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D E D I C A T E D

TO

THE NEAR AND DEAR ONES

CERTIFICATE

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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Satya Prakash

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STATEMENT

The work presented in this thesis was carried out by the author at Physical Research Laboratory, Ahmedabad, India, under the guidance of Prof.Satya Prakash.

The studies presented in this thesis can be broadly classified under two heads, namely, theoretical - pertaining to the interaction of gravity wave winds with the ionospheric plasma, and experimental - for the measurements of electron density and electric fields in the equatorial E region. The author has actively participated in designing, fabricating and testing of the payloads for the aforesaid experimental studies. He has also actively participated in the rocket launchings from Thumba Equatorial Rocket Launching Station (TERLS), India.

The electric field payload and the probe system used for the measurements of electric fields uses many novel ideas. The mutual admittance probe (MAP) system used for the measurement of electron density was an improved version of the system used earlier by Prakash and his colleagues.

Although it is generally believed that the low-latitude dynamical processes are controlled by the neutral dynamics, understanding of such a control is far from satisfactory. Thus the theoretical studies were made to assess the effects of the

gravity waves in the ionosphere in generating the electric field, currents and the ionization irregularities.

Experimental studies were aimed at measuring the ambient parameters, like the electric fields and electron density, of the E region plasma. The electron density measurements included the intercomparison of various techniques for such measurements. Such a comparison has not been attempted earlier. The electron density irregularity measurements by Prakash and his colleagues point toward the presence of small scale electric fields. However, fluctuating vertical electric fields at the equator have not been measured earlier.

The chapterwise breakup of the thesis is as follows. In chapter I, a brief account of various important processes in the upper atmosphere is given. Emphasis is more on the dynamics of the neutrals and charged particles as these are relevant to the studies in the subsequent chapters.

In chapter II, we have developed a three dimensional model for the interaction of gravity wave winds with the ionospheric E region plasma. The interaction effects in localised regions alone are considered in this chapter. The subject of mid latitude and equatorial sporadic E is also reviewed briefly.

Generation and transmission of small scale electric fields due to the gravity wave winds under a variety of situations is discussed in chapter III. Such studies have not been carried out earlier.

The spread F irregularities are discussed in chapter IV. A new mechanism for the production of large scale ionization irregularities is presented, which is based on the results of studies carried out in chapter III.

Chapter V is devoted to the experimental studies for the measurements of electron density and electric fields as discussed above.

Summary of the studies carried out in chapter II through V is given in chapter VI. The direction of future research is also given in this chapter.

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