e-Zine for meteor observers meteornews.net

MeteorNews

ISSN 2570-4745 VOL 4 / ISSUE 5 / OCTOBER 2019

Bright Perseid with flares. Canon 6D with Rokinon 24mm lens at f/2.0 on 2019 August 13, at 3h39m am EDT by Pierre Martin

- EDMOND
- CAMS BeNeLux
- UAEMM Network
- Visual observations
- Radio observations
- Fireballs

Contents

Problems in the meteor shower definition table in case of EDMOND

Masahiro Koseki

NMS (The Nippon Meteor Society), 4-3-5 Annaka Annaka-shi, Gunma-ken, 379-0116 Japan
geh04301@nifty.ne.jp

The meteor shower list of EDMOND, the J8-list, is based on the IAUMDC shower list and in most cases, it is the first line for each shower listed in the IAUMDC list. It is not good to assume that these first lines are the most reliable shower data, because they are the oldest reported data and should be rather replaced by more recent ones in several cases. Southern iota Aquariids (SIA#003), zeta Cassiopeiids (ZCS#444) and zeta Taurids (ZTA#226) are such cases. The misclassifications have an influence on the statistics obtained for these showers as well as on the neighboring showers, i.e. Southern delta Aquariids (SDA#005), Orionids (ORI#008) and Perseids (PER#007). The EDMOND results are accurate enough to study meteor showers, just like the orbit data of CAMS and SonotaCo net.

1 Introduction

There are three major video meteor orbit databases: EDMOND, SonotaCo and CAMS. All three use an original meteor shower list to classify meteors with the proper meteor shower. We can find several problematic classifications in the lists and the author analyzed some specific cases by comparing SonotaCo net with CAMS (Koseki, 2018). The author has shown the overestimated numbers of several minor showers in EDMOND (Koseki, 2019b) and in this paper he explains the probable reasons for the misclassifications. *Table 1* lists the statistics for the Southern iota Aquariids (SIA#003), zeta Cassiopeiids (ZCS#444) and zeta Taurids (ZTA#226), which are good examples to illustrate the problem.

2 Southern iota Aquariids (SIA#003)

Four entrees for the SIA-shower are included in the IAUMDC list (IAUMDC[1], version 2018 January 18) and the summary of these is shown in *Table 2*. However, the Southern iota Aquariids are one of the problematic showers (Koseki, 2016) and each of the four entrees in the IAUMDC does not show a clear distinction from the sporadic background.

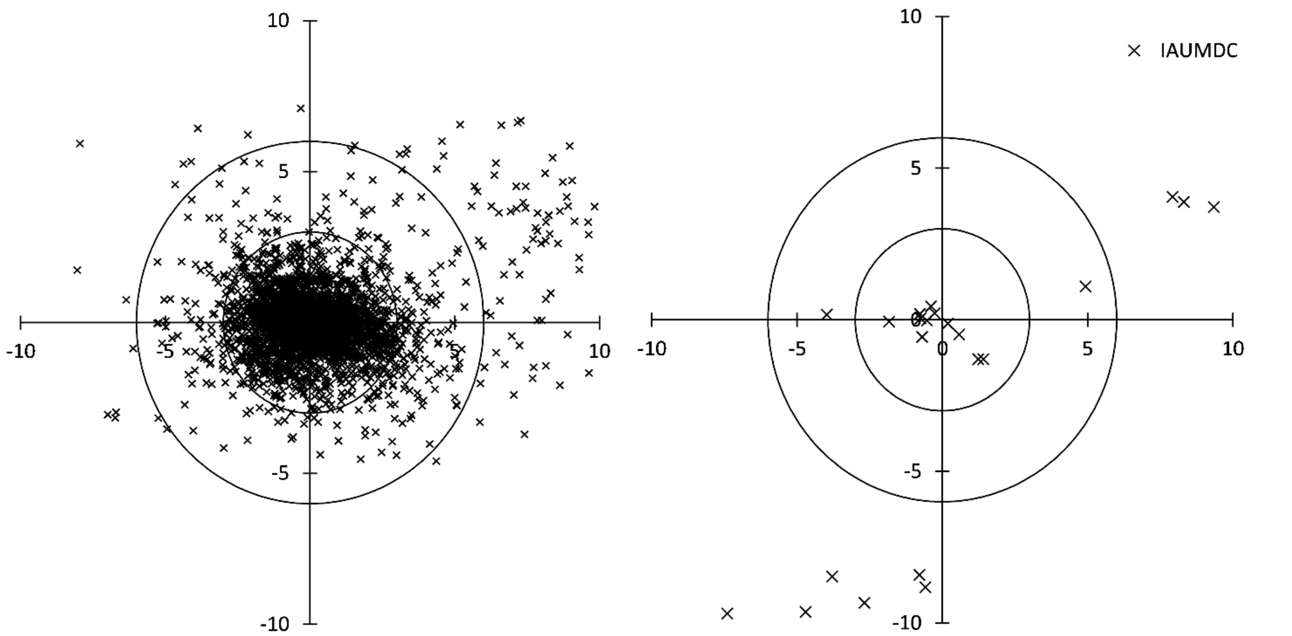


Figure 1 – The radiant distribution around the median value of the SIA orbits classified by EDMOND (Table 1). The y-axis runs through the ecliptic longitude line. At left: EDMOND video meteors classified as SIA. At right: The meteor showers in the same area during the minimum and the maximum λ_O for the EDMOND meteors (Table 1).

[1] "IAU Meteor Data Center website". https://www.ta3.sk/IAUC22DB/MDC2007/

Table 1 – The statistics for the SIA, ZCS and ZTA as like originally classified in EDMOND. The stream codes are followed by their total number of classified meteors.

Stream		λ⊙	α	δ	λ–λ⊙	β	v_g	e	q	i	ω	Ω
_J8_SIA	min	118.9	332.9	-21.2	185.4	-12	27.9	0.813	0.027	0.8	100	298.9
2915	max	146.7	345.2	-9.7	216.1	-0.3	41.8	0.997	0.45	41.2	164.9	326.7
	median	128.1	340.5	-16.2	208	-7.4	39.6	0.963	0.086	25	150	308.1
	mean	128.3	340.4	-16.2	207.6	-7.3	39.1	0.958	0.095	24.3	148.9	308.3
	sd	3.6	2.5	1.4	2.8	1.4	2.2	0.021	0.039	5.4	5.9	3.6
_J8_ZCS	min	98.4	0	36.2	264.7	34.4	46.2	0.18	0.74	93.7	92.6	98.4
2613	max	128.2	360	61.8	290.3	48.7	62.3	1.187	1.017	119.3	193.5	128.2
	median	123.6	25.6	53.5	281.4	40.7	56.9	0.879	0.967	109.1	154.1	123.6
	mean	120.8	45	53.1	280.7	41	56.7	0.855	0.968	108.8	154.9	120.8
	sd	7.1	85.1	3.3	3.4	2.4	2.2	0.139	0.027	3.9	9.4	7.1
_J8_ZTA	min	181	80.1	9.1	230.8	-14.2	54.1	0.259	0.095	141.5	3.9	1
1205	max	210.8	92.3	20.5	269.5	-2.8	72.1	1.307	1.002	174.9	148.4	30.8
	median	202.8	90.2	15.3	247.7	-8.1	65.4	0.891	0.583	163	83.1	22.8
	mean	200.7	89	15.4	248.3	-8	64.9	0.877	0.586	162.8	83	20.7
	sd	5.9	3.2	1.6	4.9	1.6	2.6	0.109	0.131	4.1	18.3	5.9

Table 2 – All entries for the SIA, ZCS and ZTA as listed in the IAUMDC meteor shower list.

Code	α	δ	λ–λ⊙	β	v_g	λ⊙	Δα	Δδ	References
003SIA00	334.7	–14.2	199.7	–3.5	33.8	131.7	1.07	0.18	Cook, 1973
003SIA01	339	–15.6	203.1	–6.3	34.8	131.7			Dutch Meteor Society 2001
003SIA02	332.9	–14.7	200.1	–3.3	30.5	129.5	0.36	–0.14	Brown et al., 2008
003SIA03	337.5	–13.3	198.7	–3.6	28.9	135.6			Jenniskens et al., 2017
444ZCS00	6.9	50.7	277.8	42.8	57.3	113.2	1.4	0.5	Segon et al., 2012
444ZCS01	5.9	50.5	277	43	57.4	113.1			Zoladek and Wisniewski 2012
444ZCS02	3.1	49.5	278.3	43.1	57.1	109	0.95	0.4	Jenniskens et al.,2016
444ZCS03	5.1	50.2	277.8	43	57.1	111.5			Jenniskens et al., 2017
226ZTA00	86.1	14.7	250.2	–8.7	67.2	196			Jenniskens, 2006
226ZTA01	71.5	28.2	240.2	5.8	56.5	193.5			Sekanina, 1976
226ZTA02	79.7	12.2	236.7	–10.9	60.6	203	0.8	–0.8	Molau and Rendtel, 2009

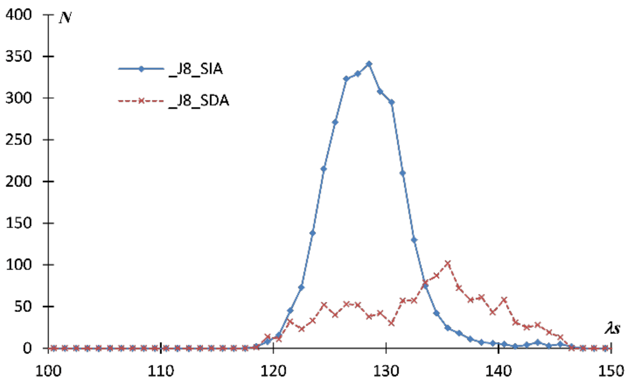


Figure 2 – The activity profiles for SIA and SDA obtained from EDMOND. The y-axis represents the observed meteor number for each bin of 1° in λ⊙. SIA: diamonds with solid blue line, SDA: crosses with broken red line.

Figure 1 (left) shows the radiant distribution of the SIA meteors as classified by EDMOND and *Figure 1 (right)* displays the active IAUMDC showers (see also *Table 3* for the positions). The activity period and the center of this period are these taken for the SIA's of EDMOND; the median values are listed in *Table 1*. *Table 1* shows that EDMOND defines the start of the SIA activity at $\lambda_\odot$ = 118.9° and the end at $\lambda_\odot$ = 146.7° with the peak activity (median) at $\lambda_\odot$ = 128.1°, the average and the standard deviation (sd) being respectively $\lambda_\odot$ = 128.3° and sd = 3.6. We can easily see from the radiant distribution of *Figure 1 (right)* that the EDMOND's SIA activity represents the SDA activity.

We can conclude that the EDMOND's SIA meteors are misclassified SDA meteors mainly by the activity profiles (*Figure 2*). The SDA activity profile looks crippled by the contamination with incorrect SIA identifications. The author described the SDA activity profiles for both CAMS and SonotaCo net and these are very similar with a maximum around $\lambda_\odot$ = 125°, but not later than $\lambda_\odot$ = 130° as suggested by EDMOND.

Table 3 – IAU showers plotted in Figure 1 (right): x, y and r indicate each shower position in Figure 1 (right) in degrees.

Stream	$\lambda_\odot$	v_g	x	y	r
183PAU0	123.7	40.5	–0.59	–8.81	8.83
183PAU3	123.7	44.1	–7.4	–9.68	12.18
5SDA0	125.6	40.5	–3.97	0.17	3.97
5SDA4	126.5	40.8	–0.69	–0.56	0.89
5SDA6	126.5	41.1	–1.83	–0.06	1.83
183PAU1	126.5	44.1	–4.71	–9.63	10.72
5SDA2	126.7	41.01	–0.39	0.45	0.59
5SDA9	126.8	40.6	–0.75	0.05	0.75
5SDA1	127.2	40.2	–0.53	–0.02	0.53
5SDA8	128	41.3	–0.76	0.2	0.79
5SDA5	128.2	40.8	–0.26	0.22	0.34
3SIA2	129.5	30.5	7.93	4.06	8.9
5SDA7	129.7	39.4	0.58	–0.48	0.75
3SIA0	131.7	33.8	8.31	3.89	9.18
3SIA1	131.7	34.8	4.93	1.1	5.05
183PAU2	133.2	42.8	–3.79	–8.46	9.27
183PAU5	135.1	42.4	–2.68	–9.33	9.7
3SIA3	135.6	28.9	9.35	3.72	10.06
183PAU4	136	43.8	–0.79	–8.41	8.45
640AOA0	137	38.2	1.24	–1.29	1.79
640AOA1	140.5	37.8	1.42	–1.29	1.92
505AIC0	145.4	37.24	0.2	–0.12	0.23

3 Zeta Cassiopeiids (ZCS#444)

The statistics of EDMOND's ZCS meteors given in *Table 1* are quite different from the four entrees in the IAUMDC list (*Table 2*). EDMOND situates the main ZCS activity later than $\lambda_\odot = 120$, although the four entrees in the IAUMDC clearly show that it occurs around $\lambda_\odot = 110$.

Figure 3 shows the radiant distribution for the ZCS orbits similar to *Figure 1*. *Figure 3 (left)* is centered at the median value of EDMOND's ZCS but the primary ZCS radiants suggested by IAUMDC list are located at the upper right of the center. Although the PER radiant is not included in *Figure 3 (right)* or *Table 4*, the concentration of radiants is mainly related to PER. *Figure 3 (right)* and *Table 4* represent the positions of the radiants at their maximum and the PER radiant reaches its maximum much later than the limit of the ZCS-activity defined by EDMOND.

The activity profile obtained from the EDMOND ZCS orbits is curious (*Figure 4*). The activity is ascending after $\lambda_\odot = 120°$. On the other hand, the activity of the PER orbits is cut off before $\lambda_\odot = 127°$. When we connect the curves of ZCS and PER, the profile of PER would be natural. The PER-activity starts after $\lambda_\odot = 120°$ and the number of PER orbits increases gradually and does not burst out after $\lambda_\odot = 128°$ as EDMOND suggests. We find that the real ZCS activity occurs around $\lambda_\odot = 110°$ with a small peak as shown in *Figure 4*.

Table 4 – IAU showers plotted in Figure 3 (right).

Stream	$\lambda_\odot$	v_g	x	y	r
507UAN2	108.8	59.7	–3.72	–6.35	7.35
444ZCS2	109	57.1	2.26	2.49	3.37
444ZCS3	111.5	57.1	2.63	2.4	3.56
549FAN1	112	60.2	–4.1	–5.75	7.06
444ZCS1	113.1	57.4	3.21	2.4	4.01
444ZCS0	113.2	57.3	2.65	2.2	3.44
549FAN0	114	60.1	–2.74	–5.85	6.46
549FAN2	116.8	59.2	–3.85	–6.47	7.53
869UCA0	124.9	53.5	4.15	8.84	9.77

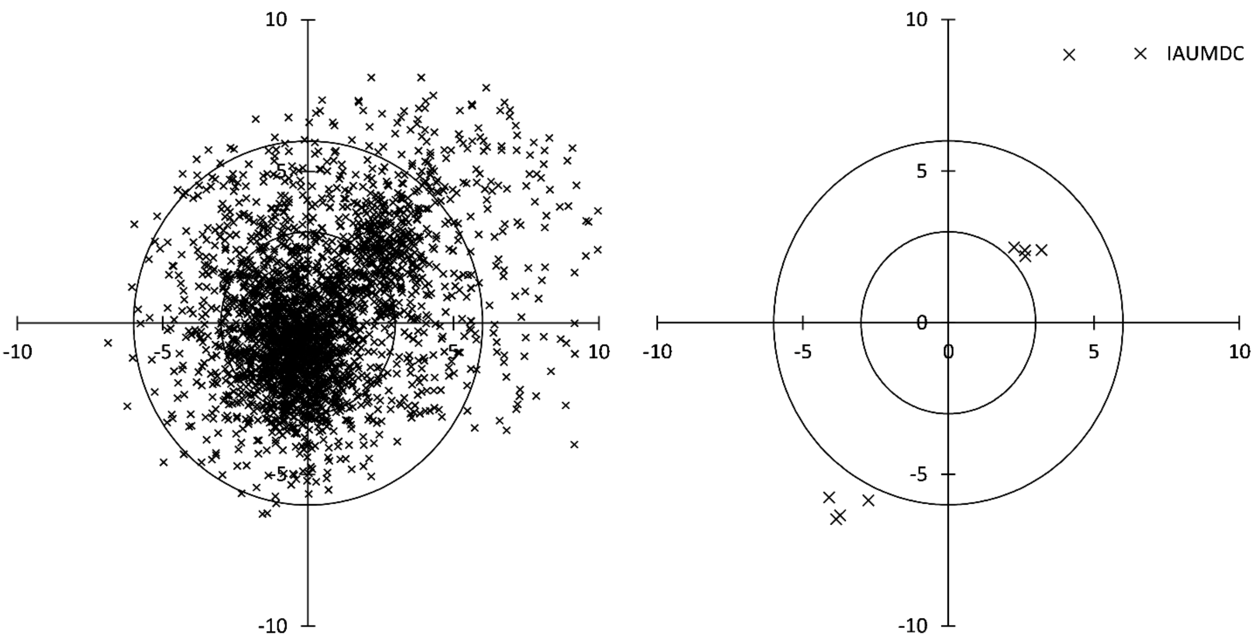


Figure 3 – The radiant distribution around the median value of the ZCS orbits classified by EDMOND (Table 1). The y-axis runs through the ecliptic longitude line. At left: EDMOND video meteors classified as ZCS. At right: the meteor showers in the same area during the minimum and the maximum $\lambda_\odot$ of EDMOND meteors (Table 1).

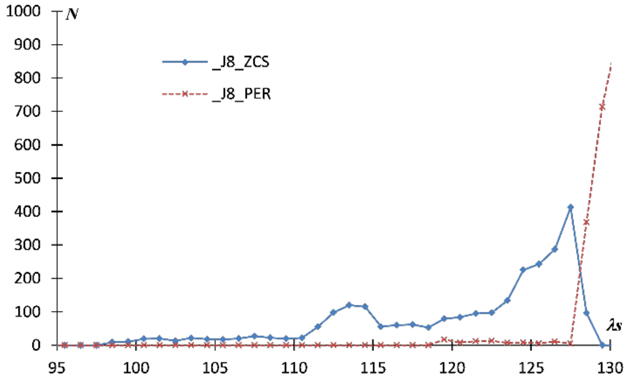


Figure 4 – The activity profiles of ZCS and PER as given by EDMOND. The y axis represents the observed meteor number for each bin of 1° in λ⊙. ZCS: diamonds with solid blue line, PER: crosses with broken red line.

4 Zeta Taurids (ZTA#226)

Figure 6 shows the radiant distribution of ZCS orbits similar to *Figure 1*. Only one ZTA radiant (ZTA0) is shown in *Table 5*, although three ZTA orbits are listed in the IAUMDC list but these are very different from each other (*Table 2*). *Figure 6 (right)* suggests that the ZTA radiant is very near to the ORI radiant. The author reminds that the meteor activity during the early Orionid activity is very complex (*Figure 23b* of Koseki, 2018). It is very difficult to distinguish nu Eridanids (NUE#337), September omicron Orionids (SOO#479), the early Orionids (ORI#008) and sporadics. The confusion with ZTAs in the IAUMDC list seems to be influenced by these circumstances. EDMOND's ZTA activity is much affected by the Orionids and its profile (*Figure 5*) shows the peak activity about 10 degrees later in solar longitude compared with ZTA0 in *Table 2*.

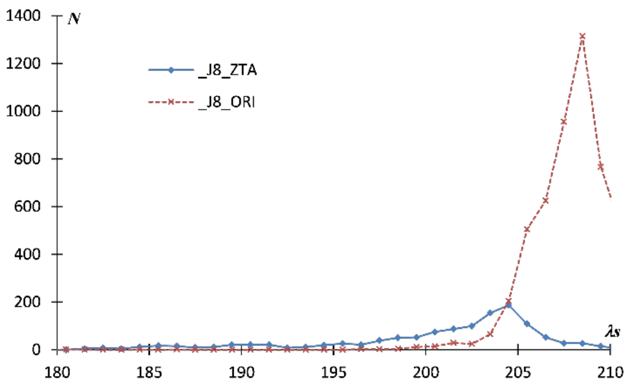


Figure 5 – The activity profiles of ZTA and ORI as given by EDMOND. The y axis represents the observed meteor number for each bin of 1° in λ⊙. ZTA: diamonds with solid blue line, ORI: crosses with broken red line.

Table 5 – IAU showers drawn in Figure 6 (right).

Stream	λ⊙	v_g	x	y	r
337NUE3	181.4	66.6	–9.27	–9.9	13.57
479SOO0	185.6	67.6	–5.83	–2.91	6.52
479SOO1	185.7	66.87	–6.77	–4.5	8.13
479SOO2	187	67.6	–6.15	–2.63	6.69
820TRD0	192.4	60.9	9.95	–1.65	10.09
226ZTA0	196	67.2	–2.45	–0.62	2.53
718XGM0	206	68.1	–3.09	–2.51	3.98
8ORI3	207.5	66.4	0.63	0.21	0.66
8ORI4	207.9	66.2	0.26	0.24	0.35
8ORI5	208	65.4	0.34	–0.06	0.35
8ORI0	208.6	66.2	1.06	0.63	1.24
8ORI1	208.7	66.53	1.83	0.61	1.93
936STO0	208.8	50.79	1.04	0.59	1.19
8ORI6	209	66.3	0.97	0.45	1.07
8ORI2	209.8	66.4	1.4	0.87	1.64
8ORI7	210.6	66.3	1.2	0.31	1.24

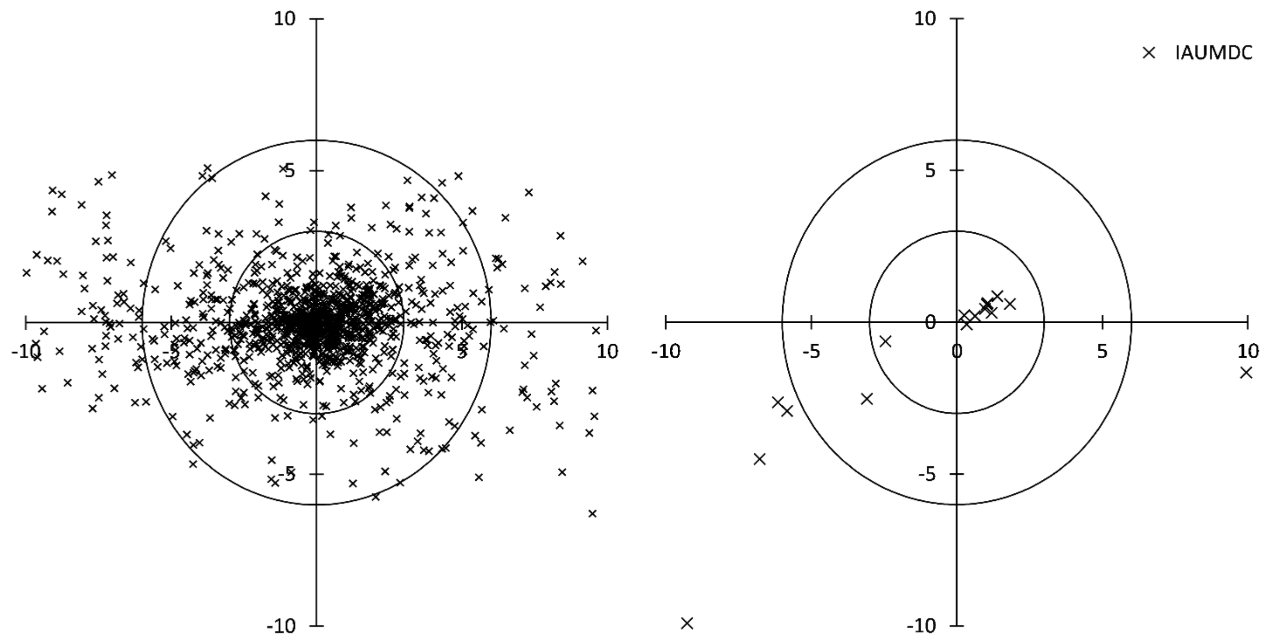


Figure 6 – The radiant distribution around the median point of the ZTA orbits classified by EDMOND (Table 1). The y-axis runs through the ecliptic longitude line. At left: EDMOND video meteors classified as ZTA. At right: the meteor showers in the same area during the minimum and the maximum λ⊙ of EDMOND meteors (Table 1).

Table 6 – The statistics of SDA: the first line (_J8_SDA) shows the EDMOND results and the lower lines the SonotaCo net results. The numbers of identified SDA meteors are_J8_SDA=1211 and _J5_sdA=2486.

