

# The 2015 February 5 event

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The past few years have seen predicted meteor outbursts which were extensively observed optically being confirmed by forward scatter radio observations. A more interesting possibility is to discover new streams via radio methods. Although discovery opportunities will be rare and will only be possible when no other major streams are active, such an event was observed on February 5 2015. Optical observations were sparse, but hopefully this stream will also be recorded optically in the future.

## 1 Introduction

In the past few years, we have reported on forward scatter observations of predicted outbursts and enhanced activity of known streams:

- the October 2011 Draconids (Steyaert, 2013);
- the May 2013  $\eta$ -Aquariids (Steyaert, 2014);
- the May 2014 209P/LINEAR Camelopardalids (Steyaert, 2014b).

These successes raise the question as to whether unforeseen and smaller outbursts can be identified.

## 2 Discovering new or unforeseen outbursts

In order to increase the chances of finding unknown activity, we start with the annual activity overview of reference observer Felix Verbelen. He has been monitoring the VVS beacon with the same receiver setup since it began in 2005.

The well-known annual streams are easily recognized: Quadrantids on January 3–4, Lyrids end April,  $\eta$ -Aquariids early May, daytime streams in June, Perseids in August, Geminids mid-December. There are also hints of the Orionids in October and of the Leonids in November (*Figure 1*).

In February and March there are no known major streams and annual sporadic activity is at its lowest level. Hence this is the period of the year (for the Northern hemisphere) at which smaller streams can show up. With the longer nights during these months, there is also a good chance of recording activity optically (weather permitting).

At other times of the year, the nighttime signal to noise ratio for a minor stream will be too low.

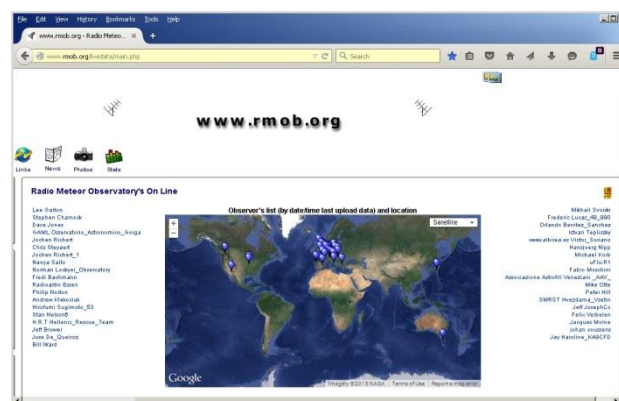
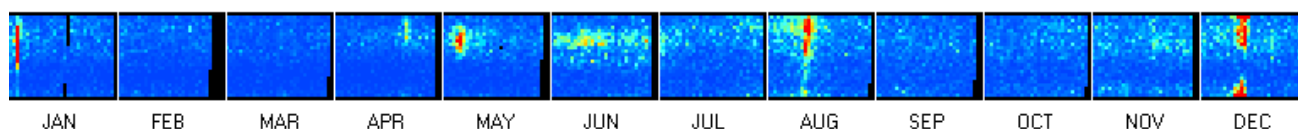


Figure 2 – Participating stations in Radio Meteor Observatories On-line.

VERBELEN 2013



VERBELEN 2014

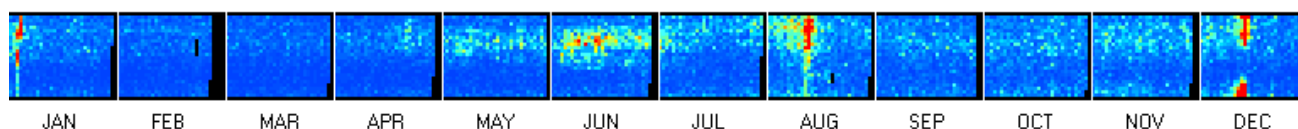


Figure 1 – Annual overview of Verbelen 2013 and 2014.

