

Stable Isotopes And Biosphere Atmosphere Interactions Processes And Biological Controls

The emerging multidisciplinary field of earth system science sets out to improve our understanding functioning ecosystems, at a global level across the entire planet. *Stable Isotopes and Biosphere - Atmosphere Interactions* looks to one of its most powerful tools — the application of stable isotope analyses — to understanding biosphere-atmosphere exchange of the greenhouse gases, and synthesizes much of the recent progress in this work. *Stable Isotopes and Biosphere - Atmosphere Interactions* describes recent progress in understanding the mechanisms, processes and applications of new techniques. It makes a significant contribution to the emerging, multidisciplinary study of the Earth as an interacting system. This book will be an important reference for students and researchers in biology, ecology, biogeochemistry, meteorology, and atmospheric science and will be invaluable for anyone with any interest in the future of the planet. Describes applications of new stable isotope techniques to the emerging fields of earth system science and global change Illustrates advances in scaling of physiological processes from leaf/soil to the global scale Contains state-of-the-art, critical reviews written by international researchers and experts

Providing an exhaustive review of this topic, *Inorganic Mass Spectrometry: Principles and Applications* provides details on all aspects of inorganic mass spectrometry, from a historical overview of the topic to the principles and functions of mass separation and ion detection systems. Offering a comprehensive treatment of inorganic mass spectrometry, topics covered include: Recent developments in instrumentation Developing analytical techniques for measurements of trace and ultratrace impurities in different materials This broad textbook in inorganic mass spectrometry, presents the most important mass spectrometric techniques used in all fields of analytical chemistry. By covering recent developments and advances in all fields of inorganic mass spectrometry, this text provides researchers and students with information to answer any questions on this topic as well as providing the basic fundamentals for understanding this potentially complex, but increasingly relevant subject.

In this authoritative review, leading international researchers explore the growing range of applications of stable isotope techniques for probing and integrating biological processes and palaeoclimatic cycles. The interdisciplinary approach covers a wide range of issues, opportunities and developments, setting interactions with plants in the context of water and nutrient cycles, exchanges with the atmosphere and modelling past and present climate change. This important book will appeal to those requiring an overview of the use of stable isotopes in aquatic, terrestrial and climatic processes and is in tune with current global concerns. In addition postgraduates and research scientists will find an extensive guide to more specialist disciplines, including developing mass spectrometer technologies, compound-specific and cellular-discrimination processes or whole organism and ecosystem responses.

An integrated guide to photosynthesis in an environmentally dynamic context, covering all aspects from basic concepts to methodologies.

Much effort has been devoted to developing theories to explain the wide variation we observe in reproductive allocation among environments. *Reproductive Allocation in Plants* describes why plants differ in the proportion of their resources that they allocate to reproduction and looks into the various theories. This book examines the ecological and evolutionary explanations for variation in plant reproductive allocation from the perspective of the underlying physiological mechanisms controlling reproduction and growth. An international team of leading experts have prepared chapters summarizing the current state of the field and offering their views on the factors determining reproductive allocation in plants. This will be a valuable resource for senior undergraduate students, graduate students and researchers in ecology, plant ecophysiology, and population biology. 8 outstanding chapters dedicated to the evolution and ecology of variation in plant reproductive allocation Written by an international team of leading experts in the field Provides enough background information to make it accessible to senior undergraduate students Includes over 60 figures and 29 tables

This book presents a comprehensive overview of nutrient cycling processes and their importance for plant growth and ecosystem sustainability. The book combines fundamental scientific studies and devised practical approaches. It contains contributions of leading international authorities from various disciplines resulting in multidisciplinary approaches, and all chapters have been carefully reviewed. This volume will support scientists and practitioners alike. Within the realm of the newly evolving discipline of environmental sciences, the stable-isotope methodology is being used to an ever-increasing extent, especially in the study of the water cycle and of paleo-climatology. This book introduces the rules of the game, by reviewing the natural variability of stable isotopes in the hydrosphere, describing the physico-chemical basis of isotope fractionation, and applying this knowledge to natural waters as they move through the hydrologic cycle from the ocean to the atmosphere, the biosphere and the lithosphere. There is a special focus on the processes at the surface-atmosphere and land-biosphere-atmosphere interfaces, since these are the sites of major changes in isotope composition. In response to the increasing awareness of our changing climate, a discussion on the global view of the changing water cycle, in the past and future, winds up the presentation.

