Altimeter sea level anomaly data in the Middle Atlantic Bight and the Gulf of Maine Assessment and application

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I. Introduction

This poster shows two tasks of coastal altimetry in the US northeast coastal region including the Gulf of Maine and Mid Atlantic Bight (Figure 1). The first is to assess appearing coastal altimeter Sea Level Anomaly (SLA) products from coastal-reprocessed 1Hz and retracking 5Hz SLA data (Section II). The second is to analyze along-track (8024, 202, 065,126,243,050,228) SLA time series along selected isobathes (Section III).

II. Objectives

- to identify the differences among the three SLA products from OSTM/Jason2
- to understand what new SLA information is being added in the 5Hz SLA

II. SLA data products

- UNH-RADS (University of New Hampshire-Radar Altimeter Database System) reprocessed 1Hz along-track SLA product (Feng and Vandemark, 2011; Scharroo 2008) with corrections applied:
  - Tidal: GOT 4.7
  - Atmos: MG2010
  - Mean Sea Level: DINSC08
- CTOH (Centre de Topographie des Oceans et de l’Hydrosphere) reprocessed 1Hz along-track SLA product (Roblou et al., 2011) with corrections applied:
  - Tidal: GOT 4.7
  - Atmos: MG2010
  - Mean Sea Level: Local MSS
- CLS-PISTACH’s reprocessed 5Hz along-track SLA products
  - RED3 = MLE3: performed on a reduced waveform; MLE4 = MLE4 applied to a filtered waveform
  - Note each with 2 low pass along-track filters with cut off frequencies of 21 pts (7km) and 11pts (3.5 km) and with corrections applied:
    - Tidal: GOT 4.7
    - Atmos: MG2010
    - Mean Sea Level: DUT

II. Preliminary summary in II

- There are higher energy in CTOH 1Hz data in wavelength from 20km-100km, most likely from local MSS different from the other two
- There are apparent “bias” in SLAs among the products,
- There appears new variation of SLA signals (or noise?) in the 5Hz data in wavelength of 10-30 km scales, and
- Further assessment needs in-situ data

III. Assessment

- Case 1: Track 50
- Case 2: Track 126

Figure 1: Study region

Left: a MODIS SST image shows 1) cold fresh Scotian Shelf Water inflow and 2) offshore warm-saline Gulf Stream induced meso- to submeso-scale eddies near shelf breaks. This is a very dynamic oceanic region with all forcings (local winds/offshore inflow) varying significantly in space and time.

Right: AVISO MDT (mean dynamic topography) and MDT-based geostrophic currents with TOPEX/Jason-1/Jason-2 satellite ground tracks whose numbers are labeled as well as isobaths (100, 200, and 1000, 2000 and 3000 m).

Figure 2: Different OSTM/Jason 2 SLAs (sea level anomaly, the top panels). MSSs (mean sea surfaces, the middle panels) and atmospheric force corrections (lower panels) for two cases of track 50 on Cycle 3 (left) and track 126 in Cycle 70 (right).

Figure 3: Average Power Spectral Densities (PSD) of OSTM/Jason2 SLA spatial variability for track 50 (left) and track 126 (right) from June 2008 to June 2010 (Cycle 317-72) for different SLA products. Wavenumber is given in cycles per km and PSD in cm²/CPD. The enlarged boxes (lower panels) indicates wavenumbers 0.055-0.2 corresponding to 50km to 5km. Two reference spectral slopes (1/0.72 to k²) are given. The spectral slopes from this study in the region are consistent with those by Xu and Fu (2011).

Figure 4: Low-pass filtered (10 point boxcar running mean) SLA time series at selected isobaths (100, 300, 500 and 1000m) from altimeter Jason 1 for the tracks #024, 202, 065,126,243,050, and 228 from top to the bottom.

Figure 5: Power Spectral Densities (PSD) of Jason1-1 low-pass SLA temporal variability for the along-tracks 024, 202, 065,126,243,050, and 228 (shown in different colors) at the 1000m isobath from June 2002 to June 2009. Frequency is given in cycles day⁻¹ (cpd) and PSD in cm²/CPD. Time-lag cross-correlations between selected track pairs (as indicated in colors and in the legend) of the low-pass SLA at the 1000m isobath.

Preliminary summary in III

- The most and secondly energetic SLA signals apper in 360 days and 60-70 day time scales respectively,
- The nature of the coastal SLA propagation along the 1000m isobath and other isobaths (not shown) is documented.
- Further assessment will be needed.

References


Acknowledgements

- NASA’s Science Directorate Physical Oceanography Program
- CLS-PISTACH’s OSTM/Jason2 retracking 5Hz SLA products
- CTOH’s reprocessed coastal SLA products

III. Applications

Figure 6: Preliminary summary in III

- The most and secondly energetic SLA signals apper in 360 days and 60-70 day time scales respectively,
- The nature of the coastal SLA propagation along the 1000m isobath and other isobaths (not shown) is documented.
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