2013 OSTST
Boulder, CO
U.S.A.
October 8-11, 2013

High-Accuracy Sea Surface Height Data in Near-Real-Time from the SARAL and Jason-2 Missions

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Abstract

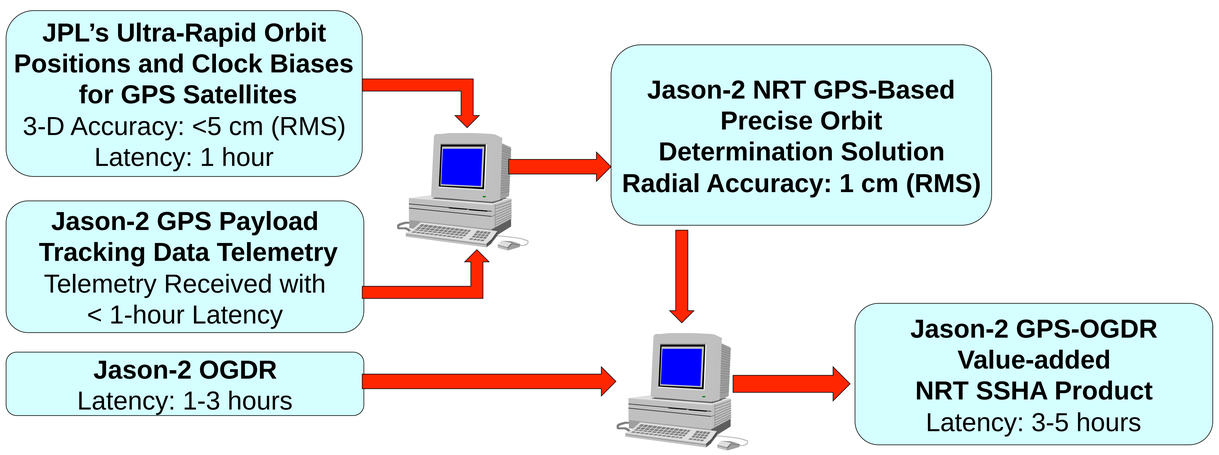
Near-real-time (NRT) sea surface height (SSH) data from satellite altimeter missions become increasingly valuable to operational applications when they are available with high spatial density and accuracy. The SARAL/Altika mission is an especially valuable new opportunity for high accuracy NRT SSH measurements given that the Jason-1 and ENVISAT missions are no longer active. We describe our approach to improving the accuracy of NRT SSH measurements from SARAL, that adds to our existing respective measurements from Jason-2. For Jason-2, we continue to generate the so-called GPS-OGDR-SSHA value-added product by combining altimeter and radiometer data from the Operational Geophysical Data Record (OGDR) with NRT GPS-based precise orbit determination. For SARAL, we similarly combine altimeter and radiometer data from the OGDR products, but determine high accuracy orbit altitudes using SSH differences with respect to those from the Jason-2 GPS-OGDR-SSHA product at ground-track crossing locations (crossovers). This approach has the added benefit of leveling the SARAL and Jason-2 NRT SSH measurements, thereby facilitating seamless combination with no additional effort.

In this presentation, we provide updated results on the performance of the NRT GPS-based orbit solutions for Jason-2, showing that they continue to achieve radial accuracies of 1 cm (RMS). We also provide results on the performance of our inter-satellite crossover-based orbit altitudes for SARAL, showing that they are achieving accuacies of < 2 cm (RMS).

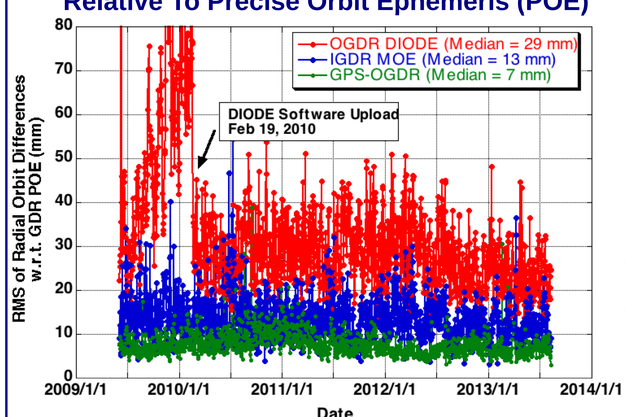
Objective

- **Generate value-added products with high-accuracy measurements of sea surface height anomaly (SSHA) in near-real-time (NRT) (latencies of < 7 hours).**
- Improve density of NRT SSHA measurements using Jason-2/OSTM and SARAL/ALTiKa.
- Operational Geophysical Data Records (OGDRs) provide altimeter measurements, and all environmental and geophysical corrections required to generate SSHA.
- Orbit altitudes on OGDRs provided by on-board DORIS DIODE navigator.
  - DIODE accuracy: 3-5 cm on Jason-2/OSTM, and 2-3 cm on SARAL.
- **Orbit altitude accuracy improved using NRT ground processing.**
  - **Jason-2/OSTM: GPS-based precise orbit determination (POD).**
  - **SARAL: Inter-satellite SSHA crossover-based orbit altitude determination with respect to Jason-2 reference.**

