

The NASA Fireball Network Database

Danielle E. Moser, Dynetics/Meteoroid Environment Office

The NASA Meteoroid Environment Office (MEO) has been operating an automated video fireball network since late-2008. Since that time, over 1,700 multi-station fireballs have been observed. A database containing orbital data and trajectory information on all these events has recently been compiled and is currently being mined for information. Preliminary results are presented here.



The NASA Fireball Network Database

Danielle Moser
Dynetics/MEO



Objectives of the NASA Fireball Network

1. Determine the speed distribution of cm-sized meteoroids
2. Determine the major sources of cm-sized meteoroids (showers/sporadic sources)
3. Characterize meteor showers (numbers, magnitudes, trajectories, orbits)
4. Determine the size at which showers dominate the meteor flux
5. Discriminate between re-entering space debris and meteors
6. Locate meteorite falls



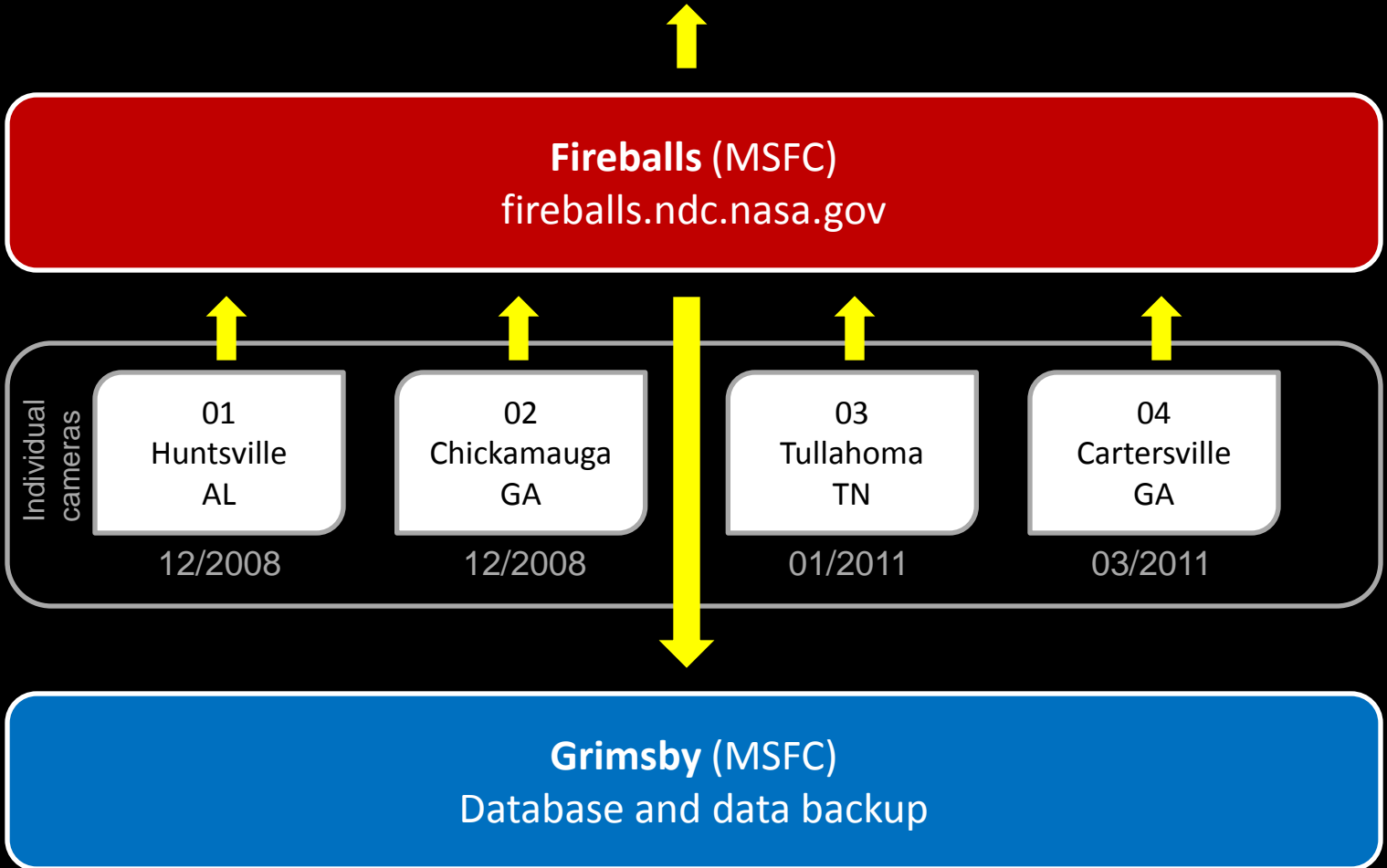
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Data Flow

Events with trajectory/orbit solutions displayed on public website



Database Computing Environment

- Programmer: Ellen Jones/MITS
- OS: Linux
- Development Language: PHP
- DB design: Navicat
- Database: MySQL
- Data browsing: PhpMyAdmin
- Custom file parsing/loading code
 - 52,000 files



Database Contents

- Trajectory
 - Beg/end location: lat, lon, ht
 - Speed
- Orbit
 - Radiant info
 - Orbital elements
- Media file links
 - Calibration plates
 - Movies
 - Images
 - Summary graphic
- Shower identification
- Camera data
 - Cams that saw event
 - GPS status
 - Number of frames detected



Database Interface

phpMyAdmin



Database

events (19) ▾

events (19)

- ev_app_log
- ev_camera
- ev_corr
- ev_day
- ev_day2event
- ev_event
- ev_event2camera_files
- ev_file_type
- ev_milig
- ev_orbit
- ev_plate_zip_files
- ev_shower_code
- ev_tmp
- qry_1
- qry_3
- src_qry
- vw_spo_dirxns
- vw_src_all
- vw_src_unk

Server: localhost ▶ Database: events ▶ View: vw_src_unk

[Browse](#) [Structure](#) [SQL](#) [Search](#) [Insert](#) [Export](#) [Drop](#)

Select fields (at least one):

- event_id
- a
- e
- incl
- omega
- asc_node
- true_anom
- jd
- src_id

DISTINCT

Number of rows per page

30

Display order:

▾

Ascending Descending

Add search conditions (body of the "where" clause): ?

