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New Handbook
Conference
Geminids
Perseids

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Administrative

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Preliminary results

Front cover photo

Composition of five different exposures with seven bright Geminids. The two brightest Geminids were magnitude −5. Exposure on 2007 December 15 between $01^{\rm h}07^{\rm m}$ and $01^{\rm h}50^{\rm m}$ UT. Camera Canon 40D, lens Canon EF $f/2.8$, 15-mm fish eye, ISO 1600, exposure time 43 seconds on $f/2.8$. Photo: Koen Miskotte. (See page 105 for details)

Writing for WGN

This Journal welcomes papers submitted for publication. All papers are reviewed for scientific content, and edited for English and style. Instructions for authors can be found in WGN **31:4**, 124–128, and at `http://www.imo.net/articles/writingforwgn.pdf` .

Cover design

Rainer Arlt

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Editorial — Greetings from the new Editor

Javor Kac

When Chris asked me to write a Janus paper earlier this year, I never imagined I would become a new WGN Editor-in-Chief instead of him. Well, that has happened and I hope that I, along with the rest of Editorial board, will provide a good service to the WGN readers. I hope that we will not make a lot of mistakes as we 'learn the ropes'. If you do notice any, we sincerely apologize.

In this issue you may find an anouncement of the new edition of 'Handbook for meteor observers', the most comprehensive guide to meteor observations available to date. Most eager observers could obtain their copy of the Handbook already at the International Meteor Conference. The IMC, as experienced by Shy Halatze of Israel, is reported in this issue. Other papers in this issue include analyses of Perseids and Geminids, and the results of IMO Video Meteor Network. I hope you will enjoy reading it!

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From the Treasurer — IMO Membership/WGN Subscription Renewal for 2009

Marc Gyssens

We invite all our members/subscribers to renew for 2009. The fees are as tabulated below. The corporate subscription rate applies to institutions, libraries, etc. Individuals pay the IMO membership fee and get WGN as part of their IMO membership. We are happy that we can offer WGN at the same rate as last year.

IMO Membership/WGN Subscription 2009				
surface mail delivery:		€26		US$ 36
airmail (outside Europe only):		€49		US$ 69
Supporting membership:	add	€26	add	US$ 36
Corporate subscription rate 2009				
surface mail delivery:		€50		US$ 70
airmail (outside Europe only):		€73		US$ 103

It is possible to renew for two years by paying double the amount.

General payment instructions can be found on the IMO's website, `http://www.imo.net`. Members and subscribers who have not yet renewed will find enclosed a leaflet with payment instructions that apply to their geographical region. Please follow these instructions! Choosing the most appropriate payment method results in low or even no additional costs for you as well as the IMO. The IMO strives to keeping these costs low in order to control the price of the journal!

When you renew, give a few minutes of thought to becoming a **supporting member**. Every year, the IMO helps active meteor workers to attend the annual International Meteor Conference, who would otherwise not have been able to come. Our ability to provide this help depends primarily on the gifts we receive from supporting members!

Another way to help meteor workers with limited funds is to offer them a gift subscription.

We already thank all our members that will renew for their continued trust in our Organization!

One final request: every year, a lot of members renew late. As a consequence, back issues that already appeared have to be sent out to these members. Please support our volunteers in their bimonthly effort to have WGN shipped to you by renewing promptly! Thank you for your understanding and cooperation!

IMO bibcode WGN-365-gyssens-renewals NASA-ADS bibcode 2008JIMO...36...93G

From the Treasurer — WGN 2009 Available in PDF Format!

Marc Gyssens

As an experiment, subscribers to WGN volume 2009 will also be given the possibility to download WGN in PDF format besides receiving the paper copy. This has the additional advantage of being able to access WGN earlier, as delays in the mail are shortcut by consulting the electronic version. Also, figures that are originally in color and are reproduced in black and white can be seen in original form in the PDF version. We will provide details of how to access this PDF version later.

If this experiment is successful, subscribers will be offered the possibility from 2010 onward to take a PDF-only subscription at a substantially reduced cost.

IMO bibcode WGN-365-gyssens-wgnpdf NASA-ADS bibcode 2008JIMO...36Q..94G

From the Treasurer — A New Handbook At Last!

Marc Gyssens

New Observing Handbook

For too long already, the IMO was not able anymore to offer the meteor community handbooks on meteor observers, because all these publications were out of print. Just reprinting them was not an option, because the old text were outdated as a consequence of rapid evolutions in available technology and new insights in meteor science.

A thorough revision was called for, and it was decided to publish a single handbook in which all oberving methods are treated rather than separate handbooks focusing on only one technique.

The new handbook covers the visual, photographic, video, telescopic and radio observation of meteors. It also includes a description of the meteor showers currently included in the IMO's Working List, with a concentration to the recent observations and up-to-date activity information.

The efforts of several contributors have resulted in 190 densely printed pages with information, maps, forms, photographs, and diagrams and other illustrations clarifying all the concepts that are introduced.

The new Handbook costs 20 EUR or 28 USD. It can be ordered via the IMO's electronic shop. To access it, just surf to `http://www.imo.net` and click on 'Publications' under 'Organization'. After having placed your order, you will then be directed to another page where you can indicate your shipping information and method of payment. Just follow the instructions; it is very easy!

The available payment options are the same as for membership renewal. However, we explicitly ask members in EU countries to give preference to bank transfers to the account of the International Meteor Organization, Mattheessensstraat 60, B-2540 Hove, Belgium, in Euro, using IBAN and BIC-numbers:

IBAN: BE30 0014 7327 5911 (omit spaces in electronic transfers)

BIC: GEBABEBB

When done correctly, such a transfer should cost you no more than a domestic transfer, and it does not generate costs for us, contrary to, e.g., PayPal. By contributing to lower these costs, you help us (and yourself) in keeping prices for publications in check!

Other publications that became recently available

We also want to point your attention to two other publications that became recently available.

- IMC 2006 Proceedings. This proceedings contain the articles of the presentations at the 2006 International Meteor Conference at Roden, the Netherlands. They are available at 15 EUR or 21 USD.
- Proceedings of the 1st EuroPlaNet Workshop on Meteor Orbit Determination. This workshop took place in conjunction with the 2006 IMC in Roden. Several articles deal with different aspects of meteor orbit determination. Only a limited number of copies of these proceedings are available for sale! The unit price is also 15 EUR or 21 USD.

As the new Handbook, these publications can be ordered via the IMO's electronic shop!

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Conferences

International Meteor Conference 2008

Shy Halatzi [1]

Received 2008 November 3

From every country
stars get together
to talk joyfully.
Haiku, by Nagatoshi Nogami.

We arrived at the Hotel Šachtička, near Banska Bystrica on Thursday afternoon. The lobby was busy with participants arriving and there was a sense of holiday in the air. After exchanging greetings with Daniel Očenáš and Stanislav Kaniansky from the local organizing committee, we quickly checked in to our room. A reminder of the internationality of the IMO was given when we were told that Shlomi Eini and myself were thought to be women, because of our non-European names, and were assigned so in the rooms until shortly before the IMC (thanks to Marc Gyssens who found the mistake and our lost manhood). Of course this was a very funny event which was sorted out quickly and gave some good joking-material for the rest of the IMC ('so this is why they were so nice when emailing with me...').

The hotel and its surroundings were beautiful, good choice by the LOC, in my opinion. A short walk up the hill also gave us a panoramic view of the Bankska Bystrica region, including the observatory which was seen small in the distance. The way down was, as we found out, a bit more tiring. But it was a worthwhile hike in a good time, since the following days were very busy, as you will soon read. Next the welcoming dinner was in good atmosphere, a great time to meet old friends, as well as making new ones, of course.

Right after dinner, started the first session – an open meeting about radio meteor observing. As someone who never had dealt with radio astronomy, it was very interesting to hear about this field of work. The group discussed challenges and problems which radio observers and analyzers face nowadays, and suggested steps that will make it possible to move things forward. Afterwards tiredness seemed to overcome most of us and we slept well before the next main lecture day.

Now let's talk each other
on the Tatra of autumn air.
Haiku, by Nagatoshi Nogami.

In the next morning, the lecture sessions began, with many interesting topics following one another. The Dynamics of Meteoroids session was interesting, including some nice graphical displays of meteoroid orbits. The Visual session included various talks focusing mainly on observer perception and accuracy, as well as a lecture from Rainer Arlt about the recently very active Orionids. In the Video Observing session, Sirko Molau had a long presentation about the growth and geographical expansion of meteor video observations in the past year as well as results of this work. It seems like video observing is a promising field, although it still has to make a long way before making visual observers obsolete. The next morning began with three talks about fireball networks in Croatia, Poland and the Czech Republic / Slovakia, including impressive images and results of bright fireballs which may have dropped meteorites in Central Europe. The Meteor Analysis session included the presentation of highly practical Virtual Meteors Observatory by Geert Barentsen and the similar Virtual Fireball Observatory by Nastassia Smeets. The last session was on various topics, including a very interesting talk about the recent Carncas meteorite impact by Cis Verbeeck. The paper is short and many more great lectures were given which I didn't mention. But I can say that,

Figure 1 – Valentin Grigore (Romania, left) discussing with Haiku author Nagatoshi Nogami (Japan, right). Photo courtesy of Rainer Arlt.

Figure 2 – Grigoris Maravelias (Greece, left) having discussion with Antonio Martinez Picar (Venezuela, right) during the visit of Maximilian Hell Observatory and Planetarium in Žiar nad Hronom. Photo courtesy of Rainer Arlt.

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Figure 3 – A happy IMC crowd in from of the Šachtička hotel. Photo courtesy of Javor Kac.

being in an IMC for the first time, I had much to learn from these sessions, much more than by from reading articles and internet material, or even books. I hope than in conjunction with the beginning of my university studies I could make a small contribution myself to the meteor talks next year.

> *On this journey*
> *I feel your warm*
> *LASKA's hospitality*[a]
> Haiku, by Nagatoshi Nogami.

But of course IMC was not 100% lectures. We also had some great social gatherings on Friday evening with the guitar or in the bar until late hours (beer helps astronomers make international cooperation and PhD lookouts).

Next there was the excursion. First we visited a Slovak gold and silver mine. All IMC participants, young and old, short or tall, were dressed in peculiar miner clothes and were given big flashlights to make our way underground. No silver or gold were found on this trip, but it was still a joy. From there we continued to visit the Maximilian Hell Observatory and Planetarium in Ziar nad Hronom. There we ate many apples and had a planetarium tour of the southern sky, in English. Surreal, considering that we were near latitude 50 and the sky was completely grey from the beginning to end of the IMC. It was a pity that (probably?) for that reason we also did not visit the observatory dome. The AstroShow was the highlight of social activities, in my opinion, an unforgettable experience (at least until IMC 2009 I suppose). I enjoyed it as a performer, together with Shlomi Eini, presenting our meteor jokes, as well as an audience, listening to various songs, Haikus or other performances. The highlight of the show for me was Andrei's performance of a black hole eating all prominent meteor showers (you had to be there to understand...this is a good reason not to miss the IMC). Many thanks and greetings to Valentine Grigore and Andrei Dorian Gheorghe for orchestrating this magnificent evening, a fantastic combination of art, science and comedy.

