

Earths Early Atmosphere And Oceans And The Origin Of Life Springerbriefs In Earth Sciences

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Dynamics of The Tropical Atmosphere and Oceans
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Discovering the Essential Universe, Second Edition
Origin and Evolution of Planetary and Satellite Atmospheres
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The Molecular Origins of Life

Planetary Atmospheres

For 65 million years dinosaurs ruled the Earth--until a deadly asteroid forced their extinction. But what accounts for the incredible longevity of dinosaurs? A renowned scientist now provides a startling explanation that is rewriting the history of the Age of Dinosaurs. Dinosaurs were pretty amazing creatures--real-life monsters that have the power to fascinate us. And their fiery Hollywood ending only serves to make the story that much more dramatic. But fossil evidence demonstrates that dinosaurs survived several mass extinctions, and were seemingly unaffected by catastrophes that decimated most other life on Earth. What could explain their uncanny ability to endure through the ages? Biologist and earth scientist Peter Ward now accounts for the remarkable indestructibility of dinosaurs by connecting their unusual respiration system with their ability to adapt to Earth's changing environment--a system that was ultimately bequeathed to their descendants, birds. By tracing the evolutionary path back through time and carefully connecting the dots from birds to dinosaurs, Ward describes the unique form of breathing shared by these two distant relatives and demonstrates how this simple but remarkable characteristic provides the elusive explanation to a question that has thus far stumped scientists. Nothing short of revolutionary in its bold presentation of an astonishing theory, *Out of Thin Air* is a story of science at the

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edge of discovery. Ward is an outstanding guide to the process of scientific detection. Audacious and innovative in his thinking, meticulous and thoroughly detailed in his research, only a scientist of his caliber is capable of telling this surprising story.

Dynamics of The Tropical Atmosphere and Oceans

Early Earth Systems provides a complete history of the Earth from its beginnings to the end of the Archaean. This journey through the Earth's early history begins with the Earth's origin, then examines the evolution of the mantle, the origin of the continental crust, the origin and evolution of the Earth's atmosphere and oceans, and ends with the origin of life. Looks at the evidence for the Earth's very early differentiation into core, mantle, crust, atmosphere and oceans and how this differentiation saw extreme interactions within the Earth system. Discusses Archaean Earth processes within the framework of the Earth System Science paradigm, providing a qualitative assessment of the principal reservoirs and fluxes in the early Earth. "The book would be perfect for a graduate-level or upper level undergraduate course on the early Earth. It will also serve as a great starting point for researchers in solid-Earth geochemistry who want to know more about the Earth's early atmosphere and biosphere, and vice versa for low temperature geochemists who want to get a modern overview of the Earth's interior."

Geological Magazine, 2008

Introduction to Medical Geology

Proceedings of the IAU Symposium No. 40, held in Marfa, Texas, U.S.A., October 26-31, 1969

Alien Oceans

Over two billion people live in tropical lands. Most of them live in intimate contact with the immediate geological environment, obtaining their food and water directly from it. The unique geochemistry of these tropical environments have a marked influence on their health, giving rise to diseases that affect millions of people. The origin of these diseases is geologic as exemplified by dental and skeletal fluorosis, iodine deficiency disorders, trace element imbalances to name a few. This book, one of the first of its kind, serves as an excellent introduction to the emerging discipline of Medical Geology.

The Chemistry of Life's Origins

Inside the epic quest to find life on the water-rich moons at the outer reaches of the solar system Where is the best place to find life beyond Earth? We often look to Mars as the most promising site in our solar system, but recent scientific missions

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have revealed that some of the most habitable real estate may actually lie farther away. Beneath the frozen crusts of several of the small, ice-covered moons of Jupiter and Saturn lurk vast oceans that may have been in existence for as long as Earth, and together may contain more than fifty times its total volume of liquid water. Could there be organisms living in their depths? *Alien Oceans* reveals the science behind the thrilling quest to find out. Kevin Peter Hand is one of today's leading NASA scientists, and his pioneering research has taken him on expeditions around the world. In this captivating account of scientific discovery, he brings together insights from planetary science, biology, and the adventures of scientists like himself to explain how we know that oceans exist within moons of the outer solar system, like Europa, Titan, and Enceladus. He shows how the exploration of Earth's oceans is informing our understanding of the potential habitability of these icy moons, and draws lessons from what we have learned about the origins of life on our own planet to consider how life could arise on these distant worlds. *Alien Oceans* describes what lies ahead in our search for life in our solar system and beyond, setting the stage for the transformative discoveries that may await us.

Thermodynamics of Atmospheres and Oceans

A non-technical (but serious) treatment of those parts of Earth history leading up to human history, as well as some pre-historical aspects of humanity. Many “events” in Earth’s history necessarily preceded the emergence of human beings (and

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intelligence). Geology has provided us with a great deal of information about these various steps on the way to intelligent life, and how and why they were important. Some of these events were on a cosmic scale (no universe – no life!), some were planetological/astronomical (no Earth – no life), some were essentially chemical (how did life emerge in the primordial ocean and why do we have oxygen in the atmosphere?), and some were details of evolutionary history (how did life colonize the land and how did mammals develop?). In this book an enthusiastic professor of geosciences presents a broad introduction from the Big Bang to the present and into the future, lucidly explaining aspects from various disciplines to interested, non-specialist readers.

Earth's Early Atmosphere and Surface Environment

For advanced undergraduate and beginning graduate students in atmospheric, oceanic, and climate science, *Atmosphere, Ocean and Climate Dynamics* is an introductory textbook on the circulations of the atmosphere and ocean and their interaction, with an emphasis on global scales. It will give students a good grasp of what the atmosphere and oceans look like on the large-scale and why they look that way. The role of the oceans in climate and paleoclimate is also discussed. The combination of observations, theory and accompanying illustrative laboratory experiments sets this text apart by making it accessible to students with no prior training in meteorology or oceanography. * Written at a mathematical level that is

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appealing for undergraduates and beginning graduate students * Provides a useful educational tool through a combination of observations and laboratory demonstrations which can be viewed over the web * Contains instructions on how to reproduce the simple but informative laboratory experiments * Includes copious problems (with sample answers) to help students learn the material.

