A statistical walk through the IAU MDC database

Željko Andreić[1], Damir Šegon[2] and Denis Vida[3]

[1] **University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering, Pierottijeva 6, 10000 Zagreb, Croatia**
zandreic@rgn.hr

[2] **Astronomical Society Istra Pula, Park Monte Zaro 2, 52100 Pula, Croatia**

Višnjan Science and Education Center, Istarska 5, 51463 Višnjan, Croatia
damir.segon@pu.htnet.hr

[3] **Astronomical Society "Anonymus", B. Radića 34, 31550 Valpovo, Croatia**

Faculty of Electrical Engineering, University of Osijek, Kneza Trpimira 2B, 31000 Osijek, Croatia
denis.vida@gmail.com

The IAU MDC database is an important tool for the study of meteor showers. Trough the history, the amount of data in the database for particular showers, and also their extent, varied significantly. Thus, a systematic check of the current database (as of 1st of June, 2014) was performed, and the results are reported and discussed in this paper.
The most obvious one is that the database contains showers for which only basic radiant data are available, showers for which a full set of radiant and orbital data is provided, and showers with data span anywhere in between. As a lot of current work on meteor showers involves D-criteria for orbital similarity, this automatically excludes showers without the orbital data from such work. A test run to compare showers only by their radiant data is performed, and was found to be inadequate in testing for shower similarities.
A few inconsistencies and typographic errors were found and are shortly described here.

1 Introduction

As the number of new shower candidates rises rapidly, there is a growing need of a standard database to help with searching for new candidates and to avoid multiple reporting of new shower candidates. Clearly, such a database has to be public and current.

The only database which at the moment fulfills these requirements is the database maintained by the Commission 22 (IAU meteor data center (MDC) homepage)[1] of the IAU. The database can be accessed online (IAU MDC list of all showers)[2]. The user is provided with a list of all showers and shower candidates reported to the IAU MDC. By clicking on a particular shower name a page with all the available data about that particular shower is opened.

The list can be sorted by the shower number in the database, the solar longitude of the shower maximum, RA or DE of the radiant and the geocentric velocity. No search options are offered by the web page.

The most valuable option of the IAU MDC web page is the possibility to download the current shower list in the CSV format, which allows users to use the database with their own software. This option is used, for example, by the search routine provided by the Croatian Meteor Network (CMN search tool for the IAU MDC database)[3] which provides a simple tool for searching the showers with similar parameters (multiple parameter search is supported) across the IAU MDC database.

For the analysis described in this paper, the list of all showers was downloaded on June 1st, 2014. from the IAU MDC page and this version was used in all further work.

2 Overview of the IAU MDC database

The downloaded CSV file contains 728 lines. The first 45 lines are comment lines, including database version (Last update: 2013.12.13) and a short explanation of individual data in the database. Vertical bar (|) is used as the field separator and all data are entered as text, with quotation mark (") used as a text qualifier. Taking this into account, the file can be imported into a spreadsheet program without any problems.

Neglecting the comment lines, the remaining 683 lines contain data about individual showers. According to the on-line statistics from the IAU MDC shower page, the database contains 578 showers, out of which 95 are established (meaning they exist without any doubt) and 95 are pro tempore, meaning that the basic data for them are not published yet. The rest is awaiting a decision of the IAU Commission 22 on their status. Additionally, 24

[1] http://www.astro.amu.edu.pl/~ jopek/MDC2007/index.php.
[2] http://www.astro.amu.edu.pl/~jopek/MDC2007/Roje/roje_lista.php?corobic_roje=0~sort_roje=0.
[3] http://cmn.rgn.hr/in-out/search.html

shower complexes (groups of showers) are listed in the database. The distribution of shower radiants on the celestial sphere is shown on Figures 1 and 2.

A nice touch is that the shower data frequently include the link to the reference from which the data originate. Altogether 427 entries have traceable publication data included. The rest is either missing, or has to be updated so the user of the database can find the reference in question.

For some showers (and complexes) several lines of data are present. Particularly, for 23 showers two different data sets are given, for 30 showers and one complex 3 data sets are given, for 7 showers and one complex 4 data sets and for 2 showers and one complex 5 datasets.

In this analysis, each line of the database is treated as an individual shower (or complex). Thus, for our purpose, the database contains 647 different showers and 36 complexes, and all numerical data quoted below are referring to this set of "shower" and "complex" data.

The data about possible (or confirmed) parent bodies are given in 173 cases, 87 of which are labeled as uncertain with one or two question marks.

