Modeling Methods For Marine Science

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Modeling Methods For Marine Science ***2023-05-31***

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Field Methods in Marine Science CRC Press
This report reviews the methods available for examining ecosystem dynamics and assessing the impact of interactions between ecosystems and human activities, particularly fisheries, and their implications for marine fisheries management. It focuses on the currently available models representative of general types such as bionergetic models, predator-prey models and minimally realistic models; with short descriptions given of model parameters, assumptions and data requirements. It discusses the advantages, disadvantages and limitations of each of the approaches; and concludes with some recommendations for the future development of multi-species and ecosystem models.
Dynamics and Modelling of Ocean Waves American Geophysical Union
With numerous real-world examples, Modelling and Quantitative Methods in Fisheries, Second Edition provides an introduction to the analytical methods used by fisheries' scientists and ecologists. By following the examples using Excel, readers see the nuts and bolts of how the methods work and better understand the underlying principles. Excel workbooks are available for download from CRC Press website. In this second edition, the author has revised all chapters and improved a number of the examples. This edition also includes two entirely new chapters: Characterization of Uncertainty covers asymptotic errors and likelihood profiles and develops a generalized Gibbs sampler to run a Markov chain Monte Carlo analysis that can be used to generate Bayesian posteriors Sized-Based Models implements a fully functional size-based stock assessment model using abalone as an example This book continues to cover a broad range of topics related to quantitative methods and modelling. It offers a solid foundation in the skills required for the quantitative study of marine populations. Explaining important

and relatively complex ideas and methods in a clear manner, the author presents full, step-by-step derivations of equations as much as possible to enable a thorough understanding of the models and methods.

Numerical Methods for Atmospheric and Oceanic Sciences Frontiers Media SA

Using R for Modelling and Quantitative Methods in Fisheries has evolved and been adapted from an earlier book by the same author and provides a detailed introduction to analytical methods commonly used by fishery scientists, ecologists, and advanced students using the open-source software R as a programming tool. Some knowledge of R is assumed, as this is a book about using R, but an introduction to the development and working of functions, and how one can explore the contents of R functions and packages, is provided. The example analyses proceed step-by-step using code listed in the book and from the book's companion R package, MQMF, available from GitHub and the standard archive, CRAN. The examples are designed to be simple to modify so the reader can quickly adapt the methods described to use with their own data. A primary aim of the book is to be a useful resource to natural resource practitioners and students. Featured Chapters: Model Parameter Estimation provides a detailed explanation of the requirements and steps involved in fitting models to data, using R and, mainly, maximum likelihood methods. On Uncertainty uses R to implement bootstrapping, likelihood profiles, asymptotic errors, and Bayesian posteriors to characterize any uncertainty in an analysis. The use of the Monte Carlo Markov Chain methodology is examined in some detail. Surplus Production Models applies all the methods examined in the earlier parts of the book to conducting a stock assessment. This included fitting alternative models to the available data, characterizing the uncertainty in different ways, and projecting the optimum models forward in time as the basis for providing useful management advice.

Joint Species Distribution Modelling Food & Agriculture Org.

This 2005 book gives a comprehensive overview of measurement techniques and theories for marine turbulence and mixing processes. It describes the processes which control the mixing of greenhouse gases, nutrients, trace elements, and hazardous substances in our oceans and shelf seas - from local to planetary scales. These processes buffer climate changes and are centrally important for regional to global ecosystem dynamics. The publication also contains source codes of turbulence models and models of the upper-ocean mixing layer (COHERENS and GOTM), and observational data sets of turbulence characteristics or corresponding proxies of waters from all over the world. These can be found at www.cambridge.org/9780521153720. Written by a team of 53 world-leading experts, it represents a rich source of data and methods for students and scientists in oceanography, hydrology, limnology, and meteorology, as well as marine, naval and civil engineers.

Modeling Methods for Marine Science Chicago Review Press

This book is written for college juniors and seniors and new graduate students in meteorology, ocean engineering, and oceanography. It begins with a brief overview of what is known about the ocean. This is followed by a description of the ocean basins, for the shape of the seas influences the physical processes in the water. Next, students will study the external

forces, wind and heat, acting on the ocean, and the ocean's response. It also includes the equations describing dynamic response of the ocean. For example, the equations of motion, the influence of earth's rotation, and viscosity. Finally, students consider some particular examples: the deep circulation, the equatorial ocean and El NiE no, and the circulation of particular areas of the ocean. Contents: 1) A Voyage of Discovery. 2) The Historical Setting. 3) The Physical Setting. 4) Atmospheric Influences. 5) The Oceanic Heat Budget. 6) Temperature, Salinity and Density. 7) The Equations of Motion. 8) Equations of Motion with Viscosity. 9) Response of the Upper Ocean to Winds. 10) Geostrophic Currents. 11) Wind Driven Ocean Circulation. 12) Vorticity in the Ocean. 13) Deep Circulation in the Ocean. 14) Equatorial Processes. 15) Numerical Models. 16) Ocean Waves. 17) Coastal Processes and Tides."

