October 2026 CARMELo report

by CARMELo network
(Cheap Amatorial Radio Meteor Echoes Logger)

Mariasole Maglione (Rete CARMELo e GAV, Gruppo Astrofili Vicentini)
Lorenzo Barbieri (Rete CARMELo e AAB, Associazione Astrofili Bolognesi)
Silvana Sarto (Rete CARMELO e AAB, Associazione Astrofili Bolognesi)
William Rivato (Rete CARMELo e MarSEC, Marana Space Exploration Center)

carmelometeor@gmail.com

Introduction

Meteor activity in October gave us the opportunity to observe two showers with very different characteristics: the Draconids and the Orionids. In the data from the CARMELo network, analysis of the RZHR allowed us to identify a fairly distinct profile corresponding to the Draconids, while for the Orionids, a period of heightened activity spanning several days emerged; interpreting this is complicated by the simultaneous presence of other showers.

Methods

The CARMELo network consists of SDR radio receivers. In them, a microprocessor (Raspberry) performs three functions simultaneously:

1) By driving a dongle, it tunes the frequency on which the transmitter transmits and tunes like a radio, samples the radio signal and through the FFT (Fast Fourier Transform) measures frequency and received power.

2) By analyzing the received data for each packet, it detects meteoric echoes and discards false positives and interference.

3) It compiles a file containing the event log and sends it to a server.

The data are all generated by the same standard, and are therefore homogeneous and comparable. A single receiver can be assembled with a few devices whose total current cost is about 210 euros.

To participate in the network read the instructions on this page.

October data

In the plots that follow, all available at this page, the abscissae represent time, which is expressed in UT (Universal Time) or in solar longitude (Solar Long), and the ordinates represent the hourly rate, calculated as the total number of events recorded by the network in an hour divided by the number of operating receivers. The time resolution is 15 minutes.

In *fig. 1*, the trend of signals detected by the receivers for the month of October.

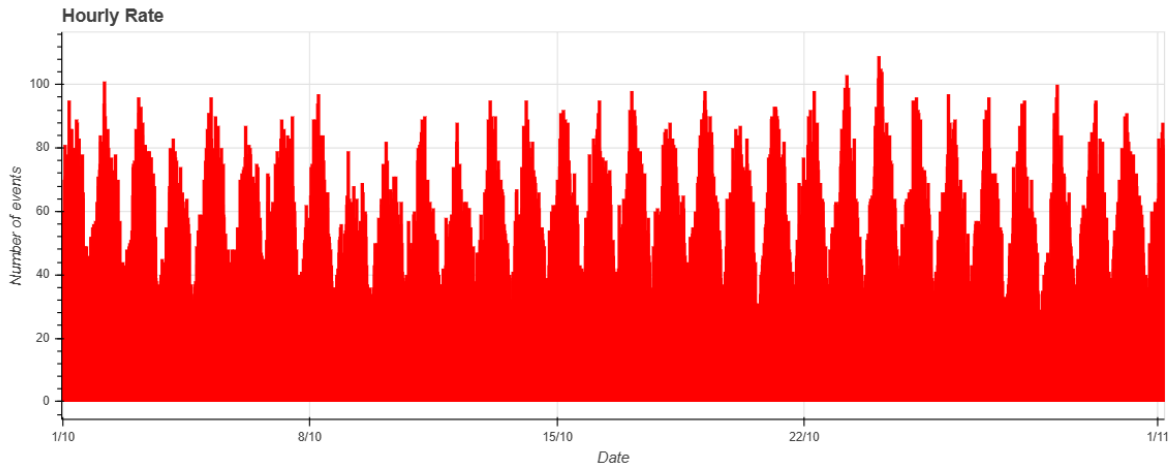


Fig. 1: October 2026 data trend.

Draconids

The Draconids (009 DRA) are associated with Comet 21P/Giacobini-Zinner and have their radiant in the constellation Draco. Generally not very active, they can produce intense outbursts when Earth passes through particularly dense regions of cometary debris, as occurred in 2011 (1). Their meteors are among the slowest of the major meteor showers, with a speed of about 20 km/s. The 2026 IMO calendar (2) indicates that the peak was expected on October 9, at a solar longitude of 195.4°.

Orionids

The Orionids (008 ORI) are produced by debris from Comet 1P/Halley, which is also responsible for the May Eta Aquarids. The radiant is located in the Orion constellation, and the meteors enter the atmosphere at about 66 km/s, a speed significantly higher than that of the Draconids.