It is also interesting to look at the number of known meteors for each shower in the database. The statistics are summarized in Table 1. A lot of shower candidates have been reported based on very few meteors, sometimes even only one. Moreover, for 174 showers the number of meteors is not known.

Table 1 – Statistics on the number of known meteors for each reported shower/shower candidate in the IAU MDC database.

number of meteors	number of showers
no data	174
1	9
2	21
3	34
4-5	37
6-9	84
10-19	101
20-49	117
50-99	22
100-199	8
200-499	33
500 and more	43

The only important data which we feel is missing from the database is data about the period of activity of the shower in question. Only the solar longitude of "maximum" activity is given, but from our experience this data alone is quite unreliable for newly discovered minor shower candidates, as the number of the orbits of such candidates is too low to allow the construction of an activity curve. Even the search in much larger single-station meteor databases, for instance on the IMO VDB (IMO video meteor database)[4] does not give enough clues about the activity curves of minor showers. Typically the solar longitude of the "maximum activity" is in such a case simply the average of solar longitudes of individual meteors that are suspected to belong to the minor shower in question. The information about the activity period can be quite useful, even if in some cases it usually corresponds to the solar longitudes of the first and the last meteor observed.

3 Minor inconsistencies and typographic errors in the IAU MDC

The CSV file was first checked for obvious errors, inconsistencies and non-standard symbols. A simple parser program was used for this purpose. This program tries to read each entry in the database, taking care of the type of the data and the standard interval in which the data should appear. In other words, integer values are parsed as integers, real numbers as floating point numbers and string values as strings. If the parsing process fails, a warning and the corresponding entry from the database are written to a log file, for later analysis.

A spreadsheet program is not useful for such test as its parser will import the file without any indication that something is not in order with the data. However, such data will be ignored in calculations performed by the spreadsheet, so the shower in question will effectively be eliminated from the database.

Starting from the first data column, we have identified the following inconsistencies or errors:

- Column 5 (shower name): in 55 occasions the name contains stars labeled with number (Flamsteed designations). Those shower names do not conform to the meteor shower naming rules (IAU MDC meteor showers nomenclature rules)[5].
- Column 7 (shower status): in 95 occasions the status is "10", a status number that is not explained in the comment lines of the CSV file.
- Column 13 (v_g): in line 93 of the CSV file the missing data is indicated by a "-.-", instead of simply leaving

[4] http://www.imonet.org/database.html.

[5] http://www.astro.amu.edu.pl/~jopek/MDC2007/Dokumenty/shower_ nomenclature.php.