Go

Or Do a "query by example" (wildcard: "%")

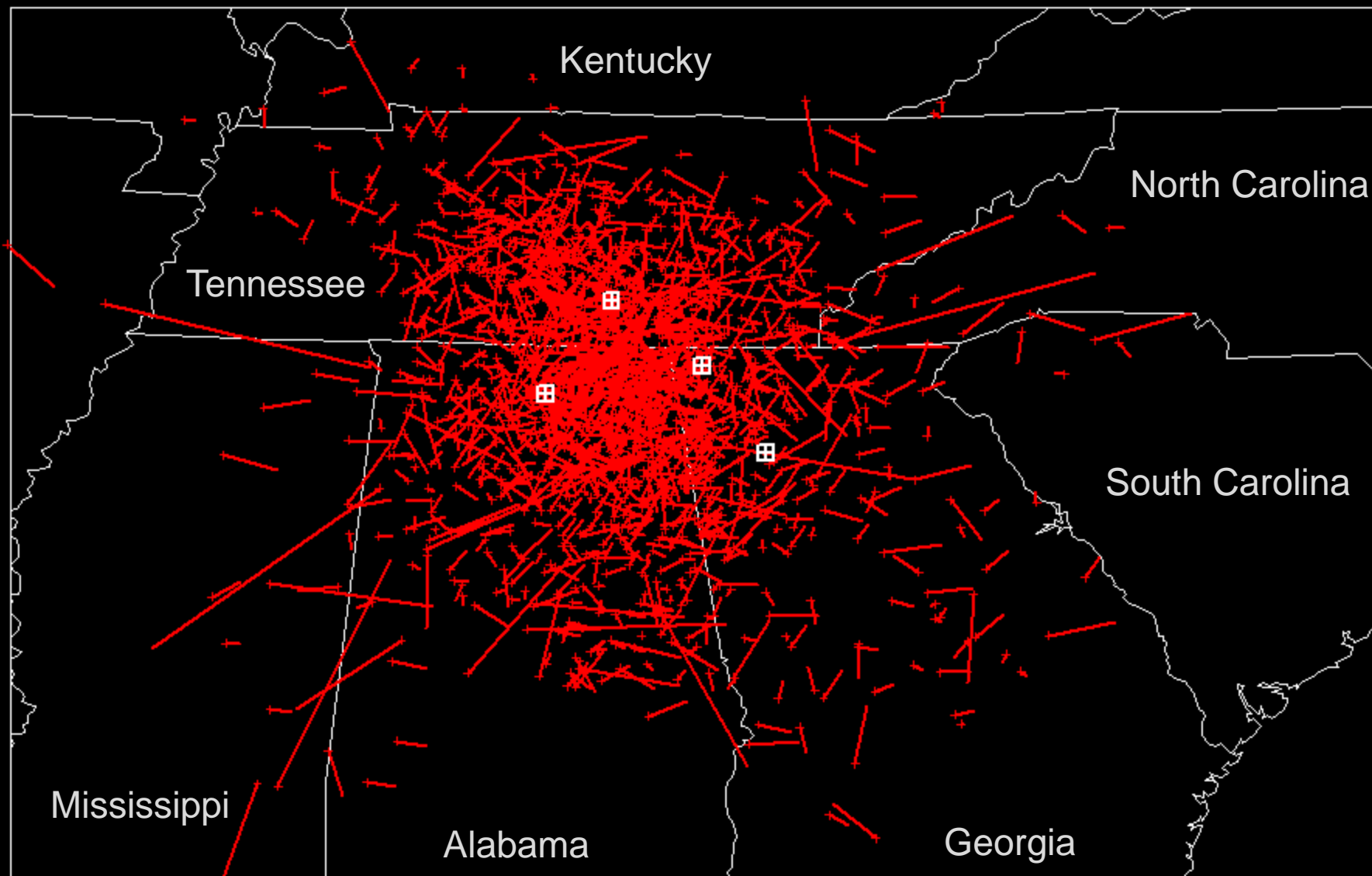
Field	Type	Collation	Operator	Value
event_id	varchar(30)	utf8_general_ci	LIKE ▾	<input type="text"/>
a	varchar(10)	utf8_general_ci	LIKE ▾	<input type="text"/>
e	varchar(10)	utf8_general_ci	LIKE ▾	<input type="text"/>
incl	varchar(10)	utf8_general_ci	LIKE ▾	<input type="text"/>
omega	varchar(10)	utf8_general_ci	LIKE ▾	<input type="text"/>
asc_node	varchar(10)	utf8_general_ci	LIKE ▾	<input type="text"/>
true_anom	varchar(10)	utf8_general_ci	LIKE ▾	<input type="text"/>
jd	varchar(30)	utf8_general_ci	LIKE ▾	<input type="text"/>

Note

- All data here is raw, with only minimal processing to retrieve $Q^* > 15$
- All results are therefore preliminary.

