20-Years of Precision Orbit Determination For Altimetry With GPS

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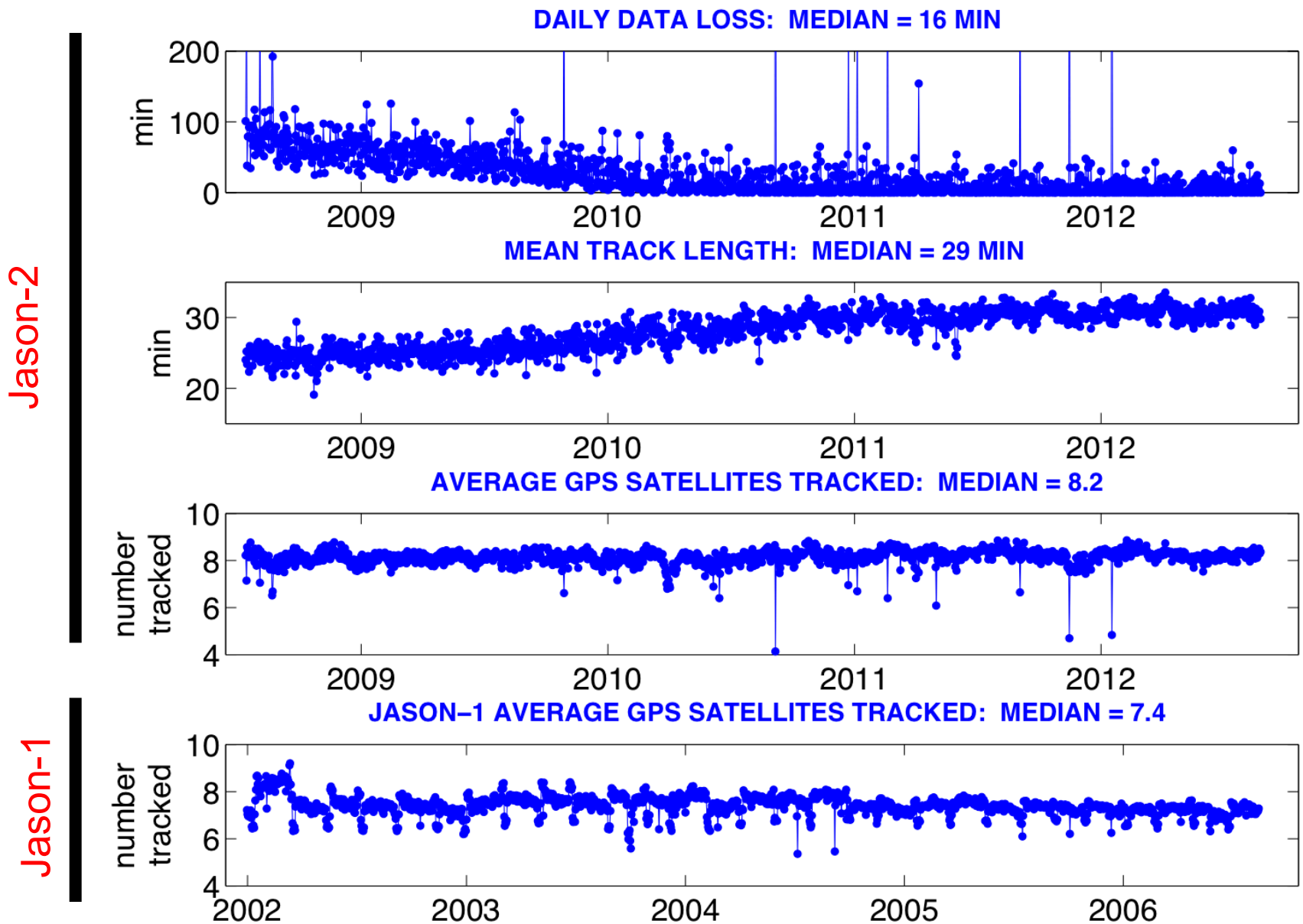
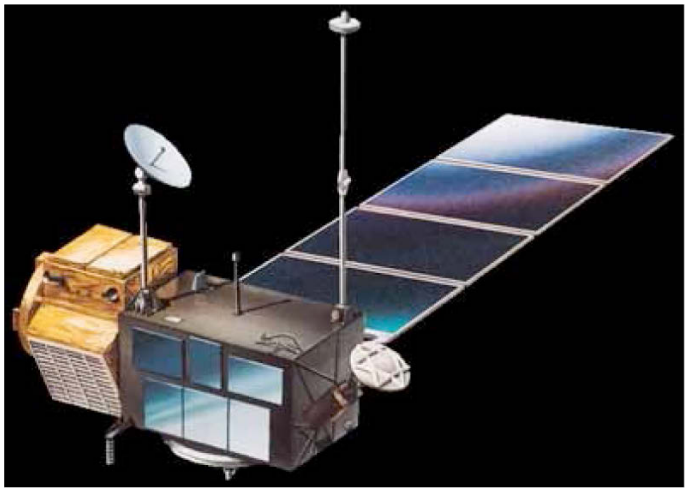
GPS Data, Jason Missions