Stream		$\lambda_\odot$	α	δ	$\lambda-\lambda_\odot$	β	v_g	e	q	i	ω	Ω
_J8_SDA	min	119	330.6	–22.5	198.1	–12.6	31.7	0.868	0.019	8.3	129.5	299
_J5_sdA		108.6	325.5	–23.9	197	–11.5	31.7	0.88	0.033	7.5	125.9	288.6
	max	145.2	355.9	–7.8	213.3	–3.3	47.2	1.028	0.237	51.1	164.8	325.2
		155	358.9	–5.9	214.1	–3.9	47.1	1.024	0.247	55.6	161	335
	median	133.8	346	–15	207.6	–7.9	39.3	0.96	0.094	26.1	148.7	313.8
		128.7	341.4	–16	207.9	–7.6	39.9	0.965	0.087	25.9	149.8	308.7
	mean	133	345	–14.9	207.5	–7.9	39.8	0.961	0.095	26.4	148.6	313
		129.7	342	–15.9	207.7	–7.6	39.7	0.963	0.09	25.8	149.3	309.7
	sd	6.3	5.2	2.1	2	1.7	3	0.024	0.032	6	5.1	6.3
		5.3	4.1	1.6	1.9	1.1	1.8	0.016	0.024	4.3	4.1	5.3

Table 7 – The comparison of the statistics of EDMOND with SonotaCo net. The total numbers for each shower are as follows _J8_CAP=2096, _J5_Cap=1077, _J8_ETA=1372, _J5_etA=2755, _J8_LEO=1743, _J5_Leo=3946.

Stream		$\lambda_\odot$	α	δ	$\lambda-\lambda_\odot$	β	v_g	e	q	i	ω	Ω
_J8_CAP	min	114.3	294.7	–18.8	170.2	1.8	17.3	0.584	0.402	1.4	251.9	114.3
_J5_Cap		105.3	291.7	–19.6	165.8	1.5	17.4	0.589	0.393	1.5	245.2	105.3
	max	138.4	317.2	–0.9	189.5	17.2	27.6	1	0.724	14.6	290.3	138.4
		147.7	320.4	1.5	190.3	17	27.6	1.043	0.758	12.1	292.9	147.7
	median	126.8	305.7	–9.5	178.9	9.6	21.9	0.75	0.597	7.1	267.9	126.8
		127.2	305.8	–9.3	178.9	9.7	22.2	0.757	0.596	7.2	267.8	127.2
	mean	126.4	305.7	–9.5	179.3	9.6	22.1	0.752	0.589	7.1	268.7	126.4
		126.2	305.5	–9.5	179.4	9.6	22.4	0.759	0.585	7.2	268.9	126.2
	sd	5.3	3.3	2.2	3	1.9	1.7	0.042	0.05	1.4	6	5.3
		7.3	4.3	2.6	3.5	1.9	1.8	0.045	0.058	1.3	7.1	7.3
_J8_ETA	min	38	329.6	–6.2	286.1	3	52.5	0.585	0.255	152.2	39.7	38
_J5_etA		25.8	0.1	–8.9	280.4	2.6	54	0.552	0.265	154.1	44.7	25.8
	max	68.2	355.9	10.3	300.4	13.9	69.7	1.185	0.791	174	122.6	68.2
		78.4	359.4	13.4	299.3	12.9	73.1	1.489	0.912	173.9	141.6	78.4
	median	46.3	338.3	–0.6	293.3	7.9	65.2	0.923	0.577	163.2	96.1	46.3
		46.2	338.2	–0.7	293.4	7.8	65.8	0.953	0.586	163.5	98	46.2
	mean	47.4	339	–0.3	293.1	7.9	64.9	0.916	0.572	163.2	95	47.4
		47.2	338.5	–0.4	293.2	7.8	65.6	0.954	0.585	163.5	97.7	47.2
	sd	4.7	3.4	1.9	1.4	1	2	0.077	0.061	2	9.5	4.7
		6.1	13.5	2.3	1.8	1.1	1.9	0.09	0.064	2.1	9.2	6.1
_J8_LEO	min	221	141.7	14.1	264.6	5	58.2	0.011	0.808	150	19.6	221
_J5_Leo		211.1	135.9	9.3	262.3	2.9	56.2	0.034	0.642	147.3	9.1	211.1
	max	247.1	164.4	30.6	281.5	16.9	74.2	1.254	0.99	171.6	358	247.1
		257	168.3	33.5	284.1	17.7	77.8	1.583	0.989	175	351.6	257
	median	236	154	21.6	272.3	10.2	69.3	0.791	0.984	162.1	172.2	236
		236.4	154.5	21.5	272.1	10.2	70.3	0.876	0.985	162.3	173.4	236.4
	mean	235.6	153.9	21.8	272.4	10.3	68.8	0.758	0.979	161.9	171.2	235.6
		236.3	154.4	21.5	272.2	10.2	70	0.862	0.978	162.2	172.6	236.3
	sd	4.9	3.3	2.3	2	1.4	2.2	0.179	0.015	2.6	11.9	4.9
		6.7	4.2	2.8	2.5	1.6	2.2	0.175	0.023	2.9	13.9	6.7

5 Discussions

The author showed the problems in the meteor shower definition in CAMS and SonotaCo net (Koseki, 2018). December alpha Draconids (DAD#334) of SonotaCo net are defined too large and, Southern Taurids (STA#002) and Northern Taurids (NTA#017) of CAMS are divided into too many sub showers.

Former days, a photographic meteor was often classified differently; one wrote it as a shower meteor and another as a sporadic. It resulted therefore in unreliable statistics for meteor showers and in some cases a false meteor shower was stated. Nowadays, the abundant video meteor data could mislead a researcher to 'invent' non-existing new showers.

EDMOND defined the SIA, ZCS and ZTA showers incorrectly and, therefore, the statistics for these showers are not suitable to be used as representative references (comparing *Table 1* with *Table 2*). These are conglomerates of some other showers and neighboring strong showers.

It is natural that the statistics of a neighboring shower might be distorted. The statistics of the SDA shower are shown in *Table 6* compared to SonotaCo net's results. The median values of the solar longitude differ by 5.1 degrees and the right ascension by 4.6, although the orbital elements are in good agreement except for the node. The timing of the observations and the radiant position are an important reference for the observers and this discrepancy cannot be disregarded.

These problems in the statistics are not caused by the observational inaccuracy. We compare the statistics of slow and fast meteor showers alpha Capricornids (CAP#001) and Leonids (LEO#013) following Koseki, 2019b in addition to the eta Aquariids (ETA#031), which has the highest SD value (Koseki, 2019a). *Table 7* clearly shows that the EDMOND results fit SonotaCo's, although the velocities of EDMOND are slightly lower than SonotaCo's. The author concluded that SonotaCo net data are accurate enough compared with CAMS.

Conclusions

We can use the three databases i.e. EDMOND, SonotaCo net and CAMS as sufficient statistically accurate.

The problems discussed above are not peculiar to EDMOND but databases have these problems commonly including the IAUMDC meteor shower list. We should be careful to use the results of the classification. It is noteworthy to note that the first lines of each IAUMDC meteor showers are not always representative.

Acknowledgment

EDMOND[2] includes: BOAM (*Base des Observateurs Amateurs de Meteores, France*), CEMeNt (*Central European Meteor Network, cross-border network of Czech and Slovak amateur observers*), CMN (*Croatian Meteor Network or HrvatskaMeteorskaMreza, Croatia*), FMA (*Fachgruppe Meteorastronomie, Switzerland*), HMN (*HungarianMeteor Network or Magyar Hullocsillagok Egyesulet, Hungary*), IMO VMN (*IMO Video Meteor Network*), MeteorsUA (*Ukraine*), IMTN (*Italian amateur observers in Italian Meteor and TLE Network, Italy*), NEMETODE (*Network for Meteor Triangulation and Orbit Determination, United Kingdom*), PFN (*Polish Fireball Network or Pracownia Komet i Meteorow, PkiM, Poland*), Stjerneskud (*Danish all-sky fireball cameras network, Denmark*), SVMN (*Slovak Video Meteor Network, Slovakia*), UKMON (*UK Meteor Observation Network, United Kingdom*).

References

Koseki M. (2016). "Research on the IAU meteor shower database". *WGN, Journal of the International Meteor Organization*, **44**, 151–169.

Koseki M. (2018). "Different definitions make a meteor shower distorted. The views from SonotaCo net and CAMS". *WGN, Journal of the International Meteor Organization*, **46**, 119–135.

Koseki M. (2019a). "Showers of the IAU Meteor Data Center in the video data of SonotaCo: a simple and clear criterion for grading meteor showers". *WGN, Journal of the International Meteor Organization*, **47**, 7–17.

Koseki M. (2019b), "EDMOND and SonotaCo net". *eMetN*, **4**, 220–224.

[2] https://fmph.uniba.sk/microsites/daa/daa/veda-a-vyskum/meteory/edmond/

July 2019 report CAMS BeNeLux

Paul Roggemans

Pijnboomstraat 25, 2800 Mechelen, Belgium
paul.roggemans@gmail.com

A summary of the activity of the CAMS BeNeLux network during the month of July 2019 is presented. July 2019 offered exceptional many clear nights resulting in 13243 multiple station meteors, with a new record number for the month of July of 4139 orbits obtained by the network.

1 Introduction

During the first seven years of the CAMS BeNeLux network the month of July often proved rather unfavorable for astronomical observations. The still short nights with only 5 to 6 hours of observing time are easily ruined by bad weather. The overall meteor activity increases significantly during this month with some well-established showers late July while Perseid activity becomes clearly visible. Until now, July 2018 was the best month of July for our CAMS network, what would July 2019 bring?

2 July 2019 statistics

CAMS BeNeLux collected 13243 multi-station meteors, good for 4139 orbits. These are the best results ever for a month of July.

July 2019 offered the same number of nights with clear sky as July 2018. More than half of all July nights were almost completely clear nights for the network, with most of the other nights offering reasonable chances to collect multiple station meteors under partial clear sky. All nights allowed to register meteors except 13–14 July. That night was too bad to have any single orbit. 17 nights had more than 100 orbits, 9 nights had more than 200 orbits. July 29–30 was most successful with as many as 504 orbits, a record so far for a July night. The statistics of July 2019 are compared in *Figure 1* and *Table 1* with the same month in previous years since the start of CAMS BeNeLux in 2012. In 8 years, 191 July nights allowed to obtain orbits with a grand total of 14640 orbits collected during this month in all these years.

The CAMS network suffered significant less technical problems than last year. Some cameras were temporary unavailable due to malfunctioning framegrabbers (EzCap) and some data was lost due to a phenomenon that we call “shuttered meteors”, fragments of detected meteors that fail to get recorded resulting in an incorrect duration and therefore erroneous velocity determination. It is not clear what caused this relative new phenomenon which occurs at stations that got a more recent version of CAMS.

BeNeLux CAMS network had a last major expansion in 2017. Unfortunately, the strategic important CAMS station Ooltgenplaat quit in June 2018 after fire damage. Finally, some more new cameras were added to the network. *Jean-Marie Biets* added a new camera (379) at Wilderen, Belgium. *Adriana and Paul Roggemans*, with the help of *Guiseppe Canonaco* and *Denis Vida* installed another RMS on the building of Cosmodrome in Genk, Belgium, while the existing new RMS cameras 3830 in Mechelen and especially the 3814 in Grapfontaine, Belgium, continued to provide plenty of multiple station data with a top score of 839 orbits in Grapfontaine!

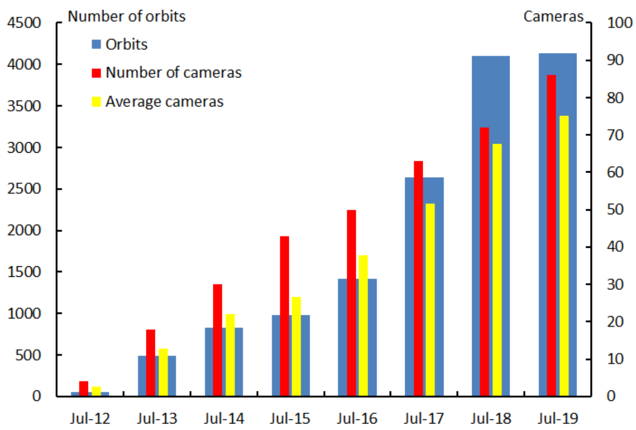


Figure 1 – Comparing July 2019 to previous months of July in the CAMS BeNeLux history. The blue bars represent the number of orbits, the red bars the maximum number of cameras running in a single night and the yellow bar the average number of cameras running per night.

Table 1 – July 2019 compared to previous months of July.

Year	Nights	Orbits	Stations	Max. Cams	Min. Cams	Mean Cams
2012	7	49	4	4	-	2.6
2013	22	484	10	18	-	12.9
2014	19	830	14	30	-	22.0
2015	28	976	15	43	-	26.7
2016	28	1420	18	50	10	37.9
2017	27	2644	20	63	30	51.6
2018	30	4098	19	72	59	67.7
2019	30	4139	21	86	63	75.2
Total	191	14640				

Altogether at best 86 cameras were available this month, 63 of which functioned all nights thanks to AutoCams. On average 87% of all operational cameras were active, against 94% one year ago.

The few new RMS cameras installed in Genk, Grapfontaine and Mechelen contributed large numbers of multiple station events. The coverage of the atmosphere over Belgium improved tremendously, especially the south-eastern part and Luxembourg. With all stations in Belgium functioning 7/7 with AutoCams, the region of interest to have common events between the video data of CAMS and the radio echoes of BRAMS improved a lot. *Table 2* lists the 20 best performing cameras in the network in terms of orbits. The monster scores of the RMS cameras are remarkable, taking into account that the 3815 and 3830 functioned less nights than most other cameras. Although the scores are good in terms of orbits and the quality of the orbits proves to be very good, still the RMS cameras suffer too often technical problems, either due to the RPi or due to network problems.

Table 2 – Comparing RMS cameras among the twenty cameras of the CAMS BeNeLux network with the best score in terms of orbits during July 2019.

Camera	Total orbits	Total nights
003814 (RMS, Grapfontaine, BE)	**839**	**31**
003830 (RMS, Mechelen, BE)	**353**	**18**
003900 (Watec, Nancy, FR)	332	31
000384 (Watec, Mechelen, BE)	290	31
000394 (Watec, Dourbes, BE)	280	31
000399 (Watec, Mechelen, BE)	278	31
000391 (Watec, Mechelen, BE)	274	31
000395 (Watec, Dourbes, BE)	274	31
003815 (RMS, Genk, BE)	**268**	**13**
000383 (Watec, Mechelen, BE)	259	31
000814 (Watec, Grapfontaine, BE)	251	30
000809 (Watec, Mechelen, BE)	242	31
000815 (Watec, Grapfontaine, BE)	225	30
000390 (Watec, Mechelen, BE)	218	31
000388 (Watec, Mechelen, BE)	215	31
000393 (Watec, Ukkel, BE)	214	31
000816 (Watec, Humain, BE)	201	31
000806 (Watec, Zoersel, BE)	192	31
003035 (Watec, Oostkapelle, NL)	187	19
000805 (Watec, Zoersel, BE)	187	31

3 Conclusion

July 2019 became the most successful month of July in the CAMS BeNeLux history as it performed slightly better than July last year.

Acknowledgment

Many thanks to all participants in the CAMS BeNeLux network for their dedicated efforts. The data on which this report is based has been taken from the CAMS website[3]. The CAMS BeNeLux team is operated by the following volunteers:

Hans Betlem (Leiden, Netherlands, CAMS 371, 372 and 373), *Jean-Marie Biets* (Wilderen, Belgium, CAMS 379, 380, 381 and 382), *Martin Breukers* (Hengelo, Netherlands, CAMS 320, 321, 322, 323, 324, 325, 326 and 327, RMS 328 and 329), *Guiseppe Canonaco* (Genk, RMS 3815), *Bart Dessoy* (Zoersel, Belgium, CAMS 397, 398, 804, 805, 806 and 888), *Jean-Paul Dumoulin and Christian Walin* (Grapfontaine, Belgium, CAMS 814 and 815, RMS 003814), *Luc Gobin* (Mechelen, Belgium, CAMS 390, 391, 807 and 808), *Tioga Gulon* (Nancy, France, CAMS 3900 and 3901), *Robert Haas* (Alphen aan de Rijn, Netherlands, CAMS 3360, 3361, 3362, 3363, 3364, 3365, 3366 and 3367), *Robert Haas* (Texel, Netherlands, CAMS 810, 811, 812 and 813), *Robert Haas / Edwin van Dijk* (Burlage, Germany, CAMS 801, 802, 821 and 822), *Klaas Jobse* (Oostkapelle, Netherlands, CAMS 3030, 3031, 3032, 3033, 3034, 3037, 3038 and 3039) , *Carl Johannink* (Gronau, Germany, CAMS 311, 312, 313, 314, 315, 316, 317 and 318), *Hervé Lamy* (Dourbes, Belgium, CAMS 394 and 395), *Hervé Lamy* (Humain Belgium, CAMS 816), *Hervé Lamy* (Ukkel, Belgium, CAMS 393), *Koen Miskotte* (Ermelo, Netherlands, CAMS 351, 352, 353 and 354), *Tim Polfliet* (Gent, Belgium, CAMS 396), *Steve Rau* (Zillebeke, Belgium, CAMS 3850 and 3852), *Paul and Adriana Roggemans* (Mechelen, Belgium, CAMS 383, 384, 388, 389, 399 and 809, RMS 003830), *Hans Schremmer* (Niederkruechten, Germany, CAMS 803) and *Erwin van Ballegoij* (Heesch, Netherlands,CAMS 347 and 348).

[3] http://cams.seti.org/FDL/index-BeNeLux.html

August 2019 report CAMS BeNeLux

Paul Roggemans

Pijnboomstraat 25, 2800 Mechelen, Belgium
paul.roggemans@gmail.com

A summary of the activity of the CAMS BeNeLux network during the month of August 2019 is presented. The CAMS BeNeLux network experienced an exceptional month with favorable weather circumstances. An all-time record number of orbits for a single month was collected in August 2019. As many as 55335 meteors were recorded, 33231 of which proved multiple station, or 60%. A total of 9921 orbits were collected during this month.

1 Introduction

The Perseid month of August remains the favorite observing month for many amateurs. The expectations were tempered for the Perseids 2019 because of the Full Moon on August 15. Luckily, video cameras with a small field of view have very little problem with moonlight and register meteors, even with the moon right in the field of view. Another advantage of Full Moon around the Perseid maximum is that no observing campaigns are planned abroad so that most camera operators stay at home with CAMS as main alternative to monitor the Perseids.

2 August 2019 statistics

CAMS BeNeLux collected 55335 meteors (27917 in August 2018) of which 33231 or 60% were multi-station (15286 and 55% in 2018), good for 9921 orbits (5403 in 2018). This is an absolute record month, improving the previous August record number of 2017 when 8738 orbits were recorded. August 2019 did even better than October 2018 when 9611 orbits were recorded in a single month.

August 2019 counted only 6 nights dominated by clouds, all August nights allowed to register at least some meteors and only 16–17 and 17–18 August remained without orbits. All other nights allowed all CAMS BeNeLux stations to record meteors resulting in hundreds of orbits per night. Four nights had more than 500 orbits and August 13-14 had as many as 1175 orbits.

The statistics of August 2019 are compared in *Figure 1* and *Table 1* with the same month in previous years since the start of CAMS BeNeLux in 2012. In 8 years, 218 August nights allowed to obtain orbits with a grand total of 36330 orbits collected during August during all these years together. The first night of August 2019 was the 2000th night since the start of CAMS BeNeLux that orbits could be collected.

Most camera operators use AutoCams, only some CAMS stations in the Netherlands and Germany do not yet use AutoCAMS. Remote control allows to operate the cameras and to report data during the summer. While the weather was exceptional favorable, more cameras were active than during any month of August in the past. August 2018 had to do with a maximum of 72 cameras, 62.4 on average. This year as many as 87 cameras were operational at maximum, 79 on average. Especially the RMS cameras scored huge numbers of orbits. Their larger field of view with still a very good resolution provides overlap with many of the small FoV Watecs at most CAMS stations.

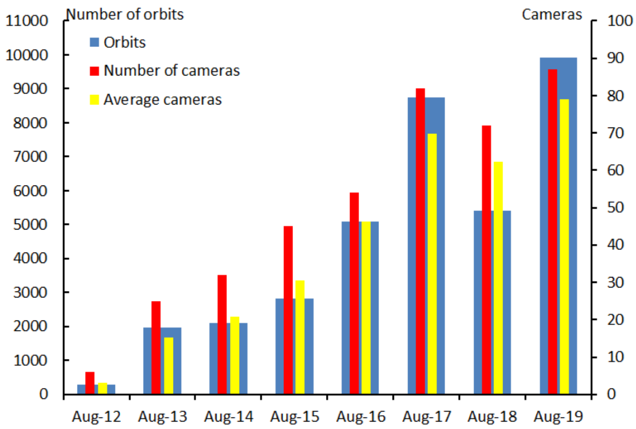


Figure 1 – Comparing August 2019 to previous months of August in the CAMS BeNeLux history. The blue bars represent the number of orbits, the red bars the maximum number of cameras running in a single night and the yellow bar the average number of cameras running per night.

Table 1 – August 2019 compared to previous months of August.

Year	Nights	Orbits	Stations	Max. Cams	Min. Camas	Mean Cams
2012	21	283	5	6		3.2
2013	27	1960	13	25		15.3
2014	28	2102	14	32		20.8
2015	25	2821	15	45		30.4
2016	30	5102	20	54	15	46.2
2017	28	8738	21	82	45	69.9
2018	30	5403	19	72	56	62.4
2019	29	9921	23	87	65	79.0
Total	218	36330				

An extra RMS camera (3831) was installed in Mechelen, pointed low towards Luxembourg to give extra coverage on the south-eastern part of the network. It is worthwhile to look at the number of orbits collected with these RMS cameras, compared to the Watecs in the CAMS BeNeLux network. The 20 best scoring cameras are listed in *Table 2*.

Table 2 – Comparing RMS cameras among the twenty cameras of the CAMS BeNeLux network with the best score in terms of orbits during August 2019.

Camera	Total orbits	Total nights
003814 (RMS Grapfontaine, BE)	**1672**	**31**
003830 (RMS Mechelen, BE)	**971**	**31**
003815 (RMS Genk, BE)	**828**	**30**
003900 (Watec, Nancy, FR)	715	31
000384 (Watec, Mechelen, BE)	679	31
000394 (Watec, Dourbes, BE)	671	31
000399 (Watec, Mechelen, BE)	643	31
000329 (RMS, Hengelo, NL)	**621**	**28**
000391 (Watec, Mechelen, BE)	607	31
000388 (Watec, Mechelen, BE)	579	31
000380 (Watec, Wilderen, BE)	565	31
000353 (Watec, Ermelo, NL)	559	26
000395 (Watec, Dourbes, BE)	553	31
000390 (Watec, Mechelen, BE)	552	31
000383 (Watec, Mechelen, BE)	550	31
000806 (Watec, Zoersel, BE)	541	31
000814 (Watec, Grapfontaine, BE)	531	31
003035 (Watec, Oostkapelle, NL)	520	26
000809 (Watec, Mechelen, BE)	493	31
000393 (Watec, Ukkel, BE)	485	31

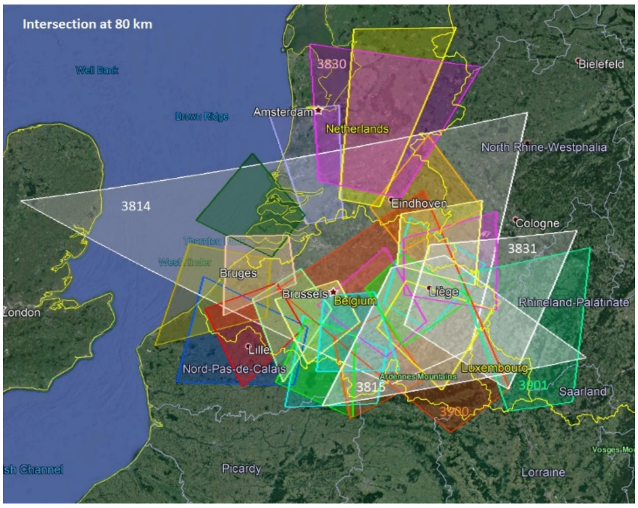


Figure 2 – RMS camera fields intersected at 80 km compared with a number of Belgian and French Watecs'FoV.

3 Conclusion

August 2019 counted exceptional many favorable nights for the CAMS BeNeLux network. In spite of the Full Moon on August 15, a record number of orbits were collected making August 2019 the best month ever since the start of the network.

