ISBN 978-2-87355-024-4

Proceedings of the International Meteor Conference

La Palma, Canary Islands, Spain

20–23 September, 2012

Published by the International Meteor Organization 2013

Edited by Marc Gyssens and Paul Roggemans

Proceedings of the International Meteor Conference
La Palma, Canary Islands, Spain, 20–23 September, 2012
International Meteor Organization
ISBN 978-2-87355-024-4

Editing team and Organization

Publisher: The International Meteor Organization
Editors: Marc Gyssens and Paul Roggemans
Typesetting: LaTeX 2_ε (with styles from Imolate 2.4 by Chris Trayner)

Printed in Belgium

Legal address: International Meteor Organization, Mattheessensstraat 60, 2540 Hove, Belgium

Distribution

Further copies of this publication may be ordered from the Treasurer of the International Meteor Organization, Marc Gyssens, Mattheessensstraat 60, 2540 Hove, Belgium, or through the IMO website (`http://www.imo.net`).

The 2011 η-Aquariids observing campaign from La Palma

Felix Bettonvil[1,2] and Thomas Weiland[2]

[1] **NOVA Optical and Infrared Instrumentation Division at ASTRON, Oude Hoogeveensedijk 4, NL-7991 PD Dwingeloo, the Netherlands**

[2] **Sterrenwacht Leiden, Universiteit Leiden, Niels Bohrweg 2, NL-2333 CA Leiden, the Netherlands**
bettonvil@strw.leidenuniv.nl

[3] **Ospelgasse 12-14/6/19, A-1200 Wien, Austria**
thomas.weiland@aon.at

Since the η-Aquariids, the only prominent stream for Southern Hemisphere observers, are difficult to watch from mid-northern latitudes, a week-long visual observing campaign was carried out in May 2011 from La Palma, Canary Islands, Spain. There, on the grounds of the Observatorio del Roque de Los Muchachos (ORM), at an altitude of more than 2000 m above sea level, observing conditions were nearly perfect. As a consequence, we managed to record more than 300 η-Aquariids in about 30 hours of effective observing time. An impression of the campaign together with a summary of the results is given.

1 How to observe the η-Aquariids

Meteor observers on the northern hemisphere are lucky: depending on lunar phases, they can choose from three major sources throughout the year—Quadrantids, Perseids, and Geminids. This is not so, however, for their fellows south of the equator down to higher latitudes, where these streams rapidly lose strength and finally vanish. Only the η-Aquariids (`ETA`) can be called a major stream there, and, with ZHRs in the range of 40 to 85, their maximum is usually the highlight of the meteor year.

However, watching the shower from mid-northern latitudes may be challenging and frustrating as well. Since its radiant reaches less than 10° elevation at the beginning of dawn, only few η-Aquariids find their way to European skies. As a consequence, one has to move south, at least down to 30° N, to observe the stream properly and obtain scientifically valuable results.

2 The 2011 observing campaign

In early 2011 both authors, Felix Bettonvil and Thomas Weiland (who had already made an attempt to gather scientific data from Arizona, USA, at 35° N, in the year 2000), decided to use the moonless spell in the following May for a week-long observing campaign from La Palma, Canary Islands, Spain.

La Palma, the northwestern most of the volcanic Canaries, offers about 270 clear nights per year, at least at its top. The latter is an effect of the dry anti-trade-wind, which prevails above its humid northeastern counterpart. It is also responsible for very low extinction and excellent seeing (the inversion layer seasonally shifts between 1200 and 1600 m and rarely goes up to 2000 m above sea level). Moreover, La Palma is one of few places on Earth successfully battling against night-sky pollution, in order to protect the Observatorio del Roque de Los Muchachos (ORM), which forms part of the European Northern Observatory (ENO). As Felix Bettonvil is employed at the Observatory, it was fairly easy to arrange for a good observing spot on its grounds.

Our observing campaign started on the night of May 3/4 and lasted until the night of May 9/10. We fully concentrated on visual observing. Additionally, Felix Bettonvil operated one single automatic DSLR camera with the goal to capture an η-Aquariid.

Even from 28°.75 N, the time window to see η-Aquariid meteors remains quite short, and, therefore, we usually began our watch about 20 minutes before the radiant rose so that our eyes could sufficiently adapt to the darkness. This also gave us an opportunity to see Earth-grazing η-Aquariids.

