Analysis of Aerobraking Accelerometer Data from Mars

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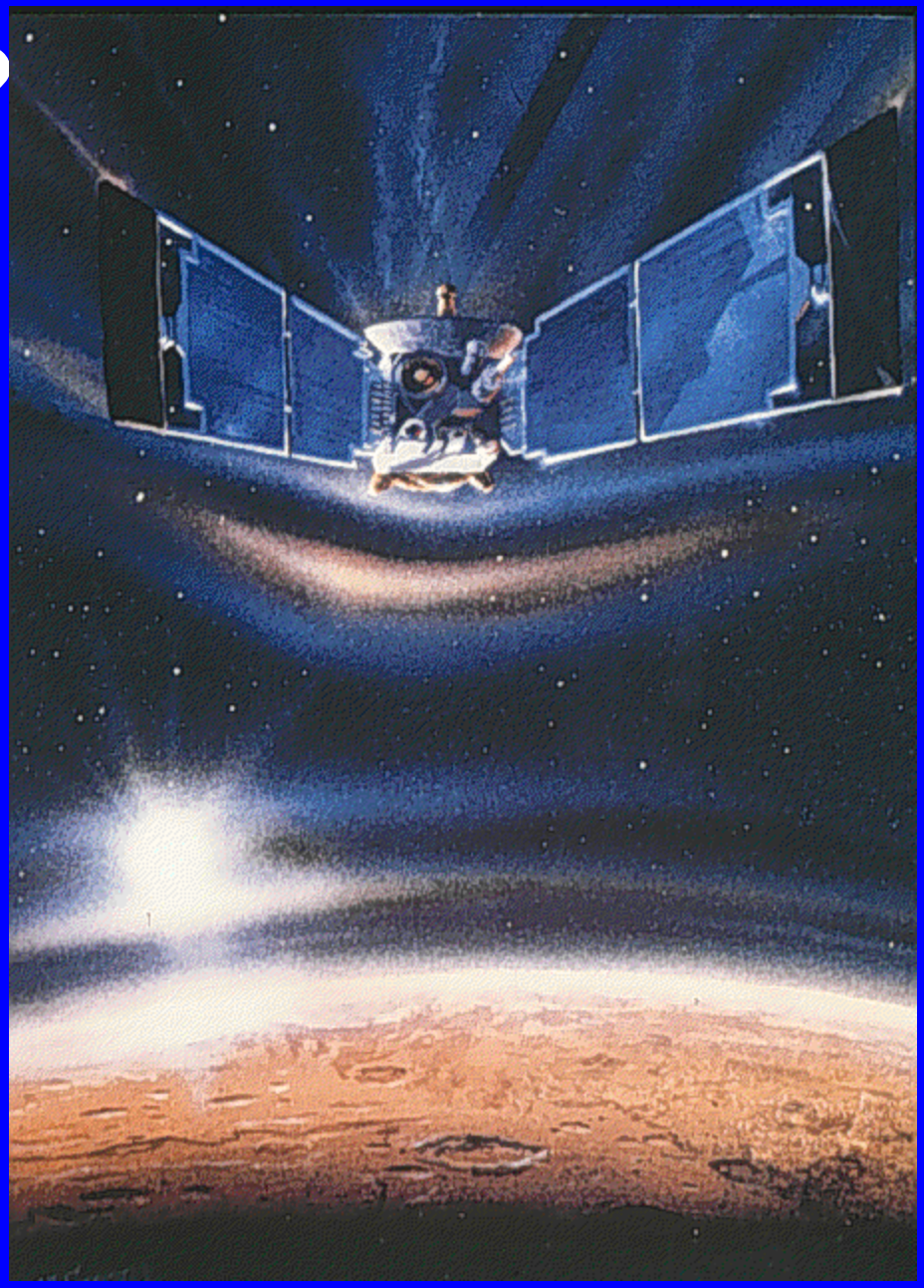
What's Going On?

- Gas prices are high in space
- Use atmospheric drag to alter orbit instead
- Operationally challenging
- Engineering or science?



Why am I talking about this?

