Ocean Biogeochemistry The Role Of The Ocean Carbo

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Nitrogen in the Marine Environment - Edward J. Carpenter 2016-10-27 Nitrogen in the Marine Environment provides information pertinent to the many aspects of the nitrogen cycle. This book presents the advances in ocean productivity research, with emphasis on the role of microbes in nitrogen transformations with excursions to higher trophic levels. Organized into 24 chapters, this book begins with an overview of the abundance and distribution of the various forms of nitrogen in a number of estuaries. This text then provides a comparison of the nitrogen cycling of various ecosystems within the marine environment. Other chapters consider chemical distributions and methodology as an aid to those entering the field. This book discusses as well the enzymology of the initial steps of inorganic nitrogen assimilation. The final chapter

deals with the philosophy and application of modeling as an investigative method in basic research on nitrogen dynamics in coastal and open-ocean marine environments. This book is a valuable resource for plant biochemists, microbiologists, aquatic ecologists, and bacteriologists.

Ocean Biogeochemistry and Global Change - Beatriz M. Baliño 2001

Role of colloids in upper ocean biogeochemistry in the northeast Pacific Ocean elucidated from 238U-234Th disequilibria - C.-A. HUH 1995

Systems Biogeochemistry of Major Marine Biomes - Aninda Mazumdar 2022-04-12 Systems Biogeochemistry of Major Marine Biomes A comprehensive system-level discussion of the geomicrobiology of the Earth's oceans In Systems Biogeochemistry of Major Marine Biomes, a team of distinguished researchers delivers a systemic overview of biogeochemistry across a number of major physiographies of the global ocean: the waters and sediments overlying continental margins; the deep sub-surfaces; the Arctic and Antarctic oceans; and the physicochemical extremes such as the hypersaline and sulfidic marine zones, cold methane seeps and hydrothermal ecosystems. The book explores state-of-the-art advances in marine geomicrobiology and investigates the drivers of biogeochemical processes. It highlights the imperatives of the unique, fringe, and cryptic processes while studying the geological manifestations and ecological feedbacks of in situ microbial metabolisms. Taking a holistic approach toward the understanding of marine biogeochemical provinces, this book emphasizes the centrality of culture-dependent and culture-independent (meta-omics-based) microbiological information within a systems biogeochemistry framework. Perfect for researchers and scientists in the fields of

geochemistry, geophysics, geomicrobiology, oceanography, and marine science, Systems Biogeochemistry of Major Marine Biomes will also earn a place in the libraries of policymakers and advanced graduate students seeking a one-stop reference on marine biogeochemistry.

The Future of Ocean Biogeochemistry in a High-CO2 World - William M. Balch 2009

Indian Ocean Biogeochemical Processes and Ecological Variability - Jerry D. Wiggert 2013-05-09 Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 185. Indian Ocean Biogeochemical Processes and Ecological Variability provides a synthesis of current knowledge on Indian Ocean biogeochemistry and ecology and an introduction to new concepts and topical paradigm challenges. It also reports on the development of more extensive/frequent observational capacity being deployed in the Indian Ocean. This represents the first collection of syntheses that emphasize a basin-wide perspective, and the contributing authors include some of the most esteemed oceanographers and Indian Ocean experts in the world. The volume is derived from invited plenary talks that were presented at the initial Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) workshop held at the National Institute of Oceanography (NIO) in Goa, India, in October 2006. The volume discusses The overlying physical processes set by monsoonal forcing and how these control biological production and variability Nutrient cycling and limitation Pelagic carbon cycling and air-sea exchange Benthic biogeochemistry and ecology The impact of climate and human activities on biogeochemistry and ecosystems. The readership for this book will consist of academic and governmental

researchers interested in exploring how oceanographic, atmospheric, and hydrological processes combine to establish the environmental setting that supports and drives the pelagic system and which are especially relevant to understanding the complex biogeochemical and ecological interactions in the Indian Ocean.

Ocean Acidification - Jean-Pierre Gattuso 2011-09-15

The ocean helps moderate climate change thanks to its considerable capacity to store CO2, through the combined actions of ocean physics, chemistry, and biology. This storage capacity limits the amount of human-released CO2 remaining in the atmosphere. As CO2 reacts with seawater, it generates dramatic changes in carbonate chemistry, including decreases in pH and carbonate ions and an increase in bicarbonate ions. The consequences of this overall process, known as "ocean acidification", are raising concerns for the biological, ecological, and biogeochemical health of the world's oceans, as well as for the potential societal implications. This research level text is the first to synthesize the very latest understanding of the consequences of ocean acidification, with the intention of informing both future research agendas and marine management policy. A prestigious list of authors has been assembled, among them the coordinators of major national and international projects on ocean acidification.

