High Resolution SSH Anomaly Fields from Multiple Mission Altimeter Observations

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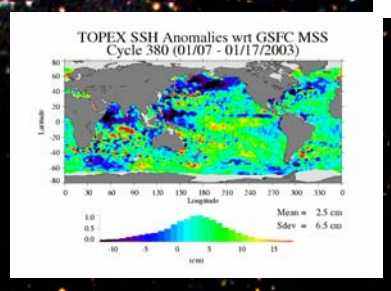
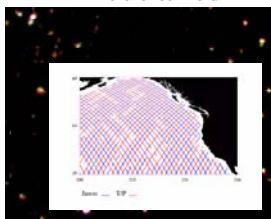
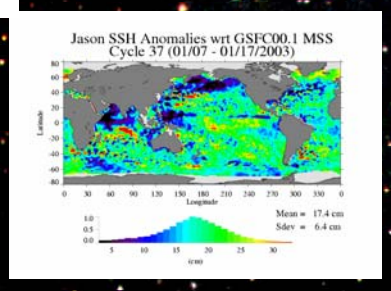
Abstract

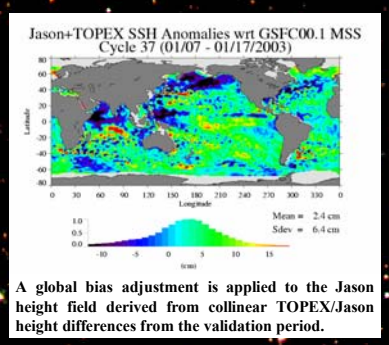
Synoptic mapping of the oceanic mesoscale variability from multiple satellite altimeter observations has proven to be an important tool in ocean circulation and climate research. TOPEX/POSEIDON, ERS-2, and GFO missions at 10, 35, and 17-day repeat periods, respectively, are providing a dense spatial sampling of the global ocean. The recent launches of follow-on missions Jason-1 and ENVISAT extends this reality into the near future. In order to accurately map the ocean mesoscale field from the combined missions, a homogeneous, inter-calibrated data set has been generated. This is achieved through the adjustment of GFO and ERS-2 (Envisat) altimetry into the more precise TOPEX/POSEIDON reference frame to minimize inter-mission biases and radial orbit errors. The current TOPEX/Jason-1 tandem orbit scenario not only improves spatial sampling, but also provides an increased reference network. This allows the tightening of the crossover time difference constraint to improve the preservation of oceanographic signals from the coincident altimetry and the observation retention rate during the adjustment procedure. In this presentation we construct global high resolution sea surface height anomaly fields from the "blended" multi-satellite data set employing the Jason/TOPEX tandem reference network.

Jason/TOPEX Tandem Adjustment Reference Field

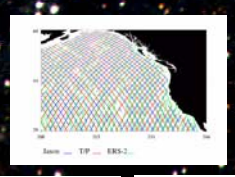


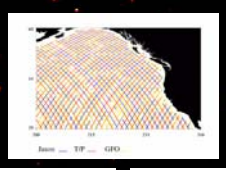


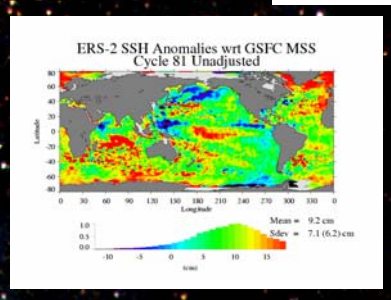


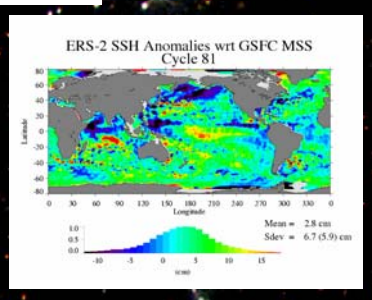


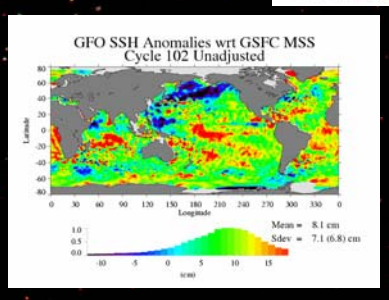
A global bias adjustment is applied to the Jason height field derived from collinear TOPEX/Jason height differences from the validation period.