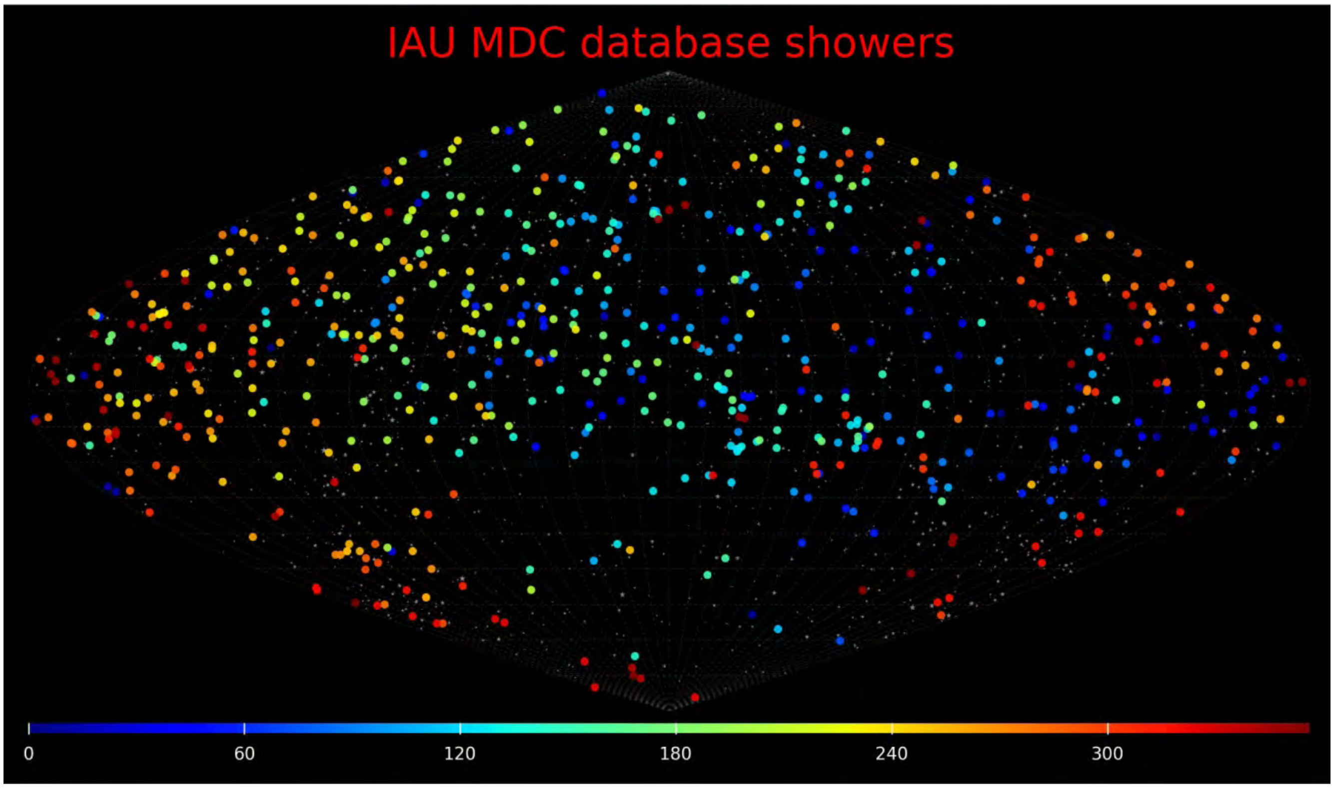

Figure 1 – All radiants from the IAU MDC database. The individual radiants are represented by small circles, with color corresponding to the solar longitude of the maximum activity of the shower in question.

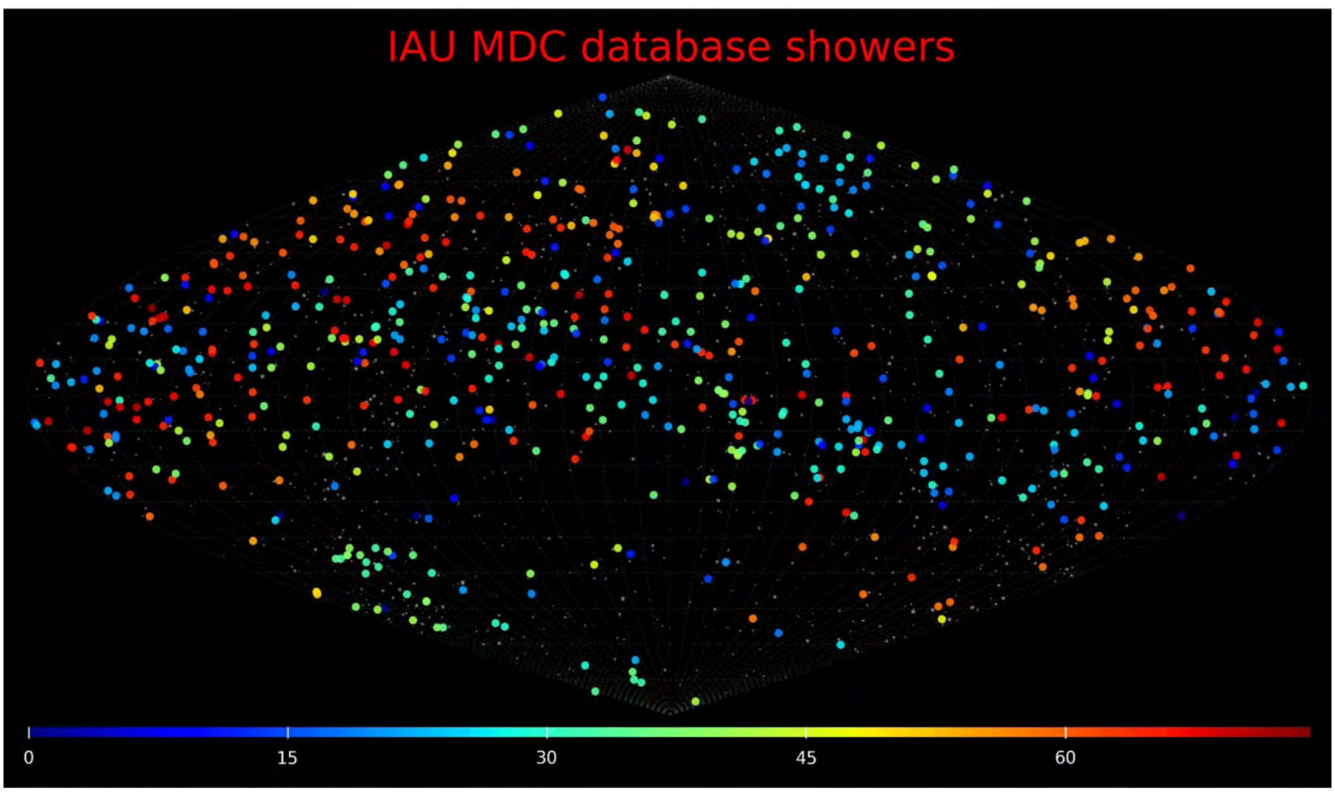

Figure 2 – All radiants from the IAU MDC database. The individual radiants are represented by small circles, with color corresponding to the geocentric velocity of the shower in question.

