

Review

A Systematic Review of the Application of the Geostationary Ocean Color Imager to the Water Quality Monitoring of Inland and Coastal Waters

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Abstract: In recent decades, eutrophication in inland and coastal waters (ICWs) has increased due to anthropogenic activities and global warming, thus requiring timely monitoring. Compared with traditional sampling and laboratory analysis methods, satellite remote sensing technology can provide macro-scale, low-cost, and near real-time water quality monitoring services. The Geostationary Ocean Color Imager (GOCI), aboard the Communication Ocean and Meteorological Satellite (COMS) from the Republic of Korea, marked a significant milestone as the world's inaugural geostationary ocean color observation satellite. Its operational tenure spanned from 1 April 2011 to 31 March 2021. Over ten years, the GOCI has observed oceans, coastal waters, and inland waters within its 2500 km × 2500 km target area centered on the Korean Peninsula. The most attractive feature of the GOCI, compared with other commonly used water color sensors, was its high temporal resolution (1 h, eight times daily from 0 UTC to 7 UTC), providing an opportunity to monitor ICWs, where their water quality can undergo significant changes within a day. This study aims to comprehensively review GOCI features and applications in ICWs, analyzing progress in atmospheric correction algorithms and water quality monitoring. Analyzing 123 articles from the Web of Science and China National Knowledge Infrastructure (CNKI) through a bibliometric quantitative approach, we examined the GOCI's strength and performance with different processing methods. These articles reveal that the GOCI played an essential role in monitoring the ecological health of ICWs in its observation coverage (2500 km × 2500 km) in East Asia. The GOCI has led the way to a new era of geostationary ocean satellites, providing new technical means for monitoring water quality in oceans, coastal zones, and inland lakes. We also discuss the challenges encountered by Geostationary Ocean Color Sensors in monitoring water quality and provide suggestions for future Geostationary Ocean Color Sensors to better monitor the ICWs.

Keywords: GOCI; inland and coastal waters; atmospheric correction; algal blooms; water quality parameters



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1. Introduction

Water accounts for about 74% of Earth's surface. Water is an important carrier and critical factor in studying the energy exchange of surface materials [1,2]. For research convenience in water color remote sensing, the Earth's water is usually divided into Case I and Case II waters based on the optical properties of water [3–5]. The optical properties of Case I waters (open oceans) are mainly determined by phytoplankton. Case II waters, including inland and coastal waters (denoted as ICWs; all abbreviations or symbols in this study are shown in Table 1 and Table S1), are optical complexes determined by phytoplankton, detritus, and colored dissolved organic matter (CDOM) [6,7]. Most of the

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Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters:

Water Optics and Water Colour Remote Sensing Yunlin Zhang, Claudia Giardino, Linhai Li, 2018-07-05 This book is a printed edition of the Special Issue Water Optics and Water Colour Remote Sensing that was published in Remote Sensing

Official Gazette Philippines, 1982 Treatise on Water Science, 2010-09-01 Water quality and management are of great significance globally as the demand for clean potable water far exceeds the availability Water science research brings together the natural and applied sciences engineering chemistry law and policy and economics and the Treatise on Water Science seeks to unite these areas through contributions from a global team of author experts The 4 volume set examines topics in depth with an emphasis on innovative research and technologies for those working in applied areas Published in partnership with and endorsed by the International Water Association IWA demonstrating the authority of the content Editor in Chief Peter Wilderer a Stockholm Water Prize recipient has assembled a world class team of volume editors and contributing authors Topics related to water resource management water quality and supply and handling of wastewater are treated in depth Fresh Water and Watersheds Yeqiao Wang, 2020-05-19 Authored by world class scientists and scholars The Handbook of Natural Resources Second Edition is an excellent reference for understanding the consequences of changing natural resources to the degradation of ecological integrity and the sustainability of life Based on the content of the bestselling and CHOICE awarded Encyclopedia of Natural Resources this new edition demonstrates the major challenges that the society is facing for the sustainability of all well being on the planet Earth The experience evidence methods and models used in studying natural resources are presented in six stand alone volumes arranged along the main systems of land water and air It reviews state of the art knowledge highlights advances made in different areas and provides guidance for the appropriate use of remote sensing and geospatial data with field based measurements in the study of natural resources Volume 4 Fresh Water and Watersheds covers fresh water and watersheds their health and conservation protection and management Organized for ease of reference it provides fundamental information on groundwater storage water quality supply and balance and water resource vulnerability New in this edition are discussions on water footprint assessment water surface dynamics and water management on a global scale Understanding the conditions of watersheds is crucial for restoring areas with degraded water quality as well as protecting healthy waters from emerging problems This volume demonstrates the key processes methods and models used through several practical case studies from around the world Written in an easy to reference manner The Handbook of Natural Resources Second Edition as individual volumes or as a complete set is an essential reading for anyone looking for a deeper understanding of the science and management of natural resources Public and private libraries educational and research institutions scientists scholars and resource managers will benefit enormously from this set Individual volumes and chapters can also be used in a wide variety of both graduate and undergraduate courses in environmental science and natural science at different levels and disciplines such as biology

