AN EXACT SOLUTION OF LINEARIZED BAROCLINIC STABILITY IN NON-HYDROSTATIC EQUILIBRIUM

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The governing equations for the geophysical problem of linearized flow through a thermal wind in an inviscid, stratified, rotating system are reduced to one second order differential equation from modified Eady's model [1]. As P.H. Stone we examine deviations of vertical motions from equilibrium in order to present an analysis of how non-hydrostatic conditions can be affected by various kinds of instabilities will arise in a baroclinic zonal flow [2] .

Under these conditions the stability properties of the flow are determined only by two parameters so as to the Richardson number Ri may be expressed following of the Rossby number Ro linked to the aspect ratio H/L as $\delta = \dfrac{HL}{\mathrm{Ro}}$.

The later parameter may be considered as a measure of the deviation from hydrostatic equilibrium $\delta = 0$ defining Eady's model studied previously by P.H. Stone [2, 3].

This work is motivated by the objective to obtain an exact solution in the linearized analysis taking into account of the influence of δ.

With the help of a particular solution we derive a general solution to provide some exact numerical results as a testing case for solution based on other approximate technique in concerned literature [3]–[6].

It is shown that such deviations $\delta \neq 0$ decrease the growth rates σ of all three kinds of instabillity which can appear: geostrophic–baroclinic instability GBI, symetric instability SI and Kelvin–Helmholtz instability KHI. The effect of δ is discussed according to the evolution of σ against zonal wave-number λ for geostrophic instabilities (hydrostatic) from $\delta = 0$ to different values of δ as Ri increase (non-hydrostatic conditions).

To conclude, the above results may now be grouped together following the different regimes of instability (GBI, SI and KHI) which can occur for different values of the two major parameters Ri and δ.

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