A wind-sheltered place (the remains of a goat farmer's shelter on the observatory grounds) at the rim of the Caldera de Taburiente (altitude 2385 m) was chosen as a comfortable observing site. On one occasion, we moved down to one of the helicopter landing strips (altitude 2180 m). Both were as perfectly dark as it could be in our civilized world, a wonderful experience! All in all, the weather was quite cooperative. Sometimes, cirrus clouds turned up during the day, but they had the friendly attitude of dissipating regularly as night-time fell. Only on May 5/6, thick patches of them pervaded and hampered our view most of the time that night, resulting in rather few η-Aquariids recorded (see Section 3.2).

Limiting magnitudes were typically between 6.51 and 6.94 (Felix Bettonvil; `BETFE`) and 6.30 and 6.39 (Thomas Weiland; `WEITH`), respectively (averaged over each night; see Table 1).

3 Results

3.1 Magnitude distribution and population index

From the total magnitude distribution (see Table 1), we see that 16% (`BETFE`), respectively 22% (`WEITH`), of all η-Aquariids were of magnitude 0 or brighter, more or less comparable to other major annual showers. Fireballs with magnitudes of -3 or brighter were seen in only two instances.

Next, population indices were derived, using the magnitude difference between the meteors and the limiting stellar magnitudes, based on Table 9.2, p. 178, and the table on p. 179 in the *Handbook for Meteor Observers* (Rendtel et al., 2011). This yielded values varying between $r = 1.76$ and 2.47 (`BETFE`; average 2.03) and 1.78 and 2.94 (`WEITH`; average 2.14). The trend, however, is nearly the same: starting out with r-values around 2.0 or slightly lower, a distinctive minimum on the order of $r = 1.75$ to 1.80 was encountered on May 6/7. After that, r-values were continuously rising beyond 2.5 on average. The comparatively lower value on May 9/10 goes hand in hand with a local, short-lived ZHR maximum encountered that night (see Section 3.2).

3.2 Hourly counts and ZHR

Maximum hourly rates started at about 10 on May 3/4 and stayed more or less on that level during the following night. Due to cloud interference on May 5/6 (see above), only 17 (`BETFE`), respectively 9 (`WEITH`), η-Aquariids were seen in total. Therefore, the results of that night have not been considered further. During the fourth run (May 6/7), the highest hourly rates had risen to nearly 20 and, according to the predicted maximum time of May 6, $13^{\rm h}$ UT (McBeath, 2010), we expected them to be at their best. To our surprise, they showed no signs of a backdrop at all, but were even slightly rising to 20–25 until May 9/10. However, averaging rates over each night yielded a slow, more or less steady decline.

ZHR calculation followed the procedure given in the *Handbook for Meteor Observers*. Since limiting magnitudes were close to or even better than the standard sky of +6.5, using individual population indices would have almost no impact on ZHR calculations. Therefore we took the average r-value of 2.14 found by `WEITH` (see Section 3.1). The zenith exponent was assumed to be $\gamma = 1.0$. No perception coefficient was applied.

Interestingly, individual ZHR-values show large fluctuations, with no distinctive trend. After averaging them over both observers and each night, the picture becomes clear. Thus-averaged ZHRs are on the order of 30 at the beginning of the campaign, slightly rising to about 35 on May 4/5. After a hiatus, due to uncertain results (see above; ZHR probably less than 50), a peak is seen on May 6/7 (ZHR $\approx$ 60). The decline which followed was unexpectedly slow, ending with ZHRs on the order of 50 on May 9/10. Additionally, a local, short-lived maximum (ZHR $\approx$ 60) was observed that night.

3.3 General appearance

As is the case with meteors of high geocentric velocity and cometary origin, η-Aquariids, especially bright ones, often leave trains. According to that rule, 28% of all η-Aquariids logged by WEITH ($N = 190$; including data of May 5/6 and data from observing intervals after $5^{\rm h}15^{\rm m}$ UT) showed a train. After dividing the total count into bright and faint magnitude numbers (40 meteors of magnitude 0 or brighter and 150 fainter than magnitude 0) the result is 78% and 15%, respectively.

Color estimates by `WEITH` yielded mainly yellow and fewer orange hues, with blue, white, and green shades to a much lesser extent.

Earth-grazing meteors were seen twice, the first one on May 6/7 (magnitude 0; radiant height $2^{\circ}\!.8$), which sported a drop-shaped orange head and left a thread-like train on its 60° long path. The second one, of magnitude +2, was seen the following night, with the radiant still below the horizon ($-0^{\circ}\!.2$). Its path spanned 60–70°.