Mathematical Methods in the Earth and Environmental Sciences
Cambridge University Press

The term "zooplankton" describes the community of floating, often microscopic, animals that inhabit aquatic environments. Being near the base of the food chain, they serve as food for larger animals, such as fish. The ICES (International Council for the Exploration of the Sea) Zooplankton Methodology Manual provides comprehensive coverage of modern techniques in zooplankton ecology written by a group of international experts. Chapters include sampling, acoustic and optical methods, estimation of feeding, growth, reproduction and metabolism, and up-to-date treatment of population genetics and modeling. This book will be a key reference work for marine scientists throughout the world. - Sampling and experimental design - Collecting zooplankton - Techniques for assessing biomass and abundance - Protozooplankton enumeration and biomass estimation - New optical and acoustic techniques for estimating zooplankton biomass and abundance - Methods for measuring zooplankton feeding, growth, reproduction and metabolism - Population genetic analysis of zooplankton - Modelling zooplankton dynamics This unique and comprehensive reference work will be essential reading for marine and freshwater research scientists and graduates entering the field.

Modelling and Quantitative Methods in Fisheries, Second Edition
Cambridge University Press

This extensively updated new edition of the widely acclaimed Treatise on Geochemistry has increased its coverage beyond the wide range of geochemical subject areas in the first edition, with five new volumes which include: the history of the atmosphere, geochemistry of mineral deposits, archaeology and anthropology, organic geochemistry and analytical geochemistry. In addition, the original Volume 1 on "Meteorites, Comets, and Planets" was expanded into two separate volumes dealing with meteorites and planets, respectively. These additions increased the number of volumes in the Treatise from 9 to 15 with the index/appendices volume remaining as the last volume (Volume 16). Each of the original volumes was scrutinized by the appropriate volume editors, with respect to necessary revisions as well as additions and deletions. As a result, 27% were republished without major changes, 66% were revised and 126 new chapters were added. In a many-faceted field such as Geochemistry, explaining and understanding how one sub-field relates to another is key. Instructors will find the complete overviews with extensive cross-

referencing useful additions to their course packs and students will benefit from the contextual organization of the subject matter Six new volumes added and 66% updated from 1st edition. The Editors of this work have taken every measure to include the many suggestions received from readers and ensure comprehensiveness of coverage and added value in this 2nd edition The esteemed Board of Volume Editors and Editors-in-Chief worked cohesively to ensure a uniform and consistent approach to the content, which is an amazing accomplishment for a 15-volume work (16 volumes including index volume)!
Modeling Methods for Marine Science Cambridge University Press
This is a textbook on modelling, data analysis and numerical techniques for advanced students and researchers in chemical, biological, geological and physical oceanography.
Remote Sensing and Modeling Academic Press
With the development of earth observation technologies (such as satellite remote sensing, unmanned aerial vehicle, autonomous underwater vehicle, etc.), an era of big data with important and non-negligible spatial/temporal attributes comes. Novel and rigorous spatiotemporal methodologies and models are needed to process and analyze marine big data. Since many marine environmental processes, such as pollutants diffusion, algae distributions etc., vary or evolve across spatiotemporal domains, detecting the distributions and patterns of marine fauna and, particularly in the coastal regions, will improve our understanding of marine systems and can be beneficial in marine environmental management. The goals of this Research Topic, therefore, are two-fold: (a) to develop methodologies and models in theory and applications, including spatiotemporal geostatistics, geographic information system, deep learning, etc.; (b) to quantitatively gain the knowledge of the marine environment. This Research Topic will provide a platform for researchers to share and exchange their new knowledge gained in a spatiotemporal domain of marine or coastal regions. This Research Topic will cover, but is not limited to, the following areas: • Spatiotemporal variations of physical/chemical/biological indicators (such as chlorophyll, temperature, salinity, colorful dissolved organic matter, suspended solids, nutrients, microplastic, etc.) in marine. • Spatiotemporal variations of potential fishing grounds in marine. • Spatiotemporal variations of the ecosystems in coastal regions, such as salt marshes, mangroves, seagrass, macroalgae, etc. • Spatiotemporal distributions of the pollutants (such as heavy metals, polycyclic aromatic hydrocarbon, etc.) in marine and sediments. • Spatiotemporal evolution pattern modeling and prediction of the marine disasters and abnormal phenomena (such as algal bloom, typhoons, SST anomalies, etc).
Ecosystem Approaches to Fisheries Elsevier
Eastern boundary upwelling systems (EBUS) have historically received attention from the scientific community due to their impact on the economic development of these highly productive systems. Remote sensing, numerical modeling, and in situ observations have increased their spatial and temporal resolutions during the last 40 years in their strategy to provide reliable products about the actual state of the ocean. The assembly of several data sources currently constitutes an opportunity to increase our knowledge about the present and future state of the relatively narrow and highly variable EBUS. The primary forcing mechanism in the upwelling regions is the