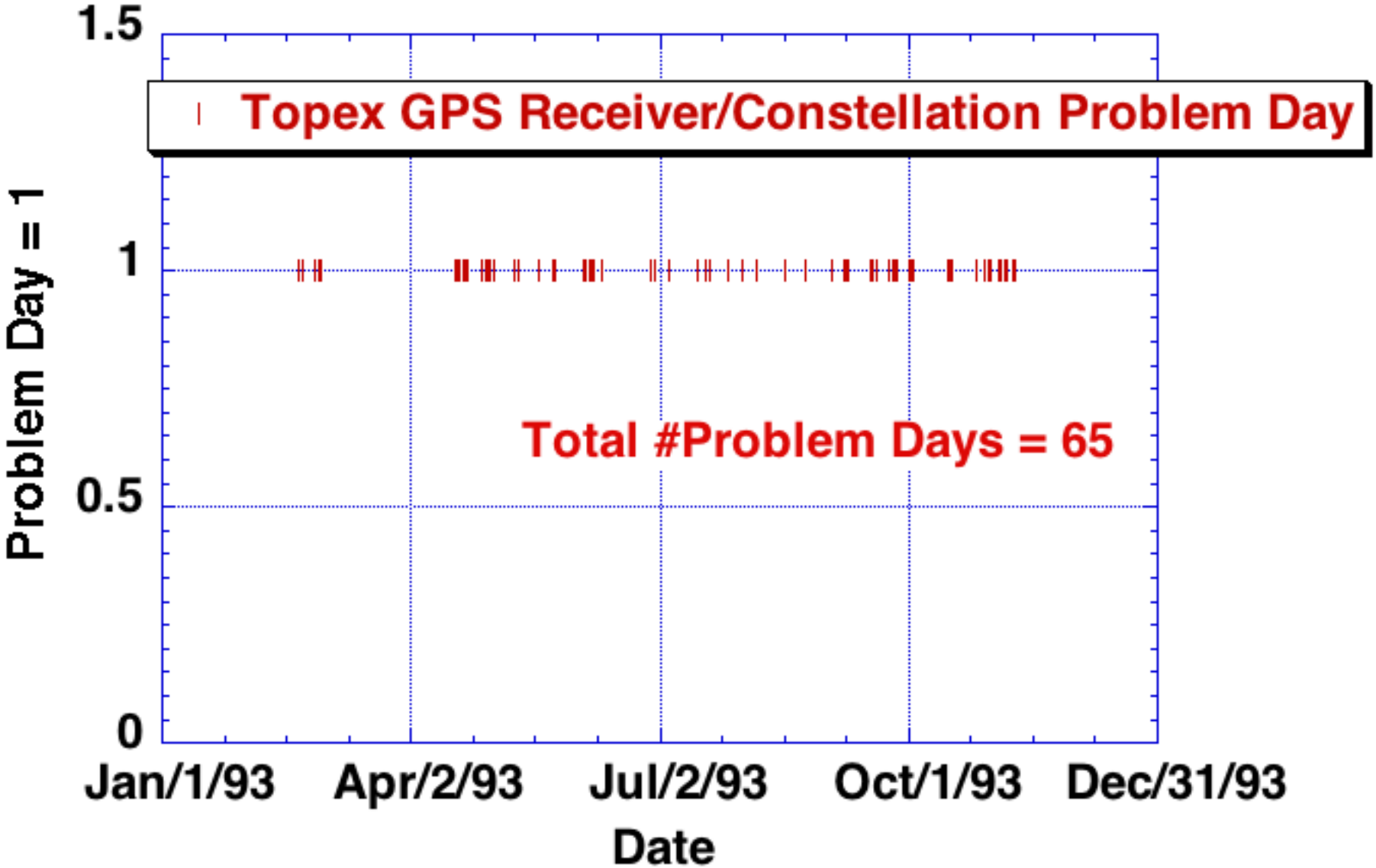
Topex GPS Data Reminders

- **Launched in August 1992**
- **Topex GPS Flight Reciever**
  - 6 Channel
  - Dual Frequency when Anti-Spoofing is off
  - ASIC Error on P2 (~25 cm)
    - Compromises use in widelane ambiguity resolution
  - Half Cycle Slips with probability of 0.5 in L1 or L2
    - Some hope of resolving half cycles, but small
- **1993 - GPS Constellation is not operational**
  - Anti-Spoofing testing
  - Individual Satellite tests
  - System bugs
  - 23-24 satellites
