

Aliased Tidal Variability in Mesoscale Sea Level Anomaly Maps

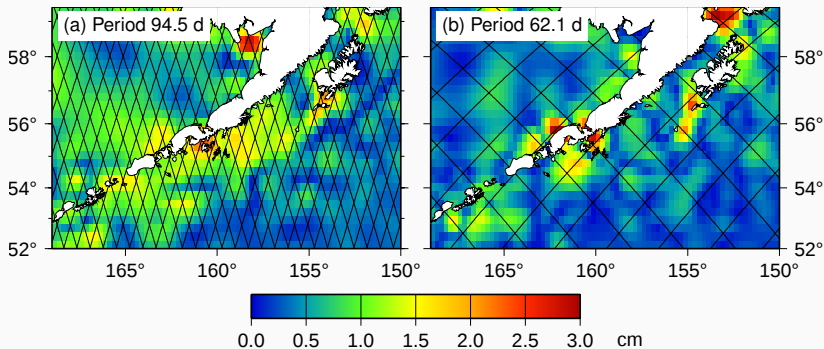
Edward D. Zaron, Portland State University

September 27, 2018

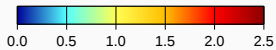
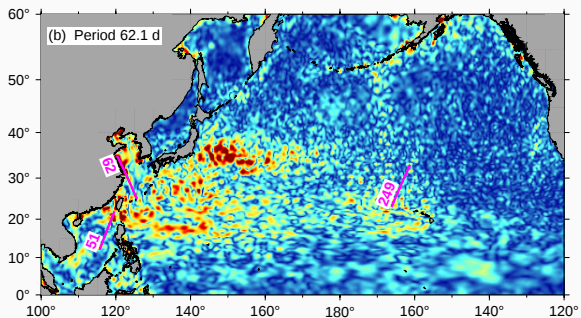
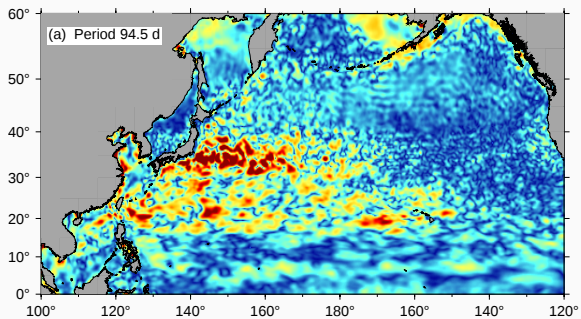
OSTST Meeting

Ponta Delgada, Azores, Portugal

Introduction



Harmonic analysis of mapped SLA finds phase-locked signals at the tidal aliases. (R. Ray)

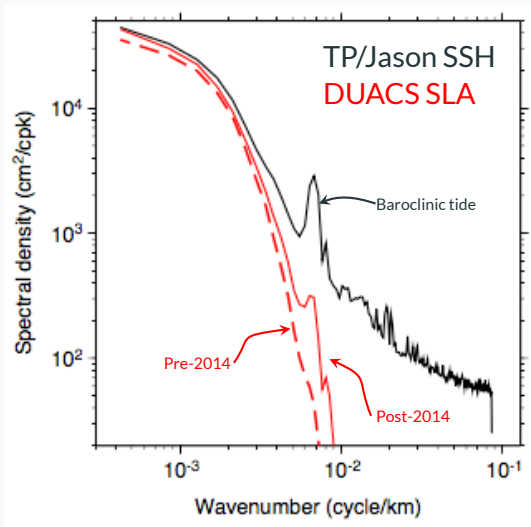


Outline

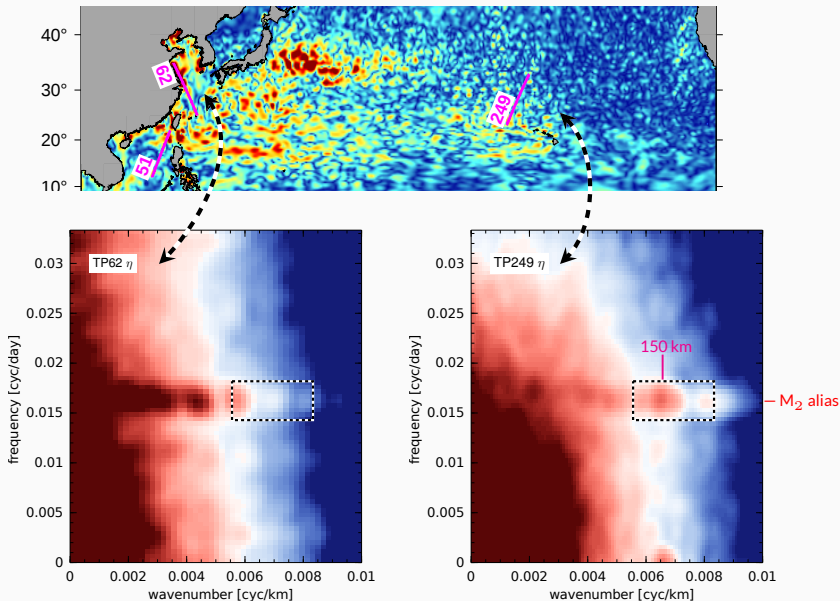
1. Tidal signals are both baroclinic (in open ocean) and barotropic (in coastal regions).
2. Filtered products have been created to reduce the tidal contamination.
3. Investigate accuracy of filtered products by comparison with *monthly mean sea level* from tide gauges.

