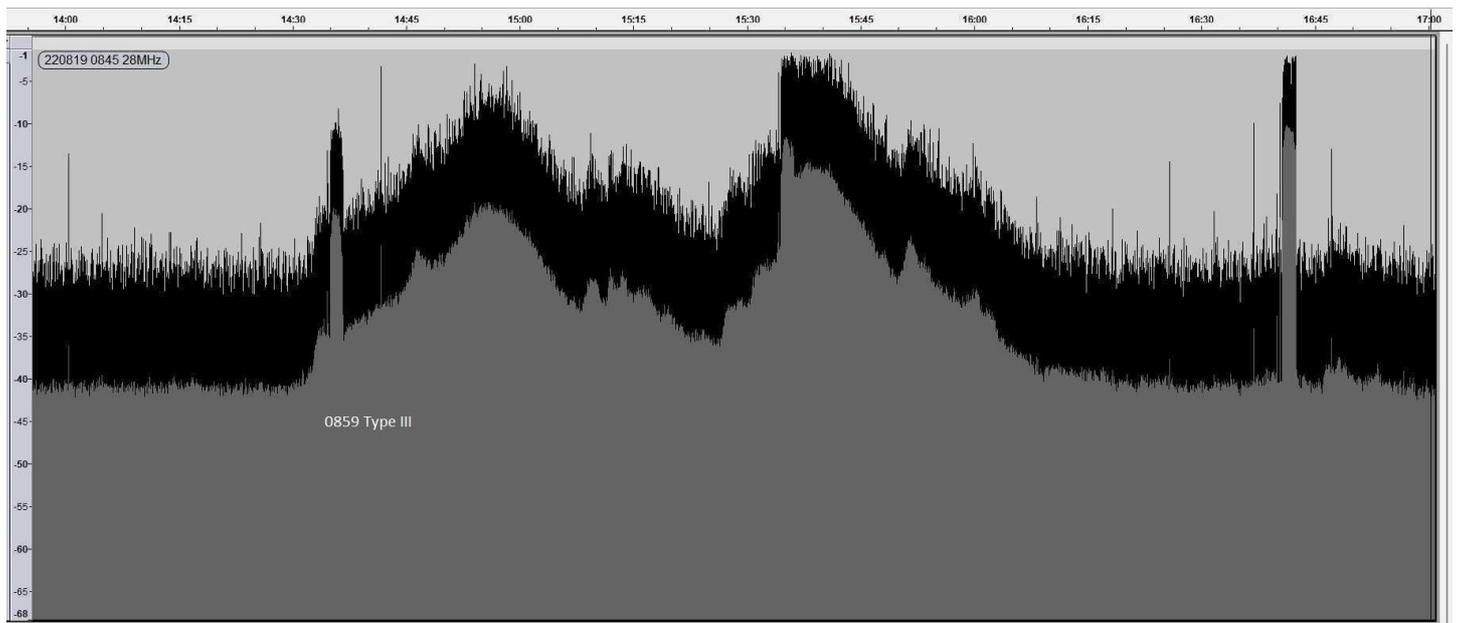
Roger Blackwell's recording from the 7<sup>th</sup> and 8<sup>th</sup> shows the magnetic disturbance from a coronal hole high speed wind. This started in the morning of the 7<sup>th</sup>, becoming more active after 21:00. The sensor is reset at midnight, which has rather distorted the offset of the Bx and Bz components. The general disturbance can still be seen through the rest of the day.

Magnetic observations received from Roger Blackwell, Colin Clements, Stuart Green, Nick Quinn and John Cook.

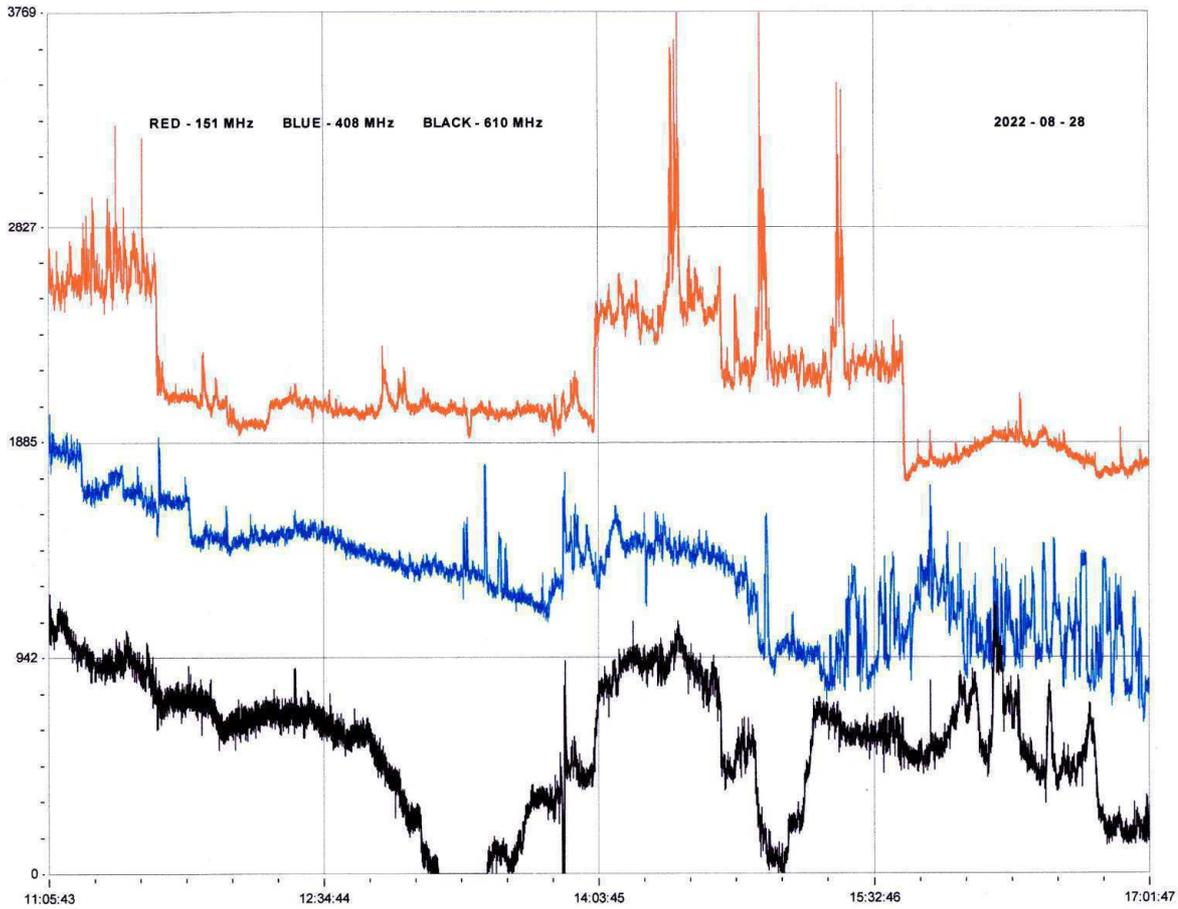
## SOLAR EMISSIONS.



