

# Perseids 2019: another peak in activity around solar longitude 141.0°?

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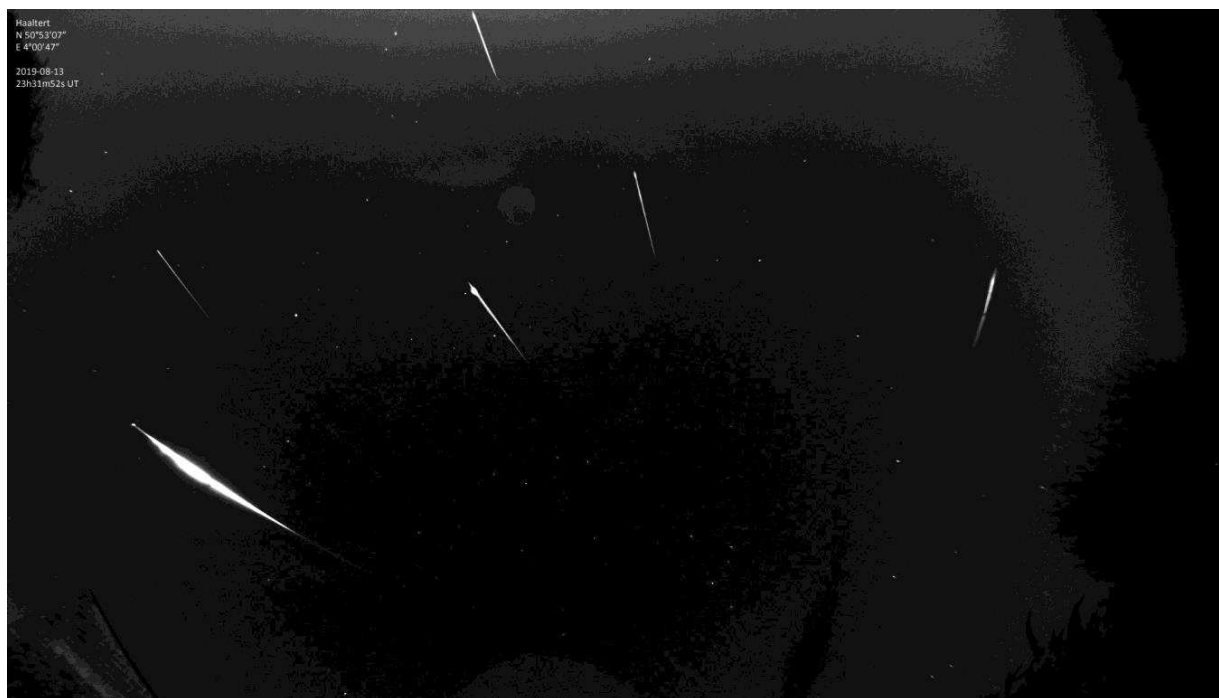
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Observations in August 2019 confirmed a secondary peak in the Perseid activity profile at solar longitude 141.0°, which was noticed in the 2018 Perseid activity as well as in previous years of observations. An analysis is presented of the 2019 observational data compared with the 2018 results.



*Figure 1* – Composition made from images of Perseids in the night 13–14 August 2019 taken with an ASI290MM camera in combination with a 2.5 mm fish eye lens. The recordings were made by Bart Declercq from his observatory in Haaltert, Belgium. The brightest Perseid was magnitude  $-7$  and left a persistent train that was visible for 1 minute by the naked eye.

## 1 Introduction

It is Tuesday morning, August 14, 2018. European meteor observers notice that the Perseids are well active that night. The first author subsequently extensively analyzed the available visual data (Miskotte, 2018a; 2018b). It showed that around the traditional maximum there was some extra activity from bright meteors caused by the Perseid filament. A bigger surprise was that a serious peak in activity was found on the night of 13–14 August! The maximum felt just before solar longitude 141.0° and had a ZHR of 85. Searching back in old data around the same solar longitude and the same moonlight conditions from 1986, 1994, 2002 and 2010 showed that there were previously peaks in

activity around solar longitude 141.0°, but the ZHR was not as high as in 2018.

## 2 2019: another peak in Perseid activity around solar longitude 141.0°?

There was excitement among the authors when the famous radio curve from Hirofumi Sigumoto was online. After the traditional maximum, a second peak in activity was found just after solar longitude 141.0°! Unfortunately, a search on the IMO website for visual observing data around solar longitude 141.0° yielded rather few observations due to moonlight and/or bad weather conditions. In this article we will take a closer look at available radio-, CAMS- and visual meteor observations.