Coverage

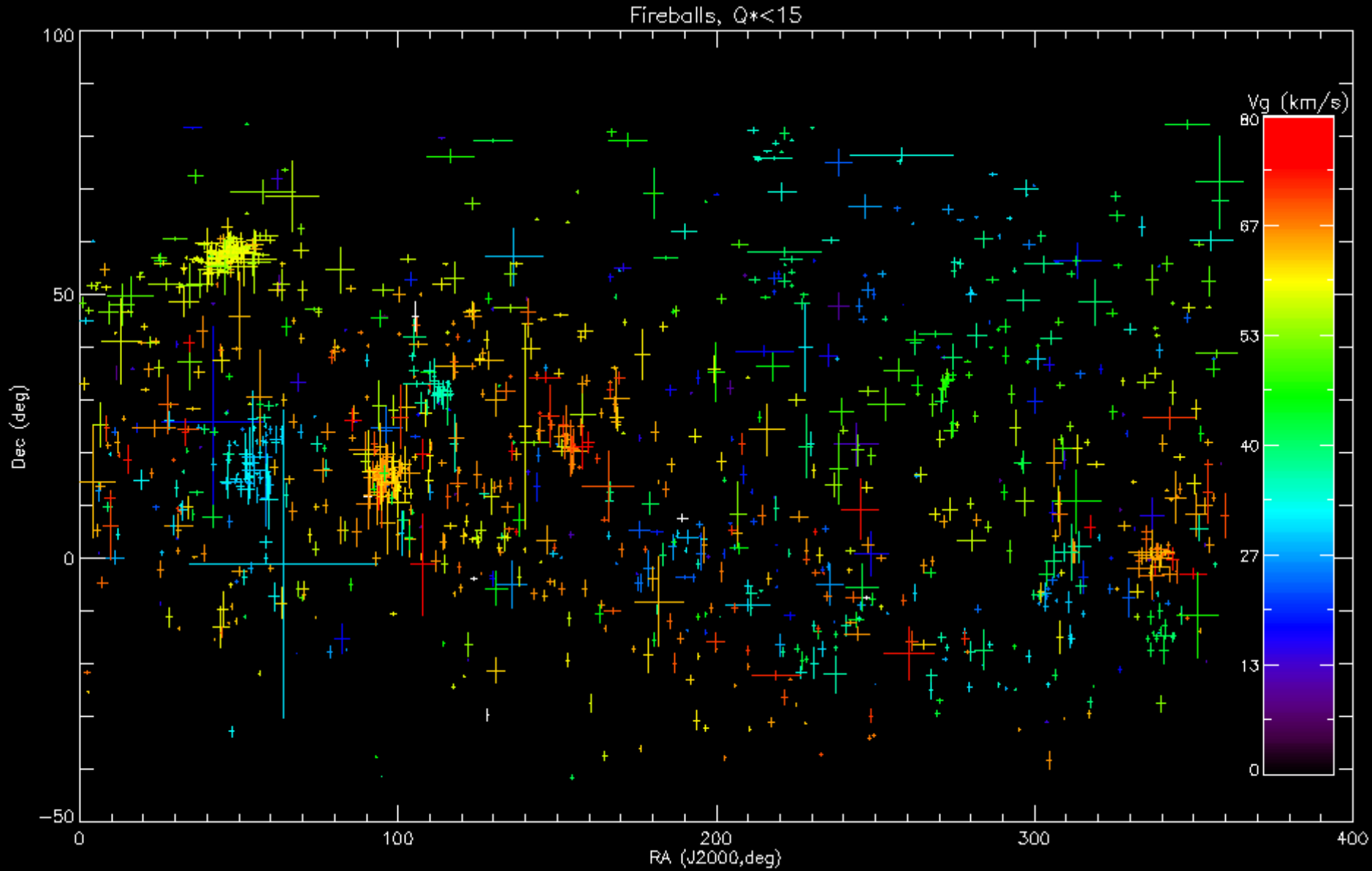
MEO Multi-Station Meteors



S.Lon.	Name	S.Lon.	Name	S.Lon.	Name	S.Lon.	Name	S.Lon.	Name
11.1	delta Pavonids	76.7	Dayt. Arietids	134	August omicron Eridanids	202	Dayt. psi Virginids	260	South. chi Orionids
13.5	beta Craterids	78	South. mu Sagittariids	135	August Lyncids	202	sigma Arietids	260.9	Dec. Monocerotids
15.7	kappa Serpentids	78	North. mu Sagittariids	135.4	beta Perseids	202	Oct. Ursae Majorids	261	December theta Aurigids
17.8	April alpha Comae Berenicids	78.6	Dayt. zeta Perseids	137	Daytime Monocerotids	202.7	October gamma Puppid	262	mu Velids
19.2	Dayt. chi Piscids	79.7	chi Librds	137.5	eta Eridanids	203	October Leporids	262	nu Geminids
20	zeta Cygnids	80	South. June Aquilids	138	gamma Eridanids	204	Dayt. alpha Canis Majorids	262.1	Geminids
20	lambda Virginids	80.4	gamma Delphinids	139.8	August Triangulids	206	October Cygnids	262.2	Dec. alpha Aurigids
22.7	South. gamma Virginids	80.5	alpha Draconids	140	August Beta Piscids	206	epsilon Geminids	262.4	Dec. Leonis Minorids
23	delta Aquilids	85.2	June Lyrids	140.2	Perseids	206	October Monocerotids	263.7	epsilon Carinids
23	April psi Ursae Majorids	85.5	Dayt. lambda Taurids	141.7	delta Librds	206	October Lyncids	265.5	sigma Hydrids
24.3	Northern gamma Virginids	86	North. June Aquilids	142	August Draconids	206.4	October gamma C etids	266	December Canis Majorids
27.8	sigma Leonids	87	South. sigma Sagittariids	143.8	beta Hydrusids	207.3	nu Aurigids	266	December Hydrids
28	alpha Virginids	92	delta Piscids	145.2	kappa Cygnids	208	October Ursae Minorids	268.9	alpha Lyncids
29.2	mu Draconids	92.3	Northern sigma Sagittariids	146	August delta Capricornids	208	alpha Doradids	269.7	lambda Velids
29.7	Dayt. lambda Pegasids	29.7	zeta Eridanids	146	upsilon Cetids	208.6	Orionids	270.7	tau Puppid
29.7	Dayt. April Cetids	94	kappa Cetids	146	zeta Arietids	209	alpha Ursae Majorids	271	Ursids
30.3	Dayt. April Piscids	94.9	Scutids	147	Dayt. zeta Cancrids	209	October iota Cassiopeiids	271	beta Monocerotids
32.4	April Lyrids	94.9	Corvids	147.7	North. iota Aquariids	209.7	Leonis Minorids	272	gamma Triangulids
33.67	pi Puppid	95	pi Cetids	148.7	Dayt. gamma Leonids	210.8	xi Draconids	273	c Velids
35	nu Cygnids	95.5	epsilon Perseids	151	eta Serpentids	211	eta Taurids	274	Dec. Comae Berenicids
36	beta Pegasids	96	Dayt. theta Aurigids	153	August Cetids	213	Dayt. beta Cancrids	275.5	sigma Serpentids
36.7	alpha Bootids	96.3	June Bootids	154	Dayt. chi Leonids	214	October beta Camelopardalids	275.5	omega Serpentids
37	April rho Cygnids	96.7	Dayt. beta Taurids	155.7	gamma Doradids	216	October kappa Draconids	280.4	Dayt. Scutids
39	gamma Librds	97.3	tau Aquariids	157.3	beta Indids	218.1	pi Leonids	280.7	eta Carinids
39	h Virginids	98	f Ophiuchids	158	Daytime Craterids	220	chi Taurids	282.5	January Leonids
39	April chi Librds	100	July beta Pegasids	158	kappa Draconids	223	Dayt. iota Virginids	283	kappa Hydrids
39	mu Virginids	100	omicron Pegasids	158	xi Aurigids	224	South. Taurids	283.3	Quadrantids
41	lambda Lyrids	100	beta Camelopardalids	158.2	Aurigids	224	North. Taurids	285.5	alpha Hydrids
42	May Lacertids	100.5	Dayt. beta Andromedids	160.3	beta Gruids	225	zeta Cancrids	286.3	xi Cetids
42.1	phi Bootids	101	July Andromedids	167	September Lyncids	227	psi Aurigids	286.3	nu Andromedids
45	May lambda Virginids	103.3	July Centaurids	167.7	beta Capricornids	228.9	Omicron Ursae Majorids	288	gamma Velids
46	Daytime Triangulids	104	Microscopids	167.9	Nu Eridanids	230.4	mu Pegasids	289.4	January gamma Delphinids
46.7	South. Dayt. omega Cetids	104	July Taurids	169	September iota Cassiopeiids	231	Andromedids	290.7	January pi Puppid
46.7	North. Dayt. omega Cetids	105.5	epsilon Pegasids	170	epsilon Eridanids	232.8	gamma Taurids	292	beta Sextantids
