Abstract View

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Alongshore Coherence on the Pacific Northwest Continental Shelf (January–April, 1975)

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ABSTRACT

During the winter and spring of 1975, current observations were made simultaneously at five locations between Tofino, British Columbia, and Newport, Oregon, a distance of 480 km. Sea level and atmospheric pressure observations were available at three locations alongshore, and wind observations, at four locations. Computed (Bakun) winds were available at 3° intervals. Low-frequency (<0.6 cpd) fluctuations in alongshore current, alongshere wind, and subsurface pressure were significantly coherent over this distance. Forcing by the local wind dominated the response at each location: alongshore current and sea level fluctuations were significantly coherent with the local alongshore wind, and local phase relationships were consistent with phases predicted by the local model of Hickey and Hamilton (1980). The high alongshore coherence observed in the current and subsurface pressure fluctuations is shown to be a result of alongshore coherence in the forcing. i.e., in the wind field, rather than due to the presence of freely propagating shelf waves: 59% of the variance in the alongshore wind field is contained in an empirical orthogonal function whose amplitude is essentially constant alongshore. This eigenfunction is significantly coherent at all frequencies with the first alongshore current eigenfunction which accounted for 67, 89 and 94% of the variance at mid-shelf near 49,47 and 45°N, respectively. Moreover, although alongshore phase differences were too small to he associated with freely propagating waves, at the frequencies where alongshore coherence of the current and sea level fluctuations was strongest, the alongshore phase differences were consistent with local wind forcing. Alongshore *differences* in fluctuations could be directly related to alongshore structure in the wind field, providing independent evidence for local wind forcing: 33% of the variance in alonS5hore current at Tofino (but <5% at other locations) was contained in an eigenfunction that changed sign between 49 and 47°N and was significantly coherent with an alongshore wind eigenfunction with a similar structure. Finally. the seasonal means south of Tofino are shown to he roughly consistent with a dynamical balance between vertically integrated alongshore pressure gradient force and the mean alongshore wind stress.

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