### 3 The observations

During February 2015, 33 sets of results were submitted to Radio Meteor Observatories On-Line (RMOB) (Figure 2)<sup>1</sup>, with most being automated counts and some still only in a testing phase.

A typical monthly graph (Figure 3) shows the daily pattern with a maximum in the morning hours local time, and a minimum in the evening. Activity from streams, such as the  $\eta$ -Aquariids around May 8, is superimposed over this.

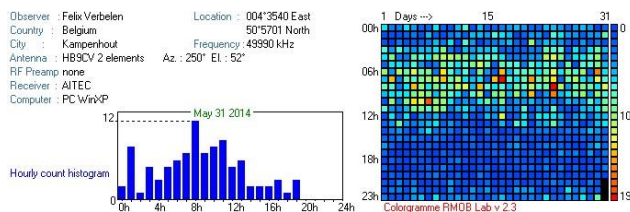


Figure 3 – Typical daily radio count pattern.

### 4 Discovery of previously unknown activity

On February 5 2015, Belgian beacons observer Lucas Pellens raised following warning flag (in Dutch) on a mailing list:

From: lucas.pellens@skynet.be  
 Subject: [radioastronomie] verhoogde activiteit  
 Date: Thu, 5 Feb 2015 12:27:45 +0100  
 List-Id: WG Radioastronomie VVS  
 <radioastronomie.ls.vvs.be>

Allen,  
 Vanmorgen hebben zich een aantal boeiende reflecties laten optekenen.  
 Enkele daarvan in bijlage.  
 gr Lucas Pellens

Translation:

Subject: [radioastronomie] **increased activity**

All,  
 This morning a number of exciting reflections were recorded.

His excitement was due to a number of consecutive 6 minutes Speclab waterfall spectra, such as that shown in Figure 4.

The spectrum in Figure 5 shows two ‘epsilons’ or strong overdense reflections, typically associated with larger streams.

No corresponding activity was seen at the same time on the preceding or following days, nor had it been seen in other years. Hence Lucas had not expected anything like it.

The activity was confirmed by – amongst others – Gaspard De Wilde, who records simultaneously the VVS and BRAMS beacons (Figure 5).

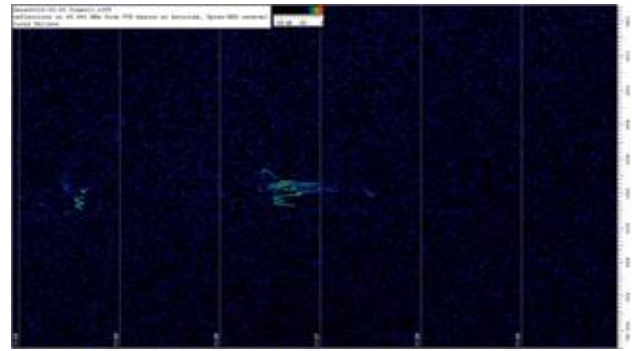


Figure 4 – Lucas Feb 5 11<sup>h</sup>04<sup>m</sup> – 11<sup>h</sup>10<sup>m</sup> UT spectrum.

Although there was no doubt that this was meteor activity it only involved short range observations of two relatively close beacons.

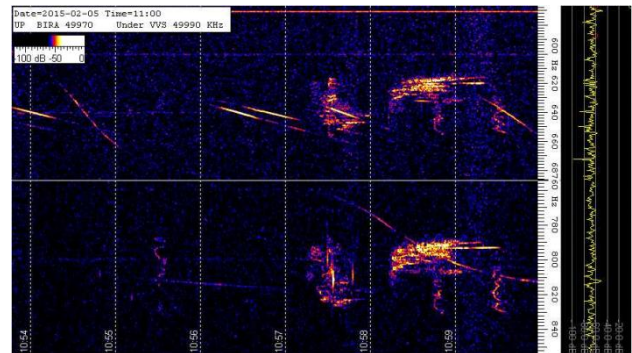


Figure 5 – De Wilde Gaspard Feb 5 10<sup>h</sup>54<sup>m</sup> – 11<sup>h</sup>00<sup>m</sup> UT spectrum.