  - 30-50 ground stations



All these problems were known prior to launch. None compromised the goals of the experiment. Quit different from the Jason1/2 era.

Topex 1993 Problem Days



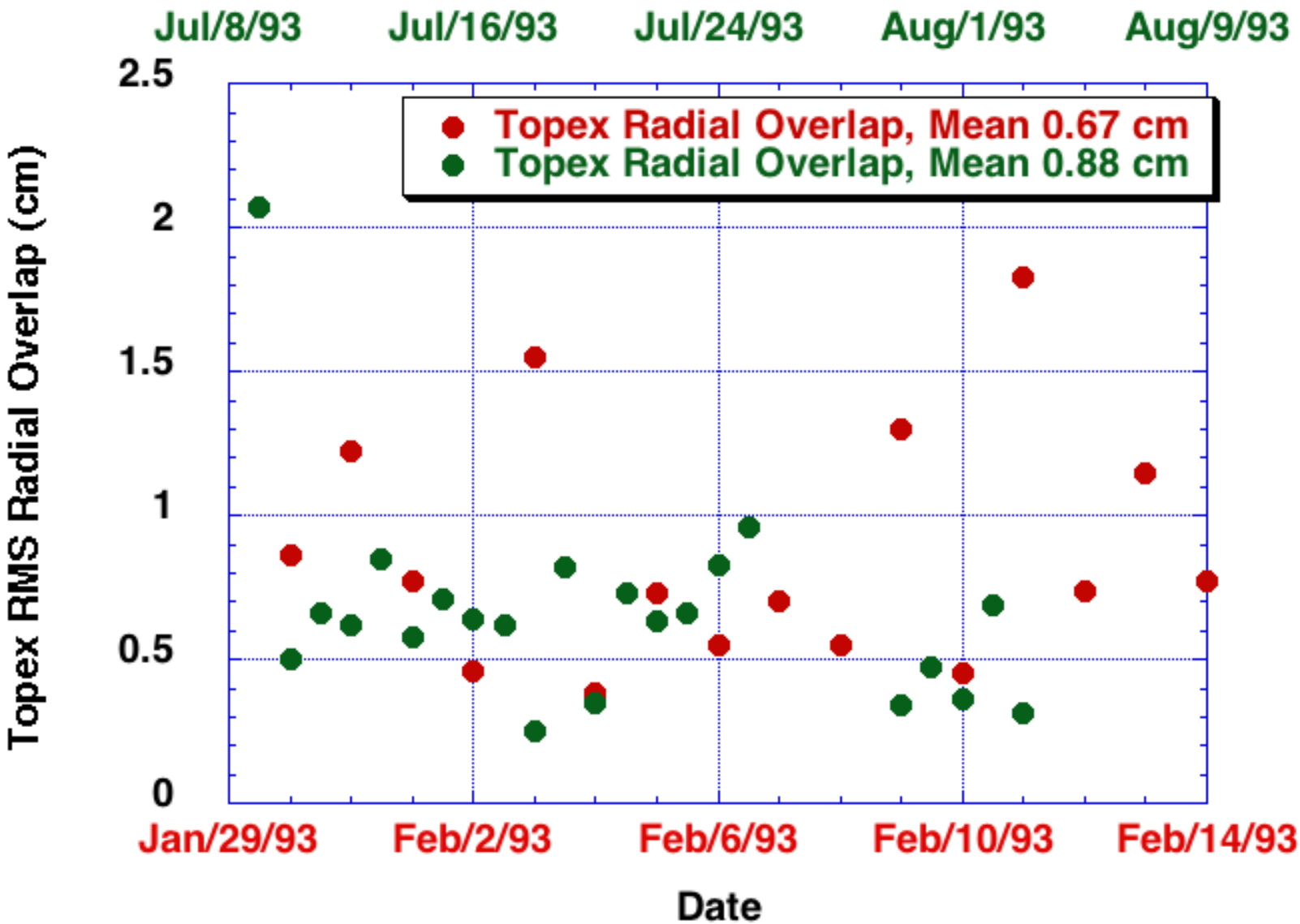
Past Experience

- **Reference JGR 1994**
  - 4-5 cm accuracy
  - 1 cm orbit overlaps
  - 5 mm phase residuals
- **Simultaneous solution for Topex and GPS orbits/clocks**
- **With the current constellation and ground network, we do not see much benefit with a simultaneous LEO**