The meteor shower is active from October 2 to November 7, with a predicted peak on October 21 at a solar longitude of 208°. During the same period, the Leonis Minorids (022 LMI) are also active, with a predicted peak on October 24 at a solar longitude of approximately 211° (2).

The construction of RZHR

By RZHR (Radio Zenithal Hourly Rate), we mean the hourly rate of radiometeors in a shower, calculated by processing data from meteor scatter receivers.

This tool allows us to make a significant leap in quality, moving away from the qualitative analysis we have conducted so far (which relied exclusively on graphs) and transitioning to the direct processing of data from our database. To do this, we developed a Python script with the help of the “Cursor” tool, an AI-powered code editor created by Anysphere. This support proved crucial in developing a satisfactory script.

First, it should be clarified that, in calculating the RZHR, we make certain approximations, including:

1) We do not take into account that the varying geographical distribution of receivers causes them to “see” meteors from slightly different angles.

2) We disregard the fact that observations are not isotropic but are influenced by antenna pointing, which favors a specific sector of the sky over the entire sky.

3) We define a contribution as “sporadic” even though it may also include meteors from small showers.

The algorithm for this calculation uses data from the database of all meteors recorded by the CARMELo network. First, it asks the user to identify certain days on which no significant meteor shower activity is expected. These days are selected as close as possible to the date being analyzed. This data is then averaged to form a second database called the “sporadic average.”

This database is then subtracted from the one for the days under examination, during which a meteor shower is presumed to be present. Any negative values are eliminated, and the profile is smoothed using a smoothing function.

The figure is then divided by the sine of the radiant’s altitude above the horizon, calculated for an average Italian location in the same way as the algorithm used to calculate the ZHR (Zenithal Hourly Rate), which, as we recall, is:

$$ZHR = \frac{N * r^{6.5-L_m}}{\sin h_R * T_{eff} * F}$$

Where:

- *N*: number of meteors counted.
- L_m : the limiting magnitude of a star that is visible to the observer.
- *r*: shower’s density (the ratio indicating how many more meteors are visible for each magnitude; typically ranging from 2.0 to 3.5).
- h_R : angular height of the radiant above the horizon in degrees.
- T_{eff} : actual observation time (in hours).
- *F*: field-of-view correction factor.

The temporal resolution, which is 15 minutes in the original data, is retained at that value; therefore, the term *H* in RZHR should be considered as $\frac{H}{4}$.

To estimate the activity of the Draconids and the Orionids, the sample of sporadic meteors (in *fig. 2*) was obtained by averaging the data from September 15 to 22.

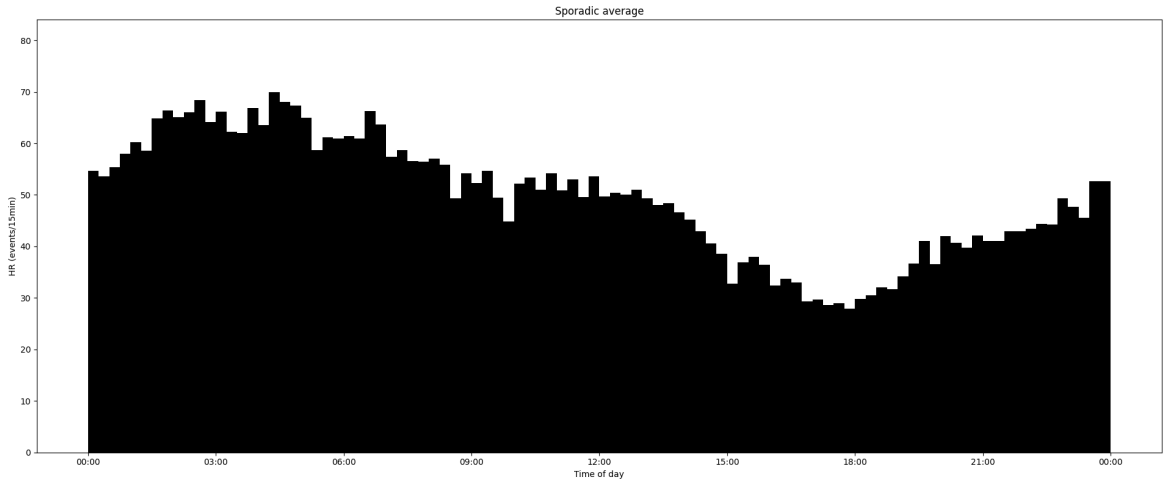


Fig. 2: A sample of sporadic meteors collected in September 2026 for analysis of the Draconids and Orionids.