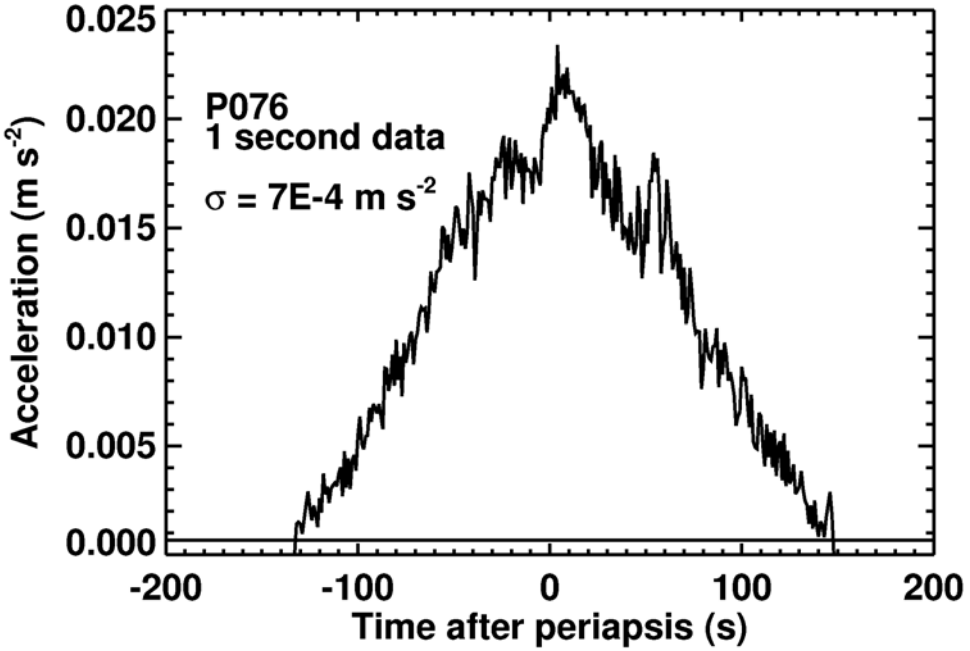
- MGS data safely archived, analysis ongoing
- Mars Odyssey data not yet archived, I'm funded to do so
- Mars Reconnaissance Orbiter aerobraking just completed, I've proposed to work on that data too, announcement expected within weeks

