May 2026 CARMELo report

by CARMELo network
(Cheap Amatorial Radio Meteor Echoes Logger)

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Introduction

May is the month of the Eta Aquarids. The peak, expected on May 7, was not particularly pronounced. To analyze the shower's activity, we used a new algorithm that attempts to distinguish the Eta Aquarids' contribution from that of sporadic meteors.

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.

May 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 May.

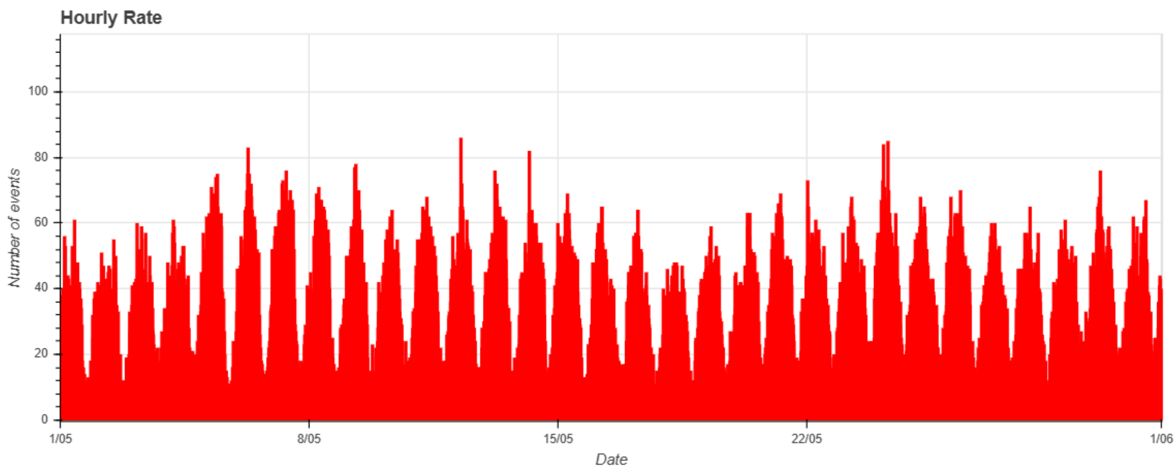

Fig. 1: May 2026 data trend.

Eta Aquarids

The Eta Aquarids (ETA) are a meteor shower active every year between mid-April and late May, with peak activity around May 6. Although less spectacular than more well-known showers, the Eta Aquarids hold particular significance due to their origin: the fragments that make them up come from the famous Halley's Comet, the same one that also gives rise to the Orionids in October (1).

The radiant of the meteor shower is located in the constellation Aquarius, near the star Eta Aquarii, from which it takes its name. At our latitudes, this point rises shortly before dawn, around 3:30 a.m., making the late hours of the night the best time for observation and recording. Due to the radiant's low position on the horizon, the number of meteors visible in Italy is generally limited to about 30–40 per hour. In southern regions, where the radiant rises much higher above the horizon, the shower offers a far more intense spectacle, with hourly rates at the zenith (ZHR) that can exceed 50–60 meteors per hour.

The Eta Aquarids are also notable for the high speed of their meteors, which can reach over 66 km/s. This makes their trails in the sky particularly bright and long-lasting, with trails that sometimes linger for several seconds. The peak of activity usually occurs during the first week of May; this year, it was expected on May 7.

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 $\frac{H}{4}$.

Fig. 2 shows the artificial sample of sporadic events derived from observational data and used as a reference for the subsequent subtraction.

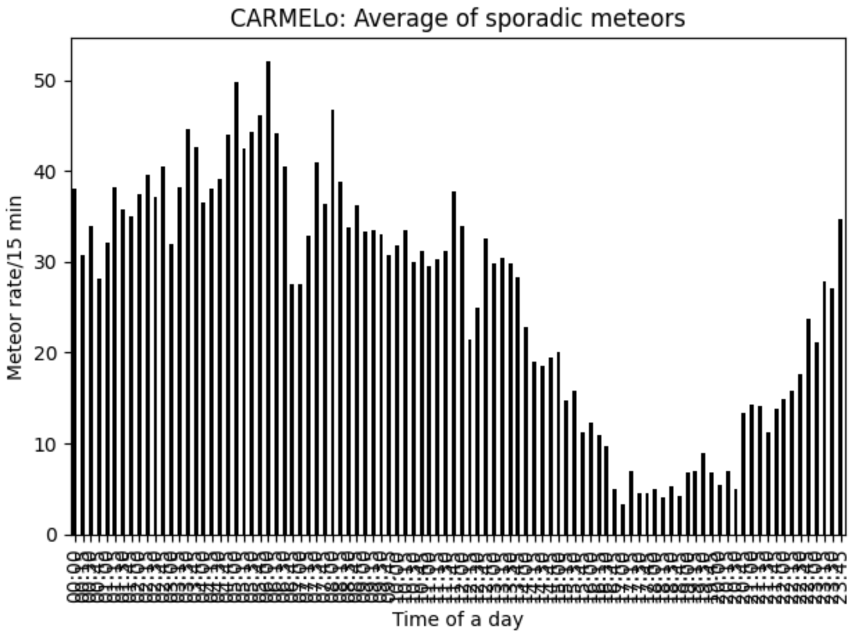

Fig. 2: Average number of sporadic meteors for the month of May 2026.

The results of the analysis are shown in *fig. 3*, which displays the residual distribution of the events alongside the position of the Eta Aquarids radiant. However, interpreting the data requires particular caution. The Eta Aquarids are, in fact, a rather diffuse meteor shower spread over an extended time interval. Furthermore, as mentioned above, at our latitudes the radiant reaches only modest heights above the horizon and is observable only in the hours preceding dawn.

