Abstract View

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Zonal Velocity Structure and Transport in the Kuroshio Extension

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ABSTRACT

The meridional structure of the zonal flow in the Kuroshio Extension is investigated using a combination of data from hydrographic sections and moored current meter arrays. We emphasize 165°E, between 30° and 42°N, where high quality and very stable current measurements at 150 and 4000 m extend over a two-year period from October 1983 to October 1985. Hydrographic (CTD/O^2) sections were occupied during the initial deployment and a second time when the array of six moorings was reset in 1984. The deep currents were extremely reproducible from one year to the next and revealed a pattern of weak eastward flow at 4000 m under the axis of the Kuroshio with strong westward flow on either flank. When combined with the hydrographic data, the total transport of the eastward flowing Kuroshio Extension was estimated to be 57.0 ± 3.7 Sv (Sv = 10^6 m^3 s^{-1}), essentially the same as when referenced to the broom (57.0 ± 2.0 Sv). South of 34°N, the velocities were westward at all levels, with a net transport of −85.1 Sv; north of 37°N the flow in the upper kilometer was eastward (22 Sv) near the axis of the Oyashio, or subarctic front, and westward elsewhere, yielding a net transport of −34.6 Sv. The net transport across the entire section from 30° to 42°N was westward and equal to −62.7 ± 12.3 Sv.

New methods of estimating transport when combining direct current and hydrographic data are illustrated where compatibility with dynamic height estimates is required. Observations of dynamic height variability across the 165°E array using the current meters suggested that the mean currents at 4000 m were consistent with the dynamic height range observed hydrograpically. However, the yearly averaged velocities al 150 m under-sampled the eastward upper level flow. Results are also compared to previously published work at 152°E and with the new data at 175°W. At 152°E, previous estimates of zonal transport over a similar latitude range yield −31 ± 16 Sv when current meter and hydrographic date were combined; our study suggests −31 ± 31 Sv. The section-averaged zonal transport changes sign across the Emperor Seamounts, becoming positive at 175°W, where the hydrographic and yearly averaged array data are totally consistent.

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