the field empty (as in all other cases when no data about geocentric velocity are given).

- Column 14 (*a*): in 16 cases the value is given between parentheses, probably indicating uncertain values. However, this would cause an error in most cases, excluding the line in question from further analysis. For instance, Microsoft Excell interpreted these numbers as negative, thus changing the orbital parameters significantly.
- Column 17 (peri): in line 114 a value of 1793 is entered as the longitude of perihelion, and in line 277 a range of values is entered as 31-24. In the second case the parser would fail. In two cases the values entered are outside the standard interval of 0-360 degrees.
- Column 18 (node): in 6 cases the given value is outside the standard interval of 0-360 degrees, sometimes being negative, sometimes larger than 360. Also, in line 360 the value is again given between parentheses.
- Column 19 (inclination): in line 277 a range of values is entered as 82-87.
- Column 20 (number of orbits): in 172 cases the missing data is indicated by a "-".

The most serious inconsistency we stumbled upon during our searches through the literature for the individual showers is that for some showers (for example IAU numbers 146, 149, 150, 209 and 409-418) instead the geocentric velocity the velocity at infinity is given, thus scrambling any attempts to compare the velocities of these showers with the other ones. Also, if one tries to derive the orbital elements from radiant data and geocentric velocity, they will be seriously wrong.

4 Shower similarities from orbital similarity

Next, the database was searched for showers with similar orbits. For this purpose, the standard D_{SH} criterion was used, and the tolerance was set to 0.15, as we did in all our searches for new shower candidates (see for example Šegon et al., 2013). The search excluded 27 complexes (out of 36) and 120 showers (out of 647) for which orbital data are missing or incomplete. Altogether 42 showers were found to have some orbital similarity to other showers in the database, and often multiple similarities were found. When arranged in pairs, 61 of them have been found. They are listed in Table 2.

5 Shower similarities from radiant search

To see what can be done with the showers without the complete orbital data, the database was searched for showers with similar radiant positions and activity periods. As a similarity criterion, we required that the difference in solar longitudes of the maxima of the two showers in question has to be less than 7°, the difference in radiant coordinates (both in RA and in DE) has to be smaller than 7°, after the corrections for the daily motion of the radiant (if data are available) and the arc contraction in RA due to the convergence of the coordinate grid towards the celestial poles have been made. In the case of daily motion, the correction is always done for the radiant of the shower with the lower IAU number, if possible.

As last, it was required that the geocentric velocities of the two showers do not differ by more than 3 km/s. Under these circumstances, 30 pairs of similar showers were found. Two of them are known to be identical, and are as such labeled in the database, and the remaining 28 pairs are listed in Table 3.

The advantage of this search is that all showers in the database are included (apart from complexes, as for most complexes no radiant data are given) so the search is complete. On the other hand, it is very difficult to conclude if two showers are similar on the radiant data and geocentric velocity only.

6 Combined results of both searches

A very interesting result is obtained when one tries to compare the results of the radiant and the orbital similarity searches. Only 4 showers appear on both lists, and we will shortly discuss these 4 cases here.

Southern March Virginids (124 SVI)

Two different orbits are given in the IAU MDC database, but only the second (AdNo=1) was found to be similar to some other shower. The radiant search found that they are similar to the Northern March Virginids (123 NVI, AdNo=1), a fact that seems to be self-explanatory. The pairing was not found by the orbital similarity search as the D_{SH} of the two mean orbits is larger than the pre-set limit, being 0.185 in this case.

The radiant plot of 124 SVI and all other radiants within the window of ±15° around the maximum activity of 124 SVI is shown on the Figure 3. The small dots in the background are meteors from the combined CMN and SonotaCo database (CMN 2007-1010, SonotaCo 2007-2011) that we used in our searches (Andreić et al., 2013), with v_g color coded. It can be seen that a lot of possibly active radiants is crowded in this area of the sky (14 altogether). Luckily, most of them are eliminated by the $\Delta v_g \leq 3$ km/s criterion, leaving only the above mentioned 123 NVI radiant as a similar one to the 124 SVI.