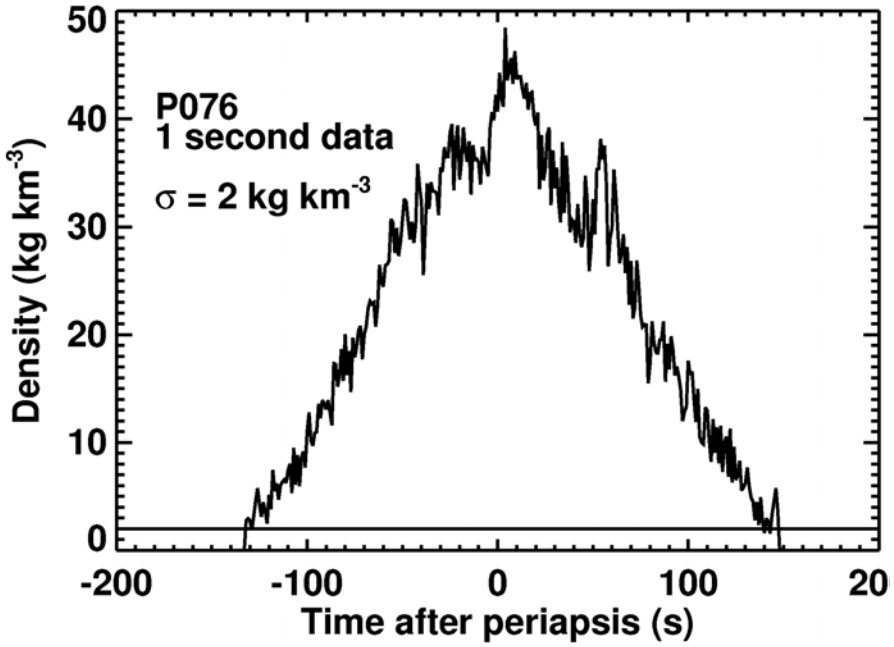
Data Processing
$ma = \rho C A v^2 / 2$

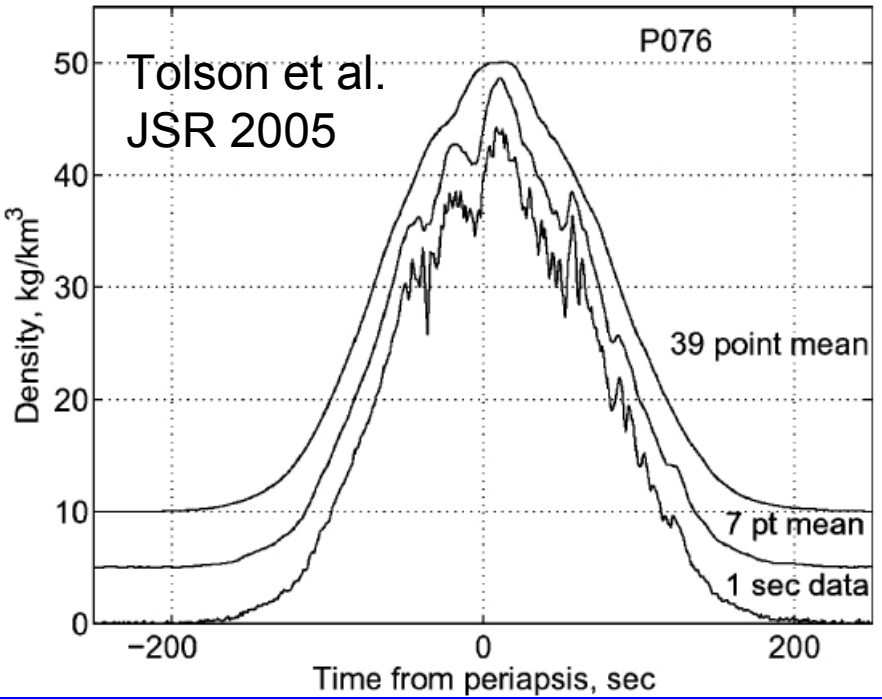
- All terms except ρ are, in principle, known
- In practice, things are complicated
  - Explain messiness for each term