Geochemistry of Organic Matter in River-Sea Systems - V.E. Artemyev 2012-12-06

One of the basic concepts of ocean biogeochemistry is that of an ocean with extremely active boundary zones and separation boundaries of extensive biochemical interactions. The areas of these zones are characterized by a sharp decrease of element migration intensity and consequently the decrease in their concentrations gave the boundaries for the naming of the geochemical barriers (Perelman, 1972). For the

purposes of biogeo chemistry the most important ones are the boundaries of separation between river-sea, ocean-atmosphere, and water-ground (Lisitzin, 1983). The most complicated of them is the river-sea boundary, where the biogeochemical processes are the most active and complicated (Monin and Romankevich, 1979, 1984). The necessity of studying organic matter in rivers, mouth regions and adjoining sea aquatories has been repeatedly pointed out by v.I. Vernadsky (1934, 1960) who noted both the importance of registration of solid and liquid run-off of rivers, coming into the sea, and "the quality and the character of those elements, which are washed-down into the sea", emphasizing that "wash-down of organic substances into the sea is of great value". The interest in studying organic matter in natural waters, including river and sea waters, has grown considerably over the last 30 years. During this period essential material was collected on the content and composition of organic matter in various types of river waters of the USSR, and this was published in papers by B.A Scopintzev, AD. Semenov, M.V.

Ocean Mixing - Michael Meredith 2021-09-16

Ocean Mixing: Drivers, Mechanisms and Impacts presents a broad panorama of one of the most rapidly-developing areas of marine science. It highlights the state-of-the-art concerning knowledge of the causes of ocean mixing, and a perspective on the implications for ocean circulation, climate, biogeochemistry and the marine ecosystem. This edited volume places a particular emphasis on elucidating the key future questions relating to ocean mixing, and emerging ideas and activities to address them, including innovative technology developments and advances in methodology. Ocean Mixing is a key reference for those entering the field, and for those seeking a comprehensive overview of how the key current issues are being addressed and what the

priorities for future research are. Each chapter is written by established leaders in ocean mixing research; the volume is thus suitable for those seeking specific detailed information on sub-topics, as well as those seeking a broad synopsis of current understanding. It provides useful ammunition for those pursuing funding for specific future research campaigns, by being an authoritative source concerning key scientific goals in the short, medium and long term. Additionally, the chapters contain bespoke and informative graphics that can be used in teaching and science communication to convey the complex concepts and phenomena in easily accessible ways. • Presents a coherent overview of the state-of-the-art research concerning ocean mixing • Provides an in-depth discussion of how ocean mixing impacts all scales of the planetary system • Includes elucidation of the grand challenges in ocean mixing, and how they might be addressed

Marine Microbiome and Biogeochemical Cycles in Marine Productive Areas - Alejandro A. Murillo 2020-01-16

Ocean Acidification - National Research Council 2010-10-14 The ocean has absorbed a significant portion of all human-made carbon dioxide emissions. This benefits human society by moderating the rate of climate change, but also causes unprecedented changes to ocean chemistry. Carbon dioxide taken up by the ocean decreases the pH of the water and leads to a suite of chemical changes collectively known as ocean acidification. The long term consequences of ocean acidification are not known, but are expected to result in changes to many ecosystems and the services they provide to society. Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean reviews the current state of knowledge, explores gaps in understanding, and identifies several key findings. Like climate change, ocean

acidification is a growing global problem that will intensify with continued CO2 emissions and has the potential to change marine ecosystems and affect benefits to society. The federal government has taken positive initial steps by developing a national ocean acidification program, but more information is needed to fully understand and address the threat that ocean acidification may pose to marine ecosystems and the services they provide. In addition, a global observation network of chemical and biological sensors is needed to monitor changes in ocean conditions attributable to acidification.