The RMOB hourly counts cover the whole world, and confirmation should be provided by at least some of them.

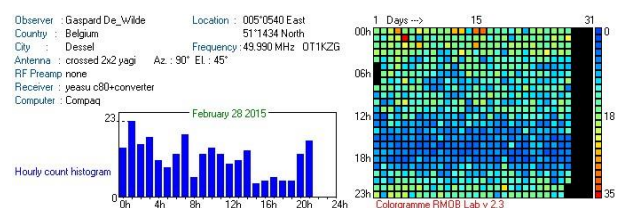


Figure 6 – Gaspard De Wilde- Belgium.

The activity is moderately seen in De Wilde’s counts, which also include underdense reflections (Figure 6). The activity is more clearly seen in Verbelen\_022015 as he only reports overdense reflections (Figure 7).

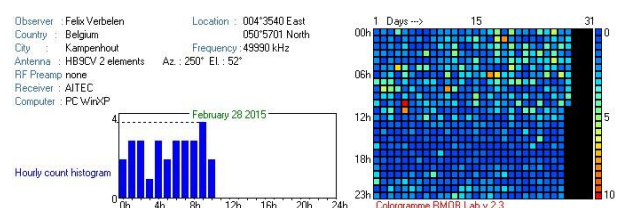


Figure 7 – Felix Verbelen - Belgium.

<sup>1</sup> <http://www.rmob.org/livedata/main.php>



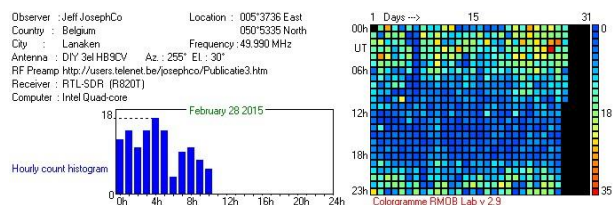
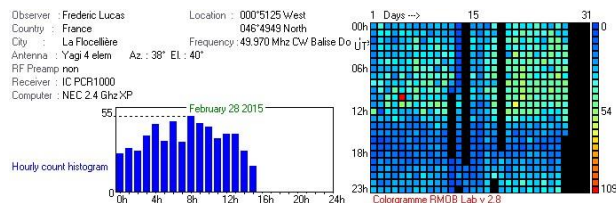


Figure 8 – Joseph Welkenhuyzen - Belgium.

Another observer of the VVS beacon (JosephCo\_022015, *Figure 8*) shows the activity for the 10<sup>h</sup> count. For Frederic Lucas (Lucas\_02201, *Figure 9*), an observer 550 km to the southwest of the 250 W BRAMS beacon (49.97 MHz) February 5, 10<sup>h</sup> UT was the highest count of the month.



*Figure 9 – Frederic Lucas - France.*

The event was recorded by all observers of the GRAVES radar (*Figure 10 to 15*).

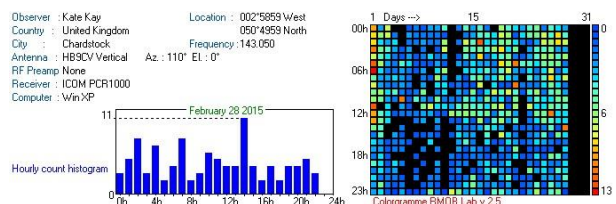


Figure 10 – Kate Kay - UK.

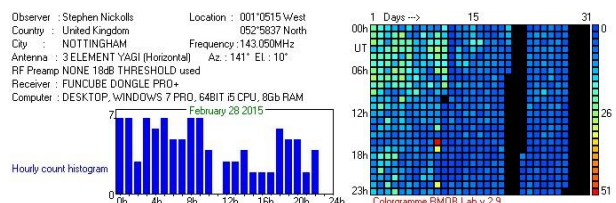


Figure 11 – Stephen Nickolls - UK.

