Mass Distributions Found Using the Jicamarca Radio Observatory

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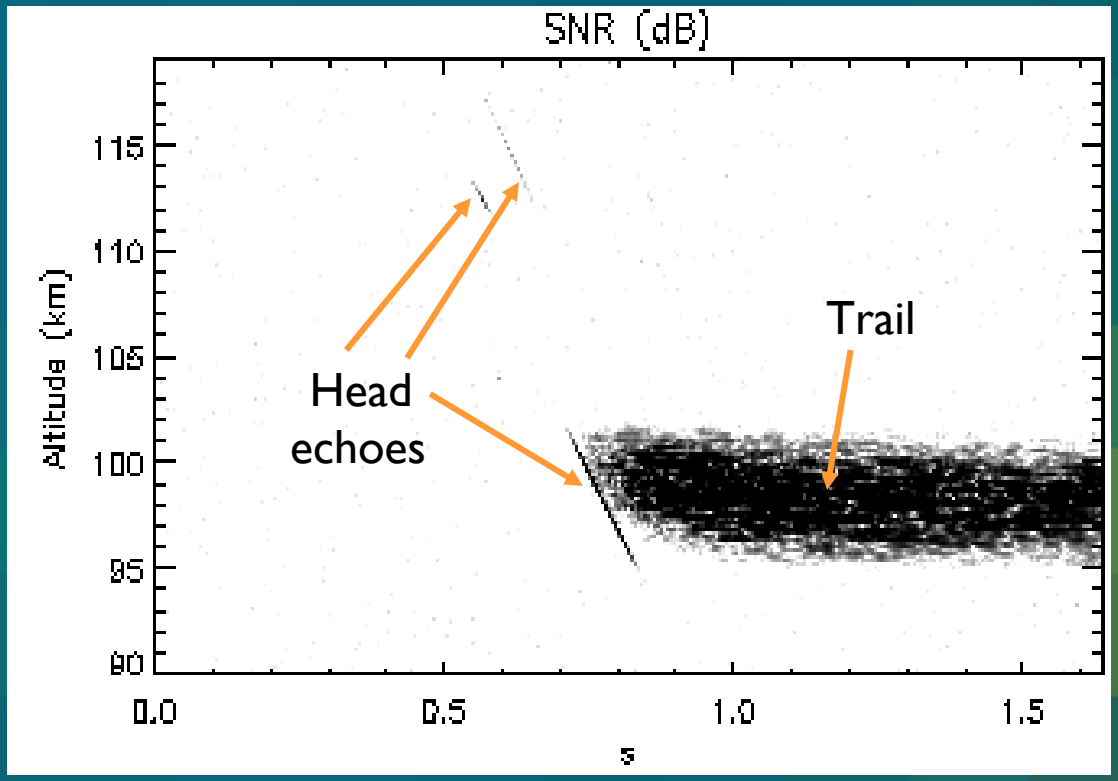
Outline

- Introduction
- Observations
- Mass Distribution
- Spatial Distributions
- Mass Index
- Conclusions