The global environment is constantly changing and our planet is getting warmer at an unprecedented rate. The study of the carbon cycle, and soil respiration, is a very active area of research internationally because of its relationship to climate change. It is crucial for our understanding of ecosystem functions from plot levels to global scales. Although a great deal of literature on soil respiration has been accumulated in the past several years, the material has not yet been synthesized into one place until now. This book synthesizes the already published research findings and presents the fundamentals of this subject. Including information on global carbon cycling, climate changes, ecosystem productivity, crop production, and soil fertility, this book will be of interest to scientists, researchers, and students across many disciplines. A key reference for the scientific community on global climate change, ecosystem studies, and soil ecology Describes the myriad ways that soils respire and how this activity influences the environment

Covers a breadth of topics ranging from methodology to comparative analyses of different ecosystem types The first existing "treatise" on the subject

This 33-chapter volume presents a critical examination of the importance of stable isotopes in understanding key plant metabolic processes. Carbon isotope analyses for estimates of plant water use and metabolism Integrated estimates of stress impacts and life history in ecological systems Hydrogen and oxygen isotope analyses for evaluating water sources and transpiration Use of stable isotopes in scaling from leaf to global levels Sections include: History and Theoretical Considerations, Ecological Aspects of Carbon Isotope Variation, Agricultural Aspects of Carbon Isotope Variation, Genetics and Isotopic Variation, Water Relations and Isotopic Composition

This book was triggered by the success story of sector field mass spectrometry in elemental and isotopic analysis from the early days when the first mass spectrum of Ne was presented a hundred years ago. The outstanding and unique features of sector field mass spectrometry - high sensitivity, high mass resolution and simultaneous multiple ion detection - paved the way for its successful and increasing application in different fields of science. Written, compiled and edited by worldwide renowned experts with profound expertise in sector field mass spectrometry related to elemental and isotopic analysis, this book is intended to provide deep insight into the topic along with fundamental knowledge about elemental and isotopic analysis. Aimed at scientists in the field of natural and life sciences, instrument manufacturers, practitioners and graduate students, this book provides solid information about the methodological background and analytical capabilities of sector field mass spectrometry. A detailed description of peculiarities and an overview of the most relevant applications making use of specific techniques using sector field mass analysers (ICP-MS, GDMS, TIMS, SIMS and IRMS) are given, including a presentation of the currently available commercial instruments. This approach guarantees that readers are thoroughly introduced to and familiarized with the fascinating inter- and transdisciplinary field of sector field mass spectrometry.

Stable Isotopes and Biosphere - Atmosphere Interactions Processes and Biological Controls Elsevier

The 20th century has experienced environmental changes that appear to be unprecedented in their rate and magnitude during the Earth's history. For the first time, Stable Isotopes as Indicators of Ecological Change brings together a wide range of perspectives and data that speak directly to the issues of ecological change using stable isotope tracers. The information presented originates from a range of biological and geochemical sources and from research fields within biological, climatological and physical disciplines covering time-scales from days to centuries. Unlike any other reference, editors discuss where isotope data can detect, record, trace and help to interpret environmental change. Provides researchers with groundbreaking data on how to predict the terrestrial ecosystems response to the ongoing rapid alterations Reveals how ecosystems have responded to environmental and biotic fluctuations in the past Includes examples from research by a wide range of biological and physical scientists who are using isotopic records to both detect and interpret environmental change

