Fifteen Years of Collecting Observations in the Visual Meteor Database

Rainer Arlt

A summary of the present status of the *Visual Meteor Database* (*VMDB*) is given as a comprehensive data source covering the years 1984–1998. Statistical accounts are given and observers' characteristics are shown. Problems of reporting meteor observations are discussed, and hints are given to ensure a high quality of visual data.

1. What is the VMDB?

Observing meteors visually involves a number of uncertainties in the results, most notably the various characteristics of the human being carrying out the observation. A meaningful result can only be derived from a sample of data. The *Visual Meteor Database* (*VMDB*) was created by Paul Roggemans in 1988 [1] in order to collect meteor observations in a standard format in computer-readable format, that is, ready-to-use for analyses of meteor showers and sporadic meteors. The database stores information on observing periods, basically beginning and end times, effective observing time, cloud obstruction, and limiting magnitude, plus numbers of meteors per shower seen in this period. The *VMDB* does not store individual meteors. Magnitude distributions of shower meteors and sporadic meteors are usually given per night; for major showers, they are given per shorter periods.

2. Current statistics

Looking at the totals of visual meteor observations collected in the *VMDB* as given in Table 1, we find a very satisfying development. In fact, the *VMDB* is now the largest meteor database in the world containing data gathered from 1.5 million meteors. Again, the *VMDB* is not a database of meteor coordinates; it stores rate information and magnitude distributions in a ready-to-use way. Thanks to the Leonids, we passed in 1998 the 10 000-hour mark of effective observing time in a single year. The following report gives an update and additional information to the report in [2].

Table 1 – *Visual Meteor Database* (*VMDB*) grand totals for 1984–1998.

Year	$T_{\rm eff}$	Meteors	Observers	Countries
1984	$516^{\rm h}$	3 990	64	4
1985	$2\,113^{\rm h}$	35 058	194	5
1986	$2\,210^{\rm h}$	40 310	191	13
1987	$1\,653^{\rm h}$	22 000	183	7
1988	$5\,684^{\rm h}$	115 298	346	17
1989	$5\,322^{\rm h}$	89 493	414	21
1990	$4\,488^{\rm h}$	79 053	339	21
1991	$5\,360^{\rm h}$	139 308	377	27
1992	$4\,529^{\rm h}$	76 811	317	29
1993	$7\,532^{\rm h}$	178 566	582	34
1994	$5\,431^{\rm h}$	105 823	462	30
1995	$5\,924^{\rm h}$	102 804	518	32
1996	$7\,832^{\rm h}$	151 396	646	35
1997	$9\,570^{\rm h}$	192 019	662	35
1998	$11\,066^{\rm h}$	222 485	933	48
Total	$79\,230^{\rm h}$	1 554 414		

The distribution of world-wide observing sites as used in 1998 is shown in Figure 1. Magnifications of this map for Europe, North America, and north-east Asia are given in Figures 2, 3, and 4. The more regular distribution of Japanese sites comes from a gridding which divides the country into longitude and latitude areas resulting in a finite number of observing sites ab initio. This method does not provide full accuracy for the individual observing site, but is completely sufficient for visual observing purposes. A diagram showing the observational coverage of each degree in solar longitude is shown in Figure 5. The peaks of major showers are cut for the sake of more detail in the less frequently covered periods. We find the lowest numbers of observations in early January after the Quadrantids and in early and mid-March.

A breakdown of observer numbers and total effective hours is given in Table 2 for the entire database from 1984 to 1998. This overview proves the global character of the *VMDB*, since almost 60% of the countries provided more than 100 hours of observations each, and did not just occasionally participate. The following statistics may be an interesting complement to the survey study of observers in [3].

