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地球卫星遥感

卷2：数据、计算的过程和工具

Earth Science Satellite Remote Sensing

Data, Computational Processing, and Tools

Volume 2

John J.Qu · Wei Gao · Menas Kafatos
Robert E. Murphy · Vincent V. Salomonson
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内 容 简 介

本书共有两卷。此为第 2 卷，共有 18 章，主要内容为 (1) 提供了有关地球科学遥感数据的信息；(2) 讨论了 MODIS 探测器的校正和特点；(3) 对当前数据处理方法进行分析和评价；(4) 介绍了不同数据中心的数据查询和定购；以及 (5) 探讨了遥感和地理信息系统产品——网络 GIS 应用和工具等内容。

该书作者均为相关领域具有权威性的专家与学者。图书内容既包括现代遥感技术的基础知识，又涉及卫星遥感的前沿领域，有广泛的实用性，可作为遥感、地学、环境、空间信息等地球科学领域的专业参考书。

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This book is dedicated to Dr. Vincent V. Salomonson

Few individuals have had such profound impact on the development of Earth remote sensing as Dr. Vincent V. Salomonson. We, his co-editors of this volume, have been chosen to dedicate it to him in recognition of his many contributions to our field. There is not a topic discussed in the book that has not been strongly influenced either by his personal research or his leadership.

After completing his undergraduate studies, he began his career as a weather officer in the US Air Force. He then returned to graduate school, earning a PhD in Atmospheric Science from Colorado State University in 1968. The bulk of his career was spent at the NASA Goddard Space Flight Center (1968 – 2005) where he conducted research and served as a branch head, laboratory chief, and, for 11 years, as the Director of Earth Sciences. He was deeply engaged in mission development, serving as the Project Scientist for Landsat-4 and -5 (1977 – 1989), and as the team leader for the Moderate Resolution Imaging Spectroradiometer (MODIS) from 1989 to the present. Under his leadership as a laboratory chief and as the Director of Earth Sciences, the men and women of the NASA Goddard Space Flight Center built the foundation for the study of global climate and environmental change using space-based systems and theoretical modeling.

He has served as the president of the American Society for Photogrammetry and Remote Sensing (ASPRS), and is a fellow of the ASPRS, as well as of the Institute for Electrical and Electronics Engineers (IEEE). He has served as an associate editor of several journals and has twice received the NASA Exceptional Scientific Achievement Medal. He has been recognized for career achievements twice, first with the William T Pecora award for his work on Landsat and the NASA Outstanding Leadership Medal for his role in establishing the Earth Sciences Directorate as an internationally recognized entity performing interdisciplinary Earth System Science.

Dr. Salomonson is now a Research Professor at the University of Utah, and the Director of Earth Sciences (Emeritus) at NASA Goddard Space Flight Center.

Foreword

Volume 2 of this book complements Volume 1 which was devoted primarily to missions, instruments, and selected applications by describing several related activities and developments focused primarily on data processing and attendant tools. Chapters 1 – 7 provide background and insights to the EOS Data and Information System (EOSDIS) providing EOS data to millions of users in science and applications throughout the world, EOS Direct Bro adcast capabilities delivering MODIS data at over 100 sites spread worldwide and supporting hundreds of users and agencies, the MODIS Rapid Response System that has been so successfully used for applications and outreach to the public, as well as the extensive efforts devoted to calibration and performance characterization of the MODIS instrument. Chapters 8 – 13 describe various formats and tools that are available to everyone and facilitate the use of data from the EOS series. Chapters 14 – 17 go on to describe the use of spaceborne products in a GIS context along with selected applications. In total the content of this volume along with the materials in Volume 1 provides the reader with a view not only of the extensive context and development activity in the NASA EOS effort, but also a glimpse into not only the present applications or utility of the data, but also the potential for future use and advancement in science and applications using spaceborne observ ations.

Vincent V. Salomonson

Senior Scientist and MODIS Science Team Leader
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Preface

Earth science satellite remote sensing has seen rapid expansion during the last decade. NASA's Earth Observing System (EOS) program is providing data for in-depth scientific understanding of the functioning of the Earth as a system through a constellation of satellites. The National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) mission, the latest in the series, will provide NASA with a continuation of global change observations following EOS Terra and Aqua missions. NPP will provide NPOESS with risk reduction demonstration and validation for the four critical NPOESS sensors, algorithms, and processing. NPOESS will provide a national, operational, polar-orbiting remote-sensing capability by converging Department of Defense (DoD) and National Oceanic and Atmospheric Administration (NOAA) satellite programs while incorporating new technologies from NASA. Scientists and students have expressed great interest in these missions. However, there is currently no textbook for graduate students to learn about the EOS, NPP and NPOESS missions, or the current and potential applications of the resulting data.

The core of this book arose from the Workshop for Earth Science Satellite Remote Sensing held at George Mason University (GMU) from Oct. 15 to 22, 2002. Updated information is included in this book. This book is designed to give readers having limited remote sensing background a thorough introduction to current and future NASA, NOAA and other Earth science remote sensing. The book is supported by the Center of Earth Observing and Space Research (CEOSR) at GMU and NASA/GSFC MODIS and NPP projects.

The goals of this volume are to (1) provide information on Earth science remote sensing data information, tools and data formats such as HDF-EOS; (2) discuss MODIS calibration and characterization; (3) evaluate current data

processing approaches; (4) introduce data searching and ordering from different public domains; and (5) explore remote sensing and GIS products and WebGIS applications. Detailed information about MODIS data products, NPP and NPOESS missions can be found in volume 1 of Eearth Science Satellite Sensing.

There are many people who assisted with this book. First, the editorial team would like to thank all authors involved in contributing chapters for the Earth Science Satellite Remote Sensing. Each author has spent extra hours in addition to existing workloads and ongoing commitments. Second, we would like to thank over eighty anonymous reviewers for their constructive comments and suggestions. The most chapters in this book were originally presented at the Second Workshop of the Earth Science Satellite Remote Sensing at George Mason University (GMU). We would also like to thank many of the Moderate Resolution Imaging Spectroradiometer (MODIS) and the NPOESS Preparatory Project (NPP) science team members who contributed their MODIS and NPOESS/NPP chapters. Much appreciation also goes the Center for Earth Observation and Space Research (CEOSR) at GMU for supporting the workshop and this book. Special thanks and appreciation go to Mr. Manny Smith for providing editing assistance and tracking chapter status with leading authors. We would like to acknowledge Ms. Lingli Wang, Ms. Bockhwa Kim and Ms. Wanting Wang of the School of Computational Sciences (SCS) at GMU spending tremendous effort working on templates, tables and figures for this book. The efforts of many individuals including Prof. George Taylor, Dr. William Sommers, Prof. Ruixin Yang, Dr. Xianjun Hao and Mr. Hank Wolf at GMU and Dr. Xiaoxiong Xiong at NASA/GSFC, who supported this book, are highly appreciated.

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