

**SOME THEORETICAL ASPECTS OF MOUNTAIN WAVES  
AND  
THEIR OBSERVED FEATURES OVER INDIAN REGION**

*by*

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**THESIS**

for the award of the degree of

**DOCTOR OF PHILOSOPHY**

*Submitted to :*

**Centre for Atmospheric Sciences  
Indian Institute of Technology  
Hauz Khas, New Delhi-110016**

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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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## ACKNOWLEDGEMENT

The work described in this Thesis was carried out at the Centre for Atmospheric Sciences, Indian Institute of Technology, Delhi under the joint supervision of Dr. U.C. Mohanty and Professor M.S. Sodha. The author is greatly indebted to them for their valuable guidance and encouragement throughout the course of this work.

In addition, the author is extremely grateful to Professor M.P. Singh, Professor of Maths. and Head, Centre for Atmospheric Sciences, I.I.T., Delhi for his untiring encouragement, invaluable interaction and thought provoking discussions all through the period of this work.

The author gratefully acknowledges the Ministry of Defence, Government of India, for according their sanction to pursue this intensive research work at I.I.T. Delhi and at the Imperial College of Science and Technology, London. The author is also grateful to the Government of U.K. for the grant of fellowship under the Indo-U.K. Technical Co-operation Training Programme, for one year during 1985.

The illuminating discussions with Prof. R. S. Scorer, Dr.F.H. Berkshire (both from the Imperial College, London), Air Vice Marshal S. Lakshminarayanan, AVSM, (Retd.), Air Vice Marshal R. K. Mathur, Sqn. Ldr. P. Kumar, Dr. N. Padmanabhan and Dr. N. Ramanathan were of immense value for which the author remains grateful to them.

The assistance provided by JWO Harish Chander Gautam (IAF) in computational work, and by Shri P.M. Padmanabhan Nambiar in the meticulous typing of this thesis, are equally valuable and the author acknowledges their help with thanks.

Institutional support provided by the India Meteorological Department and Aeronautics Research & Development Board, Ministry of Defence (R&D), Government of India is gratefully acknowledged.

Sincere thanks are definitely due to vasanthi, my wife, for her immense tolerance and encouragement, and for maintaining cheer at home all through.

Air Commodore N. Natarajan

## 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.

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