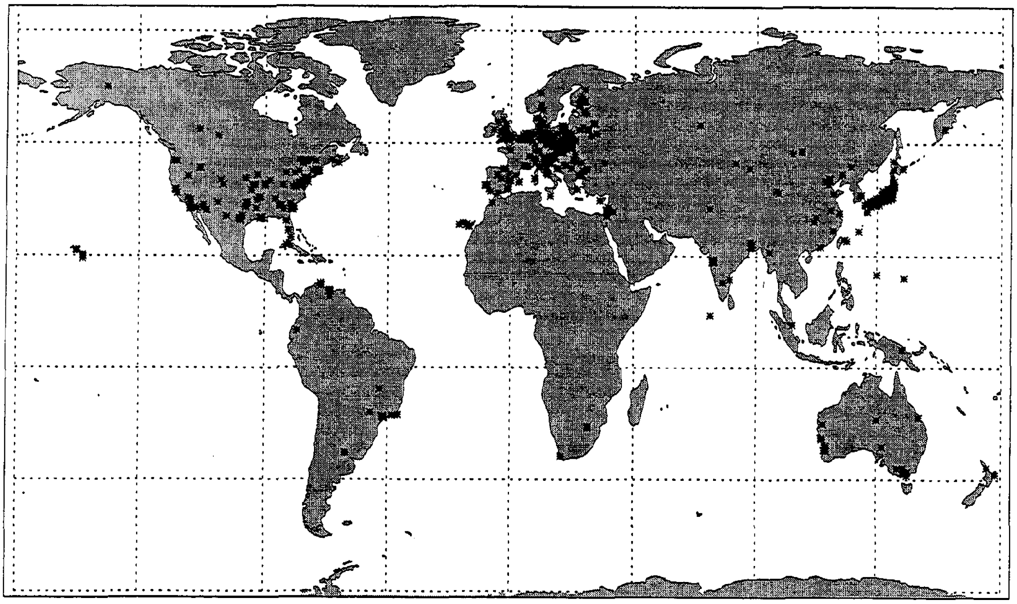

Figure 1 – Distribution of observing sites in 1998.

Table 2 – Number of observers and total effective observing time per country or region. The last column shows the number of observers per million people (country/region populations based on 1991 statistics). *Some earlier USSR observers could not be associated with the new countries anymore.

Country	Obs	$T_{\rm eff}$	Density	Country	Obs	$T_{\rm eff}$	Density
Argentina	10	$49.^{\rm h}04$	0.32	Japan	376	$8\,958.^{\rm h}53$	3.1
Australia	189	$3\,837.^{\rm h}83$	11.8	Jordan	28	$355.^{\rm h}92$	10.2
Austria	16	$130.^{\rm h}80$	2.1	Kazakhstan	3	$8.^{\rm h}90$	0.19
Belarus	17	$192.^{\rm h}03$	1.7	Malta	43	$818.^{\rm h}33$	121.1
Belgium	357	$5\,996.^{\rm h}13$	36.2	Morocco	9	$7.^{\rm h}76$	0.38
Bolivia	20	$74.^{\rm h}87$	3.0	the Netherlands	46	$1\,866.^{\rm h}40$	3.2
Brazil	17	$118.^{\rm h}89$	0.12	New Zealand	12	$902.^{\rm h}10$	3.6
Bulgaria	85	$2\,104.^{\rm h}56$	9.5	Norway	21	$547.^{\rm h}91$	5.0
Canada	45	$1\,284.^{\rm h}60$	1.8	Pakistan	1	$22.^{\rm h}71$	0.01
China	42	$334.^{\rm h}25$	0.04	Papua N. Guinea	1	$0.^{\rm h}83$	0.29
Croatia	60	$706.^{\rm h}85$	13.0	Poland	98	$5\,481.^{\rm h}48$	2.6
Cuba	7	$13.^{\rm h}46$	0.68	Portugal	8	$66.^{\rm h}24$	0.78
Czech Republic	130	$2\,073.^{\rm h}60$	12.3	Romania	16	$1\,167.^{\rm h}36$	0.70
Denmark	9	$741.^{\rm h}42$	1.8	Saudi Arabia	1	$1.^{\rm h}26$	0.09
Dominican Rep.	2	$2.^{\rm h}00$	0.31	Singapore	1	$1.^{\rm h}75$	0.39
Ecuador	1	$0.^{\rm h}50$	0.10	Slovakia	294	$6\,770.^{\rm h}19$	58.6
Estonia	10	$40.^{\rm h}74$	6.6	Slovenia	75	$498.^{\rm h}69$	47.3
Finland	42	$1\,420.^{\rm h}89$	8.6	South Africa	10	$242.^{\rm h}17$	0.30
France	12	$330.^{\rm h}46$	0.22	South Korea	2	$8.^{\rm h}32$	0.05
Germany	151	$10\,285.^{\rm h}70$	1.9	Spain	144	$3\,852.^{\rm h}74$	3.7
Gibraltar	1	$2.^{\rm h}29$	32.1	Sweden	6	$7.^{\rm h}47$	0.72
Hong Kong	8	$26.^{\rm h}68$	1.4	Taiwan	3	$12.^{\rm h}31$	0.15
Hungary	345	$5\,182.^{\rm h}97$	32.5	United Kingdom	101	$2\,067.^{\rm h}18$	1.8
India	21	$158.^{\rm h}83$	0.03	United States	254	$8\,674.^{\rm h}14$	1.0
Ireland	6	$12.^{\rm h}81$	1.7	Ukraine	19	$242.^{\rm h}66$	0.37
Israel	10	$80.^{\rm h}09$	2.1	Venezuela	10	$32.^{\rm h}96$	0.56
Italy	62	$923.^{\rm h}12$	1.1	Yugoslavia	72	$1\,173.^{\rm h}23$	7.7
USSR*	11	$97.^{\rm h}01$	-				