The Southern Hemisphere commands an increasing interest among atmospheric chemists. It has smaller and less industrialized continents than the Northern Hemisphere and thus enjoys lower emissions of anthropogenic and biogenic pollutants. As a consequence, the concentrations of trace species are lower in the Southern Hemisphere, giving rise to significant inter-hemispheric gradients. From an observation of the climatology of the various trace gas gradients important conclusions on the chemical lifetimes, the distribution of sources and transport of trace species can be derived. Thus it is only fitting that the CSIRO Division of Atmospheric Research, Aspendale, Australia, hosted the Conference on the Scientific Application of Baseline Observations of Atmospheric Composition (SABOAC). It was convened by Dr Graeme Pearman of the CSIRO and sponsored by the CSIRO and the Australian Bureau of Meteorology. Graeme Pearman and Ian Galbally of the CSIRO also agreed to serve as Guest Editors. The Conference was well attended and because of its location enjoyed an unusually large number of participants from the Southern Hemisphere. About 40 papers were presented with a large share of original contributions. At this point we would like to thank the reviewers who helped to maintain strict standards. The conference topics ranged from Nonreactive Gases, Reactive Gases, Transport, Particulates, Precipitation Chemistry, to Radiation and Carbon dioxide. The present Proceedings do not quite maintain that sequence but partly reflect the order of receipt. DIETER EHHALT 3 Journal of Atmospheric Chemistry 3 (1985), 3-27.

"The history of Earth's early atmosphere, hydrosphere, and biosphere, from Hadean through Proterozoic time, is one of geology's enduring puzzles. Ore deposits provide important insights into this history because they contain elements and minerals that are highly sensitive to the geochemical environment in which they form. Just what these minerals tell us remains a matter of considerable debate, however. When and how did life develop, an oxygen-rich atmosphere form, and sulfate dominate the ocean? This volume contains reports on these questions from both sides of the aisle for iron and manganese formations, uranium paleoplacers and hydrothermal deposits, and exhalative sulfides and oxides."--Publisher's website.

This book addresses the measurement of environmental contaminants in water, air, and soil. It also presents modifications of and improvements to existing control technologies for remediation of environmental contaminants. It covers improved designs of wastewater systems and innovations in designing newer membranes for water treatment. In addition, it includes two separate sections on the modelling and control of different existing and emerging pollutants. It covers major topics such as: pharmaceutical wastes, paper and pulp waste, poly aromatic hydrocarbons, mining dust, bioaerosols, endosulphan, biomass combustion, and landfill design aspects. It also features chapters on environmental exposure and modelling of aerosol deposition within human lungs. The content of this book will be of interest to researchers, professionals, and policymakers whose work involves environmental contaminants and related solutions.

During the past year we have submitted two manuscripts. 1. Mortazavi, B., J. Chanton, J.L. Prater, A.C. Oishi, R. Oren and G. Katul. Temporal variability in ^{13}C of respired CO_2 in a pine and a hardwood forest subject to similar climatic conditions (in Press). *Oecologia* 2. Mortazavi, B. and J.P. Chanton. Use of Keeling plots for determining sources of dissolved organic carbon in nearshore and open ocean systems (Published in *Limnology and Oceanography* (2004) Vol 49 pages 102-108). 3. Mortazavi, B., J.L. Prater, and J.P. Chanton (2004). A field-based method for simultaneous measurements of the ^{18}O and ^{13}C of soil CO_2 efflux. *Biogeosciences* Vol 1:1-16 Most recent products delivered: Mortazavi, B. and J.P. Chanton. Abiotic and biotic controls on the ^{13}C of respired CO_2 in the southeastern US forest mosaics and a new technique for measuring the of soil CO_2 efflux. Joint Biosphere Stable Isotope Network (US) and Stable Isotopes in Biosphere Atmosphere Exchange (EU) 2004 Meeting, Interlaken, Switzerland, March 31-April 4, 2004. Mortazavi, B., J. Chanton, J.L. Prater, A.C. Oishi, R. Oren and G. Katul. Temporal variability in ^{13}C of respired CO_2 in a pine and a hardwood forest subject to similar climatic conditions. American Geophysical Union Fall Meeting, San Francisco, USA, December 8-12, 2003. Prater, J., Mortazavi, B. and J.P. Chanton. Measurement of discrimination against ^{13}C during photosynthesis and quantification of the short-term variability of ^{13}C over a diurnal cycle. American Geophysical Union Fall Meeting, San Francisco, USA, December 8-12, 2003.

Mit dt., franz. und ital. Zusammenfass.

