Abstract View

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Monthly Mean Sea-Level Variability Along the West Coast of North America

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ABSTRACT

Linear statistical estimators are used to examine 29 years of nonseasonal, monthly-mean, tide-gauge sea-level data along the west coast of North America. The objective is exploration of the structure, and causes of nearshore ocean variability over time scales of months to years at 20 stations from Alaska to Mexico. North of San Francisco, 50–60% of the sea-level variability reflects a simple inverse barometric response to local atmospheric pressure. These inverted barometer effects account for only 10–15% of the variance at stations to the south.

The dominant signal of inverse-barometer-corrected sea level represents a nearly uniform rise or fall of sea level everywhere along the eastern rim of the North Pacific. The interannual aspects of this large-scale sea-level variability are closely related to El Niño occurrences in the eastern tropical Pacific which appear to propagate poloward with phase speeds of ~ 40 cm s^{-1}. Higher frequency aspects of this large-scale sea-level variability appear to represent quasi-geostrophic currents driven by basin-wide scales of wind forcing over the North Pacific.

The nature of local (individual station) inverse-barometer-corrected sea-level variability is examined through a series of statistical models and the results are compared with existing dynamical models. The longshore component of wind stress generally forces a larger response than the onshore component (except in large semi-enclosed basins) but the important dynamical aspects of the wind field appear to be basin wide rather than local. The response is consistent with that expected from Ekman dynamics. An apparent non-barometric response to local atmospheric pressure is shown to partly represent an influence of sea-level anomalies farther south. Efforts to determine the nature of this indirect coupling between local pressure and sea level at stations to the south are somewhat limited by the ability of statistical estimators to accurately isolate the responses of sea level to a number of correlated inputs. However, evidence is presented indicating that part of the apparent non-barometric response is due to longshore wind-stress

forcing at stations to the south. A response 30–50% greater than inverse barometric remains unexplained from Tofino to San Franciso.

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