The orbital similarity search revealed two other pairings, namely with one mean orbit of the α Virginids (21 AVB, AdNo=1, with D_{SH}=0.116) and with one mean orbit of the ν Hydrids (121 NHY, AdNo=2, with D_{SH}=0.138). A quick look into the IAU MDC database reveals why these two pairings were not found by the radiant search: the radiants of the 21 AVB and the 121 NHY are both outside the tolerances we set for the radiant search.

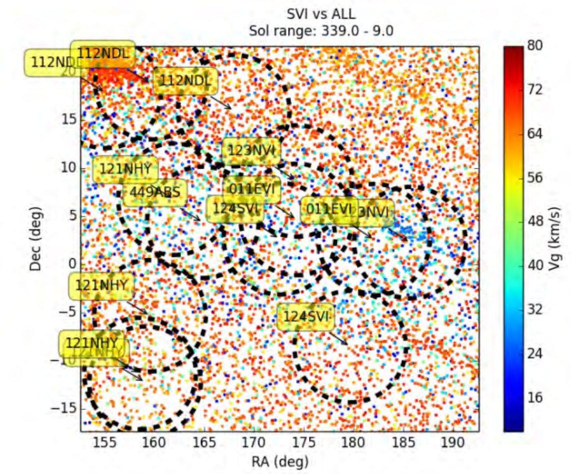

Figure 3 – The radiant plot of 124 SVI and all other radiants within the window of ±15° around the maximum activity of 124 SVI. The small dots in the background are all meteors from the combined CMN and SonotaCo databases in the plotting area and the solar longitude window, regardless of the shower affiliation. The geocentric velocity of individual meteors is color coded.

β Equuleids (327 BEQ)

Both searches have found similarities between this shower and the ε Pegasids (326 EPG). The solar longitude differs by only 1°, and radiants are separated by about 6° in both coordinates. The geocentric velocities are also quite similar, with a difference of 1.7 km/s. The D_{SH} of the mean orbits is 0.124.

The radiant plot is a lot more simple than the previous one (see Figure 4 and the similarity of the radiant positions is obvious. The radiant of the 548 FAQ is just a little farther, and is eliminated by the search criteria, the most obvious one in this case being a large difference in geocentric velocity of 6.1 km/s.

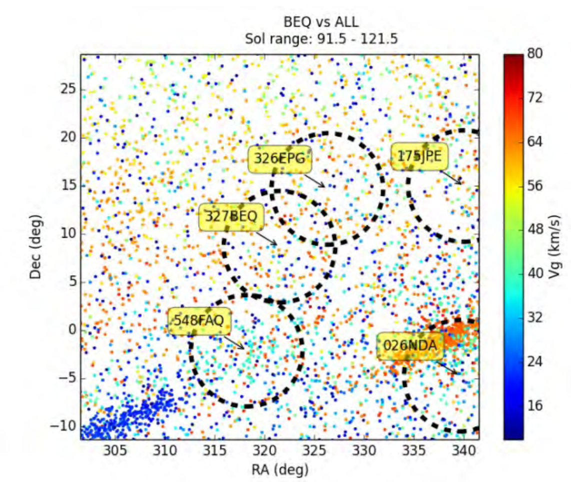

Figure 4 – The radiant plot of 327 BEQ and all other radiants within the window of ±15° around the maximum activity of 327 BEQ. The small dots in background are all meteors from the combined CMN and SonotaCo databases in the plot area and solar longitude window, regardless of the shower affiliation. The geocentric velocity of individual meteors is color coded.

υ Ursae Majorids (527 UUM)

Both searches have found large similarities between this shower and November σ Ursae Majorids (488 NSU). The solar longitudes of both showers differ by 1.6°, and the difference in radiant position is less than one degree. Moreover, the geocentric velocities differ by only 0.2 km/s. The D_{SH} of the mean orbits is 0.036. All this strongly indicates that these showers are identical, and as the 527 UUM is one of the showers found in our previous searches (Andreić et al., 2014), we checked the case thoroughly to see why we missed this fact. We have found that, at the time we reported 527 UUM, the showers 487 to 493 (including 488 NSU) were not entered into the IAU MDC database, so we were not able to check against them. We thus ended with a double detection of the 488 NSU.