This book examines the impacts of global change on terrestrial ecosystems. Emphasis is placed on impacts of atmospheric, climate and land use change, and the book discusses the future challenges and the scientific frameworks to address them. Finally, the book explores fundamental new research developments and the need for stronger integration of natural and human dimensions in addressing the challenge of global change.

Fluxes of trace gases, water and energy - the 'breathing of the biosphere' - are controlled by a large number of interacting physical, chemical, biological and ecological processes. In this interdisciplinary book, the authors provide the tools to understand and quantitatively analyse fluxes of energy, organic compounds such as terpenes, and trace gases including carbon dioxide, water vapour and methane. It first introduces the fundamental principles affecting the supply and demand for trace gas exchange at the leaf and soil scales: thermodynamics, diffusion, turbulence and physiology. It then builds on these principles to model the exchange of water, carbon dioxide, terpenes and stable isotopes at the ecosystem scale. Detailed mathematical derivations of commonly used relations in biosphere-atmosphere interactions are provided for reference in appendices. An accessible introduction for graduate students and a key resource for researchers in related fields, such as atmospheric science, hydrology, meteorology, climate science, biogeochemistry and ecosystem ecology.

In this first comprehensive handbook of the earth's sinks for greenhouse gases, leading researchers from around the world provide an expert synthesis of current understanding and uncertainties. It will be a valuable resource for students, researchers and practitioners in conservation, ecology and environmental studies.

This book provides straightforward and practical information on isotopes applied to a variety of natural sciences. It covers the basics of isotopes and includes detailed examples from a range of natural sciences: ecology, biology, human health, environment and climate, geography, and geology, highlighting their applicability in these fields. It is a must-read for all advanced-undergraduate and graduate students working with isotopes, regardless of the area, and is a very useful one-stop resource for scientists starting in isotope research.

Traditional plant physiological ecology is organism centered and provides a useful framework for understanding the interactions between plants and their environment and for identifying characteristics likely to result in plant success in a particular habitat. This book focuses on extending concepts from plant physiological ecology as a basis for understanding carbon, energy, and biogeochemical cycles at ecosystem, regional, and global levels. This will be a valuable resource for researchers and graduate students in ecology, plant ecophysiology, ecosystem research, biometeorology, earth system science, and remote sensing. Key Features * The integration of metabolic activities across spatial scales, from leaf to ecosystem * Global constraints and regional processes * Functional units in ecological scaling * Models and technologies for scaling

Protected designation of origin (PDO) taken together with other geographical indicators, such as protected geographical indication (PGI) and traditional specialty guaranteed (TSG), offer the consumer additional guarantees on the quality and authentication of foods. They are important tools that protect the names of regional foods, such as wines, cheeses, hams, sausages and olives, so that only foods that genuinely originate in a particular region are allowed to be identified as such. The economic value of these regional foods, as well as the increased interest from consumers and the food industry about the traceability and origin of food, mean that it has become necessary to establish methods for PDO and PGI authentication based on the specific characteristics and chemical markers of these kinds of products.

This book offers a complete guide of the methods available to authenticate food PDO, beginning with an explanation of the analytical and chemometric methods available for PDO authentication, before looking at the main foods covered, PGI labels and the social and legal framework for food PGIs. It will be of interest to people engaged in the fields of food production, commercialization and consumption, as well as policymakers and control laboratories. Offers a complete guide to the methods available for food Protected Designation of Origin (PDO) authentication

Explains the analytical and chemometric methods Focuses on the various food products covered by authentication labels Nitrogen (N) is potentially one of the most complex elements on the Earth. It is necessary for all biological activity, but creates negative impacts on water and air quality. There is a balancing act between deficiency and surplus and the forms of N available further complicate our understanding of the dynamics. Biological fixation provides some plants with N supply while others are totally dependent upon N being available in the soil profile for the roots to extract. Nevertheless, the demand for N will increase because the human population with its increasing growth requires more protein and thus more N. Understanding the global N cycle is imperative to meeting current and future nitrogen demands while decreasing environmental impacts. This book discusses availability, production, and recycling of N in air, water, plants, and soils. It features information on N impacts to soil and water quality, management of N in agroecosystems, and techniques to maximize the use efficiency while minimizing the risks of leakage of reactive N into the environment. This volume in the Advances in Soil Science series is specifically devoted to availability, production, and recycling of N with impact on climate change and water quality, and management of N in agroecosystems in the context of maximizing the use efficiency and minimizing the risks of leakage of reactive N (NO₃, N₂O) into the environment.