And a bit about this IMC in historical context. As veteran IMO founder Paul Roggermans told me, several important anniversaries occurred in 2008: 35 years of WGN, 30 years of the IMC and 20 years to the creation of the IMO. Formally, little attention was dedicated to these anniversaries in the conference. It seems as though the IMO and IMC are so well established that they are perceived today like a natural thing happening. As a first-timer in the IMC, I clearly say that they are not. Coming to IMC added greatly to my knowledge base and interaction/cooperation with other meteor enthusiasts. I can now fully understand the necessity of an international organization which unites the meteors community to improve our observational and research work. It also has many social benefits.

So, to conclude...congratulations to our meteors community for all the anniversaries mentioned in the previous paragraph, as well as the very successful IMC that took place in September. I recommend anyone to come to the next conference...See you in IMC 2009!

[a](LASKA = love in Slovak)

Acknowledgements

Many thanks to Nagatoshi Nogami, IMO member from Japan and IMC2008 participant, who let me use his Haiku(s) in the article.

Figure 4 – Participants enjoying the evening discussions. From left: Luc Bastiens, Nagatoshi Nogami, Urška Pajer, Antonio Martinez Picar, Nastassia Smeets, Roland Winkler and Lucie Maquet. Photo courtesy of Casper ter Kuile.

Perseids

Statistical Analysis of Perseids 2007 Local Observations in Trenčín

Jozef Drga [1, 2] *and K. Hrkota* [1]

In this article we present the results of visual observations of the Perseid meteor shower at maximum phase, on 2007 August 12 to 13, at Kykula near Trenčín, Slovakia. The maximum ZHR profile obtained from these observations and comparison with IMO results and statistical analyses will be discussed.

Received 2008 May 16

1 Results

We present the results of visual observations of the Perseid meteor shower at maximum phase, on 2007 August 12 to 13, at KYKULA (48°55′27.6″ N, 17°51′36.5″ E, altitude 790 m), close to the IMO observation site at Trenčín, 27311 Slovakia. We used the data obtained from following observers:

Michal Arbet (ARBMI), Lukáš Bulko (BULLU), Jozef Drga (DRGJO), Peter Mach (MACPE), Ondrej Odokienko, Ondrej Pelech (PELOW), Stanislav Sokol, Matej Šustr (SUSMA), Michal Šustr (SUSMI), Juraj Vančo (VANJU).

In Figure 1 you can see ZHR profile obtained from these observations. Table 2 shows the ZHR profile with a tolerance depending on solar longitude. Our calculations respect the fixed population index $r = 2.0$.

The model ZHR (MZHR) profile used as a comparison to our own observation results is a download from VMDB database of IMO, present in (IMO, 2007). It is shown in Figure 2 and Table 3.

The theoretical position of the maximum is at $\lambda_\odot = 139.^\circ 44$ (Marsden & Williams, 1995), if we use the 109P/Swift-Tuttle orbit. From our observations we obtained data for population index r. This is shown in Figure 3 and Table 1. Smaller values of population index r are typical for observations close to the theoretical maximum (Rendtel & Arlt, 1996). The average magnitude of 560 Perseids recorded was 1.33.

Table 1 – Profile of population index r.

$\lambda_\odot$	r	Δr
$139.^\circ 70$	1.74	0.58
$139.^\circ 85$	2.64	0.89

For our statistical analysis we used the non-parametric χ^2 test, comparing the MZHR profile to the observed ZHR profile from Table 4.

The obtained result (equation 1) is below the significance level of 0.01. In our calculation we used 12 degrees of freedom. We found good agreement between local and global (referred) observations. This shows the importance of local observations.

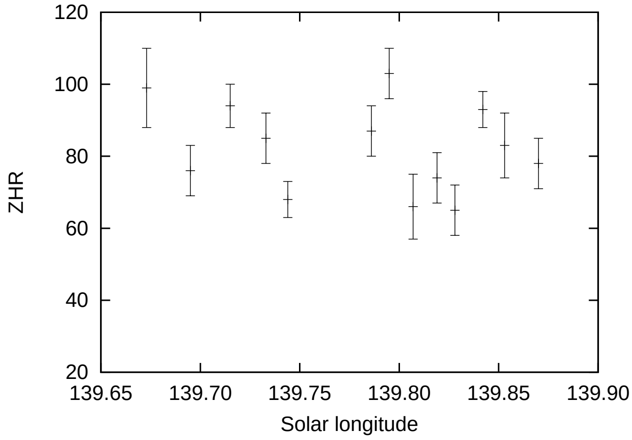

Figure 1 – Obtained local ZHR profile

Table 2 – ZHR profile obtained from observations at KYKULA.

$\lambda_\odot$	Time	Local ZHR (L)	Δ ZHR
$139.^\circ 673$	20^h55^m	99	11
$139.^\circ 695$	21^h28^m	76	7
$139.^\circ 715$	21^h59^m	94	6
$139.^\circ 733$	22^h25^m	85	7
$139.^\circ 744$	22^h42^m	68	5
$139.^\circ 756$	22^h59^m	—	—
$139.^\circ 766$	23^h15^m	—	—
$139.^\circ 775$	23^h28^m	—	—
$139.^\circ 786$	23^h45^m	87	7
$139.^\circ 795$	23^h58^m	103	7
$139.^\circ 807$	00^h16^m	66	9
$139.^\circ 819$	00^h34^m	74	7
$139.^\circ 828$	00^h48^m	65	7
$139.^\circ 842$	01^h08^m	93	5
$139.^\circ 853$	01^h26^m	83	9
$139.^\circ 870$	01^h51^m	78	7

$$\chi^2 = \Sigma_{i=1}^{13} \frac{(L-R)^2}{R} = 26.176 \quad (1)$$

2 Conclusion

Our observations are in good agreement with global (referred) ZHR profile at a significance level of 0.01. We can confirm the lower value of population index r (at $\lambda_\odot < 139.^\circ 8$ around maximum). Several minor maxima

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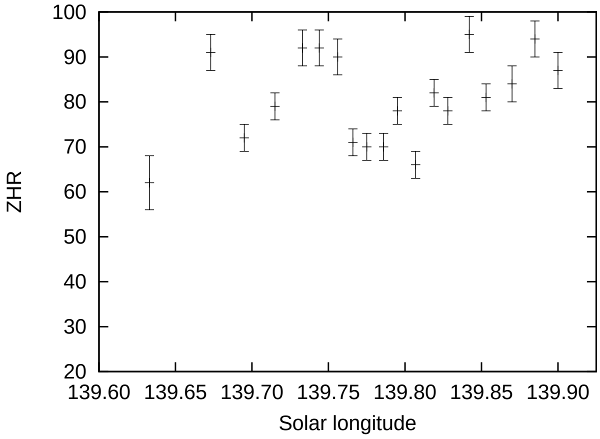

Figure 2 – MZHR profile.

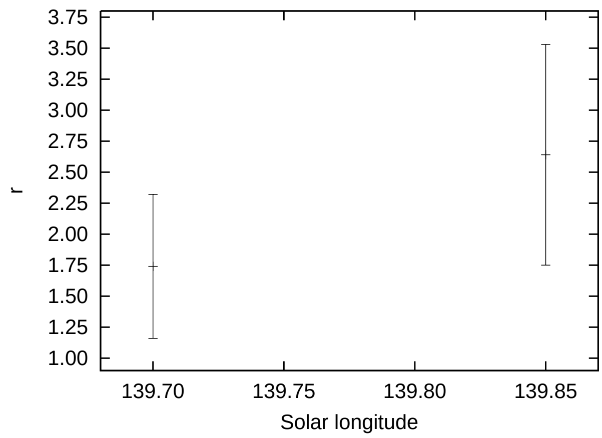

Figure 3 – Profile of population index r.

Table 3 – MZHR profile.

$\lambda_\odot$	Time	Reference ZHR (R)	Δ ZHR
$139.^\circ 633$	19^h56^m	62	6
$139.^\circ 673$	20^h55^m	91	4
$139.^\circ 695$	21^h28^m	72	3
$139.^\circ 715$	21^h59^m	79	3
$139.^\circ 733$	22^h25^m	92	4
$139.^\circ 744$	22^h42^m	92	4
$139.^\circ 756$	22^h59^m	90	4
$139.^\circ 766$	23^h15^m	71	3
$139.^\circ 775$	23^h28^m	70	3
$139.^\circ 786$	23^h45^m	70	3
$139.^\circ 795$	23^h58^m	78	3
$139.^\circ 807$	00^h16^m	66	3
$139.^\circ 819$	00^h34^m	82	3
$139.^\circ 828$	00^h48^m	78	3
$139.^\circ 842$	01^h08^m	95	4
$139.^\circ 853$	01^h26^m	81	3
$139.^\circ 870$	01^h51^m	84	4
$139.^\circ 885$	02^h13^m	94	4
$139.^\circ 900$	02^h36^m	87	4

Table 4 – Comparison between local and MZHR profiles.

$\lambda_\odot$	Reference ZHR (R)	Local ZHR (L)
$139.^\circ 673$	91	99
$139.^\circ 695$	72	76
$139.^\circ 715$	79	94
$139.^\circ 733$	92	85
$139.^\circ 744$	92	68
$139.^\circ 786$	70	87
$139.^\circ 795$	78	103
$139.^\circ 807$	66	66
$139.^\circ 819$	82	74
$139.^\circ 828$	78	65
$139.^\circ 842$	95	93
$139.^\circ 853$	81	83
$139.^\circ 870$	84	78

were found at $\lambda_\odot = 139.^\circ 75$ (lower value of population index r) and at $\lambda_\odot = 139.^\circ 85$ in both ZHR profiles. No evidence was found for potential Upsilon Pegasid and Alpha Ursa Minorid streams.

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Geminids

2006–2007 Geminids from Croatian Meteor Network video data

Željko Andreić [1, 2] *and Damir Šegon* [2, 3]

The radiant position of the Geminid meteor shower for the years 2006 and 2007 has been calculated. Results for radiant drift in Right Ascension and Declination (J2000) for the solar longitude interval 261°.2–262°.9 are presented. The graphical method proposed for radiant structure presentation agrees well with the work of Kanuchova and Svoren (2006), based on data from IAU MDC photographic orbits database.

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1 Introduction

The main goal of this work is the determination of the Geminid meteor shower radiant position from Croatian Meteor Network (CMN) video observations during the Geminids' maximum activity. Also, an estimation of CMN data accuracy was needed to asses the capabilites of the new network. Positions of the Geminid radiant for the years 2006/2007 in the solar longitude interval 261°.1–263°.0 were calculated using two methods: the standard method of weighted intersections proposed by Ceplecha (1952), and Plavec (1949), and an alternative method based on the normal distribution probability sum for 0°.1 samples.