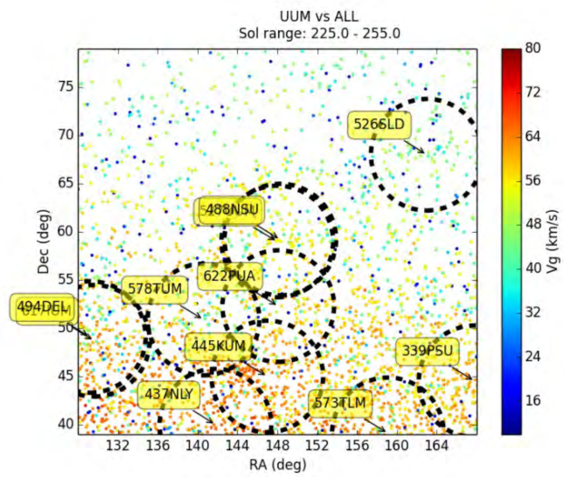

Figure 5 – The radiant plot of the 527 UUM and all other radiants within the window of ±15° around the maximum activity of the 527 UUM. The small dots in the background are all meteors from the combined CMN and SonotaCo databases in the plotting area and the solar longitude window, regardless of the shower affiliation. The geocentric velocity of individual meteors is color coded.

The radiant plot of the 527 UUM shows nicely the almost identical radiant position with the 488 NSU (see Figure 5).

Sextantids (561 SSX)

The radiant search has found similarities between this shower and the 17 Sextantids (560 SES). The solar longitudes of both showers differ by 0.4°, and the difference in radiant position is about 5° in both coordinates. The geocentric velocities differ by only 0.7 km/s. The pairing was not found by the orbital similarity search as the D_{SH} of the two mean orbits is 0.387 in this case.

The radiant plot of the 561 SSX is again quite crowded, but shows the relative vicinity of the 561 SSX and the 492 DHT clearly. The other two nearby radiants (560 SES and 585 IHY) are eliminated by the Δv_g criterion, as the differences in geocentric velocities between these three showers are very large.

The orbital similarity search has found another shower that has orbital similarity to the 561 SSX: December θ Hydrids (492 DTH). The mean orbits differ by D_{SH}=0.121. However, the difference in solar longitude is very large, 105°, indicating that this may be a case of twin showers.

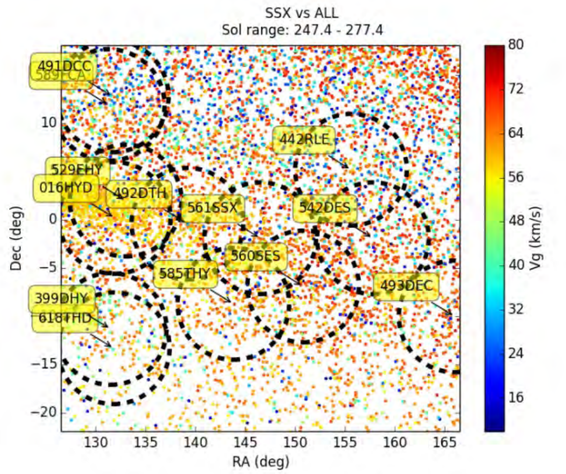

Figure 6 – The radiant plot of the 561 SSX and all other radiants within the window of ±15° around the maximum activity of the 561 SSX. The small dots in the background are all meteors from the combined CMN and SonotaCo databases in the plot area and solar longitude window, regardless of the shower affiliation. The geocentric velocity of individual meteors is color coded.

7 Discussion and conclusions

The IAU MDC database is an important tool in searches for new showers, but also in the study of existing ones. To be even more useful, we feel the need for the data formats in the database to be fully standardized (for instance, that the missing data are always indicated by an empty data field, and that entries into numerical fields are pure numbers without any other characters that may not be read correctly by a parser program). One has also to understand that the database itself is at the current moment assembled from the data taken from the literature as they are, without any attempt to check or correct them, about what the IAU MDC is highly aware, so we hope an attempt to go one step further to produce a database with the checked/unified data will be done in the future.

Through the extensive use of the database in our work we found that multiple entries for the same shower often complicate the searches, so we would like to have the most accurate data present (or to label the corresponding dataset as such). In the light of modern research techniques and tools, some early data, especially for showers with just a few members, could be labeled with an indication of their accuracy to help in assessing their similarity to newly found shower candidates.

After the database was searched for the obvious inconsistencies, we performed two searches for similar showers in the database. First, the database was searched for orbital similarity between individual showers, which was possible only for showers for which the orbital data are entered into the database (527 of them). To see what can be done about the remaining showers, a search in radiant position, solar longitude of the maximum activity and geocentric velocity was performed. This search encompassed all 647 showers in the database.