wind stress in areas close to the coast. Long-term trends in wind intensity in upwelling areas present considerable uncertainties as the different wind databases produce divergent results. On the other hand, although the effect of climate change in the interior ocean is increasing temperatures in upwelling areas, the long-term trends seem to be in the opposite direction. Hence, assessing the long-term impact of the environmental conditions on upwelling development represents a major challenge for the scientific community. This special issue aims to discuss the state-of-the-art understanding of dynamical processes governing the ocean at the eastern boundary upwelling systems in a changing ocean.

Inverse Modeling of the Ocean and Atmosphere Springer

Inspired by the work of the renowned fisheries scientist Daniel Pauly, this book provides a detailed overview of ecosystem-based management of fisheries. It explores the complex and interdisciplinary nature of the subject by bringing together contributions from some of the world's leading fisheries scientists, managers and conservationists. Combining both research reviews and opinion pieces, and reflecting the breadth of Pauly's influence within the field, the book illustrates the range of issues associated with the implementation of the ecosystem approach and the challenge of long-term sustainability. Topics covered include global biodiversity, the impact of human actions on marine life, the implications for economic and social systems and the role of science in communicating and shaping ocean policy to preserve resources for the future. This book provides a complete and essential overview for advanced researchers and those just entering the field.

Springer Handbook of Ocean Engineering Frontiers Media SA

Introduction to Ocean Circulation and Modeling provide basics for physical oceanography covering ocean properties, ocean circulations and their modeling. First part of the book explains concepts of oceanic circulation, geostrophy, Ekman, Sverdrup dynamics, Stommel and Munk problems, two-layer dynamics, stratification, thermal and salt diffusion, vorticity/instability, and so forth. Second part highlights basic implementation framework for ocean models, discussion of different models, and their unique differences from the common framework with basin-scale modeling, regional modeling, and interdisciplinary modeling at different space and time scales. Features: Covers ocean properties, ocean circulations and their modeling. Explains the centrality of a rotating earth and its implications for ocean and atmosphere in a simple manner. Provides basic facts of ocean dynamics. Illustrative diagrams for clear understanding of key concepts. Outlines interdisciplinary and complex models for societal applications. The book aims at Senior Undergraduate Students, Graduate Students and Researchers in Ocean Science and Engineering, Ocean Technology, Physical Oceanography, Ocean Circulation, Ocean Modeling, Dynamical Oceanography and Earth Science.

Deep Learning for Marine Science World Scientific Publishing Company

New Edition: Ocean Surface Waves: Their Physics and Prediction (3rd Edition)This book is intended as a handbook for professionals and researchers in the areas of Physical Oceanography, Ocean and Coastal Engineering and as a text for graduate students in these fields.It presents a comprehensive study on surface ocean

waves induced by wind, including basic mathematical principles, physical description of the observed phenomena, practical forecasting techniques of various wave parameters and applications in ocean and coastal engineering, all from the probabilistic and spectral points of view.The book commences with a description of mechanisms of surface wave generation by wind and its modern modeling techniques. The stochastic and probabilistic terminology is introduced and the basic statistical and spectral properties of ocean waves are developed and discussed in detail.The bulk of material deals with the prediction techniques for waves in deep and coastal waters for simple and complex ocean basins and complex bathymetry. The various prediction methods, currently used in oceanography and ocean engineering, are described and the examples of practical calculations illustrate the basic text.An appendix provides a description of the modern methods of wave measurement, including the remote sensing techniques. Also the wave simulation methods and random data analysis techniques are discussed. In the book a lot of discoveries of the Russian and East European scientists, largely unknown in the Western literature due to the language barrier, are referred to.

Particles in the Coastal Ocean Cambridge University Press

This book addresses both fundamental and applied aspects of ocean waves including the use of wave observations made from satellites. More specifically it describes the WAM model, its scientific basis, its actual implementation, and its many applications. The three sections of the volume describe the basic statistical theory and the relevant physical processes; the numerical model and its global and regional applications; and satellite observations, their interpretation and use in data assimilation.

