CHEMICAL EFFECTS ON ECOLOGY IN MESOSPHERIC DYNAMICS AND APPLICATIONS

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ABSTRACT

The joint interactions of hydrodynamics, radiative transfer and photochemistry destabilize a hydrodynamic system that would otherwise stable. This observation is of important interest in itself. In this paper, the stability of baroclinic, axially symmetric vortex on an f-plane to axially symmetric disturbances is studied. It is found that with photochemistry and radiative transfer disturbances are unstable regardless of the value of the Richardson Number. The growth rates under conditions relevant to the mesospheric dynamics and applications are, however, very small.

KEYWORDS: *Stability, Photochemical and Radiative process, disturbance, axially symmetric.*

I. INTRODUCTION

In this paper we deal with the stability of a zonal vortex to an axially symmetric disturbance. As per Eady [1] and Kuo [2], in case of adiabatic motion the condition for stability is

$$\frac{1}{f}\left(f-\frac{\partial u}{\partial y}\right)\frac{\frac{g}{T}\left(\frac{\partial T}{\partial z}+\frac{g}{c_p}\right)}{\frac{\partial y^2}{\partial x}} > 1 \tag{1.1}$$

where $\frac{\frac{g}{T}\left(\frac{\partial T}{\partial z}+\frac{g}{c_p}\right)}{\frac{\partial y^2}{\partial x}}$ is the Richardson number and f=2Ω where Ω is the vertical component of the earth's rotation rate. Condition (1.1) indicates that the earth's atmosphere is generally stable .It therefore appears that symmetric meridional motions, where they exist, must be drawn by external heat or momentum sources. Several Researchers (like Eliassen [3], Leovy [4] and Kuo [2], Steven [5], David.et.al [6] and Richard [12]) have studied such driven systems. The sources in these studies are usually taken to be fixed and unaffected by the circulations they drive, which results from the need for advections to maintain a steady state in the presence of these fixed sources and sinks.

In the present study, heat sources, resulting from perturbations in ozone and temperature, are not fixed, but are homogeneous functions of the perturbation velocity. We assume density variations to be negligible except where they are associated with gravity. Our equations are linear in the perturbation and coefficient function of the basic fields. We are restricted to disturbances whose vertical scale is small compared to the scale –heights for the various coefficients. The accuracy of the results of this paper is obtained by the help of MATLAB Simulation setup.

The paper has been devided into sections: stability with respect to axially symmetric disturbances - adiabatic case, Stability with respect to axially disturbance with photochemistry and radiative transfer, Influences of Vertical inhomogeneities, results and discussions, conclusion and future work.