The CILBO meteor orbit database

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Outline

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2. Dataset Quality
3. Earth-bound particles (EBP) & Interplanetary Particles (IDP)
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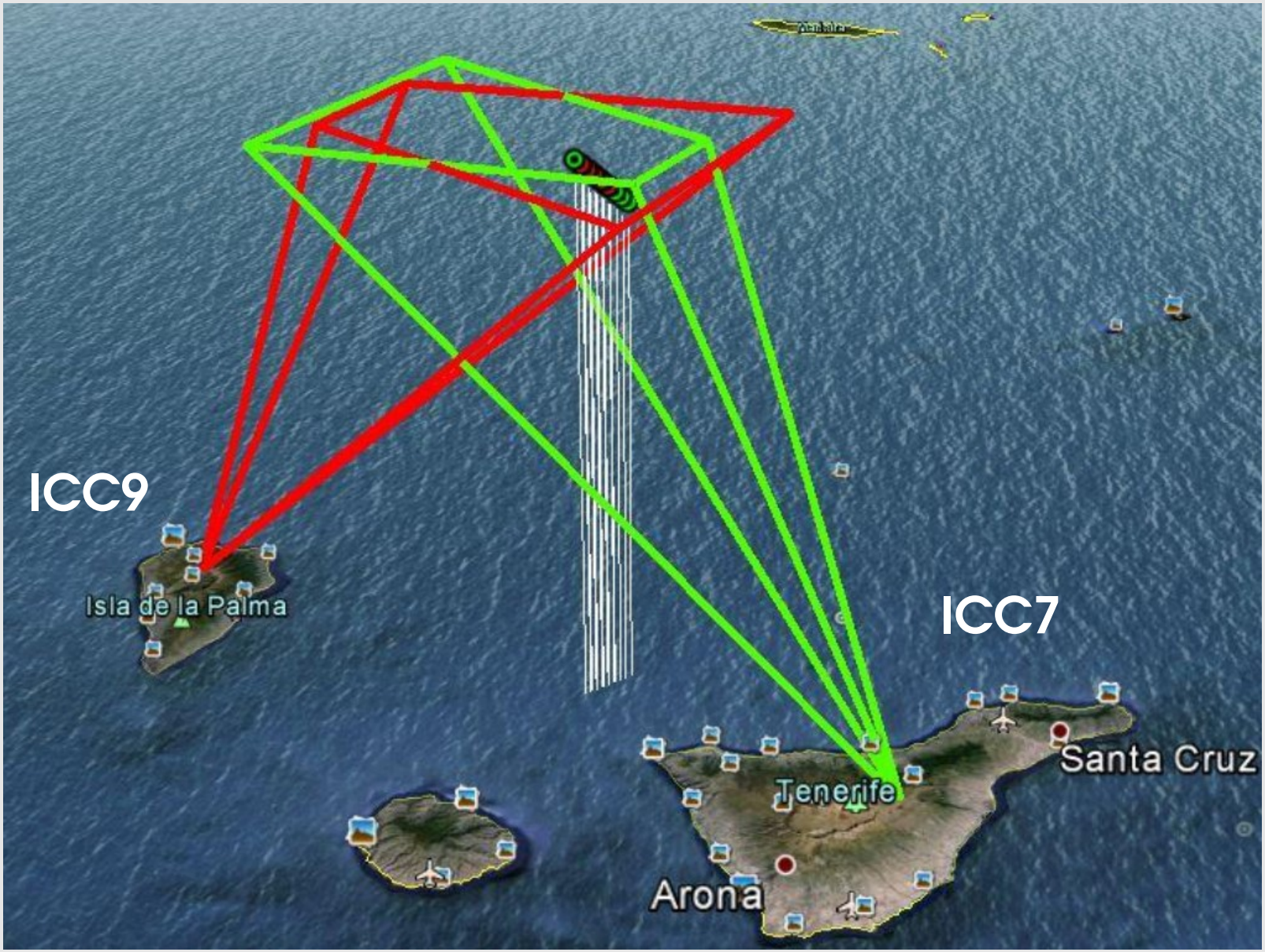
1. Introduction



1. Introduction

- Koschny & Diaz (2002) published the MOTS software for calculating trajectories from stereoscopic meteor data
- Albin *et al.* (2016, International Meteor Conference, not published yet): Monte-Carlo based MOTS extension to determine the orbital elements of meteors
  - Resample “Virtual Observations”
  - Compute an Ensemble of trajectories per meteor
  - Determine statistics → generate “cleaned” dataset

1. Introduction

Trajectory in ECLIPJ2000

Trajectory within Earth's Sphere of Influence

Sphere of Influence (~900,000 km)