Nickolls (*Figure 11*) has an outlier in the counts on Feb 15, 16<sup>h</sup> UT). Once this outlier has been removed, the Feb 5 activity becomes visible.

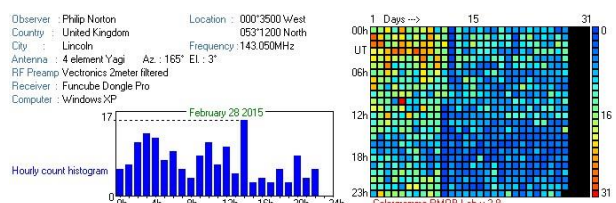


Figure 12 – Philip Norton - UK.

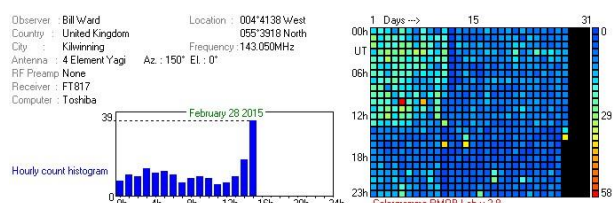


Figure 13 – Bill Ward - UK.

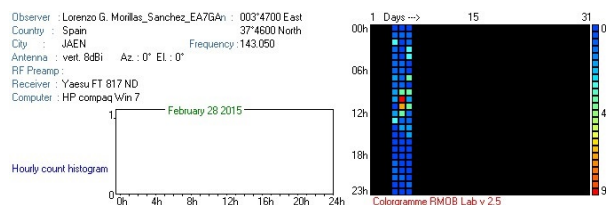


Figure 14 – Lorenzo Morillas-Sanchez - Spain.

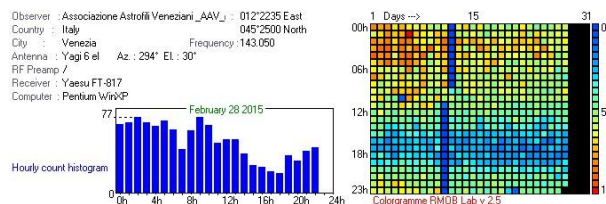


Figure 15 – Enrico Stomeo (AAV) – Italy.

Enrico Stomeo (*Figure 15*, \_AAV\_\_022015) shows a very *low* count for  $10^h$  UT. This is due to long lasting overlapping echoes, which are counted as one in the automatic counting algorithm. These can be heard on an audio fragment during the period<sup>2</sup>. Several head echoes (descending pitch) can be heard.

There are few observations from North America, and none from Japan.

## 5 Locating the radiant

Without any additional information, the radiant could in principle be anywhere in the sky of the observers (*Figure 16 – Heavens Above* generated).

The fact that the same reflections are seen from different angles indicates that the radiant has a rather high elevation. This phenomenon happens - amongst others - when the Perseid radiant culminates and the geometry for underdense reflections is unfavorable.

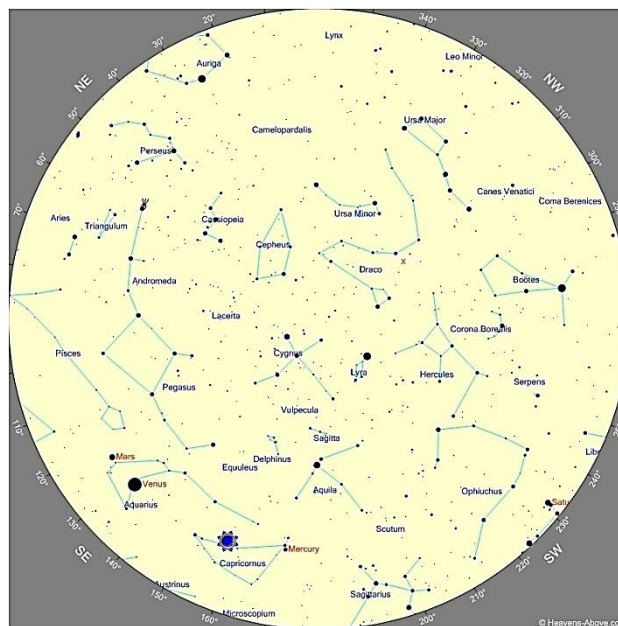


Figure 16 – Visible sky on Feb 5 11<sup>h</sup> UT for 51.2° N, 4.4° E.