Introduction



Introduction - calculating mass

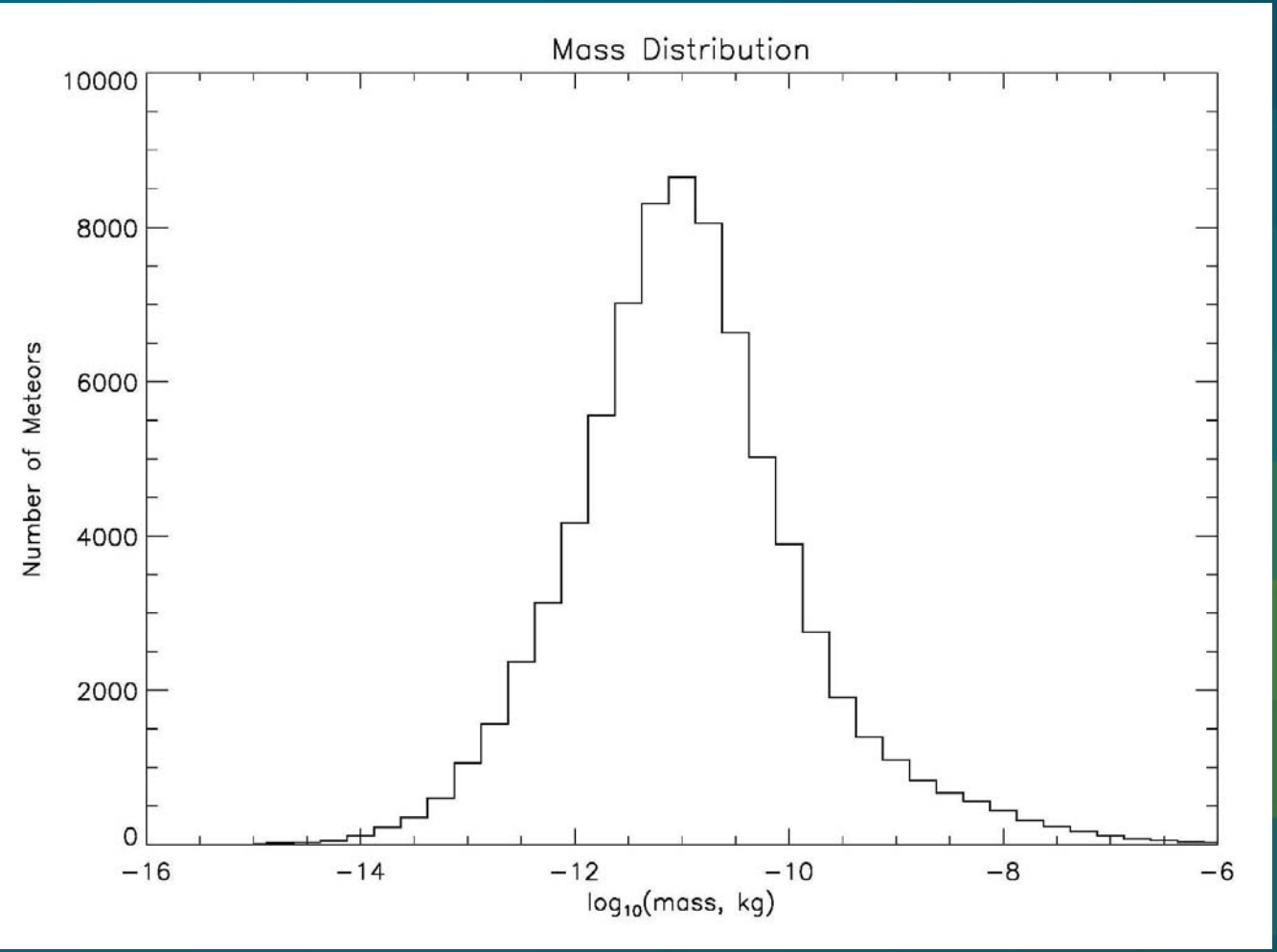
- Number of different methods
  - dynamical mass
  - scattering mass (Close et al. 2005)
  - ablation model (Bass et. al 2008)
  - differential ablation model (Janches et al. 2009)
- Dynamical mass:

$$m = \frac{9\pi}{2\rho_m^2}\left(\frac{v^2\gamma\rho_{air}}{dv/dt}\right)^3$$

Observations

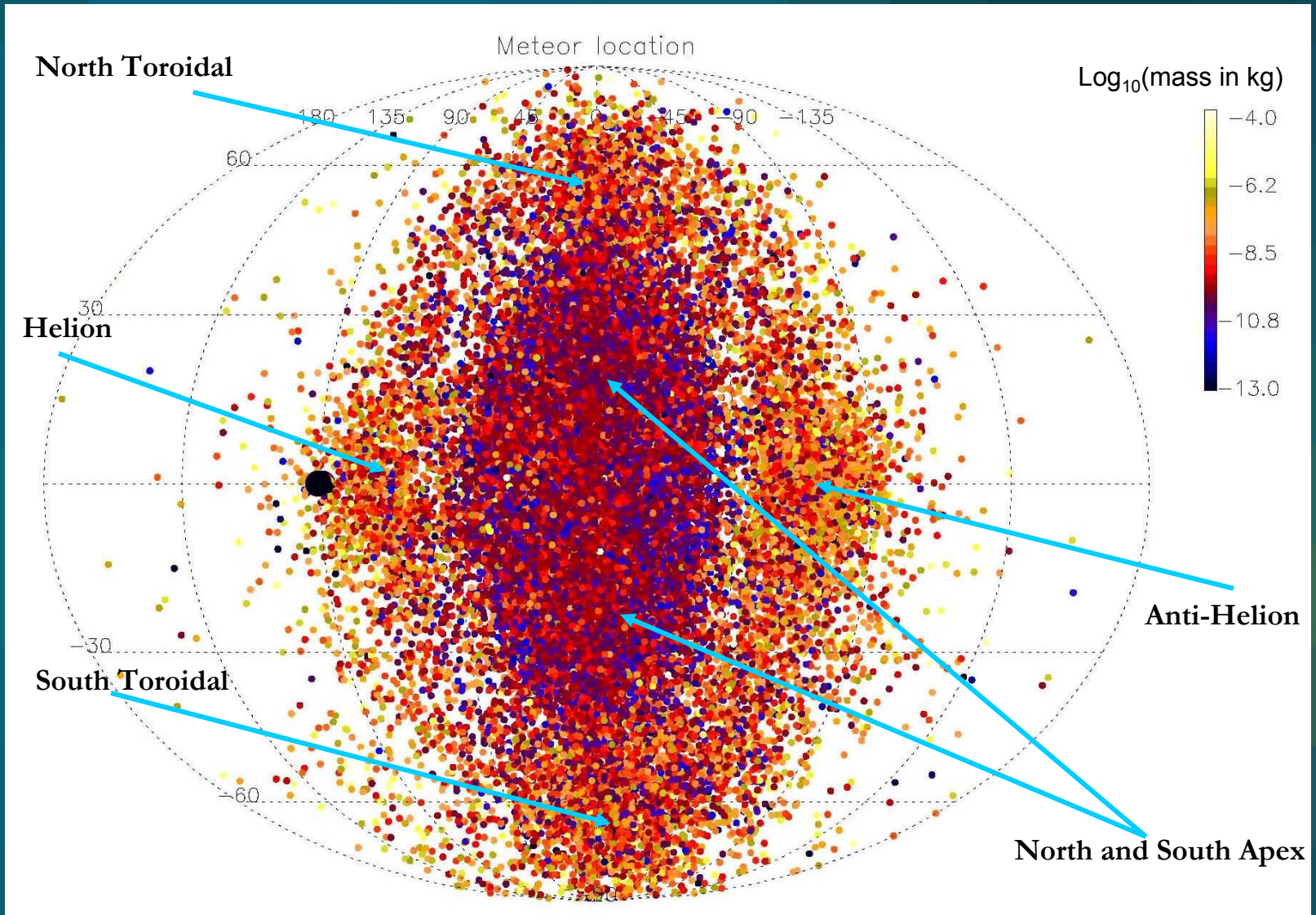
- 50 MHz radar at JRO
- Barker coded pulse
- Data collected over six days
- ~89,000 head echoes