Draconids' RZHR

Fig. 3 shows the trend in meteor activity recorded by the network, limited to the hours when the Draconid radiant was above the horizon for most of the observing stations between October 5 and 10 (between solar longitudes of approximately 192° and 197°).

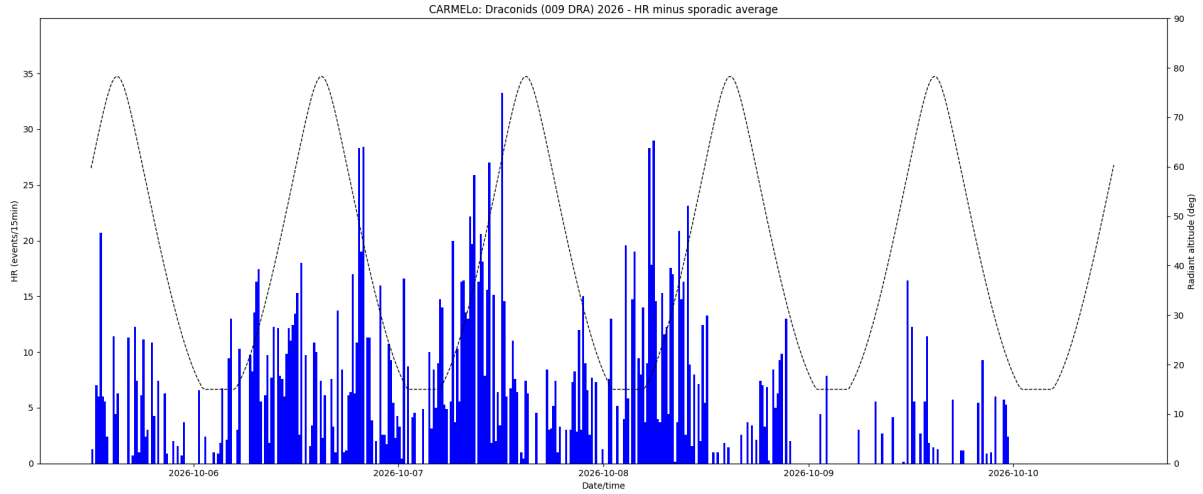


Fig. 3: Meteor activity trends between October 5 and 10, 2026, limited to the hours when the radiant was at least 10° above the horizon and the altitude of the Draconid radiant (dashed line).

Calculating the RZHR using the algorithm we developed (3) yields the results shown in *fig. 4*.

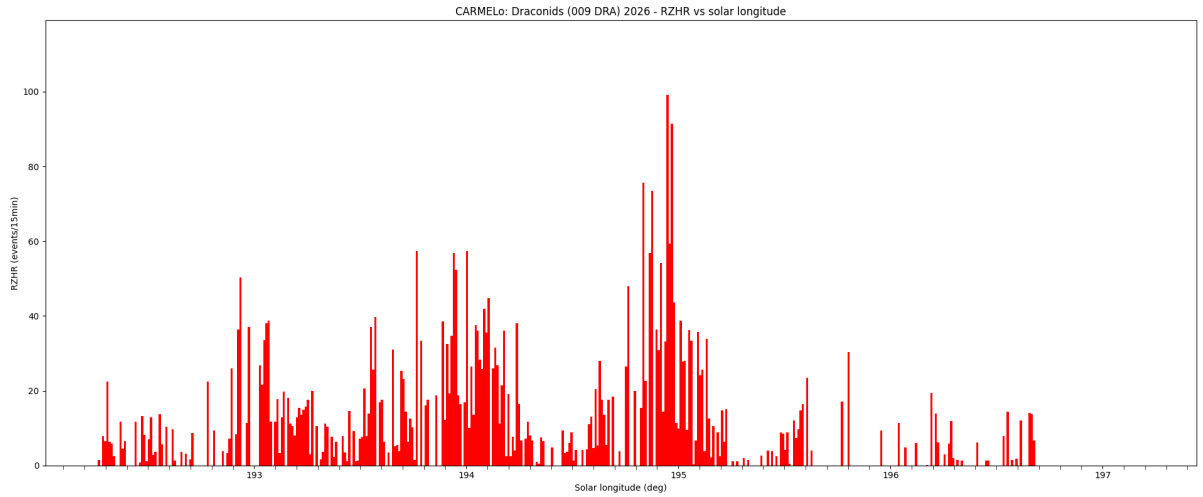


Fig. 4: Residual distribution of events for the Draconids.