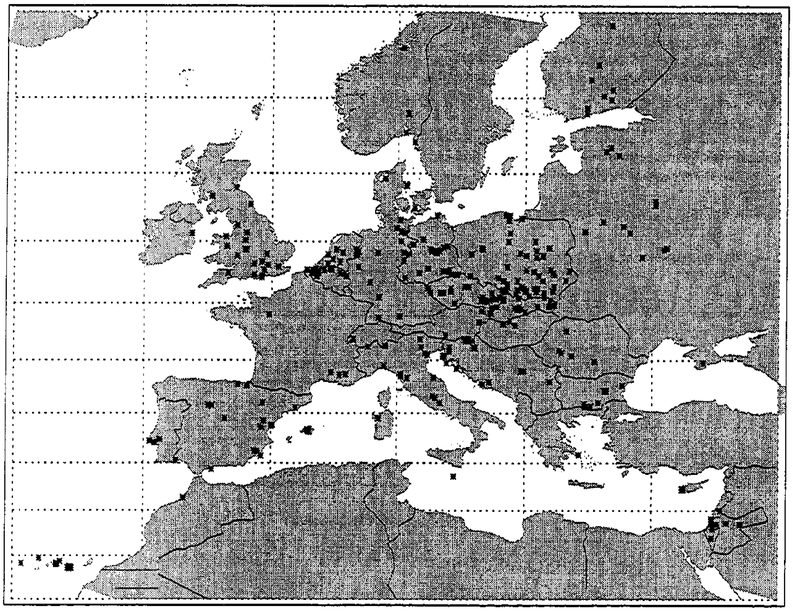

Figure 2 – European observing sites in 1998.

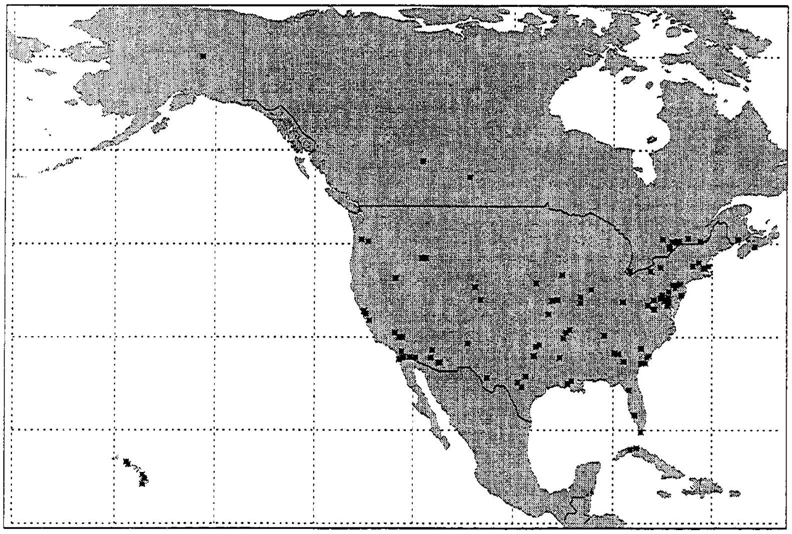

Figure 3 – North American observing sites in 1998.

How often does a meteor observer go out to log an observing session? The complete set of files was scanned, and the observing nights of each individual observer were extracted. This gives us an indication of how many observers are long-term meteor amateurs. Figure 6 shows the number of observers who watched meteors in certain numbers of nights, binned in 25-night classes. A list of the 20 most active observers as stored in the *VMDB* is given in Table 3 ranked by the number of observing nights (*left*). The last column gives the average time lapse between two observing nights in days. Quite a few observers have not contributed to the *VMDB* for many years, but have been very active recently. Table 3 also lists 20 observers reversely ranked by their average time lapse between observing nights (*right*). Here, we find a number of observers not listed in the left panel of Table 3, who use really every chance to go out and observe meteors. It should be noted, that the list contains only observers with at least 20 observations.

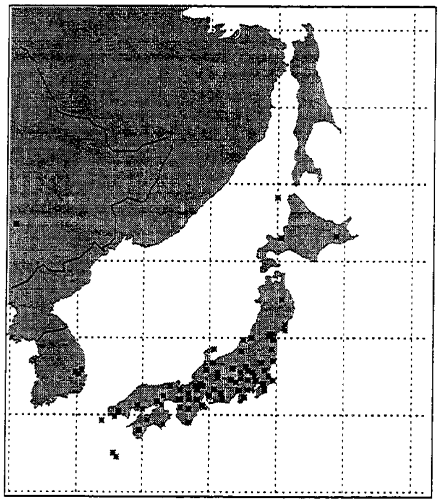

Figure 4 – Japanese and north-east Asian observing sites in 1998.

