The BeNeLux CAMS network 2012 - 2013

Paul Roggemans, Hans Betlem, Felix Bettonvil, Jean-Marie Biets, Martin Breukers, Robert Haas, Klaas Jobse, Carl Johannink, Marco Langbroek, Koen Miskotte, Piet Neels, Jos Nijland and Casper ter Kuile.

A network of CAMS, "Cameras for All sky Meteor Surveillance" is being built up since begin 2012 in the BeNeLux. The network has 18 CAMS active at 10 observing posts today. More than 1500 accurate meteor orbits were recorded so far.

1. Introduction

CAMS[1] stands for "Cameras for All sky Meteor Surveillance" and was set up by the team of Peter Jenniskens and Pete Gural to validate minor meteor showers (Jenniskens et al, 2011). The system was introduced to Dutch meteor observers at the occasion of the 2011 Draconid outburst. In order to observe the Orionids 2011, Peter Jenniskens left four WATEC 902H camera's with one of the authors, Carl Johannink, at his home in Gronau, Germany. A double station post was set up at Meterik where Peter aimed another number of CAMS. Observations were possible during most nights from 21-22 till 27-28 October and produced 60 hours of video data for both stations.

This experiment proved very successful with no less than 96 double station meteors, a result that outstrips past achievements with traditional camera's for the Orionids. The results of this October 2011 campaign were described in detail (Johannink, 2013).

2. The start with 4 camera's at 4 stations

The CAMS are all equipped with 12 mm f1.2 lenses and have a rather small FOV of about 30 x 20 degrees. Such small FOV yields more accurate astrometry measurements compared to wide angle optics. The WATEC 902H2 camera's compensate the number of recorded meteors in such small FOV by the high light sensitivity. The number of meteors that these CAMS register on average is such that statistical significant datasets can be recorded. The system can function with partial cloudy sky, under a moonlit sky and is still highly effective under severe light polluted skies.

When working with single CAMS it is most important to optimize the intersections of the camera's FOV at the meteor producing layers in the upper atmosphere in order to obtain the optimal number of multiple-station meteors. Another important factor is the geometry Station 1 - meteor - station 2. A too short baseline between two CAMS stations provides a too small parallax to enable a sufficient accurate triangulation. A too large baseline on the contrary reduces the probability to record the same meteor from very different distances and produces relative large error margins on the positional measurements of the meteor trajectory.

The network started with 4 stations in the Netherlands. Oostkapelle (OK, CAMS 331 operated by Klaas Jobse) got a perfect double station partner with Ooltgensplaat (OP, CAMS 341 operated by Piet Neels). Gronau (GN, CAMS 311 operated by Carl Johannink) got Hengelo (HL, CAMS 321 operated by Martin Breukers) with a less favorable but still suitable baseline (Figure 1). After the traditional problem solving, the first CAMS got operational in March and begin April 2012. The first double station meteors were recorded in March (Figure 3). Unfortunately the first meteor stream, the April Lyrids, was missed due to bad weather. Also May 2012 confirmed the performance of CAMS with a nice number of orbits determined.

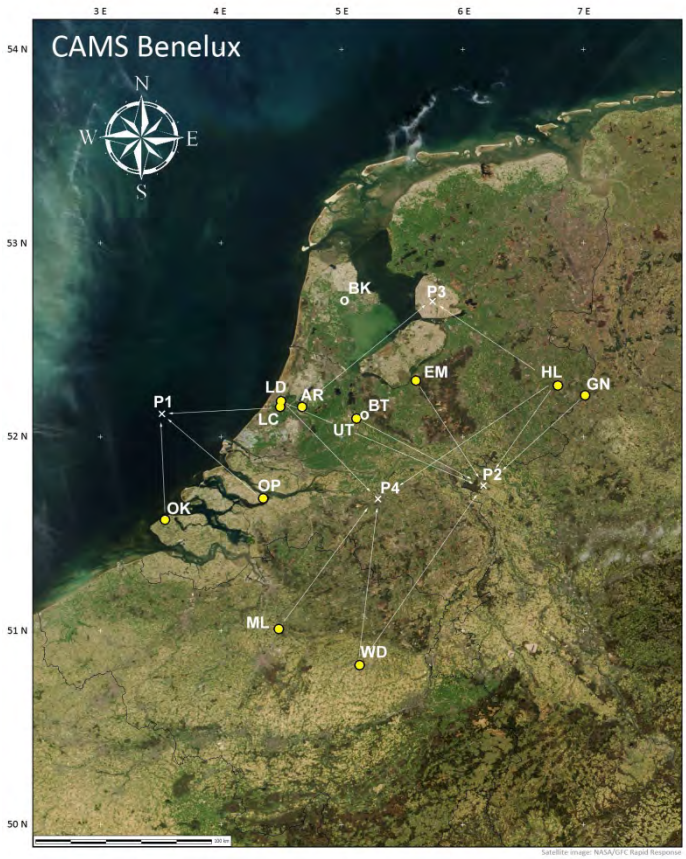

Figure 1: The current status of the BeNeLux CAMS network.

3. Required equipment

In order to obtain consistent results all participants use identical hardware and software. The Watec 902H2 ultimate can be purchased in Europe for about 300 EUR, and a 12mm f1.2 Pentax lens with C-CS mount lens adapter for another 125 EUR. The Ez-cap frame grabber, a BNC connector, 10 meter video cable and a 12 V DC power supply for the camera round up the total budget to about 500 EUR per camera. A sufficient fast Desktop PC or laptop is mostly already available. A security

[1] http://cams.seti.org/easyCAMS.html

camera housing for permanent outdoors use is an option (Figure 2).