Dynamics and Characterization of Marine Organic Matter - N. Handa 2013-03-09

Over the past decade the scientific activities of the Joint Global Ocean Flux Study (JGOFS), which focuses on the role of the oceans in controlling climate change via the transport and storage of greenhouse gases and organic matter, have led to an increased interest in the study of the biogeochemistry of organic matter. There is also a growing interest in global climate fluctuations. This, and the need for a precise assessment of the dynamics of carbon and other bio-elements, has led to a demand for an improved understanding of biogeochemical processes and the chemical characteristics of both particulate and dissolved organic matter in the ocean. A large amount of proxy data has been published describing the changes of the oceanic environment, but qualitative and quantitative estimates of the vertical flux of (proxy) organic compounds have not been well documented. There is thus an urgent need to pursue this line of study and, to this end, this book starts with several papers dealing with the primary production of organic matter in the upper ocean. Thereafter, the book goes on to follow the flux and characterization of particulate organic matter, discussed in relation to the primary

production in the euphotic zone and resuspension in the deep waters, including the vertical flux of proxy organic compounds. It goes on to explain the decomposition and transformation of organic matter in the ocean environment due to photochemical and biological agents, and the reactivity of bulk and specific organic compounds, including the air-sea interaction of biogenic gases. The 22 papers in the book reflect the interests of JGOFS and will thus serve as a valuable reference source for future biogeochemical investigations of both bio-elements and organic matter in seawater, clarifying the role of the ocean in global climate change.

Physical Controls on Southern Ocean Biogeochemistry - Channing Joseph Prend 2022

The Southern Ocean plays an outsized role in the global overturning circulation and climate system by transporting mass, heat, and tracers between basins, as well as between the surface and abyssal oceans. Consequently, the Southern Ocean accounts for a disproportionately large percentage of the total oceanic carbon uptake and helps set global nutrient inventories. Therefore, understanding the coupling between physical and biogeochemical processes in this region is crucial to reducing uncertainty in future climate projections. Historically, studying the Southern Ocean has been limited by the paucity of observational data from this remote environment. However, recent advances in autonomous observing technology have provided unprecedented spatial coverage of subsurface biogeochemical measurements. This thesis uses data from an array of more than 200 autonomous profiling floats--in conjunction with satellite data, numerical models, and theory--to investigate the fundamental question: How do physical processes in the Southern Ocean drive variability of phytoplankton biomass and carbon system parameters?

Naturally, the answer to this question will depend on the spatial and temporal scales of interest. Our approach is to consider multiple scales, with the central motivation of better understanding the carbon cycle on climatic timescales. First, we investigate regional patterns of phytoplankton seasonality in the Southern Ocean (Chapter 2). Results show that enhanced mixing at topographic features contributes to spatial variability in bloom magnitude and timing. Looking to smaller scales, we examine the generation of phytoplankton patchiness by turbulent stirring (Chapter 3). We find that parameterizing eddy transport as an enhanced diffusion requires timescale separation between the physical and biological processes, which raises concerns for the representation of subgrid scale primary productivity in coarse resolution climate models. Next, we turn to air-sea carbon fluxes. We show that carbon outgassing occurs preferentially in the Indo-Pacific sector of the Southern Ocean due to regional differences in the mixed-layer entrainment of upwelled carbon-rich deep water (Chapter 4). Finally, we quantify the relative importance of different frequency bands in driving year-to-year variations of Southern Ocean primary productivity. We find that changes in annual mean phytoplankton biomass are driven by intermittent sub-seasonal events associated with storms and eddies, rather than low frequency climate variability (Chapter 5). Together, these chapters use a novel combination of in situ measurements, satellite data, and model output to elucidate physical mechanisms that control Southern Ocean biogeochemistry. Understanding these drivers is necessary to improve climate models and predict the response of the ocean to climate change.

Introduction to Marine Biogeochemistry - Susan Libes 2011-08-29

Introduction to Marine Biogeochemistry focuses on the ocean's role in the biogeochemical cycling of selected elements and the impact of humans on the cycling of these elements. Among the topics covered are the chemical composition of seawater from the perspectives of elemental speciation and the impacts of solutes on water's physical behavior; biogeochemical phenomena which control accumulation and preservation of marine sediments; marine chemistry of radioactive and stable isotopes; and seawater pollution. The book contains many examples as well as steady-state models to aid readers in understanding this growing and complex science.. The focus of Introduction to Marine Biogeochemistry is the concept of the ocean as a system, linking land and atmospheric processes The text integrates the most current research, allowing students to learn concepts in context Includes detailed coverage of computational aspects

Primary Productivity and Biogeochemical Cycles in the Sea - Paul G. Falkowski 2013-06-26

Biological processes in the oceans play a crucial role in regulating the fluxes of many important elements such as carbon, nitrogen, sulfur, oxygen, phosphorus, and silicon. As we come to the end of the 20th century, oceanographers have increasingly focussed on how these elements are cycled within the ocean, the interdependencies of these cycles, and the effect of the cycle on the composition of the earth's atmosphere and climate. Many techniques and tools have been developed or adapted over the past decade to help in this effort. These include satellite sensors of upper ocean phytoplankton distributions, flow cytometry, molecular biological probes, sophisticated moored and shipboard instrumentation, and vastly increased numerical modeling capabilities. This volume is the result of the 37th Brookhaven Symposium in