Colin Briden has recorded 28MHz radio bursts with two of the flares that we have recorded. The first, shown above, is a type III burst at 14:34UT on the 17<sup>th</sup>, matching the start time of our SID recordings of the M1 flare. The chart shows about 20 minutes, the burst lasting about 10 minutes. The second chart, on the next page, shows a much shorter type III burst at 08:59 on the 19<sup>th</sup>. This matches with the timing of our SID recordings from the C1.9 flare. Despite being a weaker flare, the burst appears to be stronger, but Colin does note that this may be due to different levels of noise floor in the recordings.

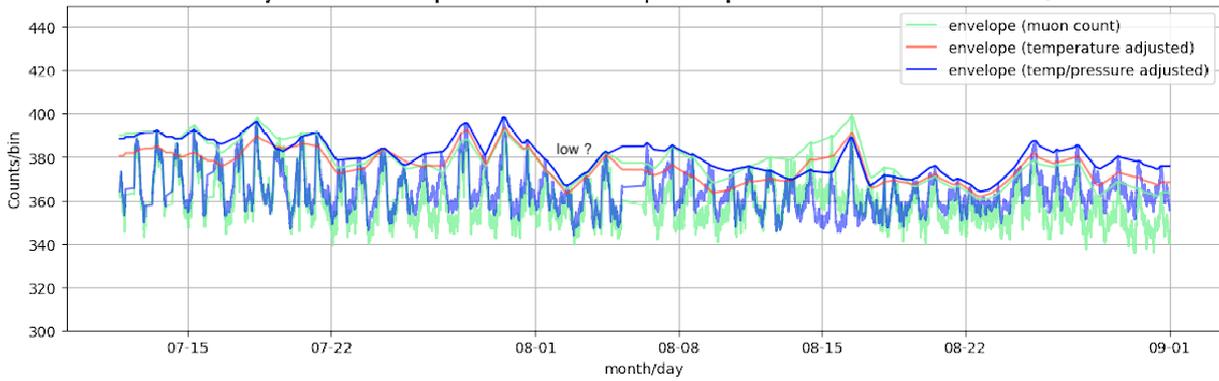


Colin Clements did not see any VHF/UHF emissions matching these events, but did record some strong emissions later in the month. This recording from the 26<sup>th</sup> shows strong 151MHz bursts during the sequence of three M-class flares. 408MHz also has some smaller noise bursts, but very little was recorded at 610MHz. A more complex pattern of emissions was recorded on the 28<sup>th</sup>, matching some of the multiple peaks seen around the C5.3 flare. The larger M6.7 flare did not produce any emissions.