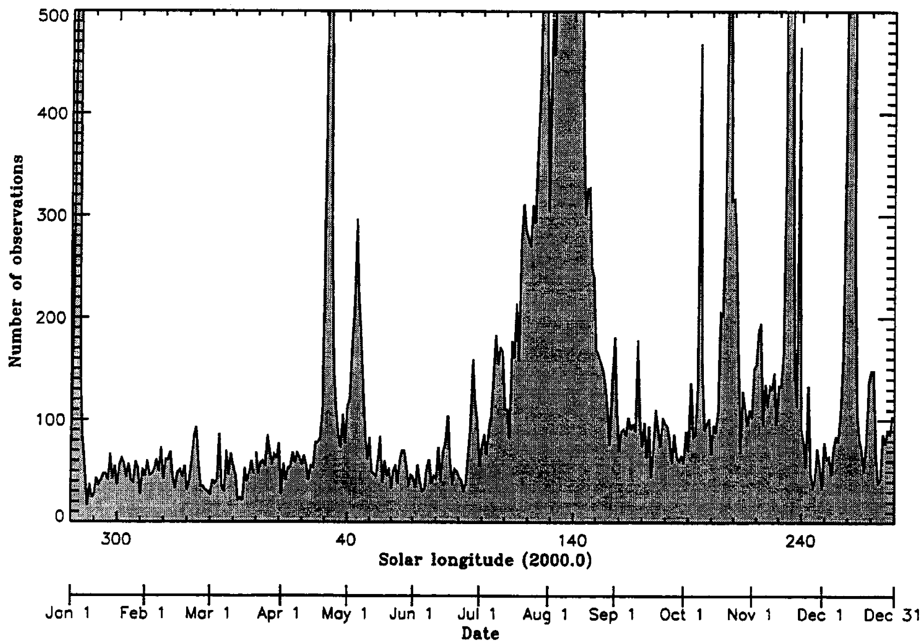

Figure 5 – Total number of observing periods per degree in solar longitude for 1984–1998.

The first column in Figure 6 for observers having less than 25 nights contains 2746 people comprising 91% of all contributors. This demonstrates that meteor observing is, first of all, a hobby. Good skills for a simple major-shower observation can be obtained in a first or second observation already, and the large number of few-time watchers is not questioning the quality. However, a substantial 34% of the observers reported only from a single night, most probably a Perseid, Leonid, or Geminid night. The contribution to the effective observing time is, of course, very low and does not exceed 3%. The contributions of few-time observers are given in Table 4.

Table 5 shows how many new observers were introduced to the database over the years. The systematic collection of meteor observation in the *VMDB* started in 1988 whence the relatively large number of "new" observers, who may have observed before as well. The perfect conditions for the 1993 Perseids attracted a substantial number of new observers and, of course, last year's Leonids again introduced a large community of amateur astronomers to meteor observing.

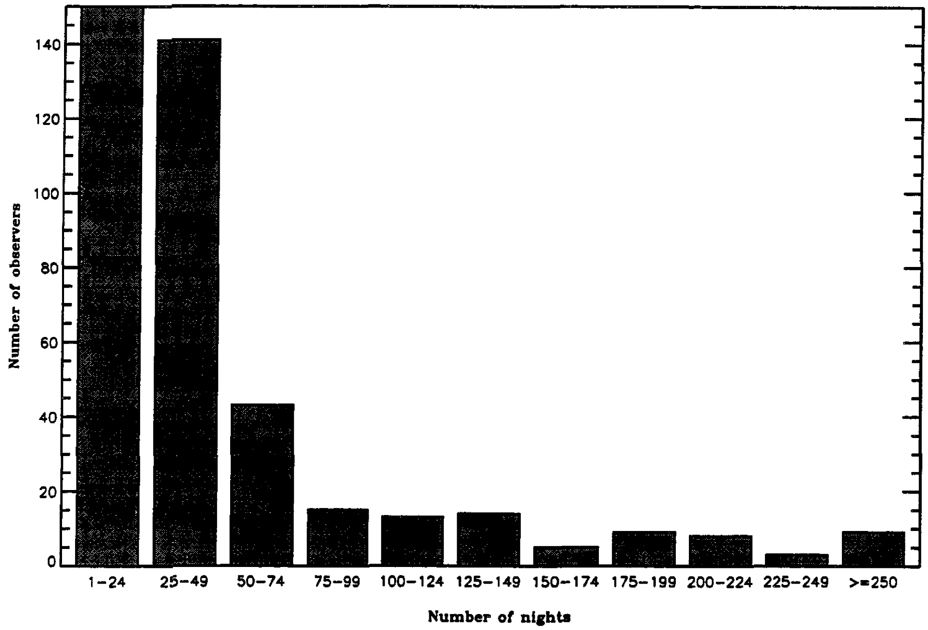

Figure 6 – Number of observers who watched for meteors in a certain number of nights. The first column includes 2746 observers with less than 25 nights.