### Bruce McCurdy's observation

The only observation around solar longitude 141.0° (= August 14, 2019 8<sup>h</sup>00<sup>m</sup> UT) comes from Bruce McCurdy from Canada. His time interval runs from August 14, 2019 6<sup>h</sup>04<sup>m</sup> to 10<sup>h</sup>22<sup>m</sup> UT. Unfortunately, due to the combination of moonlight and smoke from wildfires, McCurdy had a low limiting magnitude. He wrote:

*“Observed Perseids within ± 24 hours of the peak for the 32<sup>nd</sup> consecutive year. Barely. After a long run of crummy weather that wiped out the peak and several nights before, it cleared on the 13<sup>th</sup> to allow one session of post-peak viewing in the wee hours of the 14<sup>th</sup>. At that, bright moonlight interacting with incoming forest fire smoke reduced the sky at the “dark site” to urban or at best suburban quality, limiting magnitude about 4.5 at best. Just 27 Perseids observed in 4.0 hours  $T_{eff}$ , with a bias towards brighter members (9 of mag -1 or brighter). Better late than never, but better luck next year!”*

McCurdy didn't see Perseids in the first hour, but during the other hours he did. Despite the very poor circumstances, we calculated the data under the motto: better something than nothing. An assumed population index  $r$  of 2.00 has been used in the calculations. This resulted in ZHRs between 40 and 60.

### Michel Vandeputte's observations

Michel (2<sup>nd</sup> author) was able to observe this night from Belgium (unfortunately Ermelo hometown of the first author was cloudy that night) between 23<sup>h</sup>30<sup>m</sup> and 03<sup>h</sup>15<sup>m</sup> UT (= between solar longitude 140.661° and 140.811°). He wrote:

*“This night was also clear, actually much better in quality than the previous night. There was some wind this night. First, I had to sleep a little, but I was woken up long before my alarm went off caused by a text from Simon Vanderkerken. He had seen a fireball from his car. I couldn't sleep anymore and decided to go under the starry sky a little earlier. This time I opted for a session on the ridge, given the more stable weather situation. The moonlight seemed many times more disturbing than during 12–13 August. My view was focused on the northeast.*

*Observations were done between 23<sup>h</sup>30<sup>m</sup> and 3<sup>h</sup>00<sup>m</sup> UT. When I started immediately there appeared a grandiose -6 to -7 PER with a long persistent train across the north!! I was able to follow the persistent train for one minute. Even more bright Perseids appeared in that first hour ... Perhaps I should have observed a little earlier? I am curious what the all sky cameras will show. For the rest, the activity actually continued quite well. Certainly, in the last hour it was downright good, when the Moon disappeared behind the edge of the forest. Lots of activity, lots of weak stuff! ZHR must certainly have been > 50. The end of the session was one not to forget ... a combination of a green-white -2, a +0, a -1 and a -6 Perseid!! What an end of this session!!”*

The question here is, did Michel observe this last hour of the first increase in activity to the second peak just as in 2018?



Figure 2 – The Perseid fireball of August 14, 2019 at 3<sup>h</sup>14<sup>m</sup>38<sup>s</sup> UT (magnitude -6) recorded by Bart Declercq from Haaltert, Belgium. The fireball appeared in the constellation Auriga.

### 3 The radio ZHR curve from Hirofumi Sugimoto

Figure 3 shows the radio curve of the Hirofumi Sugimoto website<sup>8</sup>. The green line shows the ZHR curve based on radio observations from 2018. The way Sugimoto converts radio observations into a visual ZHR curve was described in his article on Meteornews (Sugimoto, 2017). The peak just after solar longitude 141.0° is clearly visible.

