CONTENTS

PREFACE                     i
LIST OF PUBLICATIONS        v

1.  INTRODUCTION

1.1. Atmosphere and its Dynamics
1.2. Composition of the Atmosphere
1.3. Vertical Structure of the Atmosphere
1.4. Radiative Processes
1.5. Thermal Equilibrium in the Atmosphere and Atmospheric Motions
1.6. Atmospheric Waves
1.7. Equatorial Waves
   1.7.1. Theoretical Understanding of the Equatorial Wave Characteristics
      1.7.1.1. Atmospheric Kelvin Waves
      1.7.1.2. Rossby Gravity Waves
   1.7.2. Generation Mechanisms of Equatorial Waves
   1.7.3. Interaction of Equatorial Waves with the Mean Flow to Generate QBO
   1.7.4. Role of Kelvin Wave in the Generation of SAO
   1.7.5. Observational Evidence of Equatorial Waves
1.8. Atmospheric Tides
   1.8.1. Classical Tidal Theory
   1.8.2. Development of More Realistic Models of Tides
   1.8.3. Tidal Interactions
   1.8.4. Nonmigrating Tides
   1.8.5. Dynamic Coupling between the Lower and Upper Atmosphere by Tides
1.9. Scope of the Present Study

2.  MST RADAR WIND MEASUREMENTS

2.1 Introduction
2.2. MST Radars
2.3. Radio Refractive Index and Radar Equation
2.4. Scattering and Reflection Mechanisms
   2.4.1. Turbulent Scatter
   2.4.2. Fresnel (Partial) Reflection and Scattering
2.4.3. Thomson (Incoherent) Scatter

2.5. Configuration of Indian MST Radar
   2.5.1. Antenna Array Configuration
   2.5.2. T/R Switches
   2.5.3. Transmitter System
       2.5.3.1. Waveform Selection
       2.5.3.2. Pulse Compression Techniques
   2.5.4. Receiver System

2.6. Signal Processing
   2.6.1. Ranging
   2.6.2. Coherent Integration
   2.6.3. Fourier Analysis

3. ESTIMATION OF EQUATORIAL WAVE MOMENTUM FLUXES USING MST RADAR MEASURED WINDS

3.1. Introduction

3.2. Estimation of Equatorial Wave Momentum Fluxes Using Radiosonde Data

3.3. Momentum Flux Calculations Using Radar Measured Winds

3.4. Estimation of Velocity Components
   3.4.1. Incoherent Integration (Spectral Averaging)
   3.4.2. Power Spectrum Cleaning
   3.4.3. Noise Level Estimation
   3.4.4. Moments Estimation
   3.4.5. Doppler Effect - Line of Sight Velocities
   3.4.6. 3-Dimensional Winds

3.5. Present Method to Estimate the Equatorial Wave Momentum Fluxes

3.6. Accuracy of Momentum Flux Estimates

3.7. Comparison with Other Methods

3.8. Summary

4. SEASONAL VARIATION OF EQUATORIAL WAVE MOMENTUM FLUXES

4.1. Introduction

4.2. Data and Method of Analysis

4.3. Estimation of Equatorial Wave Momentum Fluxes
   4.3.1. Autumnal Equinox
   4.3.2. Winter
   4.3.3. Vernal Equinox
   4.3.4. Summer

4.4. Seasonal Variation of Momentum Flux Values

4.5. Simulation of Meanflow Acceleration Induced by the Equatorial Waves

4.6. Conclusion
### 5. SEASONAL VARIATION OF DIURNAL TIDES IN THE TROPICAL LOWER ATMOSPHERE

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1. Introduction</td>
<td>134</td>
</tr>
<tr>
<td>5.2. Data and Method of Analysis</td>
<td>134</td>
</tr>
<tr>
<td>5.3. Vertical Structure of Atmospheric Tides</td>
<td>136</td>
</tr>
<tr>
<td>5.3.1. Autumnal Equinox</td>
<td>136</td>
</tr>
<tr>
<td>5.3.2. Winter</td>
<td>150</td>
</tr>
<tr>
<td>5.3.3. Vernal Equinox</td>
<td>155</td>
</tr>
<tr>
<td>5.3.4. Summer</td>
<td>160</td>
</tr>
<tr>
<td>5.4. Seasonal Variation of Vertical Structure of Diurnal Tides</td>
<td>164</td>
</tr>
<tr>
<td>5.5. Discussion</td>
<td>170</td>
</tr>
<tr>
<td>5.6. Conclusion</td>
<td>172</td>
</tr>
</tbody>
</table>

### 6. SIMULATION OF DIURNAL TIDES IN THE LOWER ATMOSPHERE OVER GADANKI

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1. Introduction</td>
<td>174</td>
</tr>
<tr>
<td>6.2. The Classical Tidal Theory</td>
<td>174</td>
</tr>
<tr>
<td>6.2.1. Structure of Tidal Perturbation Fields</td>
<td>179</td>
</tr>
<tr>
<td>6.3. Nomenclature of Tides</td>
<td>181</td>
</tr>
<tr>
<td>6.4. Simulation of Tidal Fields over Gadanki and Comparison with Observations</td>
<td>182</td>
</tr>
<tr>
<td>6.5. Conclusion</td>
<td>208</td>
</tr>
</tbody>
</table>

### 7. SUMMARY AND CONCLUSIONS

REFERENCES 215