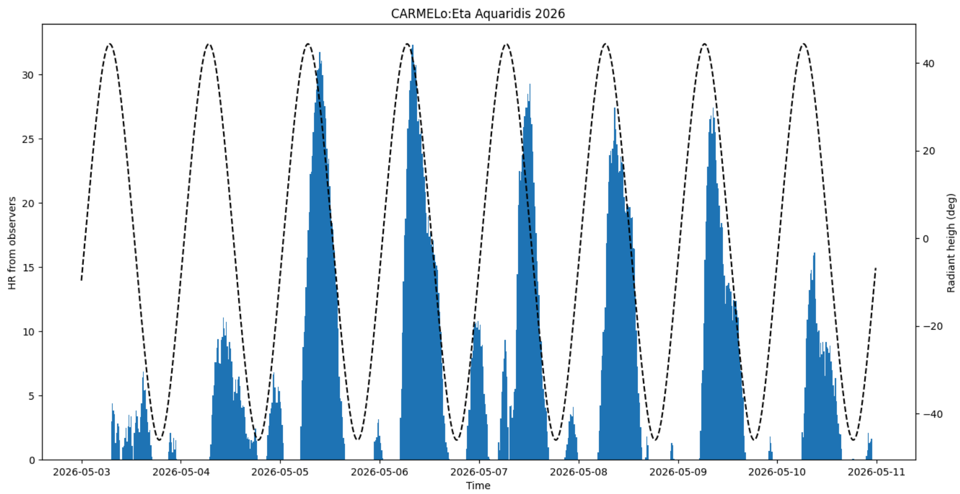

Fig. 3: Residual distribution of events and position of the radiant of the Eta Aquarids.

For these reasons, it is not possible to attribute the entire residual signal with certainty to the Eta Aquarids. With all due caution, however, this residual can be considered an estimate of the shower's contribution.

To test the robustness of the result, all meteors observed less than 10° above the horizon were excluded from the analysis in *fig. 4*. Even in this case, a signal consistent with the one shown in the previous graph remains.

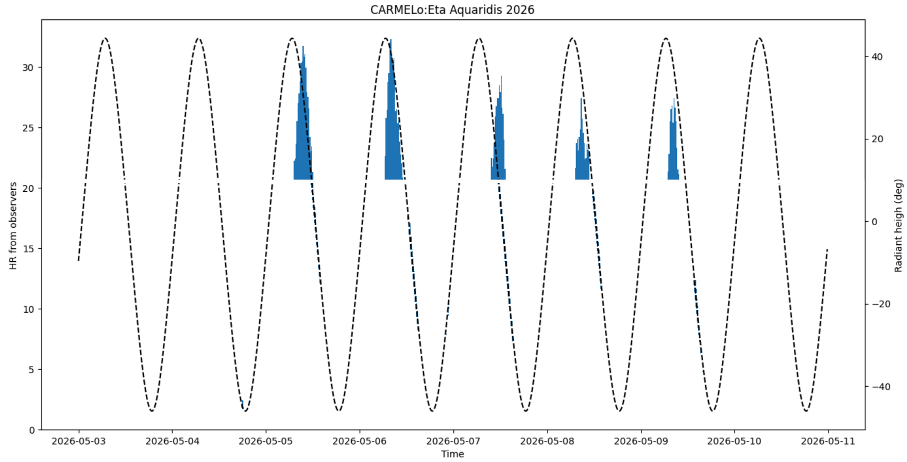

Fig. 4: Residual distribution of events and radiant position of the Eta Aquarids, excluding all meteors observed less than 10° above the horizon.

Finally, by focusing on the predicted peak date, May 7, and using solar longitude as the x-axis, we obtain the distribution shown in *fig. 5*. This reveals a peak in activity at solar longitude 46.6°. This value is consistent with both the forecasts and the results obtained by other observational networks, including the GMN (Global Meteor Network) project.

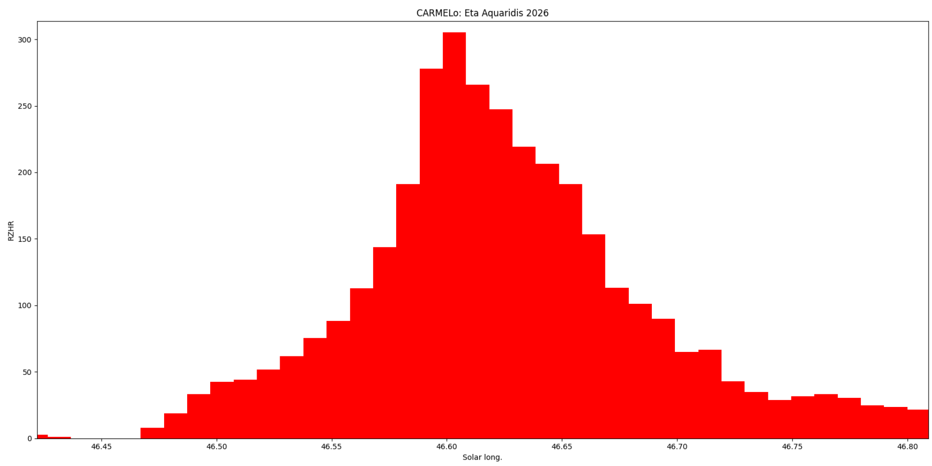

Fig. 5: Residual distribution of events on May 7, 2026, with solar longitude on the x-axis.

The CARMELo Network

The network currently consists of 16 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

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

Bibliography:

(1) A. Egal et al. (2020): Activity of the Eta-Aquariid and Orionid meteor showers, *Astronomy & Astrophysics, Vol. 640*

(2) P. Roggemans (1989): IMO Handbook for Visual Meteor Observations, *Sky Publishing Co.*