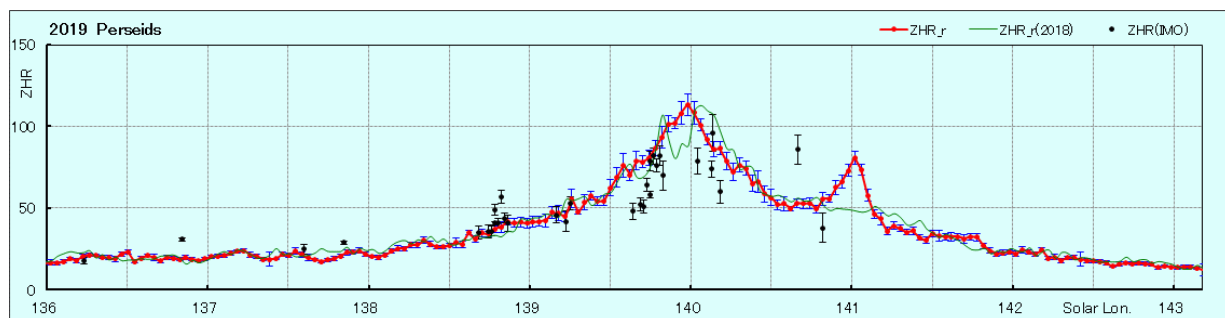


Figure 3 – The Perseid 2019 ZHR curve based on data collected worldwide by RMOB and made by Sugimoto.

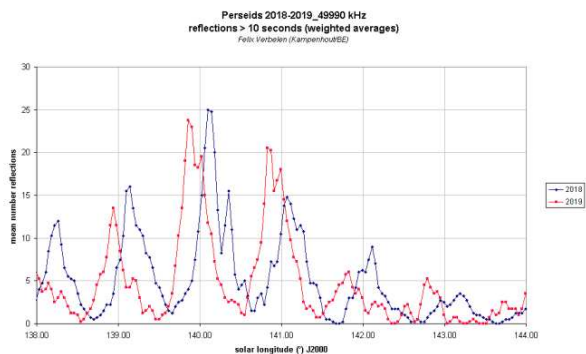
<sup>8</sup> <http://www.5f.biglobe.ne.jp/~hro/Flash/2019/PER/index.html>

## 4 Radio observations by Felix Verbelen (Belgium)

Inquiries with radio observer Felix Verbelen also yielded an interesting observation. *Figure 4* shows a comparison between 2018 and 2019. It concerns the radio reflections of more than 10 seconds (counted manually). The hour totals always relate to the past hour and were averaged according to the formula:

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

Felix always uses the reflections that last longer than 10 seconds because they usually correspond best with the visual observations.



*Figure 4* – Radio data from the Perseids 2019 of Felix Verbelen with reflections of 10 or more seconds. The blue curve represents 2018, the red curve 2019.

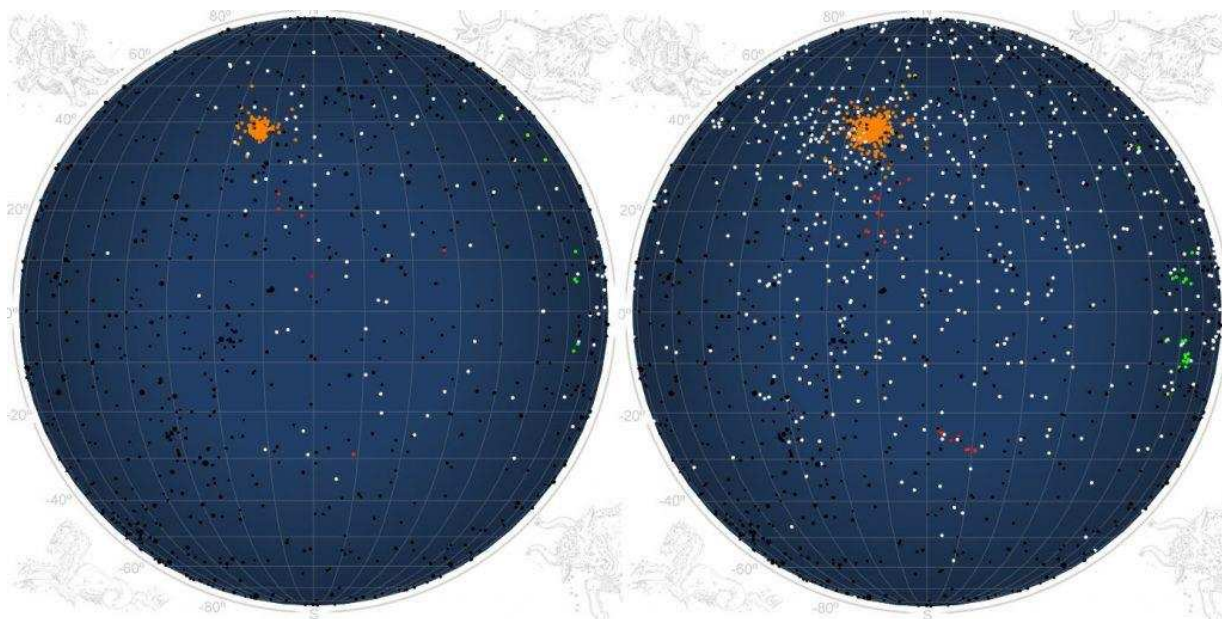
It is clearly visible that the activity of the Perseids with reflections of 10 or more seconds in 2019 was higher than in 2018. Unfortunately, his data from 2018 shows no

additional activity as observed by European visual observers.

