Abstract View

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Horizontal Divergence and Vorticity Estimates from Velocity and Temperature Measurements in the MODE Region

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ABSTRACT

Estimates of horizontal derivatives of velocity made by differencing velocity measurements are used to show that the observed velocity field due to low-frequency mesoscale motions during the preliminary Mid-Ocean Dynamics Experiment (MODE-0) field program is horizontally nondivergent within estimated errors. The errors in horizontal derivatives of 0.15×10^{-6} s^{-1} art are too large for direct estimates of horizontal divergence to be made accurately. The vorticity, however, can be estimated from these horizontal derivatives with an error small compared with its magnitude. Over the measurement period of 50 days, the advection of planetary vorticity balances only one-half of the local change of vorticity so these observations cannot be explained in terms of barotropic Rossby waves alone. There are indications that vortex stretching, estimated from a linear heat balance, may balance the remaining local change of vorticity as expected for baroclinic Rossby waves. Based on other measurements in this regions, however, it is likely that the horizontal advection of relative vorticity is also important in the vorticity balance. A positive, but not significantly different from zero, correlation between estimates of relative vorticity and advection of planetary vorticity suggests that the enstrophy of the observed velocity field is decreasing with time. In conjunction with a similar result for the perturbation potential energy obtained in this region, this result supports the view that the MODE region is a region of decay, rather than growth, of the low-frequency mesoscale motions.