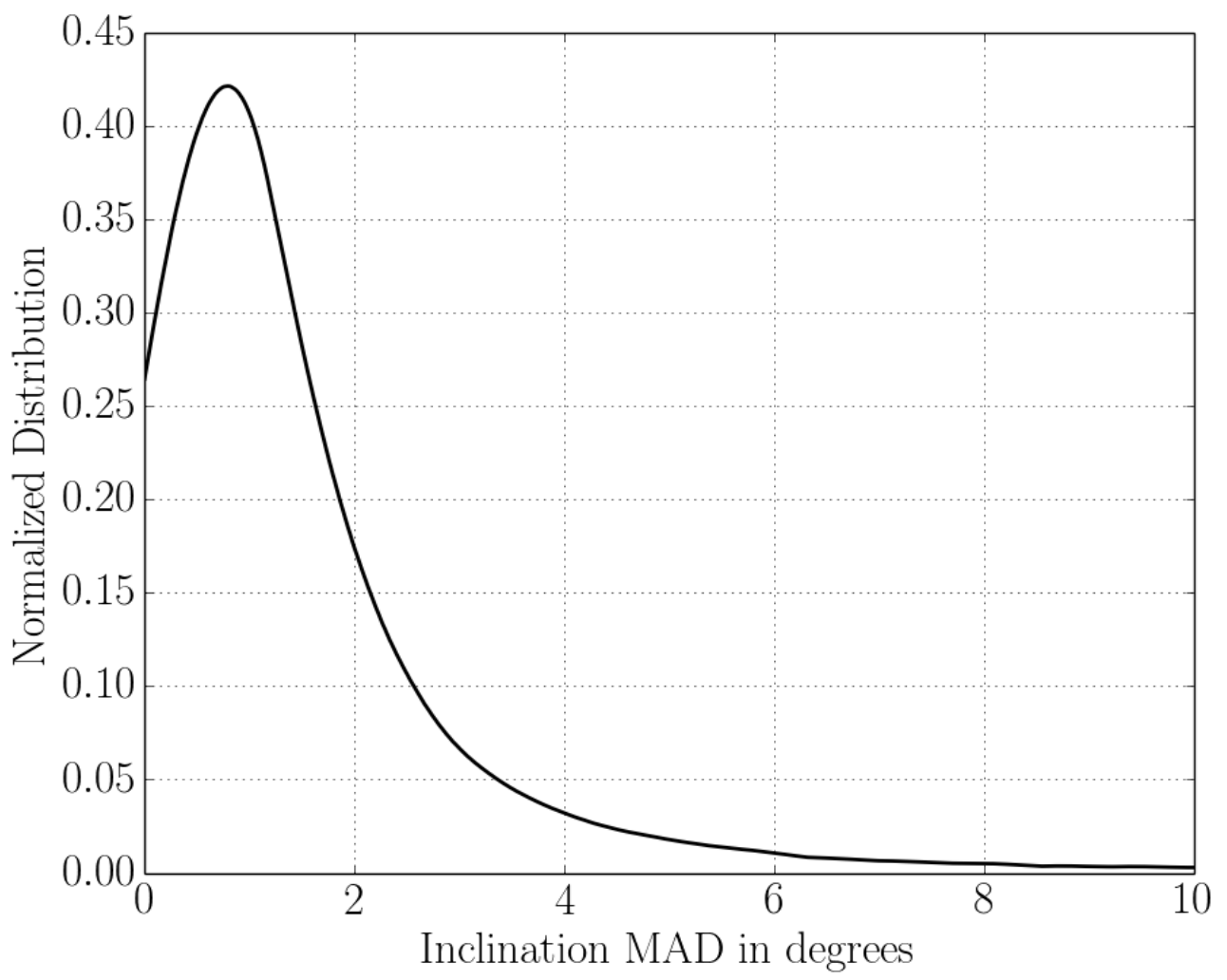
1. Introduction

- “Cleaned” and unbiased Database:
  - No meteors with frames less than 4 (velocity bias, Albin *et al.* 2015b)
  - No trajectory deviations with more than 500 meters
  - Altitude check (at least 80 km altitude)
- This leads to a database with 12,045 meteors

  (Jan 2013 – AUG 2015)
- Quantitative “quality” of the data ...