Acknowledgment

Many thanks to all participants in the CAMS BeNeLux network for their dedicated efforts. The data on which this report is based has been taken from the CAMS website[4]. The CAMS BeNeLux team is operated by the following volunteers:

Hans Betlem (Leiden, Netherlands, CAMS 371, 372 and 373), *Jean-Marie Biets* (Wilderen, Belgium, CAMS 379, 380, 381 and 382), *Martin Breukers* (Hengelo, Netherlands, CAMS 320, 321, 322, 323, 324, 325, 326 and 327, RMS 328 and 329), *Guiseppe Canonaco* (Genk, RMS 3815), *Bart Dessoy* (Zoersel, Belgium, CAMS 397, 398, 804, 805, 806 and 888), *Jean-Paul Dumoulin and Christian Walin* (Grapfontaine, Belgium, CAMS 814 and 815, RMS 003814), *Luc Gobin* (Mechelen, Belgium, CAMS 390, 391, 807 and 808), *Tioga Gulon* (Nancy, France, CAMS 3900 and 3901), *Robert Haas* (Alphen aan de Rijn, Netherlands, CAMS 3360, 3361, 3362, 3363, 3364, 3365, 3366 and 3367), *Robert Haas* (Texel, Netherlands, CAMS 810, 811, 812 and 813), *Robert Haas / Edwin van Dijk* (Burlage, Germany, CAMS 801, 802, 821 and 822), *Klaas Jobse* (Oostkapelle, Netherlands, CAMS 3030, 3031, 3032, 3033, 3034, 3037, 3038 and 3039) , *Carl Johannink* (Gronau, Germany, CAMS 311, 312, 313, 314, 315, 316, 317 and 318), *Hervé Lamy* (Dourbes, Belgium, CAMS 394 and 395), *Hervé Lamy* (Humain Belgium, CAMS 816), *Hervé Lamy* (Ukkel, Belgium, CAMS 393), *Koen Miskotte* (Ermelo, Netherlands, CAMS 351, 352, 353 and 354), *Tim Polfliet* (Gent, Belgium, CAMS 396), *Steve Rau* (Zillebeke, Belgium, CAMS 3850 and 3852), *Paul and Adriana Roggemans* (Mechelen, Belgium, CAMS 383, 384, 388, 389, 399 and 809, RMS 003830 and 003831), *Hans Schremmer* (Niederkruechten, Germany, CAMS 803), *Erwin van Ballegoij* (Heesch, Netherlands,CAMS 347 and 348) and Marco van der Weide (Hengelo, Netherlands, CAMS 3110).

[4] http://cams.seti.org/FDL/index-BeNeLux.html

The UAEMMN: A prominent meteor monitoring system in the Gulf Region

Dr. Ilias Fernini[1], Aisha Alowais[2], Mohammed Talafha[2], Maryam Sharif[2], Yousef Eisa[2], Masa Alnaser[2], Shahab Mohammad[2], Akhmad Hassan[2], Issam Abujami[2], Ridwan Fernini[2] and Salma Subhi[2]

[1] **Deputy Director of the Research Laboratories and Observatory at SAASST and Associate Professor at the Applied Physics & Astronomy Department at the University of Sharjah, United Arab Emirates**

[2] **Sharjah Academy for Astronomy, Space Sciences and Technology, United Arab Emirates**
aalowais@sharjah.ac.ae, mtalafha@sharjah.ac.ae

An introduction of the United Arab Emirates Meteor Monitoring Network (UAEMMN) and its equipment is presented.

1 Introduction

Monitoring meteors is an activity that has been practiced ever since human beings lived on planet Earth. Only those who dared to look up at the sky and contemplate them noticed the flashing meteors and questioned them for so long until science solved the mystery. Meteors were previously observed only by naked eyes, until the 1940s when radar meteor observations became possible and huge investments in meteor cameras were made to study the risks of collisions with meteoroids for space exploration. Today, hundreds of meteor monitoring stations are up and running in different parts of the world. In the Gulf region, meteor observations have been done on a small scale by the United Arab Emirates Astronomical Camera Network for the study of meteor showers since Sept. 2016 (e.g., Jenniskens and Odeh, 2017; Jenniskens et al., 2018; 2019).

By considering both the danger and the value of a meteorite when it lands on the Earth surface, the Sharjah Academy for Astronomy, Space Sciences, and Technology established the United Arab Emirates Meteor Monitoring Network (UAEMMN). The network is funded by the UAE Space Agency, and it started operating with only one camera station in September 2018.

2 UAEMMN camera stations' locations

To ensure having the right observing conditions, a clear sky site must be selected. The first camera station was built at the academy for one main reason: to have a nearby camera station for easy access and perform initial tests before installing the remaining camera stations in remote locations. The first, second, and third camera station were installed at Sharjah ($\varphi = 25.235611°$ N, $\lambda = 55.539645°$ E), Al-Ain ($\varphi = 24.285922°$ N, $\lambda = 55.463625°$ E), and Liwa ($\varphi = 23.104722°$ N, $\lambda = 53.754828°$ E), respectively. The location of the last two camera stations was provided by the National Centre for Meteorology and Seismology (NCMS). Furthermore, the selected sites were based on an STK simulation to maximize the coverage of the UAE sky (*Figure 1*).

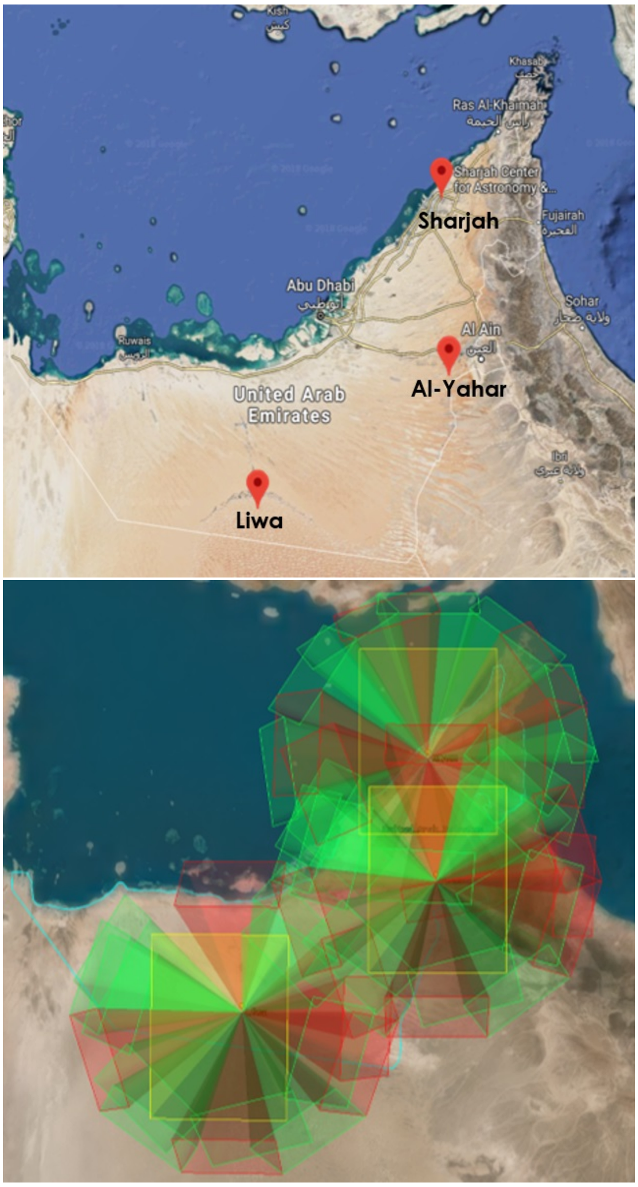


Figure 1 – UAEMMN camera stations' locations (top) based on STK simulation (bottom).

3 The camera stations

Seventeen cameras of different lens types (2 mm, 6 mm, and 8 mm) were mounted at the top of each camera mounting. The 6 mm and 8 mm lenses are used to observe distant meteors and fireballs, while the 2 mm is placed at the center of the camera orientation ring to have an all-sky full-view (360 degrees) of the sky. This combination of lenses provides a convenient and sufficient sky coverage as the 8 mm lens covers an area of 884 square degrees of the sky, and the 6 mm covers 1523 square degrees as shown in *Figure 2*. *Figure 3* illustrates the camera orientation, a critical element which distinguishes the UAEMMN from other meteor monitoring stations. From September 2018 until September 2019, the UAEMMN camera stations were able to detect more than 12000 meteors. *Figure 4* shows a bright meteor captured on the 20th of September 2019 by the Liwa camera station at 4^h59^m a.m. (local time) or 0^h59^m UTC.

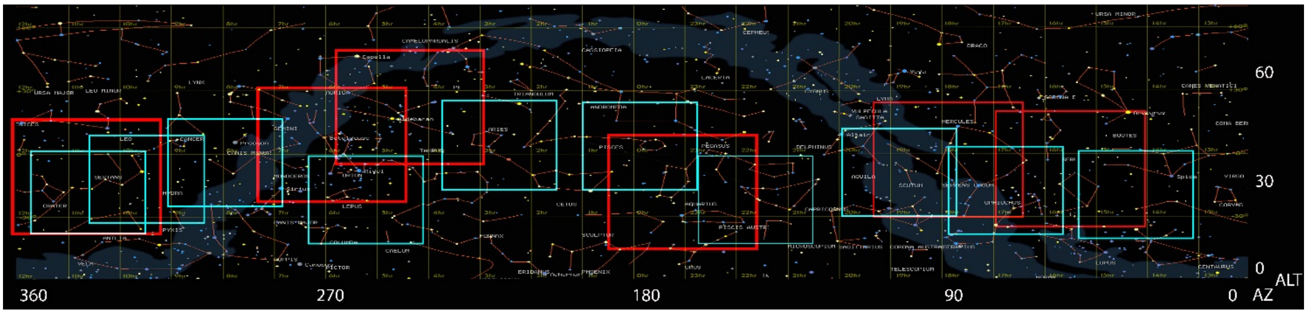


Figure 2 – Red squares represent 6 mm sky coverage, while the blue ones represent the 8 mm sky coverage.

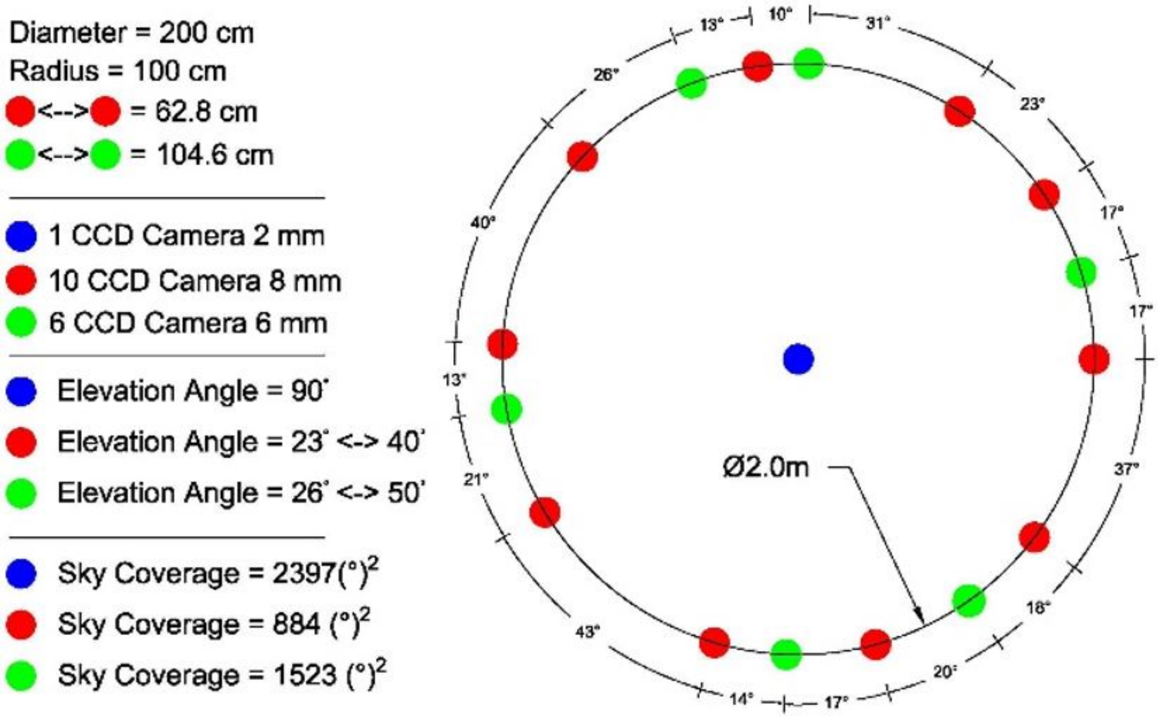


Figure 3 – Camera orientation.

Figure 4 – A bright meteor captured by the Liwa camera station on the 20th of September 2019.

References

Jenniskens P., Odeh M. (2017). "Alpha Monocerotids 2017". *CBET*, **4457**. D. W. E. Green (ed.), IAU Central Bureau Electronic Telegrams.

Jenniskens P., Baggaley J., Crumpton I., Aldous P., Pokorny P., Janches D., Gural P. S., Samuels D., Albers J., Howell A., Johannink C., Breukers M., Odeh M., Moskovitz N., Collison J., Ganju S. (2018). "A survey of southern hemisphere meteor showers". *Planetary & Space Science*, **154**, 21–29.

Jenniskens P., Lyytinen E., Johannink C., and Odeh M. (2019). "Outburst of 15-Bootids meteor shower". *CBET*, **4624**. D. W. E. Green (ed.), Central Bureau for Astronomical Telegrams.

Summer observations 2019

Pierre Martin

Ottowa, Canada

meteorshowersca@yahoo.ca

An overview is given of the 2019 July and August meteor observations by the author, covering the summer meteor showers.

1 2019 July 28–29

Ivan Zuger and I enjoyed a very relaxing camping trip at Bon Echo Provincial Park (about 200 km west of Ottawa), from late July to early August. We had three beautiful clear nights, and I took advantage of the dark remote area to kick off my summer meteor observing campaign. The late July period is always one of my favorites time of the year for meteor activity. Several minor showers are active, the Southern delta Aquariids peak over the span of a few nights and the Perseids start to become quite noticeable. For the first clear night, Ivan and I decided to try out the Irvine Lake airstrip (also known as Nirvana within the local amateur astronomy community), a short few minutes' drive north of the park.

It's been a few years since I've been to this site, and it looked pretty much the same as always… a large, quiet, wide open area with access to the entire sky! The short hill leading up to the airstrip is in need of repairs and must be taken carefully, to avoid scrapping the bottom of the car. Once up, it is very level ground with ample room for many setups. On this night, I had my 12.5" dob to observe deep sky objects in the evening, and then I switched to meteor observing at midnight. The transparency was good (3/5) with a great Milky Way, although a very thin smoke layer affected the sky slightly. I also enjoyed sharp views of Saturn through Ivan's refractor. Then, a very slow grazing meteor came out of the Bootes area, and persisted for several seconds. For the rest of the night, I observed from the comfort of my reclining lawn chair.

In 3.5 hours towards dawn, I saw 93 meteors (27 Southern delta Aquariids, 13 Perseids, 11 alpha Capricornids, 5 Northern delta Aquariids, 4 gamma Draconids, 3 49-Andromedids, 1 Anthelion, 1 phi Piscid and 28 sporadics).

There was several nice meteors, but the highlight was at 2^h57^m am with the –3 yellow-blue alpha Capricornid. It flared twice in Cetus on a long path and left a 3 seconds persistent train.

July 28/29 2019, 04^h00^m – 08^h10^m UT (00^h00^m – 04^h10^m EDT)
Location: Irvine Lake Airstrip, Denbigh, Ontario, Canada (Long: -77 deg 15' 46″ West; Lat: 45 deg 1' 47″ North)

Observed showers:

- gamma Draconids (GDR) – 18:40 (280) +50
- alpha Capricornids (CAP) – 20:10 (303) -10
- Anthelion (ANT) – 21:08 (317) -16
- Northern delta Aquariids (NDA) – 22:07 (332) -04
- Southern Delta Aquariids (SDA) – 22:34 (339) -17
- Piscids Austrinids (PAU) – 22:52 (343) -25
- Perseids (PER) – 01:40 (025) +54
- eta Eridanids (ERI) – 02:04 (032) -17
- 49 Andromedids (FAN) – 02:11 (033) +51
- phi Piscids (PPS) – 02:37 (039) +34
- psi Cassiopeiids (PCA) – 03:00 (045) +75

04^h00^m – 05^h00^m UT (00^h00^m – 01^h00^m EDT); clear; 3/5 trans; F 1.00; LM 6.75; facing S50 deg; t_{eff} 1.00 hr

- SDA: five: +1; +2; +3(2); +5
- PER: five: 0; +2; +3(2); +5
- CAP: four: 0; +3(2); +4
- GDR: two: +2; +4
- NDA: one: +3
- FAN: one: +3
- Sporadics: five: +1; +3; +4; +6(2)
- Total meteors: Twenty-three

05^h26^m – 06^h26^m UT (01^h26^m – 02^h26^m EDT); clear; 3/5 trans; F 1.00; LM 6.75; facing S50 deg; t_{eff} 1.00 hr

- SDA: eight: +1; +2; +3(3); +4; +5; +6
- PER: two: 0; +3
- CAP: two: +1; +5
- GDR: one: +1
- NDA: one: +5
- PPS: one: 0
- Sporadics: eight: +2; +3(2); +4(3); +5; +6
- Total meteors: Twenty-three

06^h26^m – 07^h30^m UT (02^h26^m – 03^h30^m EDT); clear; 3/5 trans; F 1.00; LM 6.75; facing S50 deg; t_{eff} 1.06 hr

- SDA: twelve: +1; +2(4); +3(2); +4(4); +5
- PER: five: +2; +3; +4(2); +5
- CAP: five: -3; +2; +4(2); +5
- NDA: two: +2; +4
- GDR: one: +4
- ANT: one: +2
- FAN: one: +4

- Sporadics: nine: 0; +2; +3; +4(2); +5(3); +6
- Total meteors: Thirty-six

07^h40^m – 08^h10^m UT (03^h40^m – 04^h10^m EDT); clear; 3/5 trans; F 1.00; LM 6.60; facing S50 deg; t_{eff} 0.50 hr

- SDA: two: +2; +4
- PER: one: +2
- NDA: one: +2
- FAN: one: +2
- Sporadics: six: +1(2); +4; +5(3)
- Total meteors: Eleven

2 2019 July 30–31

On the next clear night, we decided to setup on a quiet beach at Bon Echo Park with an open view of the sky. The sky was great, with just some minor low lying fog. The sky further improved late at night, and the summer Milky Way was very impressive with a wealth of structure. It was a very beautiful and peaceful viewing session by the water.

I observed for two and a half hours until dawn and I saw 77 meteors (23 Southern delta Aquariids, 14 Perseids, 5 alpha Capricornids, 4 Anthelions, 4 Northern delta Aquariids, 2 49-Andromedids, 2 phi Piscids, 1 gamma Draconid, 1 eta Eridanid and 21 sporadics).

The highlight was a –4 alpha Capricornid fireball at 3^h07^m am, that travelled slowly through Taurus, and flared. Also noteworthy was the flurry four meteors all within the span of a few seconds, each coming from a different active shower.

July 30/31 2019, 05^h45^m – 08^h20^m UT (01^h45^m – 04^h20^m EDT)
Location: Bon Echo Provincial Park, Ontario, Canada, (Long: -77 deg 12’ 30″ West; Lat: 44 deg 53’ 36″ North)

Observed showers:

- gamma Draconids (GDR) – 18:40 (280) +50
- alpha Capricornids (CAP) – 20:10 (303) -10
- Anthelion (ANT) – 21:08 (317) -16
- Northern delta Aquariids (NDA) – 22:07 (332) -04
- Southern delta Aquariids (SDA) – 22:34 (339) -17
- Piscids Austrinids (PAU) – 22:52 (343) -25
- Perseids (PER) – 01:40 (025) +54
- eta Eridanids (ERI) – 02:04 (032) -17
- 49 Andromedids (FAN) – 02:11 (033) +51
- phi Piscids (PPS) – 02:37 (039) +34
- psi Cassiopeiids (PCA) – 03:00 (045) +75

05^h45^m – 06^h45^m UT (01^h45^m – 02^h45^m EDT); clear; 3/5 trans; F 1.00; LM 6.72; facing SE50 deg; t_{eff} 1.00 hr

- SDA: thirteen: -2; +1; +2(2); +3(3); +4(3); +5(2); +6
- PER: seven: +1; +2(3); +4; +5; +6
- NDA: four: +2; +3; +4; +5
- CAP: two: +5(2)
- ANT: one: +5
- Sporadics: ten +1(2); +2(2); +3; +4; +5(2); +6(2)
- Total meteors: Thirty-seven

06^h45^m – 07^h45^m UT (02^h45^m – 03^h45^m EDT); clear; 3/5 trans; F 1.00; LM 6.78; facing S50 deg; t_{eff} 1.00 hr

- SDA: eight: +3(2); +4(4); +5(2)
- PER: five: 0; +1; +2; +3; +5
- CAP: three: -4; +1; +4
- ANT: two: +2; +3
- FAN: two: +3(2)
- PPS: two: +4; +5
- GDR: one: +1
- Sporadics: five: +2; +4; +5; +6(2)
- Total meteors: Twenty-eight

07^h45^m – 08^h20^m UT (03^h45^m – 04^h20^m EDT); clear; 3/5 trans; F 1.00; LM 6.61; facing S50 deg; t_{eff} 0.58 hr

- SDA: two: +3; +5
- PER: two: +2; +5
- ANT: one: +5
- ERI: one: +5
- Sporadics: six: 0; +2; +5(4)
- Total meteors: Twelve

3 2019 July 31–August 1

For the third night of observing, Ivan and I once again setup on the beach by the water facing the south-east sky. This time, Ivan used a handy folding cart to carry his telescope and gear from the parking lot, over to the beach. We did two short trips, and we used one of the picnic tables there to put all the gear. Once again, the beach was completely quiet and dark. It’s a rare thing to see in a campground that is filled with hundreds of people and yet have such a quiet and secluded area with no one around. There are two other beaches that are much easier to access, busier and more popular, so we avoided them in favor of the quiet spot.

I observed for three hours until dawn and saw 49 meteors (16 Southern delta Aquariids, 11 Perseids, 5 alpha Capricornids, 2 Anthelions, 2 eta Eridanids, 1 gamma Draconid, 1 Northern delta Aquariid, 1 phi Piscid and 10 sporadics).

By far, the big highlight was the spectacular –5 Perseid fireball at 2^h13^m am that shot 40 degrees in the south. It ended with a terminal flash that lit up the sky and left a sharp 12 seconds persistent train!

It felt like a strange night. After a strong first hour (beginning just after 1^h00^m am local time) with 22 meteors, the rest of the night had much slower meteor rates. Sporadic rates were quite weak overall. The big Perseid fireball and the beautiful dark sky by the lake more than made it up for it! The zodiacal light was also easily visible. The night seemed to go by quickly, a sign that it was well enjoyed!

Observation July 31/August 1 2019, 05^h10^m – 08^h35^m UT (01^h10^m – 04^h35^m EDT)

Location: Bon Echo Provincial Park, Ontario, Canada, (Long: -77 deg 12’ 30″ West; Lat: 44 deg 53’ 36″ North).

