AN ASSESSMENT OF MULTIPLE WESTWARD PROPAGATING SIGNALS IN SOUTH PACIFIC SEA LEVEL ANOMALIES

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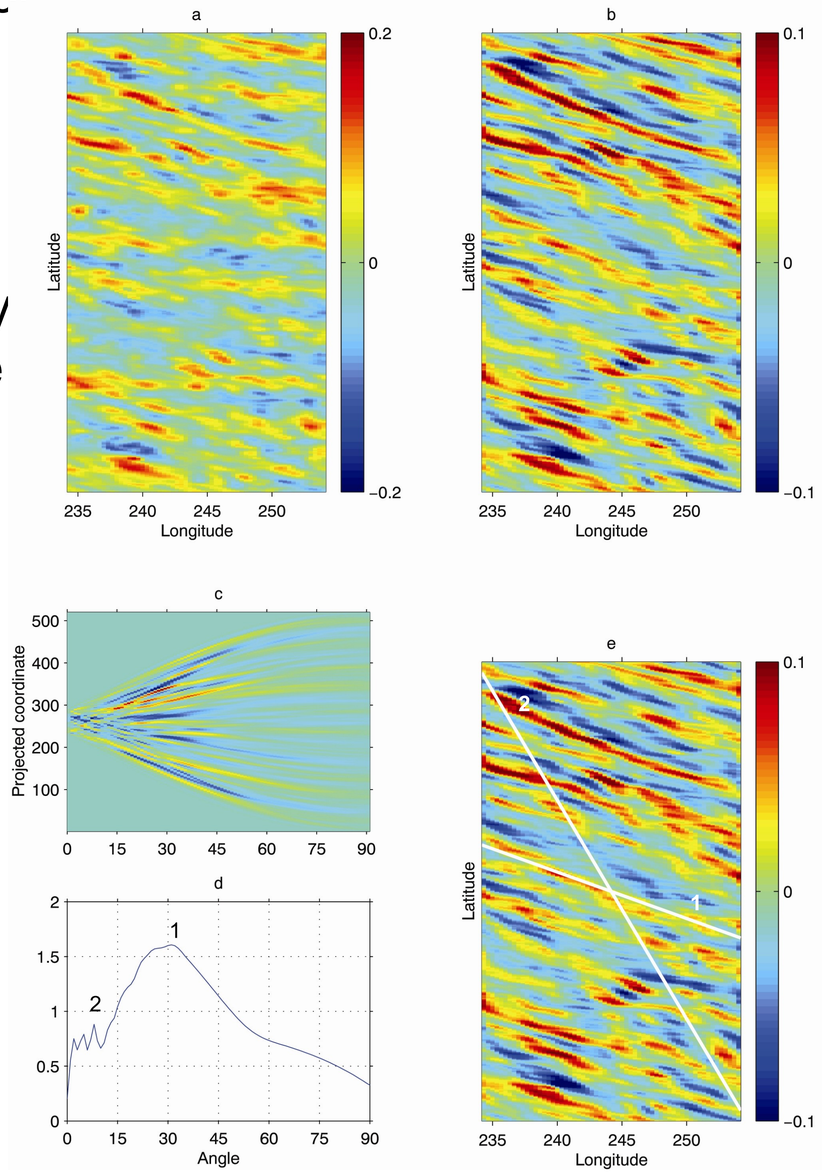
Introduction: This study examines the prevalence and characteristics of multiple westward propagating signals in the South Pacific sea level anomalies (SLA) between 10°S and 50°S using the two-dimensional Radon Transform (2D-RT). Our main hypothesis is that multiple propagating signals detected in the SLA are most likely to be the signature of the first few baroclinic Rossby wave modes. We test this by comparing the estimated phase speeds of the 2D-RT peaks against the first four baroclinic mode Rossby wave speed predictions from the Extended theory.



