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An Objective Analysis of the POLYMODE Local Dynamics Experiment. Part II: Streamfunction and Potential Vorticity Fields during the Intensive Period

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ABSTRACT

An analysis is made of the geostrophic streamfunction, potential vorticity and dynamical balances for the mesoscale flow during the intensive Period of the POLYMODE Local Dynamics Experiment. The methodology is Objective analysis based upon three-dimensional, anisotropic covariance functions and an expansion in the vertical modes of linear theory. The flow field during the Intensive Period is highly anisotropic in both vertical modes. The barotropic mode behaves as a propagating wave with significant rotation in the latter part of the period; its dynamical balances are substantially linear except at the time of the rotation, when there is also a transfer of energy from the first baroclinic mode. The baroclinic flow exhibits a frontogenetic intensification into a strong jet due to straining of an initially large-scale baroclinic flow by the barotropic wave, together with some aspects of phase propagation as well. The baroclinic modal dynamical balance has identifiable linear contributions, but they are relatively weak compared to the nonlinear terms, in contrast with the barotropic model balance. Comparisons are made with MODE analyses and various calculations of homogeneous, geostrophic turbulence.

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