Observed showers:

- gamma Draconids (GDR) – 18:40 (280) +50
- alpha Capricornids (CAP) – 20:10 (303) -10
- Anthelion (ANT) – 21:08 (317) -16
- Northern delta Aquariids (NDA) – 22:07 (332) -04
- Southern Delta Aquariids (SDA) – 22:34 (339) -17
- Piscids Austrinids (PAU) – 22:52 (343) -25
- Perseids (PER) – 01:40 (025) +54
- eta Eridanids (ERI) – 02:04 (032) -17
- 49 Andromedids (FAN) – 02:11 (033) +51
- phi Piscids (PPS) – 02:37 (039) +34
- psi Cassiopeiids (PCA) – 03:00 (045) +75

05^h10^m – 06^h20^m UT (01^h10^m – 02^h20^m EDT); clear; 3/5 trans; F 1.00; LM 6.73; facing SE50 deg; t_{eff} 1.16 hr

- SDA: ten: +1; +2; +3; +4(3); +5(2); +6(2)
- PER: three: –5; +1; +6
- CAP: three: +2(2); +5
- ANT: two: –1; +6
- NDA: one: +2
- PPS: one: +3
- Sporadics: two: 0; +4
- Total meteors: Twenty-two

06^h45^m – 07^h45^m UT (02^h45^m – 03^h45^m EDT); clear; 3/5 trans; F 1.00; LM 6.75; facing SE50 deg; t_{eff} 1.00 hr

- SDA: four: +2; +3; +4; +6
- PER: four: 0; +1; +3; +4
- ERI: two: 0; +2
- Sporadics: five: +3; +4(2); +5(2)
- Total meteors: Fifteen

07^h45^m – 08^h35^m UT (03^h45^m – 04^h35^m EDT); clear; 3/5 trans; F 1.00; LM 6.47; facing SE50 deg; t_{eff} 0.83 hr

- PER: four: -2; +1; +2; +5
- SDA: two: +1; +4
- CAP: two: +2; +4
- GDR: one: 0
- Sporadics: three: +3; +5; +6
- Total meteors: Twelve

4 2019 August 2–3

On the morning of August 3, I observed at Bootland Farm (located 80 km west of Ottawa) for a couple of hours until morning twilight. It was a warm (20° C), muggy night with lots of mosquitoes. The sky was hazy and covered in a thin veil of forest fire smoke, but clear and decent (limiting magnitude about 6.35). A distant thunderstorm below the southern horizon made its presence known with occasional flashes that eventually subsided.

I saw 33 meteors (9 Southern delta Aquariids, 6 Perseids, 2 alpha Capricornids, 1 gamma Draconid, 1 anthelion and 14 sporadics). A few of the SDAs might have been PAUs since both radiants lined up.

The highlight was the mag +1 anthelion at 4^h14^m am that had a beautiful golden color, and brightened gradually over a 40 degrees path.

I cannot really explain the sharp drop in rates during the second hour, with only half of the numbers seen in the previous hour. Morning twilight had a small effect towards the end but I don’t think it was enough to explain this. Also, I was well awake until the end, so fatigue was not a factor.

Observation August 2/3 2019, 06^h30^m – 08^h30^m UT (02^h30^m – 04^h30^m EDT)

Location: Bootland Farm (Stewartville), Ontario, Canada, (45°23’N 76°29’W).

Observed showers:

- gamma Draconids (GDR) – 18:40 (280) +50
- alpha Capricornids (CAP) – 20:10 (303) -10
- Anthelion (ANT) – 21:08 (317) -16
- Northern delta Aquariids (NDA) – 22:07 (332) -04
- Southern Delta Aquariids (SDA) – 22:34 (339) -17
- Piscids Austrinids (PAU) – 22:52 (343) -25
- Perseids (PER) – 01:40 (025) +54
- eta Eridanids (ERI) – 02:04 (032) -17
- 49 Andromedids (FAN) – 02:11 (033) +51
- phi Piscids (PPS) – 02:37 (039) +34
- psi Cassiopeiids (PCA) – 03:00 (045) +75

06^h30^m – 07^h30^m UT (02^h30^m – 03^h30^m EDT); clear but hazy; 2/5 trans; F 1.00; LM 6.35; facing S55 deg; t_{eff} 1.00 hr

- SDA: seven: +2; +3(2); +4(3); +5
- PER: four: +2; +3(3)
- CAP: one: +2
- Sporadics: ten: +1; +2(3); +3; +4(3); +5(2)
- Total meteors: Twenty-two

07^h30^m – 08^h30^m UT (03^h30^m – 04^h30^m EDT); clear but hazy; 2/5 trans; F 1.00; LM 6.16; facing S55 deg; t_{eff} 1.00 hr

- SDA: two: +5(2)
- PER: two: +1; +2
- GDR: one: +3
- CAP: one: +4
- ANT: one: +1
- Sporadics: four: +1; +4; +5(2)
- Total meteors: Eleven

5 2019 August 4–5

On the night of August 4/5, I returned to Bootland Farm to join Dan Vasiu who was also there to observe meteors. We arrived together at about 11^h pm, near moonset. The sky was much better than the previous session, even though a thin smoke haze was still a bit present. The transparency improved to above-average after midnight.

I observed from 11^h20^m pm to 4^h30^m am (5 hours); a very productive night! I saw 122 meteors (32 Perseids, 20 Southern delta Aquariids, 6 kappa Cygnids, 6 alpha Capricornids, 6 anthelions, 5 Northern delta Aquariids, 3 Piscids Austrinids, 3 eta Eridanids, 3 49-Andromedids and 38 sporadics).

The hourly meteor rates were pretty much what I'd expected for this time of the year; a lot of action all over the sky! Nearly every showers active produced activity. In particular, I was surprised to see the three PAUs. This radiant is so low in the south at best for my latitude, that the sight of these meteors are relatively rare. Many times, they line up with the much more active SDA radiant. However the PAUs I observed were low in the south-east or and moved horizontally with long paths, revealing their identity. The SDAs continued producing steady rates, even a week after they peaked. At 11^h41^m pm, a pair of long SDAs were seen just 2 seconds apart in the same sky area. The PERs started off slowly, but increased late at night with rates around 10/hr.

The brightest meteor was a –2 PER at 2^h26^m am with a terminal flash and a 4 secs train. However the highlight came at 3h38m am with a –1 eta Eridanid (ERI) that shot 30 degrees in the south! It had a vivid orange/blue color and left a 2 secs train. The ERIs are among my favourites of the minor showers. Every August, I am impressed at the brightness and colors of these meteors, including some of the finest earthgrazers that I've seen.

At 3^h06^m am, I saw two satellites moving from north to south, in close proximity high in the south that each brightened dramatically (up to -4) for a brief time. After the flares, the satellites dimmed. I've seen this satellite pair a few times, and the speed and orbit are different than the ISS.

At 3^h45^m am, I felt that the sky was suddenly brighter and looked different, as is a very soft light illuminated the tree line and grass around me. I look up and behind me to the north… and much to me surprise, the aurora borealis was visible! There was a large glow extending from the north-west to the north-east, and several greenish bands within it were developing. For a few minutes, these bands extended more than two-thirds of the way to Polaris! The bands moved, danced and became quite active for a period of about 30 minutes before the display subsided. I certainly didn't expect to see this, and on the next day I realized that a fast-moving stream of solar wind was responsible for this activity.

What a great night!

Observation August 4/5 2019, 03^h20^m – 08^h30^m UT (23^h20^m – 04^h30^m EDT), Location: Bootland Farm (Stewartville), Ontario, Canada, (45°23'N 76°29'W).

Observed showers:

- kappa Cygnids (KCG) – 18:40 (280) +45
- alpha Capricornids (CAP) – 20:38 (309) -08
- Anthelion (ANT) – 21:36 (324) -14
- Northern delta Aquariids (NDA) – 22:33 (338) -02
- Southern Delta Aquariids (SDA) – 23:01 (345) -15
- Piscids Austrinids (PAU) – 23:10 (349) -22
- Perseids (PER) – 02:20 (035) +55
- eta Eridanids (ERI) – 02:32 (038) -14
- 49 Andromedids (FAN) – 02:41 (040) +53
- psi Cassiopeiids (PCA) – 03:47 (057) +78

03^h20^m – 04^h20^m UT (23^h20^m – 00^h20^m EDT); clear; 3/5 trans; F 1.00; LM 6.43; facing S50 deg; t_{eff} 1.00 hr

- SDA: three: +3; +4(2)
- PER: two: +4; +5
- KCG: two: +4(2)
- ANT: one: +4
- NDA: one: +5
- Sporadics: five: +1; +3(2); +4(2)
- Total meteors: Fourteen

04^h20^m – 05^h20^m UT (00^h20^m – 01^h20^m EDT); clear; 3/5 trans; F 1.00; LM 6.45; facing S50 deg; t_{eff} 1.00 hr

- PER: four: +1; +2; +4; +5
- SDA: three: +2; +3(2)
- CAP: three: 0; +2; +3
- KCG: one: +2
- PAU: one: +4
- FAN: one: +5
- Sporadics: seven: 0; +1; +2; +3(3); +4
- Total meteors: Twenty

05^h20^m – 06^h20^m UT (01^h20^m – 02^h20^m EDT); clear; 4/5 trans; F 1.00; LM 6.52; facing S50 deg; t_{eff} 1.00 hr

- PER: ten: +1; +2; +3(2); +4(3); +5(3)
- SDA: three: +2; +4; +5
- CAP: three: +1(2); +3
- ANT: two: +3; +4
- NDA: one: +5
- PAU: one: +2
- FAN: one: +2
- Sporadics: five: +1; +3; +4(2); +5
- Total meteors: Twenty-six

06^h20^m – 07^h20^m UT (02^h20^m – 03^h20^m EDT); clear; 4/5 trans; F 1.00; LM 6.52; facing S50 deg; t_{eff} 1.00 hr

- PER: nine: –2; +1; +2; +3(3); +4(2); +5
- SDA: seven: 0; +1; +2; +4(3); +5
- ANT: two: +3; +5
- KCG: one: +2
- NDA: one: +4
- PAU: one: +4
- Sporadics: eleven: –1; +2(3); +3(3); +5(4)
- Total meteors: Thirty-two

07^h21^m – 08^h30^m UT (03^h21^m – 04^h30^m EDT); clear; 4/5 trans; F 1.00; LM 6.39; facing S50 deg; t_{eff} 1.08 hr, 4 min dead time (break)

- PER: seven: +3(2); +4(2); +5(3)
- SDA: four: +3; +4(2); +5
- ERI: three: –1; +3; +5
- KCG: two: 0; +2
- NDA: two: +3; +5
- ANT: one: +4
- FAN: one: +3
- Sporadics: ten: +3; +4(7); +5(2)
- Total meteors: Thirty

6 2019 August 5–6

The sky cleared briefly on August 5/6 to allow a quick one hour meteor watch at around midnight. I drove to the Moose Creek site, which is a shorter drive from home (about 50 km), and it also allowed me to check out the location since I haven't been there in a while. The sky was clear but with below-average transparency and clouds approaching from the west. It was 22°C, dry, without any bugs, no humidity, and very comfortable to be outside. I was pretty much observing from the middle of a large corn field.

Between 11^h25^m pm – 12^h25^m am (local time), I saw 10 meteors (5 Perseids, 2 anthelions and 3 sporadics).

The nicest meteor was the –1 PER at 11^h34^m pm that shot 30 degrees with a 2 sec train.

Clouds rapidly moved in after one hour, so I called it quits.

Observation August 5/6 2019, 03h25m – 04h25m UT (23h25m – 00h25m EDT). Location: Moose Creek, Ontario, Canada, (45°15'13″N 75°02'57″W).

Observed showers:

- kappa Cygnids (KCG) – 18:40 (280) +45
- alpha Capricornids (CAP) – 20:38 (309) -08
- Anthelion (ANT) – 21:36 (324) -14
- Northern delta Aquariids (NDA) – 22:33 (338) -02
- Southern Delta Aquariids (SDA) – 23:01 (345) -15
- Piscids Austrinids (PAU) – 23:10 (349) -22
- Perseids (PER) – 02:20 (035) +55
- eta Eridanids (ERI) – 02:32 (038) -14
- 49 Andromedids (FAN) – 02:41 (040) +53
- psi Cassiopeiids (PCA) – 03:47 (057) +78

03^h25^m – 04^h25^m UT (23^h25^m – 00^h25^m EDT); clear; 2/5 trans; F 1.00; LM 6.20; facing SE60 deg; t_{eff} 1.00 hr

- PER: five: –1; 0; +1; +3; +5
- ANT: two: +4(2)
- Sporadics: three: +1; +2; +4
- Total meteors: Ten

7 2019 August 8–9

The stretch of clear nights over eastern Ontario continued! Here's my results for the morning of August 9. I observed for three hours at the Bootland Farm site until morning twilight. The sky was clear but very hazy and humid, and there was an enormous amount of dew. There was ground fog from rain earlier in the evening but a breeze kept it from becoming too thick, so the sky remained decent (LM = 6.3). A bigger concern I had was the distant thunderstorms to the south, south-east, north and west. I felt that I was surrounded by flashes of lightning! My main concern was the storm cell to the west and north, and if it would be coming my way. I took a few breaks to keep an eye on the radar and satellite images. Fortunately, the storm passed to the north and caused just a few residual clouds during the last hour of observing.

In those three hours, I saw 69 meteors (31 Perseids, 9 Southern delta Aquariids, 3 kappa Cygnids, 3 Northern delta Aquariids, 3 eta Eridanids, 2 anthelions and 18 sporadics).

The Perseids were now the main source of meteor activity, with hourly rates up to the mid-teens during the last hour. The SDAs continued to produce decent numbers. The sporadics rates started off well, then dipped during the second hour, but recovered in the third.

The +1 eta Eridanid (ERI) at 1^h48^m am was very impressive! It shot 40 degrees through Pegasus, with a vivid orange/blue color and a 3 sec train. Less than half an hour later, another nice ERI appeared, this time a mag 0, yellow in Cetus, with a 2 sec train.

Observation August 8/9 2019, 05^h15^m – 08^h26^m UT (01^h15^m – 04^h26^m EDT). Location: Bootland Farm (Stewartville), Ontario, Canada, (45°23'N 76°29'W).

Observed showers:

- kappa Cygnids (KCG) – 18:40 (280) +45
- alpha Capricornids (CAP) – 20:38 (309) -08
- Anthelion (ANT) – 21:36 (324) -14
- Northern delta Aquariids (NDA) – 22:33 (338) -02
- Southern Delta Aquariids (SDA) – 23:01 (345) -15
- Piscids Austrinids (PAU) – 23:10 (349) -22
- Perseids (PER) – 02:20 (035) +55
- eta Eridanids (ERI) – 02:32 (038) -14
- 49 Andromedids (FAN) – 02:41 (040) +53

05^h15^m – 06^h20^m UT (01^h15^m – 02^h20^m EDT); 10-20% cirrus clouds; 2/5 trans; F 1.03; LM 6.25; facing SSE60 deg; t_{eff} 1.00 hr

- PER: seven: 0; +2(2); +3; +4(2); +5
- KCG: two: +3; +5
- ERI: two: 0; +1
- SDA: one: +5
- ANT: one: +5
- NDA: one: +3

- Sporadics: eight: +2(3); +3(3); +4(2)
- Total meteors: Twenty-two

06^h20^m – 07^h22^m UT (02^h20^m – 03^h22^m EDT); clear; 2/5 trans; F 1.00; LM 6.33; facing SSE60 deg; t_{eff} 1.00 hr

- PER: ten: +1; +2(4); +3; +4(2); +5(2)
- SDA: five: +2; +3(3); +4
- ANT: one: +3
- NDA: one: +3
- Sporadics: two: +1; +4
- Total meteors: Nineteen

07^h22^m – 08^h26^m UT (03^h22^m – 04^h26^m EDT); 10–20% cirrus clouds; 2/5 trans; F 1.07; LM 6.29; facing SSE60 deg; t_{eff} 1.04 hr

- PER: fourteen: +1(4); +2(3); +3(5); +4; +5
- SDA: three: +1; +4; +5
- KCG: one: +4
- NDA: one: +5
- ERI: one: +2
- Sporadics: eight: 0; +2(2); +3(2); +4(2); +5
- Total meteors: Twenty-eight

8 2019 August 10–11

Here's the second half of my 2019 Perseids meteor observing campaign. Most of the Perseid action occurs every year on or near August 12, but I have always enjoyed following the rising and declining stages of all the meteor showers. This period can last anywhere from a few hours in the case of some showers with little or no background activity, to several weeks when it comes to the old, well established ones (such as the Perseids).

This summer, I've had the fortune of being out for multiple clear nights (late July to mid-August). The waxing moon phase meant that most of my sessions approaching the peak were held late at night after moonset. Sometimes, the sky cleared after midnight as well. These late nights were actually ideal timing due to the rising radiant, but at times, I will admit that it was a bit difficult with my sleep patterns ☺.

On the evening of August 10, I joined Raymond Dubois to observe at Shane Finnigan's beautiful property near Renfrew (about 90km west of Ottawa). Raymond did a full "dry run" setup to test some new accessories for the upcoming Mercury transit. As I waited for the Moon to go down, I spent the evening with Shane and Raymond. The sky was surprisingly crisp even with the 10 days old gibbous moon up in the south. Shane and I took a walk and we saw a nice –3 KCG heading down slowly in the east and fragmenting before it faded away!

I signed-on at 1^h30^m am EDT, about half an hour before moonset. The sky gradually darkened as the Moon descended, the Milky Way became more structured and the meteor rates increased. It's really neat seeing so many faint stars quickly appear in a dark sky site at moonset! Some cirrus clouds were present occasionally but did not affect the viewing, and the sky was quite transparent (LM=6.4).

I observed for almost 2.71 hours, and saw 67 meteors (47 Perseids, 7 South delta Aquariids, 2 Kappa Cygnids, 1 alpha Capricornid, 1 eta Eridanids and 9 sporadics). The Perseids dominated with hourly rates of up to 20/hr.

For most of the night, the Perseids appeared to be more on the faint side. That was until 2^h36^m am when a blue-green –4 PER fireball flared near the radiant and left an 8 sec persistent train! This prompted Raymond and I to quickly setup our cameras. Just a few minutes later while on break, another –4 PER was seen, descending in the north with a 12 sec train!

I also saw a few meteors that could be possible beta Perseids (BPE) but I officially counted them as sporadics. The rates for sporadics was lower than expected on this night.

I finished at 4^h35^m am just as the morning twilight started, and a band of cirrus clouds formed. It was a cool night, down to just a few degrees!

Observation August 10/11 2019, 05^h30^m – 08^h35^m UT (01^h30^m – 04^h35^m EDT), Location: Renfrew, Ontario, Canada, (45°25'48″N 76°38'24″W)

Observed showers:

- kappa Cygnids (KCG) – 18:56 (284) +49
- alpha Capricornids (CAP) – 21:05 (316) -07
- Anthelion (ANT) – 22:04 (331) -12
- Northern delta Aquariids (NDA) – 22:58 (344) +01
- Southern delta Aquariids (SDA) – 23:27 (352) -12
- Piscids Austrinids (PAU) – 23:41 (355) -19
- Perseids (PER) – 03:01 (045) +57
- eta Eridanids (ERI) – 02:56 (044) -12

05^h30^m – 06^h37^m UT (01^h30^m – 02^h37^m EDT); clear; 3/5 trans; F 1.00; LM 6.22; facing SE60 deg; t_{eff} 1.11 hr; temp 8C.

- PER: twenty: –4; 0; +1(2); +2(8); +3(3); +4(3); +5(2)
- SDA: two: +1; +5
- ERI: one: +3
- Sporadics: four: +3; +4; +5(2)
- Total meteors: Twenty-seven

06^h59^m – 07^h59^m UT (02^h59^m – 03^h59^m EDT); clear; 3/5 trans; F 1.00; LM 6.43; facing SE50 deg; t_{eff} 1.00 hr; temp 5C.

- PER: seventeen: –1; +1; +2(3); +3(6); +4(4); +5(2)
- SDA: two: +3; +5
- KCG: two: +1; +4
- Sporadics: three: +3; +4(2)
- Total meteors: Twenty-four

Figure 1 – I opted to use a 24mm lens, and aim the camera to the west, unguided (just camera on tripod) using short 15 sec exposures at ISO6400. All the meteors captured in the span of 1.5 hours were then combined together to form this composite image.

07^h59^m – 08^h35^m UT (03^h59^m – 04^h35^m EDT); clear; 3/5 trans; F 1.00; LM 6.12; facing SE50 deg; t_{eff} 0.60 hr; temp 4C.

- PER: ten: +1(2); +2(3); +3; +4(2); +5(2)
- SDA: three: +1; +4(2)
- CAP: one: +1
- Sporadics: two: –1; 0
- Total meteors: Sixteen

9 2019 August 11–12

On the following night, I decided to go to the Moose Creek site (60km east of Ottawa) for a short one hour pre-dawn session to see what the Perseids were up to just one day before the peak. It was a bit of a race against an approaching cloud bank in the west, but the sky was very clear overhead. I rushed to setup but I wasn't sure how long the clear sky would last. It was a comfortably mild night with a light breeze and no humidity. The sky was extremely impressive for this location (LM = 6.5) thanks to the clouds keeping the Ottawa light pollution glow from spilling up. I faced the south-east to observe as long as I could away from the approaching clouds.

In one hour, I saw 35 meteors (27 Perseids, 2 Southern delta Aquariids, 2 eta Eridanids, 1 Northern delta Aquariid, 1 Piscids Austrinid and 2 sporadics). Some long, bright Perseids were seen but no fireballs.

At 3^h45^m am EDT, the clouds started affecting my field of view, and at 4^h10^m am, it was enough that I called it a night. It was a short and sweet session!

Observation August 11/12 2019, 07^h08^m – 08^h10^m UT (03^h08^m – 04^h10^m EDT), Location: Moose Creek, Ontario, Canada, (45°15'13″N 75°02'57″W).

Observed showers:

- kappa Cygnids (KCG) – 18:56 (284) +49
- alpha Capricornids (CAP) – 21:05 (316) -07
- Anthelion (ANT) – 22:04 (331) -12
- Northern delta Aquariids (NDA) – 22:58 (344) +01
- Southern delta Aquariids (SDA) – 23:27 (352) -12
- Piscids Austrinids (PAU) – 23:41 (355) -19
- Perseids (PER) – 03:01 (045) +57
- eta Eridanids (ERI) – 02:56 (044) -12

07^h08^m – 08^h10^m UT (03^h08^m – 04^h10^m EDT); increasing clouds during final 20 min; 4/5 trans; F 1.09; LM 6.53; facing SE50 deg; t_{eff} 1.03 hr

- PER: twenty-seven: 0(2); +1; +2(8) +3(5); +4(6); +5(5)
- SDA: two: –1; +5
- ERI: two: +2; +4
- NDA: one: +5
- PAU: one: +3
- Sporadics: two: +3; +5
- Total meteors: Thirty-five

10 2019 August 12–13

I nearly "wrote off" the Perseids peak night because of poor weather. The forecasts for areas around Ottawa was kind of all over the map. It changed from "clouding over" to overcast and then possibly some clear skies. By late afternoon, it looked like there was a renewed hope that it would clear during the night. I decided to wait for the Moon (just 2 days to being full) to descend, and go to Shane Finnigan's property near Renfrew. When I arrived, the sky was covered in patchy clouds but there was some decent clearing. It was a very mild night at 18°C. I positioned myself deep into the property to keep the moon's glare behind the trees and maximize my view of the northern sky. While I was setting up my tracking mount and two cameras, a nice –3 PER flashed in the south-east, leaving behind a train persisting for several seconds. I signed on at 2^h22^m am EDT, the sky was mostly clear to the north, and the Perseids were very active! I actually enjoyed the moon's soft illumination on the ground.

In the first hour from 2^h22^m – 3^h37^m am EDT (effective viewing time) with strong moonlight, I saw 23 Perseids. Moonset occurred at 3^h54^m am, allowing for a short "dark window" until morning dawn, and what a difference that did! In the next 1.35 hours, from 3^h37^m – 5^h00^m am EDT, the Perseids rates jumped to 78, for an average of over one meteor per minute! As usual, some minutes would be quiet, followed by two meteors appearing just a second or two apart!

Many nice meteors were seen. The big highlight was 3^h39^m am EDT with a –5 PER fireball that flared and exploded in the east, leaving behind a 30 seconds train! It lit up a part of the sky. Unfortunately, my two cameras were not positioned to capture this meteor, but I was glad to have seen it!

Totals seen in 2.35 minutes: 116 meteors (101 Perseids, 1 Southern delta Aquariid, 1 alpha Capricornid and 13 sporadics).

Observation August 12/13 2019, 06^h22^m – 09^h00^m UT (02^h22^m – 05^h00^m EDT), Location: Renfrew, Ontario, Canada, (45°25'48″N 76°38'24″W).

Observed showers:

- kappa Cygnids (KCG) – 18:56 (284) +49
- alpha Capricornids (CAP) – 21:05 (316) -07
- Anthelion (ANT) – 22:04 (331) -12
- Southern delta Aquariids (SDA) – 23:27 (352) -12
- Perseids (PER) – 03:01 (045) +57
- eta Eridanids (ERI) – 02:56 (044) -12

06^h22^m – 07^h37^m UT (02^h22^m – 03^h37^m EDT); 10–20% cirrus clouds; 3/5 trans; F 1.09; LM 5.63; facing NNE60 deg; t_{eff} 1.00 hr, 15 min dead time (breaks)

- PER: twenty-three: –1; 0(3); +1(4); +2(2); +3(8); +4(4); +5
- Sporadics: four: +2; +3(2); +4
- Total meteors: Twenty-seven

07^h37^m – 08^h39^m UT (03^h37^m – 04^h39^m EDT); clear; 3/5 trans; F 1.00; LM 6.33; facing NNE50 deg; t_{eff} 1.00 hr, 2 min dead time (break).