Despite the modest activity of the Draconid meteor shower and the low speed of the meteors, the RZHR analysis from the CARMELo network yields a fairly clear profile. The peak detected on October 8 (at a solar longitude of approximately 195°) appears to occur slightly before the reference solar longitude (195.4°, as mentioned above).

It is interesting to compare this result with the 2011 outburst (1): observations from the IMO video network placed the main peak at a solar longitude of 195.036°, which was also earlier than the predicted value of 195.4°.

Orionids' RZHR

Fig. 5 shows the trend in meteor activity recorded by the network, limited to the hours when the Orionid radiant was above the horizon for most of the observing stations between October 1 and November 3 (between solar longitudes of approximately 185° and 220°).

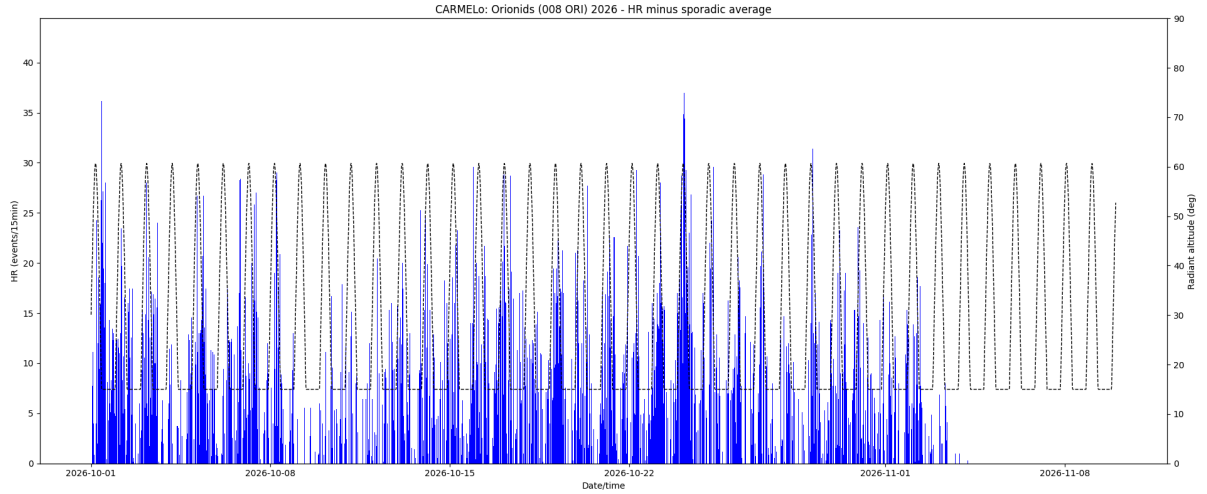


Fig. 5: Meteor activity between October 1 and November 3, 2026, limited to the hours when the radiant was at least 10° above the horizon and the altitude of the Orionid radiant (dashed line).

Calculating the RZHR using the algorithm we developed (3) yields the results shown in *fig. 6*.

