Some observations for Gravity waves in Mesosphere Region

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Abstract*- A new and general model of gravity waves propagating in the mesospheric thermal duct has been prepared and its analysis has been obtained in detail. Analytic eigenfunctions, dispersion equations and dispersion relation are derived. Wave structures of different wave modes are considered separately due to their different velocities in the duct layer. It has been concluded that characteristics of the gravity wave in certain thermal duct is primarily obtained by the initial horizontal wave number.*

Keywords*- Gravity waves, Mesospheric atmosphere, Thermal duct, Mode analysis, Numerical simulation*

I. INTRODUCTION

The analysis of gravity wave propagation is the most important aspect in the mesospheric thermal duct. Its influences on atmospheric circulations, structures, and variability are remarkable. When propagating in the atmosphere, gravity waves are ducted within a narrow height range by any one of the following :(i) gradient in the brunt frequency (ii) wind shear or by both in special case.Chimonas et.al have observed that ducts where wave trapping is caused primarily by wind gradients are Doppler ducts, while that wave trapping is caused primarily by gradients of Brunt frequency are thermal ducts [4-6].Meriwether et.al have observed that studies also show that stable thermal ducts always occur at places where temperature varied intensely with altitude, such as the lower thermosphere and the stratospheric region, yet those Doppler ducts induced by wind shears usually exist locally for a short time [7-11].

In this paper the linear theory of trapped gravity waves within a mesospheric thermal duct and numerical dispersion relations are discussed. Numerical simulations of ducted gravity waves are obtained.

II. WAVE MODE ANALYSIS

In this paper, application field of ducted wave model is extended to mesospheric height. In this case vertical distribution of Brunt frequency in a mesospheric thermal duct is:

$$N^2(z) = N_0^2, \qquad z - z_0 < h \qquad (1)$$

$$N^2(z) = N_1^2 < N_0^2, \qquad z - z_0 > h \qquad (2)$$

Where z is vertical coordinate, z_0 is center height of the thermal duct and h is the half width of duct. The distribution of Brunt frequency in Eq. (1) is symmetric about the altitude of z_0 and Brunt frequency is N_0 inside the

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