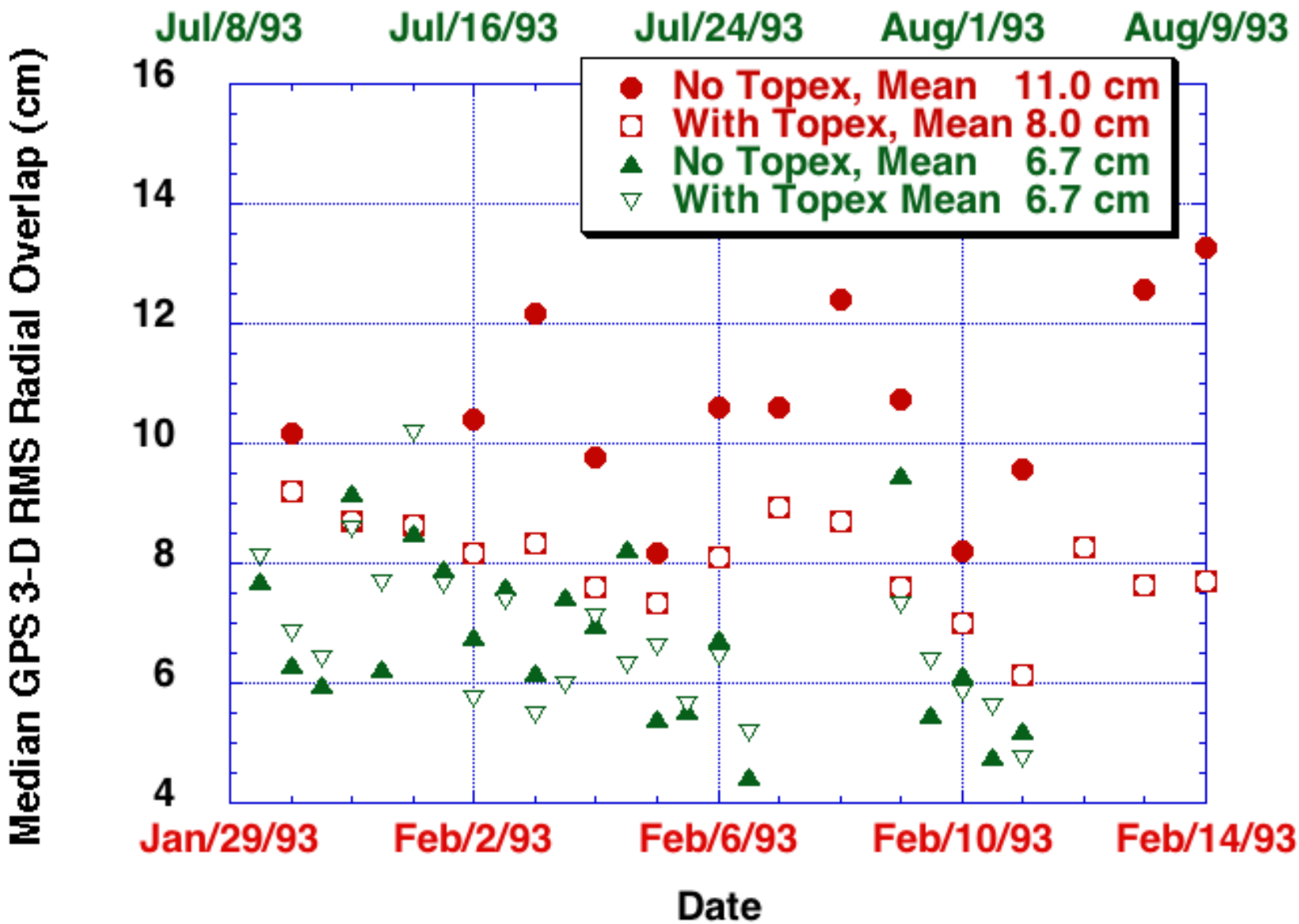
New Solution Strategies

- **Use current static gravity model (GRACE)**
- **ITRF08 coordinates and IERS2010 standards**
- **GPS Transmitter Antenna Calibrations**
- **Separate GPS Orbit Clock Solution**
  - Produced poorer Topex and GPS overlaps
- **Simultaneous Topex/GPS Constellation Solution**
  - ~7-8 mm overlaps (better than 1993 processing of 10-12 mm)