geography earth system science and ecology

Colour and Light in the Ocean, volume II Shubha

Sathyendranath, Gemma Kulk, Astrid Bracher, Jamie Shutler, Victor Martinez-Vicente, Tiit Kutser, Javier A.

Concha, Marie-Helene Rio, Heather Bouman, 2024-11-12 Marine ecosystems are open and dissipative systems that rely on an external energy source light for their sustenance The magnitude of the light flux and the spectral quality of the light field which determines colour determine the rate of marine photosynthesis by phytoplankton in the ocean and the types of phytoplankton communities that flourish in different parts of the ocean and in different seasons Ocean colour determined by the spectral quality of light scattered out of the sea and back into the atmosphere can be monitored using satellite sensors and used to map the distribution of the major phytoplankton pigment chlorophyll a at global scales Remote sensing of ocean colour first realised in 1977 has revolutionised the field of biological oceanography Over the years the quality of satellite products has continued to improve and the range of products available has extended beyond chlorophyll concentration to encompass many variables of interest to biological oceanography and ocean biogeochemistry However it is well recognized that satellite observations have to be integrated with and complemented by field measurements and modelling to obtain the full picture The research topic proposed will cover a range of recent developments in ocean colour remote sensing and allied fields

Color of Inland and Coastal Waters Dmitry Pozdnyakov, Hartmut Graßl, 2011-04-10 The inorganic and organic water constituents often called color producing agents CPAs responsible for water color are generally referred to as water quality parameters Utilization of water color for assessment of water quality parameters can be achieved by using the established techniques in aquatic optics attained over many decades Aquatic optics can be subdivided according to whether the natural water body is salty marine inland or fresh limnological or coastal often brackish The authors describe the transformation of water color under varying natural and anthropogenically driven conditions and for the first time in a quantitative manner a closed circle of issues related to remote sensing of water quality in optically complex waters generally inherent to inland and marine coastal waters Primarily the text synthesizes the solutions of problems in remote sensing incorporating mathematics hydrobiology hydrochemistry atmospheric optics and ecology

The Handbook of Natural Resources, Second Edition, Six Volume Set Yeqiao Wang, 2022-05-29 Authored by world class scientists and scholars the Handbook of Natural Resources Second Edition is an excellent reference for understanding the consequences of changing natural resources to the degradation of ecological integrity and the sustainability of life Based on the content of the bestselling and CHOICE awarded Encyclopedia of Natural Resources this new edition demonstrates the major challenges that the society is facing for the sustainability of all wellbeing on planet Earth The experience evidence methods and models used in studying natural resources are presented in six stand alone volumes arranged along the main systems land water and air It reviews state of the art knowledge highlights advances made in different areas and provides guidance for the appropriate use of remote sensing data in the study of natural resources on a global scale The six volumes in this set cover Terrestrial Ecosystems and

