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Existence and Formation Mechanism of the North Hawaiian Ridge Current

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ABSTRACT

Available surface drifter data are analyzed to determine the characteristics of the North Hawaiian Ridge Current (NHRC) and its relation to the ocean circulation around the Hawaiian waters. The NHRC is found to exist as a mean entity along the coasts of the Hawaiian Islands. It originates as a northern branch of westward moving interior flow and flows coherently along the islands at an average speed of 0.10–0.15 m s⁻¹. The NHRC veers westward at the northern tip of the Hawaiian Islands, and its subsequent path is not influenced by the presence of the submerged Hawaiian Ridge. This finding does not support the theory that the NHRC is forced by westward propagating, baroclinic Rossby waves reflecting off the Hawaiian Ridge. Using a 2½-layer reduced gravity model of the North Pacific, it is shown that the mean NHRC is due primarily to the mean rather than the time-varying wind forcing. The NHRC exists due to the imbalance between the interior Sverdrup transport and the net southward transport, constrained by the presence of the Hawaiian Islands. The path and transport of the observed NHRC are found to be consistent with the flow pattern proposed by this theory.

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