Improving Sea Surface Height Measurements on the Jason-2/ OSTM OGDRs Using Near-Real-Time GPS-Based Orbits

Shailen D. Desai and Bruce J. Haines
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, U.S.A.

Abstract

We are developing a value-added research version of the Jason-2/OSTM Operational Geophysical Data Record Sea Surface Height (OGDR-SSH) product that will use near-real-time (NRT) GPS-based orbits to derive the sea surface height measurements on the OGDR-SSH product. The value-added OGDR-SSH product will include two additional fields to the formal product from the project, a NRT GPS-based orbit altitude and a sea surface height measurement derived by replacing the DIODE orbit with the NRT GPS- based orbit. These NRT GPS-based orbits are computed within 3-5 hours of real time, or within 15-minutes of data availability, and have radial orbit accuracies of better than 2.5 cm (RMS). We describe the approach used to compute the NRT GPS-based orbits and present results that demonstrate their accuracy. We also demonstrate the improvements to the accuracy of NRT SSH measurements from Jason-2 through comparisons to the SSH measurements from the Interim Geophysical Data Record.

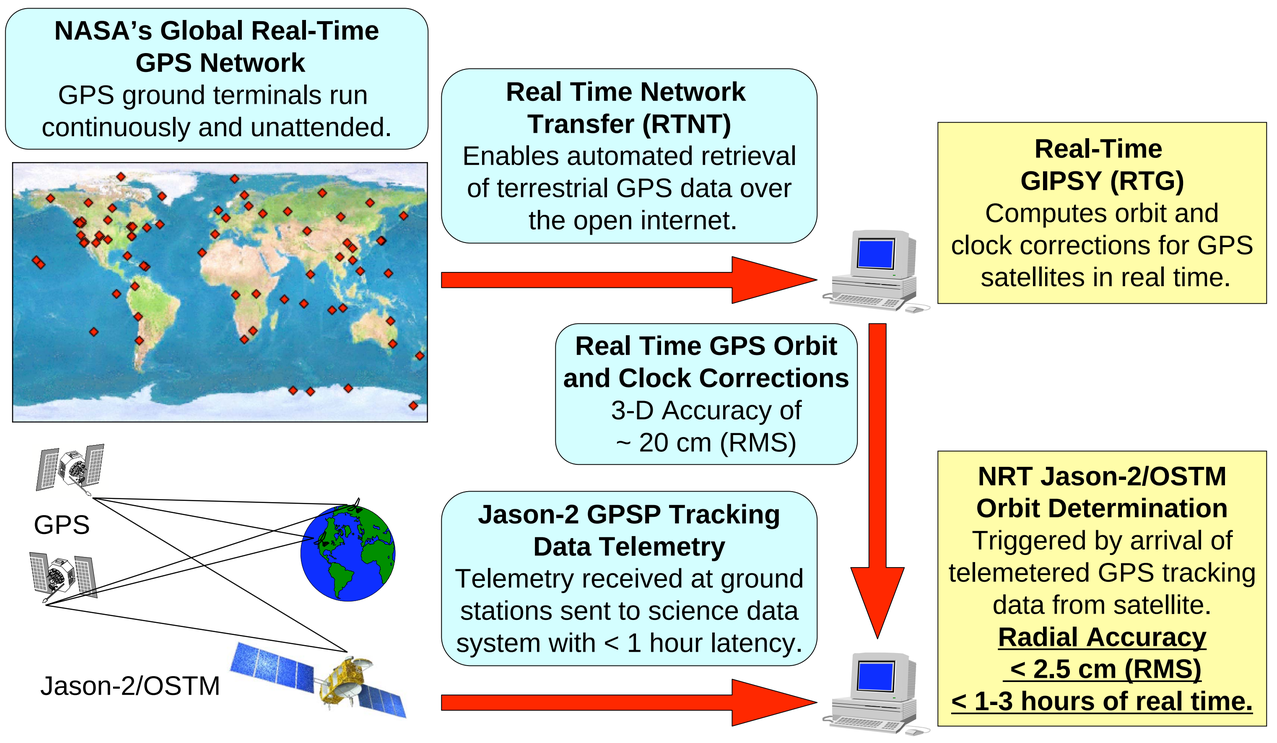
Near-Real-Time (NRT) GPS-Based Orbit Determination System for Jason-2/OSTM

Leverage from experience generating Near-Real-Time (NRT) GPS-based orbits for Jason-1's NRT Sea Surface Height Product. from the OSDRs.

- Real-time GPS orbit and clock corrections available from NASA's Global Differential GPS System (GDGPS).
  - Accuracy of GDGPS products is ~20 cm (3-D RMS).
  - See http://www.gdgps.net/
- GPS tracking data from GPSP payload on Jason-2/OSTM:
  - Available in 1.5-2 hour telemetry blocks.
  - Available within 1 hour of last measurement.
- Latency of NRT GPS-based orbit determination is < 3 hours of real time.
  - Covers same period from most recent Operational Geophysical Data Record (OGDR).