Biology, in which a wide spectrum of oceanographers, chemists, biologists, and modelers discussed the progress in understanding the role of primary producers in biogeochemical cycles. The symposium is dedicated to Dr. Richard W. Eppley, an intellectual giant in biological oceanography, who inspired a generation of scientists to delve into problems of understanding biogeochemical cycles in the sea. We gratefully acknowledge support from the U.S. Department of Energy, the National Aeronautics and Space Administration, the National Science Foundation, the National Oceanic and Atmospheric Administration, the Electric Power Research Institute, and the Environmental Protection Agency. Special thanks to Claire Lamberti for her help in producing this volume.

Surface Ocean - Corinne Le Quéré 2013-05-02

Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 187. The focus of Surface Ocean: Lower Atmosphere Processes is biogeochemical interactions between the surface ocean and the lower atmosphere. This volume is an outgrowth of the Surface Ocean-Lower Atmosphere Study (SOLAS) Summer School. The volume is designed to provide graduate students, postdoctoral fellows, and researchers from a wide range of academic backgrounds with a basis for understanding the nature of ocean-atmosphere interactions and the current research issues in this area. The volume highlights include the following: Background material on ocean and atmosphere structure, circulation, and chemistry and on marine ecosystems Integrative chapters on the global carbon cycle and ocean biogeochemistry Issue-oriented chapters on the iron cycle and dimethylsulfide Tool-oriented chapters on biogeochemical modeling and remote sensing A framework of underlying physical/chemical/biological principles, as well as

perspectives on current research issues in the field. The readership for this book will include graduate students and/or advanced undergraduate students, postdoctoral researchers, and researchers in the fields of oceanography and atmospheric science. It will also be useful for experienced researchers in specific other disciplines who wish to broaden their perspectives on the complex biogeochemical coupling between ocean and atmosphere and the importance of this coupling to understanding global change.

Encyclopedia of Ocean Sciences - 2019-04-12

The oceans cover 70% of the Earth's surface, and are critical components of Earth's climate system. This new edition of Encyclopedia of Ocean Sciences summarizes the breadth of knowledge about them, providing revised, up to date entries as well coverage of new topics in the field. New and expanded sections include microbial ecology, high latitude systems and the cryosphere, climate and climate change, hydrothermal and cold seep systems. The structure of the work provides a modern presentation of the field, reflecting the input and different perspective of chemical, physical and biological oceanography, the specialized area of expertise of each of the three Editors-in-Chief. In this framework maximum attention has been devoted to making this an organic and unified reference. Represents a one-stop. organic information resource on the breadth of ocean science research Reflects the input and different perspective of chemical, physical and biological oceanography, the specialized area of expertise of each of the three Editors-in-Chief New and expanded sections include microbial ecology, high latitude systems and climate change Provides scientifically reliable information at a foundational level, making this work a resource for students as well as active researches

Biogeochemistry of Marine

Dissolved Organic Matter - Dennis A. Hansell 2014-10-02
Marine dissolved organic matter (DOM) is a complex mixture of molecules found throughout the world's oceans. It plays a key role in the export, distribution, and sequestration of carbon in the oceanic water column, posited to be a source of atmospheric climate regulation. Biogeochemistry of Marine Dissolved Organic Matter, Second Edition, focuses on the chemical constituents of DOM and its biogeochemical, biological, and ecological significance in the global ocean, and provides a single, unique source for the references, information, and informed judgments of the community of marine biogeochemists. Presented by some of the world's leading scientists, this revised edition reports on the major advances in this area and includes new chapters covering the role of DOM in ancient ocean carbon cycles, the long term stability of marine DOM, the biophysical dynamics of DOM, fluvial DOM qualities and fate, and the Mediterranean Sea. Biogeochemistry of Marine Dissolved Organic Matter, Second Edition, is an extremely useful resource that helps people interested in the largest pool of active carbon on the planet (DOC) get a firm grounding on the general paradigms and many of the relevant references on this topic. Features up-to-date knowledge of DOM, including five new chapters The only published work to synthesize recent research on dissolved organic carbon in the Mediterranean Sea Includes chapters that address inputs from freshwater terrestrial DOM

Marine Geochemistry - Roy Chester 2012-08-24
Marine Geochemistry offers a fully comprehensive andintegrated treatment of the chemistry of the oceans, theirsediments and biota. The first edition of the book received strongcritical acclaim and was described as ‘a standard text foryears to come.’ This third edition of

