Geosciences in

Volume 21: Solar Terrestrial (ST)

Advances in Geosciences

Volume 21: Solar Terrestrial (ST)

Editor-in-Chief

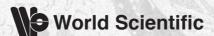
Wing-Huen Ip

National Central University, Taiwan

Volume Editor-in-Chief

Marc Duldig

Australian Antarctic Division, Australia



Published by

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601 UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

ADVANCES IN GEOSCIENCES A 6-Volume Set

Volume 21: Solar Terrestrial (ST)

Copyright © 2010 by World Scientific Publishing Co. Pte. Ltd.

All rights reserved. This book, or parts thereof, may not be reproduced in any form or by any means, electronic or mechanical, including photocopying, recording or any information storage and retrieval system now known or to be invented, without written permission from the Publisher.

For photocopying of material in this volume, please pay a copying fee through the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA. In this case permission to photocopy is not required from the publisher.

ISBN-13 978-981-283-808-7 (Set) ISBN-10 981-283-808-2 (Set) ISBN-13 978-981-283-819-3 (Vol. 21) ISBN-10 981-283-819-8 (Vol. 21)

Typeset by Stallion Press

Email: enquiries@stallionpress.com

Printed in Singapore.

ADVANCES IN GEOSCIENCES

Volume 15: Planetary Science (PS)

ISBN-13 978-981-283-621-2 ISBN-10 981-283-621-7

Editor-in-Chief: Wing-Huen Ip (National Central University, Taiwan)

A 5-Volum	e Set	A 6-Volume Set	
Volume 1:	ISBN-10 981-256-985-5	Volume 16:	Atmospheric Science (AS) ISBN-13 978-981-283-809 ISBN-10 981-283-809-0
Volume 3:	Solar Terrestrial (ST) ISBN-10 981-256-984-7 Planetary Science (PS)	Volume 17:	Hydrological Science (HS) ISBN-13 978-981-283-811
volume 3.	ISBN-10 981-256-983-9		ISBN-10 981-283-811-2
Volume 4:	Hydrological Science (HS) ISBN-10 981-256-982-0	Volume 18:	Ocean Science (OS) ISBN-13 978-981-283-813- ISBN-10 981-283-813-9
Volume 5:	Oceans and Atmospheres (OA) ISBN-10 981-256-981-2	Volume 19:	Planetary Science (PS) ISBN-13 978-981-283-815-
A 4-Volum	e Set		ISBN-10 981-283-815-5
Volume 6:	Hydrological Science (HS) ISBN-13 978-981-270-985-1 ISBN-10 981-270-985-1	Volume 20:	Solid Earth (SE) ISBN-13 978-981-283-817- ISBN-10 981-283-817-1
Volume 7:	Planetary Science (PS) ISBN-13 978-981-270-986-8 ISBN-10 981-270-986-X	Volume 21:	Solar Terrestrial (ST) ISBN-13 978-981-283-819- ISBN-10 981-283-819-8
Volume 8:	Solar Terrestrial (ST) ISBN-13 978-981-270-987-5 ISBN-10 981-270-987-8		
Volume 9:	Solid Earth (SE), Ocean Science (OS) & Atmospheric Science (AS) ISBN-13 978-981-270-988-2 ISBN-10 981-270-988-6		
A 6-Volum	e Set		
Volume 10	: Atmospheric Science (AS) ISBN-13 978-981-283-611-3 ISBN-10 981-283-611-X		
Volume 11	Hydrological Science (HS) ISBN-13 978-981-283-613-7 ISBN-10 981-283-613-6		
Volume 12	Ocean Science (OS) ISBN-13 978-981-283-615-1 ISBN-10 981-283-615-2		
Volume 13	Solid Earth (SE) ISBN-13 978-981-283-617-5 ISBN-10 981-283-617-9		
Volume 14	Solar Terrestrial (ST) ISBN-13 978-981-283-619-9 ISBN-10 981-283-619-5		