- PER: sixty-four: –5; 0; +1(6); +2(12); +3(15); +4(13); +5(16)
- SDA: one: +3
- CAP: one: 0
- Sporadics: seven: +2(2); +4(3); +5(2)
- Total meteors: Seventy-three

$08^h39^m – 09^h00^m$ UT ($04^h39^m – 5^h00^m$ EDT); clear; 3/5 trans;
F 1.00; LM 5.53; facing NNE55 deg; t_{eff} 0.35 hr

- PER: fourteen: 0(2); +1(3); +2(2); +3(3); +4(3); +5
- Sporadics: two: +2; +3
- Total meteors: Sixteen

Figure 2 – Here's a 32 Perseids composite image. All the meteors captured in the span of 2.5 hours are combined together. Canon 5D with Rokinon 14mm lens at f/2.8.

Figure 3 – Here's a 15 Perseids composite image. All the meteors captured in the span of 2.5 hours are combined together. Canon 6D with Rokinon 24mm lens at f/2.0.

Figure 4 – Here's a bright Perseid with flares. Canon 6D with Rokinon 24mm lens at f/2.0.

Radio meteors July 2019

Felix Verbelen

Vereniging voor Sterrenkunde & Volkssterrenwacht MIRA, Grimbergen, Belgium

felix.verbelen@skynet.be

An overview of the radio observations during July 2019 is given.

1 Introduction

The graphs show both the daily totals (*Figure 1 and 2*) and the hourly numbers (*Figure 3 and 4*) of “all” reflections counted automatically, and of manually counted “overdense” reflections, overdense reflections longer than 10 seconds and longer than 1 minute, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during the month of July 2019.

The hourly numbers, for echoes shorter than 1 minute, are weighted averages derived from:

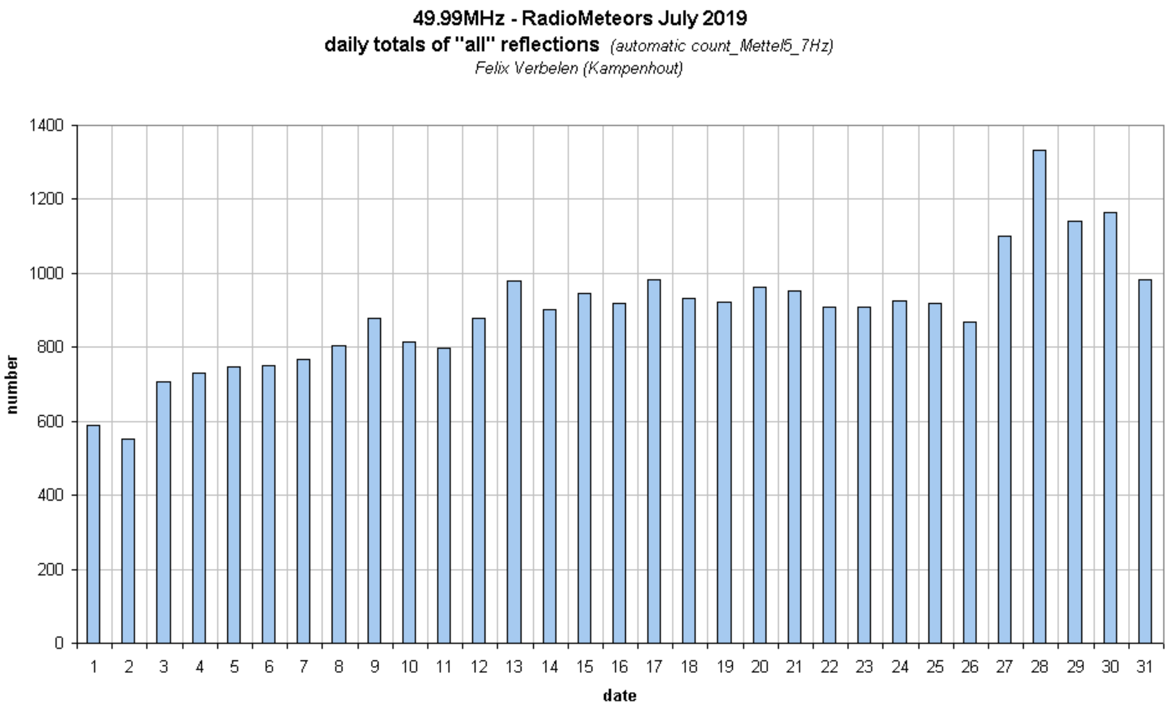
$$N(h) = \frac{n(h-1)}{4} + \frac{n(h)}{2} + \frac{n(h+1)}{4}$$

During this month the registrations were quite often disturbed by moderate local interferences, on 1 day by weak “sporadic E” (Es) and on 7 days by sometimes strong lightning activity. The automatic countings were manually corrected in order to eliminate as much as possible the effects of these disturbances.

As expected, meteor activity increased in the course of the month, with a significant increase as from 26 July.

Long-lasting reflections were also more numerous. SpecLab pictures of a selection of eye-catching reflections are shown in *Figures 5 to 13*.

If you are interested in the actual figures, please send me an e-mail: felix.verbelen at skynet.be.



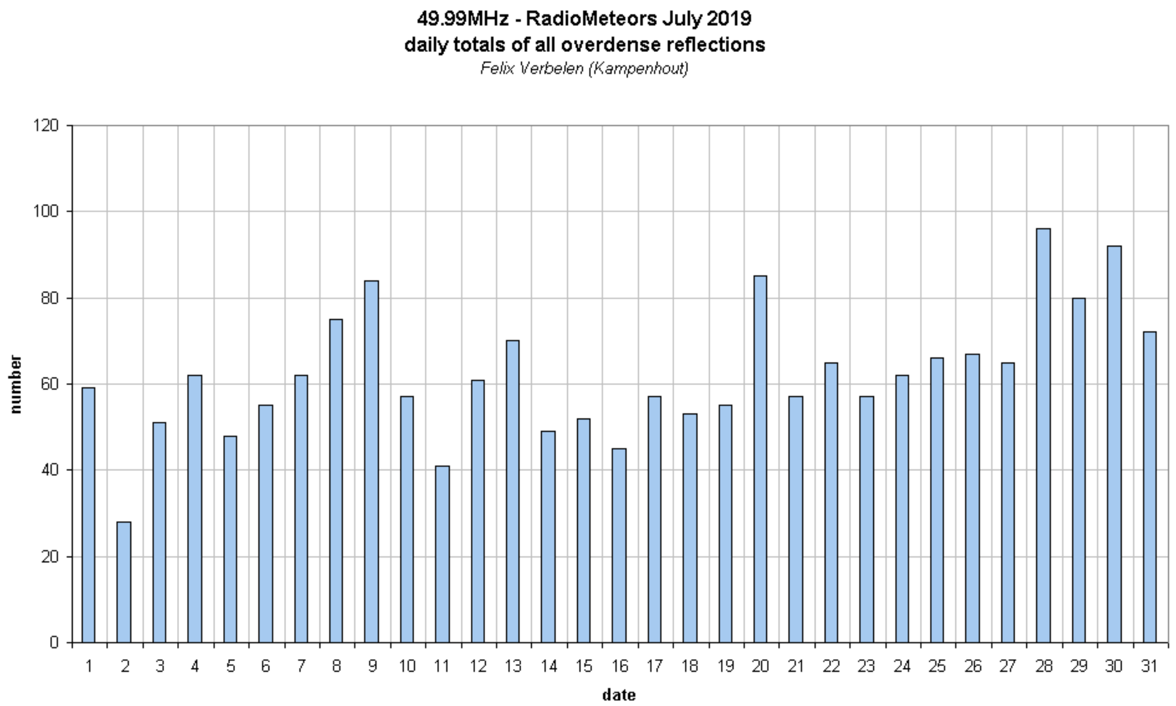


Figure 1 – The daily totals of "all" reflections counted automatically, and of manually counted "overdense" reflections, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during July 2019.

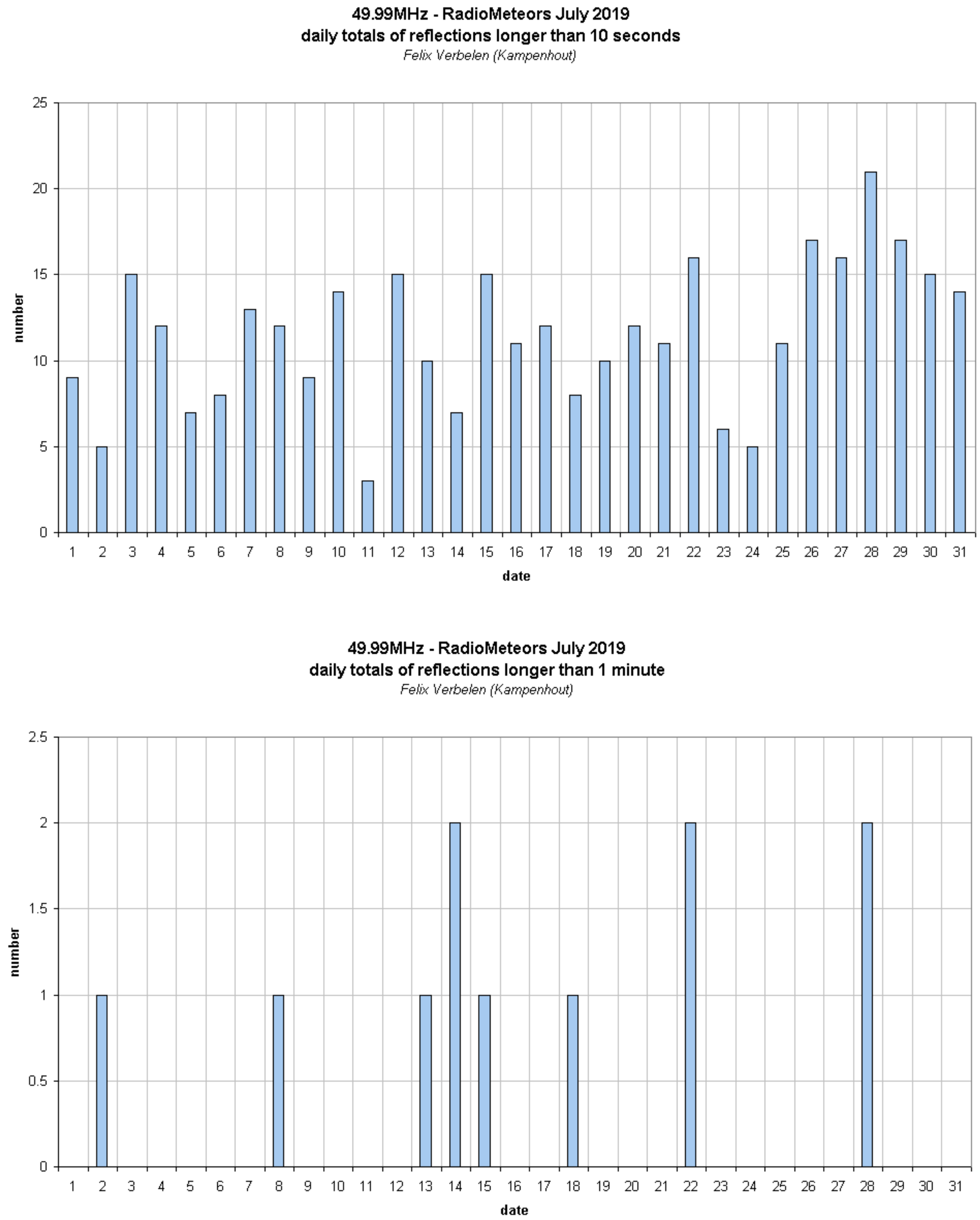
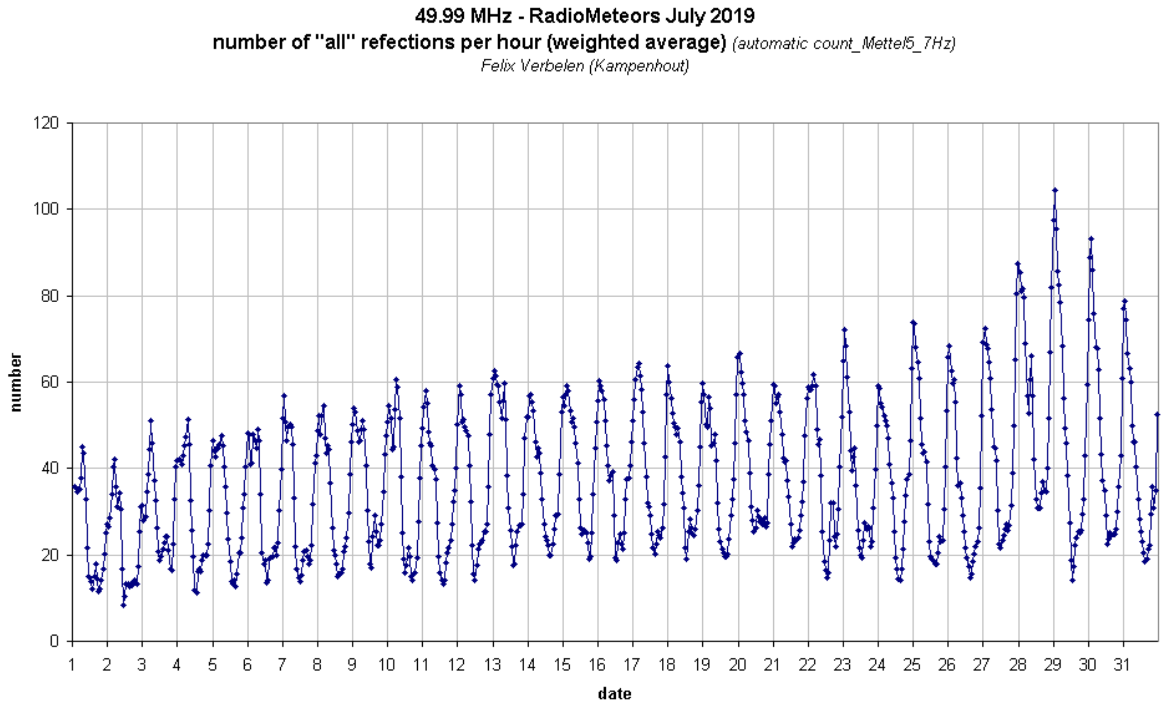


Figure 2 – The daily totals of overdense reflections longer than 10 seconds and longer than 1 minute, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during July 2019.



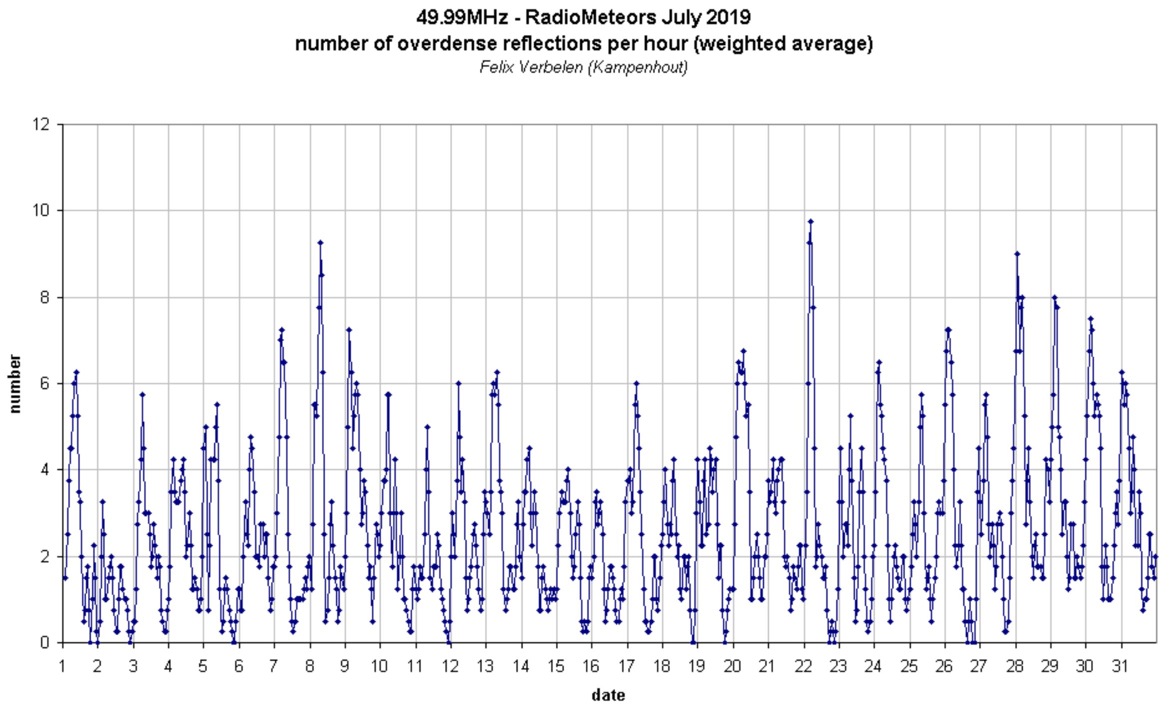
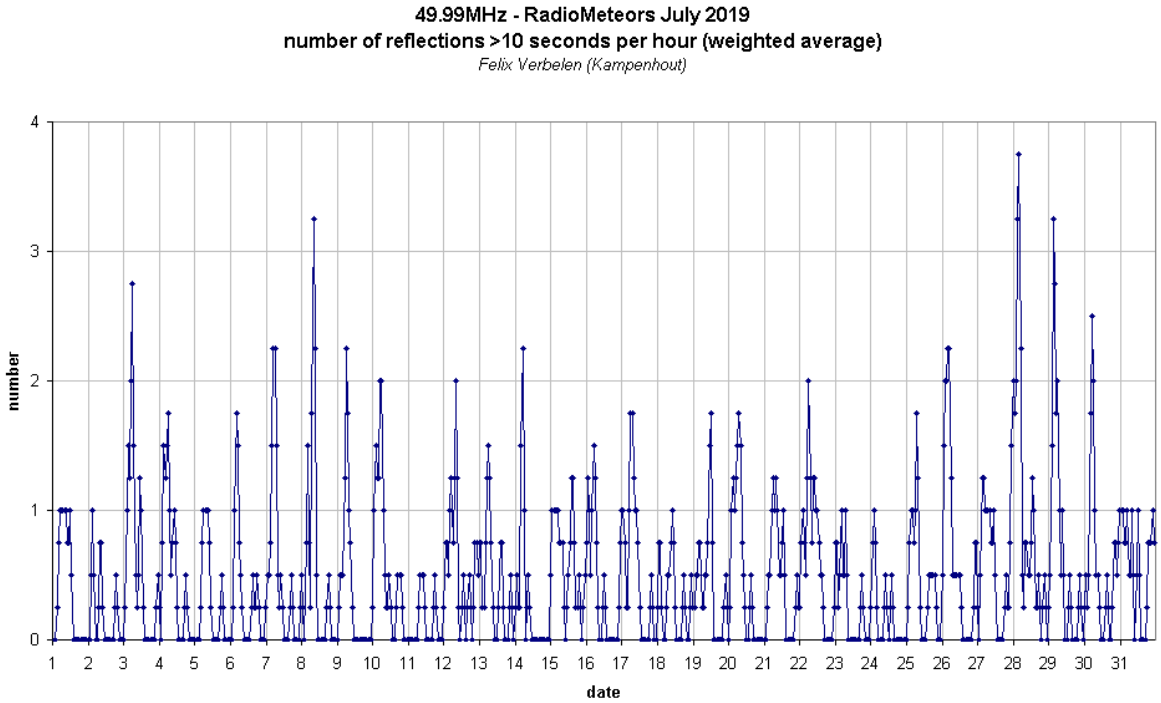


Figure 3 – The hourly numbers of "all" reflections counted automatically, and of manually counted "overdense" reflections, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during July 2019.



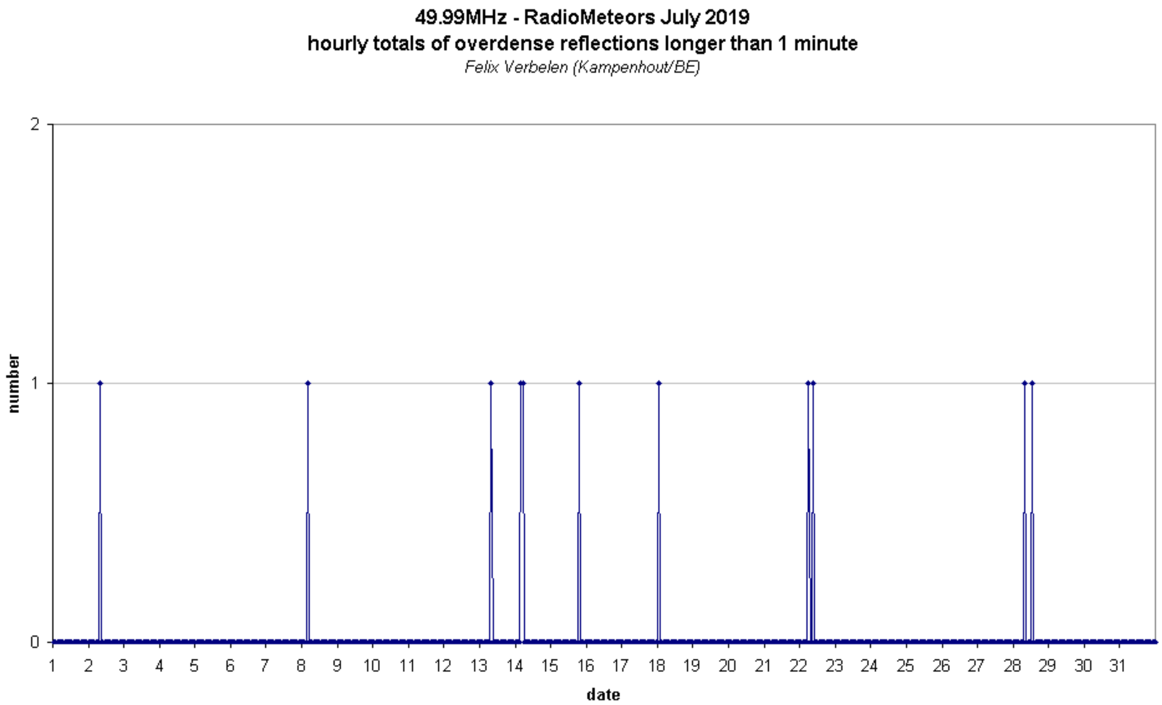


Figure 4 – The hourly numbers of overdense reflections longer than 10 seconds and longer than 1 minute, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during July 2019.

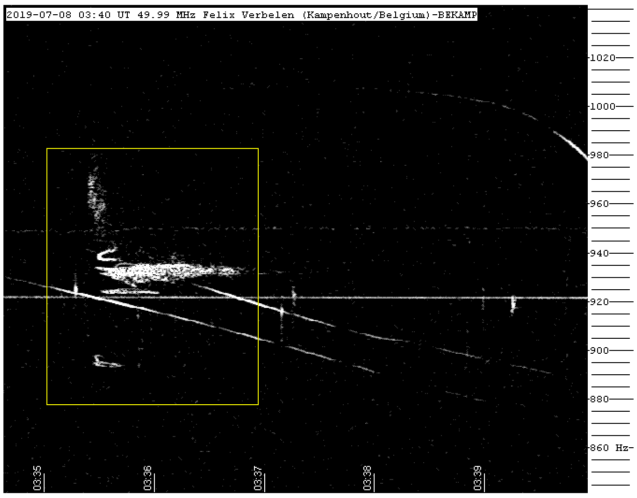


Figure 3 – 8 July 2019 03ʰ40ᵐ UT.

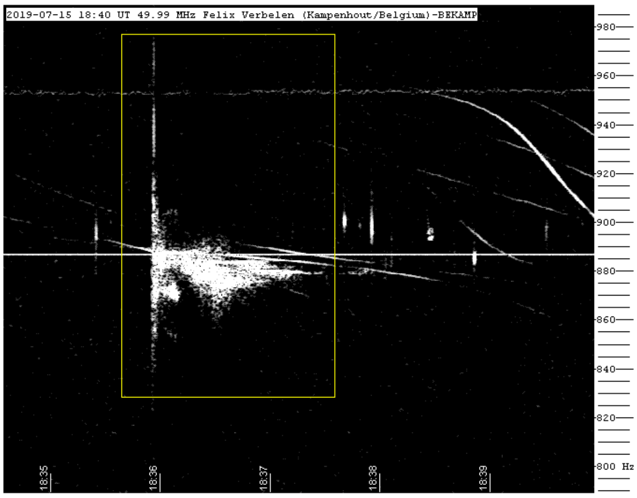


Figure 6 – 15 July 2019 18ʰ40ᵐ UT.