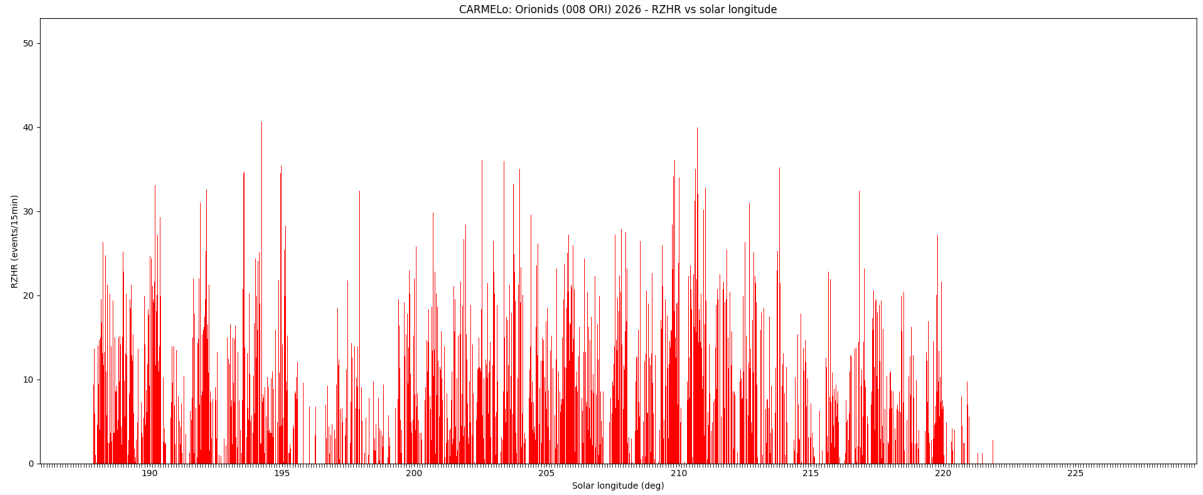


Fig. 6: Residual event distribution for the Orionids.

Analyzing the RZHR is more complex than analyzing the Draconids. The Orionid meteor shower's activity is spread out over many days, and the overlap with smaller showers makes it less straightforward to attribute the observed increases.

The CARMELo plots show a period of increased activity occurring approximately between solar longitudes of 207° and 211°, which includes the predicted maximum for the shower. This result suggests a broad maximum rather than a single, clearly isolated peak, which is consistent with the behavior described in the visual observations.

The possible presence of the Leonis Minorids calls for particular caution when interpreting the final portion of this interval. The residual profile obtained by subtracting the sporadic background may, in fact, contain contributions from multiple meteor showers, which cannot be reliably distinguished based solely on an analysis of the hourly rate.

A-Carinids

Among this month's reports is also an increase in activity from the A-Carinids, IAU shower 842, reported by Peter Jenniskens and colleagues in CBET Bulletin 5758 (5). Video networks in the southern hemisphere recorded significant activity between October 12 and 16, 2026, with an apparent peak on October 15.

With an altitude of approximately -57°, the radiant remains below the horizon from the Italian locations in the network. The geometry is therefore highly unfavorable for our observations, and there is no basis for attributing any variations in the CARMELo counts to this meteor shower.

The CARMELo Network

The network currently consists of 19 receivers located in Italy, Spain, the UK, Switzerland and the USA. The European receivers are tuned to the Graves radar station frequency in France, which is 143.050 MHz. Participating in the network are:

- Lorenzo Barbieri, Budrio (BO) ITA
- Associazione Astrofili Bolognesi, Bologna ITA
- Associazione Astrofili Bolognesi, Medelana (BO) ITA
- Paolo Fontana, Castenaso (BO) ITA
- Associazione Astrofili Pisani, Orciatico (PI) ITA
- Gruppo Astrofili Persicetani, San Giovanni in Persiceto (BO) ITA
- Roberto Nesci, Foligno (PG) ITA
- MarSEC, Marana di Crespadoro (VI) ITA
- Gruppo Astrofili Vicentini, Arcugnano (VI) ITA
- Associazione Ravennate Astrofili Rheyta, Ravenna (RA) ITA
- Mike German, Hayfield, Derbyshire UK
- Mike Otte, Pearl City, Illinois USA
- Yuri Malagutti, Comano (TI) CH
- Leslie Fry, Trawscoed Ceredigion, Wales UK
- Brian Coleman, Redenham Observatory, Andover, England UK
- Radio club La Salle University, Barcellona ESP
- Alberto Latini, Carona (TI) CH
- AstroCampania, Agerola (NA) ITA
- Giancarlo Madurini, La Spezia (SP) ITA

The authors' hope is that the network can expand both quantitatively and geographically, thus allowing the production of better quality data.

Bibliography:

(1) J. Vaubaillon et al. (2011): The coming 2011 Draconids meteor shower, *WGN 39:3*
(2) IMO Calendar 2026
(3) L. Barbieri, M. Maglione (2026): May 2026 CARMELo report, *eMetN Meteor Journal, vol. 11, issue 4, p. 307-310*
(4) S. Molau, G. Barentsen (2014): Real-time Flux Density Measurements of the 2011 Draconid Meteor Outburst, *Earth Moon Planets 112, 1-5*
(5) CBET 5758