



Transverse and streamwise vertical motions and their respective roles in the mid-latitude cyclone life cycle

J. Martin

Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison,
Madison, Wisconsin USA 53706

The quasi-geostrophic vertical motion is partitioned into components transverse and streamwise to the tropospheric thermal wind shear in order to examine the roles of each mode of vertical motion in the mid-latitude cyclone life cycle. It is demonstrated that the streamwise vertical motion, physically associated with rotation of the potential temperature gradient vector, is the predominant cyclogenetic mode as it generates vortices along the baroclinicity which serve to produce thermal waves. The transverse vertical motions, associated with changes in the magnitude of the potential temperature gradient vector, are associated with the fronts and jet streaks that characterize the cyclone. The evolution of these two modes of vertical motion throughout the life cycle of a powerful winter cyclone that affected Central Europe from 18-20 November 2004 is shown in an effort to offer a novel conceptual perspective on the dynamics of the cyclone life cycle.