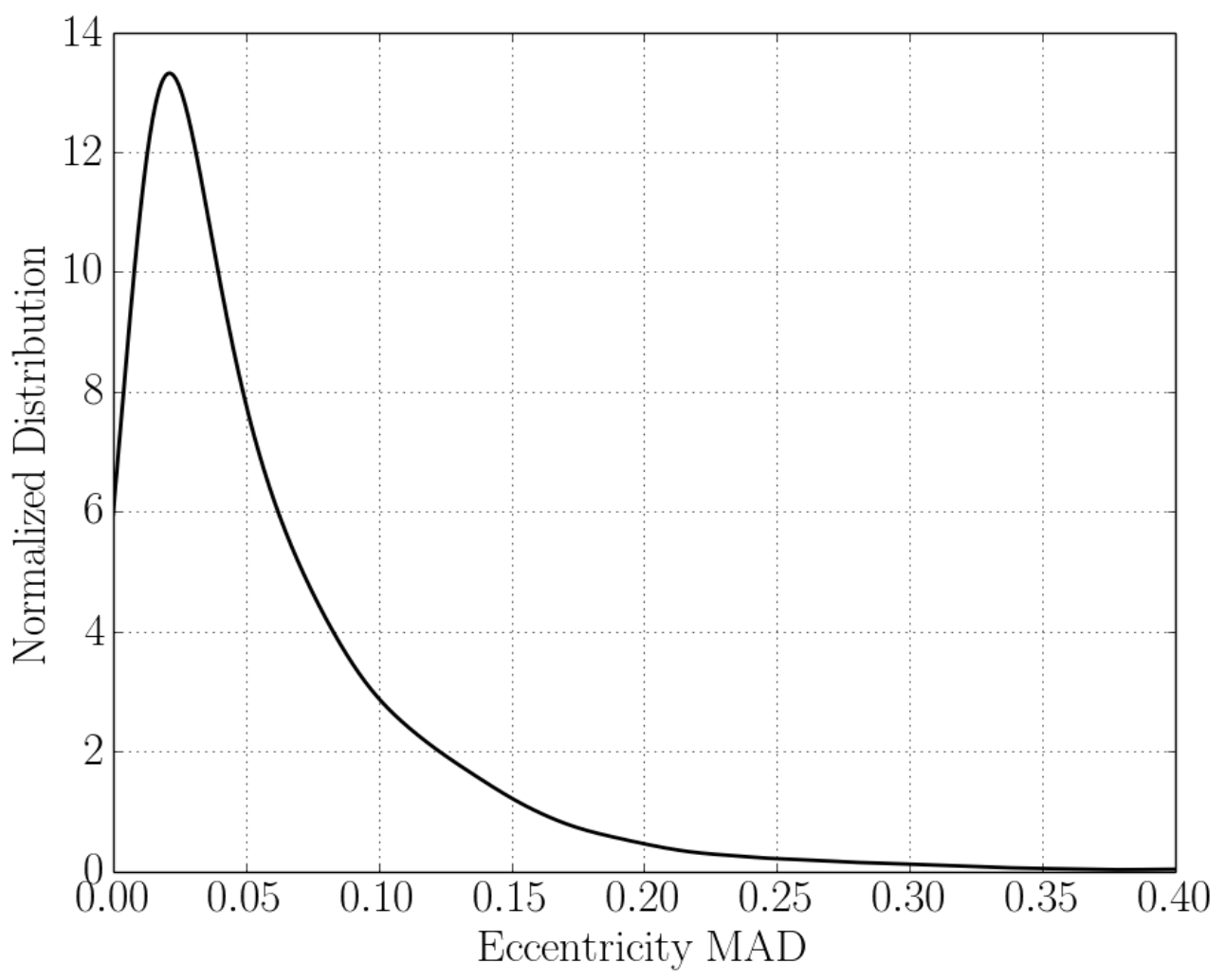
2. Data Quality

- Median Absolute Deviation (Inclination)



