Contents

Pref	Preface		
Ch	apter 1	Introductory and Background Material	
1.1	Scope and	Goals of the Text	1
1.2	Structure of	of the Neutral Atmosphere and the lonosphere	4
1.3	1.3 The Earth's Magnetic Field and Magnetosphere		
Refe	rences		21
Ch	apter 2	Fundamentals of Ionospheric Plasma Dynamics	
2.1	The Basic	Fluid Equations	24
2.2	Steady-Sta	ite Ionospheric Plasma Motions Due to Applied Forces	34
2.3	Generation	n of Electric Fields	41
2.4	Electric Fi	ield Mapping	42
2.5	Elements	of Magnetospheric Physics	48
2.6			62
Refe	erences		62
Ch	apter 3	Electrodynamics of the Equatorial Zone	
3.1	Motions o	f the Equatorial F Region: The Data Base	65
3.2	The Equat	torial F-Region Dynamo	71
3.3	E-Region	Dynamo Theory and the Daytime Equatorial Electrojet	83
3.4	Further Co	omplexities of Equatorial Electrodynamics	92
3.5	Feedback	between the Electrodynamics and the Thermospheric Winds	104
Refe	erences		110

viii Contents

Chapter 4 Equatorial Plasma Instabilities

4.1	č				
4.2	Development and Initiation of Equatorial Spread F				
4.3	Nonlinear Theories of ESF				
4.4	Short Wavelength Waves in Equatorial Spread F				
4.5	ESF Summary	154			
4.6	E-Region Plasma Instabilities: The Observational Data Base	154			
4.7	Linear Theories of Electrojet Instabilities	16			
4.8	Nonlinear Theories of Electrojet Instabilities	174 182			
4.9 Refe	Future Directions ences	182			
Cha	pter 5 The Mid-Latitude Ionosphere				
5.1	Competing Influences on the Tropical and Mid-Latitude Ionospheres	187			
5.2	Electrodynamics of the Tropical and Mid-Latitude Zone	197			
5.3	Irregularities in the Mid-Latitude Ionosphere	219			
5.4	Mid-Latitude Plasma Instabilities	238			
Refe	ences	257			
Cha	pter 6 High-Latitude Electrodynamics				
6.1	Electrical Coupling between the Ionosphere, Magnetosphere, and Solar Wind	26			
6.2	Observations of Ionospheric Convection	273			
6.3	Simple Models of Convection in the Magnetosphere	284			
6.4	Empirical and Analytic Representations of High-Latitude Convection	29			
6.5	Observations of Field-Aligned Currents	290			
6.6	Horizontal Currents at High Latitudes	304			
Refe	rences	309			
Cha	apter 7 Effects of Plasma Flow at High Latitudes				
7.1	Ionospheric Effects of Parallel Plasma Dynamics	31			
7.2	Ionospheric Effects of Perpendicular Plasma Dynamics	322			
7.3	Electrodynamic Forcing of the Neutral Atmosphere	333			
	Summary	341			
	rences	342			
Ch	anton 9 Instabilities and Structure in the				
Cn	apter 8 Instabilities and Structure in the High-Latitude Ionosphere				
	riigh-Latitude foliosphere				
8.1	Planetary and Large-Scale Structures in the High-Latitude F Region	345			
8.2	Intermediate-Scale Structure in the High-Latitude F Region	369			
8.3	Small-Scale Waves in the High-Latitude F Region	390			
8.4	Plasma Waves and Irregularities in the High-Latitude E Region—Observations	396			

		Contents	ix
8.5 A	uroral Electrojet Theories		406
8.6 St	ımmary		419
Referen	ces		419
Appe	ndix A Ionospheric Measurement Techniques		
A.1 R	adio Wave Techniques in Ionospheric Physics		425
A.2 I	n Situ Measurements		437
References		455	
Appe	ndix B Reference Material and Equations		
B.1 A	atmospheric and Ionospheric Structure		459
B.2 N	Aiscellaneous Formulas		465
B.3 S	urface Magnetic Field Measurements and Magnetic Activity Indices		467
Referen	nces		471
Index			473
International Geophysics Series		485	