EDITORS

Editor-in-Chief: Wing-Huen Ip

Volume 16: Atmospheric Science (AS)

Editor-in-Chief: Jai Ho Oh Editors: G. P. Singh

C. C. Wu K.-J. Ha

Volume 17: Hydrological Science (HS)

Editor-in-Chief: Namsik Park

Editors: Ji Chen

Joong-Hoon Kim Jinping Liu Young-Il Moon Sanjay Patil

Ashok Kumar Rastogi

Simon Toze

Volume 18: Ocean Science (OS)

Editor-in-Chief: Jianping Gan
Editors: Minhan Dai
Anne Mueller

Murty Vadiamani

Volume 19: Planetary Science (PS)

Editor-in-Chief: Anil Bhardwaj
Editors: Yasumasa Kasaba

Guillermo Manuel Muñoz Caro

Takashi Ito Paul Hartogh C. Y. Robert Wu S. A. Haider

v

vi Editors

Volume 20: Solid Earth (SE)

Editor-in-Chief: Kenji Satake

Volume 21: Solar & Terrestrial Science (ST)

Editor-in-Chief: Marc Duldig

Editors: P. K. Manoharan

Andrew W. Yau

Q.-G. Zong

REVIEWERS

The Editors of Volume 21 (Solar & Terrestrial Science) would like to acknowledge the following referees who have helped to review the papers published in this volume:

A. Asai	Bo Li
Nanan Balan	Jun Lin
Dipankar Banerjee	D. Maia
I. V. Chasei	C. Mandrini
Yen-Hsyang Chu	P. K. Manoharan
Mark Conde	Karim Meziane
Len Culhane	Wojciech Miloch
P. Demoulin	Kyoung Min
Marc Duldig	Yong-Jae Moon
Bhola Dwivedi	Harm Moraal
Malcolm Dunlop	Tomoko Nakagawa
Peter Dyson	Viviane Pierrard
Geza Erdos	Ian Richardson

John French
T. A. Fritz
Zenjiro Fuji
Ivan Galkin
J.-N. Tu
Ivan Galkin
J.-W. Handkin

Yoshifumi Saito

R. A. Fallows

Chaosong Huang Ilya Usoskin Boian Kirov Qian Wu

Masayoshi Kojima Andrew W. Yau
Axel Korth Jingxiu Wang
Karel Kudela Y-F. Wang
James LaBelle Q.-G. Zong

This page is intentionally left blank

PREFACE

The present volume set of Advances in Geosciences (ADGEO) contains papers from the Busan annual meeting in 2008 and some from the Singapore annual meeting in 2009. As Editor-in-Chief, I must apologize to the AOGS members and authors for this delay. Since 2006 we have published 20 volumes in total. This publication project has been supported by the AOGS Council, World Scientific Publication Company (WSPC), the team of hard working editors and the broad membership and participants of AOGS. As with the main purpose of the Society, ADGEO is meant to promote information exchange and to forge scientific cooperation in the area of Earth science and environmental study. As witnessed by the negotiation efforts at the United Nations Climate Change Conference in Copenhagen in December 2009, all these issues have become more and more important and vital in the Asia-Pacific region. It is not a matter of exaggeration in saying that the solution to global warming, if there is one, has to come from the emerging economies and developing countries covered by AOGS. By design, ADGEO has its fundamental role to play. In practical terms, it is actually a difficult task because of many factors involved in deciding the quality of manuscripts, editorial and review processes, publication procedure, scientific impacts, readership, policy of the AOGS Council, and last but not least, marketing from the point of view of the publisher. Any small mishap in this long chain of interactive steps could lead to a major discontinuity. We have encountered such a situation with the publication of the Busan manuscripts. It is only with the cooperation of the authors, the ADGEO editorial team, WSPC, and the AOGS Secretariat Office, that we are able to produce these volumes, albeit a long delay. With this lesson learned, we hope to consolidate the ADGEO management and editorial system so that it would become an essential publication in our understanding of Earth and space science and information tool books in the battle against climate change. Finally, I would like to take this opportunity to thank the Volume Editors-in-Chief who are the driving force in making ADGEO possible: A. Bhardwaj (Planetary Science), M. Duldig (Solar and Terrestrial Science), J.P. Gan (Ocean Science), J.H. Oh (Atmospheric x Preface