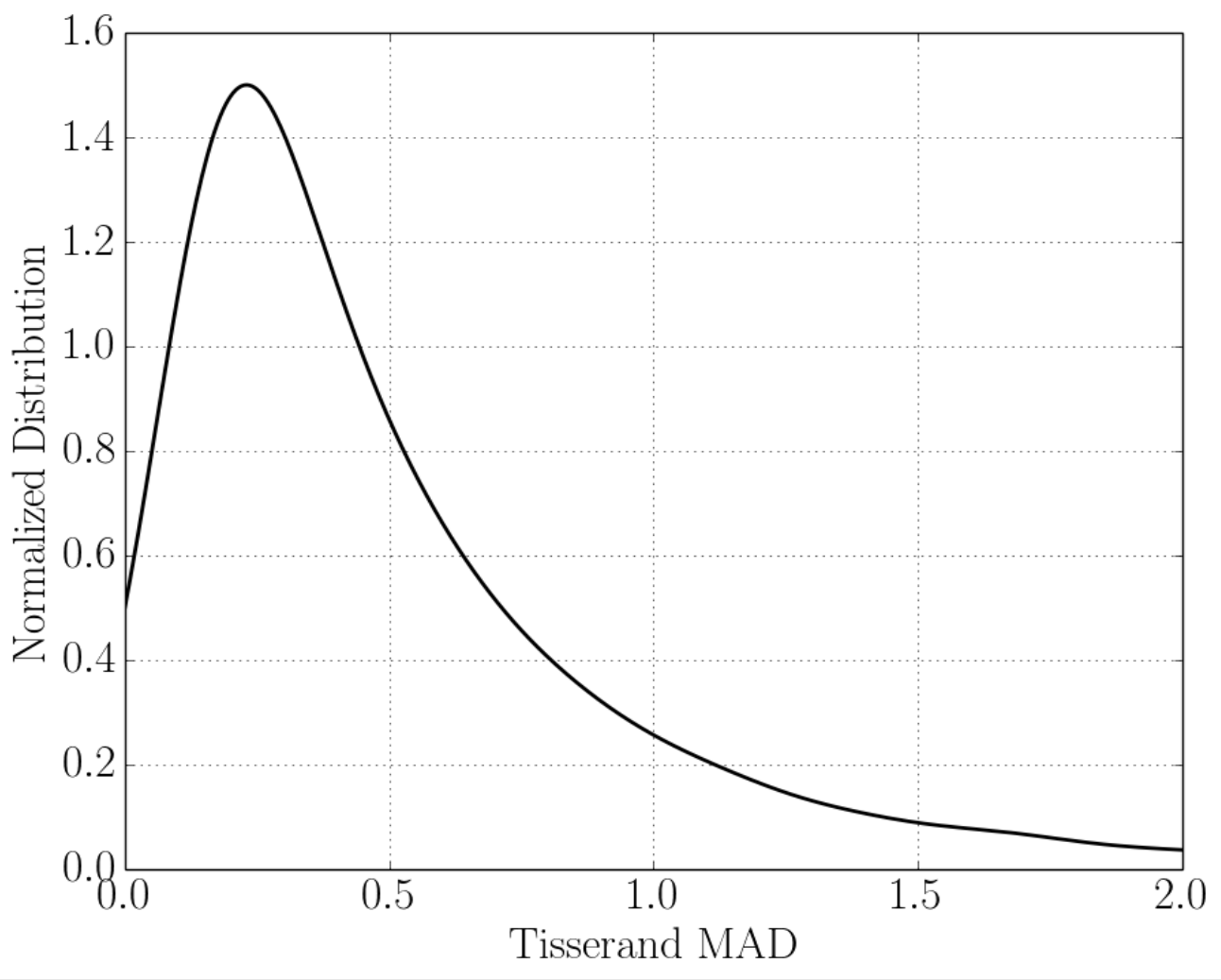
2. Data Quality

- Median Absolute Deviation (Eccentricity)



2. Data Quality

- Median Absolute Deviation (Tisserand (Jupiter))