<sup>2</sup> <https://www.dropbox.com/s/rs6apbx8ptdxm3l/2eteor20150205104405.way?dl=0>

Felix Verbelen searched the IAU MDC, and found a candidate, the 427 FED February  $\eta$ -Draconids with a maximum on February 7. This radiant is indicated with a blue cross to the right top of the word 'Draco'. This radiant was indeed at a high elevation at the time of the outburst.

Low radiant elevations are less likely, as the correction factor for the effective number of reflections is similar to that for optical meteors at low radiant elevations.

## 6 Optical observations

The author then reported the radio event via the [IMO-News] mailing list and asked for confirmation.

There was an immediate response from the video community. Carl Johannink, coordinator of CAMS Benelux, reported that no 427 FED's had been recorded in video observations in the hours and days before and after the radio event. At the time of the event itself, however, it was daytime in Europe. Sirko Molau came to the same conclusion based on the complete February results.

Christoph Gerber replied privately;

Date: Tue, 17 Feb 2015 09:56:20 +0100

*Hi Chris, finally I am glad to hear on this topic! The CMOR map<sup>3</sup> of Feb.5 (sol.long 2015-316) shows an outburst-like pattern just north of Gamma Lyr at 285+35° - it would be the candidate, since it was also near the local zenith. Not very strong, but very evident! (It is a pity that no archive exists for the radar charts of CMOR!!)*

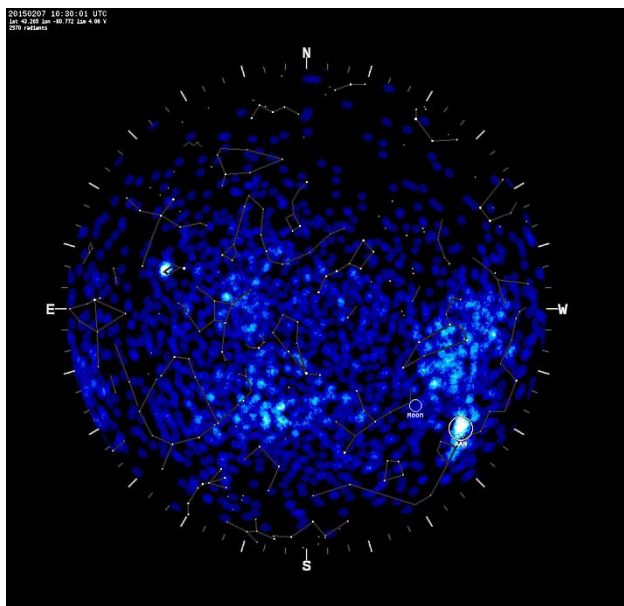


Figure 17 – CMOR map of Feb 5 (solar long 316 deg).

It should be noted that the CMOR map (Figure 17) is the integration of a complete day. Hence the maximum intensity of a short living event is underreported

compared to that of longer lasting streams. The FED radiant was not active on February 5.

Christoph went on to say:

*After I realized this "outburst", I also looked at the NASA fireball site<sup>4</sup> and found indeed one possible candidate (observer: lat 31.44 deg lon 249.22 deg)*

*time 20150205 10.50 hours*

*alp 283.3 +/- 0.2 deg del 34.72 +/- 0.04 deg*

*v\_inf 36.5 +/- 0.3 km/s*

An orbit is also given for this fireball. However, we would rather not speculate on comet association and evolution based on a single fireball orbit.

## 7 Stream intensity estimation

It would be interesting to estimate the intensity of this outburst in optical terms, such as a ZHR.