- **Radial orbit accuracy of NRT GPS-based orbit is ~ 2.5 cm (RMS).**
  - **Available within minutes of availability of OGDR.**

- **Increasing latency of NRT orbit solution by 1-2 hours (until next telemetry download) improves radial orbit accuracy of NRT GPS-based orbits to ~ 2.0 cm (RMS).**
  - **Available with a lag of 1 OGDR.**

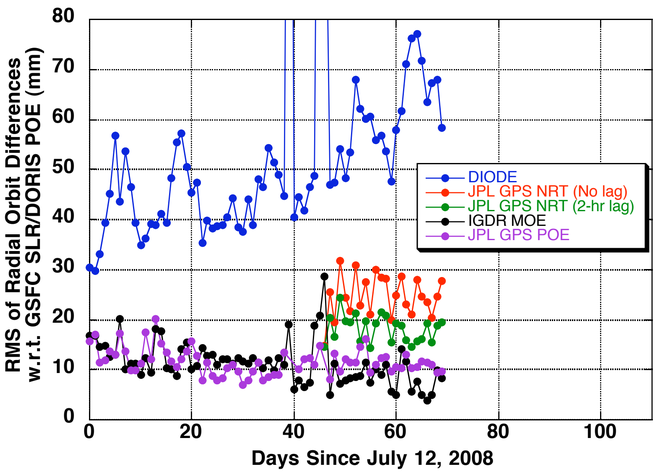


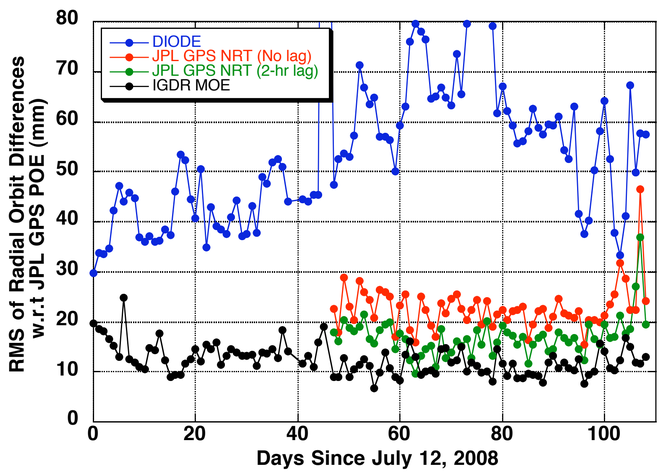
Comparisons to Precise Orbit Ephemeris (POE)

- Two independent precise orbit ephemeris (POE) solutions used to validate short latency solutions.
  - SLR/DORIS-based POE from GSFC.
  - GPS-based POE from JPL.
- Four short latency orbits solutions compared to POEs.
  - **DIODE** - On-board DIODE real time orbit solution.
  - **GPS NRT (no lag)** -GPS-based NRT solution with no lag to most recent OGDR.
  - **GPS NRT (2-hr lag)** GPS-based NRT solution with 2-hour (or 1 OGDR) latency.
  - **IGDR MOE** - DORIS-based Medium-accuracy orbit ephemeris (MOE) from IGDR.

Median of Daily RMS Differences with POE
Units: (mm)

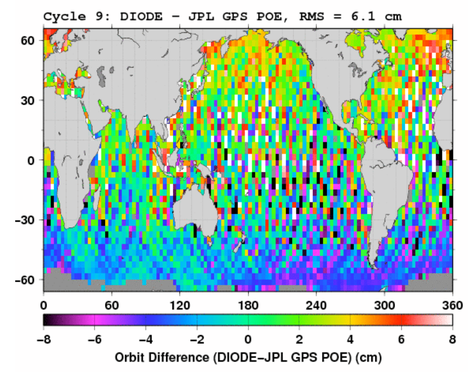
	GSFC SLR/DORIS POE	JPL GPS POE
JPL GPS POE	11.4	
DIODE	47.7	52.5
GPS NRT (no lag)	**24.7**	**22.4**
GPS NRT (2-hr lag)	**19.3**	**16.8**
IGDR MOE	11.2	12.0

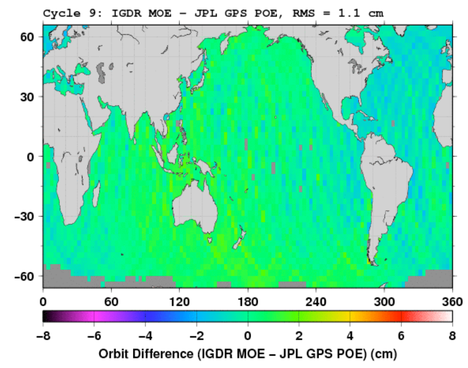


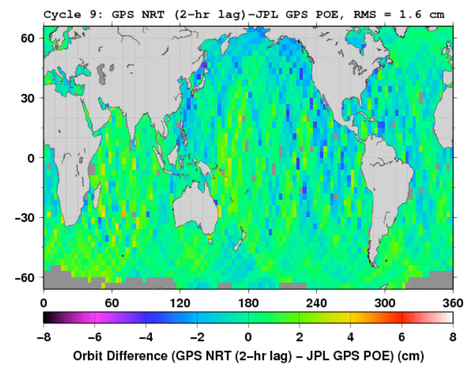


Geographically Correlated Orbit Differences

- Orbit differences computed for repeat cycle 9.
  - After software uploaded to DIODE that improved orbit quality (September 25, 2008).
- **GPS-based orbit reduces geographically correlated orbit differences w.r.t GPS-based POE from 6.1 to 1.6 cm (RMS).**
  - IGDR MOE differences w.r.t. POE are 1.1 cm (RMS).







Plans to Apply GPS-Based NRT Orbits to OGDR

- **JPL will generate a GPS-based OGDR-SSHA research product (OGDR-SSHAGPS) in February 2008.**
  - **To be released through PODAAC.**
- Currently fine-tuning NRT orbit determination strategy.
  - Incorporating quaternions operationally.
  - Applying GPS antenna calibrations.
- Will add two fields to OGDR-SSHA formal project product.
  - NRT GPS-based orbit altitude.
  - Sea Surface Height Anomaly derived from NRT GPS-based orbit solution.

For more information contact: Shailen.Desai@jpl.nasa.gov