Table 3 – Top 20 observers measured by their number of nights ("Nr") stored in the *VMDB* (*left*), respectively by the average time lapse between two observing nights ("Days") (*right*). Only observers with at least 20 nights in the *VMDB* were taken into consideration.

Top 20 by observing nights			Top 20 by time lapse between observations		
Observer and code	Nr	Days	Observer and code	Nr	Days
Jürgen Rendtel (Germany, RENJU)	791	5.0	Mitsue Sakaguchi (Japan, SAKMI)	183	3.3
Kazuhiro Osada (Japan, OSAKA)	489	6.1	Jakub Koukal (Czech Rep., KOUJA)	49	3.7
Robert Lunsford (USA, LUNRO)	428	9.1	John Gallagher (USA, GALJO)	127	3.7
G.M. Kristensen (Denmark, KRIGO)	376	5.6	Jarosław Dygos (Poland, DYGJA)	171	4.3
George Zay (USA, ZAYGE)	359	7.3	Sven Näther (Germany, NATSV)	106	4.7
Koetu Sato (Japan, SATKO)	298	8.8	Jürgen Rendtel (Germany, RENJU)	791	5.0
Katuhiko Mameta (Japan, MAMKA)	297	14.8	Tomasz Żywczak (Poland, ZYWTO)	137	5.1
Kiyoshi Izumi (Japan, IZUKI)	270	16.0	Mark Mikutis (USA, MIKMR)	22	5.4
Koen Miskotte (Netherlands, MISKO)	266	17.2	G.M. Kristensen (Denmark, KRIGO)	376	5.6
Leo Rajala (Finland, RAJLE)	241	18.9	Tomasz Fajfer (Poland, FAJTO)	179	5.9
Yasuo Yabu (Japan, YABYA)	237	18.5	Kazuhiro Osada (Japan, OSAKA)	489	6.1
Ralf Koschack (Germany, KOSRA)	235	16.7	Gracjan Maciejewski (Poland, MACGR)	92	6.1
Josep M. Trigo (Spain, TRIJO)	223	17.7	Graham Wolf (New Zealand, WOLGR)	161	6.8
Alastair McBeath (UK, MCBAL)	218	21.8	Konrad Szaruga (Poland, SZAKO)	120	7.1
André Knöfel (Germany, KNOAN)	217	17.9	George Zay (USA, ZAYGE)	359	7.3
Takema Hashimoto (Japan, HASTA)	215	20.4	Paweł Trybus (Poland, TRYPA)	67	7.7
Adam Marsh (Australia, MARAD)	211	16.9	Maciej Kwinta (Poland, KWIMA)	159	7.9
Jeff Wood (Australia, WOOJE)	210	18.7	Maciej Reszelski (Poland, RESMA)	184	8.0
Francisco Sevilla (Spain, SEVFR)	208	10.4	Pierre Martin (Canada, MARPI)	149	8.4
Richard Taibi (USA, TAIRI)	204	21.5	Koetu Sato (Japan, SATKO)	298	8.8

The "endurance" of observers is given in Table 6 showing that the majority of amateurs observe only in a single year. A substantial part of these 1760 observers is formed by 1998 Leonid watchers who are very much encouraged to take part in observations this year, too. Observers who have watched in at least three years form 31% of all observers. We find even three observers who contributed to the *VMDB* in all the 15 years. There will be more of these long-term observers once the files prior to 1988 have been updated more systematically.

Table 4 – Contributions to the effective observing time of observers with only a few observing nights.

Number of nights per observer	1	≤ 2	≤ 3	≤ 4	≤ 5	< 25
Percentage of the total T_{eff}	2.7%	5.0%	7.1%	9.4%	11.7%	35.3%

Table 5 – Distribution of observers versus their first year of reporting to the *VMDB*.

First year	Observers	First year	Observers	First year	Observers
1984	64	1989	208	1994	184
1985	167	1990	175	1995	199
1986	121	1991	165	1996	273
1987	95	1992	122	1997	253
1988	239	1993	305	1998	435

Table 6 – Distribution of observers versus the duration of their activities in years.

Duration	Observers	Duration	Observers	Duration	Observers
1	1760	6	77	11	38
2	328	7	57	12	22
3	258	8	53	13	10
4	179	9	40	14	2
5	132	10	46	15	3

Apart from the major meteor showers, the *VMDB* endeavors to store information on minor meteor showers, too. Weak-activity showers require much more care upon associating meteors with the radiants than major showers, since the relative error of a mis-classification is much larger. Plotting meteors into star charts with a careful analysis after the observation is the best way of minor-shower observing. Table 7 shows the development of the proportion of "plotting" observations over the years. The percentage shows no significant trend, probably because the number of medium-experienced observers starting to plot meteors is comparable to the number of new-comers starting with a major shower in the same year.

Table 7 – Development of observations during which meteors are plotted into star charts.