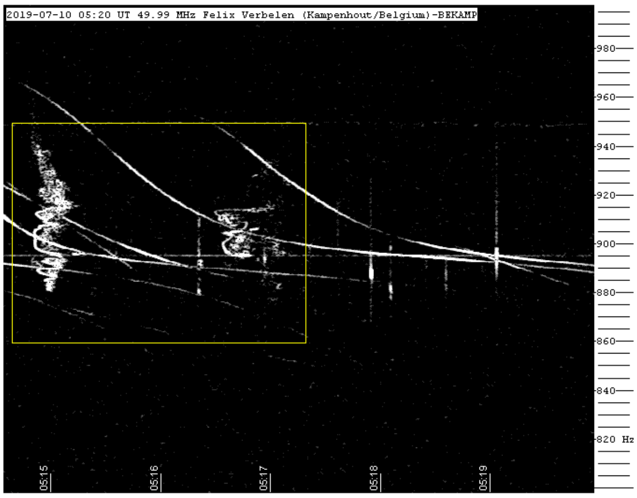


Figure 4 – 10 July 2019 05ʰ20ᵐ UT.

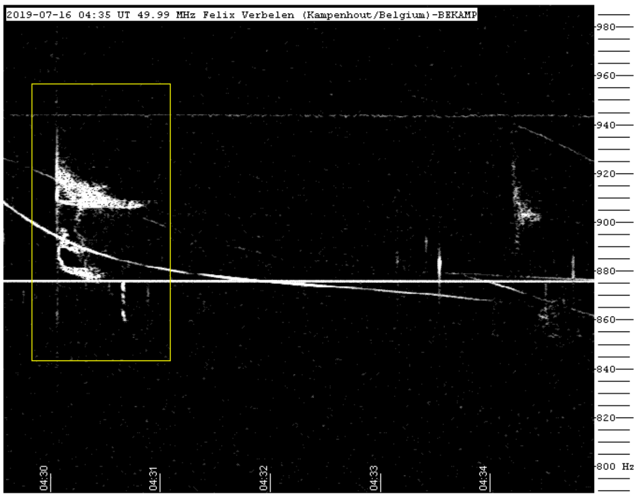


Figure 7 – 16 July 2019 04ʰ35ᵐ UT.

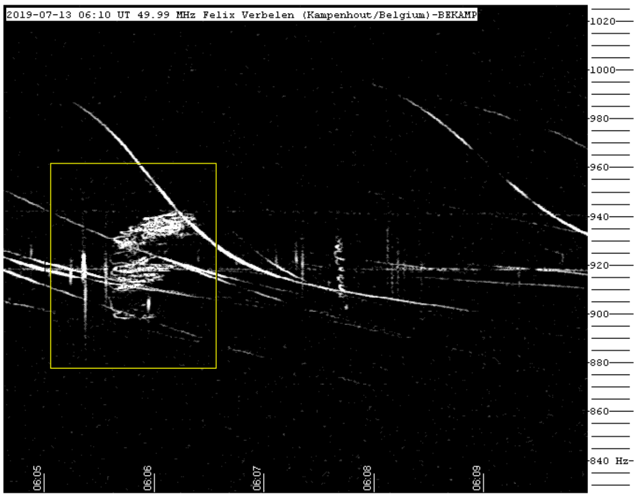


Figure 5 – 10 July 2019 06ʰ10ᵐ UT.

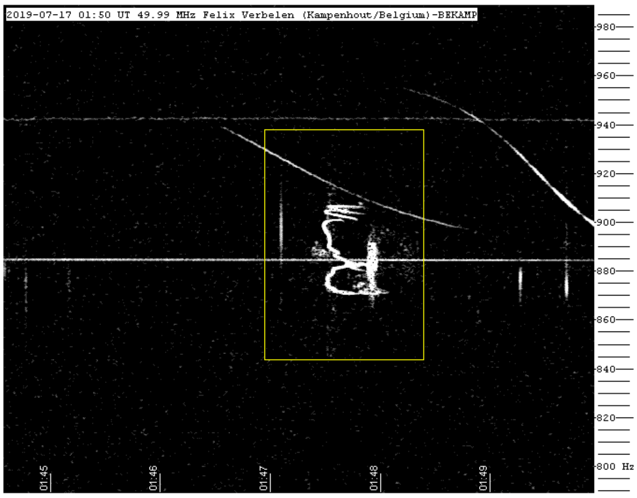


Figure 8 – 17 July 2019 01ʰ50ᵐ UT.

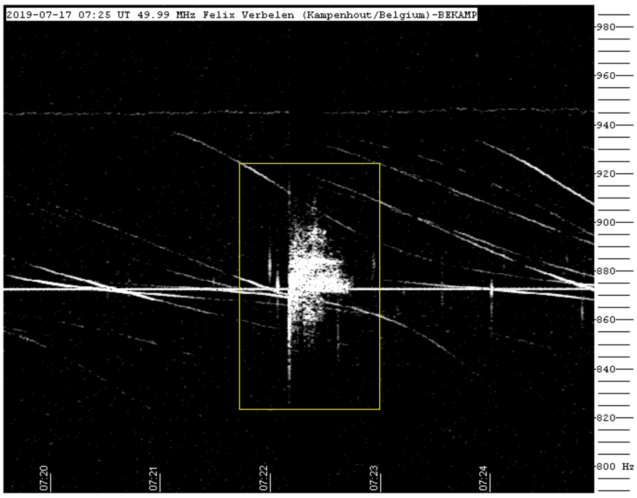


Figure 9 – 17 July 2019 07^{h}25^m UT.

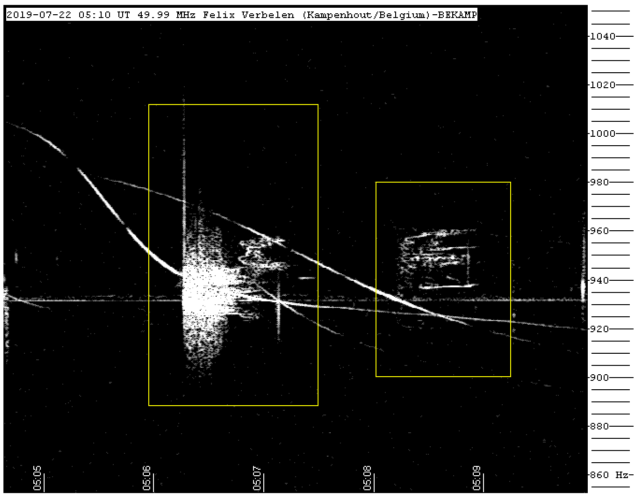


Figure 10 – 22 July 2019 05^{h}10^m UT.

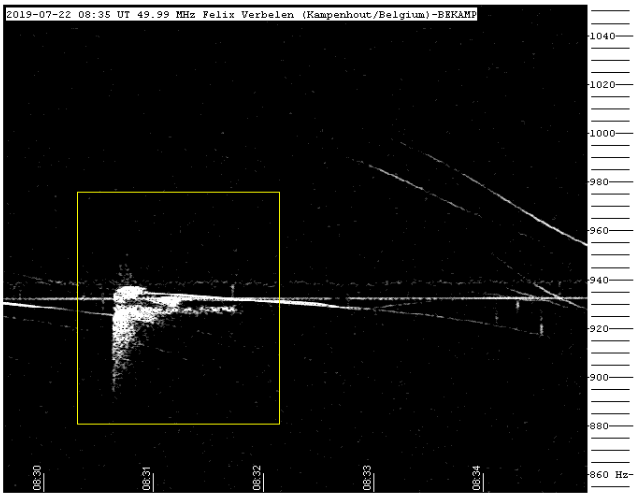


Figure 11 – 22 July 2019 08^{h}35^m UT.

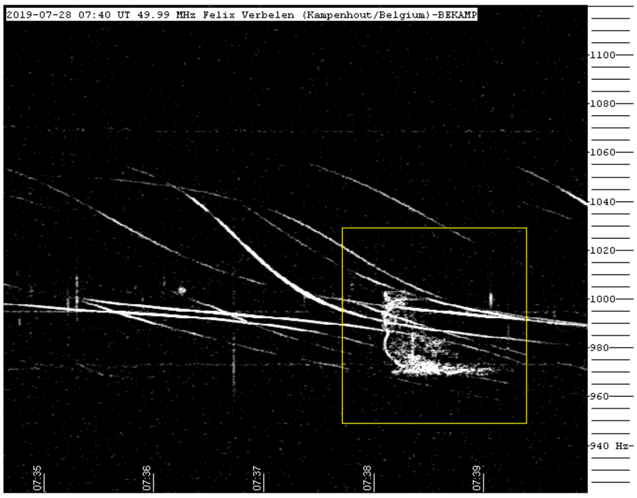


Figure 12 – 28 July 2019 07^{h}40^m UT.

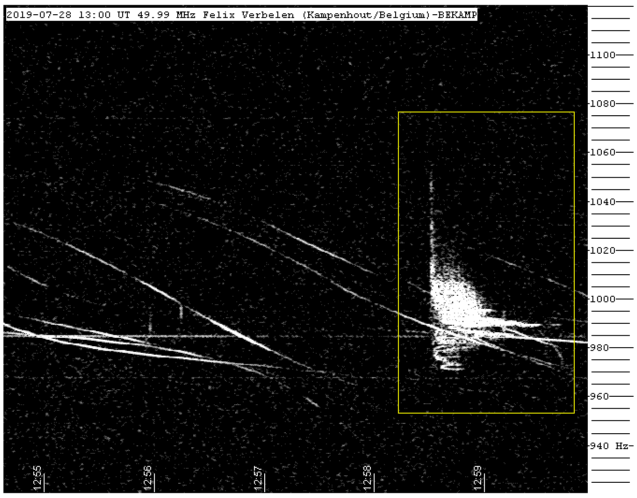


Figure 13 – 28 July 2019 13^{h}00^m UT.

Radio meteors August 2019

Felix Verbelen

Vereniging voor Sterrenkunde & Volkssterrenwacht MIRA, Grimbergen, Belgium

felix.verbelen@skynet.be

An overview of the radio observations during August 2019 is given.

1 Introduction

The graphs show both the daily totals (*Figure 1 and 2*) and the hourly numbers (*Figure 3 and 4*) of "all" reflections counted automatically, and of manually counted "overdense" reflections, overdense reflections longer than 10 seconds and longer than 1 minute, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during the month of August 2019.

The hourly numbers, for echoes shorter than 1 minute, are weighted averages derived from:

$$N(h) = \frac{n(h-1)}{4} + \frac{n(h)}{2} + \frac{n(h+1)}{4}$$

During this month the registrations were quite often disturbed by moderate local interferences, on 3 days by weak "sporadic E" (Es) and on 5 days by sometimes strong lightning activity.

The automatic countings were manually corrected in order to eliminate as much as possible the effects of these disturbances.

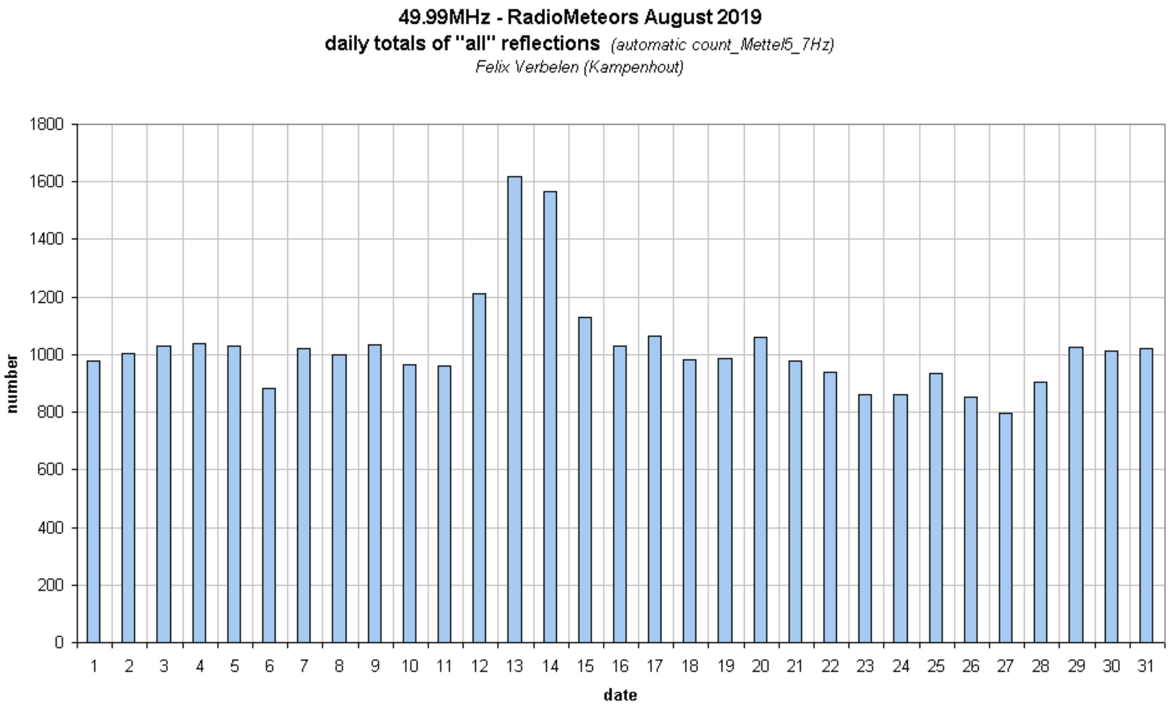
The Perseids were of course the main meteor shower of the month, showing many radio reflections lasting longer than 10 seconds on both the 13th and 14th. Surprisingly, reflections lasting longer than 1 minute were observed mainly on August 13th but were far less numerous on August 14th.

As in previous years, the general meteor activity was important the days before the main peaks of 13th and 14th August, and sharply decreased thereafter.

The eye-catcher of the month was a more than 3 minutes reflection on August 13th, starting at 23^{h}31^m UT (*Figure 12*).

SpecLab pictures of this and of a small selection of other eye-catching reflections are displayed in *Figures 3–14*.

If you are interested in the actual figures, please send me an e-mail: felix.verbelen at skynet.be.



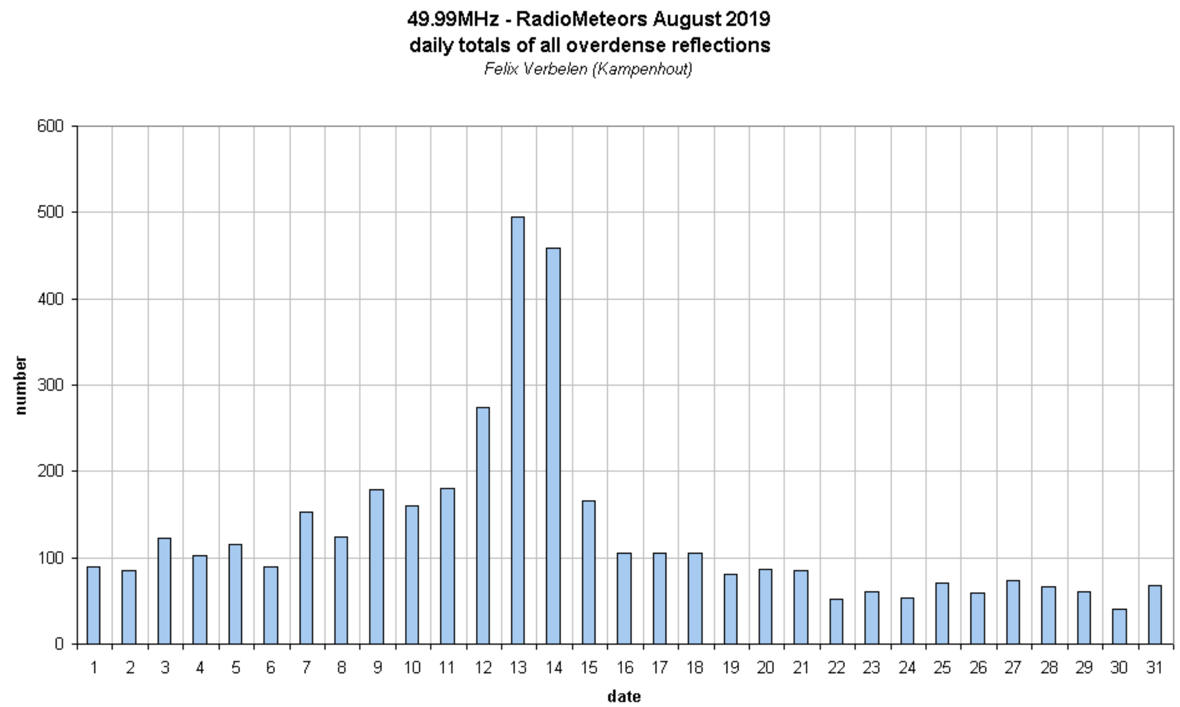


Figure 1 – The daily totals of "all" reflections counted automatically, and of manually counted "overdense" reflections, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during August 2019.

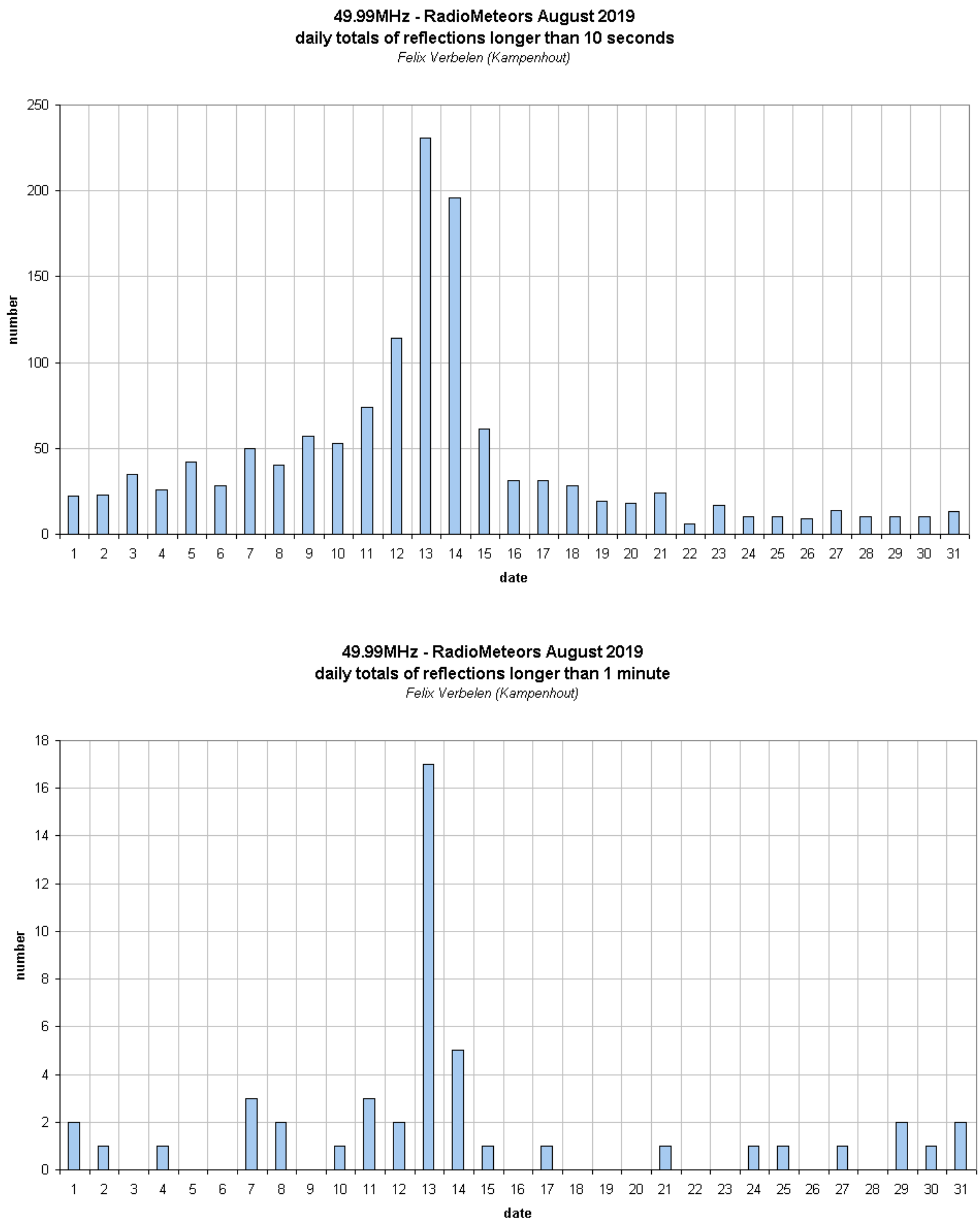
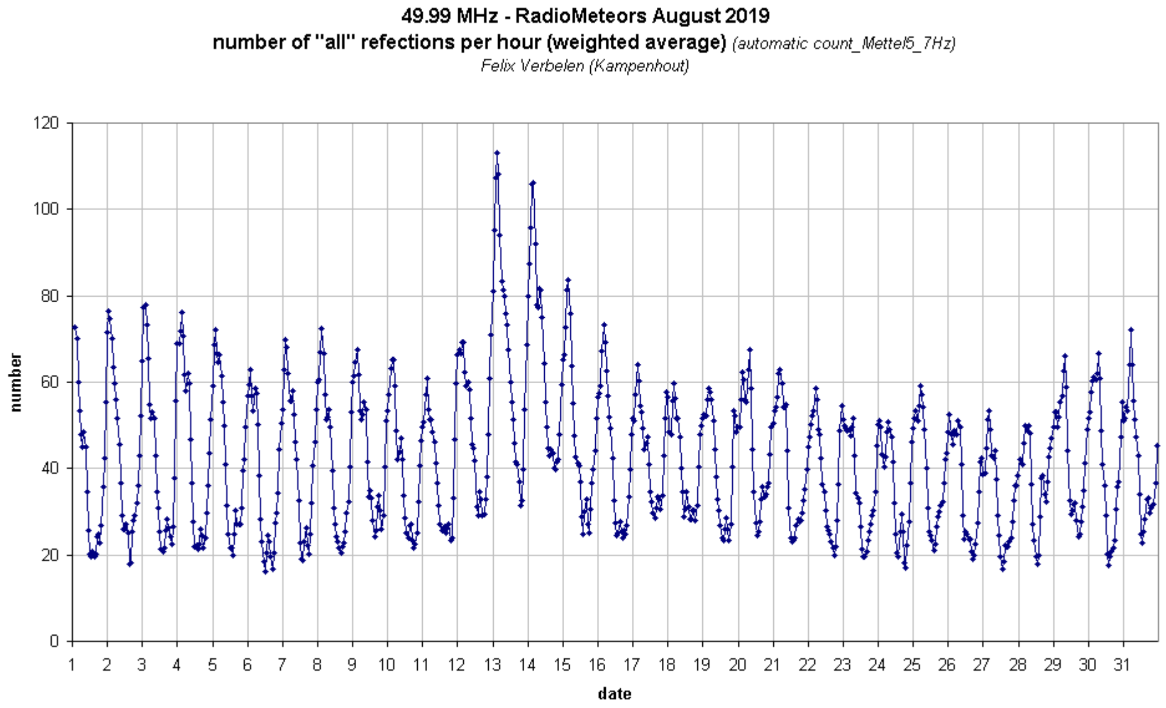


Figure 2 – The daily totals of overdense reflections longer than 10 seconds and longer than 1 minute, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during August 2019.