In total, 1073 meteors were recorded during the 2006-2007 video observations, out of which 866 were Geminids. During the 2006 observations, only one observing station was active (it was the very beginning of CMN), while in 2007 data were obtained from seven stations. Very unstable weather conditions during the 2007 Geminid maximum affected the detection of double- and multi-station meteors, thus only 33 meteors were recorded simultaneously by two or three stations. Orbit determination for these meteors will be part of some future work. Video data at each station were obtained with modified 1004X cameras and SkyPatrol software (author Mark Vornhusen). The recorded images were archived on CDs for post-processing.

Postprocessing starts with corrections for optical distortion. This calibration is done using PIXY_2 software (Yoshida, 2008). Observational error estimated by the same program is 0°.05. Next, positions of points of the meteor trail were refined and extracted from images using CMN SkyPatrolAnalyzer software, which makes several corrections to the raw trail data. And finally, all relevant trail data (positions of beginning/end of the meteor in question, its duration and observing uncertainties, etc.) were extracted with the help of CMN METMATH and METRAD software and stored in the CMN database. Observation summaries are presented in Table 1.

2 Radiant position determination

The first method used is the standard method of weighted intersections described by Ceplecha (1952), and Plavec (1949), and the results (including mean errors) are summarised in Table 2. The second method is based on the sum of normal (Gaussian) distribution probabilities, calculated from the estimated observational error, meteor path length, distance of the meteor from the radiant and position angle (Figure 1). Chance alignments with the radiant are eliminated in the first step of the calculation procedure. First, all meteors that miss the supposed radiant for more than 7°.5 are eliminated. The chance alignments of sporadics are discriminated by their angular velocities, using the method described on IMO web pages (IMO, 2008). After that, an empty matrix is constructed (i.e. all values in the matrix are set to zero). Each matrix element corresponds to a

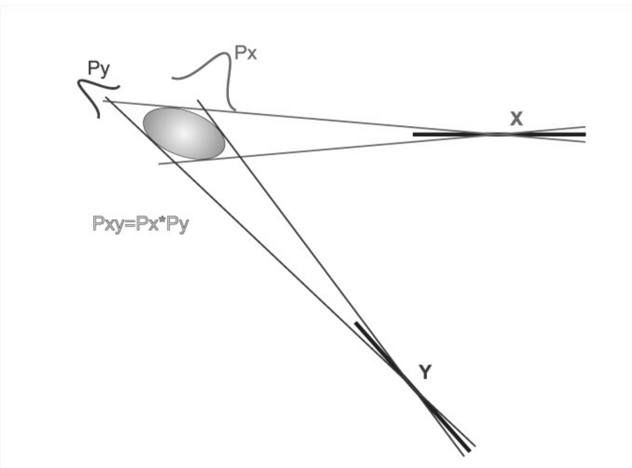

Figure 1 – Constructing the radiant position probability for two meteors. The trail of each meteor is recorded with a certain angular error, which is determined from observational data during the post-processing of meteor trails. The same happens with the second trail. Overlapping both trails, with their errors included, produces an area in which the radiant should lie. It is assumed that this area can be described by a two-dimensional normal (Gaussian) distribution, whose x- and y-widths are determined from trail data obtained during post-processing of meteor images. The procedure is repeated for all meteor pairs (after elimination of sporadics of course) and all probabilities are numerically added to obtain the most probable radiant position.

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Table 1 – Summary of observation data gathered during the 2006 and 2007 observing campaigns.

2006				2007			
station	13/14	14/15		station	13/14	14/15	
PUA	197	87		PUA	67	98	
PUB	-	-		PUB	68	-	
MEA	-	-		MEA	74	1	
OSA	-	-		OSA	-	212	
ZGA	-	-		ZGA	32	35	
RIA	-	-		RIA	124	-	
VAA	-	-		VAA	54	24	
Total	197	87	284	Total	419	370	789
GEM	166	68	234	GEM	341	291	632
Spo	31	19	50	Spo	78	79	157

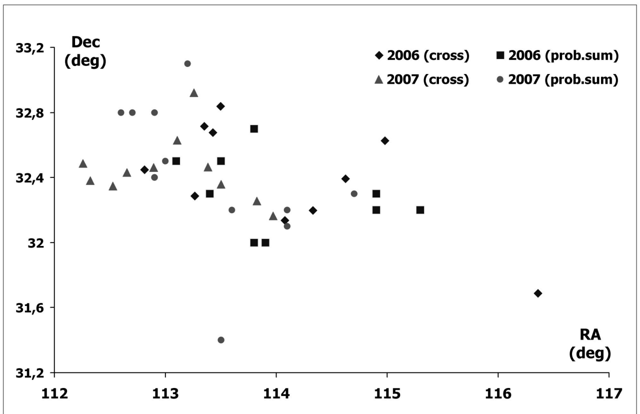

Figure 4 – Geminid radiant positions for solar longitude interval 261.°1–263.°0, calculated with the standard crossings method and the probability sum method.

particular position on the celestial sphere, usually in a dense mesh with characteristic mesh size of 0.°1 square, in both coordinates, the supposed radiant coordinates being at the center of the mesh. After that, a probability distribution is constructed for the first meteor pair. The RA and Dec half-widths of the probability distribution for this pair are determined by the data reduction software from the length of the recorded trails, their distances from the supposed radiant and deviations of the trail points from the best-fit great circles. Depending on the meteor brightness and length of the trail, the typical RA and Dec uncertainties of the beginning/end trail point are a few arc minutes. During construction of the probability distributions they are projected to the supposed radiant position. Depending on the distance of the meteor from the radiant and the length of the trail, the corresponding half-widths at the radiant position are usually an order of magnitude larger than the RA/Dec uncertainties of the beginning/end trail points. Short trails far away from the radiant produce the largest half-widths, but at the moment they are not eliminated from the calculations.

The probability of this particular meteor pair having a radiant at celestial coordinates corresponding to an element of the previously constructed matrix is calculated and added to the probability values already stored in the appropriate place in the matrix. This procedure is repeated for all matrix elements (celestial coordinates) and all meteor pairs. At the end, the matrix contains relative probabilities that radiant lies at the specific position on the celestial sphere. The place(s) in the matrix with the largest sum(s) is declared to be the most probable radiant position(s) for this moment. An example of a three meteor probability sum is presented in Figure 2.

Evidently, this method cannot be applied for calculation of the radiant position in cases of small number of meteors or radiants with high dispersion. However, it can be very useful for displaying radiant structure. Results of this method are summarized and compared to the results obtained with the standard method in Table 2. For both methods, meteor paths have been corrected for diurnal aberration and zenith attraction according to Lovell (1954), and Gural (2000), respectively.

Table 2 – Summary of radiant position calculations for 0.°2 solar longitude interval and 0.°1 square samples.

Sol. long.		crossings (Ceplecha, Plavec)		probability sum	
2006	n	RA	Dec	RA	Dec
261.5	19	113.27±0.2	32.29±0.3	113.4	32.3
261.6	51	112.81±0.1	32.45±0.1	113.1	32.5
261.7	78	113.43±0.1	32.68±0.1	113.8	32.7
261.8	87	113.50±0.1	32.84±0.1	113.5	32.5
261.9	69	113.35±0.1	32.71±0.1	113.5	32.5
262.5	11	116.36±0.3	31.69±0.2	114.9	32.2
262.6	24	114.98±0.2	32.63±0.1	114.9	32.3
262.7	35	114.08±0.2	32.14±0.1	113.8	32.0
262.8	31	114.33±0.2	32.20±0.1	113.9	32.0
262.9	23	114.62±0.2	32.39±0.2	115.3	32.2
2007	n	RA	Dec	RA	Dec
261.2	10	112.32±0.2	32.38±0.2	113.5	31.4
261.3	47	112.26±0.1	32.49±0.1	112.6	32.8
261.4	148	112.53±0.1	32.35±0.1	112.7	32.8
261.5	238	112.66±0.1	32.43±0.1	112.9	32.4
261.6	171	112.89±0.1	32.46±0.1	113.0	32.5
261.7	56	113.11±0.1	32.63±0.1	112.9	32.8
262.3	47	113.26±0.1	32.92±0.1	113.2	33.1
262.4	122	113.82±0.1	32.26±0.1	114.1	32.2
262.5	180	113.38±0.1	32.47±0.1	113.6	32.2
262.6	159	113.50±0.1	32.36±0.1	114.1	32.1
262.7	64	113.97±0.1	32.16±0.1	114.7	32.3

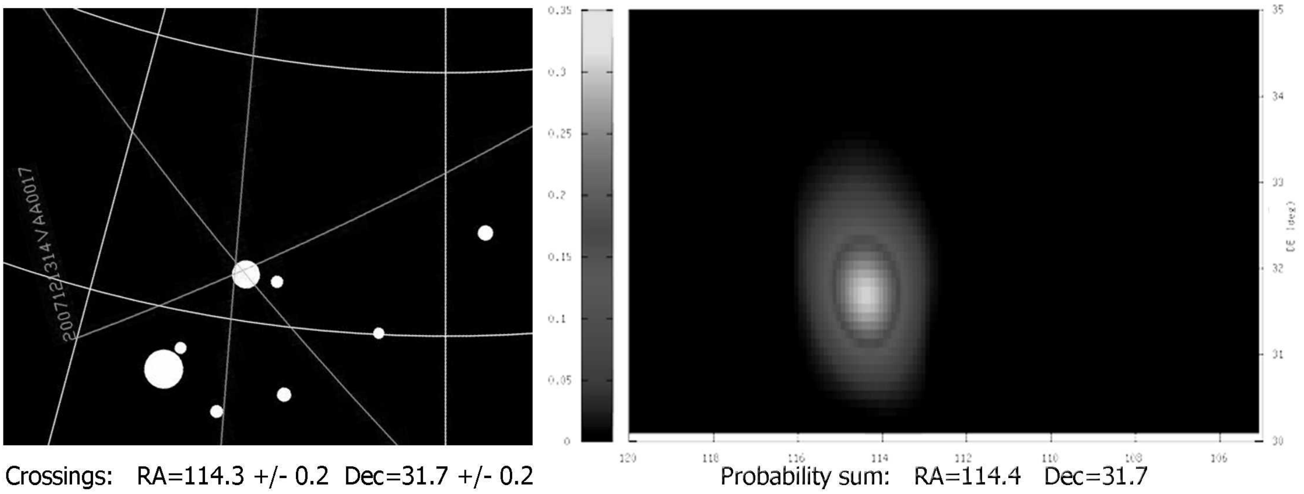

Figure 2 – An example of using the probability sum method in case of three meteors. First, two-dimensional normal distributions are constructed as described before (see Fig. 1) for all meteor pairs (right). These distributions are then numerically added on a grid of closely spaced coordinate points arranged in an x-y matrix. The final result is the probability of the radiant being at particular coordinates (left). This method will reveal the subradiants also, if they exist.