Jason-2 NRT POD System and Value-Added SSHA Product

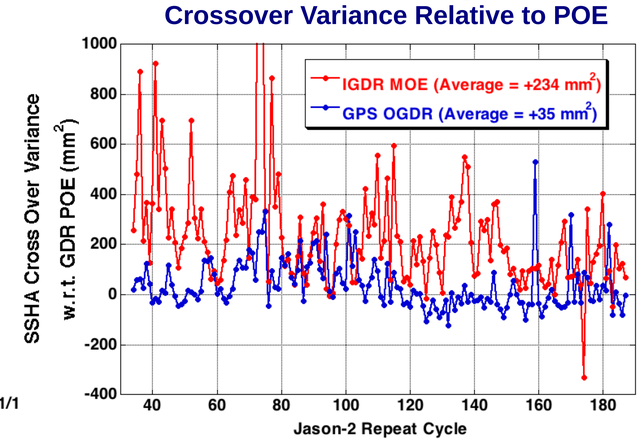


Intercomparison of Jason-2 Orbit Solutions Relative To Precise Orbit Ephemeris (POE)



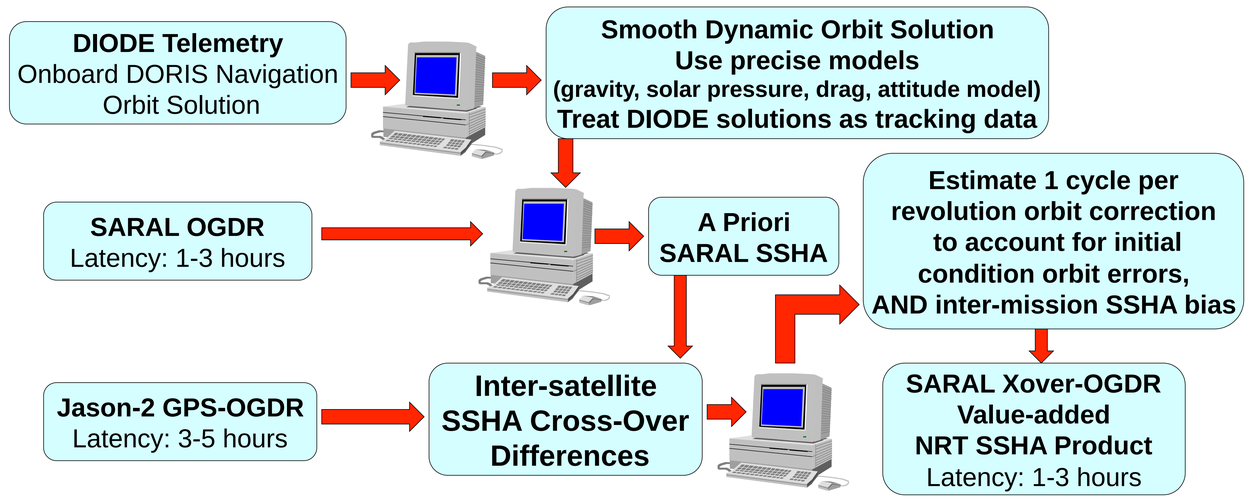
- NRT GPS-based precise orbit determination solution have similar accuracy to POE on GDR.

Jason-2 Sea Surface Height Anomaly Crossover Variance Relative to POE

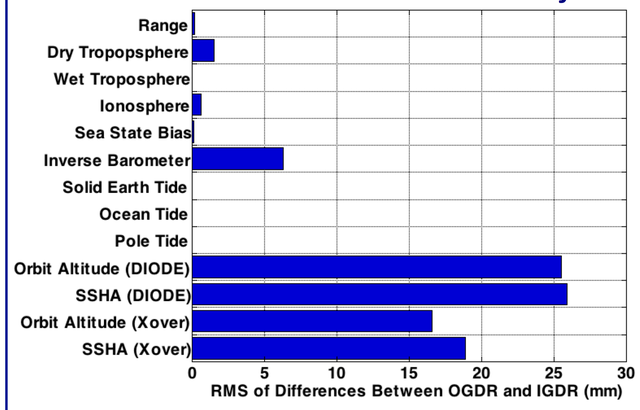


- Sea surface height crossover variance from GPS based OGDR is lower than on IGDR.