Acceleration -> Density

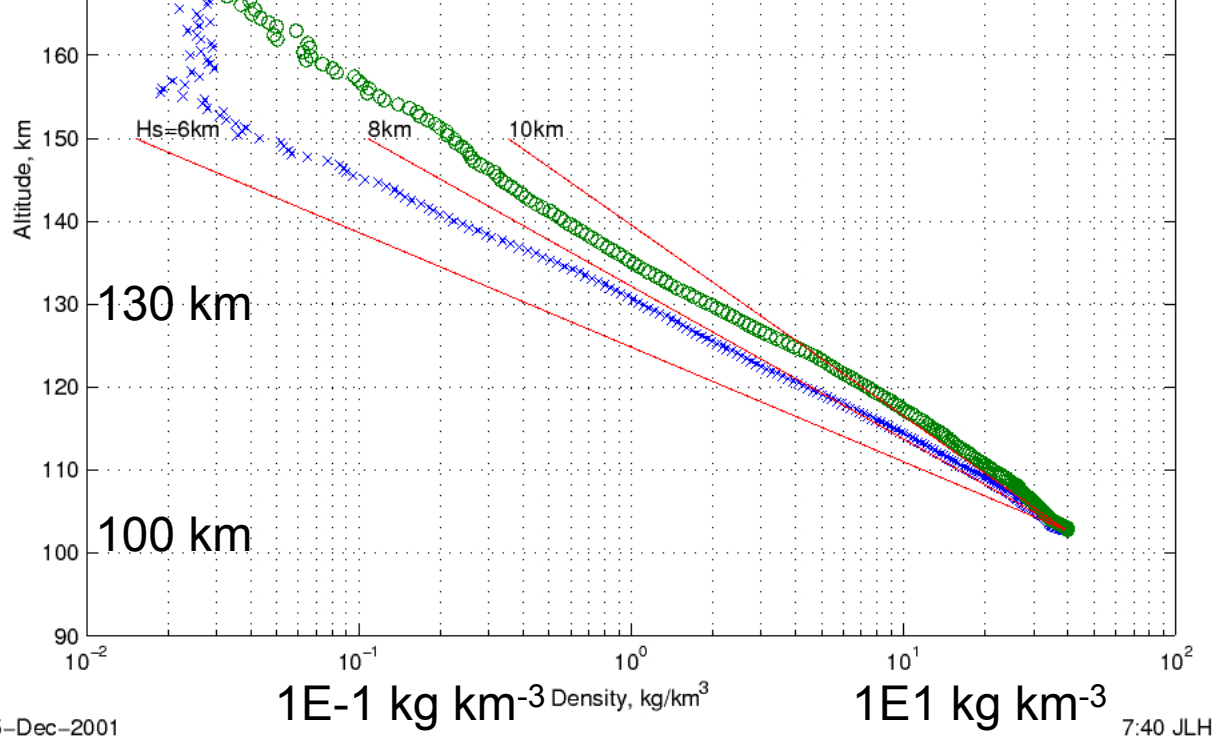
- $ma = \rho C A v^2 / 2$

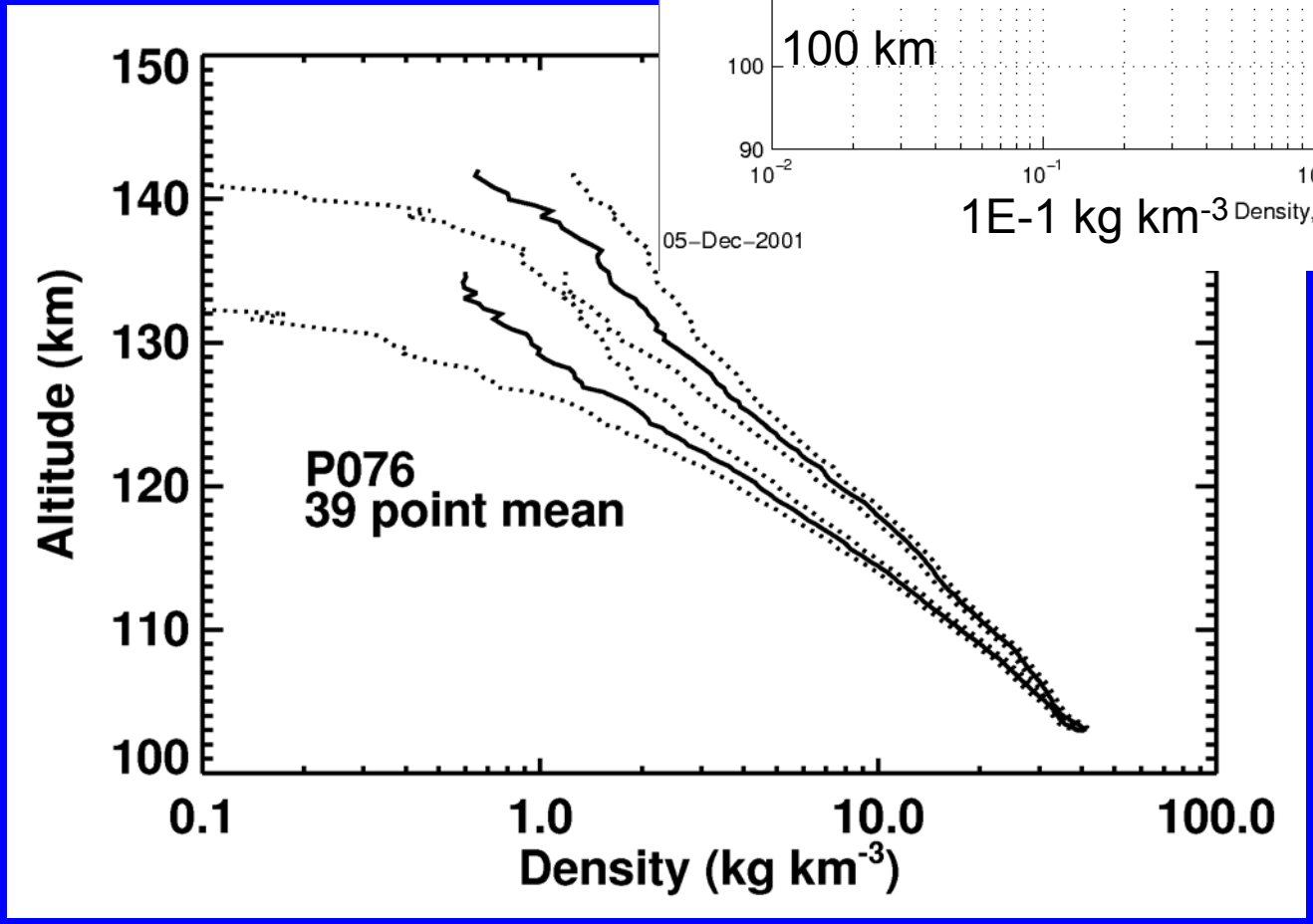


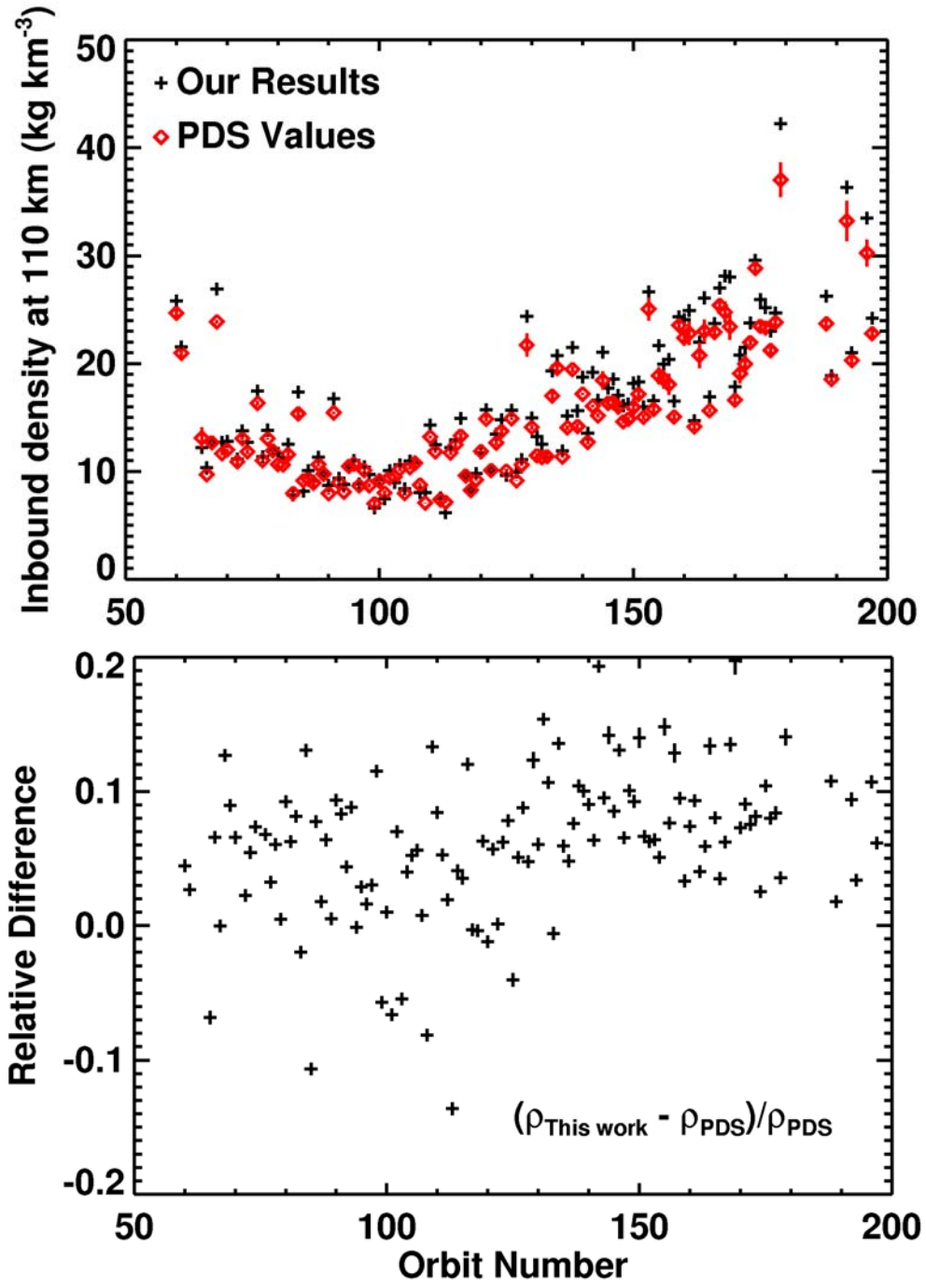




Quick Look Report for orbit P076 --->





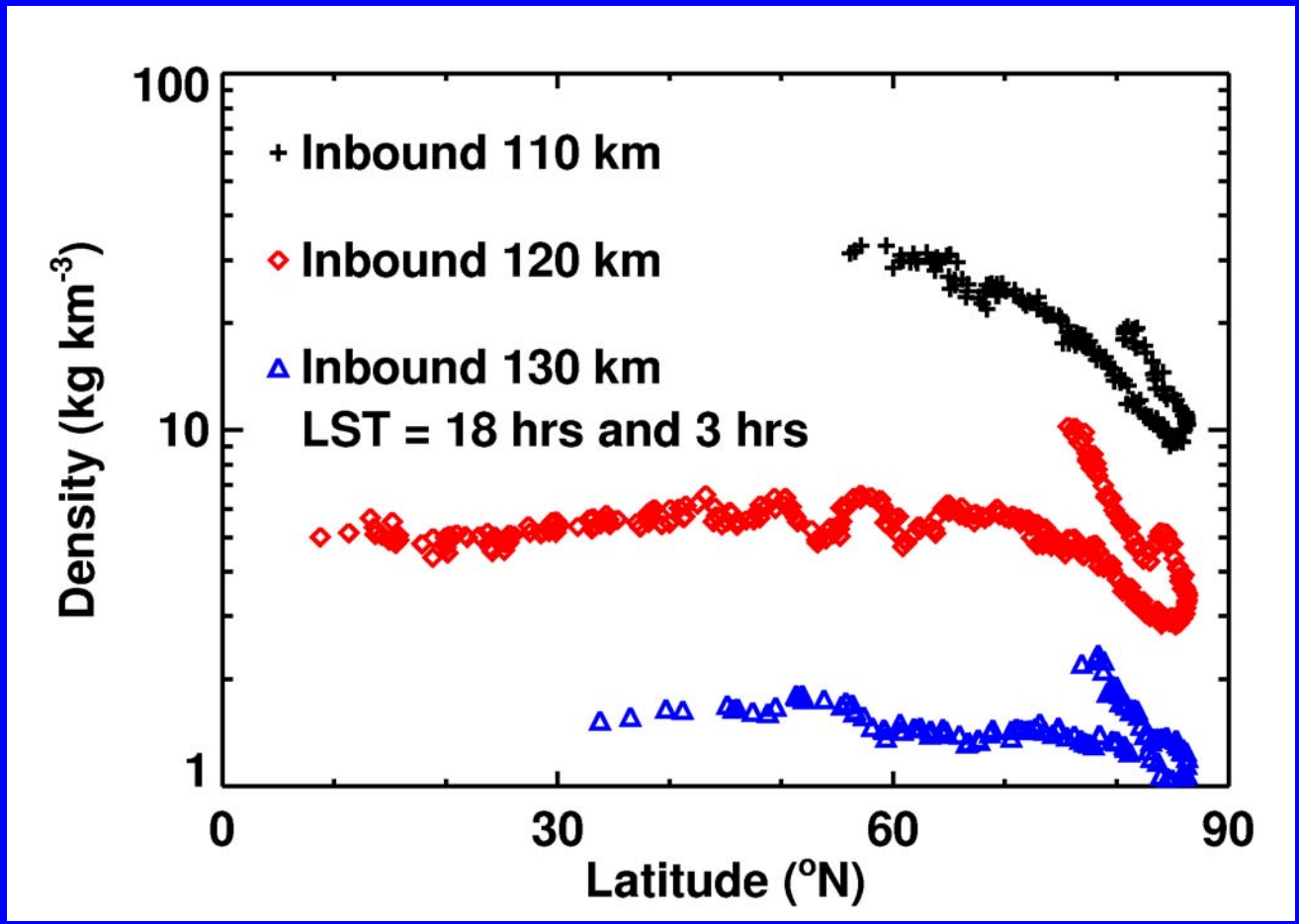


Results agree well with those that have been archived at the PDS

Density and density scale height at 110 and 120 km

Inbound density at 110 km shown here

- Thermal tides were important for MGS, what about Odyssey?
- Contrast south pole at winter (MGS) and north pole at winter (Odyssey)
- What are the smallest scale density variations?
- Test model predictions



The End

Background

- Odyssey aerobraked from October 2001 to January 2002

- “A reduced accelerometer dataset is being archived with the PDS. At the present time, it is mostly undocumented and has not undergone a peer review” – PDS website, October 2006

- Odyssey Participating Scientist Program selected “Analysis of Accelerometer Data from Aerobraking” (PI: Mendillo) proposal

Objectives

- Obtain atmospheric densities from measured accelerations
- Deliver raw data, data products (density profiles and densities at fixed altitude), and documentation to PDS
- Do some science

Validation

- Engineering papers
- Quick-Look Reports produced during aerobraking
- 110 and 120 km densities and scale heights at PDS

Ongoing Work

- Acquire high-rate ACC data
- Deal with thrusters and angular motions
- Acquire accurate C_D and m
- Use same “sea level” as everyone else
- Validate, validate, validate
- Document, document, document
- PDS formatting