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

Fireballs (MSFC)
fireballs.ndc.nasa.gov

Grimsby (MSFC)
Database and data backup

Individual cameras

01
Huntsville
AL

02
Chickamauga
GA

03
Tullahoma
TN

04
Cartersville
GA

12/2008

12/2008

01/2011

03/2011
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

### Database Interface Screenshot

- **Server:** localhost
- **Database:** events
- **View:** vw_src_unk

**Select fields (at least one):**
- event_id
- a
- e
- incl
- omega
- asc_node
- true_anom
- jd
- src_id

- **Number of rows per page:** 30

- **Display order:**
  - Ascending
  - Descending

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

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

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Collation</th>
<th>Operator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<td>varchar(30)</td>
<td>utf8_general_ci</td>
<td>LIKE</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>varchar(10)</td>
<td>utf8_general_ci</td>
<td>LIKE</td>
<td></td>
</tr>
<tr>
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<td>varchar(30)</td>
<td>utf8_general_ci</td>
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</tr>
</tbody>
</table>
Note

• All data here is raw, with only minimal processing to retrieve Q*>15
• All results are therefore preliminary.
<table>
<thead>
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<td>Beta Centaurids</td>
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<td>Kappa Serpentids</td>
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<td>Alpha Camelopardalids</td>
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<td>Zeta Taurids</td>
<td>30.9</td>
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<td>32.3</td>
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<td>34.0</td>
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**Note:** The table contains a list of meteor showers with their Southern Longitude (S.L.) values, which are used to identify the approximate position of each shower in the sky. The showers are listed in order of their S.L. values.

**Source:** NASA Workshop on Meteor Video Observations & Analysis, Aug 4-5, 2011
Raw Radiant Distribution

Fireballs, Q>15
Raw Radiant Distribution - Sporadics

Sporadics, Q* > 15
Sporadic Velocity Distribution

Sporadics
Q* > 15, outlier removed

Count

0 10 20 30 40 50 60 70 80 90

v_g (km/s)
2010 Perseids

Number of meteors per date:

- 1 meteor on 8/2
- 1 meteor on 8/3
- 2 meteors on 8/4
- 4 meteors on 8/5
- 1 meteor on 8/6
- 1 meteor on 8/7
- 2 meteors on 8/8
- 1 meteor on 8/9
- 6 meteors on 8/10
- 3 meteors on 8/11
- 1 meteor on 8/12
- 31 meteors on 8/13
- 7 meteors on 8/14
- 1 meteor on 8/15
- 1 meteor on 8/16
2010 Perseids

![Histogram showing the distribution of meteor speeds (km/s) with the number of meteors recorded for each speed range. The histogram peaks around 59.0 km/s with a significant drop off at lower and higher speeds.]
Future Work

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