The only comparable medium sized stream is the regular April Lyrids:

- 'Feb' Lyrids:  $\alpha = 283.3^\circ$ ,  $\delta = +34.7^\circ$ ,  $v_\infty = 36.5$  km/s
- April Lyrids:  $\alpha = 270^\circ$ ,  $\delta = +34^\circ$ ,  $v_\infty = 49$  km/s

The February 5 11<sup>h</sup> UT geometrical observing conditions are comparable to those for the Lyrids on April 22 5<sup>h</sup> UT.

Unfortunately, no clear correlation was found between the hourly radio counts of the Lyrids at that time and the IMO visual data quicklook ZHR's<sup>5</sup>.

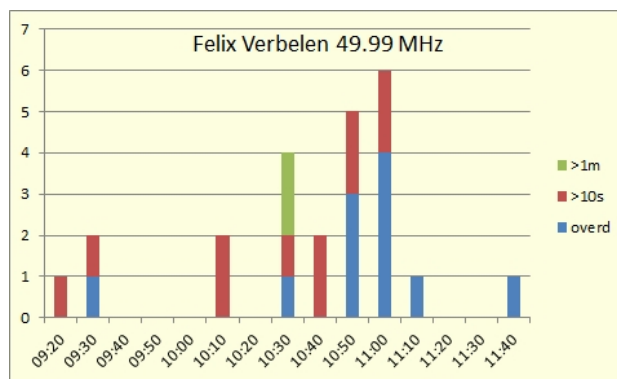


Figure 18 – Histogram of Verbelen's reflections.

We now attempt a rough estimate based on Verbelen's detailed 10 minute counts. There was activity in part of both the 10<sup>h</sup> and 11<sup>h</sup> intervals, implying that the maximum activity is underestimated when looking at hourly counts.

Radio counts do not show streams with a ZHR of 10 or lower, even in the quieter months of February and March. The February 5 event was also not stronger than the

<sup>3</sup> [http://meteor.uwo.ca/research/radar/cmor\\_ops.html](http://meteor.uwo.ca/research/radar/cmor_ops.html)

<sup>4</sup> <http://fireballs.ndc.nasa.gov/>

<sup>5</sup> <http://www.imo.net/live/lyrids2013/> and other years

major annual streams. The author's guess for the maximum ZHR is 50.

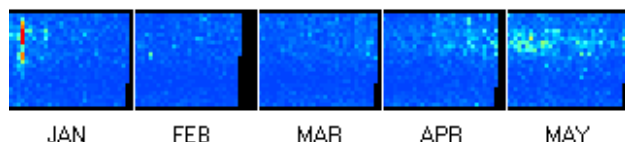


Figure 19 – Annual overview of Verbelen 2015.

Figure 19 clearly shows the February 5  $10^{\text{h}}-11^{\text{h}}$  UT event, and no others in February or March. In Figure 1 an increase was seen in the 2014, not on February 5 but on February 7. This timing corresponds better to the FED's, but this still needs to be checked.

## 8 Conclusion

There was an outburst of mainly bright meteors on Feb 5  $10^{\text{h}}30^{\text{m}} - 11^{\text{h}}15^{\text{m}}$  UT most probably from a radiant in Lyra, which has not yet been observed in the visual range.

## 9 Analysis opportunity

Readers interested in making their own analysis of the February 5 event or any other stream can find the basic data in the Visual RMOB Archives<sup>6,7</sup>. Monthly submissions have been steadily increasing both in their number and quality since it started in 2000.

## Acknowledgment

The author wishes to thank the `rmob.org` contributors, in particular Felix Verbelen. Pierre Terrier has been hosting `rmob.org` for 15 years. Lucas Pellens triggered the investigation about this event, and Christoph Gerber made the link with other available observations. Sirko Molau, and Carl Johannink checked their video results. Juergen Rendtel, Enrico Stomeo and Mike Otte made useful suggestions and provided observational material.

## References

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<sup>6</sup> <http://www.rmob.org/articles.php?lng=en&pg=28>

<sup>7</sup> <http://rmob.org/visual/2015/>