Science), N.S. Park (Hydrological Science), K. Satake and C.H. Lo (Solid Earth). They have to work very hard to ensure both the quantity and quality of the published papers in ADGEO. Of equal importance, the support from WSPC is essential and its foresight in identifying the academic and social values of Earth science and environmental study to be sustained and articulated by ADGEO is very much appreciated.

Wing-Huen Ip Editor-in-Chief

PREFACE TO ST VOLUME

Solar terrestrial science is concerned with the interactions between the earth, the sun, and interplanetary space and the resulting effects these interactions induce at the earth such as those collectively know as space weather. This volume comprises recent research results and invited reviews on solar terrestrial research with an emphasis on work undertaken in the Asia Oceania region. Aspects of Solar Terrestrial research covered include: the solar cycle, sunspots, coronal magnetic fields, the solar wind, coronal mass ejections, the magnetosphere, the ionosphere, the mesosphere, cosmic rays and the heliosphere, and spacecraft mission instrument design. Observational measurements, modelling and theoretical developments are included and over one third of the papers are invited reviews by leading international researchers.

Marc Duldig ST Volume Editor-in-Chief

This page is intentionally left blank

CONTENTS

Editors	V
Reviewers	vii
Preface	ix
Preface to ST Volume	xi
Acceleration and Heating of Solar Wind Ions by Nonlinear Waves $L.\ Ofman$	1
Relation Between Loop-Shaped Interplanetary Disturbances and the Magnetic Flux Rope M. Tokumaru, M. Kojima, K. Fujiki, K. Munakata, T. Kuwabara and K. Marubashi	21
Solar Wind and CME Studies of the Inner Heliosphere Using IPS Data from Stelab, ORT, and EISCAT M. M. Bisi, B. V. Jackson, R. A. Fallows, G. D. Dorrian, P. K. Manoharan, J. M. Clover, P. P. Hick, A. Buffington, A. R. Breen and M. Tokumaru	33
Relationship Between Earth-Directed Solar Eruptions and Magnetic Clouds at 1 AU: A Brief Review Vasul Yurchushum and Duraesh Trinathi	51

xiv Contents

Large Geomagnetic Storms Associated with Limb Halo Coronal Mass Ejections	71
Nat Gopalswamy, Seiji Yashiro, Hong Xie, Sachiko Akiyama and Pertti Mäkelä	
Two Major Processes of The Solar Wind-Magnetosphere- Ionosphere Coupling Xiaoyan Zhou, Wei Sun, Aimin Du and Aaron J. Ridley	83
Global Simulation of the Magnetosphere Using Nested Grids Model With Inner Boundary of $1R_{\rm E}$ Keiichiro Fukazawa	97
The Fate of Langmuir Waves: Wind and Stereo Observations	109
P. J. Kellogg	
Foreshock Turbulence	119
Yasuhito Narita	
The Predominant Frequencies of the Atmospheric Perturbations and Geomagnetic Oscillations	129
M. Matsumura, T. Iyemori, M. Nose, M. Utsugi, Y. Odagi, Y. Tanaka, D. Han, N. Oshiman, H. Shinagawa and Y. Tabata	
Near-Real Time Monitoring of TEC Over Japan at NICT (RWC Tokyo OF ISES) W. Miyake and H. Jin	143
Improve the Topside Ionospheric Model Using Cosmic Electron Density Profile Data X. Shi, P. Guo and J. S. Ping	155
Derivation of Thermosphere Density Variation Responses to Space Weather Events During Apr. 2002 to Jul. 2007 using FY1D Satellite Track Data Cong Huang, Dan-Dan Liu, Jing-Song Wang and Tao Yu	167