1990	1991	1992	1993	1994	1995	1996	1997	1998
$1042^{\text{h}}.73$ 23%	$1272^{\text{h}}.62$ 24%	$1902^{\text{h}}.78$ 42%	$1570^{\text{h}}.55$ 21%	$1381^{\text{h}}.37$ 25%	$2267^{\text{h}}.34$ 34%	$1854^{\text{h}}.03$ 24%	$2716^{\text{h}}.85$ 28%	$3112^{\text{h}}.75$ 28%

The 1998 Leonids have attracted a variety of casual meteor observers, mostly amateur astronomers, who logged a meteor observation for the first time. Since highest activity was expected over Asian geographical longitudes, amateurs from a number of countries new to the *VMDB* contributed with reports. Therefore, I think it is helpful to summarize a few observational principles, below, for the sake of improving the quality of future reports.

3. Improvements in reporting observations

Despite the growing flux of observations, which helps us in achieving global data collecting, we should not forget to remind the contributors to sustain a high level of quality in both meteor recording and observational reports.

An item which is often neglected in observational reports is the *center of the field of view*. Indeed, meteor numbers and brightness depend on the elevation of the field of view. In many cases, the deviations will be small, but can be significant under peculiar circumstances as shown in the analysis of the 1998 Leonid shower in [4].

> *I strongly recommend to give the center of the field of view. Please give the field in degrees for both the right ascension and the declination. An accuracy of* 10° *is sufficient.*

A given field center automatically allows the study of the dependence of meteor numbers and characteristics versus radiant distance of the field. The field center also allows to judge on how difficult it was for the observer to discriminate specific meteor showers.

The *breakdown* of an observing night is often too coarse, particularly in the case of major-shower maxima. A former argument in favor of long of periods was the small significance of a few meteors, but this argument has become obsolete. Indeed, the considerable amount of data covering the same period now permits the derivation of reasonable results, since many short periods can be stacked for a reliable average.

> *The observation may be broken down into groups of 10–20 meteors per period. For the case of a major-shower maximum, this can result in 10-minute or 15-minute periods.*
>
> *Please do not forget to give the numbers of other than the major-shower meteors and sporadics for the same short periods.*
>
> *Magnitude distributions of major showers should also be broken down into several per night. A good quantity in a distribution is 20–30 meteors.*
>
> *Please use the same time marks for the magnitude breakdown as in the breakdown of observing periods. This is not a scientific requirement; it is just more convenient for the utilization of your reports.*

The *distinction between a zero-meteor shower and a shower not observed* should by all means be clear. There is an enormous difference between not considering a particular shower during observation/analysis and considering that shower but observing no meteors from it. Observers often tend to use a slash or a hyphen if they did not see meteors from a shower. This is most misleading. Sometimes, a shower which was observed but from which no meteors were seen during the entire session does not even appear in the table header!

> *Please mark exactly those showers which you considered during your observation and, in the table of periods, distinguish between "–" (not considered during that period) and "0" (considered, but no meteors seen during that period).*

Finally, you must mention the *observing method*.

> *Do not forget to mention your observing method on the form, which is "C" for "counting" (direct shower association under the sky; e.g., simple tape-recorder observation), "P" for "plotting" (meteors were plotted into star charts), and "R" (meteor positions were recorded on tape or paper using reference objects).*

Plotting meteors has two main purposes:

1. The association with meteor showers can be carried out with fairly objective methods, such as the application of standard plotting errors and speed errors for the decision upon shower membership. Plotting is therefore the recommended observing method for all minor showers. (Notice that major showers like the Perseids must be considered minor if observed outside the period around the maximum.) This means, whenever you mark "P" in your observing form, you should have carried out a shower association *after the observation* applying association criteria concerning path direction, angular speed, and meteor length.
2. Plotting allows saving the complete information on the meteors. Plotting makes the observation useful for confirming new showers at any time, since the full information of the meteors is preserved. Whenever shower association criteria have been refined, or better computer programs have been developed for a consistent shower analysis, or just a possible new shower needs to be confirmed, we can easily re-use these plotting observations.

4. Reporting by electronic mail

Whereas the printed visual observing form is widely used, the submission of data in electronic formats is far from standardized. As a general rule, the electronically delivered report should be in a similar format as the printed form (such as given at `http://www.imo.net/visual/imoform.html`). Your report should be composed of simple ASCII characters. For those of you who did not grow up with computers, but started to use them with a screen full of little pictures and buttons, I would like to emphasize, that everything you store on disk with the `Save` menu item from your business text or spread sheet software, is not ASCII. The files you create are unreadable for everybody who has not the particular version of this program. It is unreadable for everybody who has not a PC, but a Unix workstation, for example.

A PC program which is as simple as the purpose we wish to fulfil, is called NOTEPAD. It creates ASCII files, and allows you to type table-like structures by simply tabulating with blank spaces. Notepad uses a character font, which is mono-spaced, i.e., all characters have the same width. Your report may look jumbled when loading it into another program, like your mail program; just send it off, and the recipient will be happy.