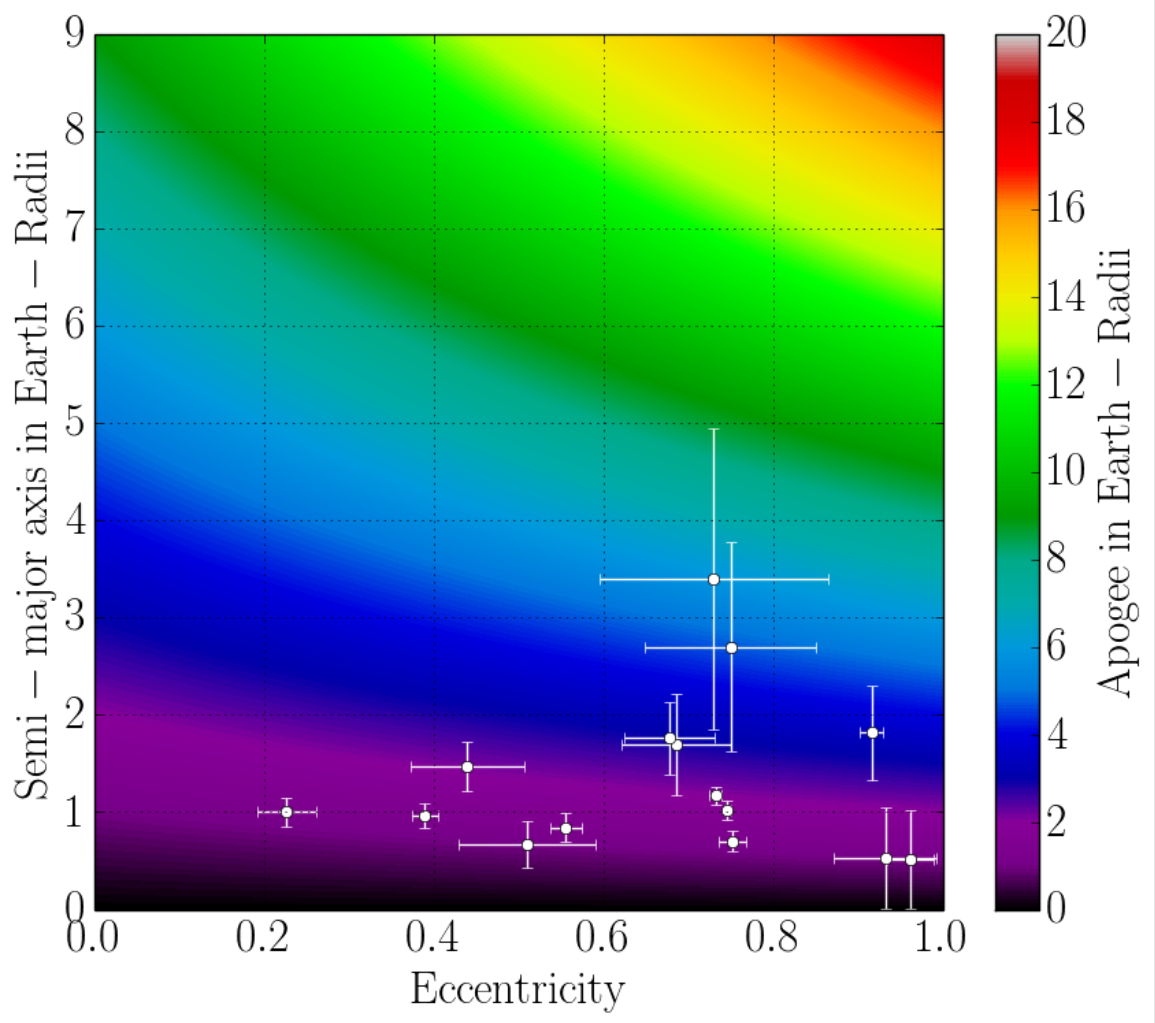


3. EBP & IDP

- Some meteors in the MC Simulation did not reach Earth's SOI
- The determined initial velocity of the meteor was smaller than 11.2 km/s
  - Meteor decelerated already before detection
  - Captured IDP in Earth's SOI
  - Space Debris

