



De-biasing CILBO Meteor Observational Data to Mass Fluxes

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Overview



- CILBO double station
- Bias towards fast and large meteoroids
- Influence of the bias on
 - the velocity distribution
 - the mass influx
- Method for de-biasing the data
- Resulting de-biased mass flux
- Future work



Canary Island Long Baseline Observatory

- Two automated stations with image-intensified video cameras
- One station on Tenerife (ICC7) and one on La Palma (ICC9)
- → Simultaneous meteor detections
- 13415 simultaneous observations from January 2012 to June 2015









Velocity distribution

- Drolshagen and Ott (2014)
- Comparison of CILBO velocity distribution and theoretical distribution by ECSS (2008)
- → Bias towards fast and large meteoroids







Velocity distribution

 Meteoroid mass by 0.14 ECSS model Verniani (1973): CILBO m > 1g - Verniani 0.12 0.12 0.10 $-M + 64.09 - 10 \cdot \log(v)$ to 2.5 m = 10Velocity distribution 0.02 of large meteoroids 0.00 10 20 70 50 30 40 60 80 (m > 1g)

\rightarrow fits theoretical velocity distribution

Meteor velocities in km/s





Flux

- CILBO flux / flux model Grün et al. (1985)
- Flux slope of large meteoroids is similar
- CILBO higher flux values
- Bias leads to low flux values at small masses
- \rightarrow CILBO flux needs to be de-biased







Velocity distribution

 Comparison of different mass bins calculated using the formula by Verniani (1973) and CILBO measurements







De-biasing method

- Velocity distribution at the highest velocities is assumed to be correctly distributed
- Should follow the slope of theoretical velocity distribution
- The scaling factor applied to the theoretical curve is the de-biasing factor for the considered mass interval







De-biasing method

- 561 meteoroids in this mass bin
- ECSS model multiplied by factor: 1240
- → Estimated number of meteoroids entering Earth's atmosphere in this mass range: 561 x 1240 = 695640







De-biasing method



IMC 2015





De-biasing factors



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Flux 10⁻⁹ Gruen (1985) 10^{-1} CILBO - Verniani De-biased CILBO - Verniani 10-11 ^r s 10⁻¹² ^N u 10⁻¹³ 10⁻¹⁴ C 10⁻¹³ 10-15 10-16 10-17 10-6 10-4 10-3 10-5 10^{0} 10-2 10^{-1} Meteoroid mass in kg

Considering all calculated masses:

- \rightarrow Estimated actual number of meteors \approx 4.4 million
- \rightarrow Only 0.3% were detected by CILBO (13323 meteors)





Future work

- De-biasing works well but can be further improved
- Different formulas for the mass calculation







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