Significance? Mostly of concern for studies of internal tides or high-frequency processes (where DUACS SLA is used as a correction).

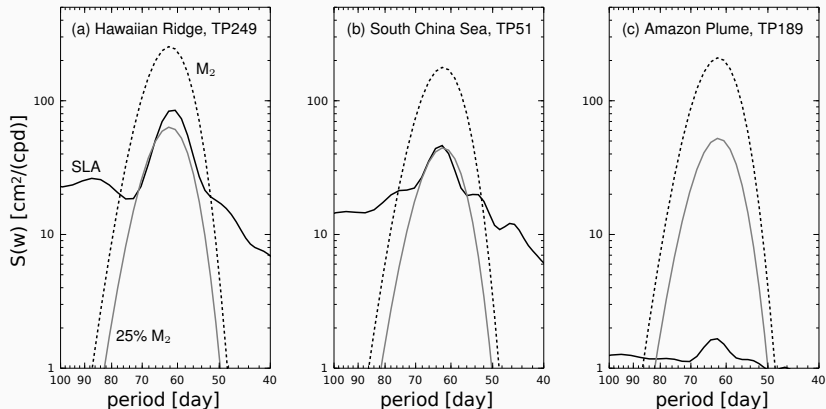
Wavenumber Spectra



Wavenumber–Frequency Spectra of DUACS Mapped SLA



More Examples: frequency spectra at baroclinic tide wavelength



Dashed line: M_2 from empirical baroclinic tide model

Thin solid line: 25% of M_2

Thick solid line: DUACS mapped SLA

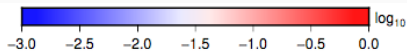
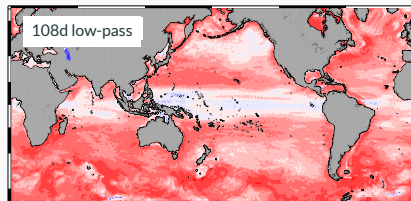
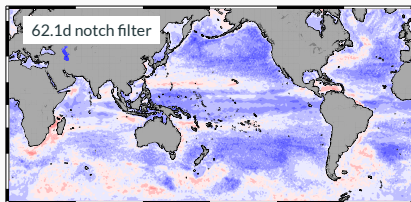
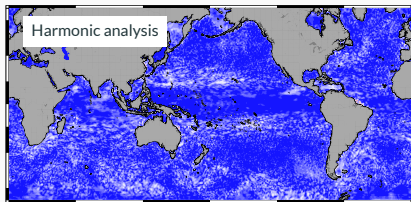
Filters to remove the tide from mapped SLA

Experiments with filters to remove tidal SLA:

1. Harmonic analysis at 62.1d and 94.5d aliases.
2. Notch filter at 62.1d.
3. Low-pass time filter (108d half-power point).
4. Combined space and time filter (108d, 200km).

See forthcoming JTech article for details.

Filters: fraction of variance removed



- Harmonic analysis: < 5%
- Notch filter: 1% to 10%
- Low pass: 5% to 50%

Filters remove a significant amount of SLA variance, but they improve agreement with tide gauges.

Comparison with PSMSL monthly mean sea level

591 PSMSL stations with 10yr or more of monthly sea level data during 1993–2018, within $\pm 50^\circ$ latitude.

Example: Lusi

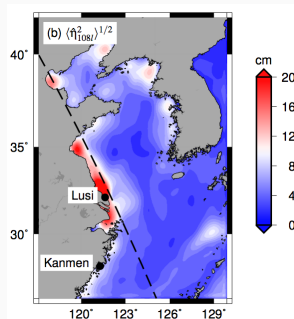
PSMSL variance = 219cm^2

Δ^2 w.r.t. mapped SLA variance = 377cm^2

Δ^2 w.r.t. filtered SLA = 136cm^2

Considering all stations, the median agreement of *monthly mean sea level* is improved by only 1cm^2 .

See forthcoming JTech article for details.



Summary

1. Tidal variability (both phase-locked and broadband) is present in the SSALTO/DUACS SLA maps.
2. The tidal signals are larger in the post-2014 processing products as compared with pre-2014 products.
3. The baroclinic tidal signal is generally small, ± 1 cm.
4. Filtering can reduce the tidal signals, and it improves SLA agreement with PSMSL *monthly mean sea level*.

Open questions:

- How has tidal contamination varied over time w.r.t. the altimeter constellation?
- Internal tide models are available for corrections prior to mapping. Do these reduce the tidal contamination significantly?