Both searches have found several dozens of showers with at least some similarity between their orbital (61 pair) and radiant (28 pair of showers) data. The comparison between two sets of "similar" shower pairs resulted in only 4 cases where the same pairs have been found by both searches. However, in two cases, the pairing found were different for the two search methods. If we give more weight to orbital similarity methods, this clearly shows that searching for similar showers by the radiant data only does not produce reliable results.

Finally, we looked a little deeper into the search data to see why there is so little overlap between results of two search methods described here. We took the results of the orbital similarity search, and looked at the radiant data of the shower pairs detected by this search. After eliminating obvious mismatches in the radiant data, we found out that the tolerances for the radiant search have to be more relaxed, especially the tolerance in the solar longitude of the shower maximum, which turned out to be around 20°. This again stresses the need for entering information about the period of activity of the showers into the database. The more relaxed tolerances for the coordinates of the radiant are 14° in RA and 8° in DE. The effect of the radiant declination on the tolerance for the right ascension (due to convergence of coordinate grid towards the celestial poles) was found to be minor. Finally, the tolerance for the geocentric velocity is confirmed, being about 3 km/s.

Recently, as this paper was already finished, a nice reference about the IAU MDC database was published in the Meteoroids 2013 conference proceedings (Jopek and Kaňuchová, 2013). It covers the history of the database, its current status and future plans. It explains, for instance, why Flamsteed numbers entered the naming of new showers. More important, the authors are aware of the current problems and needs and they are working on improving the database.

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References

Andreić Ž., Gural P., Šegon D., Novoselnik F., Vida D., and Skokić I. (2013). “Ten possible new showers from the Croatian Meteor Network and SonotaCo datasets”. *WGN, Journal of the IMO*, **41:3**, 103–108.

Andreić Ž., Gural P., Šegon D., Skokić I., Korlević K., Vida D., Novoselnik F., and Gostinski D. (2014). “The results of CMN 2013 search for new showers across CMN and SonotaCo databases I”. *WGN, Journal of the IMO*, **42:3**, 90–97.

Andreić Ž., Šegon D. (2010). “The first year of Croatian meteor network”. In Kaniansky S. and Zimnikoval P., editors, *Proceedings of the International Meteor Conference*, Šachtička, Slovakia, 18 – 21 Septermber 2008. IMO, pages 16–23.

Jopek T. J. and Kaňuchová Z. (2013). “Current status of the IAU MDC meteor showers database”. In Jopek T. J., Rietmeijer F. J. M., Watanabe J., and Williams I. P., editors, *Proceedings of the Meteoroids 2013 Conference*, Poznań, Poland, 26-30 August 2013. A.M. University Press, pages 353–364.

Šegon D., Andreić Ž., Korlević K., Novoselnik F., and Vida D. (2012). “Croatian Meteor Network Catalogue of Orbits for 2007.”. WGN, *Journal of the IMO*, **40:3**, 94–97.

Šegon D., Andreić Ž., Korlević K., Novoselnik F., Vida D. and Skokić I. (2013). “8 new showers from Croatian meteor network data”. WGN, *Journal of the IMO*, **41:3**, 70–74.

Table 2 – Pairs of similar showers found by orbital similarity search. The identification of the first shower is given in three first columns, following identification of the second shower and the D_{SH} of the two mean orbits is in the last column.