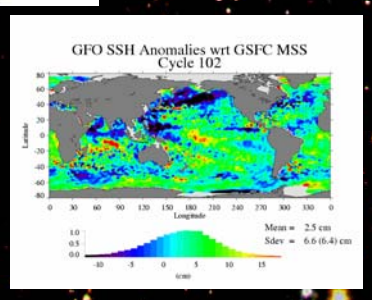




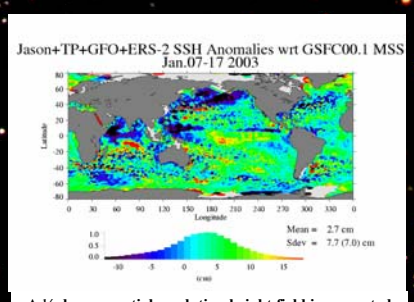




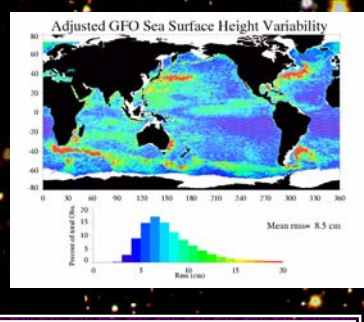


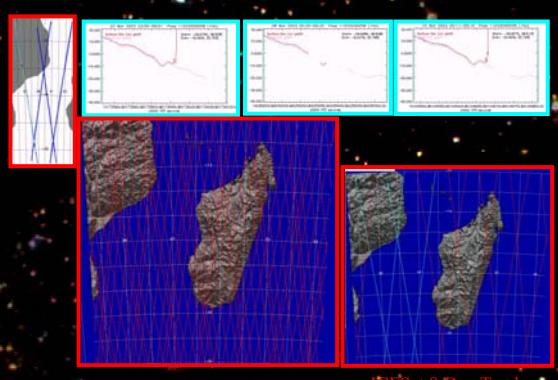


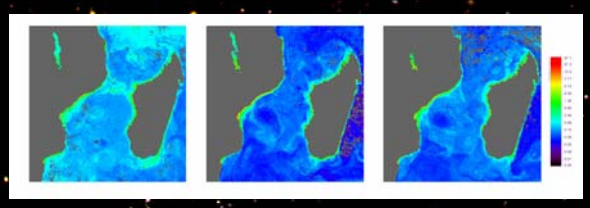
ERS-2 and GFO altimetry are adjusted into the Jason/TOPEX tandem reference network. Inter-mission biases and residual orbit errors are modeled through least squares SSH crossover minimization with a 1/rev sinusoidal and bias term. Previous adjustment procedures into the TOPEX only frame employed a crossover time difference constraint of 5 days to preserve oceanographic signals with the coincident altimetry. The tandem reference network provides four times the number of crossovers with sufficient crossovers to permit a 2 day time constraint. Note, for comparison purposes the standard deviation in parenthesis is that computed over the TOPEX spatial extent of +/ 66 degrees.



A ¼ degree spatial resolution height field is generated from the adjusted multi-satellite altimetry.







The utility of ICESat data is being investigated to provide additional observations in the coastal zones. Work is underway to merge laser and radar altimeter returns over ocean surfaces. Validation tools are being developed employing satellite imagery such as the time series of 8 day averages of chlorophyll a observed by MODIS to assist in determining the eddy resolving capabilities of the high resolution sea surface height fields from altimetry.

GEOSAT Follow-On Precise Orbit Determination
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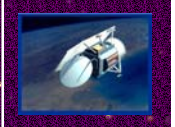
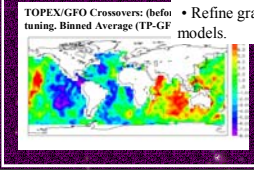
Objective
Develop the highest quality orbits for GFO to support ocean mapping with the radar altimeter.

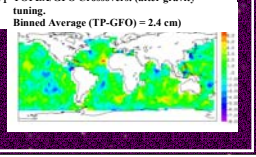
Method
• Demonstrate that SLR and altimeter crossover data can be used to determine precise orbits for GFO.
• Refine gravi models.



TOPEX/GFO Crossovers: (befo tuning. Binned Average (TP-GF



TOPEX/GFO Crossovers: (after gravity tuning.
Binned Average (TP-GFO) = 2.4 cm)



Through the joint efforts of the NOAA Laboratory of Satellite Altimetry and GSFC, GFO is providing a valuable data set to monitor ocean mesoscale variability at high spatial resolutions.