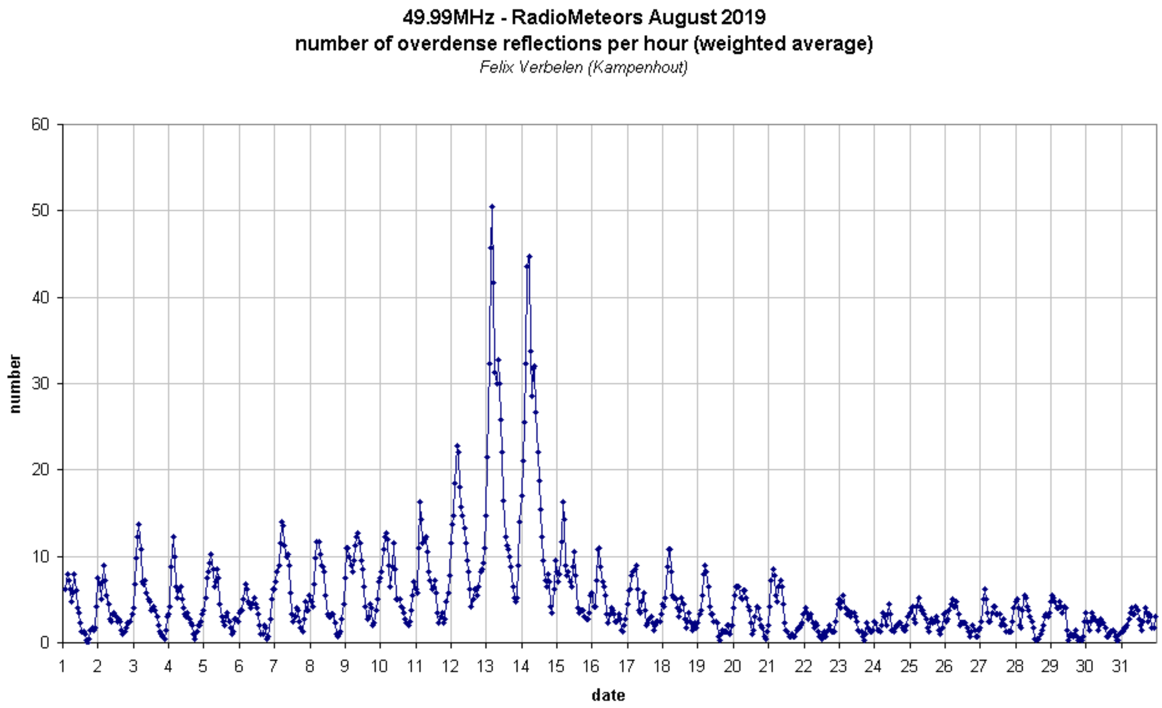
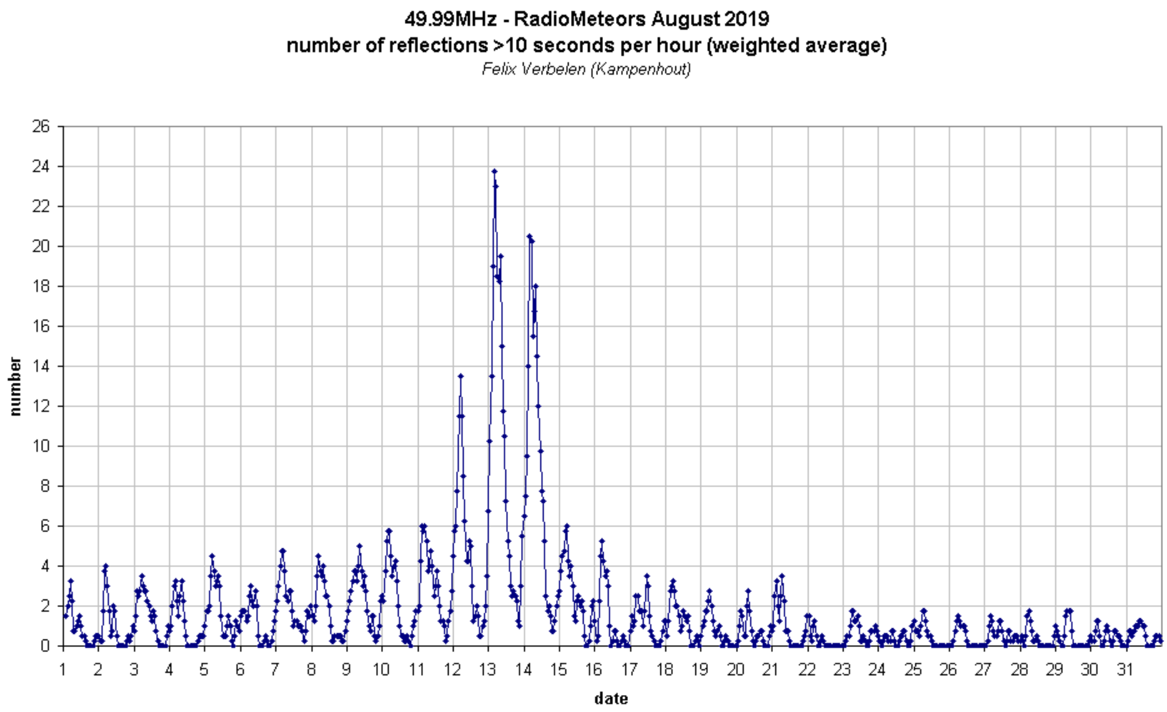


Figure 3 – The hourly numbers of "all" reflections counted automatically, and of manually counted "overdense" reflections, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during August 2019.



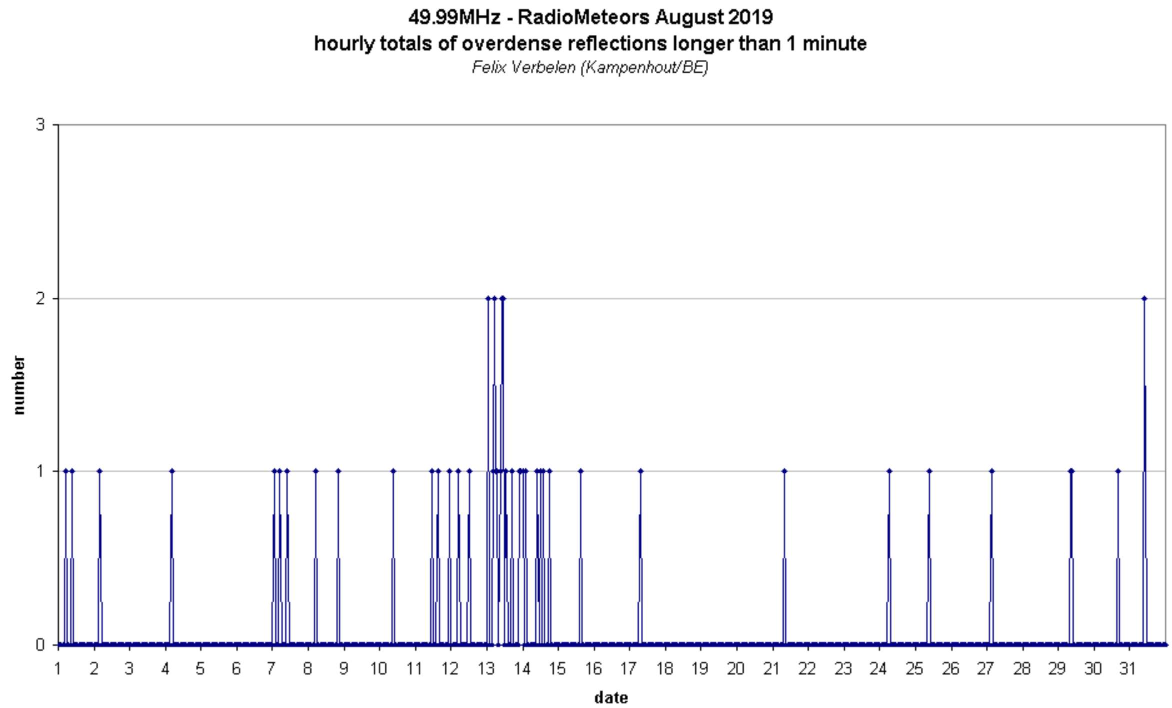


Figure 4 – The hourly numbers of overdense reflections longer than 10 seconds and longer than 1 minute, as observed here at Kampenhout (BE) on the frequency of our VVS-beacon (49.99 MHz) during August 2019.

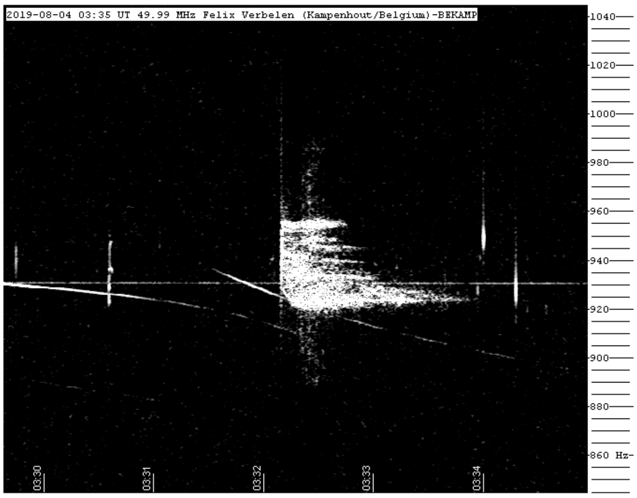


Figure 3 – 2019 August 4 at 3^{h}35^m UT.

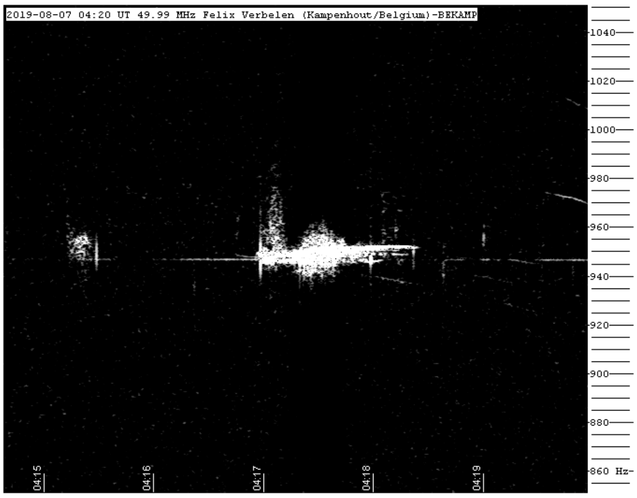


Figure 4 – 2019 August 7 at 4^{h}20^m UT.

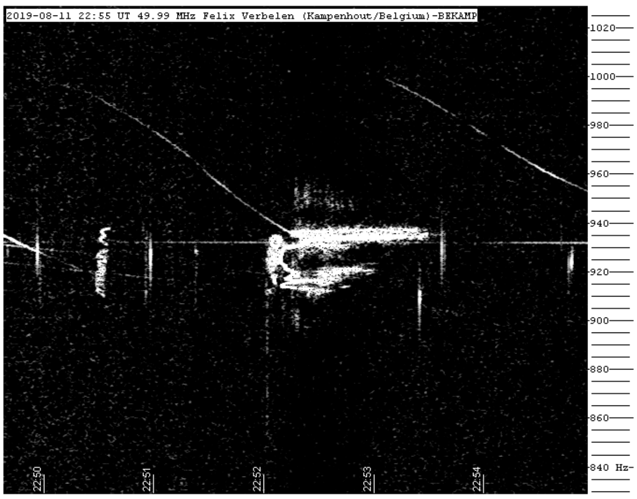


Figure 5 – 2019 August 11 at 22^{h}55^m UT.

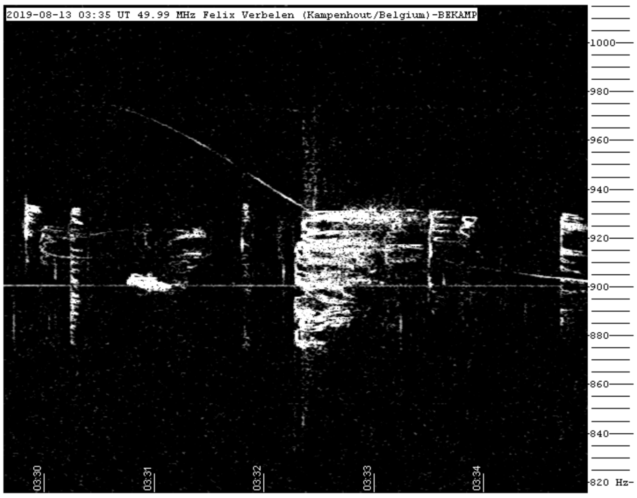


Figure 6 – 2019 August 13 at 03^{h}35^m UT.

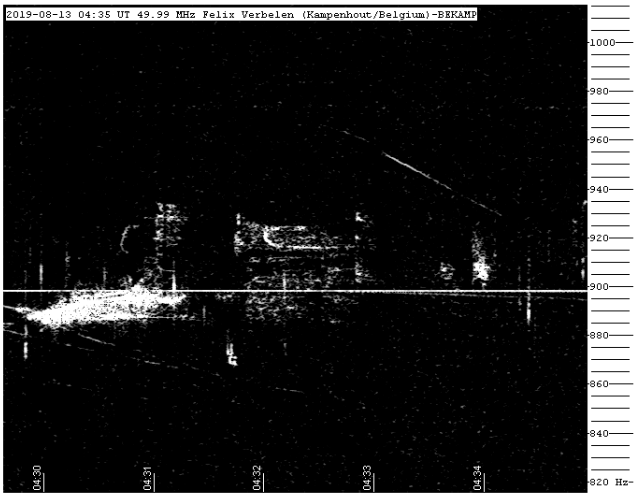


Figure 7 – 2019 August 13 at 4^{h}35^m UT.

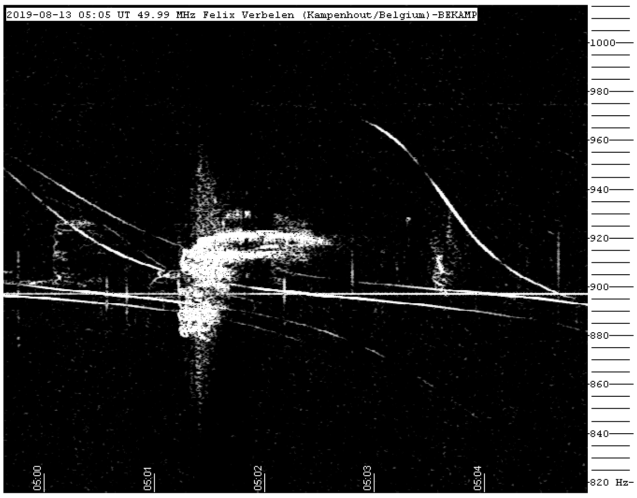


Figure 8 – 2019 August 13 at 05^{h}05^m UT.

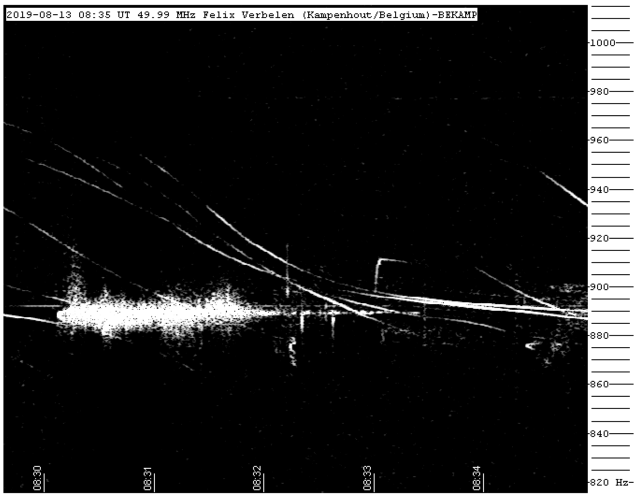


Figure 9 – 2019 August 13 at 08^{h}35^m UT.

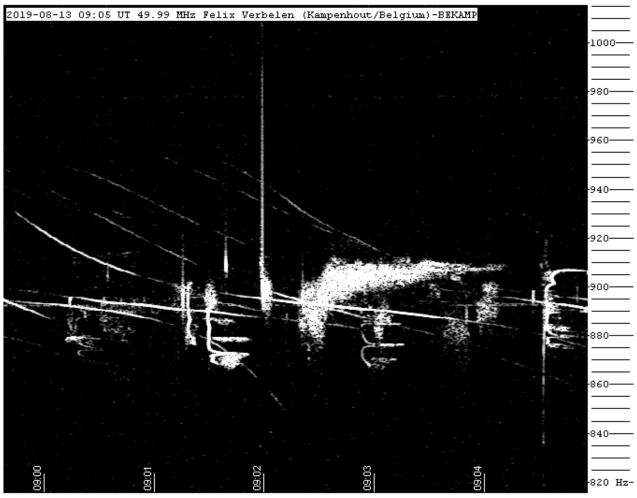


Figure 10 – 2019 August 13 at 09^{h}05^m UT.

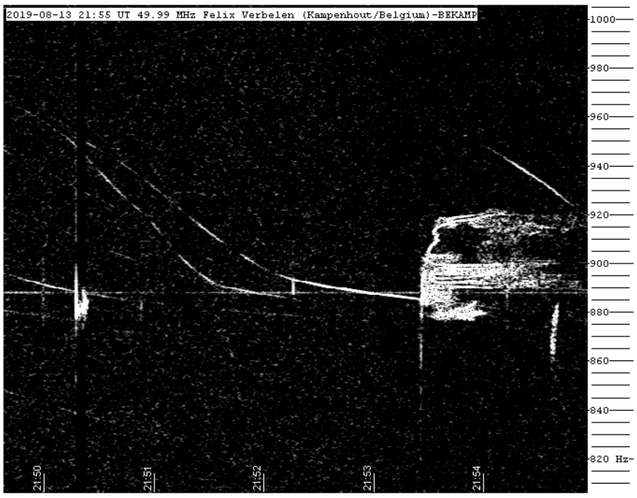


Figure 11 – 2019 August 13 at 21^{h}55^m UT.

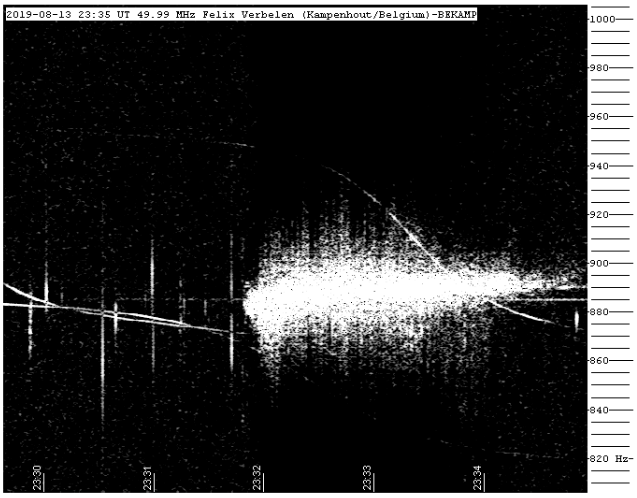


Figure 12 – 2019 August 13 at 23^{h}35^m UT.

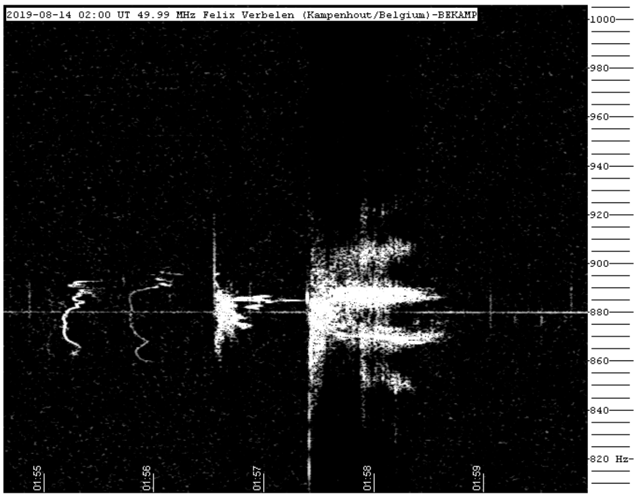


Figure 13 – 2019 August 14 at 02^{h}00^m UT.

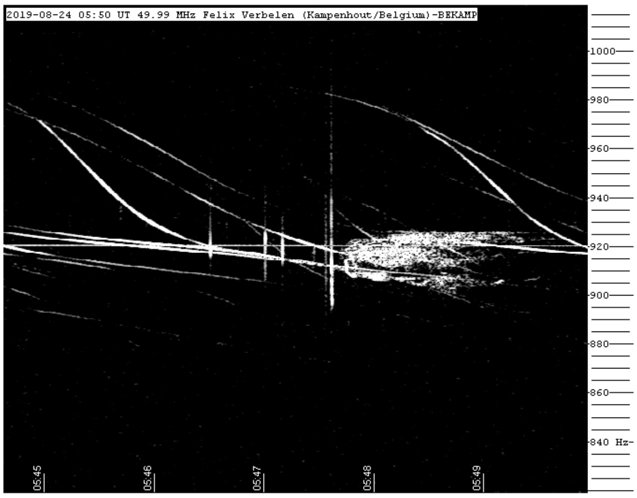


Figure 14 – 2019 August 24 at 05^{h}50^m UT.

Super bolide over the Mediterranean Sea on August 16, 2019

Tioga Gulon

6, rue Rodin, F-54710 Fléville-devant-Nancy, France
france.allsky.camera@gmail.com

A spectacular fireball appeared 2019 August 16 at 20h36m02s UTC. The video recordings allowed to calculate the trajectory of the fireball.

On Friday, August 16^{th}, 2019, at $22^h36^m02^s$ CEST ($20^h36^m02^s$ UTC) a huge fireball was observed from all around the west Mediterranean Sea.

Numerous people from Spain, Italy and France witnessed this event as reported on the IMO website form.

On social media networks, Algeria citizens from Batna, Biskra, Sétif, Constantine and Alger described their amazing sighting. But most of the witnesses are located at the islands Sardinia and Corsica where the fireball enlightened the ground.

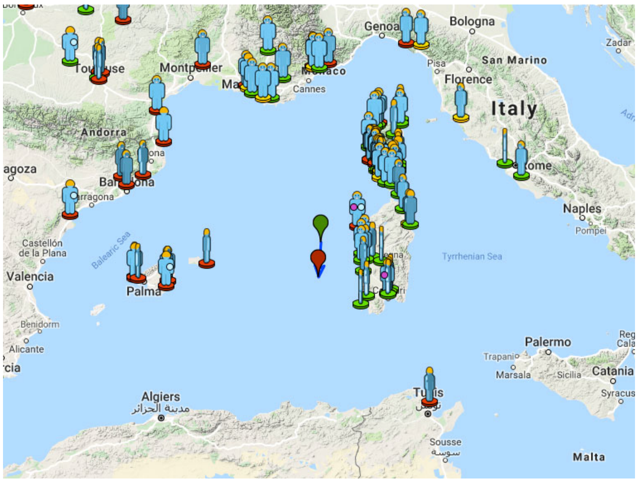


Figure 1 – The ground path of the fireball of 2019 August 16, $20^h36^m02^s$ UTC according to 93 reports on 3790–2019 event IMO page.

The object crossed the field of the DSLR camera of Francesco Malica[5] when he made tests for star trail pictures at S'Archittu.

Also a driver at Sardinia, Claudio P. was on the Stella Maris road at Oristano when he caught the fireball with his dashcam[6].

Somewhere on the west coast of Sardinia, the fireball streaked across the sky during a country dance music performance[7].

Figure 2 – The fireball in the field of the DSLR camera of Francesco Malica at S'Archittu.

This super bolide was so bright that it was spotted by a video meteor camera[8] located at Ibiza on the Puig des Molins observatory, 600 km away from Sardinia. The Spanish Meteor and Fireball Network (SPMN) operating this station evaluated the luminosity as magnitude –16.

Using videos and pictures recorded, the location of the atmospheric entry of the meteor can be found. The azimuths and elevations are derived from the records of Francesco Malica/S'Archittu, Claudio P./Oristano, AAE observatory/Ibiza and on a fourth picture from the meteor webcam at Asuni.

[5] https://www.instagram.com/p/B1Pb8BlomJd/?utm_source=ig_embed
[6] https://youtu.be/xqmo6RqxqRs
[7] https://www.facebook.com/castedduonline/videos/2401148006831234/
[8] https://assets.meteornews.net/wp-content/uploads/2019/08/SPMN160819.gif

Figure 3 – 20190816_203602 Fireball recorded by the weather camera of the city of Asuni/Sardinia.

Table 1 – The positional data for the four locations.

Observer	Location	Latitude (°)	Longitude (°)	Altitude (m)	Azimuth (°)	Elevation (°)	Comment
AAE Observatory	Ibiza	38.9060	1.4292	42	90°	–	First big burst
Francesco Malica	S'Archittu	40.0906	8.4934	20	225°	13°	First big burst
Claudio P. at 22:43:32	Oristano	39.9109	8.5305	2	229°	–	First big burst
Modighina webcam	Asuni	39.8872	8.9741	600	243°	15°	–

Figure 4 – 20190816 fireball coordinates assessment on 4 records.

The first big burst location could be determined with a sufficient accuracy on the direction from the pictures of Francesco Malica and Claudio P. as well as with a less good accuracy from AAE observatory footage.

We can compare the locations derived from these pictures and the trajectory found from the visual reports of the IMO, the meteor passed 100 km west of the coast of the island Sardinia, heading South but a hundred kilometers SSW of the trajectory calculated by the IMO.

According to the CNEOS/NASA/JPL report from the U.S. Government space sensors, the velocity of the asteroid was 14.9km/s at its maximum brightness position was at lat : 38.9°N , long : 7.0E at an altitude :of 36km

They calculated an impact energy close to 0.9 kt.