Introduction to Ocean Circulation and Modeling Orange Grove Text Plus

This Research Topic is the second volume of this collection. You can find the original collection via https://www.frontiersin.org/research-topics/45485/deep-learning-for-marine-science Deep learning (DL) is a critical research branch in the fields of artificial intelligence and machine learning, encompassing various technologies such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), Transformer networks and Diffusion models, as well as self-supervised learning (SSL) and reinforcement learning (RL). These technologies have been successfully applied to scientific research and numerous aspects of daily life. With the continuous advancements in oceanographic observation equipment and technology, there has been an explosive growth of ocean data, propelling marine science into the era of big data. As effective tools for processing and analyzing large-scale ocean data, DL techniques have great potential and broad application prospects in marine science. Applying DL to intelligent analysis and exploration of research data in marine science can provide crucial support for various domains, including meteorology and climate, environment and ecology, biology, energy, as well as physical and chemical interactions. Despite the significant progress in DL, its application to the aforementioned marine science domains is still in its early stages, necessitating the full utilization and continuous exploration of representative applications and best practices.

Official Gazette of the United States Patent and Trademark Office Elsevier Inc. Chapters

Field Methods in Marine Science: From Measurements to Models is an authoritative guide of the methods most appropriate for field research within the marine sciences, from experimental design to data analysis. Written for upper-level undergraduate and graduate students as well as early-career researchers, this textbook also serves as an accessible introduction to the concepts and practice of modeling marine system dynamics. This textbook trains the next generation of field scientists to move beyond the classic methods of data collection and statistical analysis to contemporary methods of numerical modeling; to pursue the assimilation and synthesis of information, not the mere recording of data. Boxes and side bars highlight important questions, interesting facts, relevant examples, and research techniques that supplement the text. Students and researchers alike will find the thorough appendices useful as a way of expanding comprehension of fundamental concepts.

Ecosystem-Based Fisheries Management World Scientific

Ocean physics plays a central role in structuring the large-scale patterns and functioning of ocean ecosystems, and climate variability impacts marine biota in a wide variety of ways. Primary production by phytoplankton forms the base of the pelagic-ocean food web and is modulated by temperature, nutrient supply, light, and mixed layer depth. Temperature influences a host of organism physiological rates, and temperature and circulation are determining factors in the geographic ranges of many marine species. Climate variations alter predator–prey interactions, interspecies competition, the seasonal timing of biological events or phenology, the spread of diseases, parasites and invasive species, and the biogeochemical cycling of carbon, nutrients, and many trace chemicals. Ocean biology, in turn, can affect climate by influencing the atmospheric composition of radiatively important trace gases such as carbon dioxide, nitrous oxide, and dimethyl sulfide; chlorophyll also modifies the vertical absorption profile of solar radiation and thus influences sea-surface temperature and mixed layer depth. Based on historical observations, biological effects are already evident in response to anthropogenic ocean warming and sea-ice melt. Future climate change impacts are expected to grow in magnitude due to further warming and other physical changes as well as synergistic effects with other human stressors such as ocean acidification, deoxygenation, and coastal nutrient eutrophication.

Spatiotemporal Modeling and Analysis in Marine Science Cambridge University Press

This book summarizes the modeling of the transport, evolution and fate of particles in the coastal ocean for advanced students and researchers.

Oceanographic Analysis with R Cambridge University Press

This book is geared for advanced level research in the general subject area of remote sensing and modeling as they apply to the coastal marine environment. The various chapters focus on the latest scientific and technical advances in the service of better understanding coastal marine environments for their care, conservation and management. Chapters specifically deal with advances in remote sensing coastal classifications, environmental monitoring, digital ocean technological advances, geophysical methods, geoacoustics, X-band radar, risk assessment models,

GIS applications, real-time modeling systems, and spatial modeling. Readers will find this book useful because it summarizes applications of new research methods in one of the world's most dynamic and complicated environments. Chapters in this book will be of interest to specialists in the coastal marine environment who deals with aspects of environmental monitoring and assessment via remote sensing techniques and numerical modeling.

Marine Science for Kids CRC Press

This advanced textbook on modeling, data analysis and numerical techniques for marine science has been developed from a course taught by the authors for many years at the Woods Hole Oceanographic Institute. The first part covers statistics: singular value decomposition, error propagation, least squares regression, principal component analysis, time series analysis and objective interpolation. The second part deals with modeling techniques: finite differences, stability analysis and optimization. The third part describes case studies of actual ocean models of ever increasing dimensionality and complexity, starting with zero-dimensional models and finishing with three-dimensional general circulation models. Throughout the book hands-on computational examples are introduced using the MATLAB programming language and the principles of scientific visualization are emphasised. Ideal as a textbook for advanced students of oceanography on courses in data analysis and numerical modeling, the book is also an invaluable resource for a broad range of scientists undertaking modeling in chemical, biological, geological and physical oceanography.