MarineGeochemistry has been written at a time when the role of theoceans in the Earth System is becoming increasingly apparent. Following the successful format adopted previously, thisnew edition treats the oceans as a unified entity, and addressesthe question ‘how do the oceans work as a chemicalsystem?’ To address this question, the text hasbeen updated to cover recent advances in our understanding oftopics such as the carbon chemistry of the oceans, nutrient cyclingand its effect on marine chemistry, the acidification of sea water,and the role of the oceans in climate change. In addition, theimportance of shelf seas in oceanic cycles has been re-evaluated inthe light of new research. Marine Geochemistry offers both undergraduate andgraduate students and research workers an integrated approach toone of the most important reservoirs in the Earth System. Additional resources for this book can be found at: ahref="http://www.wiley.com/go/chester/marinegeochemistry" www.wiley.com/go/chester/marinegeochemistry/a.

The Biogeochemistry of Iron in Seawater - David R. Turner 2001-11-28

Intensive research carried out during the 1990's (known as the "Iron Age of Oceanography") provided a wealth of new information and this title, written by acknowledged experts and reviewed by international specialists, provides the authoritative and comprehensive review of the subject area. A joint venture between SCOR and IUPAC, it expertly addresses the current state of knowledge of the biogeochemistry of iron in seawater and covers: * Chemical speciation * Analytical techniques * Transformation of iron * It includes evidence for iron limitation of primary production of High Nutrient Low Chlorophyll (HNLC) areas in the ocean * Structured into a series of chapters it has been reviewed by international

specialists- SCOR (Scientific Committee for Ocean Research) and IUPAC (International Union for Pure and Applied Chemistry) * The final chapter summarises the conclusions of the book and discusses the priorities for future research * Ideal for scientists studying the environmental impact of metals and their role in marine ecosystems; Marine Scientists and Oceanographers; Environmental Analytical Chemists

Three studies of interannual variations in ocean biogeochemistry at northern high latitudes - Are Olsen 2002

Ocean Biogeochemistry and Air-sea CO2 Exchange - P. Williamson 1991

Ocean Dynamics and the Carbon Cycle - Richard G. Williams 2011-07-14

This textbook for advanced undergraduate and graduate students presents a multidisciplinary approach to understanding ocean circulation and how it drives and controls marine biogeochemistry and biological productivity at a global scale. Background chapters on ocean physics, chemistry and biology provide students with the tools to examine the range of large-scale physical and dynamic phenomena that control the ocean carbon cycle and its interaction with the atmosphere. Throughout the text observational data is integrated with basic physical theory to address cutting-edge research questions in ocean biogeochemistry. Simple theoretical models, data plots and schematic illustrations summarise key results and connect the physical theory to real observations. Advanced mathematics is provided in boxes and appendices where it can be drawn on to assist with the worked examples and homework exercises available online. Further reading lists for each chapter and a comprehensive glossary provide students and instructors with a complete learning package.

The Biogeochemical Cycle

of Silicon in the Ocean - Bernard Quéguiner 2016-06-20
In the biogeochemical dynamics of marine ecosystems, silicon is a major element whose role has, for a long time, been underestimated. It is however indispensable to the activity of several biomineralizing marine organisms, some of which play an essential role in the biological pump of oceanic carbon. This book presents notions indispensable to the knowledge on the silicon biogeochemical cycle in ocean systems, first of all describing the main quantitative analysis techniques and examination of the major organisms involved in the cycle. The author then moves on to study the most up-to-date processes to control the use of silicon and its regeneration in natural conditions, before mentioning the central role played by this original element in the control of all the biogeochemical cycles in the global ocean. The available information finally enables the global biogeochemical budget of silicon in the marine environment to be quantified.

The Ocean Carbon Cycle and Climate - Mick Follows 2004-08-03
Our desire to understand the global carbon cycle and its link to the climate system represents a huge challenge. These overarching questions have driven a great deal of scientific endeavour in recent years: What are the basic oceanic mechanisms which control the oceanic carbon reservoirs and the partitioning of carbon between ocean and atmosphere? How do these mechanisms depend on the state of the climate system and how does the carbon cycle feed back on climate? What is the current rate at which fossil fuel carbon dioxide is absorbed by the oceans and how might this change in the future? To begin to answer these questions we must first understand the distribution of carbon in the ocean, its partitioning between different ocean reservoirs (the "solubility" and "biological" pumps of carbon), the mechanisms controlling these

reservoirs, and the relationship of the significant physical and biological processes to the physical environment. The recent surveys from the JGOFS and WOCE (Joint Global Ocean Flux Study and World Ocean Circulation Ex periment) programs have given us a first truly global survey of the physical and biogeochemical properties of the ocean. These new, high quality data provide the opportunity to better quantify the present oceans reservoirs of carbon and the changes due to fossil fuel burning. In addition, diverse process studies and time-series observations have clearly revealed the complexity of interactions between nutrient cycles, ecosystems, the carbon-cycle and the physical envi ronment.