Figure 2: CAMS 381 & 382 (Wildert) operated by Jean-Marie Biets.

The biggest advantage of this CAMS project is beyond any doubt the highly effective software developed by Pete Gural. Contrary to UFOCapture, this software is provided for free. Once the camera is connected to a PC, The program CameraLiveViewer.exe allows to focus and to point the camera. After closing CameraLiveViewer.exe, the recording starts with FTP_Capture.exe for the predefined duration without requiring any supervision. For each 8,5 seconds a video file is created and stored. The next day these video's can be made visible by running FTP_CameraMovies.exe. The astrometry runs very smooth with FTP_MeteorCal.exe, requiring just the center of FOV and the identification of 6 reference stars by a simple click, followed by an automatic selection of more than 100 reference stars. Plate constants are computed within an accuracy of 1 arc minute. With FTP_Reprocess.exe all recorded video fragments are automatically searched for meteors, any other events such as planes, satellites or flies are rejected. The result is a data file with all positional data of recorded possible meteor traces that has to be sent to the networks coordinator, in case of the Benelux, Carl Johannink.

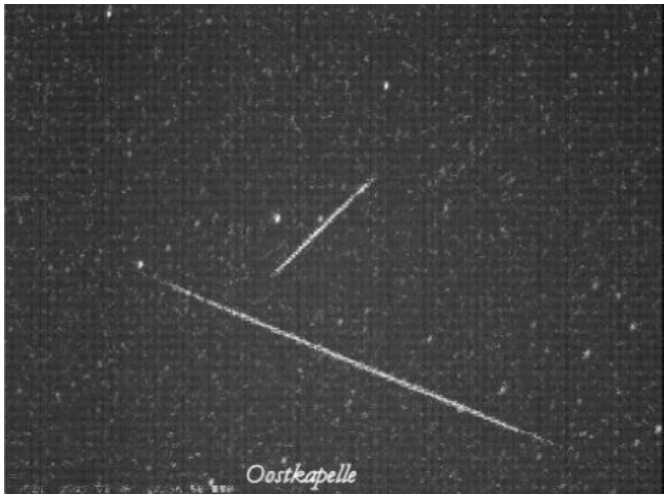

Figure 3 Two of the very first simultaneous meteors recorded in Oostkapelle in March 2012.

Some more advanced programs offer the possibility to analyse the video files while recording and it is possible to let the CAMS run in an automatic way. Seeking for double or multiple station meteors, trajectory and orbit calculations are all totally automated. More about the CAMS software can be found online [2].

4. Meteor orbits obtained

Although the weather hasn't been very cooperative since the start of the network, over 1500 accurate meteor orbits were derived which is amazing efficient compared to the time and money consuming analog photography of the 1970's, 1980's and 1990's (see Figure 4). The first few months only 4 camera's were functioning.

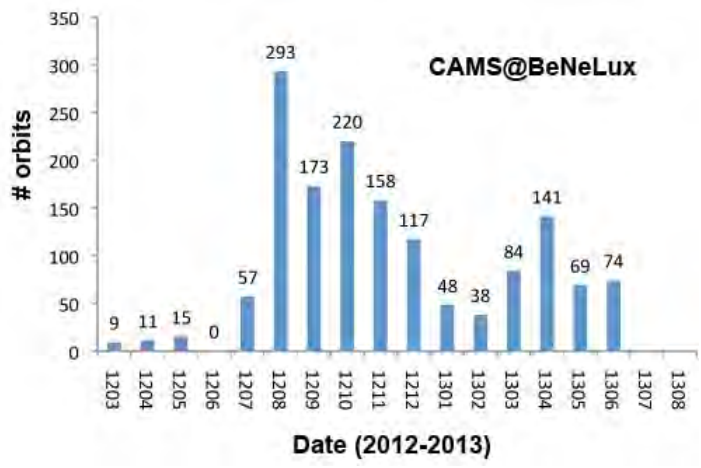

Figure: 4 the number of accurate meteor orbits derived per month.

A 5th station got operational in August 2012 at Ermelo (EM, CAMS 351 operated by Koen Miskotte). Since October Robert Haas operates station AR (Alphen a/d Rijn). In 2013 the network expanded quickly: Marco Langbroek and Hans Betlem started in Leiden, Jean Marie Biets in Wildert en Paul Roggemans in Mechelen. More stations are still planned and existing stations are reinforced by extra camera's. Results are systematically published in eRadiant and in WGN.

Conclusion

CAMS proved to be a very time and cost effective project which is affordable for amateurs with limited free time. The system is functional under light polluted sky conditions, partial cloud cover and moonlit sky. The advanced software runs automatically and requires only a minimum of time to manage the observational output.

References

- Jenniskens P., Gural P.S., Grigsby B., Dynneson L., Koop M. and Holman D. (2011). "CAMS: Cameras for Allsky Meteor Surveillance to validate minor meteor showers". *Icarus*, **216**, 40-61.
- Johannink C. (2013). "Results for a CAMS double-station video observation Meterik - Gronau". *WGN, Journal of the IMO*, **41**, 14-21.
- Johannink C. (2013). " Results of the CAMS project in 2012". *WGN, Journal of the IMO*, **in press**.

[2] http://cams.seti.org/singlecamera.html