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THE EFFECTS OF SHEAR AND ROTATION ON THE EVOLUTION OF LINEARIZED PERTURBATIONS IN A DOUBLY DIFFUSIVE CONVECTIVE INSTABILITY

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Abstract

The stability problem of a linear horizontal stratified shear flow in an unbounded rotating fluid is investigated within the framework of WKBJ approximation. The asymptotic solutions of the system are found both in the presence and absence of the diffusivities. It is found that, in the absence of dissipation the linear shear eventually causes hybrid rotating gravity waves to decay algebraically. The effect of shear is to shorten the vertical length scale. Hence with the addition of even small diffusivity, dissipation is strongly stabilizing and all the modes eventually collapse exponentially, generally at a fast rate even in the presence of rotation. When the fluid is bounded by horizontal planes, the stability criterion is obtained using nonlinear energy method (Liapunov method). It is observed that the linear shear and rotation decreases the stability of the system.

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