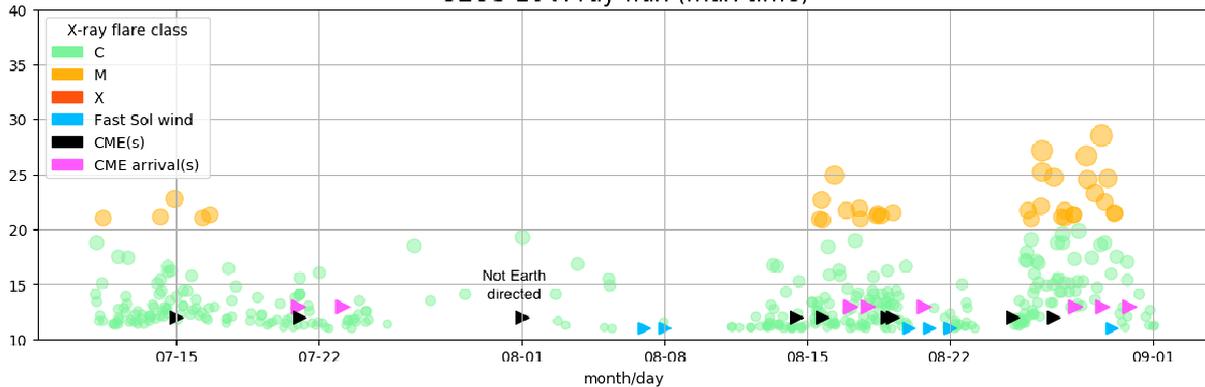


### MUONS.

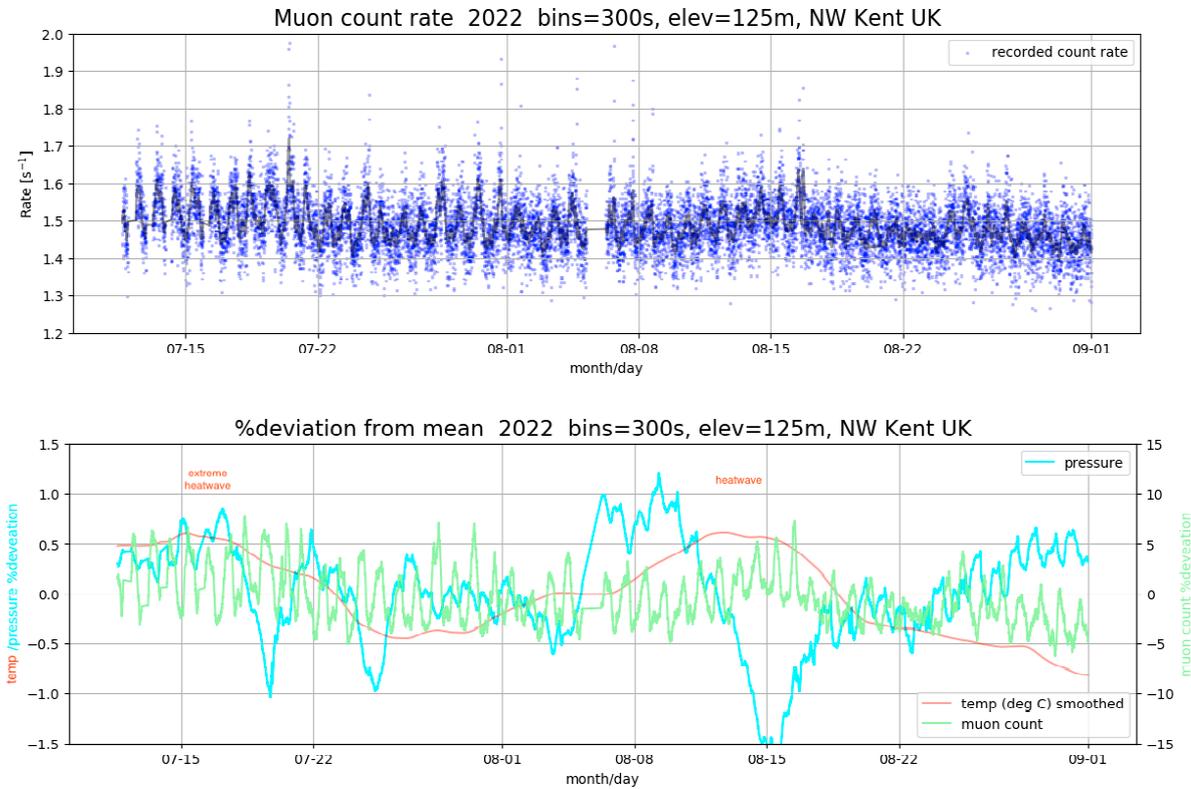
Muon count adjusted for temperature & atmospheric pressure 2022 bins=300s, elev=125m



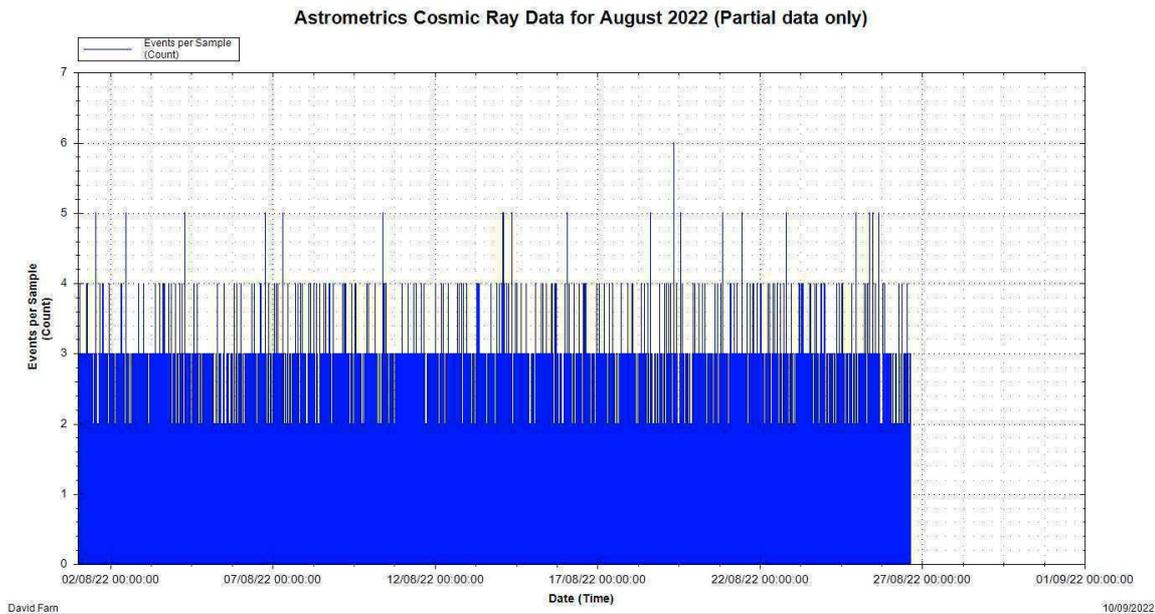
GEOS 16 X-ray flux (max time)