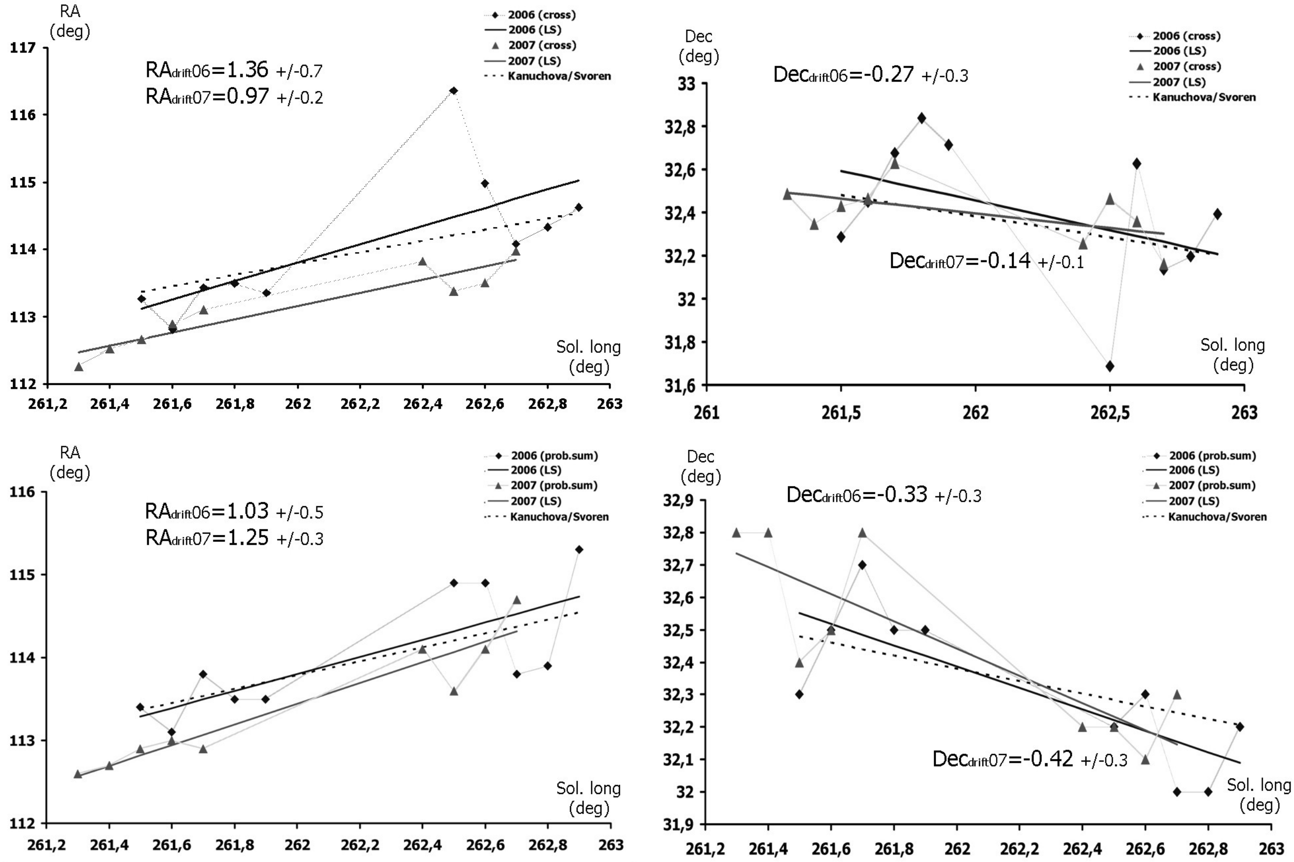

Figure 3 – Geminid radiant drift (epoch 2000) for the solar longitude interval 261.°1–263.°0, determined with the standard crossings method and the probability sum method.

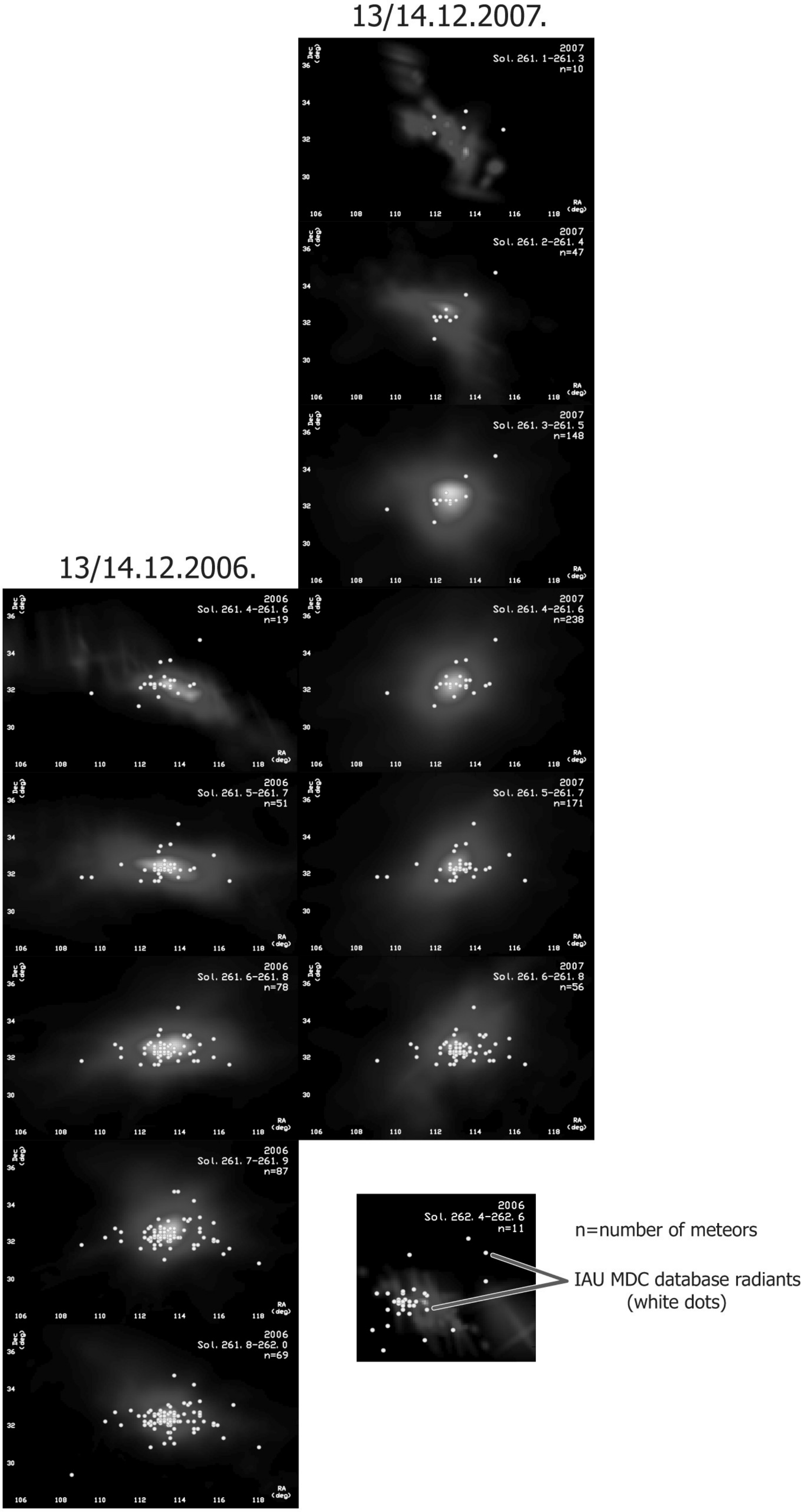

Figure 5 – Geminid radiant spread from probability sum calculations for December 13/14 and from the IAU Orbit database (white dots).

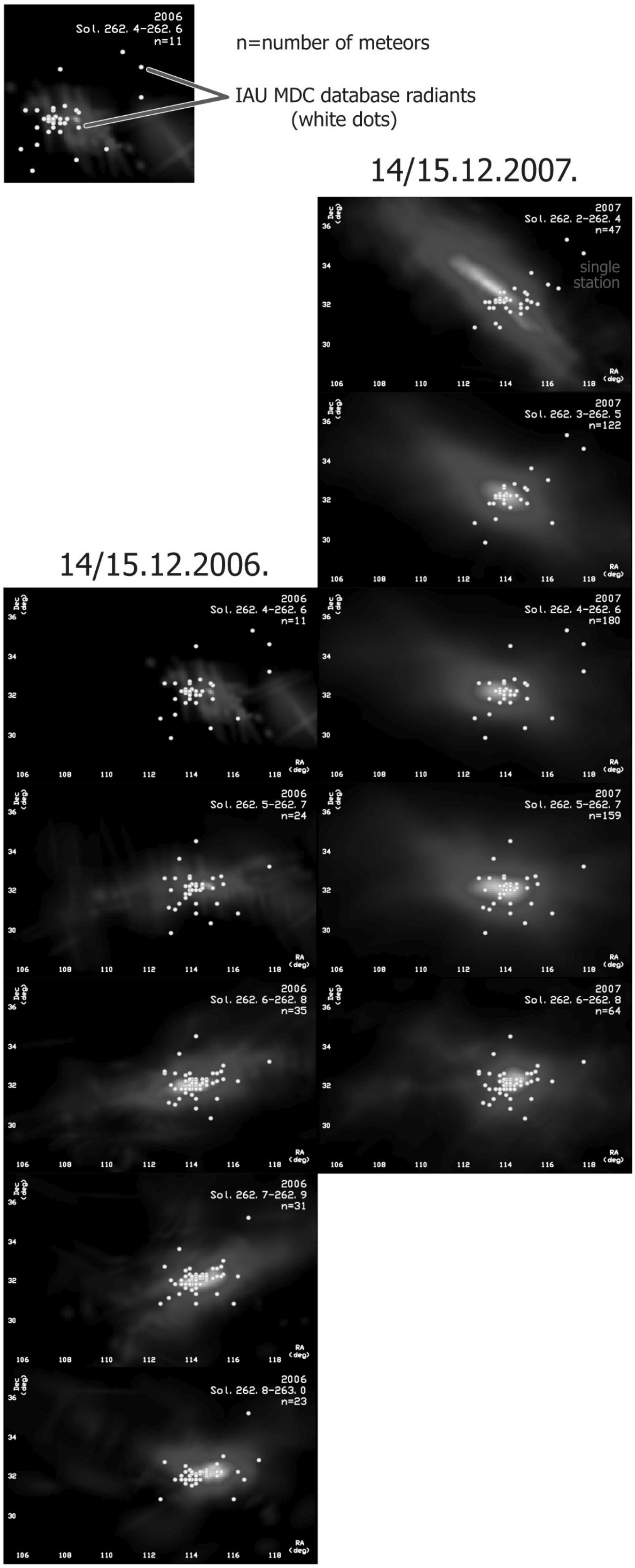

Figure 6 – Geminid radiant spread from probability sum calculations for December 14/15 and from the IAU Orbit database (white dots).