Ocean Biogeochemical Dynamics - Jorge L. Sarmiento 2013-07-17

Ocean Biogeochemical Dynamics provides a broad theoretical framework upon which graduate students and upper-level undergraduates can formulate an understanding of the processes that control the mean concentration and distribution of biologically utilized elements and compounds in the ocean. Though it is written as a textbook, it will also be of interest to more advanced scientists as a wide-ranging synthesis of our present understanding of ocean biogeochemical processes. The first two chapters of the book provide an introductory overview of biogeochemical and physical oceanography. The next four chapters concentrate on processes at the air-sea interface, the production of organic matter in the upper ocean, the remineralization of organic matter in the water column, and the processing of organic matter in the sediments. The focus of these chapters is on analyzing the cycles of organic carbon, oxygen, and nutrients. The next three chapters round out the authors' coverage of ocean biogeochemical cycles with discussions of silica, dissolved inorganic carbon and alkalinity, and CaCO3. The

final chapter discusses applications of ocean biogeochemistry to our understanding of the role of the ocean carbon cycle in interannual to decadal variability, paleoclimatology, and the anthropogenic carbon budget. The problem sets included at the end of each chapter encourage students to ask critical questions in this exciting new field. While much of the approach is mathematical, the math is at a level that should be accessible to students with a year or two of college level mathematics and/or physics.

The Mediterranean Sea in the Era of Global Change 1 - Christophe Migon 2020-02-19

Due to its particular characteristics, the Mediterranean Sea is often viewed as a microcosm of the World Ocean. Its proportionally-reduced dimensions and peculiar hydrological circulation render it susceptible to environmental and climatic constraints, which are rapidly evolving. The Mediterranean is therefore an ideal site to examine, in order to better understand a number of key oceanographic phenomena. This is especially true of the Ligurian Sea where, due to its geology, oceanic conditions are found close to the coast. As such, 30 years ago, an offshore time-series site provided a fresh impetus to a long history of marine biology research, which has generated a very important body of data and knowledge. This is the first volume, in a two-volume series, that summarizes this research. Across these two books, the reader will find 13 chapters that examine the geology, physics, chemistry and biology of the Ligurian Sea ? always with the goal of providing key elements of oceanography in a changing world.

Marine Carbon Biogeochemistry - Jack J. Middelburg 2019-01-25

This open access book discusses biogeochemical processes relevant to carbon and aims to provide readers, graduate students and researchers, with insight into the functioning of marine

ecosystems. A carbon centric approach has been adopted, but other elements are included where relevant or needed. The book focuses on concepts and quantitative understanding of primary production, organic matter mineralization and sediment biogeochemistry. The impact of biogeochemical processes on inorganic carbon dynamics and organic matter transformation are also discussed.

Capturing Optically Important Constituents and Properties in a Marine Biogeochemical and Ecosystem Model - 2015

We present a numerical model of the ocean that couples a three-stream radiative transfer component with a marine biogeochemical–ecosystem component in a dynamic three-dimensional physical framework. The radiative transfer component resolves the penetration of spectral irradiance as it is absorbed and scattered within the water column. We explicitly include the effect of several optically important water constituents (different phytoplankton functional types; detrital particles; and coloured dissolved organic matter, CDOM). The model is evaluated against in situ-observed and satellite-derived products. In particular we compare to concurrently measured biogeochemical, ecosystem, and optical data along a meridional transect of the Atlantic Ocean. The simulation captures the patterns and magnitudes of these data, and estimates surface upwelling irradiance analogous to that observed by ocean colour satellite instruments. We find that incorporating the different optically important constituents explicitly and including spectral irradiance was crucial to capture the variability in the depth of the subsurface chlorophyll a (Chl a) maximum. We conduct a series of sensitivity experiments to demonstrate, globally, the relative importance of each of the water constituents, as well as the crucial feedbacks between the light field, the relative

fitness of phytoplankton types, and the biogeochemistry of the ocean. CDOM has proportionally more importance at attenuating light at short wavelengths and in more productive waters, phytoplankton absorption is relatively more important at the subsurface Chl a maximum, and water molecules have the greatest contribution when concentrations of other constituents are low, such as in the oligotrophic gyres. Scattering had less effect on attenuation, but since it is important for the amount and type of upwelling irradiance, it is crucial for setting sea surface reflectance. Strikingly, sensitivity experiments in which absorption by any of the optical constituents was increased led to a decrease in the size of the oligotrophic regions of the subtropical gyres: lateral nutrient supplies were enhanced as a result of decreasing high-latitude productivity. This new model that captures bio-optical feedbacks will be important for improving our understanding of the role of light and optical constituents on ocean biogeochemistry, especially in a changing environment. Further, resolving surface upwelling irradiance will make it easier to connect to satellite-derived products in the future.