Mark Prescott has been experimenting with a UKRAA muon detector, and has been able to make some interesting measurements. This recording covers the period from mid July to the end of August, showing counts recorded in 300 second bins, adjusted for local atmospheric pressure and temperature in the top panel. The lower panel identifies the major flares and CMEs over this period. These adjustments were made on the basis of similar adjustments in professional data.

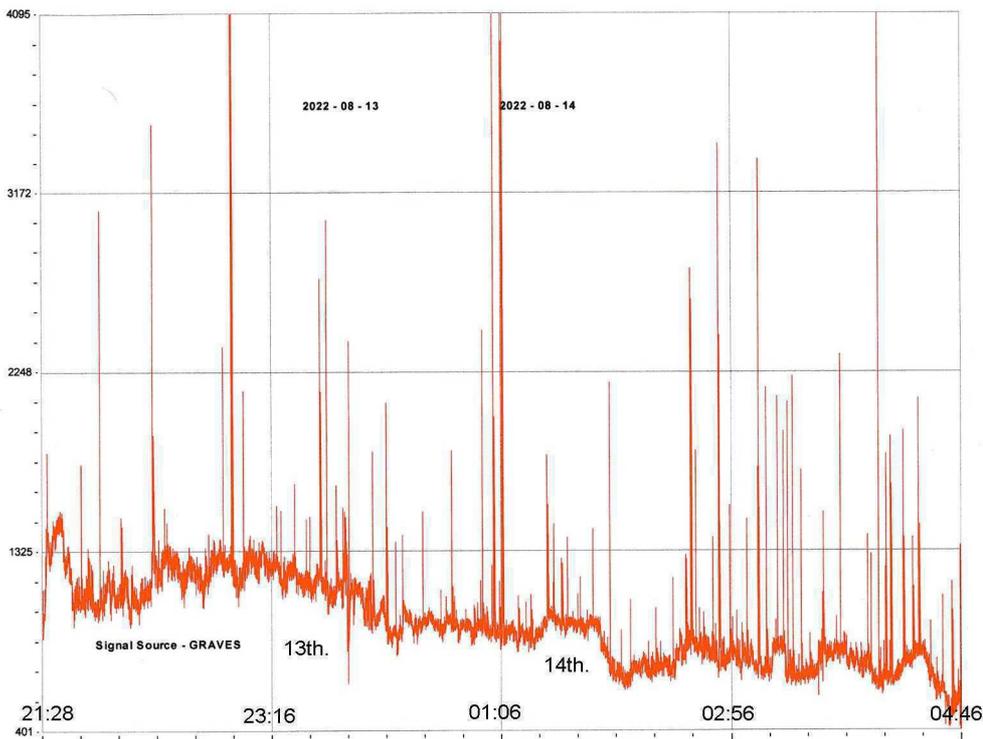
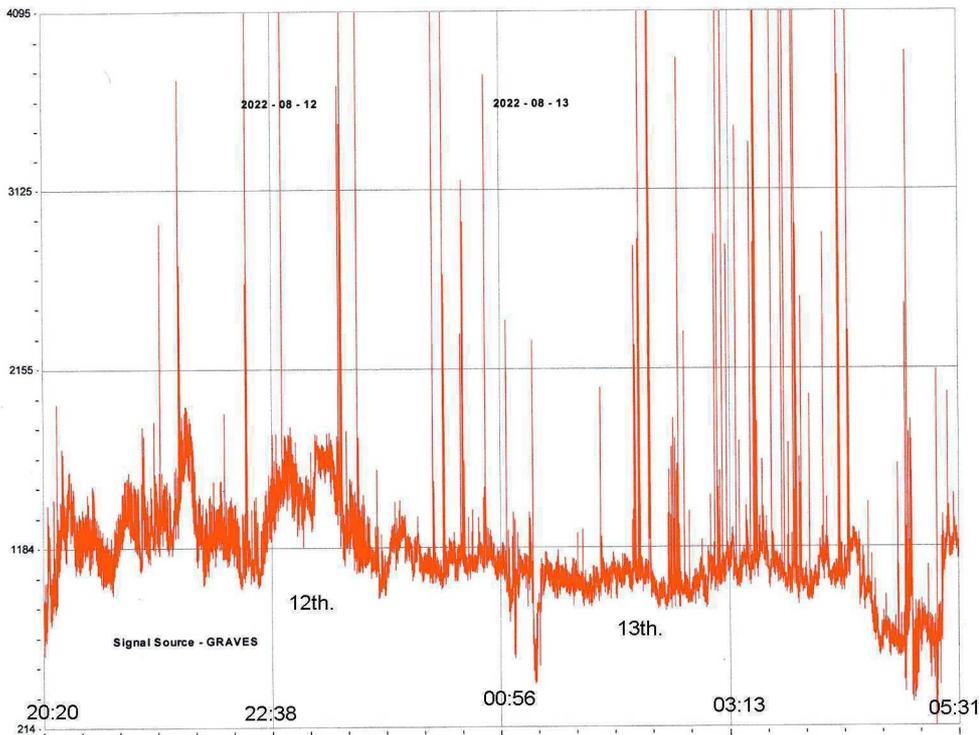


This shows the raw data in the upper panel, with deviation from the mean value in the lower panel. Mark has also added the temperature data in red, noting in particular the strong heatwaves experienced over the summer.