Biodiversity Landscape and Land Capacity Wetlands and Habitats Fresh Water and Watersheds Coastal and Marine Environments and finally Atmosphere and Climate Written in an easy to reference manner the Handbook of Natural Resources Second Edition as a complete set is essential for anyone looking for a deeper understanding of the science and management of natural resources Public and private libraries educational and research institutions scientists scholars and resource managers will benefit enormously from this set Individual volumes and chapters can also be used in a wide variety of both graduate and undergraduate courses in environmental science and natural science courses at different levels and disciplines such as biology geography Earth system science ecology etc Colour and Light in the Ocean Victor Martinez-Vicente, Astrid Bracher, Didier Ramon, Shubha Sathyendranath, Tiit Kutser, 2020-03-26 CLEO publications in Frontiers in Marine Science Foreword Josef Aschbacher Director of ESA's Earth Observation Programmes Satellite data have drastically changed the view we have of the oceans Covering about 70% of Earth's surface oceans play a unique role for our planet and for our life but large areas remain unexplored and are difficult to reach Since the 1980s Earth orbiting satellites have helped to observe what is happening at the ocean surface Sensors like CZCS AVHRR SeaWiFS and MODIS provided the first ocean colour data from space Starting in 2002 ESA's Medium Resolution Imaging Spectrometer MERIS on board the environmental satellite Envisat provided detailed information on phytoplankton biomass and concentrations of other matter in the global oceans These satellite observations laid the groundwork for studying the marine environment and how it responds to climate change and the research community has since delivered information on the variability of marine ecosystems Part of this work is reflected in this stunning collection of peer reviewed publications presented at the workshop Colour and Light in the Ocean from Earth Observation CLEO held at ESA's ESRIN site in Frascati Italy on 6-8 September 2016 The event attracted more than 160 participants from all over the world including remote sensing experts marine ecosystem modelers in situ observers and users of Earth observation data Scientifically the meeting covered applications in climate studies over primary productivity and ocean dynamics to pools of carbon and phytoplankton diversity at global and regional scales It also demonstrated the potential of Earth observation and its contribution to modern oceanography Looking to the future new satellites developed by ESA under the coordination of the European Commission will further our scientific and operational observations of the seas With Sentinel 3A in orbit and its twin Sentinel 3B following in 2017 there is a new category of data available for operational oceanographic applications and climate studies for years to come These data are free and easy to access by anyone interested Looking at the role of oceans in our daily lives I am sure that this collection of scientific excellence will be valued by scientists of today and will inspire the next generation to carry these ideas into the future Research Grants Index National Institutes of Health (U.S.). Division of Research Grants, 1965 Astronautics for Peace and Human Progress L. G. Napolitano, 2013-10-22 Astronautics for Peace and Human Progress contains the proceedings of the 29th Congress of the International Astronautical Federation held in Dubrovnik Croatia on October 1-8

1978 The papers explore the role of astronautics in the pursuit of peace and human progress and cover topics ranging from space exploration and communication satellites to space technology and Earth exploration from space This book is comprised of 32 chapters and opens with a discussion on space programs of countries such as the United States Japan Germany USSR and Italy The following chapters focus on systems for space exploration such as SPACELAB and those associated with the Voyager program and the International Solar Polar Out of Ecliptic Mission The evolution of Space Power Systems is also described along with Earth exploration from space Spaceborne sensors automatic data analysis and Landsat imagery are considered The final two sections deal with communication satellites and space technology This monograph will appeal to space scientists and astronautical engineers

Manual of Remote Sensing, Remote Sensing for Natural Resource Management and Environmental Monitoring Susan L. Ustin, 2004-05-03 Part of an ongoing series of manuals covering the range of applications of remotely sensed imagery Volume 4 addresses the use of this technology in natural resource management and environmental monitoring Comprehensive authoritative and up to date it covers terrestrial ecosystems aquatic ecosystems and agriculture ecosystems as well as future directions in technology and research

Review of Radio Science W. Ross Stone, 2002-08-12 A triennial summation of the state of the art in radio science This book is the fourth in the modern series of triennial reviews prepared by the International Union of Radio Science to further communication and understanding of the status and future of radio science both for those working in the field and for those who want to know what is of current importance in this area The International Union of Radio Science URSI Union Radio Scientifique Internationale has divided the subject of Radio Science according to the ten topics of the Scientific Commissions that make up URSI This volume consists of thirty eight original peer reviewed papers Each paper provides a critical in depth review of and in many cases tutorial on advances and research that have been of significant importance within the area of interest of the Commissions during the past three to four years Among the topics covered are Electromagnetic metrology Fields and waves Signals and systems Electronics and photonics Electromagnetic noise and interference Wave propagation and remote sensing Ionospheric radio and propagation Waves in plasmas Radio astronomy Electromagnetics in biology and medicine With an included CD ROM of the full book text allowing the user to do full text searching of all the papers the Review of Radio Science 1999 2002 is a resource of vital importance to anyone working in or with an interest in radio science