Stages of the data processing and method (case example):

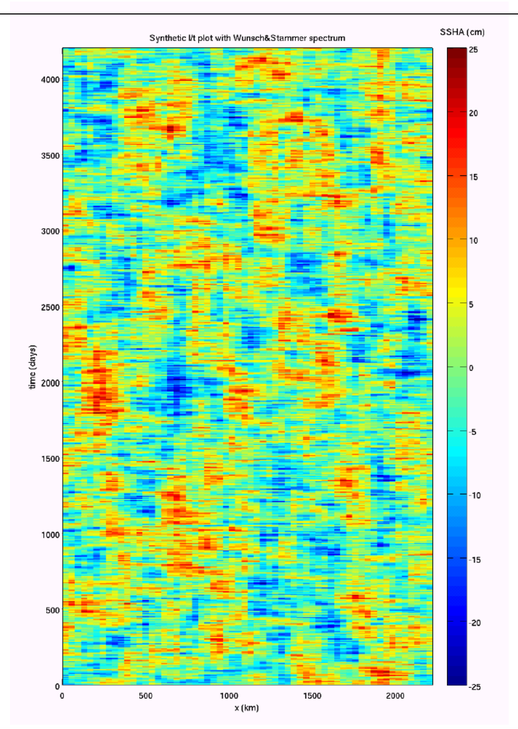
(a)Hovmoller plot of the SLA (m) centred on 30S, 224E

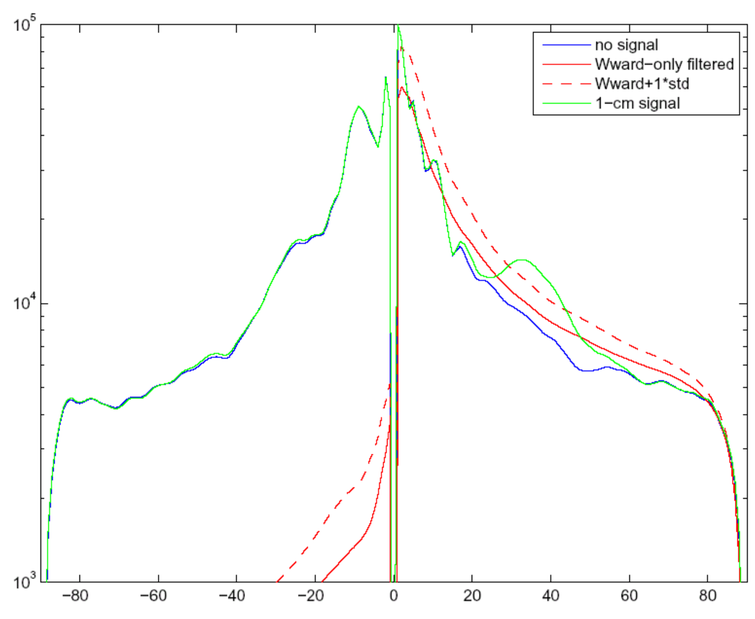
(b) same plot filtered for westward propagation only

(c) Radon energy over a range of angles

(d) standard deviation of the Radon energy and

(e) plot b with two peak angles of propagation detected by the RT.