46.9	eta Aquariids	105.5	alpha Lacertids	170	Sept. epsilon Perseids	233.6	Nov. iota Aurigids	292	January Hydrids
47	zeta Ophiuchids	106	phi Piscids	170.1	Sept. gamma Sagittariids	234	omega Eridanids	292	January zeta Aurigids
49	sigma Cetids	106	theta Perseids	170.3	nu Draconids	234.7	Omicron Eridanids	293	Canum Veneticids
49.1	eta Lyrids	106	alpha Pegasids	173	Sept. beta Cassiopeiids	235	Nov. Hydrids	294.5	xi Coronae Borealids
49.7	North. May Ophiuchids	106	epsilon Ursae Majorids	174	omega Piscids	235.1	Leonids	295	January pi Virginids
53	Dayt. delta Triangulids	106	psi Cassiopeiids	174	South. delta Piscids	237	November theta Aurigids	295.5	lambda Bootids
54	phi Pegasids	106.5	beta Equuleids	174	Daytime pi Leonids	239.3	alpha Monocerotids	295.6	upsilon Eridanids
54	Daytime xi Cetids	107.5	July Pegasids	179	Sept. mu Arietids	240.2	omega Taurids	296.3	South. delta Cancrids
54	May Vulpeculids	109	gamma Camelopardalids	179	kappa Aquariids	240.8	Nov. epsilon Eridanids	296.3	North. delta Cancrids
54.4	nu Ursae Majorids	110	sigma Capricornids	179.3	beta Aurigids	241	November i Draconids	296.5	theta Coronae Borealids
54.7	beta Coronae Australids	110	c Andromedids	181	Dayt. kappa Leonids	241	Nov. nu Arietids	297	rho Geminids
55	Northern Dayt. May Arietids	110.3	July Phoenicids	183	Dayt. delta Leonids	241	November delta Draconids	299	gamma Ursae Minorids
55	Dayt. epsilon Arietids	112.2	July mu Serpentids	183	Sept. alpha Orionids	242	rho Bootids	299.7	alpha Crucids
55	South. Dayt. May Arietids	114	mu Serpentids	184	Dayt. gamma Virginids	244.7	Columbids	300	mu Hydrids
55	tau Ophiuchids	114.8	kappa Pavonids	184	beta Ursae Majorids	245	Nov. Orionids	300.6	January Xi Ursae Majorids
55.2	alpha Scorpiids	115.5	omicron Draconids	184	North. delta Piscids	247	alpha Canis Majorids	301	January Comae Berenicids
56.7	South. May Ophiuchids	115.7	July zeta Draconids	186	September-October Lyncids	249.4	Theta Pyxidids	303.5	alpha Cancrids
57.9	May Microscopids	116	mu Lyrids	188.4	Dayt. Sextantids	250.2	December Kappa Draconids	304.7	January alpha Pixidids
58.1	chi Capricornids	117.2	omicron Cygnids	189.7	October Capricornids	252.4	Dec. Canis Minorids	304.9	Dayt. xi Sagittariids
59	epsilon Aquilids	117.7	Dayt. xi Orionids	191	October delta Aurigids	252.9	Psi Ursae Majorids	307.1	epsilon Columbids
60	phi Aquariids	120	alpha Triangulids	191.7	sigma Orionids	253	Phoenicids	307.9	January nu Orionids
60	May zeta Cygnids	122	zeta Draconids	192.6	October Camelopardalids	253.7	sigma Puppid	311.2	alpha Carinids
62	omega Ursae Majorids	123.4	North. delta Aquariids	195	October epsilon Piscids	254	Dayt. delta Scorpiids	311.3	Dayt. chi Capricornids
62	iota Cassiopeiids	123.7	Piscis Austrinids	196	zeta Taurids	254.7	zeta Puppid	312.5	Dayt. Sagittariids-Capricornids
63	psi Pegasids	125.3	July Gamma Draconids	196	lambda Draconids	255	gamma Puppid	313.1	alpha Antliids
64.9	Southern Librds-Luppid	125.6	South. delta Aquariids	196.4	October Draconids	256.3	b Puppid	315.1	February eta Draconids
65	theta Serpentids	126	Dayt. mu Cancrids	198.5	South. October delta Arietids	256.5	North. Dec. delta Arietids	315.8	Dayt. epsilon Aquariids
67.8	Northern Librds-Luppid	126.6	beta Cassiopeiids	199	lambda Cygnids	256.5	December Alpha Draconids	316.2	beta Cancrids
70	South. omega Scorpiids	127	alpha Capricornids	199	psi Aurigids	256.5	South. Dec. delta Arietids	317.1	pi Hydrids
70	North. omega Scorpiids	128	iota Sculptorids	200	gamma Piscids	256.7	December Chi Virginids	317.5	omega Cassiopeiids
72.6	tau Herculis	129.7	nu Phoenicids	200.8	delta Cygnids	257	gamma Canis Majorids	318	February alpha Orionids
73.9	alpha Circinids	131.7	South. iota Aquariids	201	October eta Eridanids	257.3	North. chi Orionids	319.4	alpha Centaurids
74	June mu Cassiopeiids	132	August Piscids	201.7	North. October delta Arietids	259	Dayt. kappa Librds	319.7	delta Velids