I would like to give two examples of an e-mail report here, the first of which will be adequate for a straightforward major-shower observation and requires a minimum of coordinating and typing. Despite their conciseness, contributions like these are most welcome and useful. The second example is a very detailed report for all those who wish to make the maximum of visual meteor observing.

```
Date: 1998/12/13-14
Site: Potsdam (11157)
Position: 13deg 04min E, 52deg 24min N, 30m
Observer: Rainer Arlt (ARLRA)

Time (UT)  Field   Teff   F    lm     GEM    SPO
0203-0230 100 +20  0.45  1.0  6.20  C 15    C 4
0230-0248 100 +20  0.30  1.0  6.15  C 12    C 2
0417-0432 120 +30  0.25  1.0  5.80  C  8    C 1

GEM: -1(2) 0(1) +1(5) +2(8) +3(12) +4(5) +5(2)
SPO: +2(3) +3(2) +4(2)
```

The way of reporting the magnitude distributions ensures that the report is unambiguous, even if you did not manage to use a monospaced character font. The "C" indicates that the meteors were counted and associated with the shower under the sky; they were not plotted. The second example is a marginally modified report by George Zay:

```
DATE: July 14/15, 1998 BEGIN: 4h05 UT END: 7h20 UT
OBSERVER : George J. Zay, IMO code: ZAYGE
LOCATION : Long: 116 deg 37' 30'' West; Lat: 32 deg 50' 18'' North
           Descanso, CA, USA; Elev: 1019 meters, IMO code: 25052

OBSERVED SHOWERS:

SHOWER   RA    DEC.             |    SHOWER   RA    DEC.
SAG      298   -21              |    JPE      344   +16
PAU      328   -34              |    SDA      325   -19
CAP      293   -14              |    NDA      317   -10
PER      007   +53              |
-------------------------------------------------------
OBSERVING PERIODS: For Plottings, 30 sec/meteor was subtracted
from observing times & 10 sec/meteor for Non-plots.
0 = None seen;     / = shower not watched.
PERIOD(UT)  FIELD   Teff  F   LM    SAG    JPE    PAU    SDA    CAP    NDA    PER    Spor
-------------------------------------------------------------------------------------------
4h05-5h09   264d+13 1.00  1  5.92  P 2    / /    / /    P 0    P 0    P 0    P 0    P 3
5h09-6h15   285d+14 1.00  1  6.00  P 0    P 0    P 0    P 0    P 0    P 1    P 0    P 5
6h15-7h20   297d+09 0.98  1  6.00  P 0    P 1    P 0    P 0    P 1    P 0    P 1    P 3
-------------------------------------------------------------------------------------------
MAGNITUDE DISTRIBUTIONS:
SHOWER  -6  -5  -4  -3  -2  -1   0  +1  +2  +3  +4  +5  +6  TOTAL
SAG                                      1   1                  2
JPE                              1                              1
CAP                                          1                  1
NDA                                              1              1
PER                                      1                      1
SPOR                     1           1   5   1   1   2         11
------------------------------------------------------------------
SKY OBSCURED: 0        Ki X Min               1
                      -------- = K'= 0     ------- = F = 1
                        T min                1 - K'
------------------------------------------------------------------
DEAD TIME: 16.0 minutes (Includes camera operation time.)
BREAKS    : none
Teff      : 2.98 hours
------------------------------------------------------------------
```

LIMITING MAGNITUDE:

TIME	STAR AREA	STAR COUNT	LM
4h05	15	8	5.8
4h05	13	12	5.9
4h35	13	13	6.0
4h35	15	8	5.8
5h09	5	8	6.0
5h09	13	13	6.0
5h40	5	8	6.0
5h40	13	13	6.0
6h15	5	8	6.0
6h15	13	14	6.0
6h45	5	8	6.0
6h45	13	14	6.0
7h20	5	8	6.0
7h20	13	13	6.0

MEAN LIMITING MAGNITUDE: 5.96

METEOR DATA

#	TIME UT	MAG	SPEED	COLOR	TRAIN SEC	SHWR	MAP #	PLOT
1	4h28	2	2	orange		spor	3	1
2	4h30	3	3	white		spor	3	1
3	4h44	2	3	white		SAG	3	1
4	4h47	1	3	white	1	spor	6	1
5	5h00	3	3	white		SAG	9	2
6	5h10	2	4	white		spor	6	1
7	5h18	5	3	white		spor	9	1
8	5h38	4	4	white		NDA	3	1
9	6h03	2	5	white	1	spor	6	1
10	6h09	4	2	white		spor	9	1
11*	6h12m46s	-2	3	orange		spor	9	2
12	6h29	2	5	white		spor	6	1
13	6h40	5	3	white		spor	9	1
14	6h44	2	5	white		spor	9	2
15	6h47	3	2	white		CAP	6	1
16	7h07	2	5	white		PER	6	1
17	7h13	0	5	white	2	JPE	9	1
##	7h20 ## STOP ##################################							

