SOME THEORETICAL ASPECTS OF MOUNTAIN WAVES

AND

THEIR OBSERVED FEATURES OVER INDIAN REGION

by

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THESIS

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CERTIFICATE

This is to certify that the thesis entitled "Some Theoretical Aspects on Mountain Waves and their Observed Features over Indian Region", being submitted by Air Commodore N. Natarajan for the award of the degree of DOCTOR OF PHILOSOPHY, is a record of the original bona fide research work carried out by him. He has worked under our joint guidance and supervision and has fulfilled the requirements for the submission of this thesis. The results presented in this thesis have not been submitted in part or full to any other University or Institute for the award of any degree/diploma.

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A B S T R A C T

The contents of this thesis have broadly been divided into 3 parts :

1. Analytical studies related to the linear lee-wave solutions with real and complex resonance modes.
2. Numerical study for the development of a reversed flow in a shallow valley.
3. Observed features of lee-wave clouds over Indian region and the utility of a nomogram for their prediction.

The significance of low level wind shear has been investigated in detail and an analytical solution to quantify the effects of surface wind shear is arrived at (Chapter 2). In Chapter 3, the effects of release of latent heat on lee-waves have been studied and their effects in both hydrostatic and non-hydrostatic cases are discussed. A more generalised model for linear lee-wave studies is presented in Chapter 4 yielding a solution for the entire spectrum of resonance modes. The results have also been compared in a few cases with satellite observations. Chapter 5 provides a comparatively easy method to arrive at the leaky modes generating waves extending to stratosphere and decaying downstream.

Using Pielke's meso-scale numerical model, the details of flow across a shallow valley are examined in Chapter 6 and the resulting reversed flow across the valley is discussed.

The lee-wave cloud imageries over the Indian region are studied for a period of 4 years and the emerging sequence of the wave zones is presented in Chapter 7. Chapter 8 provides a nomogram that can be used by the forecasters for the prediction of lee-waves over Jammu and Kashmir region.

C O N T E N T S