Ocean Biogeochemistry in the Northern Gulf of Mexico, the East/Japan Sea, and the South Pacific with a Focus on Denitrification - Il Nam Kim 2012

Ocean nitrogen fixation and denitrification are crucial nitrogen source and sink mechanisms for the global ocean environment. While recent studies have reported that oceanic denitrification has increased over the last few decades, others have suggested that global ocean nitrogen fixation rates have been underestimated, and still others that anthropogenic perturbations have altered the global nitrogen cycle. This implies that the current estimates of the oceanic nitrogen inventory are incomplete and they need to be revised with more information.

In addition, current denitrification estimates need to be reexamined due to their large associated uncertainties. Thus, I have conducted research estimating denitrification rates in three different locations: the northern Gulf of Mexico (GOM), the East/Japan Sea (EJS), and the South Pacific: from coastal to marginal to open ocean scale in different oceanographic conditions. Denitrification rates in the bottom layer (including bottom waters+sediments) at the shallow and often hypoxic northern GOM ranged from 103-544 [mu]mol N m−2 d−1 (=1.4 to 7.4 Gg N mon−1 with area=3.24x1010m2), and were controlled not only by biogeochemical factors (i.e. organic matter supply and remineralization), but also by physical factors (i.e. stratification and relative contributions from different water masses). Despite high dissolved oxygen concentrations, the significant decrease in nitrate concentrations below the expected levels, low N/P ratio (

Ocean Dynamics and the Carbon Cycle - Richard G. Williams 2011-07-14

This textbook for advanced undergraduate and graduate students presents a multidisciplinary approach to understanding ocean circulation and how it drives and controls marine biogeochemistry and biological productivity at a global scale. Background chapters on ocean physics, chemistry and biology provide students with the tools to examine the range of large-scale physical and dynamic phenomena that control the ocean carbon cycle and its interaction with the atmosphere. Throughout the text observational data is integrated with basic physical theory to address cutting-edge research questions in ocean biogeochemistry. Simple theoretical models, data plots and schematic illustrations summarise key results and connect the physical theory to real observations. Advanced mathematics is provided in boxes and appendices where it

can be drawn on to assist with the worked examples and homework exercises available online. Further reading lists for each chapter and a comprehensive glossary provide students and instructors with a complete learning package.

Seasonal patterns of ocean biogeochemistry at the U.S. JGOFS Bermuda Atlantic Time-series Study site - A.F. MICHAELS 1994

Parameterizing the Marine Silicon Cycle - Morgan Marie Franklin 2008

Primary Productivity and Biogeochemical Cycles in the Sea - Paul G. Falkowski 1992-05-31

Biological processes in the oceans play a crucial role in regulating the fluxes of many important elements such as carbon, nitrogen, sulfur, oxygen, phosphorus, and silicon. As we come to the end of the 20th century, oceanographers have increasingly focussed on how these elements are cycled within the ocean, the interdependencies of these cycles, and the effect of the cycle on the composition of the earth's atmosphere and climate. Many techniques and tools have been developed or adapted over the past decade to help in this effort. These include satellite sensors of upper ocean phytoplankton distributions, flow cytometry, molecular biological probes, sophisticated moored and shipboard instrumentation, and vastly increased numerical modeling capabilities. This volume is the result of the 37th Brookhaven Symposium in Biology, in which a wide spectrum of oceanographers, chemists, biologists, and modelers discussed the progress in understanding the role of primary producers in biogeochemical cycles. The symposium is dedicated to Dr. Richard W. Eppley, an intellectual giant in biological oceanography, who inspired a generation of scientists to delve into problems of understanding biogeochemical cycles in the sea. We gratefully

acknowledge support from the U.S. Department of Energy, the National Aeronautics and Space Administration, the National Science Foundation, the National Oceanic and Atmospheric Administration, the Electric Power Research Institute, and the Environmental Protection Agency. Special thanks to Claire Lamberti for her help in producing this volume.