Contents xv

Observations of OH Airglow and Lightning Excitations from the Formosat-2 Satellite	177
Jan B. Nee and Ting-Hung Peng	
Solar Cycle Length and Solar Activity	189
Shinichi Watari	
Drift Effects and the Average Features of Cosmic Ray Density Gradient in CIRS During Successive Two Solar Minimum Periods	199
A. Fushishita, T. Narumi, C. Kato, S. Yasue, K. Munakata, Y. Okazaki, T. Kuwabara, J. W. Bieber, P. Evenson, M. R. Da Silva, A. Dal Lago, N. J. Schuch, M. Tokumaru, M. L. Duldig, J. E. Humble, I. Sabbah and J. Kóta	
Sky-Maps of the Sidereal Anisotropy of Galactic Cosmic Ray Intensity and its Energy Dependence	211
K. Munakata, N. Matsumoto, S. Yasue, C. Kato, S. Mori, M. Takita, M. L. Duldig, J. E. Humble and J. Kóta	
Toward a New Era of Canadian Ground-Based Research of Geospace Science	227
William Liu, John Manuel and Richard Giroux	
Micro/Mini Satellites for Earthquake Studies — Toward International Collaboration	251
KI. Oyama, Y. Kakinami, J. Y. Liu, C. Y. Chen and T. Kodama	
Solar Transition Region in the Quiet Sun and Active Regions	277
H. Tian, W. Curdt and JS. He	
Active Latitudes for Sunspot Occurrences in the Solar Cycle 23	289
V. V. Zharkova and S. I. Zharkov	

xvi Contents

Magnetic Helicity Injection and Chirality Changing in Penumbral Filaments $J.\ T.\ Su$	301
On the Observations of Multiple MHD Oscillations in the Solar Loops A. K. Srivastava	315
Modelling the Coronal Magnetic Field Using Hinode (and Future) Data M. S. Wheatland, S. A. Gilchrist and S. Régnier	327
Solar Mass Ejection Imager (SMEI) and Interplanetary Scintillation (IPS) 3D-Reconstructions of the Inner Heliosphere B. V. Jackson, P. P. Hick, A. Buffington, M. M. Bisi, J. M. Clover and M. Tokumaru	339
Interplanetary Shock Generated Ionospheric Traveling Convection Vortex Near Local Noon XY. Zhou, D. G. Sibeck, O. Amm and J. M. Ruohoniemi	367
Ionospheric Observation using FM-CW Radar Array A. Ikeda, A. Yoshikawa, M. G. Cardinal, K. Yumoto, M. Shinohara, K. Nozaki, B. M. Shevtsov, V. V. Bychkov, Q. M. Sugon, Jr. and D. McNamara	379
Dynamics of the Earth's Magnetosphere from Some Modern Data Analysis Tools A. T. Y. Lui	393
Remote Sensing of Earth's Plasmasphere A. K. Singh	415
Complex Plasma Physics and the Earth's Dusty Mesosphere S. V. Vladimirov and B. A. Klumov	429

Development of Stiff and Extendible Electromagnetic Sensors for Space Missions	447
Y. Kasaba, A. Kumamoto, K. Ishisaka, H. Kojima, K. Higuchi, A. Watanabe and K. Watanabe	
Miniaturization of Plasma Wave Receivers Onboard Scientific Satellites and Application to the Sensor Network System for Monitoring Electromagnetic	404
Environments in Space H. Kojima, H. Fukuhara, Y. Mizuochi, S. Yagitani, H. Ikeda, V. Miyake, H. Usui, H. Iwai, Y. Takizawa	461

Y. Ueda and H. Yamakawa

Contents

xvii