Abstract View

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Modeling Sea Level During El Niño

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ABSTRACT

We test the hypothesis that sea level variations associated with EL Niño events are a response to wind changes in the central Pacific and that the signal is transmitted to the coast of South America by packets of equatorial Kelvin waves. A linear model is forced by wind stress anomalies composited from six EL Niños occurring between 1951 and 1972 (Rasmusson and Carpenter). Model sea level is compared with similar composites of tidegage measurements from selected equatorial Pacific stations.

Although several vertical modes are included in the calculation, only the two gravest baroclinic modes make significant contributions to the sea level signal. Model results duplicate the pattern and timing of the observed sea level anomalies but amplitudes are systematically low. This is especially true at central and western Pacific stations, and it is suggested that the poor quality of the forcing data may be at fault there. Results at the east provide better support for the theory: in particular, the twin-peaked signal characteristic of El Niño sea-level anomalies is reproduced. The second peak is shown to be a response to the massive collapse of the trades occurring in the middle of the El Niño year and its amplitude is correctly hindcast by the model. The first peak is a response to the weaker wind changes occurring in the boreal fall preceding El Niño; its calculated amplitude is too small. The implication of this discrepancy is that the linear Kelvin wave theory will have to be modified if it is to account for the initial El Niño warning.