## 5 Comparison of CAMS data from 2018 and 2019

We also looked at the CAMS data (worldwide) from 2018 and 2019 (*Figure 5*)<sup>9</sup>. In 2019 we clearly see a much larger amount of Perseids. But unfortunately, this is also the case with the other meteor showers and sporadic meteors. So here unfortunately disruption due to the weather and / or influences by the new CAMS networks in the southern hemisphere plays a role here. In order to eliminate weather and new network influences, we also looked at the relationship between the numbers of Perseids and other meteor showers.

The well-known images (*Figure 5*) also have a table with the numbers of meteors for each meteor shower. This determines the ratio in percentages of Perseids compared to the other showers in the night of August 14, 2016, 2018 and 2019. Here again we encountered the problem that the new southern CAMS networks record relatively more meteors from the southern meteor showers such as e.g. the Aquariid complex or meteor showers such as the eta Eridanids (in 2016: 4 meteors; in 2018: 2 meteors; in 2019: 36 meteors) and August Omicron Aquariids (in 2016: 4 meteors; in 2018: 12 meteors; in 2019: 43 meteors). That is why calculations were made without these meteor showers. The result is shown in *Table 1*. It is noticeable that the share of the Perseids in the total amount of meteor showers is virtually the same. So, this way no additional confirmation has been found of higher Perseid activity in 2018 and 2019 compared to 2016. Unfortunately, we can't do much with the CAMS data in this case.



*Figure 5* – CAMS data from 14 August 2018 (left) and 2019 (right).

<sup>9</sup> Source: <http://cams.seti.org/FDL/>

Table 1 – Ratio Perseids and other meteor showers on August 14, 2016, 2018 & 2019.

| Date         | nPer | nSHO | %PER | Date         | nPER | nSHO | %PER | Date         | nPER | nSHO | %PER |                      |
|--------------|------|------|------|--------------|------|------|------|--------------|------|------|------|----------------------|
| 14–8<br>2016 | 263  | 30   | 89.8 | 14–8<br>2018 | 905  | 73   | 92.5 | 14–8<br>2019 | 2383 | 234  | 91.1 |                      |
| 14–8<br>2016 | 263  | 22   | 92.3 | 14–8<br>2018 | 905  | 59   | 93.9 | 14–8<br>2019 | 2383 | 155  | 93.9 | Excl.<br>AOA<br>&ARI |

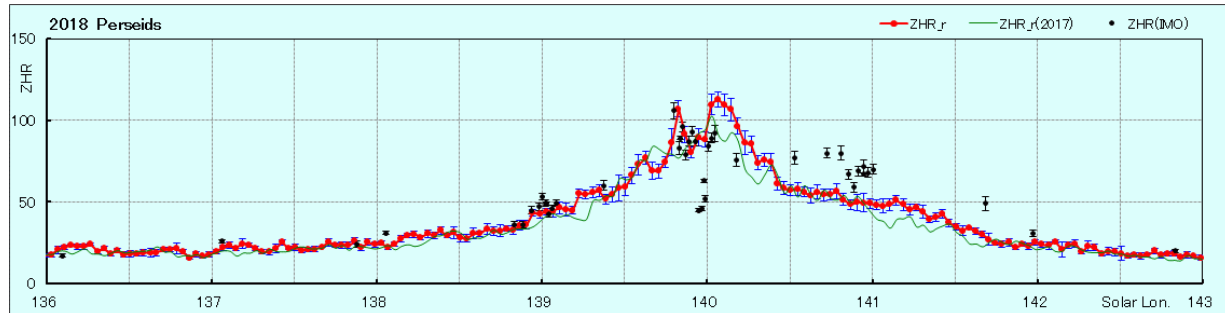


Figure 6 – Perseid ZHR curve for 2018 based on worldwide radio observations (RMOB) and made by Sugimoto.

## 6 What do we know now?

Unfortunately, there is hardly any visual evidence that there was a peak in activity in 2019 at solar longitude 141.0°. In 2018 this peak was well observed. The 2019 radio curve of Sugimoto indicates a significant peak in activity, comparable to the visual peak of 2018. Unfortunately, Sugimoto’s curve for 2018 (Figure 6) does not show a peak in activity.