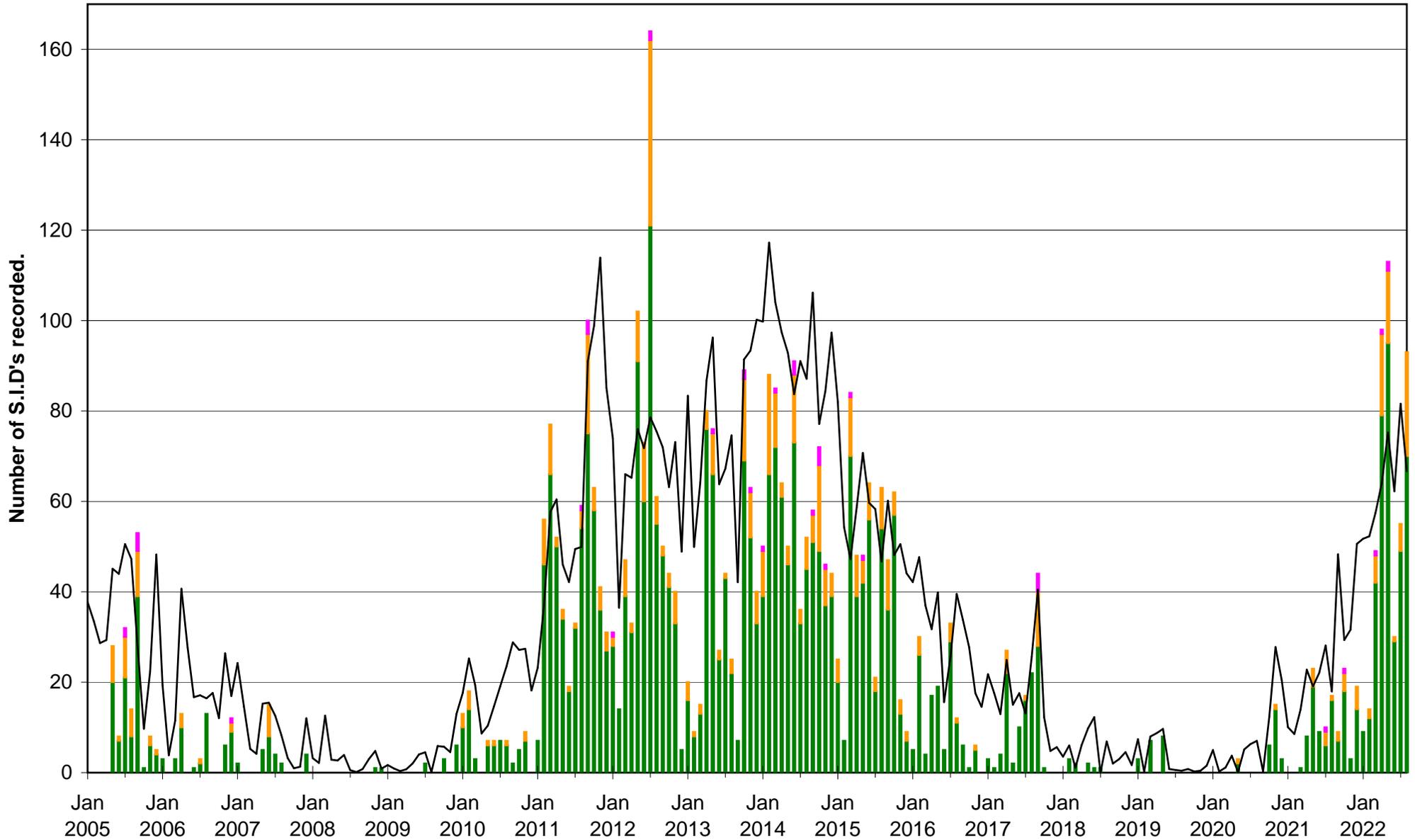
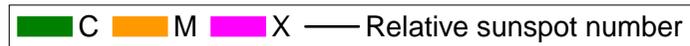
David Farn has also provided his detection results for August. David uses 10 second bins for averaging, giving a background count of about 12 events per minute. No major events were noted, making comparisons difficult.

## METEORS.



Colin Clements made recordings of the Perseid meteor shower using the GRAVES radio signal. The charts show echoes detected from 20:20UT on the 12<sup>th</sup> to 04:46 on the 14<sup>th</sup>. A peak in activity is clear in the early hours of the 13<sup>th</sup>, as predicted in the BAA handbook. A smaller activity peak is also shown early on the 14<sup>th</sup>. A much smaller peak was also recorded in the early hours of the 15<sup>th</sup>. A few detections were recorded on the 12<sup>th</sup>.

