

Contents

Contributors xi

Author Biographies xiii

Preface xv

Passive Remote Sensing of Aerosol Height

XIAOGUANG XU, JUN WANG, YI WANG, ALEXANDER KOKHANOVSKY

- 1 Introduction 2
- 2 Aerosol Vertical Distribution 5
- 3 Passive Remote Sensing Techniques for Retrieval of Aerosol Layer Height 7
- 4 Conclusions and Outlook 17
- Acknowledgments 18
- References 18
- Further Reading 22

Vertical Profiling of Aerosol Optical Properties From LIDAR Remote Sensing, Surface Visibility, and Columnar Extinction Measurements

KWON H. LEE, MAN S. WONG

- 1 Introduction 23
- 2 Characterization of Vertical Variables With Active Remote-Sensing Techniques 25
- 3 Aerosol Vertical Profile Derived From Passive Remote Sensing 32
- 4 Applications to the Radiative Impacts of Aerosols 39
- 5 Conclusion 41
- Acknowledgments 41
- References 42

Remote Sensing of Aerosols From Space: Retrieval of Properties and Applications

ALAA MHAWISH, MANISH KUMAR, AKHILA K. MISHRA, PRASHANT K. SRIVASTAVA, TIRTHANKAR BANERJEE

- 1 Introduction 45
- 2 Aerosols: Heterogeneity and Climatic Implications 48

3 Satellite Observations for Aerosol Monitoring: Developments 51

4 Satellite Retrieval of Aerosol Properties 52

5 Satellite Aerosol Database 56

6 Aerosol Remote Sensing Over the Indo-Gangetic Plain, South Asia 72

7 Conclusions and Future Prospects 76

Acknowledgments 77

References 77

Further Reading 83

Remote Sensing of Heavy Aerosol Pollution Episodes: Smoke and Dust

SONOYO MUKAI

1 Introduction 85

2 Detection of Aerosol Episodes 86

3 Aerosol Retrieval Framework 96

4 Retrieval of Biomass Burning Episodes 101

5 Miscellaneous-Polarization Remote Sensing 103

6 Concluding Remarks 105

References 106

Aerosol and Cloud Bottom Altitude Covariations From Multisensor Spaceborne Measurements

LUCA LELLI, MARCO VOUNTAS

1 Introduction 109

2 Data and Methods 111

3 Results 117

4 Summary and Conclusions 122

Acknowledgments 123

References 123

Cloud-Aerosol-Precipitation Interactions Based of Satellite Retrieved Vertical Profiles of Cloud Microstructure

DANIEL ROSENFELD

1 Introduction 129

2	Physical Considerations in Retrieving Vertical Microphysical Profiles	131
3	The Microstructure of Vertical Profiles of Adiabatic Convective Clouds	131
4	The Observed Microstructure of Convective Clouds Vertical Profiles	136
5	Impacts of CCN and Updrafts on Vertical Microphysical Profiles of Convective Clouds	137
6	Application of $r_e(T)$ to Observe Anthropogenic Aerosols Suppressing Precipitation	140
7	Application of $r_e(T)$ to Observe Large Hygroscopic Aerosols Restoring Precipitation	143
8	Impacts of Aerosols on Clouds' Glaciation Temperature and Mixed Phase Precipitation	143
9	Vertical Microphysical Profiles of Severe Convective Storms	147
10	Applications of Vertical Profiles of $r_e(T)$ to Retrieve N_{db} and CCN(S)	148
11	Conclusions	149
	References	150
	Further Reading	152

Polarimetric Technique for Satellite Remote Sensing of Superthin Clouds

WENBO SUN, ROSEMARY R. BAIZE, GORDEN VIDEEN,
YONGXIANG HU

1	Introduction	153
2	Polarization Signature of Light Backscattered by Clouds	156
3	Method for Retrieving Superthin Cloud Optical Depth	162
4	Summary and Conclusion	170
	Acknowledgments	171
	References	171

Cloud Screening and Property Retrieval for Hyper-Spectral Thermal Infrared Sounders

YU SOMEYA, RYOICHI IMASU

1	Introduction	175
2	Sensor Characteristics	176
3	Typical Cloud Detection Techniques	177

4	Cloud Detection Strategy for the Sounders	179
5	Conclusion	185
	References	185
	Further Reading	187

Surface Remote Sensing of Liquid Water Cloud Properties

CHRISTINE KNIST, HERMAN RUSSCHENBERG

1	Introduction	189
2	Principle Method and Basic Assumptions	190
3	Case Study: Using Radiation Measurements for Validation	193
4	Conclusions	207
	References	207
	Further Reading	209

Measuring Precipitation From Space

FRANCISCO J. TAPIADOR

1	Introduction	211
2	Infrared and Visible Frequencies Methods	212
3	Microwave-Based Methods	212
4	Methods Based on IR + MW Fusion	215
5	The Tropical Rainfall Measurement Mission (TRMM)	216
6	The Global Precipitation Measuring (GPM) Mission	217
7	The Future of Satellite Estimates of Precipitation	217
	Acknowledgments	219
	References	219
	Further Reading	221

Measurement of Precipitation from Satellite Radiometers (Visible, Infrared, and Microwave): Physical Basis, Methods, and Limitations

ATUL K. VARMA

1	Background	223
2	Satellite Rainfall Estimation Methods	224
3	Conclusion	243
	References	245

Development of a Rain/No-Rain Classification Method Over Land for the Microwave Sounder Algorithm

SATOSHI KIDA, TAKUJI KUBOTA, SHOICHI SHIGE, TOMOAKI MEGA

- 1 Introduction 249
- 2 Data 251
- 3 Comparison of Rain/No-Rain Classification (RNC) Over Land Using the 89-GHz Channel With PR and MSPPs Rain Estimates 253
- 4 Proposed RNC Method 255
- 5 Conclusion 263
- Acknowledgments 263
- References 264

Remote Sensing of Precipitation from Airborne and Spaceborne Radar

STEPHEN J. MUNCHAK

- 1 Introduction 267
- 2 Radar Precipitation Measurement Fundamentals 269
- 3 The Particle Size Distribution 272
- 4 Single-Frequency Methods 277
- 5 Multifrequency Methods 280
- 6 Effects of Nonuniform Beam Filling 283
- 7 Multiple Scattering 287
- 8 Radar-Radiometer Methods 291
- 9 Summary 293
- Acknowledgments 294
- References 294
- Further Reading 299

Status of High-Resolution Multisatellite Precipitation Products Across India

SATYA PRAKASH, ASHIS K. MITRA, RAKESH M. GAIROLA, HAMID NOROUZI, DAMODARA S. PAI

- 1 Introduction 301
- 2 A Review of Recent Evaluations of High-Resolution MSPPs Across India 304
- 3 Evaluation of Five High-Resolution MSPPs for the Indian Monsoon 2014 305
- 4 Operational Merged Satellite-Gauge Rainfall Product in India 307
- 5 Summary and Conclusion 310
- Acknowledgments 312
- References 312

Real-Time Wind Velocity Retrieval in the Precipitation System Using High-Resolution Operational Multi-radar Network

HAONAN CHEN, VENKATACHALAM CHANDRASEKAR

- 1 Introduction 315
- 2 Multiple-Doppler Methodology for Wind Retrieval 318
- 3 Real-Time Multiple-Doppler Retrieval System for CASA Radar Networks 321
- 4 Observations, Results, and Validation 330
- 5 Summary 337
- Acknowledgments 338
- References 338

Index 341