3 Results and discussion

As can be seen from Figure 4, radiant drift in RA as well as in Dec is obvious even on the $0.^{\circ}1$ scale (2.4 hours). The least squares method has been used for calculating the radiant drift, results of which are shown in Figure 3. A noticeable difference between 2006 and 2007 is due to the single station data in 2006. The solar longitude $262.^{\circ}2$–$262.^{\circ}4$ segment from 2007 observations has been excluded from these calculations since only one station had records for that period. Additionally, the estimated radiant drift obtained by Kanuchova and Svoren (2006) is shown as comparison. It is important to note that Kanuchova and Svoren calculated radiant drift for the whole period of Geminid shower activity, not only for the maximum activity part.

Data interpretation of the probability sum method is much easier when it is presented graphically. For better visualization and result comparison, Geminid radiant positions from IAU MDC photographic meteor orbits database are included in the graphs, as given by Kanuchova and Svoren. A comparison with radiants from the IAU orbital database and our results is presented in Figures 5 and 6.

4 Conclusions

Results obtained show that CMN observations can be used for precise radiant position determination. However, in case of single station data accuracy is reduced, so care has to be taken in such cases. The problem does not come from single-station as such, but from the constant, small field of view. If the field of view would be changed often (say every hour) in order to cover larger part of celestial sphere, the accuracy should be as good as with several stations. We did not try this yet as it requires constant operator attention while our cameras were unattended during the Geminids. As can be seen from the data, single station observations (2006, and $262.^{\circ}2$–$262.^{\circ}4$ solar longitude interval in 2007 when data from only one station are available) are not as accurate as data from multiple stations. This is more pronounced in the case of low radiant elevations. The main reason for this is the small angle between meteor paths, which is easily avoided if other station(s) do not look at the same part of the sky. However, even in those cases, radiant position does not differ from the expected values by more than 1°–2°.

Acknowledgements

This work is result of CMN observations from stations operated by Ivica Čiković (Rijeka - RIA), Dario Klarić (Osijek - OSA), Željko Andreić (Zagreb - ZGR, Merenje - MEA, Varaždin - VAA) and Damir Šegon (Pula - PUA and PUB). Special thanks to Filip Lolić for camera modifications, Igor Terlević for software development and Korado Korlević for great job on organizing the Croatian Meteor Network.

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Geminids 2007: analyses of the observations

Carl Johannink [1] *and Koen Miskotte* [2]

The DMS Geminid-campaign was very successful with nearly 6000 Geminids observed in Teff = 84.6 hours. Maximum activity remained above 100 Geminids per hour for almost the entire night of December 13/14 and possibly in the early evening of December 14. As expected this shower peaked around mid-day of December 14. The decrease of in activity during the night of December 14/15 was compensated by an increased number of bright meteors. The calculated population index r showed a minimum value of ~ 2.1, against 2.6 early that night and on December 13/14, close to the normal value. ZHRs were calculated with $\gamma = 1$ instead of the normally used value of 1.4, this time. Because the Geminids showed a plateau in activity during the night of December 13/14, using $\gamma = 1.4$ would 'overestimate' the ZHR-values in the early evening hours because of the low altitude of the radiant (Fig. 4). Using $\gamma = 1.4$ would in fact show a small decrease of activity, contradictory to the peak observed on December 14 by the IMO.

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1 Introduction

The 2007 Geminid project produced one of the largest datasets for this stream in the existence of Dutch Meteor Society (DMS), a good reason for a detailed analysis of this data. Table 1 lists the observers who contributed reports for the Geminid activity period. Unfortunately the weather turned out to be very uncooperative in the Netherlands with just some clear skies of short duration in the early evening hours of December 13 and 14. A team of four observers departed with a last minute flight via Münster to Lisbon where observations were possible during three clear nights in the Portuguese hinterland: December 12/13, 13/14 and 14/15. The transported equipment consisted of a Canon EOS 40D provided with a Canon EF $f/2.8$, 15-mm fish eye lens driven by a timer/controller TC 80N3. In total 49 and 69 meteors were photographed during the nights 2007 December 13/14 and 14/15, respectively.

2 ZHR profile Geminids 2007

The ZHR distribution is plotted in Figure 1 as derived from the DMS observations listed in Table 1 and in Figure 2 as derived from the webpage of IMO (2007).

The ZHR calculations were obtained in the usual way, described by Johannink and Miskotte (2005a), but with the zenith exponent $\gamma = 1.0$ instead of the normally used value $\gamma = 1.4$. The motivation for this decision is described later in this article. The magnitude distributions for the night of December 13/14 gave a population index r of 2.6 and for the night of December 14/15 the population index was 2.15, calculated according to Johannink and Miskotte (2005b). The population index r was rather constant during the night of December 13/14, but during the night of December 14/15 the value of r decreased, see Figure 3.

The r-values of 2.6 for the night of December 13/14 and of 2.15 for the night of December 14/15 are used for each night respectively. For the other nights (December

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IMO bibcode WGN-365-johannink-geminids
NASA-ADS bibcode 2008JIMO...36..105J

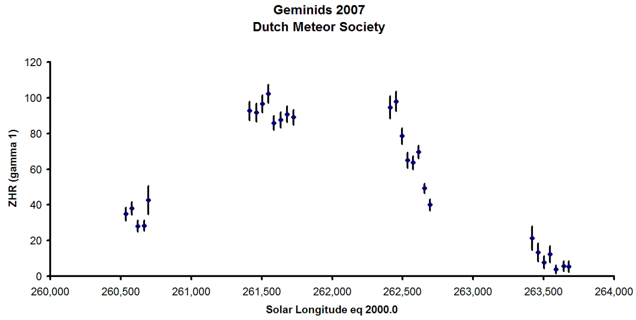

Figure 1 – ZHR profile based on the observations listed in Table 1.

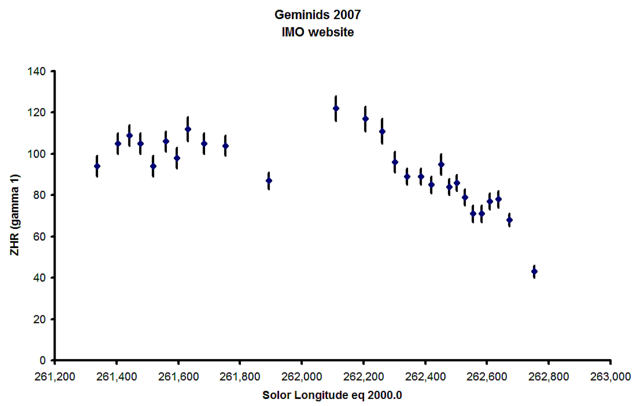

Figure 2 – Preliminary ZHR profile of the on-line analysis based on the observations of IMO (2007).

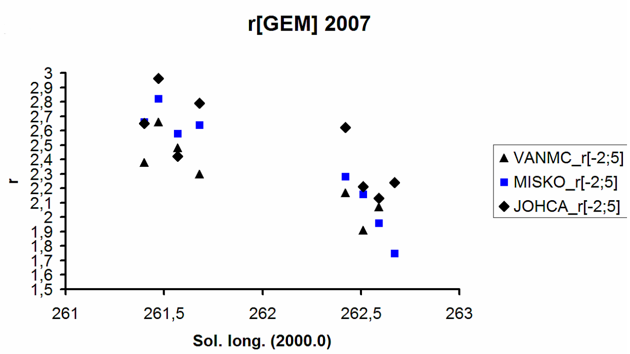

Figure 3 – Population index r profile for the nights December 13/14 and December 14/15 for the observers VANMC, MISKO and JOHCA.

Table 1 – Observers of the 2007 Geminids

Observer	IMO code	Location	Number of nights	Teff [h]	GEM	Spor	Total
Felix Bettonvil	BETFE	La Palma (SP)	1	2.21	221	26	247
Sietse Dijkstra	DIJSI	Netherlands	3*	9.09	86	72	158
Carl Johannink	JOHCA	Portugal	2	14.51	814	221	1035
Peter Van Leuteren	LEUPE	Netherlands	3	9.83	71	98	169
Koen Miskotte	MISKO	Portugal	2	15.27	1281	182	1463
Jos Nijland	NIJJO	Netherlands	2	3.00	109	29	138
Michel Vandeputte	VANMC	Portugal	3	21.68	1850	426	2276
Simon Vanderkerken	VANSI	Portugal	3	20.40	1611	237	1848
8 observers				95.99	6043	1291	7334

* the data of DIJSI arrived after the analysis was finished, so these data are not used in this analysis

12/13 and December 15/16) we used the standard value of $r = 2.6$ as given by Rendtel et al. (1995).

Back to Figures 1 and 2, both profiles support the conclusion that the maximum of the Geminids occured between solar longitude 261°.8 and 262°.1 (J2000.0) as expected. This time corresponds to the daylight hours of December 14.

The maximum ZHR values were about 120 but this shower surprised during several hours with ZHRs above 100. In the future paper we will look at the 2007 Geminids in a more historic perspective comparing them with earlier successful years of Geminid observations.

3 The effect of the zenith exponent $\gamma = 1.4$ on the ZHR calculations

We focus especially on the ZHR profiles for the nights December 13/14 and 14/15. Figure 4 displays the ZHRs for the night of December 13/14 based on a population index $r = 2.6$ and zenith exponent $\gamma = 1.4$ as well as a linear regression line.

The linear regression shows a slight decrease. This is strange because of the fact that the night of December 13/14 was well before the maximum and rates should rather increase. Although the difference in ZHR for the evening hours of December 13 and the morning hours of December 14 probably remained rather small, at least some increasing trend would be expected.

A possible explanation could be our usual application of the zenith exponent $\gamma = 1.4$ which means that ZHRs obtained with low radiant altitudes get a stronger zenith distance correction than those with high radiant altitudes. Since the Geminid radiant climbs much steeper on the sky in Portugal compared to the sky in the Netherlands, the ZHR calculations are more sensitive to this effect. A real ZHR increase risks being turned into a false picture with an apparent declining ZHR because the ZHR-values of the evening hours get inflated by overcorrection caused by $\gamma = 1.4$.

Therefore we decided to re-compute the ZHR values but with $\gamma = 1.0$. The result is plotted in Figure 5. It is very clear now that the ZHR values of the first hours are a bit lower. At midnight the deviation in ZHR is about zero while the ZHR values in Figure 5 get a bit lower for the morning values than in Figure 4.

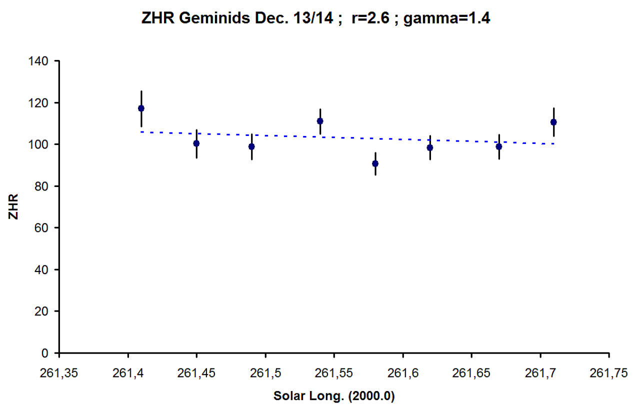

Figure 4 – ZHR distribution for the night of December 13/14 with population index $r = 2.6$ and zenith exponent $\gamma = 1.4$.

