Decadal variability off the South American coast: the connection with the modulation of the intraseasonal equatorial Kelvin wave

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Climate trends modify the nature of Tropical Pacific Ocean and atmosphere interactions and consequently have an impact on the El Niño Southern Oscillation (ENSO) characteristics. For instance the abrupt climate shift in the Pacific circulation centred in the Tropics that occurred in the 70s has increased both the average amplitude and frequency of the El Niño events. Associated to the ENSO modulation, the sub-seasonal variability of the equatorial Pacific also experiences change in characteristics. Of particular interest are the intraseasonal and semi-annual equatorial Kelvin waves that transmit energy along the Peru/Chile coast as coastal-trapped Kelvin waves. Due to the nonlinearities of the coastal ecosystem, this high-frequency variability although with a weaker amplitude than the ENSO event itself can have a large impact on the coastal marine resources over long period of time.

In this study we investigate the relationship between the changes in characteristics of the intraseasonal variability along the equator with the one along the coast. In situ data for the equator band (FSU, CAC) and Reanalysis (SODA) are first used to document the low frequency modulation of the intraseasonal variability along the equator, focusing on the (~70) days-1, (~120) days-1, semi-annual and near-annual frequencies. It is shown first that these signals experiences change in vertical structure variability, which consists mostly in a swinging of energy between the first and second baroclinic modes at decadal timescales. Second the near-annual equatorial mode exhibits a change in its dominant period depending on the decade.

In the light of the linear theory for coastal-trapped wave, in situ data for the period 1950-2005 and altimetric data for the period 1992-2005 along the coast (5°S-38°S) are interpreted focusing on particular frequency bands. It is shown that the changes in the dominant period and baroclinic mode energy distribution of the intraseasonal equatorial variability, associated to change in vertical stratification, relates to the changes in coastal variability: In particular, the change in dominant period and vertical structure of the equatorial forcing modifies the critical latitude at which the coastal variability is trapped. It is suggested that such process could explain some observed decadal patterns of the fish abundance off the coast of South-America and Humboldt Current Ecosystem.

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