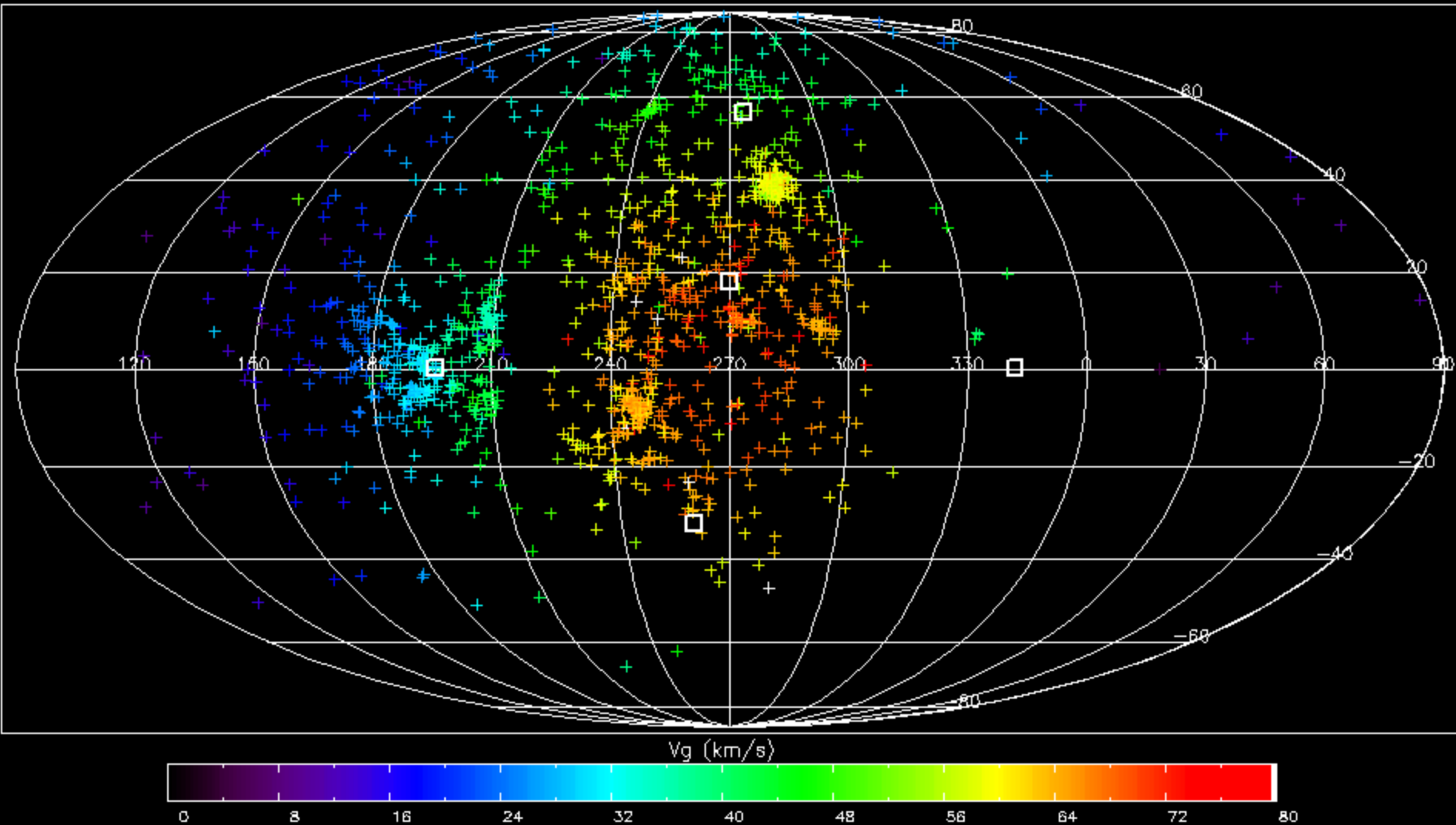


Raw Radiant Map



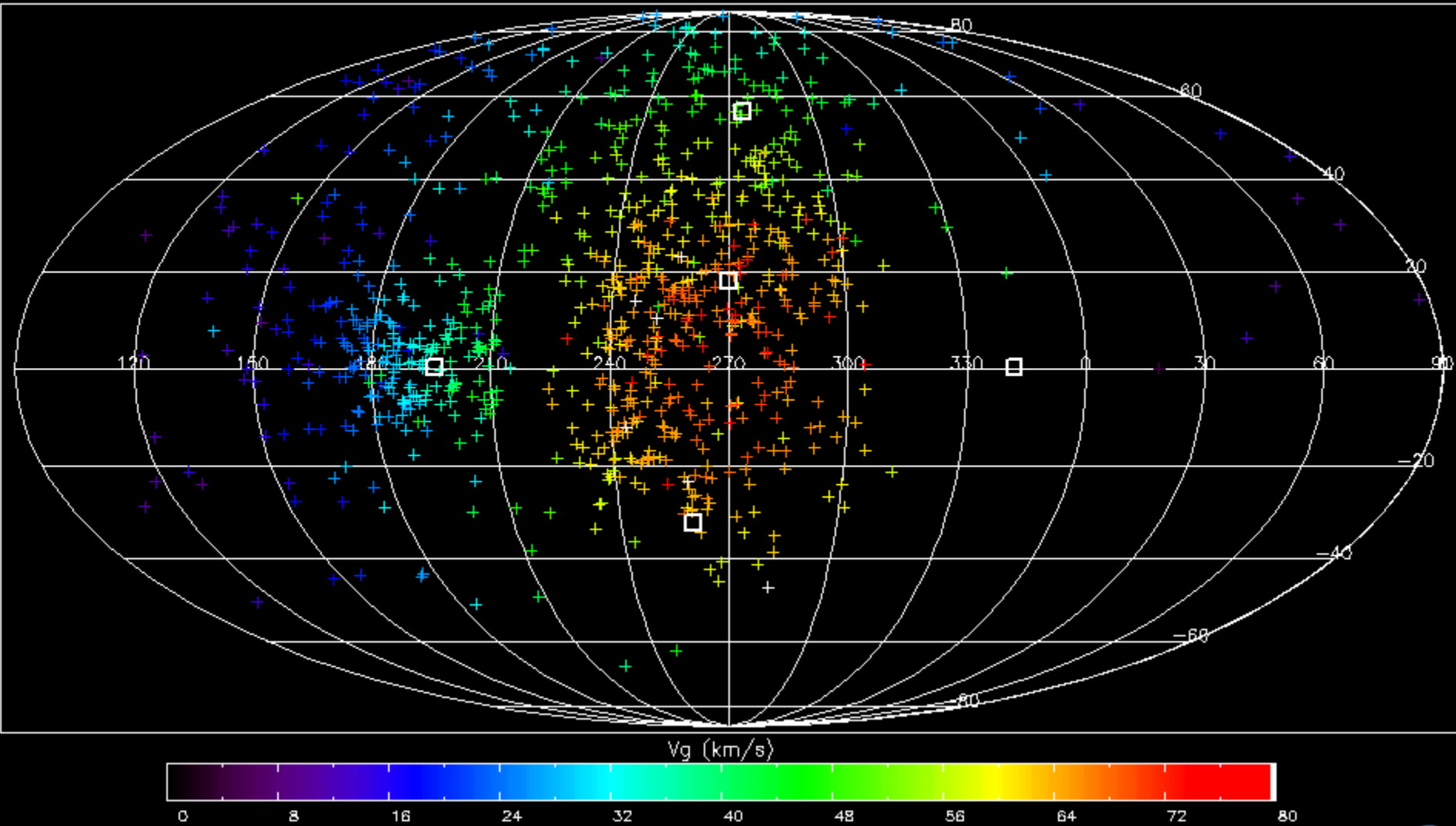
Raw Radiant Distribution