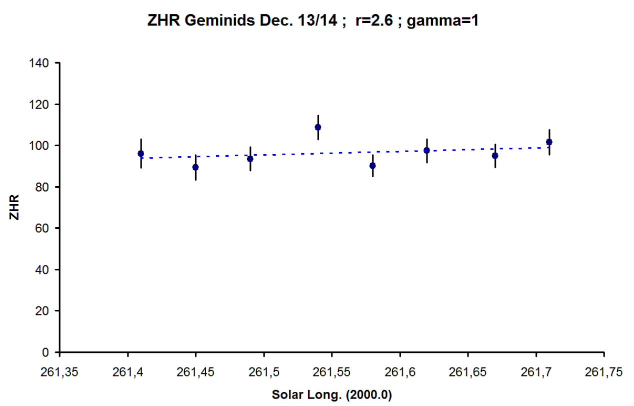

Figure 5 – ZHR distribution in the night of December 13/14 for a population index $r = 2.6$ and zenith exponent $\gamma = 1.0$.

As a result the trend line of increasing activity becomes visible. This seems to suggest that it is quite acceptable to set $\gamma = 1.0$ in this case. Also for the night December 14/15 the ZHR values were recalculated using $\gamma = 1.0$.

As expected a steep decline in ZHR values occurs. This decline is very clear after solar longitude 262°.45. We were also interested in the ZHR profiles for this night for the individual observers. Therefore the observations of MISKO, VANMC and JOHCA were split into comparable periods of one hour per person for which the

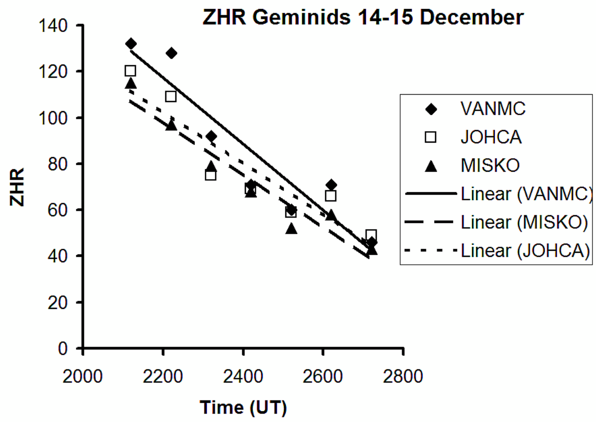

Figure 6 – Individual ZHR for observers JOHCA, MISKO and VANMC for the night December 14/15.

ZHR was calculated (Figure 6).

The distributions for MISKO and JOHCA show almost identical rates of decrease. The trend line for VANMC shows a steeper decline. This is due to the high ZHR-values at the beginning of the night as shown on the graph. It is notable that the spread of the ZHRs among the three observers is larger in the beginning of the night than towards the end of the night. We think that this is due to the larger uncertainty on the ZHR for lower radiant altitude: each meteor more or less with the radiant at low altitude has a large effect on the ZHR. This effect may have occurred in earlier analyses too.

4 Conclusions

The Geminids displayed a strong return in 2007 with many bright meteors especially during the second part of the night of December 14/15. The maximum probably occurred during daylight hours on December 14. High ZHR values were still recorded in the early evening hours of this day by the observers in Portugal but the low radiant altitude caused a somewhat larger scatter on the results. During that night a steep decrease in activity occurred while the average magnitude of the meteors increased.

The observations from Portugal were completed with data from Felix Bettonvil who observed in the morning hours of December 15 from La Palma and Jos Nijland who got about one hour of clear sky during the night of December 13/14 in Benningbroek, the Netherlands.

In the night of December 15/16 Jos Nijland from Benningbroek and the team Peter van Leuteren/Sietse Dijkstra from Lattrop were able to catch a few remaining Geminids. The ZHR decreased that night to values of about 10. In spite of this, Sietse and Peter made an observing marathon of no less than 8 hours and contributed in this way a nice dataset to the observations from Portugal.

Acknowledgements

We thank all visual observers who contributed to this observing project. We also thank Paul Roggemans for the translation of this article for WGN.

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Figure 7 – Composition of 5 different exposures with 7 bright Geminids. The two brightest Geminids were magnitude −5. Exposure on 2007 December 15 between 01^h07^m and 01^h50^m UT. Camera Canon 40D, lens Canon EF $f/2.8$, 15-mm fish eye, timer/controller TC 80N3, settings: ISO 1600, exposure time 43 seconds on $f/2.8$. Photo: Koen Miskotte.

Figure 8 – Composition of six different exposures with 7 bright Geminids. The brightest Geminids are −3 and −2 (two times). Exposure on 2007 December 15 between 23^h00^m and 23^h42^m UT. Camera Canon 40D, lens Canon EF $f/2.8$, 15-mm fish eye, timer/controller TC 80N3, settings: ISO 1600, exposure time 43 seconds on $f/2.8$. Photo: Koen Miskotte.

Preliminary results

Results of the IMO Video Meteor Network — August 2008

Sirko Molau [1] *and Javor Kac* [2]

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August leaves me with mixed impressions. Subjectively I would say, it was a poor month (probably because I missed almost the complete Perseid maximum because of clouds). However, looking at the network statistics, it couldn't have been that poor. After all, there are six cameras with 25 and more observing nights, which is only rarely achieved. At some observing sites it was overcast at the Perseid maximum, but there were 22 active cameras on August 10/11 and only two observing sites could not provide data in that night. In the second half of August the data got sparser, but even then there have been other months with much fewer observations (Figure 1 and Table 1).

So let's have a look at the overall statistics of August 2008. With roughly 2 100 hours of effective observing time, it ranks second after February this year. Also those 14 000 meteors have only been beaten in August 2007 and October 2006. So it looks is if it was indeed a good month.

With respect to analyses, August was characterised by preparations for the IMC, where I intended to present a new full analysis of the IMO Video Meteor Database. To keep the analysis perfectly up to date, all observing data until end of July 2008 were included – the last of which I received just a week before the IMC. As in 2006, the analysis was carried out in two steps.

The computationally more demanding first step was to determine all active radiants (alpha, delta, vinf) at each solar longitude. Whereas the base algorithm was left untouched (it was computed, with what probability each meteor would belong to each possible radiant, these probabilities were accumulated for each possible radiant, and finally the radiants with highest probability were selected), I improved the procedure in some details to make the results even more relevant. Details of these changes can be found in my IMC presentation at `http://www.imonet.org/imc08/imc08ppt.pdf`. Furthermore, the data set (360 000 meteors) had almost doubled compared to 2006. Still, I could abstain from distributed computing, since I could employ two IBM x3850 M2 servers with four quad core CPUs each in the test lab of my company. Running on 30 CPU kernels in parallel, the calculation was finished in roughly half a week. Once more, the result of the first step has been made available online (`http://www.imonet.org/imc08/radiants.html`), so everyone can look on his own for meteor showers, or

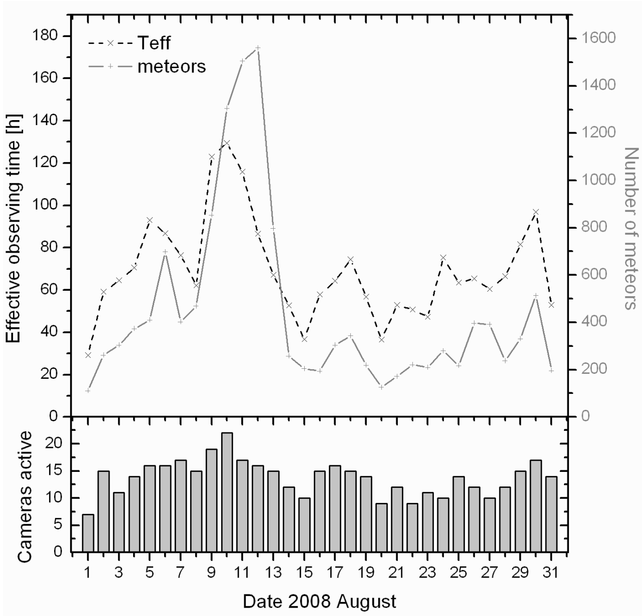

Figure 1 – Monthly summary for the effective observing time (solid black line), number of meteors (dashed gray line) and number of cameras active (bars) in August 2008.

can check in case of suspected activity of an unknown shower, whether the radiant is also found in the IMO video data.

The second step was to search for radiants with similar parameters in subsequent solar longitude intervals, and to find meteor shower with longer activity intervals. This part of the analysis was identical to 2006, so there is still room for improvement. Contrary to last time, my IMC presentation did not contain all showers detected, but only the most active and long-lasting ones. In the following, I would like to present the results for two typical August showers in detail.

First of all there is the most active shower in the video data – the Perseids. With almost 18 000 meteors they make up for 5% of the full IMO Video Meteor Database. The new 'Handbook for Meteor Observers' of IMO lists an activity interval from July 17 to August 24, which is a bit too short. In the video data, the Perseid radiant shows up on July 9 for the first time, and remains visible until August 27. As can be seen in the radiant plot (Figure 2), the drift is uniform between July 13 and August 25, i.e. in that time the shower can be detected with high confidence. The position of the radiants fits well to the ephemeris in all but the last 5 days – no wonder if you remember that the list position was derived from our video data as well.

The activity profile of the Perseids (Figure 3) shows a minor dip on July 19, but otherwise a gradually but persistent increase. There is a small pre-maximum on August 7/8, before the rate reduces a bit and reaches a

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NASA-ADS bibcode 2008JIMO...36..109M

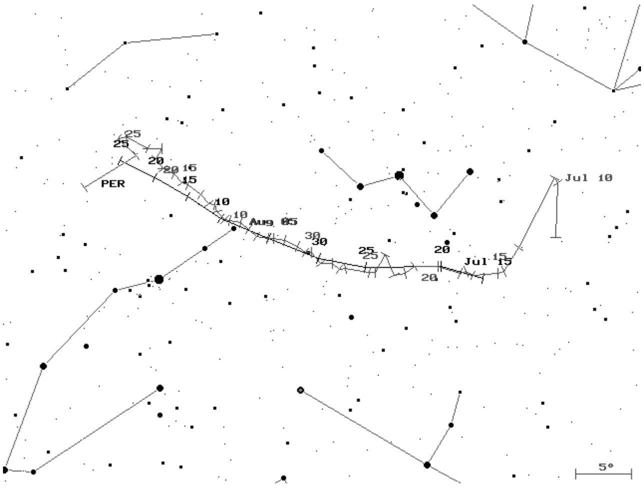

Figure 2 – Perseid radiant position derived from nearly 18 000 shower members (single station) of the IMO Video Meteor Database (gray).