3. EBP & IDP

- Earth-bound particles



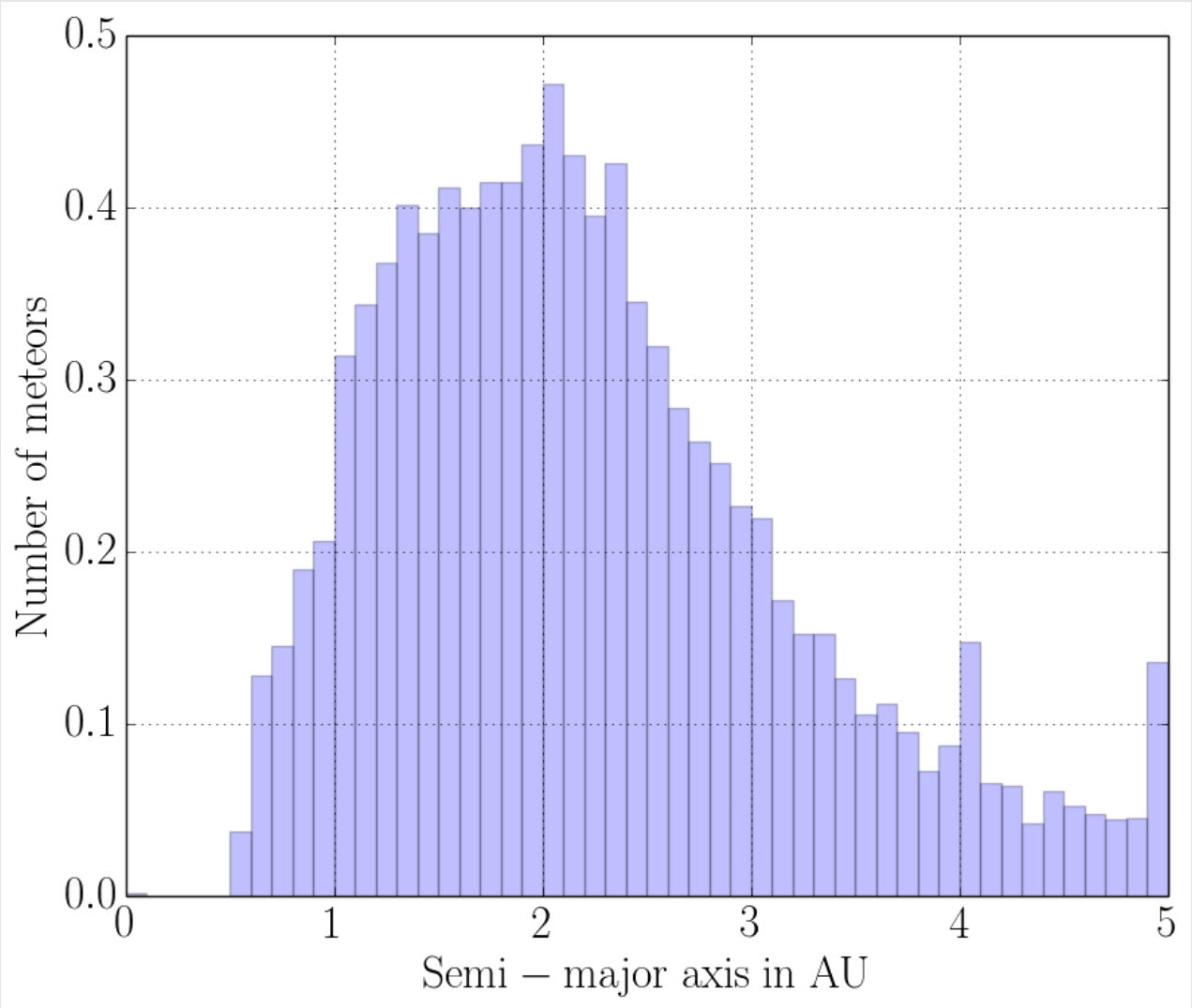
3. EBP & IDP

- The database contains approximately 10,000 IDPs
- Classification by the Tisserand (Jupiter) Parameter:
  - T > 3 (Asteroidal) ~ 50 %
  - T < 2 (JFC) ~ 30 %
  - 2 < T < 3 (Halley-type) ~ 20 %