To see how radio ZHR values relate to individual visual ZHR values, the ZHR values found from the data of Bruce McCurdy and Michel Vandeputte were put together in one graph. The result is displayed in Figure 7.

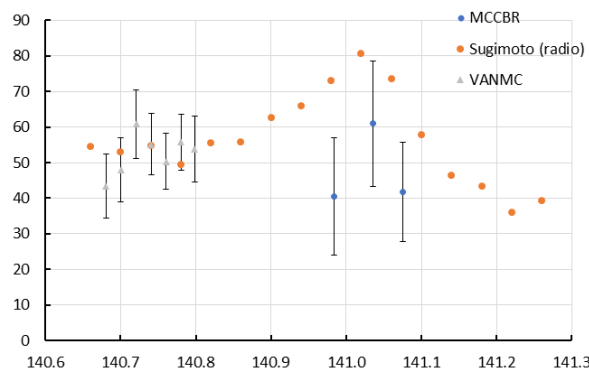


Figure 7 – The ZHR values found from the data from Bruce McCurdy from Canada (blue dots) and Michel Vandeputte from Belgium (grey triangles) compared to the radio curve from Sugimoto (orange points).

Michel Vandeputte’s data fits in nicely with the radio ZHR graph of Sugimoto. The ZHR found from the observation of Bruce McCurdy does not fit well, but does have the highest ZHR around the maximum of the radio ZHR curve. The lower ZHR curve relative to the radio ZHR curve is perhaps

due to the greater atmospheric extinction caused by the smoke from the wildfires.

Finally, the shape of the ZHR curve was also examined. Therefore, a graph has been made that combines the radio ZHR curve from 2019 with the visual ZHR curve from 2018. Figure 8 shows the result.

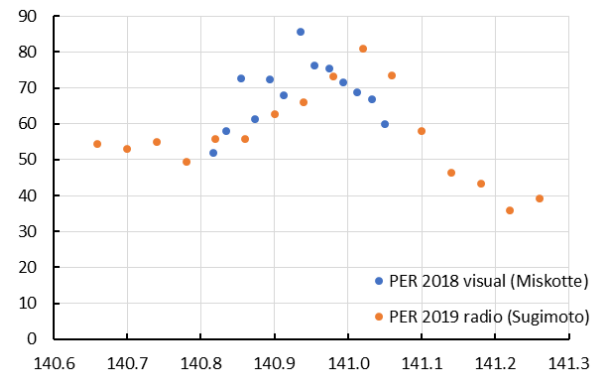


Figure 8 – Comparison of the visual Perseids 2018 ZHR graph with the radio Perseids 2019 ZHR graph.

It is striking that both peaks are reasonably in agreement in terms of appearance and height. The radio peak fell two hours later in 2019 compared to the visual peak in 2018. The question now arises as to why the radio data from 2018 shows NO peak around solar longitude 141.0°? Perhaps it can be explained by the fact that the visual observations from 2018 show that the *r* value was almost normal during that peak. The observations of Vandeputte and McCurdy from 2019 suggest brighter Perseids. The radio data from Felix Verbelen seems to support this. Perhaps an explanation is that the radio observation method picks up the bright meteors better than the weak meteors.

## 7 Conclusions and call for observations

It is clear that in 2019 the Perseids showed an extra peak in activity around solar longitude 141.0. This is mainly confirmed by radio data and barely by visual observations. In 2019, it seems that the peak was accompanied by somewhat brighter Perseids than in 2018. Therefore, an important call for observers in western North America, the Pacific and East Asia to continue to properly monitor Perseids beyond the traditional maximum! Perhaps another surprise is possible after 2018 and 2019.

The maximum found in 2018 (solar longitude 140.94°) will appear in 2020 on 13 August at 12<sup>h</sup>45<sup>m</sup> UT. It can still be observed from California until around 12<sup>h</sup>30<sup>m</sup> to 12<sup>h</sup>45<sup>m</sup>, so at a peak around 12<sup>h</sup>45<sup>m</sup> UT the increasing activity can still be observed well. Also, in north-east Asia it is possible to observe around that time, but the radiant will still be low. If the peak at the maximum found in 2019 (141.02° based on radio data), then this will take place at 14<sup>h</sup>45<sup>m</sup> UT. In that case, only the first increase to this peak is visible from California. Australia and East Asia are better locations, although the radiant in Australia remains low.

## Acknowledgment

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## References

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