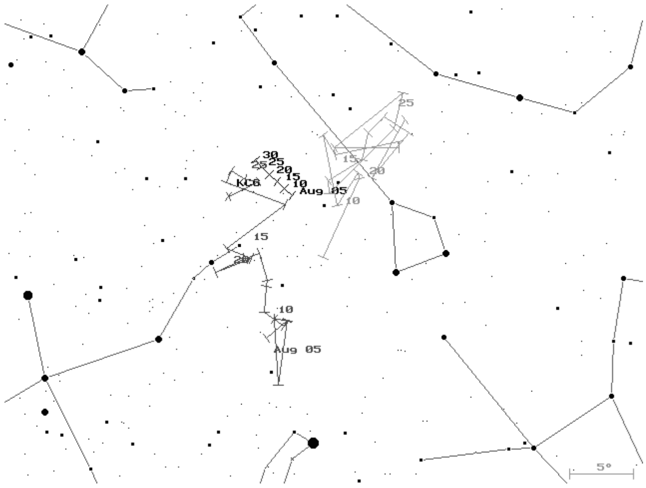

Figure 4 – Radiant position of two August meteor showers which fit well to the kappa-Cygnids.

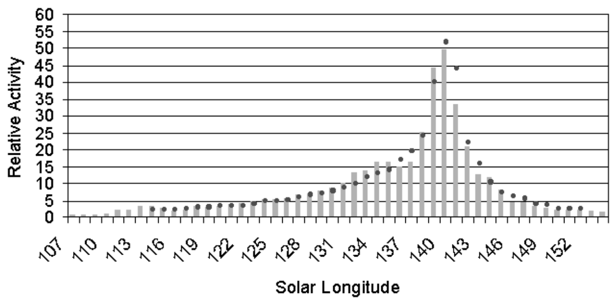

Figure 3 – Long-term activity profile of the Perseids derived from video data (grey bars). The black dots mark the ZHR profile form the new IMO handbook with an identical interval length of 2 degree.

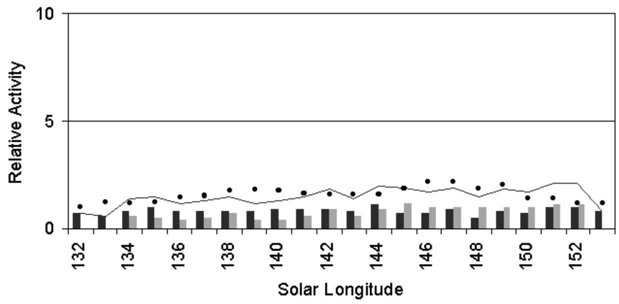

Figure 5 – Long-term activity profile of both August showers (bars). The black line is the accumulated activity of both showers, and the black dots represent the ZHR profile from the current IMO handbook.

strong peak on August 12/13. The dip on August 9 is also known to visual observers, even though the latest long-term activity profile given in the IMO handbook (black dots) does not show it. The descending Perseid branch is very steep, such that they are hardly recognizable anymore by August 20.

All in all, the video results fit very well to visual rates from the VMDB. On the one hand that is due to the large data set. On the other hand it still remarkable if you remember, that the video profile was derived only from the number of Perseids and sporadic meteors, recorded with a wide variety of video cameras. There were no limiting magnitudes, effective observing times or r-value profiles involved.

For the second typical shower of August, the kappa-Cygnids, the situation is a bit trickier. According to the new IMO handbook, they are active between August 3 and 25. They reach their maximum on August 17 (according to the table) respectively 19 (according to the activity profile in the handbook) with a ZHR of 2. The radiant is almost stationary all the time. The 2006 video analysis revealed two showers (or two segments of the same shower) near the expected position and with an activity interval of 20 days, but with a different radiant drift velocity and direction. The new analysis suggests that there might in fact be two showers with nearby radiants. Both of them have a velocity of 23 km/s, i.e. a little less than the list value of the kappa-Cygnids (25 km/s). The primary shower was detected between August 5 and 26 with an overall of 870 meteors. In the beginning, the radiant is roughly 10 degrees south of the expected KCG position (Figure 4). The direction of the radiant drift is about the expected one, only the drift velocity is much higher. Thus, the radiant is nearly at the expected position by the end of the activity interval. The activity profile (Figure 5) is flat and shows only on August 17 and 24/25 small raisings. The first one fits to the maximum from the visual data.

The second shower was detected with about 700 meteors between August 7 and 25. Its radiant is roughly 5 to 10 degrees west of the expected KCG position. The scatter of the individual positions is much higher, but on average to position of the radiants is almost constant as presented in the IMO handbook. The maximum of this shower is on August 18 and comparable to the maximum of the primary shower.

It is not possible to give final conclusions for the kappa-Cygnids yet. As both showers are quite similar in many respects, but differ in radiant position by about 10 degrees, I would currently speak about two branches of the same shower or a double radiant.

For comparison, a plot for August 18 based on the same data set was obtained with the Radiant software. It also shows a double radiant, but the primary shower

Table 1 – Observers contributing to August 2008 data of the IMO Video Meteor Network.

Code	Name	Place	Camera	FOV	LM	Nights	Time (h)	Meteors
BRIBE	Brinkmann	Herne	HERMINE (0.8/6)	⊘ 55°	3 mag	26	97.9	513
CASFL	Castellani	Monte Baldo	BMH1 (0.8/6)	⊘ 55°	3 mag	15	83.7	414
			BMH2 (0.8/6)	⊘ 55°	3 mag	27	127.4	519
CRIST	Crivello	Valbrevenna	STG38 (0.8/3.8)	⊘ 80°	3 mag	11	58.6	434
ELTMA	Eltri	Venezia	MET38 (0.8/3.8)	⊘ 80°	3 mag	15	100.0	706
GONRU	Goncalves	Tomar	TEMPLAR1 (0.8/6)	⊘ 55°	3 mag	27	187.5	1223
			TEMPLAR2 (0.8/6)	⊘ 55°	3 mag	3	18.0	106
HERCA	Hergenrother	Tucson	SALSA (1.2/4)	⊘ 80°	3 mag	20	116.6	357
HINWO	Hinz	Brannenburg	AKM2 (0.85/25)	⊘ 32°	6 mag	13	82.8	340
KACJA	Kac	Kostanjevec	METKA (0.8/8)	⊘ 42°	4 mag	21	142.8	585
		Kamnik	REZIKA (0.8/6)	⊘ 55°	3 mag	12	80.4	935
		Ljubljana	ORION1 (0.8/8)	⊘ 42°	4 mag	29	162.8	870
		Mala Kopa	ORION2 (0.8/8)	⊘ 42°	4 mag	4	25.4	610
LUNRO	Lunsford	Chula Vista	BOCAM (1.4/50)	⊘ 60°	6 mag	9	36.0	808
MOLSI	Molau	Seysdorf	AVIS2 (1.4/50)	⊘ 60°	6 mag	13	52.2	1055
			MINCAM1 (0.8/6)	⊘ 60°	3 mag	27	124.3	516
		Ketzür	REMO1 (0.8/3.8)	⊘ 80°	3 mag	23	97.8	693
			REMO2 (0.8/3.8)	⊘ 80°	3 mag	25	100.0	742
SLAST	Slavec	Ljubljana	KAYAK1 (1.8/28)	⊘ 50°	4 mag	15	88.3	284
STOEN	Stomeo	Scorze	MIN38 (0.8/3.8)	⊘ 80°	3 mag	16	108.0	593
STRJO	Strunk	Herford	MINCAM2 (0.8/6)	⊘ 55°	3 mag	21	63.1	300
			MINCAM3 (0.8/8)	⊘ 42°	4 mag	17	61.5	273
			MINCAM5 (0.8/6)	⊘ 55°	3 mag	19	61.1	426
WEBMI	Weber	Chouzava	TOMIL (1.4/50)	⊘ 50°	6 mag	5	11.1	272
YRJIL	Yrjl	Kuusankoski	FINEXCAM (0.8/6)	⊘ 55°	3 mag	13	68.6	221
					Overall	31	2155.4	13785

is much stronger (Figure 6). In fact, the picture changes significantly if the standard deviations for velocity and position errors are modified. This underlines that the last word on the kappa-Cygnids is not yet spoken.

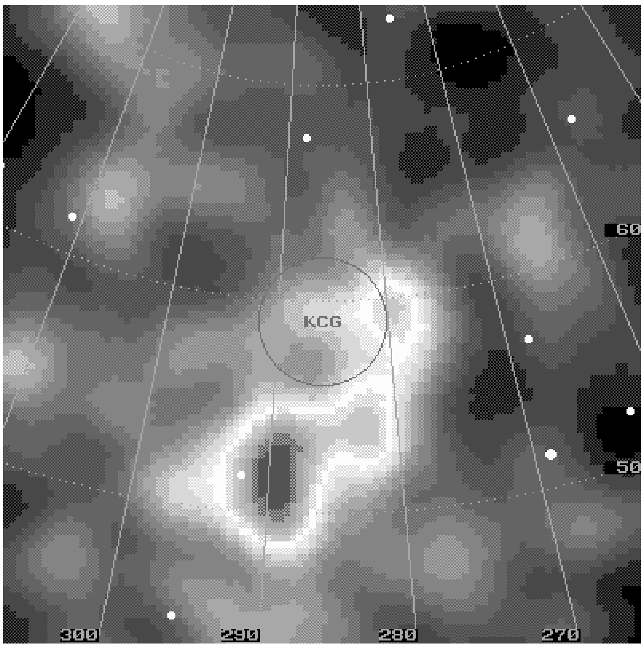

Figure 6 – Radiant plot of August 18 (solar longitude 144–146) with the Radiant software.

Results of the IMO Video Meteor Network — September 2008

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The weather was mediocre in September 2008. Many cameras got just a few longer cloud gaps or had to pause completely inbetween. Only around September 10 and 25 there were longer spells of clear sky at most sites (Figure 1). Once more, Carl Hergenrother was the exception: he enjoyed perfect weather all month long at Tucson and missed just a single night (Table 1).

The monthly total of more than 2000 hours of effective observing time and almost 9000 meteors was only thanks to the fact, that more than half of all cameras are automated by now and therefor run without interruption. With respect to the observing time, the last month was slightly behind the best September 2006, and with respect to the meteor number it was slightly ahead.

There are no major meteor showers is September. However, that does not mean that there is nothing interesting to be observed. This time, the analysis was centered around the minor shower of the September Perseids (SPE). According to the IMO handbook, this shower is active between September 5 and 17 and reaches a peak ZHR of roughly 5 near September 9. The shower was confirmed by the first complete meteor shower analysis two years ago, but the radiant position derived from the video data differed by more than 10 degrees from the expected position.

This year Enrico Stomeo informed me, that his camera MIN38 had recorded seven meteors on September 8/9, which seemed to originate from a radiant at $\alpha = 48°$, $\delta = 38°$ (Figure 2). That radiant fits much better to the epsilon-Perseids of Peter Jenniskens' list ($\alpha = 50°$, $\delta = 39°$) than to the September Perseids of IMO ($\alpha = 60°$, $\delta = 47°$). So it was a good occasion to examine this shower in more detail.