Mass distribution

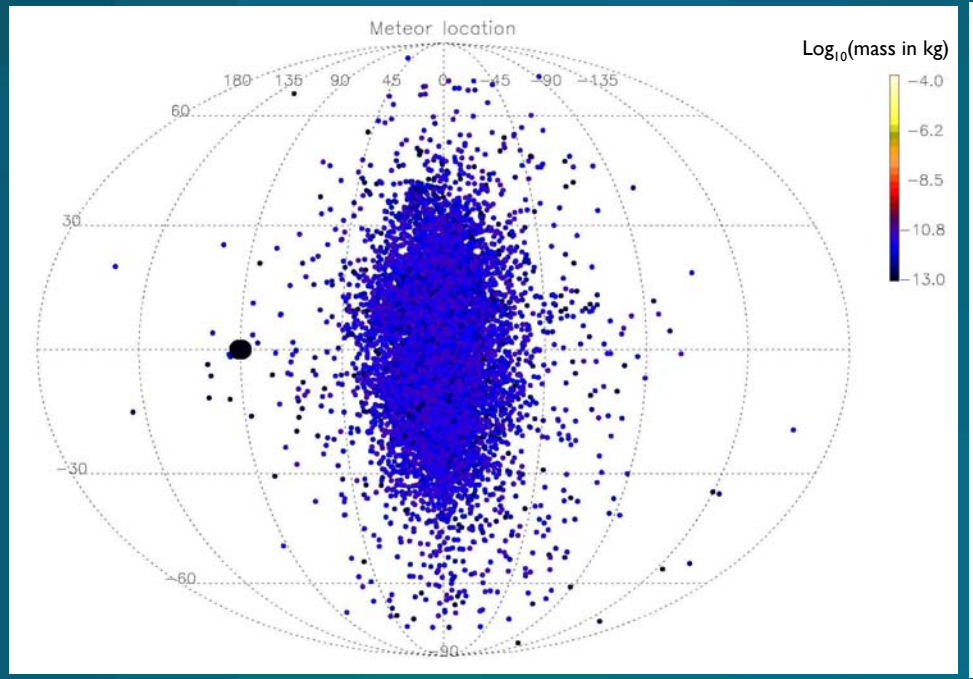


Spatial distributions

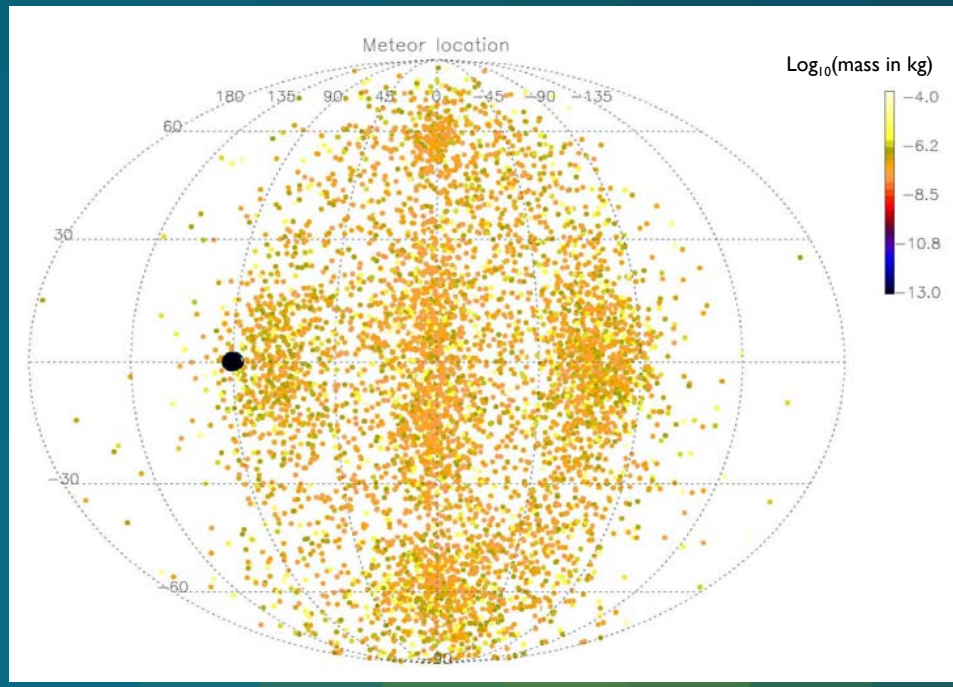
All Meteoroid Masses