IAU No	Ad No	Code	IAU No	Ad No	Code	D_{SH}	IAU No	Ad No	Code	IAU No	Ad No	Code	D_{SH}
527	0	UUM	488	0	NSU	0.036	473	0	LAQ	33	1	NIA	0.130
223	0	GVI	124	1	SVI	0.039	264	0	XCE	263	0	NAN	0.131
478	0	STC	469	0	AUS	0.042	31	1	ETA	8	1	ORI	0.132
452	0	TVI	21	3	AVB	0.051	325	0	DLT	221	0	DSX	0.132
536	0	FSO	535	0	THC	0.064	495	0	DMT	288	0	DSA	0.132
173	0	BTA	17	1	NTA	0.065	532	0	MLD	451	0	CAM	0.132
240	0	DFV	123	0	NVI	0.068	452	0	TVI	21	2	AVB	0.133
31	0	ETA	8	1	ORI	0.078	478	0	STC	218	0	GSA	0.133
173	1	BTA	17	0	NTA	0.084	230	0	ICS	22	0	LMI	0.135
136	0	SLE	123	0	NVI	0.086	475	0	SAQ	467	0	ANA	0.137
286	0	FTA	154	1	DEA	0.096	124	1	SVI	121	2	NHY	0.138
456	0	MPS	261	0	DDC	0.101	167	1	NSS	115	1	DSC	0.138
230	0	ICS	22	1	LMI	0.102	473	0	LAQ	33	0	NIA	0.138
31	2	ETA	8	1	ORI	0.106	286	0	FTA	257	0	ORS	0.139
172	0	ZPE	28	0	SOA	0.107	469	0	AUS	200	0	ESE	0.139
223	0	GVI	21	1	AVB	0.109	367	0	OPG	366	0	JBP	0.140
240	0	DFV	136	0	SLE	0.113	453	0	MML	133	1	PUM	0.140
282	0	DCY	83	0	OCG	0.113	453	0	MML	133	2	PUM	0.140
124	1	SVI	21	1	AVB	0.116	330	0	SSE	320	0	OSE	0.141
218	0	GSA	200	0	ESE	0.116	223	0	GVI	121	2	NHY	0.141
479	0	SOO	226	0	ZTA	0.116	475	0	SAQ	471	0	ABC	0.143
481	0	OML	480	0	TCA	0.117	453	0	MML	125	0	SAL	0.143
476	0	ICE	155	1	NMA	0.118	168	0	SSS	115	3	DSC	0.144
423	0	SLL	161	0	SSC	0.119	449	0	ABS	268	0	BCD	0.145
513	0	EPV	428	0	DSV	0.119	289	0	DNA	288	0	DSA	0.146
167	1	NSS	115	0	DSC	0.120	167	1	NSS	115	2	DSC	0.147
561	0	SSX	492	0	DTH	0.121	469	0	AUS	218	0	GSA	0.147
327	0	BEQ	326	0	EPG	0.124	173	2	BTA	28	0	SOA	0.148
173	0	BTA	2	0	STA	0.125	168	0	SSS	115	4	DSC	0.149
168	0	SSS	115	2	DSC	0.129	123	1	NVI	121	2	NHY	0.150
173	0	BTA	17	0	NTA	0.130							

Table 3 – Pairs of similar showers found by the radiant search. The identification of the first shower is given in three first columns, following identification of the second shower and differences in coordinates of the radiants and geocentric velocity.

IAU No	Ad No	Code	IAU No	Ad No	Code	Δ $\lambda_\odot$	Δ RA	Δ DE	Δ v_g
308	0	PIP	93	0	VEL	-5.3	-6.6	4.3	-0.1
390	0	THA	248	0	IAR	3.4	7.6	0.9	-0.2
527	0	UUM	488	0	NSU	-1.6	0.6	-0.7	-0.2
315	0	OCA	105	1	OCN	-0.7	3.0	-0.9	-0.4
522	0	SAP	175	1	JPE	3.0	-0.2	0.2	-0.6
508	0	TPI	26	3	NDA	7.0	0.4	1.2	0.7
508	0	TPI	342	0	BPI	7.0	0.4	1.2	0.7
561	0	SSX	560	0	SES	0.4	-4.6	5.1	-0.7
582	0	JBC	567	0	XHY	-0.2	-6.8	5.2	-0.8
350	0	MAL	348	0	ARC	5.0	8.1	-2.4	1.2
547	0	KAP	190	0	BPE	2.1	-7.8	4.8	-1.5
585	0	THY	561	0	SSX	-0.5	-2.3	-6.9	-1.5
617	0	IUM	588	0	TTL	6.4	8.8	-0.6	1.6
327	0	BEQ	326	0	EPG	1.0	-6.3	-6.4	1.7
356	0	MVL	151	0	EAU	-5.0	5.6	6.4	1.7
387	0	OKD	385	0	AUM	7.0	0.0	2.7	1.7
577	0	FPI	415	0	AUP	1.7	3.6	-5.1	-1.8
622	0	PUA	488	0	NSU	4.3	-4.5	-4.9	1.9
622	0	PUA	527	0	UUM	5.9	-3.1	-5.0	2.1
585	0	THY	560	0	SES	-0.1	-6.9	-1.8	-2.2
354	0	DDT	351	0	DTR	7.0	-0.6	-0.4	2.2
560	0	SES	542	0	DES	-1.3	-6.1	-5.4	-2.3
589	0	FCA	491	0	DCC	-4.1	3.2	-2.0	2.5
347	0	BPG	143	0	LPE	6.3	3.0	5.8	2.6
17	1	NTA	2	0	STA	0.0	-5.4	5.9	2.7
615	0	TOR	609	0	BOT	2.4	-6.2	-6.4	2.7
616	0	TOB	90	0	JCO	-1.3	5.1	6.2	-2.7
124	1	SVI	123	1	NVI	0.0	-1.7	-6.0	-3.0