There are currently intense efforts devoted to understand plant respiration (from genes to ecosystems) and its regulatory mechanisms; this is because respiratory CO₂ production represents a substantial carbon loss in crops and in natural ecosystems. Thus, in addition to manipulating photosynthesis to increase plant biomass production, minimization of respiratory loss should be considered in plant science and engineering. However, respiratory metabolic pathways are at the heart of energy and carbon skeleton production and therefore, it is an essential component of carbon metabolism sustaining key processes such as photosynthesis. The overall goal of this book is to provide an insight in such interactions as well as an up-to-date view on respiratory metabolism, taking advantage of recent advances and concepts, from fluxomics to natural isotopic signal of plant CO₂ efflux. It is thus a nonoverlapping, complement to Volume 18 in this series (Plant Respiration From Cell to Ecosystem) which mostly deals with mitochondrial electron fluxes and plant-scale respiratory losses.

A solid introduction to stable isotopes that can also be used as an instructive review for more experienced researchers and professionals. The book approaches the use of isotopes from the perspective of ecological and biological research, but its concepts can be applied within other disciplines. A novel, step-by-step spreadsheet modeling approach is also presented for circulating tracers in any ecological system, including any favorite system an ecologist might dream up while sitting at a computer. The author's humorous and lighthearted style painlessly imparts the principles of isotope ecology. The online material contains color illustrations, spreadsheet models, technical appendices, and problems and answers.

This two-volume reference serves as a handbook containing a wealth of information for all isotope chemists working in a wide range of disciplines including anthropology to ecology; drug detection methodology to toxicology; nutrition to food science; and the atmospheric sciences to geochemistry. Complementing the first volume, Volume II includes matters that are not strictly confined to the analytical techniques themselves, but relate to analysis of stable isotopes, such as the views on the development of mass spectrometers, isotopic scales, standards and references, and directives for setting up a laboratory. ALSO AVAILABLE: Volume I: Dec. 2004, 0444511148/9780444511140, \$176.00 Volume I and II (set): Oct. 2007, 0444511164/9780444511164, \$205.00 * Presents an encyclopedic overview of stable isotope analytical techniques in an objective way * Includes descriptions of methods and diagrams of analytical devices * Addresses how older techniques formed the basis for present-day techniques, which can be useful in constructing modern analytical systems * Complements Volume I of the set

Terrestrial carbon balance is uncertain at the regional and global scale. A significant source of variability in mid-latitude ecosystems is related

to the timing and duration of phenological phases. Spring phenology, in particular, has disproportionate effects on the annual carbon balance. However, the traditional phenological indices that are based on leaf-out and flowering times of select indicator species are not universally amenable for predicting the temporal dynamics of ecosystem carbon and water exchange. Phenology of Ecosystem Processes evaluates current applications of traditional phenology in carbon and H₂O cycle research, as well as the potential to identify phenological signals in ecosystem processes themselves. The book summarizes recent progress in the understanding of the seasonal dynamics of ecosystem carbon and H₂O fluxes, the novel use of various methods (stable isotopes, time-series, forward and inverse modeling), and the implications for remote sensing and global carbon cycle modeling. Each chapter includes a literature review, in order to present the state-of-the-science in the field and enhance the book's usability as an educational aid, as well as a case study to exemplify the use and applicability of various methods. Chapters that apply a specific methodology summarize the successes and challenges of particular methods for quantifying the seasonal changes in ecosystem carbon, water and energy fluxes. The book will benefit global change researchers, modelers, and advanced students.