Fireballs, $Q^* > 15$

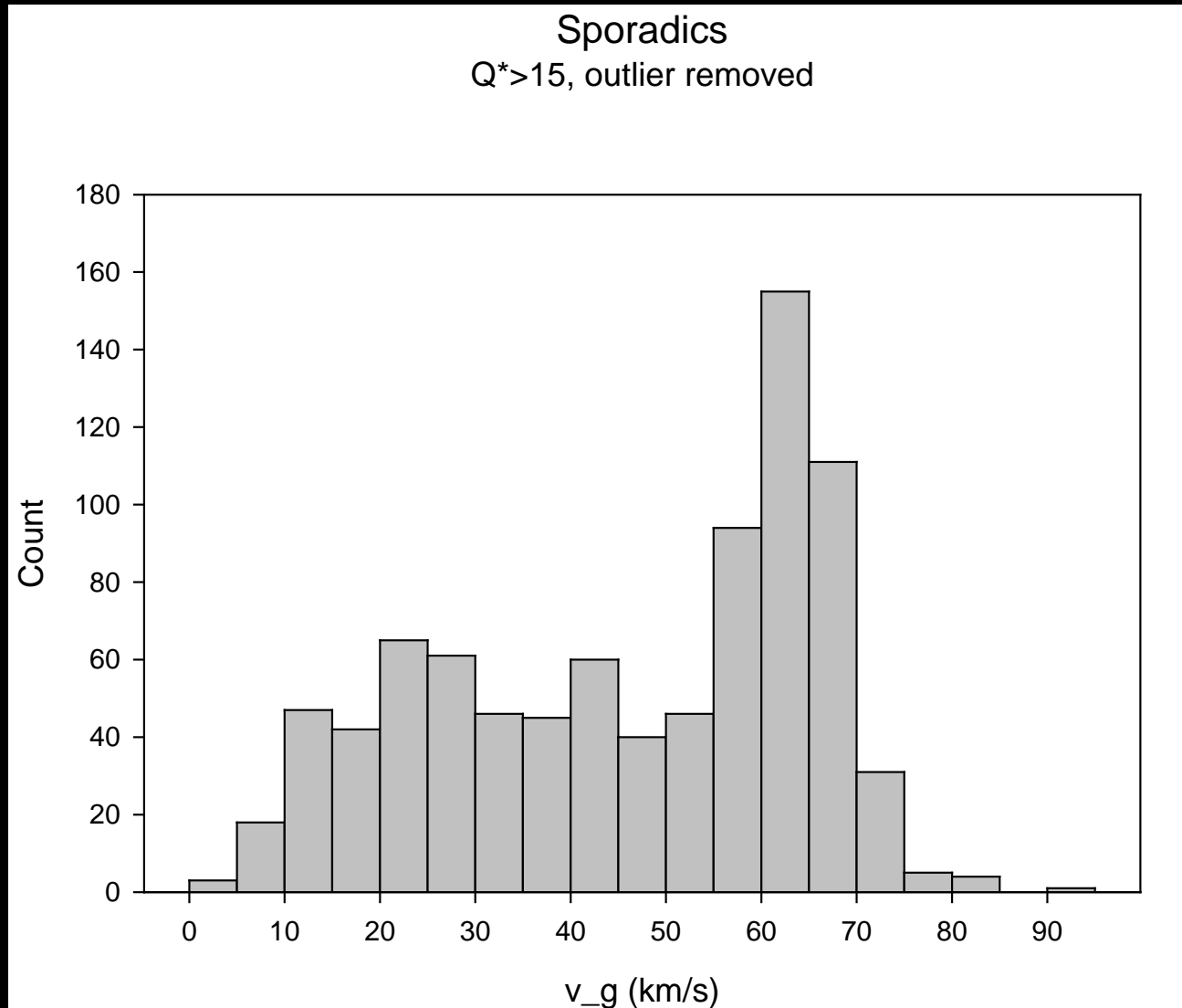


Raw Radiant Distribution - Sporadics

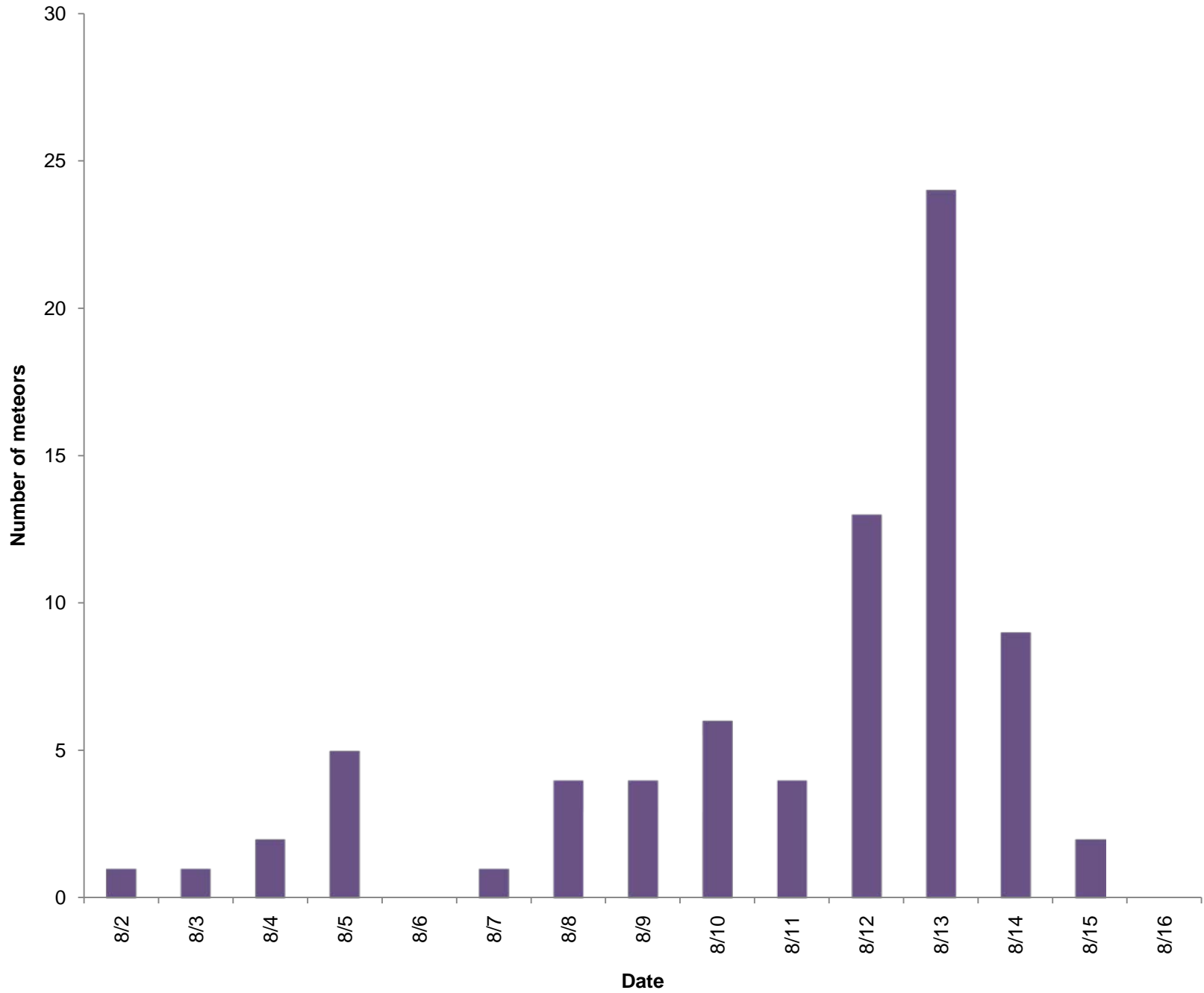