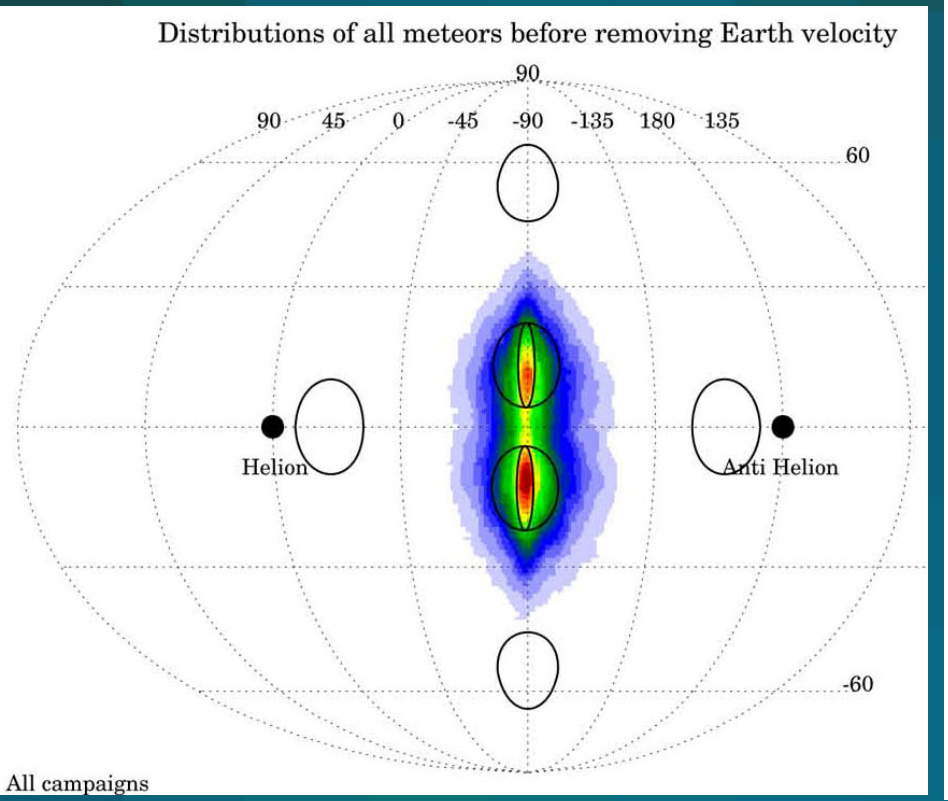


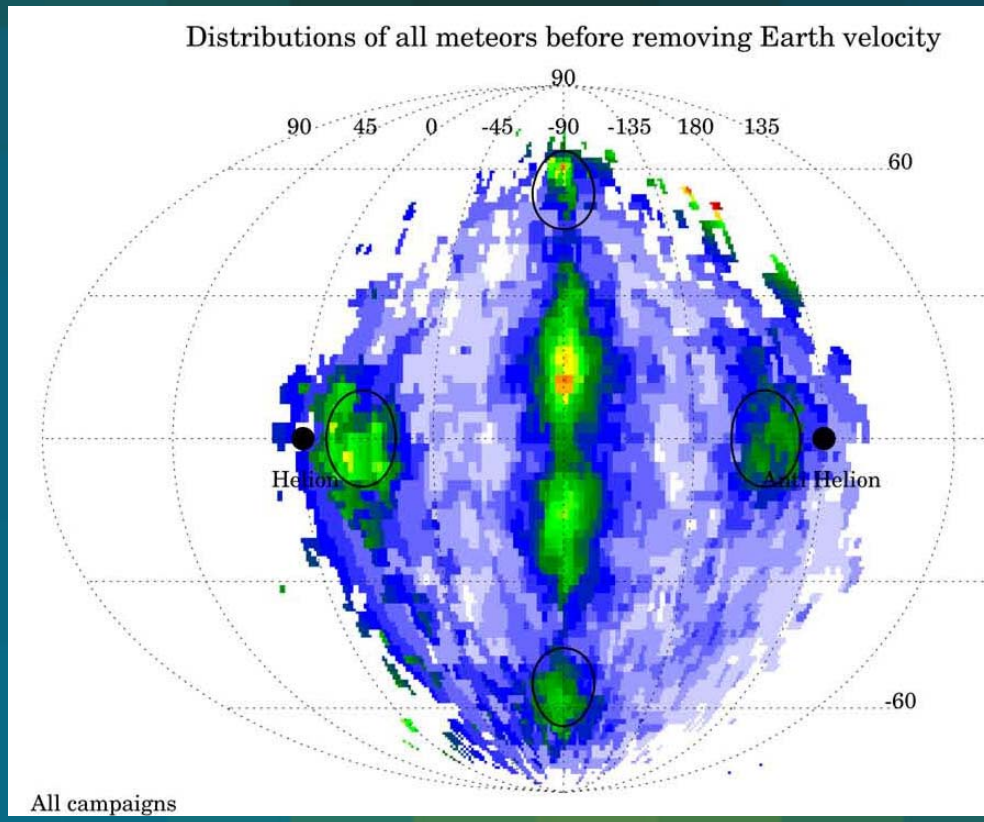
Meteoroids With Mass Less Than 10^{-12} kg