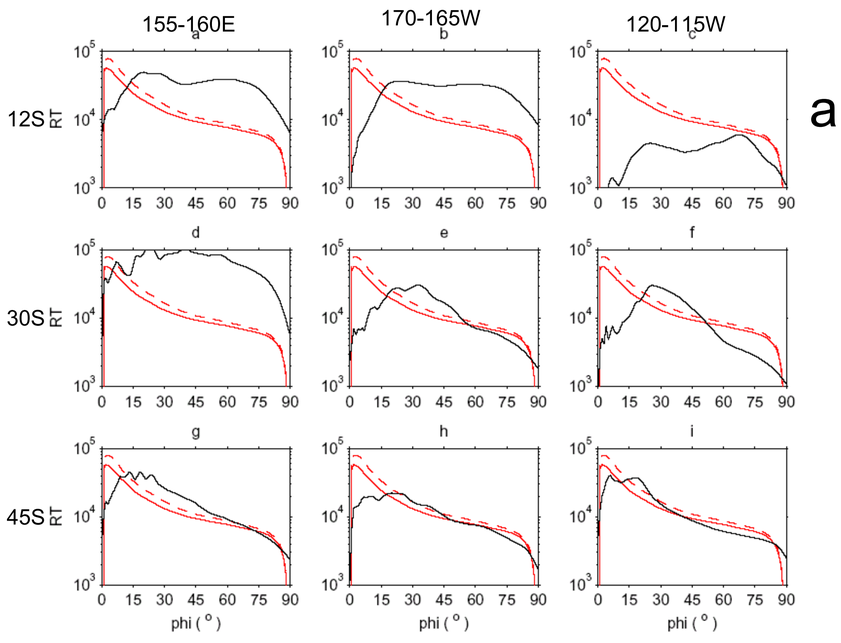




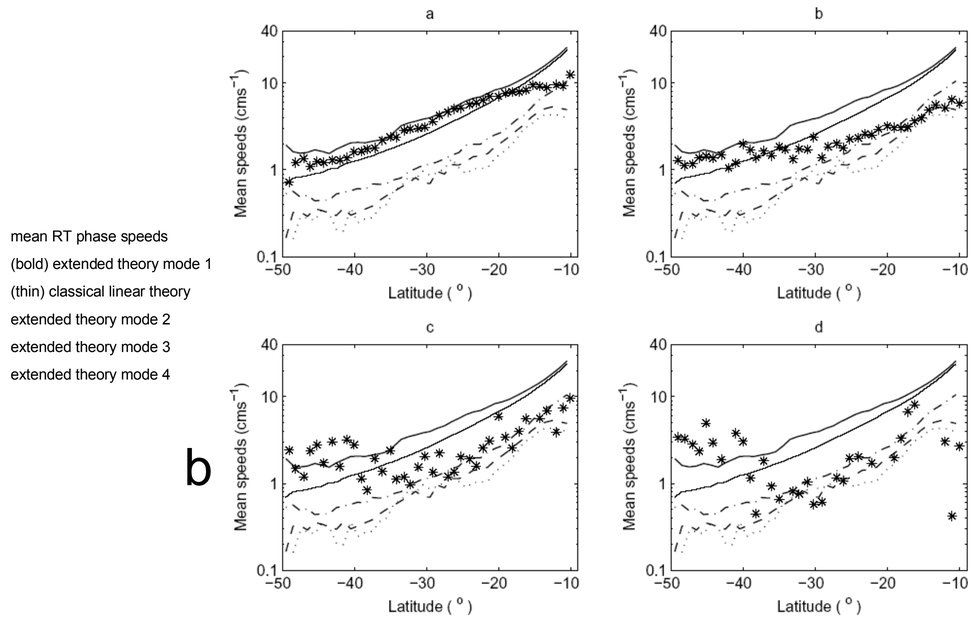
Peak Screening: To determine whether the peaks found by the RT analysis are significant (i.e., whether the signal is real) we set a threshold based on a mean "reference" spectrum for the global ocean. This is based on a global frequency wavenumber spectrum of global temporal variability from TOPEX/POSEIDON (Wunsch and Stammer 1995). Peaks must lie more than one standard deviation above the threshold to pass.

Results:

a) RT variance for westward-only signals for nine case studies across the South Pacific (black). The red line denotes a "reference" variance for the ocean



a



b

b) Comparison of the Killworth and Blundell (2003a,b) extended theory baroclinic Rossby wave phase speed estimates against peaks 1-4 (a-d) from the RT analysis.

Conclusion: Regional variability in the spectral characteristics of the peaks suggests that different dynamical regimes dominate the east and west side of the South Pacific basin. We conclude that the first and second peaks are most likely to represent the signature of long Rossby waves, but the dynamics behind subsequent peaks is unclear.

References: Killworth and Blundell (2003a) Long extra-tropical planetary wave propagation in the presence of slowly varying mean flow and bottom topography. I: the local problem, J. Phys. Oceanogr., 33, 784-801.

Killworth and Blundell (2003b) Long extra-tropical planetary wave propagation in the presence of slowly varying mean flow and bottom topography. II: ray propagation and comparison with observations, J. Phys. Oceanogr., 33, 802-821.

Wunsch and Stammer (1995) The global frequency-wavenumber spectrum of oceanic variability estimated from TOPEX/POSEIDON altimetric measurements, J. Geophys. Res., 100 (C12) 24895-24910.