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Effects of stable stratification on the elliptic instability in vortex pairs KEIKO NOMURA, LAURA BRANDT, JAMES ROTTMAN, University of California, San Diego — The effects of stable stratification on the dynamics of both counter-rotating and co-rotating vortex pairs are studied using direct numerical simulations. Here, the vortices are oriented horizontally in a vertically stratified fluid. In particular, we are interested in the three-dimensional elliptic instability that may occur in these flows and the two-dimensional dynamics that influence its development. The instability is associated with the ellipticity of the streamlines due to the strain induced by one vortex on the other and results in an antisymmetric sinusoidal deformation of the vortex cores. In the case of the counter-rotating vortex pair, for weak to moderate stratification, the primary effect of stratification is to reduce the vortex separation distance which enhances the mutually induced strain. Consequently, the instability has an earlier onset and higher growth rate but otherwise develops the same as in unstratified flow. For strong stratification, the baroclinic vorticity detrains fluid from the primary vortices and significantly alters the instability. In the case of the co-rotating vortex pair, the two-dimensional merging process is a dominant aspect of the flow evolution. For weak to moderate stratification, baroclinic torque assists merging thereby impeding the development of the instability.

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