Advances in Phytoplankton Ecology Lesley Clementson, Ruth Eriksen, Anusuya Willis, 2021-12-08 Phytoplankton ecology has developed from an understanding of taxonomy species dynamics and functional roles and species interactions with the surrounding environment New and emerging technologies enable a paradigm shift in the ways we monitor and understand phytoplankton in a range of environments Advances in Phytoplankton Ecology Applications of Emerging Technologies is a practical guide to these new technologies and explores their application with case studies to show how recent advances have changed our understanding of phytoplankton ecology Part one of this book explores how traditional

taxonomy and species identification has changed moving from morphological to molecular techniques Part two explores the new technologies for remote and automatic monitoring and sensor technology and applications for management Part three explores the explosion of omics techniques and their application in species identification functional populations trait characterization interspecific interactions and interaction with their environment This book is an invaluable guide for marine and freshwater ecology researchers to how new technologies can enhance our understanding of ecology Combines traditional techniques with new technologies and methods Explores the influence of new technology on our understanding of phytoplankton ecology Provides practical applications of each technique through case studies in each chapter **Canada**

[1608-1954] in Maps and Charts Olin Dee Morrison,1954 *SIMBIOS Project 2001 Annual Report* Giulietta S.

Fargion,2002 **Scientific and Technical Aerospace Reports** ,1992 *Inversion and Data Assimilation in Remote*

Sensing Yajing Yan,2024-11-27 Remote sensing data are now the primary sources for observing Earth and the Universe Data inversion and assimilation techniques are the main tools for estimating and predicting the geophysical parameters that characterize the evolution of our planet and the Universe using remote sensing data Inversion and Data Assimilation in Remote Sensing explores recent advances in the inversion and assimilation of remote sensing data It presents traditional and current neural network methods as well as a number of topics where these methods have been developed or adapted to suit the specific nature of the field The assimilation section covers prediction problems in volcanology and glaciology Lastly the inversion section covers biomass inversion using SAR images bio physio hydrological inversion in coastal areas using multi and hyperspectral images and astrophysical inversion using telescope data Earth Resources ,1977 National

Geographic Illustrated Birds of North America, Folio Edition Jon Lloyd Dunn,2009 Gives readers a view of our avian world

This book includes 970 species with 700 enlarged range maps **Hyperspectral Remote Sensing** Prem Chandra

Pandey,Prashant K. Srivastava,Heiko Balzter,Bimal Bhattacharya,George P. Petropoulos,2020-08-05 Hyperspectral Remote Sensing Theory and Applications offers the latest information on the techniques advances and wide ranging applications of hyperspectral remote sensing such as forestry agriculture water resources soil and geology among others The book also presents hyperspectral data integration with other sources such as LiDAR Multi spectral data and other remote sensing techniques Researchers who use this resource will be able to understand and implement the technology and data in their respective fields As such it is a valuable reference for researchers and data analysts in remote sensing and Earth Observation fields and those in ecology agriculture hydrology and geology Includes the theory of hyperspectral remote sensing along with techniques and applications across a variety of disciplines Presents the processing methods and techniques utilized for hyperspectral remote sensing and in situ data collection Provides an overview of the state of the art including algorithms techniques and case studies

The book delves into Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters. Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters is a crucial topic that must be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:
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 - Chapter 2: Essential Elements of Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters
 - Chapter 3: Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters in Everyday Life
 - Chapter 4: Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters in Specific Contexts
 - Chapter 5: Conclusion
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 3. In chapter 2, this book will delve into the foundational concepts of Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters. This chapter will elucidate the essential principles that need to be understood to grasp Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters in its entirety.
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 6. In chapter 5, the author will draw a conclusion about Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters. This chapter will summarize the key points that have been discussed throughout the book.
- This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Color Of Inland And Coastal Waters Color Of Inland And Coastal Waters.

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