Evolution of Primary Producers in the Sea - Paul Falkowski 2011-08-31

Evolution of Primary Producers in the Sea reference examines how photosynthesis evolved on Earth and how phytoplankton evolved through time – ultimately to permit the evolution of complex life, including human beings. The first of its kind, this book provides thorough coverage of key topics, with contributions by leading experts in biophysics, evolutionary biology, micropaleontology, marine ecology, and biogeochemistry. This exciting new book is of interest not only to students and researchers in marine science, but also to evolutionary biologists and ecologists interested in understanding the origins and diversification of life. Evolution of Primary Producers in the Sea offers these students and researchers an understanding of the molecular evolution, phylogeny, fossil record, and environmental processes that collectively permits us to comprehend the rise of phytoplankton and their impact on Earth's ecology and biogeochemistry. It is certain to become the first and best word on this exhilarating topic. Discusses the evolution of phytoplankton in the world's oceans as the first living organisms and the first and basic producers in the earths food chain Includes the latest developments in the evolution and ecology of marine phytoplankton specifically with additional information on marine ecosystems and biogeochemical cycles The only book to consider of the evolution of phytoplankton and its role in molecular evolution, biogeochemistry, paleontology,

and oceanographic aspects Written at a level suitable for related reading use in courses on the Evolution of the Biosphere, Ecological and Biological oceanography and marine biology, and Biodiversity

Modeling Methods for Marine Science - David M. Glover 2011-06-02

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.

Ocean Biogeochemistry - Michael J.R. Fasham 2012-12-06

Oceans account for 50% of the anthropogenic CO2 released into the atmosphere. During the past 15 years an international programme, the Joint Global Ocean Flux Study (JGOFS), has been studying the ocean carbon cycle to quantify and model the biological and physical processes whereby CO2 is pumped from the ocean's surface to the depths of

the ocean, where it can remain for hundreds of years. This project is one of the largest multi-disciplinary studies of the oceans ever carried out and this book synthesises the results. It covers all aspects of the topic ranging from air-sea exchange with CO2, the role of physical mixing, the uptake of CO2 by marine algae, the fluxes of carbon and nitrogen through the marine food chain to the subsequent export of carbon to the depths of the ocean. Special emphasis is laid on predicting future climatic change.

The Global Carbon Cycle - Martin Heimann 2013-06-29

This book is the outcome of a NAill Advanced Study Institute on the contemporary glo bal carbon cycle, held in n Ciocco, Italy, September 8-20, 1991. The motivation for this ASI originated from recent controversial findings regarding the relative roles of the ocean and the land biota in the current global balance of atmospheric carbon dioxide. Consequently, the pur pose of this institute was to review, among leading experts in the field, the multitude of known constraints on the present day global carbon cycle as identified by the fields of meteorology, physical and biological oceanography, geology and terrestrial biosphere sciences. At the same time the form of an Advanced Study Institute was chosen, thus providing the opportunity to convey the information in tutorial form across disciplines and to young researchers entering the field. The first three sections of this book contain the lectures held in II Ciocco. The first sec tion reviews the atmospheric, large-scale global constraints on the present day carbon cycle including the emissions of carbon dioxide from fossil fuel use and it provides a brief look into the past. The second section discusses the role of the terrestrial biosphere and the third the role of the ocean in the contemporary global carbon cycle.

Climate Change and the Oceanic Carbon Cycle - Isabel Ferrera 2017-01-12

This title includes a number of Open Access chapters. This valuable compendium provides an overview of the variables and consequences of oceanic carbon cycling in the context of climate change. The chapters highlight the importance of marine plankton in carbon processing as well as the effects of rising CO2 and temperature in their functioning. Marine ecosystems are being increasingly threatened by growing human pressures, including climate change. Understanding the consequences that climate change may have is crucial to predict the future of our oceans. Rising temperatures and ocean acidification may profoundly alter the mode of matter and energy transformation in marine ecosystems, which could have irreversible consequences for our planet on ecological timescales. For that reason, the scientific community has engaged in the grand challenge of studying the variables and consequences of oceanic carbon cycling in the context of climate change, which has emerged as a relevant field of science. The book is broken into four sections: Understanding the Importance of Ocean Biogeochemistry Quantifying Oceanic Carbon Variables Phytoplankton and Oceanic Carbon Cycle Ocean Acidification Edited by a researcher with many years of experience and with contributions from scientists from around the world, this volume explores the most important topics on climate change and oceanic carbon cycling.

Importance of coastal nutrient supply for global ocean biogeochemistry - X. GIRAUD 2008