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THE COMPOSITION OF THE UPPER ATMOSPHERE

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BY

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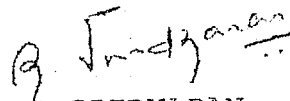
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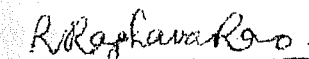
DEDICATED  
TO  
THE MEMORY OF  
PROF. J. S. SHIRKE

C E R T I F I C A T E

I hereby declare that the work presented in this thesis is original and has not formed the basis for award of any degree or diploma by any University or Institution.

  
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5 MAY 1983

## STATEMENT

The present study on the ion and neutral composition of the equatorial ionosphere is based on the results obtained from the insitu measurements of composition and electron density over Thumba. Evolving out of a collaborative programme between the then Hydrometeorological services (now SCHCNE), Moscow and the Physical Research Laboratory these measurements form one of the first such systematic study of the equatorial atmosphere. The data from insitu measurements have been used to delineate the day to night and day to day variabilities of the relative ion and neutral composition. The important role played by dynamics in the maintenance and redistribution of ionization is demonstrated. Joule heating of the eastwest current is shown to be significant in enhancing the electron temperatures over that of the neutrals. The validity of simple photochemical theory during night and early morning hours is studied and shown that it is inadequate without transport terms, in order to explain some of the observed features in minor constituents.

The author has played a key role in the development of radio-frequency mass spectrometers in Physical Research Laboratory. He had been actively participating in the fabrication, integration of the sensor and had developed the necessary vacuum techniques and facilities for the

testing and calibration of the same. He had involved himself in the development of the necessary electronics for the radio frequency mass spectrometer, and also in the integration of the payload and preflight checks. He had taken part in conducting the campaigns and in the analysis and interpretation of the data, initially under (late) Prof. J. S. Shirke and later under the guidance of Prof. R. Raghavarao.

This thesis, consisting eight chapters, starts with an introduction to the field of composition measurements. Chapter I deals with the instrumentation built by the author in the course of this study. Chapter 2 deals with the night-time ion composition results and the important role of dynamics. Chapter 3 contains discussions on the relative ion composition during day time and early morning hours. Chapter 4 deals with relative neutral composition, their variations, and delineates the important role of turbopause height in effecting such variations. Chapter 5 essentially contains the results of simultaneous measurements of neutral composition from equatorial and mid latitude stations. Chapter 6 deals with the variabilities of NO, one of the important minor constituent in the D & E regions as derived from the ion composition data revealing the inadequacy of the assumption of photochemical equilibrium. Chapter 7 deals with metallic ions and their

possible role in the formation of sharp ion layers in the equatorial E-region and the generation and maintenance of density irregularities.

The important conclusions arrived at from the present study are listed in Chapter 8.

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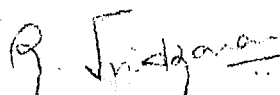
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