### VLF flare activity 2005/22



| DAY | Xray class | Observers | John Cook (23.4kHz/22.1kHz)                         |       |          |    | Roberto Battaola 20.9kHz |       |          |    | Paul Hyde (22.1kHz/24kHz)            |       |          |    | Mark Edwards (24.0/22.1/19.6kHz)  |       |          |    | Colin Clements (37.5/21.75/23.4kHz)                          |       |          |    |
|-----|------------|-----------|---|-------|----------|----|--------------------------|-------|----------|----|--------------------------------------|-------|----------|----|-----------------------------------|-------|----------|----|--|-------|----------|----|
|     |            |           | 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. |       |          |    |
|     |            |           | START   | PEAK  | END (UT) |    | START                    | PEAK  | END (UT) |    | START                                | PEAK  | END (UT) |    | START                             | PEAK  | END (UT) |    | START  | PEAK  | END (UT) |    |
| 2   | C4.2       | 6         | 15:28   | 15:35 | 16:00    | 1+ |                          |       |          |    | 15:26                                | 15:37 | 16:06    | 2  | 15:30                             | 15:38 | 16:03    | 2  | 15:29  | 15:38 | 16:29    | 2+ |
| 3   | C1.7       | 1         |   |       |          |    |                          |       |          |    |                                      |       |          |    | 17:17                             | 17:23 | 17:37    | 1  |  |       |          |    |
| 5   | C6.9       | 5         | 17:01   | 17:09 | 17:48    | 2+ |                          |       |          |    | 17:00                                | 17:10 | 17:42    | 2  | 17:02                             | 17:09 | 17:54    | 2+ |  |       |          |    |
| 5   | C5.5       | 1         |   |       |          |    |                          |       |          |    | 06:03                                | 06:08 | 06:18    | 1- |                                   |       |          |    |  |       |          |    |
| 5   | C4.9       | 4         |   |       |          |    |                          |       |          |    | 06:38                                | 06:46 | 07:00    | 1  | 06:39                             | 06:45 | 06:53    | 1- |  |       |          |    |
| 11  | C1.1       | 1         |   |       |          |    |                          |       |          |    | 10:11                                | 10:29 | 11:11    | 2+ | 16:22                             | 16:27 | 16:29    | 1- | 09:54  | 10:17 | 10:32    | 2  |
| 12  | C2.1       | 3         |   |       |          |    |                          |       |          |    | 16:22                                | 16:33 | 17:06    | 2+ |                                   |       |          |    |  |       |          |    |
| 12  | C1.2       | 2         |   |       |          |    |                          |       |          |    | 07:26                                | 07:37 | 08:11    | 2  | 07:26                             | 07:38 | 08:31    | 2+ |  |       |          |    |
| 13  | C6.8       | 6         | 07:26   | 07:34 | 08:07    | 2  |                          |       |          |    | 08:33                                | 08:43 | 09:06    | 2  |                                   |       |          |    |  |       |          |    |
| 13  | C2.8       | 2         |   |       |          |    |                          |       |          |    | 12:35                                | 12:52 | ?        | -  | 12:39                             | 12:56 | ?        | -  |  |       |          |    |
| 13  | C6.7       | 2         |   |       |          |    |                          |       |          |    | 12:54                                | 13:03 | 13:29    | 2  | 12:58                             | 13:02 | ?        | -  |  |       |          |    |
| 13  | C6.7       | 6         | 12:39   | 13:03 | 14:04    | 2+ |                          |       |          |    | 13:36                                | 13:41 | 14:41    | 2+ | 15:14                             | 15:20 | 15:25    | 1- |  |       |          |    |
| 13  | C1.4       | 1         |   |       |          |    |                          |       |          |    | 18:19                                | 18:19 | 18:24    | 1- | 18:19                             | 18:19 | 18:24    | 1- |  |       |          |    |
| 13  | C1.4       | 1         |   |       |          |    |                          |       |          |    | 13:55                                | 14:03 | 14:29    | 2  | 13:59                             | 14:05 | 14:42    | 2  |  |       |          |    |
| 13  | C2.1       | 1         |   |       |          |    |                          |       |          |    | 09:39                                | 09:48 | 10:20    | 2  | 09:42                             | 09:48 | 10:19    | 2  |  |       |          |    |
| 14  | C5.3       | 5         |   |       |          |    |                          |       |          |    | 11:04                                | 11:13 | 11:51    | 2+ | 11:06                             | 11:14 | 11:42    | 2  | 11:07  | 11:15 | 11:53    | 2+ |
| 15  | C2.6       | 4         | 09:41   | 09:45 | 10:01    | 1  |                          |       |          |    | 12:02                                | 12:04 | ?        | -  | 12:02                             | 12:13 | ?        | -  |  |       |          |    |
| 15  | C3.1       | 6         | 11:06   | 11:17 | 11:39    | 2  |                          |       |          |    | 12:35                                | 12:54 | 13:15    | 2  | 12:35                             | 12:54 | 13:15    | 2  | 14:33  | 14:41 | 15:20    | 2+ |
| 15  | C2.3       | 3         | 12:01   | 12:04 | ?        | -  |                          |       |          |    | 14:31                                | 14:38 | 15:11    | 2  | 14:33                             | 14:40 | 15:54    | 2+ |  |       |          |    |