Sporadics, $Q^* > 15$



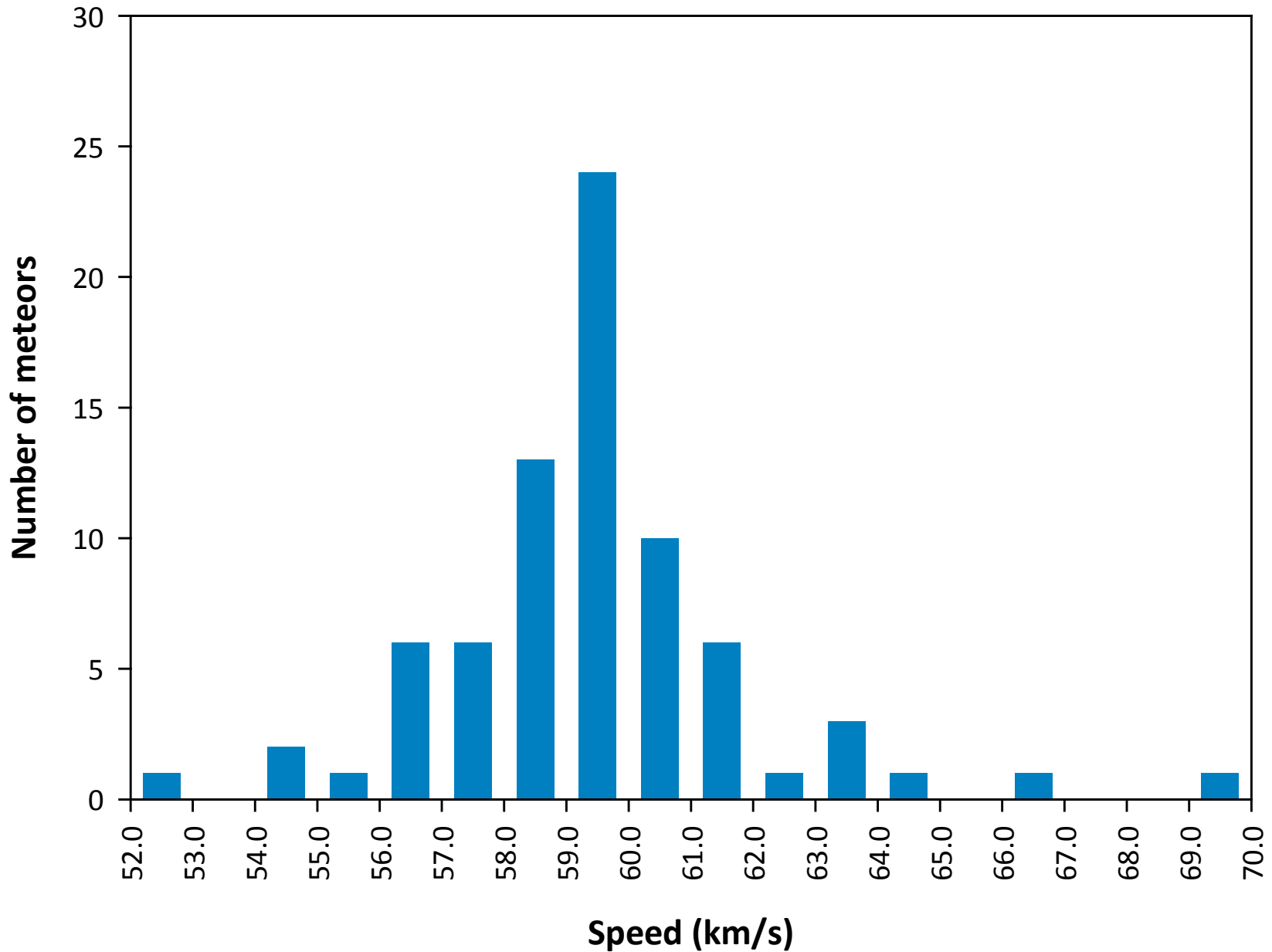
Sporadic Velocity Distribution



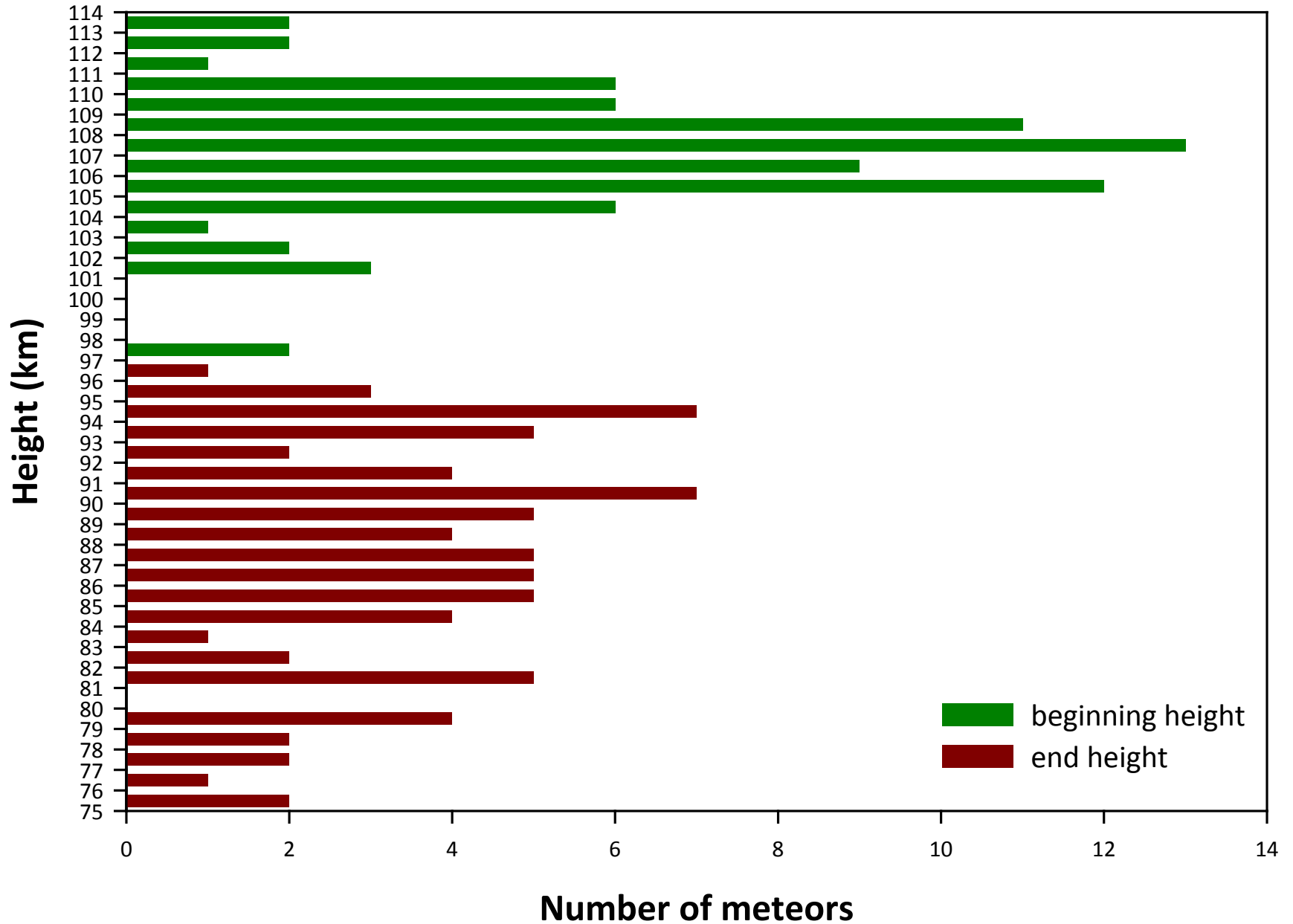
2010 Perseids



2010 Perseids



2010 Perseids



Future Work

- Data quality assurance
- Magnitude estimates
- Database auto-update