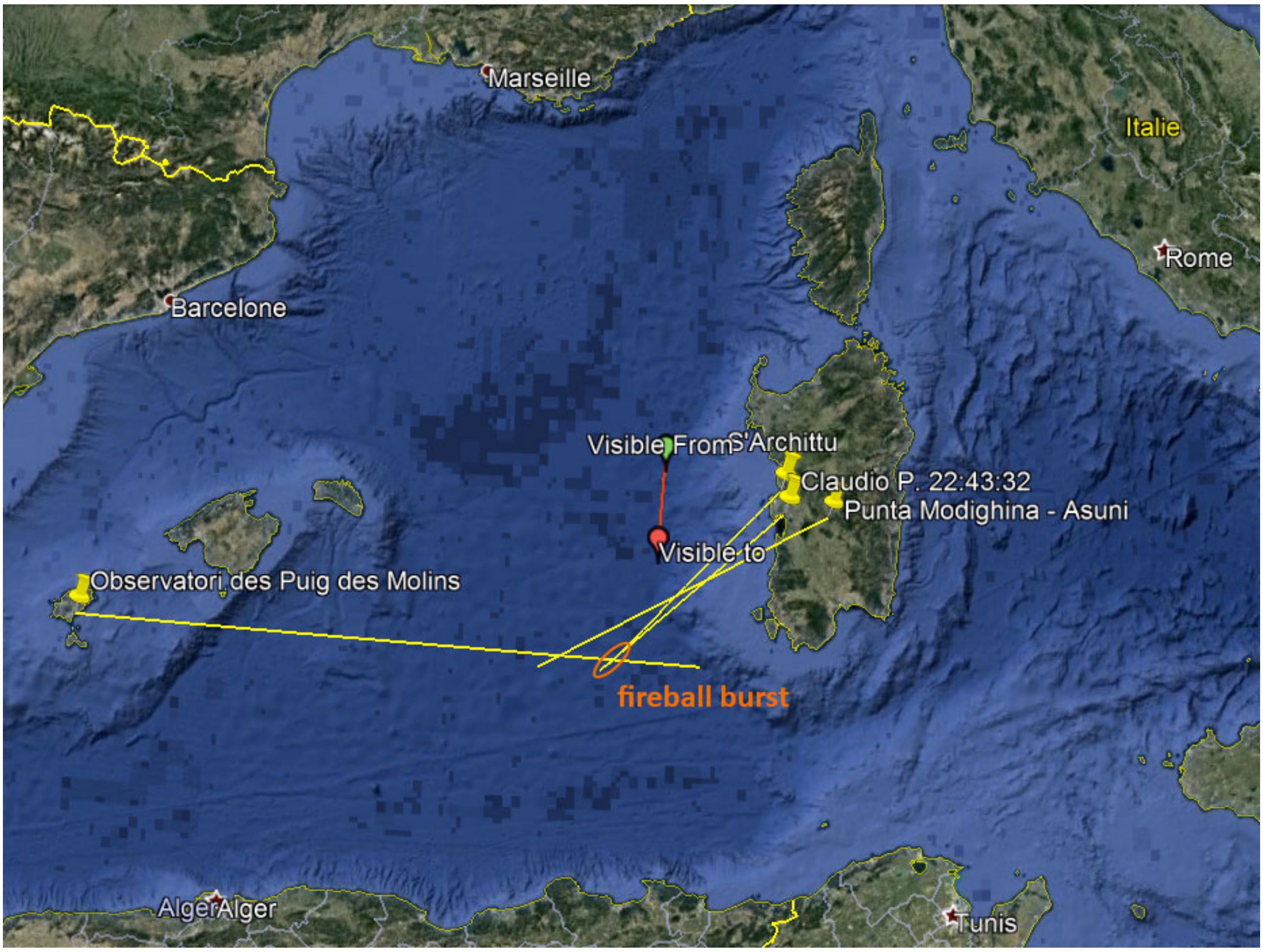


Figure 5 – Estimated location of the first big burst of the 20190816 fireball.

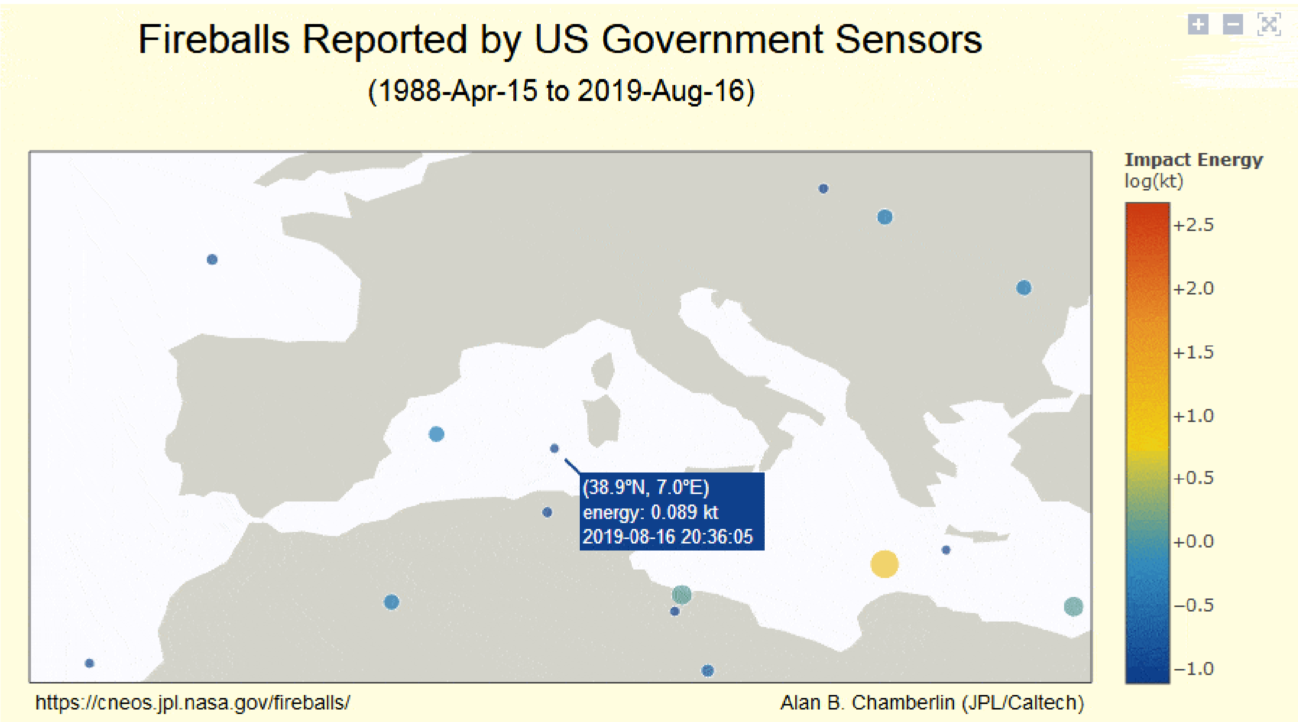


Figure 6 – 20190816_203602 fireball report map – https://cneos.jpl.nasa.gov/fireballs/.

UKMON and BOAM record a fireball over the English Channel

Richard Kacerek

19 Comet Close, Ash Vale, Surrey, GU125SG, United Kingdom
rickzkm@gmail.com

A bright fireball appeared between France and England on 2019 September 8. A trajectory could be computed from the video data.

Sunday 8 September 2019 at 4^{h}51^{m}43^s UT British UKMON and French BOAM meteor detection networks recorded a great fireball across the channel. The event was a slow-moving bright meteor, captured by four cameras in the UK and one in France.

There are 91 public reports so far from Île-de-France, Bretagne, England, Hauts-de-France, Nouvelle-Aquitaine, Pays de la Loire and Wales. Many reports indicate a fragmentation of at least two pieces.

Figure 1 – Richard Bassom, New Forest, UK.

Figure 2 – Steve Bosley, Clanfield Observatory, UK.

Figure 3 – Richard Fleet, Wilcot, UK.

Figure 4 – Stéphane Jouin, May-sur-Orne, France.

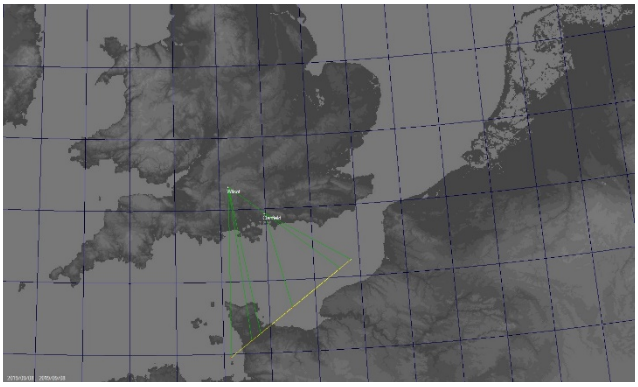


Figure 5 – Trajectory calculated by Steve Bosley from Clanfield Observatory using UKMON data from Wilcot and Clanfield.

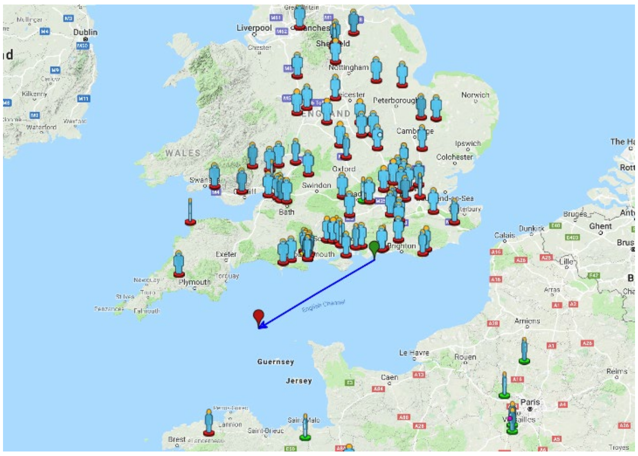


Figure 6 – The trajectory according to the IMO fireball observations.

In the UK a concerned public reported a loud noise which triggered a two police helicopters search in the Plymouth area, thought to be a crashed plane.

Both networks are currently gathering data from cameras and trying to triangulate the event.

Judging from the location, over the English Channel, there is virtually zero chance of recovery of any potential meteorites.

Figure 7 – Trajectory as calculated by FRIPON and SCAMP camera in Honiton.

Bright fireball 9 September 2019

Ivan Sergei

Mira Str.40-2, 222307, Molodechno Belarus
seriv76@tut.by

A -10 fireball was reported from Lithuania, Estonia, the European part of Russia and Belarus.

My all-sky camera picked up part of the path of a bright fireball on 9 September 2019 at 17h58m UT. This fireballs was seen in Belarus, Northern Russia and the Baltic States. The article[9] presents the video of the flight. The approximate brightness was about –10. Judging by the video, there was fragmentation.

On the night of September 9–10 a fireball was seen at the sky over Lithuania, Estonia, the European part of Russia and Belarus. In particular, according to breaking.lv, a meteor was noticed over Vilnius, Kaliningrad and Baranovichi, Lida and Slutsk. According to preliminary data, residents of Minsk could also see the heavenly phenomenon. In Estonia, a fireball was observed both in the north of the country in Western Virumaa and in the south in the districts of Tartu and Põlva.

Belarussians saw an amazing phenomenon. According to inhabitants of Minsk the fireball was "large, bright white, flying along a ballistic trajectory. Then it began to split into pieces that flew parallel and then burning yellow-red before fading. The white dot also faded in the sky."

Videos can be consulted online[10,11,12 and 13].

Figure 1 – All-sky camera path of the fireball on 9 September 2019 at 17^h58^m UT by Ivan Sergei.

[9] https://42.tut.by/652887
[10] https://youtu.be/b21Ph1mqGjU
[11] https://twitter.com/deduktors/status/1171127311149744130
[12] https://youtu.be/YdtnZtWV01w
[13] https://t.me/belamova/2115

Daylight fireball over northern Germany 2019 September 12

Paul Roggemans

Pijnboomstraat 25, 2800 Mechelen, Belgium
paul.roggemans@gmail.com

Many people witnessed a spectacular daylight fireball, visible from far away above northern Germany on 2019 September 12 at 12h50m UT. The event was registered by a satellite of the Center for Near Earth Object Studies (CNEOS). This data allowed to calculate a trajectory and an orbit.

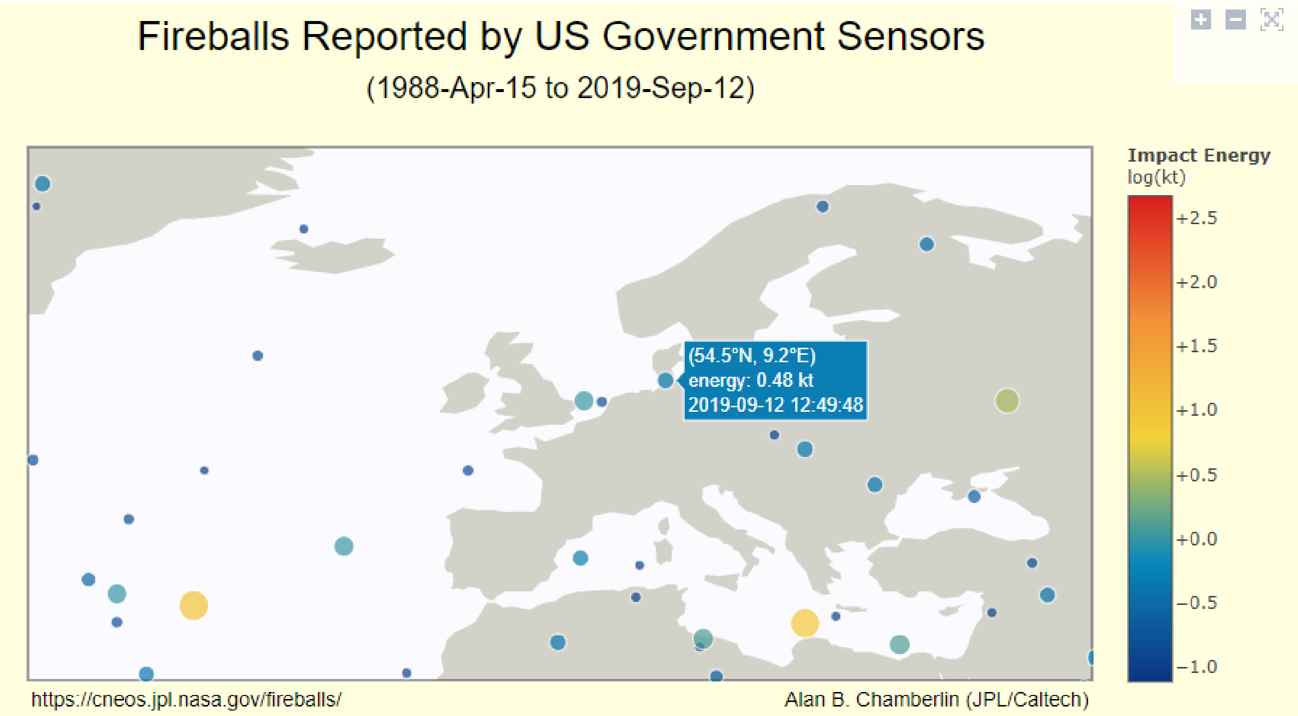


Figure 1 – Map of satellite observed major fireballs.

1 Introduction

A bright daylight fireball appeared on September 12 at $12^h49^m48^s$ UT, seen by thousands of casual witnesses in north-western Europe. The event took place over Northern Germany (*Figure 1*), just south of Denmark (φ = 54.5° N, λ = 9.2° E). The peak brightness was reached at an altitude of 42 km. The fireball had a velocity of 18.5 km/s and had a total impact energy of 0.48 kt[14].

2 Estimating the trajectory

The position differs significantly from an earlier released fireball trajectory based on the visual reports of casual witnesses. Like usually the quality of this kind of data did not allow to compute a reliable trajectory (see *Figure 2*). Only measurable photographic or video records allow to compute more reliable trajectories. There are a few video records which may help to determine the trajectory[15]. Meanwhile an adjusted trajectory was computed and published by the American Meteor Society[16].

Figure 2 – Fireball trajectory according to IMO reports.

[14] https://cneos.jpl.nasa.gov/fireballs/ (Center for Near Earth Object Studies (CNEOS))
[15] https://youtu.be/ys-KQw4tdDk
[16] https://www.amsmeteors.org/2019/09/daytime-fireball-over-north-sea-on-sept-12th-2019/

Figure 3 – The fireball was registered accidently by a kite surfer.

3 Trajectory and orbit

Dr. Marco Langbroek, expert in this matter, obtained an estimate for the radiant from the velocity vector and computed a heliocentric orbit for this fireball. The satellite data gives only a position for the point of maximal brightness (54.5 N, 9.2 E, 42 km) and a velocity vector. The begin- and endpoint of the fireball are unknown, but the entrance angle and direction are known. The solid line in *Figure 4* represents the vector between 80 and 42 km elevation, the dotted line extrapolates this until 27 km elevation. Dr. Marco Langbroek published the following orbital elements:

- R.A. $\alpha_g = 183°$
- Declination $\delta_g = -19.6°$
- Velocity $v_g = 14.8$ km/s
- Perihelion distance $q = 0.855$ AU
- Semi-major axis $a = 2.369$ AU
- Eccentricity $e = 0.639$
- Inclination $i = 6.96°$
- Argument of perihelion $\omega = 307.838°$
- Longitude of the ascending node $\Omega = 349.202°$
- Length of perihelion $\Pi = 297.1°$
- Period 3.8 yr

The orbit is an Apollo type orbit, hence asteroidal (Tisserand 3.2), the fireball was caused by an about 2 meter diameter sized asteroidal fragment.

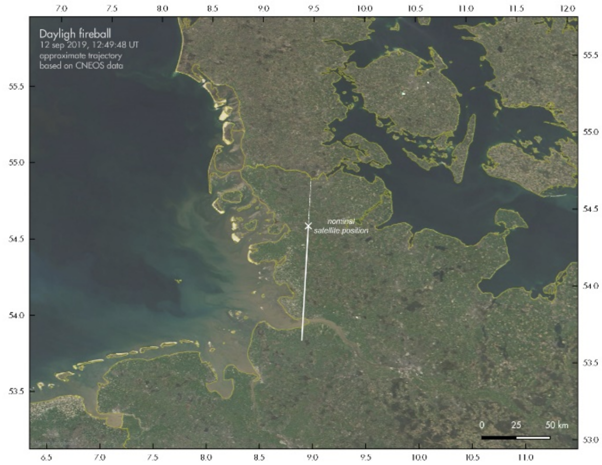


Figure 4 – Trajectory computed by Dr. Marco Langbroek.

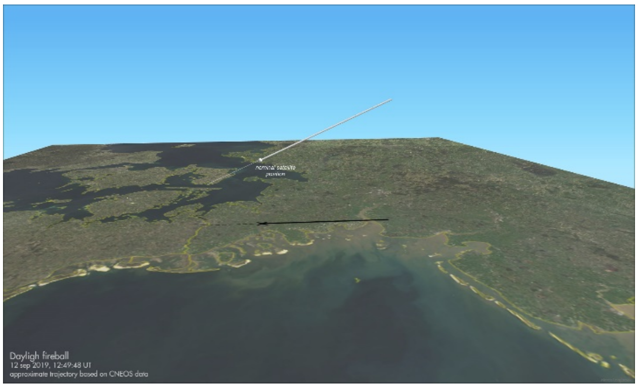


Figure 5 – Trajectory computed by Dr. Marco Langbroek.

Stunning meteor events over Spain in September 2019

José María Madiedo

Instituto de Astrofísica de Andalucía
madiedo@iaa.es

An overview is presented of the exceptional fireball events by the meteor observing stations operated by the SMART Project from Sevilla and Huelva during August and September 2019.

1 Fireball 2019 September 7

This amazing meteor overflew the south of Spain on 2019 September 7 at about 4^h05^m local time (equivalent to 2^h05^m UT). It was generated by a meteoroid following an asteroid-like orbit that hit the atmosphere at about 120000 km/h. It began at an altitude of about 84 km over the region of Murcia, and ended at a height of around 29 km over Almería.

The event was recorded in the framework of the SMART project, operated by the Southwestern Europe Meteor Network (SWEMN), from the meteor-observing stations located at Calar Alto (Almería), La Hita (Toledo), La Sagra (Granada), and Sevilla[17].

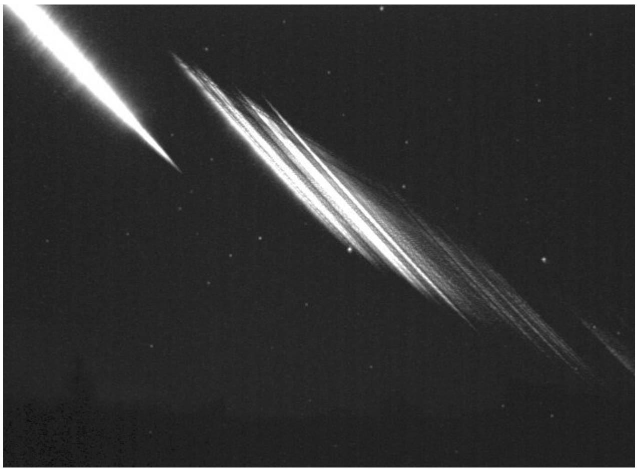


Figure 1 – Fireball 2019 September 7, 2^h05^m UT.

2 Fireball 2019 September 25

This amazing meteor overflew the Mediterranean Sea on 2019 September 25 at about 00^h59^m local time (equivalent to 22^h59^m universal time on September 24). It was generated by a rock from a comet that hit the atmosphere at about 140000 km/h. It began at an altitude of about 108 km over the sea, and ended at a height of around 60 km.

The event was recorded in the framework of the SMART project, operated by the Southwestern Europe Meteor Network (SWEMN), from the meteor-observing stations located at Calar Alto (Almería), La Hita (Toledo), La Sagra (Granada), Sierra Nevada (Granada), and Sevilla[18].

3 Fireball 2019 September 29

This stunning meteor overflew the Atlantic Ocean on 2019 September 29 at about 22^h31^m UT. It was generated by a rock from an asteroid that hit the atmosphere at about 72000 km/h. It began at an altitude of about 93 km over the sea, and ended at a height of around 28 km.

The event was recorded in the framework of the SMART project, operated by the Southwestern Europe Meteor Network (SWEMN), from the meteor-observing stations located at La Hita (Toledo), La Sagra (Granada), and Sevilla[19].

Figure 2 – Fireball 2019 September 29, 22^h31^m UT.

[17] https://youtu.be/WO18GmHFBJw
[18] https://youtu.be/5BoHY2OFMDY
[19] https://youtu.be/AYZwntkAvjg

The mission of MeteorNews is to offer fast meteor news to a global audience. Without editorial constraints, a swift exchange of information in all fields of active amateur meteor work. MeteorNews content is freely available without subscription or registration and is dedicated to active amateur meteor observers.

You are welcome to contribute to MeteorNews on a regular or casual basis if you wish to. Anyone can become an author or editor, send an email to us. For more info read: https://meteornews.net/writing-content-for-emeteornews/

The running costs for website hosting are covered by a team of sponsors. We want to thank Peter Campbell-Burns, Kai Frode Gaarder, Tioga Gulon, J Andreas Howell, Richard Kacerek, Robert Lunsford, Koen Miskotte, Paul Roggemans, Enrico Stomeo and E.J. van Ballegoij for their financial contributions.

You can support MeteorNews by a small PayPal donation and actively contribute to our growing citizen science community.

Webmaster & account administrator:

Richard Kacerek (United Kingdom): rickzkm@gmail.com

Contributing to this issue:

- ***Issam Abujami***
- ***Masa Alnaser***
- ***Aisha Alowais***
- ***Yousef Eisa***
- ***Tioga Gulon***
- ***Dr. Ilias Fernini***
- ***Ridwan Fernini***
- ***Akhmad Hassan***
- ***Richard Káčerek***
- ***Masahiro Koseki***
- ***José María Madiedo***
- ***Shahab Mohammad***
- ***Pierre Martin***
- ***Paul Roggemans***
- ***Ivan Sergei***
- ***Maryam Sharif***
- ***Salma Subhi***
- ***Mohammed Talafha***
- ***Felix Verbelen***

ISSN 2570-4745 Online publication https://meteornews.net

Listed and archived with ADS Abstract Service: https://ui.adsabs.harvard.edu/search/q=eMetN

MeteorNews Publisher:

Valašské Meziříčí Observatory, Vsetínská 78, 75701 Valašské Meziříčí, Czech Republic