Enhanced analytical capabilities and separation techniques, improved detection limits, and accessibility of instrumentation have led to massive strides in the use of isotopes to assess microbial processes in surface and subsurface sediments. Considering the rapid growth of research and commercial interest in stable isotope and radioisotope applications for contaminant hydrology and microbial ecology, an up-to-date overview of the field is long overdue. Environmental Isotopes in Biodegradation and Bioremediation comprehensively covers established and emerging isotope methods for environmental applications, focusing on biodegradation and bioremediation. This book is an invaluable tool for researchers, practitioners, and regulators who require an extensive understanding of the application of isotope methods to natural compounds and environmental contaminants. It addresses questions including: What amount of a compound comes from anthropogenic release? Do the chemicals involved undergo degradation in the environment? Do they persist and accumulate? This book is divided into four sections: Isotope Fundamentals covers important background and theoretical information needed to understand later chapters Isotopes and Microbial Processes discusses the application of isotopes to different environmental redox conditions that dictate the predominant microbial processes that will occur Isotopes in Field Applications describes the transformation of anthropogenic pollutants and the application of isotope tools to field sites Isotope Emerging Areas addresses the use of compounds labeled with stable isotopes, including stable isotope probing and the use of radiocarbon at natural abundance and novel stable isotopes This reference details how isotope tools can be used to gain insight into the origin and fate of natural compounds and contaminants in the environment. Integrating theoretical and practical knowledge, the authors examine the principles of isotope tools and then present an extensive overview of key environmental processes that can be investigated with isotope methods. They also discuss analytical and data evaluation procedures, addressing established and emerging applications. To illustrate concepts and methodology, the authors use a wide range of case studies and recent field and laboratory research from various disciplines currently employing these methods. This book is a valuable tool for expanding the application of both stable isotopes and radioisotopes into untapped areas. Thoroughly updated and revised, this second edition of the bestselling Soil Sampling and Methods of Analysis presents several new chapters in the areas of biological and physical analysis and soil sampling. Reflecting the burgeoning interest in soil ecology, new contributions describe the growing number and assortment of new microbiological

Stable isotope ratio variation in natural systems reflects the dynamics of Earth systems processes and imparts isotope labels to Earth materials. Carbon isotope ratios of atmospheric CO₂ record exchange of carbon between the biosphere and the atmosphere; the incredible journeys of migrating monarchs is documented by hydrogen isotopes in their wings; and water carries an isotopic record of its source and history as it traverses the atmosphere and land surface. Through these and many other examples, improved understanding of spatio-temporal isotopic variation in Earth systems is leading to innovative new approaches to scientific problem-solving. This volume provides a comprehensive overview of the theory, methods, and applications that are enabling new disciplinary and cross-disciplinary advances through the study of "isoscapes": isotopic landscapes. "This impressive new volume shows scientists deciphering and using the natural isotope landscapes that subtly adorn our spaceship Earth.", Brian Fry, Coastal Ecology Institute, Louisiana State University, USA "An excellent timely must read and must-have reference book for anybody interested or engaged in applying stable isotope signatures to questions in e.g. Anthropology, Biogeochemistry, Ecology, or Forensic Science regarding chronological and spatial movement, changes, or distribution relating to animals, humans, plants, or water.", Wolfram Meier-Augenstein, Centre for Anatomy & Human Identification, University of Dundee, UK "Natural resources are being affected by global change, but exactly where, how, and at what pace? Isoscapes provide new and remarkably precise answers.", John Hayes, Woods Hole Oceanographic Institution, USA "This exciting volume is shaping a new landscape in environmental sciences that is utilizing the remarkable advances in isotope research to enhance and extend the capabilities of the field.", Dan Yakir, Weizmann Institute of Science, Israel

Stable isotopes and physiological processes; Ecosystem scale processes; Global scale processes.

This international rigorously peer-reviewed volume critically synthesizes current knowledge in forest hydrology and biogeochemistry. It is a one-stop comprehensive reference tool for researchers and practitioners in the fields of hydrology, biogeoscience, ecology, forestry, boundary-layer meteorology, and geography. Following an introductory chapter tracing the historical roots of the subject, the book is divided into the following main sections: · Sampling and Novel Approaches · Forest Hydrology and Biogeochemistry by Ecoregion and Forest Type · Hydrologic and Biogeochemical Fluxes from the Canopy to the Phreatic Surface · Hydrologic and Biogeochemical Fluxes in Forest Ecosystems: Effects of Time, Stressors, and Humans The volume concludes with a final chapter that reflects on the current state of knowledge and identifies some areas in need of further research.