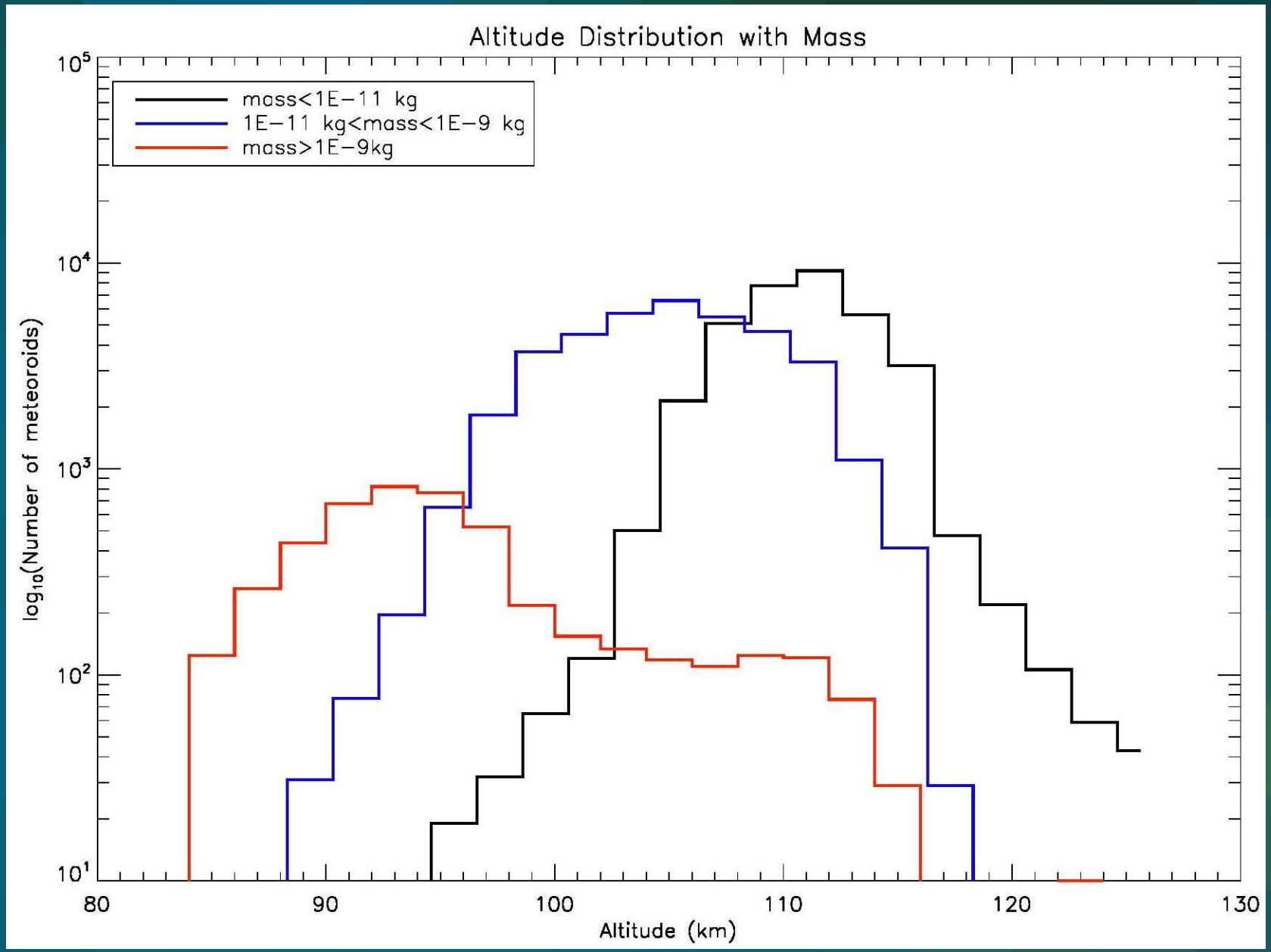
Meteoroids With Mass Greater Than 10^{-9} kg



