# Non-Stationary Tides Inferred from Along-Track Altimetry

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Question: How much internal tide variance is missing from internal tide models based on analysis of long records?

## **Example: Spectra for Southeast Atlantic**



- Remove barotropic tides, non-tidal mesoscale, and coherent tides
- Compute spectrum of residual

## **Example: Spectra for Southeast Atlantic**



- Identify the bandwidth of the internal tide
- Subtract a model of the broadband continuum
- Integrate across the bandwidth

## Where is the Spectral Bump Visible?



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## Coherent and Incoherent Internal Tide [rms cm]









## **Ratio of Incoherent to Total Semidiurnal Variance**



Not plotted where total variance is less than twice the standard error of the coherent  $M_2$ .

#### Summary

- After removing the barotropic tide, the large-scale mesoscale SLA, and the coherent internal tide, the incoherent (i.e., non-stationary) mode-1 semidiurnal internal tide is evident in the along-track power spectrum at many locations.
- Quantitative measures of the incoherent tide are influenced by the choice of bandwidth and model for the broadband non-tidal spectrum.
- The incoherent internal tide is spatially variable, but in much of the Tropics it is as large or larger than the coherent internal tide.
- Mean peak-to-peak incoherent tidal contamination of SWOT ought to be less than 1.4 cm, but in some regions it will be as large as 3 cm.

## Backup Slide #1



Sea-level variability (rms, centimeters) obtained by integrating the wavenumber power spectrum,  $S_0(k)-S_\epsilon$ , from k=0 to  $k=k_\epsilon.$ 

# Backup Slide #2



The white noise level of the altimeter spectra (rms, centimeters). Oceanic regions with noise off scale, below 1.75 cm, are too close to land or contain too few data to reliably determine the wavenumber power spectrum.



The standard error estimate ( $\sigma_{M2}$ , in centimeters) of the M<sub>2</sub> harmonic constant obtained from the harmonic analysis.



The absolute vector error (centimeters) of the  $M_2$  harmonic constants as determined by differencing independent estimates from ascending and descending orbit tracks.