Die Erde ist ein außergewöhnlicher Planet. Und seine Geheimnisse sind noch keineswegs entschlüsselt. Lernen Sie das System Erde mit diesem Buch besser kennen und erfahren Sie, wie Geowissenschaftler heute die Strukturen, Prozesse und Wechselwirkungen unseres Heimatplaneten erforschen und zu welch überraschenden Entdeckungen sie dabei immer wieder kommen. Earth is an exceptional planet. And by no means have all its secrets been deciphered yet. With this book, you are invited to gain a better knowledge of System Earth, and you will learn how today's geoscientists examine the structures, processes and interactions of our home planet and what surprising discoveries they often make. Einen Planeten wie die Erde gibt es im All nach unserem heutigen Wissen kein zweites Mal. Unser Heimatplanet erweist sich bei näherer Betrachtung als ein einzigartiges System von Beziehungen und Wechselwirkungen zwischen den großen Teilsystemen Geosphäre, Atmosphäre, Hydrosphäre, Kryosphäre und Biosphäre. Deren überraschend fein abgestimmtes Zusammenspiel konnte Leben – einschließlich des Menschen –

hervorbringen, das seinerseits wiederum die Teilsysteme modifiziert. Im Zuge der Erforschung dieses hochkomplexen Systems haben sich die Geowissenschaften in den letzten Jahrzehnten stark gewandelt. Ihre einzelnen Fachdisziplinen verstehen sich heute auch als Teilkomponenten einer systemischen Betrachtung. Und Themen wie Klimawandel und Ressourcenverknappung zeigen, dass moderne Geoforschung nicht nur faszinierend, sondern für den Menschen, der die Erde als Lebens- und Gestaltungsraum nutzt, unverzichtbar ist. Dabei haben wir noch viel zu entdecken. Die Erkundung der Erde – sei es an deren direkt zugänglicher Oberfläche oder im tiefen Untergrund, sei es im Labor oder bei der Beobachtung aus dem Weltraum – bringt ständig neue, erstaunliche Einsichten hervor. Aber es geht um mehr als packende Wissenschaft: Ohne geowissenschaftliche Forschung, die heute ein global vernetztes Unterfangen ist, sind Antworten auf die Herausforderungen einer ständig wachsenden Weltbevölkerung und einer zunehmenden Inanspruchnahme der natürlichen Lebensgrundlagen nicht zu finden. Große Forschungseinrichtungen wie das Deutsche GeoForschungsZentrum GFZ in Potsdam leisten hierfür bedeutende Beiträge. GFZ-Mitarbeiter gewähren in diesem ebenso spannend wie verständlich geschriebenen Buch faszinierende Einblicke in ihre Arbeit – eine Arbeit, die dem besseren Verständnis des Systems Erde dient und die Grundlagen für ein möglichst umfassendes Erdsystemmanagement liefert. As far as we know, there is no other planet like Earth in the universe. At closer inspection our home planet reveals itself as a unique system of relationships and interactions of the major subsystems, the geosphere, atmosphere, hydrosphere, cryosphere, and biosphere. Their surprisingly fine-tuned interactions were capable to bring forth life, including the evolution of humans, and life in turn modifies the subsystems yet again. In researching this highly complex system, the Earth sciences have changed significantly in recent decades. Today, its various disciplines are considered to be components of a systemic approach. At the same time topics such as climate change and shortage of resources indicate that modern geological research is not only fascinating but also indispensable for us humans, who use Earth as habitat and creative space. There is much to discover still. In the ongoing exploration of Earth – be it at its easily accessible surface or deep below, be it in the lab or from space – new, astonishing findings are constantly being uncovered. But geoscientific research does not simply focus on exciting science. It is a truly global undertaking, without which answers to the many challenges of a continuously growing world population and an increasing pressure on the natural life systems cannot be found. Large research institutions such as the GFZ German Research Centre for Geosciences in Potsdam make important contributions to this progress. In this exciting and very accessible book, GFZ researchers provide fascinating insights into their work – work that serves a better understanding of System Earth and provides the basis for the best possible and comprehensive Earth system management.

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