| 15  | C3.5       | 2         |   |       |          |    |                          |       |          |    | 16:42                                | 16:56 | ?        | 1- | 16:42                             | 16:06 | 16:14    | 1- |  |       |          |    |
| 15  | M1.0       | 6         | 14:33   | 14:36 | 14:57    | 1  |                          |       |          |    | 16:44                                | 16:57 | ?        | -  | 17:17                             | 17:29 | 17:35    | 1- | 16:48  | 16:58 | 17:33    | 2  |
| 15  | C2.5       | 1         |   |       |          |    |                          |       |          |    |                                      |       |          |    | 19:49                             | 19:53 | 20:05    | 1- | 17:33  | 17:38 | 18:03    | 1+ |
| 15  | M2.7       | 8         | 16:52   | 16:56 | 17:27    | 2  |                          |       |          |    |                                      |       |          |    |                                   |       |          |    |  |       |          |    |
| 15  | M0.9       | 5         | 17:32   | 17:36 | 18:06    | 2  |                          |       |          |    |                                      |       |          |    |                                   |       |          |    |  |       |          |    |
| 15  | C3.9       | 1         |   |       |          |    |                          |       |          |    |                                      |       |          |    |                                   |       |          |    |  |       |          |    |
| 16  | M5.0       | 8         | 07:55   | 08:01 | 08:19    | 1  | 13:19                    | 13:27 | 13:34    | 1- | 07:54                                | 08:01 | 09:01    | 2+ | 07:55                             | 07:58 | 08:12    | 1- | 07:54  | 08:04 | 09:25    | 3  |
| 16  | C6.4       | 8         | 13:29   | 13:32 | 13:56    | 1+ | 14:00                    | 14:07 | 14:24    | 1- | 13:23                                | 13:34 | 13:55    | 1+ | 13:29                             | 13:33 | ?        | -  | 13:28  | 13:35 | 13:46    | 1- |
| 16  | C5.8       | 7         | 14:02   | 14:05 | 14:41    | 2  |                          |       |          |    | 13:57                                | 14:05 | 14:47    | 2+ | 13:57                             | 14:07 | 14:33    | 2  |  |       |          |    |
| 17  | C9         | 8         | 08:16   | 08:21 | ?        | -  | 08:12                    | 08:28 | 09:07    | 2+ | 08:12                                | 08:26 | ?        | -  | 08:15                             | 08:26 | ?        | -  | 08:15  | 08:28 | 09:30    | 2+ |
| 17  | ?          | 2         |   |       |          |    |                          |       |          |    | 08:44                                | 08:49 | ?        | -  | 08:44                             | 08:49 | ?        | -  |  |       |          |    |
| 17  | C4.0       | 6         | 09:30   | 09:36 | 10:03    | 2  |                          |       |          |    | 09:28                                | 09:39 | 10:00    | 1+ | 09:31                             | 09:37 | 10:06    | 2  |  |       |          |    |
| 17  | C4.3       | 6         | 11:24   | 11:33 | ?        | -  |                          |       |          |    | 11:16                                | 11:34 | 12:33    | 2+ | 11:23                             | 11:32 | 12:23    | 2+ |  |       |          |    |
| 17  | M2.0       | 10        | 13:43   | 13:46 | 14:36    | 2+ | 13:41                    | 13:47 | 14:14    | 2  | 13:40                                | 13:47 | ?        | -  | 13:42                             | 13:48 | 14:29    | 2+ | 13:42  | 13:50 | 14:27    | 2  |
| 17  | M1.0       | 7         | 14:42   | 14:46 | 14:57    | 1- |                          |       |          |    | 14:39                                | 14:51 | 16:04    | 2+ | 14:37                             | 14:50 | 15:46    | 2+ | 14:27  | 14:54 | 16:35    | 3+ |
| 18  | C5.7       | 1         |   |       |          |    |                          |       |          |    | 05:59                                | 06:06 | 06:37    | 2  |                                   |       |          |    |  |       |          |    |
| 18  | C3.6       | 2         |   |       |          |    |                          |       |          |    | 08:44                                | 08:55 | 09:37    | 2+ |                                   |       |          |    |  |       |          |    |
| 18  | M1.3       | 7         | 10:06   | 10:11 | ?        | -  | 09:57                    | 10:06 | 10:11    | 1- | 10:40                                | 10:12 | 10:32    | 1+ | 10:06                             | 10:11 | 10:31    | 1  |  |       |          |    |
| 18  | M1.5       | 7         | 10:43   | 10:54 | 12:28    | 3  | 10:38                    | 10:56 | 12:27    | 3  | 10:40                                | 10:54 | 11:49    | 2+ | 10:42                             | 10:57 | ?        | -  |  |       |          |    |
| 18  | M1.3       | 8         | 14:11   | 14:15 | 14:47    | 2  | 14:09                    | 14:16 | 14:42    | 2  | 14:12                                | 14:17 | 14:57    | 2  | 14:09                             | 14:15 | 15:01    | 2+ | 14:12  | 14:15 | 14:45    | 2  |
| 18  | C4.2       | 4         | 15:52   | 15:54 | 16:10    | 1- |                          |       |          |    | 15:50                                | 15:56 | 16:20    | 1+ | 15:51                             | 15:53 | 16:17    | 1+ |  |       |          |    |
| 18  | C3.0       | 2         | 10:25   | 10:30 | ?        | -  |                          |       |          |    | 19:36                                | 19:40 | 19:51    | 1- | 19:36                             | 19:40 | 19:51    | 1- |  |       |          |    |
| 19  | M1.6       | 1         |   |       |          |    |                          |       |          |    | 08:05                                | 08:14 | 08:44    | 2  | 08:08                             | 08:13 | 08:53    | 2  | 08:07  | 08:15 | 08:36    | 1+ |
| 19  | C4.5       | 5         |   |       |          |    |                          |       |          |    | 08:58                                | 09:11 | 09:53    | 2+ | 08:45                             | 09:10 | 09:50    | 2+ |  |       |          |    |