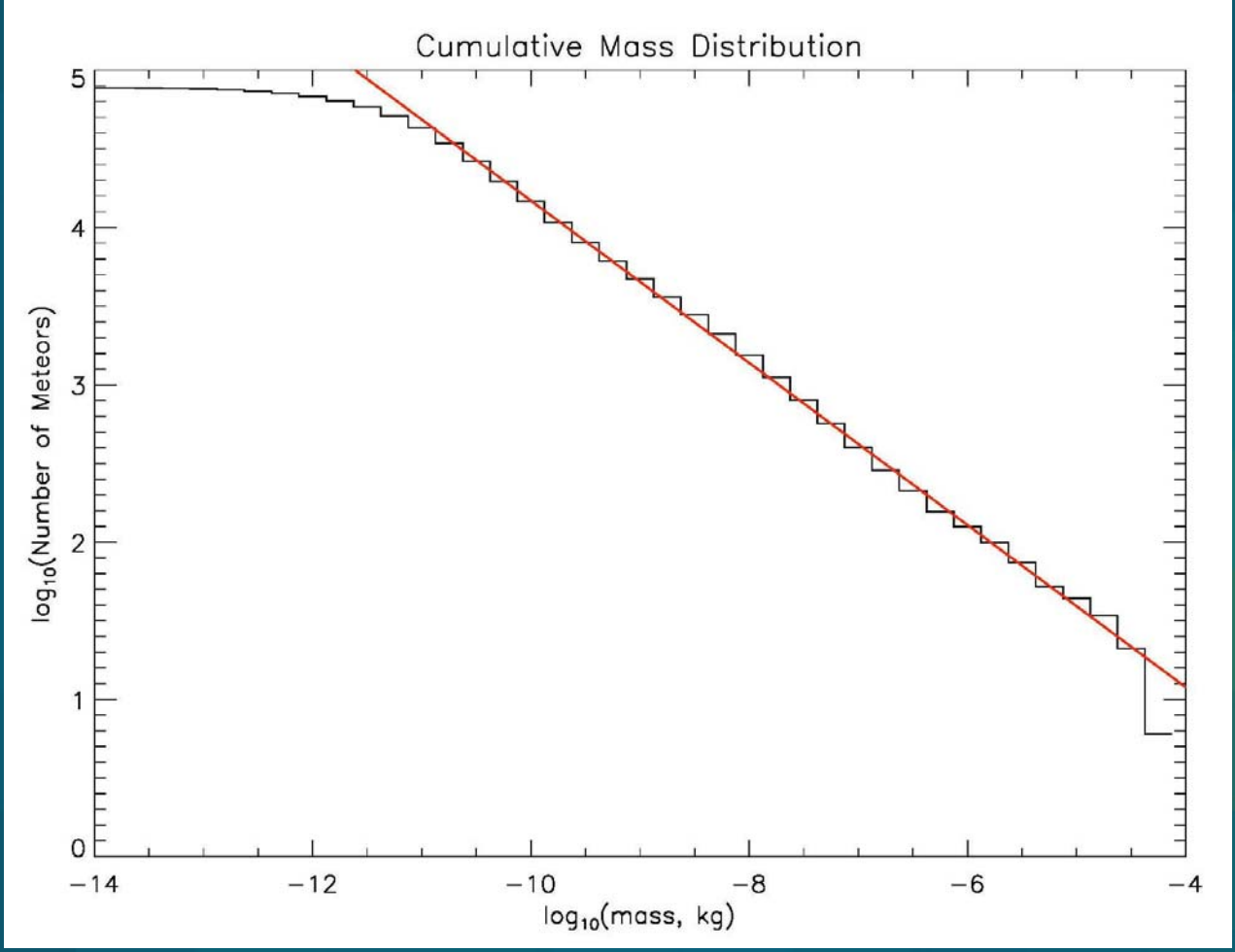




Chau et al. 2007


Altitude Distribution with Mass
mass<1E−11 kg
1E−11 kg<mass<1E−9 kg
mass>1E−9kg
log10(Number of meteoroids)
10^5
10^4
10^3
10^2
10^1
80
90
100
110
120
130
Altitude (km)

Cumulative mass index



$$N(m > m_0) \propto m_0^{-\alpha}$$

- α = -0.515±0.004
- Previous studies:
  - ALTAIR: α =0.94 *(Close et al. 2007)*
  - Photographic: α =1.36 *(Whipple, 1967)*
  - Specular: α =1.0 *(Galligan and Baggaley, 2004)*

Conclusions

- Meteoroids with smallest masses seen from Apex sources
- Larger meteoroids seen from all six sources
- Unusually low cumulative mass index found: $\alpha = 0.515$