$$T = \frac{a_p}{a} + 2 \cdot \sqrt{\frac{a}{a_p}\left(1 - e^2\right)} \cos i$$

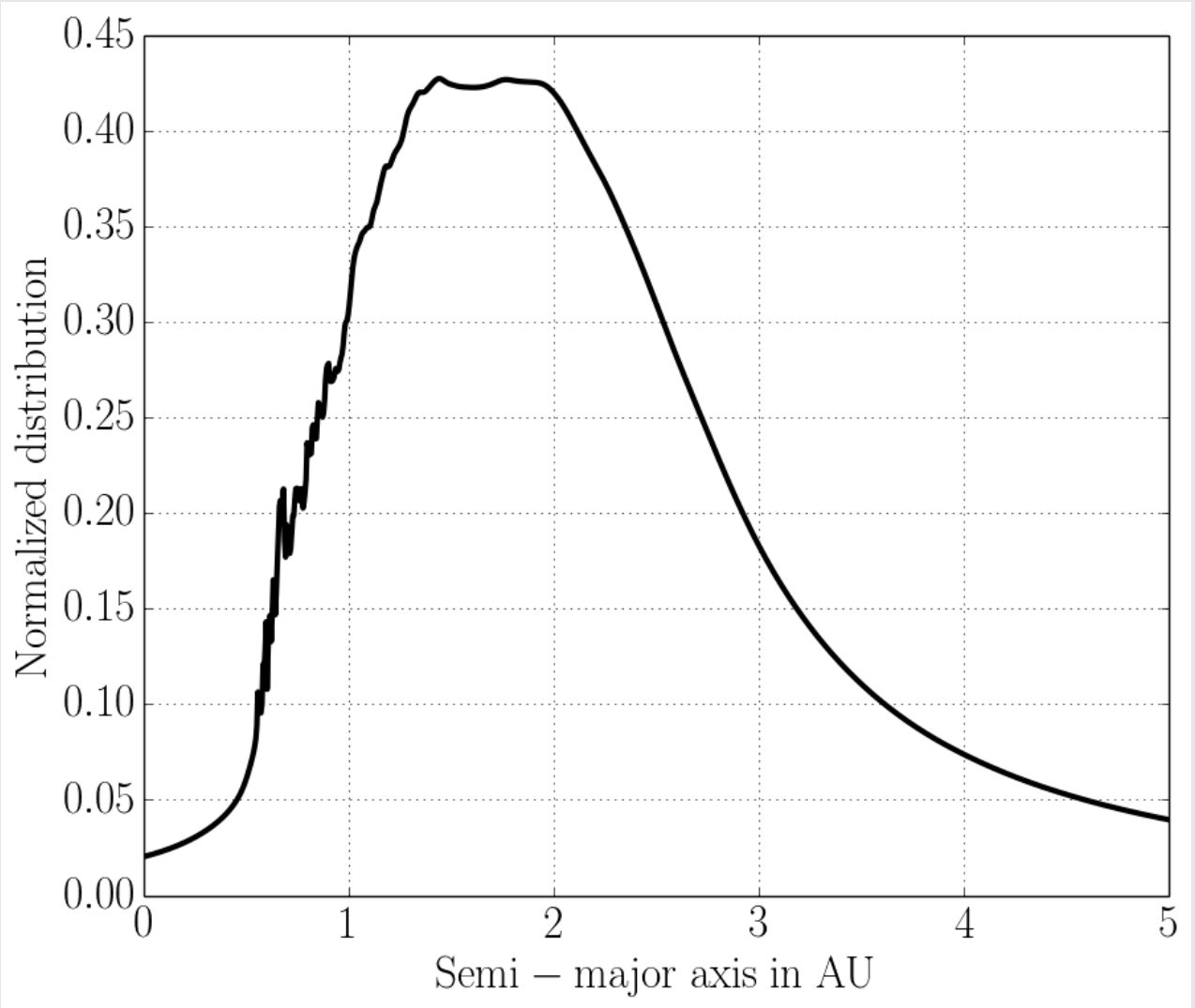
3. EBP & IDP

- Interplanetary Particles



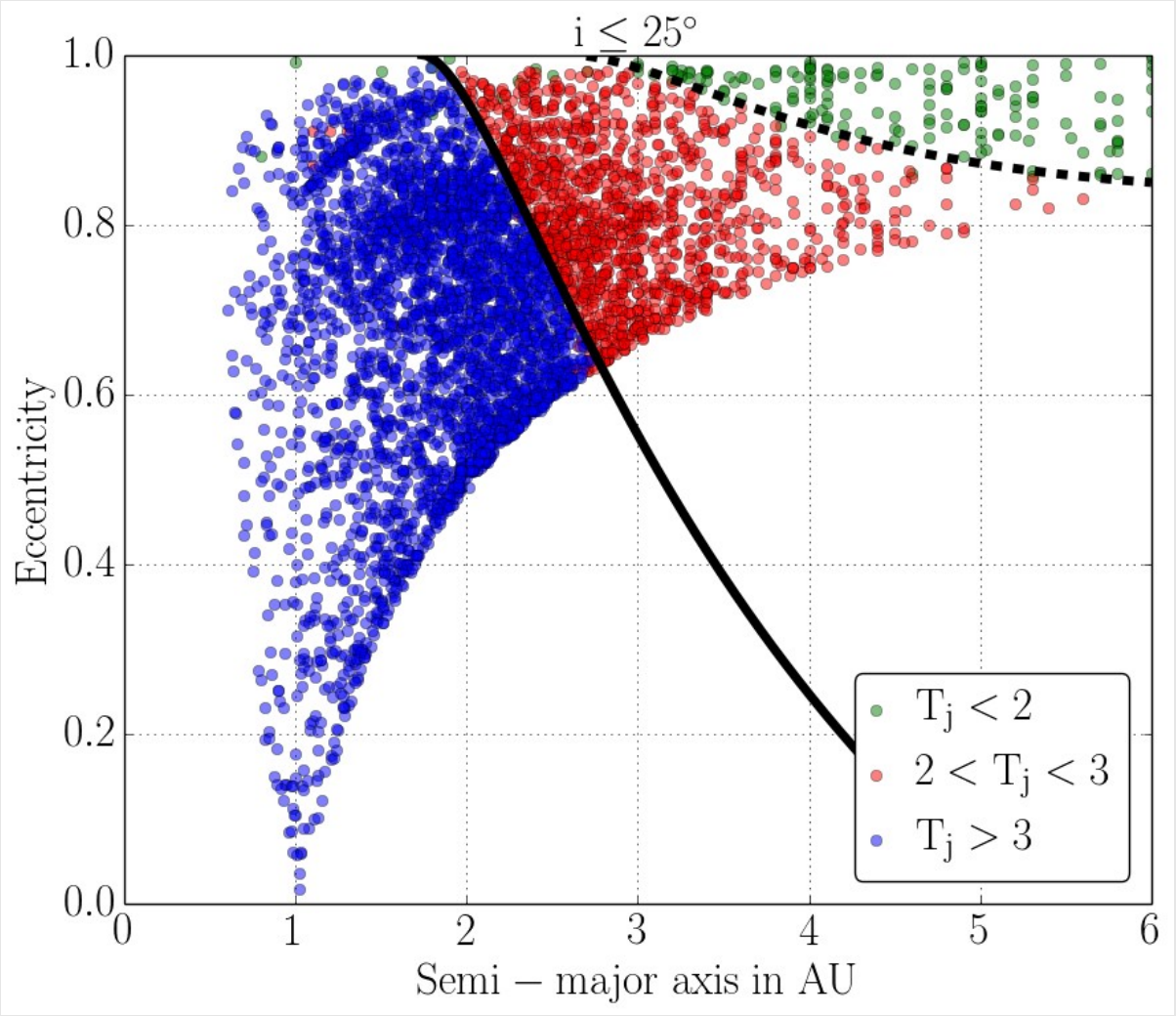
3. EBP & IDP

- Interplanetary Particles



3. EBP & IDP

- Interplanetary Particles

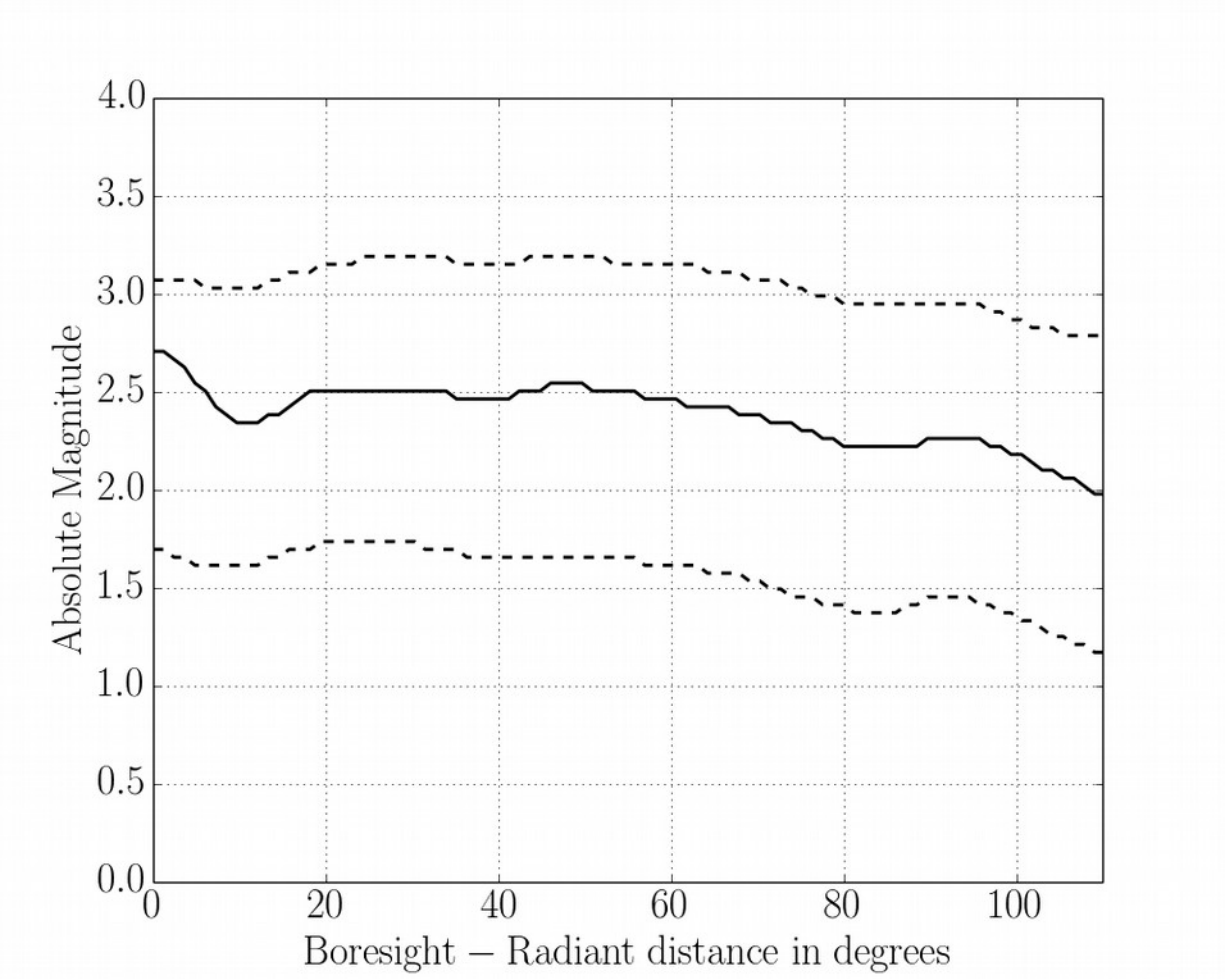


4. Bias Effects

- The large database allows also extensive bias analysis
- In previous works we have identified miscellaneous bias effects
  - Velocity determination bias (Albin *et al.* 2015b)
  - Velocity distribution bias (Kretschmer *et al.* 2015)
  - Camera pointing bias (Albin *et al.* 2015a)
- With the database we can determine possible camera and pointing depending bias effects

4. Bias Effects

- Brightness distribution depending on the radiant-boresight distance
- Possible consequence: mass index of streams varies during the night (?)



5.1 Summary

- Database with over 12,000 meteor orbits
  - Orbital elements in ECLIPJ2000 and Earth-centric coordinates
  - Detection parameters (altitude, angular distance, radiant, velocity, …)
- Database: SQLite
  - No server needed
  - One file
  - Several programming languages understand the format

5.2 Outlook

- Analysis of:
  - IDPs
  - ISDs (Hyperbolic Particles)
  - Earth-bound particles
- Identification of source regions (streams, sporadics), mass index → and comparison with e.g. the IMEX model (R. H. Soja's presentation at 10.00 am)
- Unbiasing of the dataset

/1/ http://www.rssd.esa.int/index.php?project=METEOR&page=Index