The second analyses of the IMO Video Meteor Database presented this year yielded a shower with an activity interval between September 3 and 14 consisting of 760 shower members. Figure 3 shows the radiant positions that were derived. Between September 6 and 13 (grey) the radiant is well-defined. The drift is uniform and fits well to the radiant drift expected for SPE. However, the offset in the radiant position by more than 10 degrees compared to the IMO handbook was confirmed. On September 8/9, it is located at $\alpha = 47°$, $\delta = 39°$, which fits well to the figures given by Enrico and to the epsilon-Perseids of Jenniskens. The velocity was determined to 65 km/s which is in good agreement to the IMO handbook (64 km/s) and Jenniskens' list (64.5 km/s).

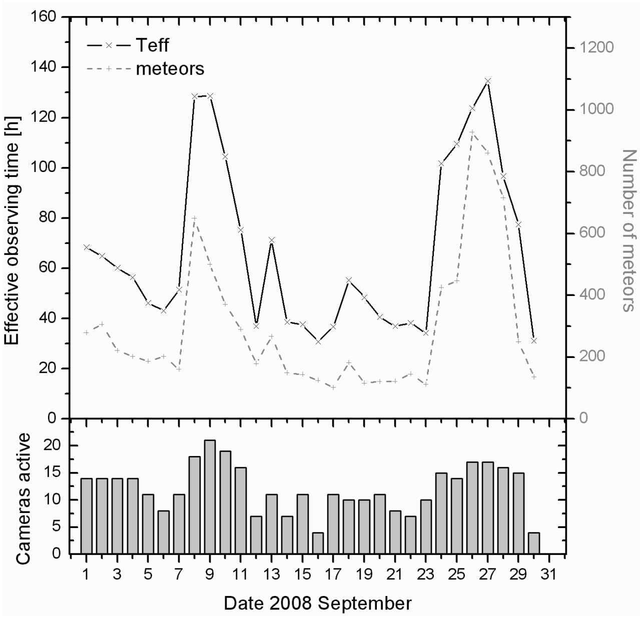

Figure 1 – Monthly summary for the effective observing time (solid black line), number of meteors (dashed gray line) and number of cameras active (bars) in September 2008.

Due to the similarity of both showers there is certain evidence, that the September Perseids of IMO are identical to the epsilon-Perseids of Jenniskens, whereby the radiant position in the IMO working list is erroneous.

A glimpse at the activity profile of the September Perseids (Figure 4, bars) shows a weak maximum between September 9 and 11. That fits well to the long-term activity profile of IMO (dots). Only the short-term peak at September 9 is not visible. However, as the interval length of the video data analysis is two degrees, there is a chance that a short peak is smeared out. In addition we should remember that the visual activity profile is based on a radiant that differs more than 10 degrees from the true position.

And what about 2008? Different American observers reported enhanced activity in the morning hours of September 9. Two all-sky cameras recorded more than 20 bright meteors and fireballs up to −8 mag. The enhanced rates lasted between $6^{\rm h}$ and $10^{\rm h}$ UT. This was confirmed by a visual observer, who observed many shower members between $7^{\rm h}$ and $9^{\rm h}$ UT. His highest count were 12 September Perseids between $8^{\rm h}$ and $8^{\rm h}30^{\rm m}$ UT.

What do our video data show? Unfortunately, the most interesting time interval was outside the European night time hours, when most cameras were active. Still, the data of 13 cameras from the European night of September 8/9 were analysed first. In the beginning, the meteor shower assignment was recomputed with the corrected radiant position. Then, the hourly September Perseid count was determined for each camera separately, the counts were corrected by the radiant altitude,

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Figure 2 – The radiant plot of MIN38 from 2008 September 8/9, shows a radiant away from the position expected for the September Perseids.

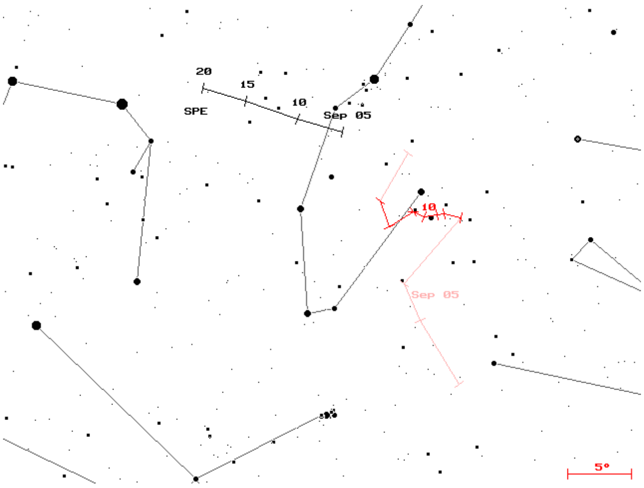

Figure 3 – Radiant position of the September Perseids derived from the IMO Video Meteor Database.

and finally averaged over all cameras. In parallel, the hourly sporadic count was determined. Figure 5 shows the resulting 2008 activity profile based on 68 SPE and 427 SPO. The radiant altitude corrected activity profile of the September Perseids was almost constant in the course of the nights, whereas the sporadic activity increased towards the morning as expected. Overall the SPE count was 15% of the SPO count, which fits well to the long-term value from the IMO database (13%). That is, the activity was not unusual as confirmed by visual observers in Europe.

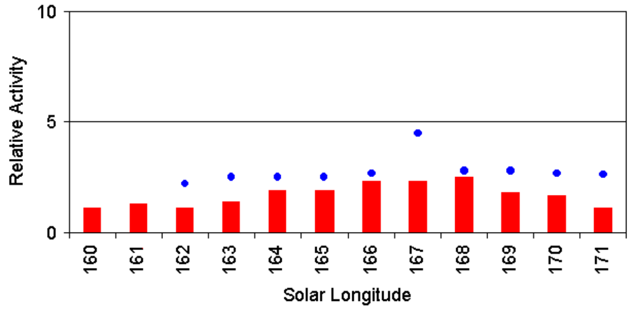

Figure 4 – Activity profile of the September Perseids. Dots represent the ZHR curve from the current IMO handbook.

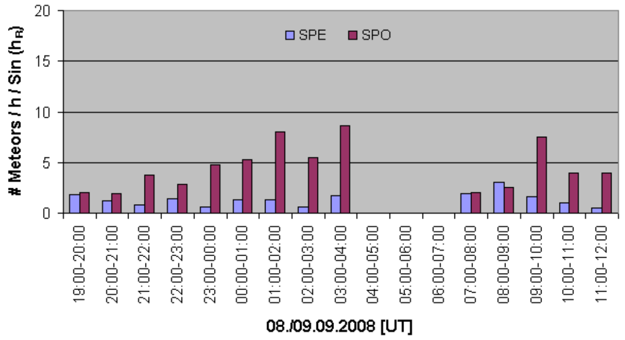

Figure 5 – Activity profile of the September Perseids from video observations on 2008 September 8/9.

The two American cameras SALSA and BOCAM enjoyed clear skies, too, even though they recorded less meteors because of lower camera sensitivity and a brighter observing site, respectively. Between 7^{h} and 12^{h} UT both cameras recorded an overall of 13 SPE and 38 SPO. The increase in the fraction of September Perseids is obvious. Half of the SPE recorded by SALSA were captured between 8^{h} and 9^{h} UT, whereas the shower meteors were equally distributed in the data set of BOCAM. If the data from both cameras are averaged, we find rates that were enhanced by a factor of four to five compared to the hours before. This leads to an peak ZHR estimate of 10 to 20, which is of the same order of magnitude as the visual results.

From the all-sky recordings alone one might have expected an even higher ZHR, but the population index was obviously very small. As the number of meteors increased only slightly towards the fainter meteors, the all-sky cameras were able to record a significant fraction of the shower meteors even with their low limiting magnitude. That pretended higher activity.

Table 1 – Observers contributing to September 2008 data of the IMO Video Meteor Network.

Code	Name	Place	Camera	FOV	LM	Nights	Time (h)	Meteors
BRIBE	Brinkmann	Herne	HERMINE (0.8/6)	⊘ 55°	3 mag	24	120.9	431
CASFL	Castellani	Monte Baldo	BMH2 (0.8/6)	⊘ 55°	3 mag	15	74.6	181
CRIST	Crivello	Valbrevenna	STG38 (0.8/3.8)	⊘ 80°	3 mag	11	60.8	401
ELTMA	Eltri	Venezia	MET38 (0.8/3.8)	⊘ 80°	3 mag	2	16.4	62
GONRU	Goncalves	Tomar	TEMPLAR1 (0.8/6)	⊘ 55°	3 mag	24	181.9	955
HERCA	Hergenrother	Tucson	SALSA (1.2/4)	⊘ 80°	3 mag	29	223.6	460
HINWO	Hinz	Brannenburg	AKM2 (0.85/25)	⊘ 32°	6 mag	10	47.3	197
KACJA	Kac	Kostanjevec	METKA (0.8/8)	⊘ 42°	4 mag	10	57.2	137
		Kamnik	REZIKA (0.8/6)	⊘ 55°	3 mag	6	41.6	269
		Ljubljana	ORION1 (0.8/8)	⊘ 42°	4 mag	18	67.1	143
KOSDE	Koschny	Noord-wijkerhout	TEC1 (1.4/12)	⊘ 30°	4 mag	5	19.9	45
LUNRO	Lunsford	Chula Vista	BOCAM (1.4/50)	⊘ 60°	6 mag	22	125.8	779
MOLSI	Molau	Seysdorf	AVIS2 (1.4/50)	⊘ 60°	6 mag	9	58.2	1036
			MINCAM1 (0.8/6)	⊘ 60°	3 mag	21	82.5	221
		Ketzür	REMO1 (0.8/3.8)	⊘ 80°	3 mag	21	111.4	448
			REMO2 (0.8/3.8)	⊘ 80°	3 mag	19	114.7	382
PRZDA	Przewozny	Berlin	ARMEFA (0.8/6)	⊘ 55°	3 mag	14	90.9	376
SLAST	Slavec	Ljubljana	KAYAK1 (1.8/28)	⊘ 50°	4 mag	14	62.7	131
STOEN	Stomeo	Scorze	MIN38 (0.8/3.8)	⊘ 80°	3 mag	8	35.5	116
STORO	Stork	Kunzak	KUN1 (1.4/50)	⊘ 55°	6 mag	2	5.4	155
		Ondrejov	OND1 (1.4/50)	⊘ 55°	6 mag	3	22.7	489
STRJO	Strunk	Herford	MINCAM2 (0.8/6)	⊘ 55°	3 mag	23	92.5	279
			MINCAM3 (0.8/8)	⊘ 42°	4 mag	17	85.4	249
			MINCAM5 (0.8/6)	⊘ 55°	3 mag	17	99.8	404
WEBMI	Weber	Chouzava	TOMIL (1.4/50)	⊘ 50°	6 mag	2	4.4	178
YRJIL	Yrjölä	Kuusankoski	FINEXCAM (0.8/6)	⊘ 55°	3 mag	17	104.1	372
					Overall	30	2007.3	8896

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