| 19  | C1.9       | 3         |   |       |          |    |                          |       |          |    | 10:22                                | 10:30 | 10:54    | 1+ | 10:24                             | 10:29 | 11:03    | 2  | 10:27  | 10:39 | 10:50    | 1  |
| 19  | C3.0       | 6         |   |       |          |    |                          |       |          |    | 11:07                                | 11:20 | 11:51    | 2  | 11:09                             | 11:22 | ?        | -  |  |       |          |    |
| 19  | C4.0       | 5         |   |       |          |    |                          |       |          |    | 11:52                                | 11:58 | 12:05    | 1- | 11:52                             | 11:58 | 12:05    | 1- |  |       |          |    |
| 19  | C1.8       | 1         |   |       |          |    |                          |       |          |    | 15:19                                | 15:24 | 15:32    | 1- | 15:19                             | 15:24 | 15:32    | 1- |  |       |          |    |
| 19  | C1.2       | 1         |   |       |          |    |                          |       |          |    | 17:51                                | 17:58 | 18:06    | 1- | 17:51                             | 17:58 | 18:06    | 1- | 17:45  | 17:48 | 18:53    | 2+ |
| 19  | B5.5       | 3         |   |       |          |    |                          |       |          |    | 20:27                                | 20:28 | 20:36    | 1- | 20:27                             | 20:28 | 20:36    | 1- |  |       |          |    |
| 19  | B5.9       | 1         |   |       |          |    |                          |       |          |    | 18:12                                | 18:21 | 18:36    | 1  | 09:36                             | 09:40 | 09:50    | 1- |  |       |          |    |
| 21  | C2.0       | 1         |   |       |          |    |                          |       |          |    | 14:02                                | 14:11 | 15:17    | 2+ |                                   |       |          |    | 14:05  | 14:13 | 14:30    | 1  |
| 22  | C1.4       | 3         | 12:03   | 12:09 | 12:24    | 1  |                          |       |          |    | 11:59                                | 12:08 | 12:19    | 1  |                                   |       |          |    |  |       |          |    |
| 22  | ?          | 7         | 14:06   | 14:11 | 15:05    | 2+ | 14:01                    | 14:12 | 14:29    | 1+ | 14:02                                | 14:11 | 15:17    | 2+ |                                   |       |          |    |  |       |          |    |
| 25  | C1.8       | 1         |   |       |          |    |                          |       |          |    | 09:36                                | 09:40 | 09:50    | 1- | 09:36                             | 09:40 | 09:50    | 1- |  |       |          |    |
| 25  | C3.6       | 4         | 10:00   | 10:02 | 10:16    | 1- |                          |       |          |    | 09:59                                | 10:03 | 10:32    | 2  | 09:59                             | 10:03 | 10:32    | 2  |  |       |          |    |
| 25  | C2.0       | 2         |   |       |          |    |                          |       |          |    | 11:14                                | 11:22 | 11:42    | 1+ | 11:19                             | 11:24 | 11:45    | 1+ |  |       |          |    |
| 25  | C1.7       | 2         |   |       |          |    |                          |       |          |    | 13:48                                | 13:58 | 14:11    | 1  | 13:54                             | 13:59 | 14:11    | 1- |  |       |          |    |
| 25  | C1.5       | 2         |   |       |          |    |                          |       |          |    | 14:21                                | 14:29 | 14:37    | 1- | 14:24                             | 14:26 | 14:36    | 1- |  |       |          |    |
| 25  | C1.7       | 2         |   |       |          |    |                          |       |          |    | 15:14                                | 15:25 | 15:33    | 1  | 15:14                             | 15:19 | 15:36    | 1  |  |       |          |    |
| 25  | C2.4       | 3         | 15:45   | 15:50 | 15:58    | 1- |                          |       |          |    | 15:45                                | 15:54 | 16:14    | 1+ | 15:46                             | 15:49 | ?        | -  |  |       |          |    |
| 25  | ?          | 1         |   |       |          |    |                          |       |          |    | 15:58                                | 16:05 | 16:28    | 1+ | 15:58                             | 16:05 | 16:28    | 1+ |  |       |          |    |
| 25  | C3.2       | 3         | 16:38   | 16:42 | 17:05    | 1+ |                          |       |          |    | 16:36                                | 16:46 | 17:26    | 2+ | 16:38                             | 16:44 | 17:04    | 1+ |  |       |          |    |
| 25  | C1.9       | 1         |   |       |          |    |                          |       |          |    | 17:19                                | 17:24 | 17:35    | 1- | 17:19                             | 17:24 | 17:35    | 1- |  |       |          |    |
| 25  | C7.3       | 2         |   |       |          |    |                          |       |          |    | 17:54                                | 18:04 | 18:45    | 2+ | 17:54                             | 18:02 | 18:46    | 2+ |  |       |          |    |
| 25  | C8.0       | 2         |   |       |          |    |                          |       |          |    | 18:50                                | 19:05 | ?        | -  | 18:54                             | 19:00 | ?        | -  |  |       |          |    |
| 25  | ?          | 1         |   |       |          |    |                          |       |          |    | 19:06                                | 19:07 | 19:43    | 2  | 19:06                             | 19:07 | 19:43    |    |  |       |          |    |