VELOCITY SCALE:	PLOT ACCURACY:
0 = STATIONARY	1 = ACCURATE PLOT
1 = VERY SLOW	2 = NORMAL PLOT
2 = SLOW	3 = GENERALIZED AREA/DIRECTION
3 = MEDIUM	
4 = FAST	
5 = VERY FAST	

All plotting charts are postal mailed to Rainer Arlt of IMO.
* Meteor #11 was photographed. Information about it will be mailed to Juergen Rendtel.

Two showers could not be analyzed reasonably in the first period, since their radiants were below or near the horizon. They are clearly distinguished from "none observed." The July Pegasids and the Perseids are actually not active according to the *IMO Shower Calendar*—a fuzziness of the activity limits of a few days is allowed though.

The development of clear instructions—mainly with programmers of meteor software in mind—on how a standard output of an observing report should look like are planned for the near future.

5. Availability of the VMDB

The data are published in the annual *WGN Observational Report Series*; the 1999 issue containing the 1998 observational data contains 288 pages [5]. The database is also available in the form of ASCII text files at the Internet home page of the *IMO*: `http://www.imo.net/visual/vmdb.html`. The data are freely available, provided (*i*) they are used for scientific and/or educational purposes, and (*ii*) articles in which these data are used contain appropriate reference to the *VMDB* archives in their publications, either in the form of *a citation of this article* or a citation of the specific *WGN Observational Report Series* volume (see, e.g., [5]).

6. Other visual meteor archives

A positional meteor database POSDAT was created in 1991 [6]. The main purpose was to make available a compact database with visual, telescopic, photographic, and video meteor positions. The general information about the observations was reduced to a minimum necessary for radiant searches.

A much more comprehensive system for visual meteor observations has been developed by Rattei and Richter [7]. The VISDAT system was created to simplify and standardize the observer's input and analysis of a meteor observation. It thus saves nearly the full information of the field log in a database, including meteor positions. The actual database format is a superset of the POSDAT structure. The big advantage is the objective shower association according to standard criteria reducing the uncertainties to the plotting and speed errors during the observation.

Acknowledgments

Personally and on behalf of analysts of the data, I would like to express my gratitude to all the observers who contributed to the *VMDB*. I would like to specially thank Jürgen Rendtel and Luis Bellot Rubio for their help in typing in observations from Germany and Spain. I felt all the work is worth being done, encouraged by the enthusiasm of amateur astronomers. I would also like to thank professional astronomers who realized this archive and its output is not just an amateurs playground, but a substantial source of scientific material, gathered by amateurs. The combination of professional and amateur work makes astronomy such a world-wide fascinating field.

References

[1] P. Roggemans, "The Visual Meteor Database (VMDB)", *WGN* 16, 1988, pp. 179–186.

[2] R. Arlt, "The Present Visual Meteor Database", *WGN* 23, 1995, pp. 4–5.

[3] G. Baldacchino, "Observing the Meteor Observer. A Global Survey of Meteor Observers", *WGN* 24, 1996, pp. 187–200.

[4] R. Arlt, "Bulletin 13 of the International Leonid Watch: The 1998 Leonid Meteor Shower", *WGN 26*, 1998, pp. 239–248.

[5] R. Arlt, *WGN Observational Report Series* 11, 1999, pp. 1–288.

[6] D. Koschny, "PosDat—The Positional Meteor Database of the IMO", *WGN* 20, 1992, pp. 136-139.

[7] J. Richter, "VISDAT: A Database System for Visual Meteor Observations", *WGN* 27, 1999, pp. 2–4.

Hints for Visual 1999 Leonid Observations

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1. The prediction

Summarizing the predictions in short, we expect a strong, narrow outburst of Leonids in November 1999. Since the behavior of the 1998 Leonids and that of many previous years and epochs can be reconstructed with particle models in impressive agreement with the observations, the prediction following from the same models are thought to be quite accurate, too (see, e.g., [1,2] for such models). According to [3], a to-the-minute prediction is possible for November 18, 2^h08^m UT. This is the time of passing the closest dust trail which was ejected by the parent Comet 55P/Tempel-Tuttle in 1899. Meteoroids from other epochs will add to this picture, but strongest activity is expected for this time with no larger deviation than one hour according to the fully independent study in [2]. The maximum ZHR is supposed to be of the order of 1000, but half or twice this value is easily possible, since the prediction of rates is most difficult. Maximum visible rates under a magnitude +6.5 sky will range from almost 15 meteors per minute as seen from the Near East to about 5 meteors per minute on the Canary Islands where the radiant is significantly lower.