3.4 Photographic results

Despite η-Aquariids being rather swift and therefore difficult to get onto film or chip, Felix Bettonvil captured one on the night of May 9/10 (Figure 1).

4 Conclusions and future work

Overall, r-values and ZHRs are comparable to those of previous returns (Cooper, 1996; Rendtel et al., 2011), although the 2011 activity profile looks rather skew.

Figure 1 – An η-Aquariid meteor crossing the Milky Way, with Delphinus at the lower left and Lyra at the top (Canon 350D, Sigma 18 mm $f/3.5$, ISO 1600, 30 s exposure).

Table 1 – Observer statistics, magnitude distributions, and meteor numbers.

Date	Period (UT)	T_{eff}	Lm	−3	−2	−1	0	+1	+2	+3	+4	+5	+6	Tot	Obs
May 03/04	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}00^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}50$	6.94	0	1	0	0	2	1	6	2	2	0	14	BETFE
May 03/04	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}00^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}45$	6.39	0	2	0	2	1	1	2	5	2	0	15	WEITH
May 04/05	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}14^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}73$	6.86	0	0	2	1	4	1	7	3	2	1	21	BETFE
May 04/05	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}68$	6.30	0	0	2	3	3	3	3	3	4	0	21	WEITH
May 06/07	$3^{\mathrm{h}}47^{\mathrm{m}}$–$5^{\mathrm{h}}24^{\mathrm{m}}$	$1\overset{\mathrm{h}}{.}62$	6.51	1	3	4	1	1	3	5	7	2	1	28	BETFE
May 06/07	$2^{\mathrm{h}}40^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}47$	6.39	1	3	5	4	2	2	6	8	4	0	35	WEITH
May 07/08	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}22^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}87$	6.71	0	0	3	2	6	6	7	8	3	0	35	BETFE
May 07/08	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}64$	6.39	0	0	4	3	6	2	7	8	3	0	33	WEITH
May 08/09	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}18$	6.74	1	0	0	2	1	2	4	7	3	2	22	BETFE
May 08/09	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}65$	6.37	0	0	1	2	0	3	6	17	7	0	36	WEITH
May 09/10	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}57$	6.58	0	0	2	1	3	4	7	6	4	0	27	BETFE
May 09/10	$2^{\mathrm{h}}30^{\mathrm{m}}$–$5^{\mathrm{h}}15^{\mathrm{m}}$	$2\overset{\mathrm{h}}{.}65$	6.33	0	0	2	3	1	2	6	13	3	0	30	WEITH
Total		$14\overset{\mathrm{h}}{.}47$		2	4	11	7	17	17	36	33	16	4	147	BETFE
Total		$15\overset{\mathrm{h}}{.}54$		1	5	14	17	13	13	30	54	23	0	170	WEITH

However, the latter is not untypical for this stream, as η-Aquariid activity has been proven to vary from year to year, both with respect to its height and shape (Cooper, 1996; Rendtel et al., 2011). With some caution, due to uncertain results on May 5/6 (see above), it can be concluded that the 2011 η-Aquariids reached their maximum around May 6/7 (ZHR around 60), about half a day later than predicted (McBeath, 2010).

If one further assumes that bigger particles are more or less concentrated towards the denser parts of the stream (see Section 3.1) and that Earth-grazing meteors will predominantly appear around maximum time (see Section 3.3), it seems likely that the shower indeed reached its maximum at the given time. The subsequent somewhat delayed decline may be regarded as peculiar to this year, as is the case with the local, short-lived maximum seen on May 9/10.

After carrying out this splendid campaign, which gave a fantastic view on the shower, the authors really dream of watching the η-Aquariids display from a country in the Southern Hemisphere (for instance, Namibia) to see the shower in all its glory.

Years such as 2019, 2021, and 2022, with little or no moonlight interference and when the planet Jupiter will probably shift the stream's core a bit closer to the Earth again, seem to be the next good occasions!

References

Cooper T. (1996). "A decade of visual η-Aquarid meteor observations". *WGN, Journal of the IMO*, **24**, 157-161.

McBeath A. (2010). *Meteor Shower Calendar 2011.* IMO.

Rendtel J., Arlt R., and Asher D., editors (2011). *Handbook for Meteor Observers.* Third edition. IMO.