Abstract View

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On the Subtropical Frontal Zone North of Hawaii During Winter

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ABSTRACT

Oceanic fronts in the subtropical frontal zone north of Hawaii are investigated and related to atmospheric forcing. Particular attention is paid to the winter of 1974 when a detailed study was made of the thermohaline structure aboard the R.V. *Thomas G. Thompson*. In that winter, well-defined fronts occurred at 34, 31 and 28°N. In the upper 100 m, these fronts are nearly vertical and are characterized by temperature, salinity and sound velocity gradients of up to 2°C $(27\ km)^{-1}$, 0.3‰ $(27\ km)^{-1}$ and 12 m s^{-1} $(27\ km)^{-1}$, respectively. Horizontal density gradients across the northern two fronts are small because of compensating horizontal temperature and salinity gradients. A thin layer of increased stability is encountered between 100 and 125 m. Below this layer, there are prominent lateral intrusions of cool and low-salinity subsurface water under warmer and higher salinity surface water, at latitudes north of 31°N and longitudes east of 155°W. The 0/1500 db dynamic height topography bears no similarity to the configurations of the surface isotherms and isohalines, indicating that surface thermohaline fronts are not determined by the baroclinic flow field. Instead, agreement is found between the subtropical frontal zone and the Ekman confluence zone on long time scales. A warm and saline anticyclonic eddy with large thermohaline gradients around its periphery is found near 29°30′N, 158°W. The mean baroclinic flow in the subtropical frontal zone is ~0.04 m s^{-1} and does not vary with season. Perturbations from the mean flow are up to 0.4 m s^{-1} and vary strongly with season. Aspects of frontogenesis in the subtropical frontal zone are investigated. In the upperlayer, wind-induced differential horizontal advection of the Ekman type leads to concentration of horizontal thermohaline gradients. In the lower layer, differential vertical advection is primarily responsible for the concentration of such gradients.

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