SARAL NRT POD System and Value-Added SSHA Product

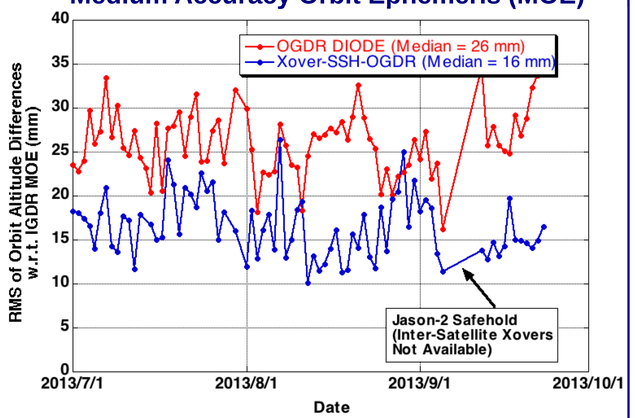


Comparison of SSH Component Measurements Provided on SARAL OGDR and IGDR – Cycle 5

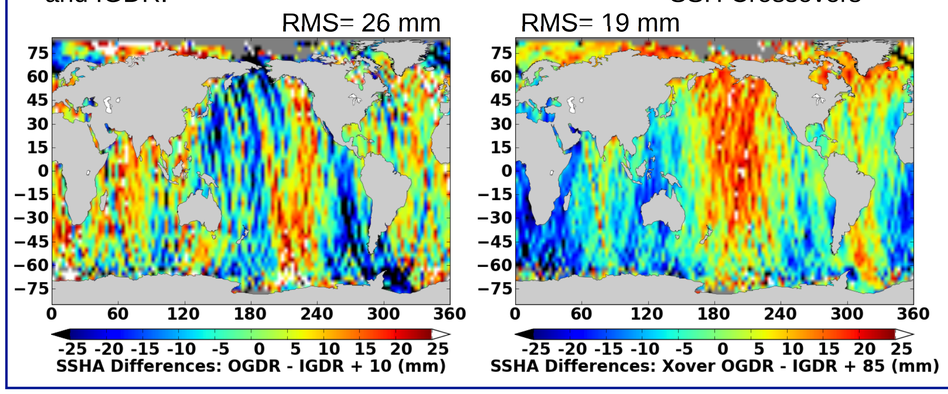


- Orbit error dominates differences between OGDR and IGDR.

Comparison of SARAL Orbit Solutions w.r.t. Medium Accuracy Orbit Ephemeris (MOE)

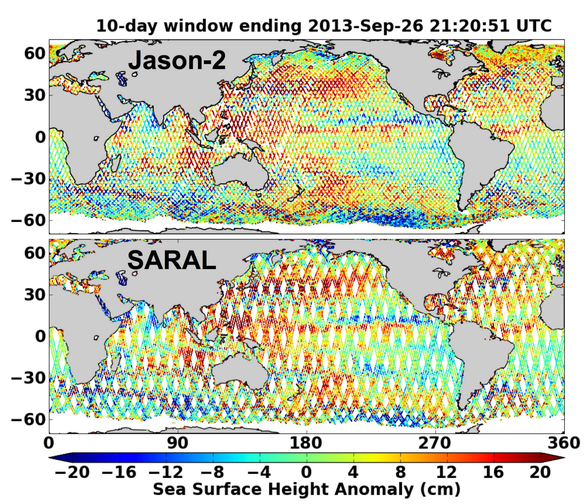


- Improved orbit altitude accuracy from inter-satellite SSH Crossovers

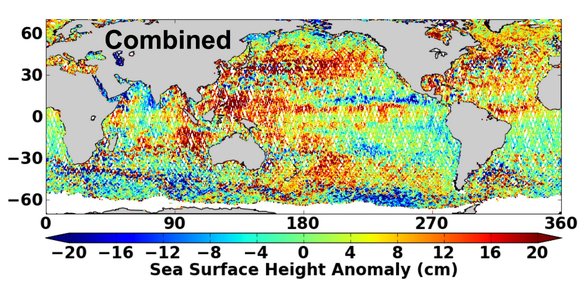


- Crossover-based orbit altitudes reduce trackiness in SSHA differences with IGDR.
- Exposes remaining geographically correlated orbit errors between Xover-OGDR and IGDR.
- Will be reduced in future versions.

High Accuracy and Spatial Resolution SSHA Measurements from Combination of Jason-2 and SARAL Value-Added Products



- Seamless combination of SSHA from value-added products.
  - SARAL data implicitly leveled to Jason-2.
- Each pixel on maps is 1-Hz measurement.
  - No smoothing applied.



Acknowledgements

- Our thanks to the CNES for providing SARAL/ALTiKa DORIS DIODE and OGDR products.

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