Abstract View

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Horizontal and Vertical Structure of the Gulf Stream Velocity Field at 68°W

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ABSTRACT

A curent meter mooring, instrumented from the bottom into the thermocline, was deployed in the Gulf stream at 68°W for a year. Data from the uppermost instrument indicate the Gulf Stream moved back and forth across the mooring site, so that the horizontal as well as vertical structure of the Stream may be deduced. The two key points to the success of the analysis are: 1) the well-defined relationship between temperature and cross-stream distance in the thermocline, enabling the use of the former as a horizontal coordinate; and 2) a daily-changing definition of Gulf Stream flow direction based on the shear between the thermocline and 2000 m depth. Time-series of daily-rotated velocities may be used to calculate empirical orthogonal functions for the along- and cross-stream vertical structures, which are decoupled and are respectively baroclinic and barotropic. Using the inferred horizontal coordinate one can estimate masss, momentum and kinetic energy fluxes agree well with historical data. Bryden's method has been used to calculate vertical velocities from the temperature equation; the resulting time-series of *w* are visually coherent throughout the water column and their vertical amplitude structure looks like that of a first baroclinic mode. The rms vertical velocities are large [O(.05 cm s^{-1})], and these as well as other estimates have been used to explore the validity of the quasi-geostrophic approximation at the mooring site. The Rossby number for the thermocline flow is about 0.3, and for the deep flow is $\leq$ 0.1.