Radial RMS Overlaps Cycles 14-15, 30-32

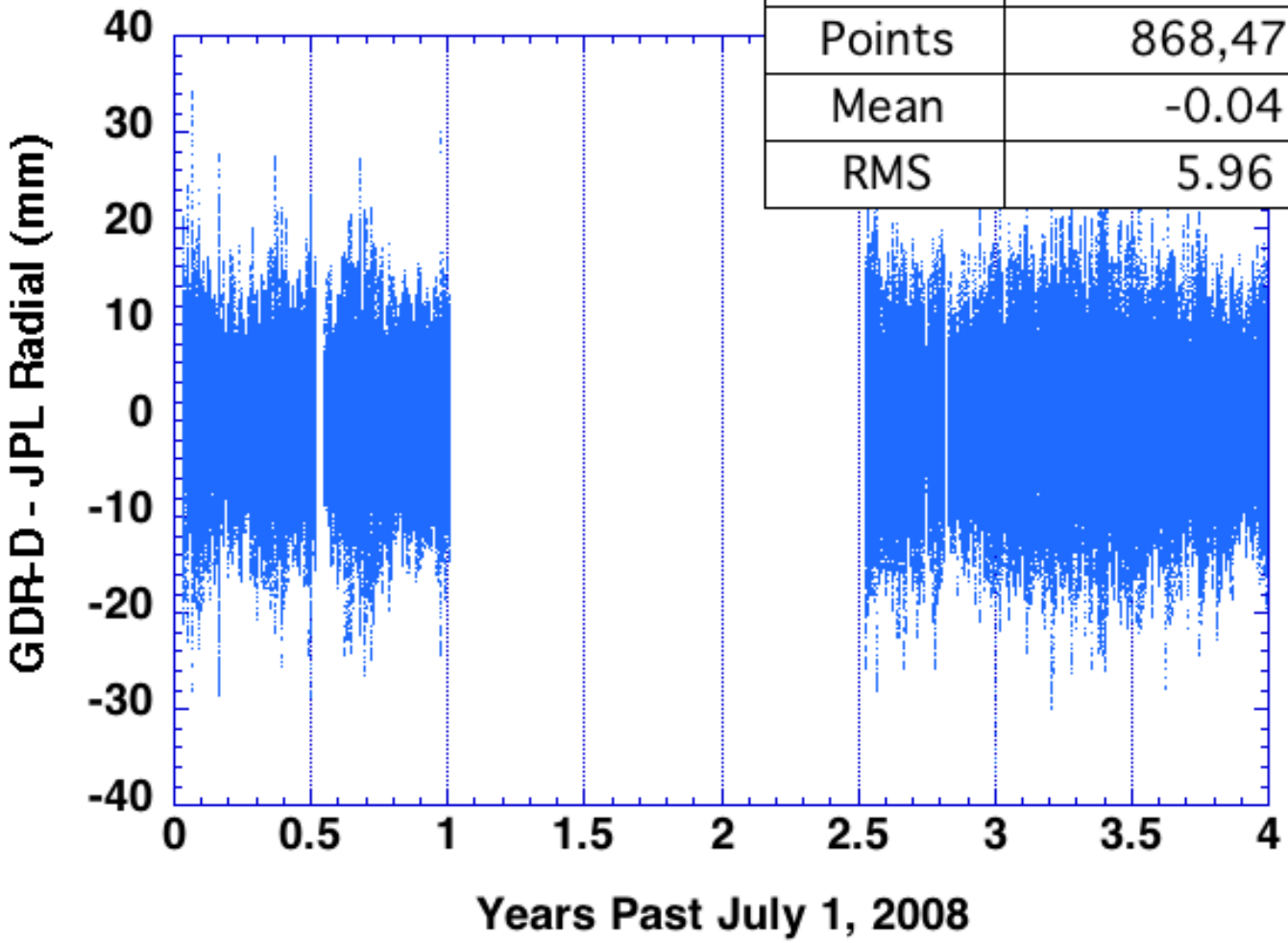


GPS 3-D Median RMS Overlaps With and Without Topex

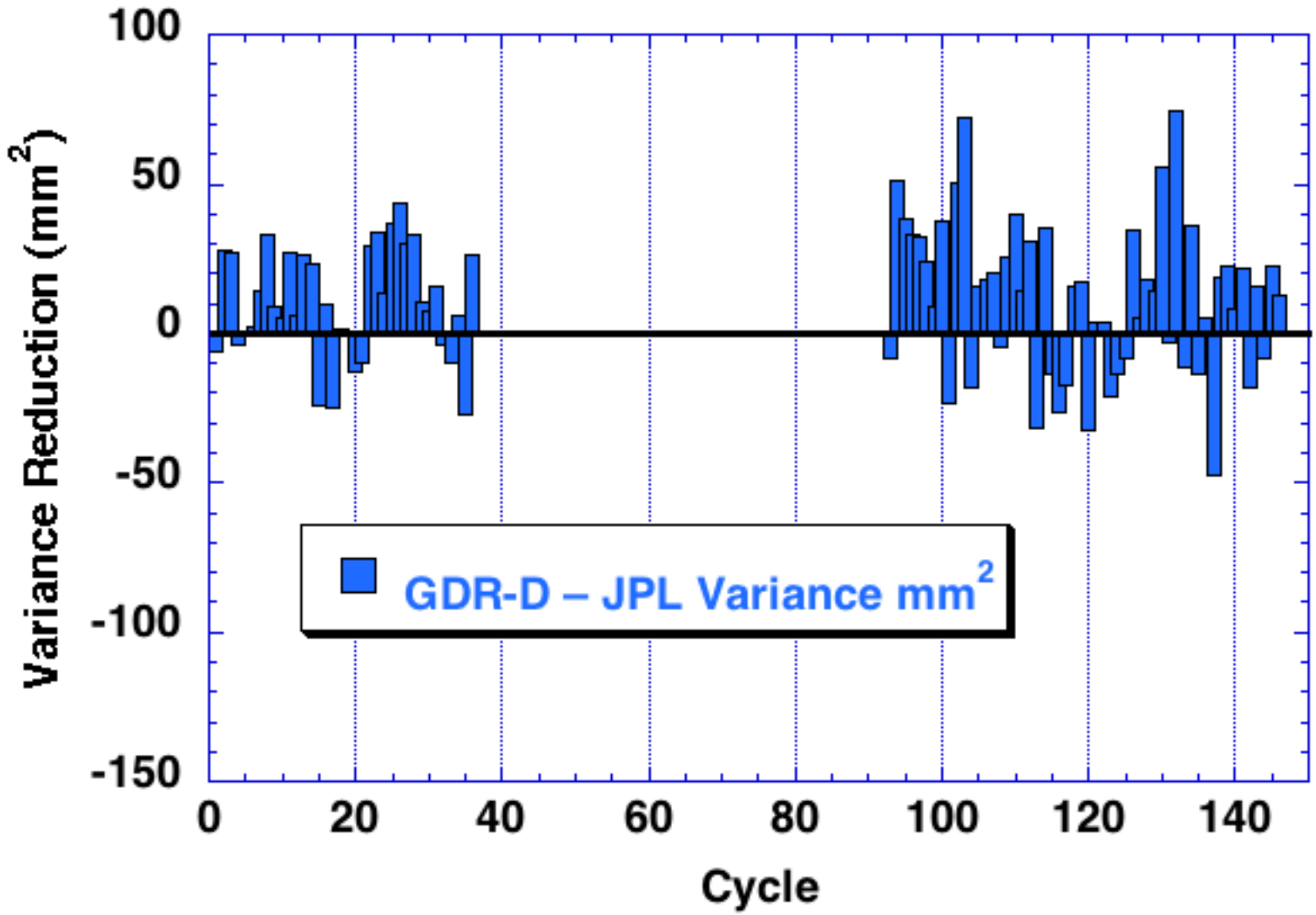


Radial Differences GDR-D

	GDR-D - JPL (mm)
Minimum	-36.5
Maximum	34.1
Points	868,473
Mean	-0.04
RMS	5.96



Jason-2 Crossover Comparison with GDR-D



Mean Reduction: 11.4 mm^2

Summary

- Topex, 1993 GPS is harder than Willy remembered
- Preliminary Topex reprocessing shows significant improvements, but bias fixing maybe very difficult
- Jason-2 GPS continues excellent performance
- JPL GPS Jason-2 and GDR-D agree at the 6 mm level

Backups