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Sources of Interannual Baroclinic Waves in the Eastern Subtropical North Pacific

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ABSTRACT

Time sequences of XBT observations (1966–79) on the great circle transect from Honolulu to San Francisco are used to investigate the source mechanisms of interannual baroclinic long waves in the eastern subtropical North Pacific. The character of baroclinic long waves is represented by interannual changes in dynamic thickness (100/500 db), computed from the thermal structure information, the latter interpolated to standard locations along the transect (100 km separation), and filtered to remove sub-annual fluctuations. Two source mechanisms are hypothesized to have been important to the generation of these waves, i.e., short-term climatic variability in sea level along the eastern boundary, associated with El Niño (e.g., Chelton and Davis, 1982), and short-term climatic variability in wind-stress curl over the northeast Pacific.

The source mechanism involving sea level variability along the eastern boundary is observed to have dominated the wind-driven mechanism for the region south of 30°N, where short-term climatic variability along the transect had an rms difference of 3–5 dyn cm. North of 30°N, the eastern boundary mechanism is observed to have disappeared, for reasons unknown, replaced by the wind-driven mechanism. Generally, short-term climatic fluctuations in wind-stress curl were intensified near the eastern boundary, so that along the transect, those generated earlier to the east (i.e., 1–2 dyn. cm) were observed to propagate westward at the speed of baroclinic long waves.

Over the latitude band from 24–30°N, “El Niño” signals (1969, 1972, 1974), observed in coastal sea level, were also observed in dynamic thickness along the transect 2–3 years later, having taken that time for the baroclinic long wave to travel from the coast to the transect. These waves were directly associated with the poleward propagation of the El Niño signal by coastally trapped baroclinic Kelvin waves (e.g., Chelton and Davis, 1982). North of 30°N, these waves were locally driven by associated changes in the wind-stress curl regime at these latitudes.

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