Great Moments in the History of Life

The ocean is an integral component of the Earth's climate system. It covers about 70% of the Earth's surface and acts as its primary reservoir of heat and carbon, absorbing over 90% of the surplus heat and about 30% of the carbon dioxide associated with human activities, and receiving close to 100% of fresh water lost from land ice. With the accumulation of greenhouse gases in the atmosphere, notably carbon dioxide from fossil fuel combustion, the Earth's climate is now changing more rapidly than at any time since the advent of human societies. Society will increasingly face complex decisions about how to mitigate the adverse impacts of climate change such as droughts, sea-level rise, ocean acidification, species loss, changes to growing seasons, and stronger and possibly more frequent storms. Observations play a foundational role in documenting the state and variability of components of the climate system and facilitating climate prediction and scenario development. Regular and consistent collection of ocean observations over decades to centuries would monitor the Earth's main reservoirs of heat,

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carbon dioxide, and water and provides a critical record of long-term change and variability over multiple time scales. Sustained high-quality observations are also needed to test and improve climate models, which provide insights into the future climate system. Sustaining Ocean Observations to Understand Future Changes in Earth's Climate considers processes for identifying priority ocean observations that will improve understanding of the Earth's climate processes, and the challenges associated with sustaining these observations over long timeframes.

Atmosphere, Ocean and Climate Dynamics

Nothing provided

Deep Carbon

This volume contains the lectures presented at the second course of the International School of Space Chemistry held in Erice (Sicily) from October 20 - 30 1991 at the "E. Majorana Centre for Scientific Culture". The course was attended by 58 participants from 13 countries. The Chemistry of Life's Origins is well recognized as one of the most critical subjects of modern chemistry. Much progress has been made since the amazingly perceptive contributions by Oparin some 70 years ago when he first outlined a possible series of steps starting from simple molecules to

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basic building blocks and ultimate assembly into simple organisms capable of replicating, catalysis and evolution to higher organisms. The pioneering experiments of Stanley Miller demonstrated already forty years ago how easy it could have been to form the amino acids which are critical to living organisms. However we have since learned and are still learning a great deal more about the primitive conditions on earth which has led us to a rethinking of where and how the condition for prebiotic chemical processes occurred. We have also learned a great deal more about the molecular basis for life. For instance, the existence of DNA was just discovered forty years ago.

Early Earth Systems

The integration of Tectonics/Geochemistry, up-to-date reviews by leading scientists as well as a broad topical coverage of the Archean, are some of the features of this particular volume. As geochronology has progressed in the last 20 years, the Archean has continued to attract interest. Advancements in the understanding of Archean crustal and mantle evolution have progressed rapidly since the first International Archean Symposium in Western Australia (1970). The landmark for the Archean was the NATO Advanced Study Institute at Leicester (1975). At this meeting the Archean truly "came of age". Investigators from many different disciplines focused their expertise on the early history of the earth. For the first time, the nature of the atmosphere, oceans, and life during the Archean was an

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important part of an Archean symposium. During the most recent Archean Symposium in Perth in 1990, there was a shift in interest from field and trace element data to the new rapidly evolving high-precision U/Pb geochronology of Archean rocks and to detailed structural studies of both low and high grade Archean terrains. The terrane concept so widely applied to the Phanerozoic was proposed for the Archean Yilgarn Province in Western Australia and is now widely accepted for the Archean (as evident by the articles in this book). Plate tectonics is now widely accepted as the principal process that controls the history of continents and oceans. There are, though, well substantiated differences between Archean and post-Archean rocks that indicate that Archean tectonic regimes must have differed in some respects from modern ones. The question of how and to what degree did Archean plate tectonics differ from modern plate tectonics is treated in many of the chapters of this book. Altogether, the editor has presented a selection of articles that provide a fascinating insight into the latest observations in this field.

Out of Thin Air

The author of the best-selling *Science Matters* outlines a radical new approach to geologic history that advances controversial theories that the Earth evolved and that life evolved from minerals, assessing supportive findings while explaining the impact of human actions.

Astrobiology

An integrated discussion of the similarities and differences between the atmospheres of various bodies of the solar system, including the Earth.

Essentials of Geochemistry

A comprehensive guide to carbon inside Earth - its quantities, movements, forms, origins, changes over time and impact on planetary processes. This title is also available as Open Access on Cambridge Core.

Oxygen

This book provides concise and cutting-edge reviews in astrobiology, a young and still emerging multidisciplinary field of science that addresses the fundamental questions of how life originated and diversified on Earth, whether life exists beyond Earth, and what is the future for life on Earth. Readers will find coverage of the latest understanding of a wide range of fascinating topics, including, for example, solar system formation, the origins of life, the history of Earth as revealed by geology, the evolution of intelligence on Earth, the implications of genome data, insights from extremophile research, and the possible existence of life on other

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planets within and beyond the solar system. Each chapter contains a brief summary of the current status of the topic under discussion, sufficient references to enable more detailed study, and descriptions of recent findings and forthcoming missions or anticipated research. Written by leading experts in astronomy, planetary science, geoscience, chemistry, biology, and physics, this insightful and thought-provoking book will appeal to all students and scientists who are interested in life and space.

Atmosphere—Ocean Dynamics

A comprehensive and authoritative text on the formation and evolution of planetary atmospheres, for graduate-level students and researchers.

The Atmosphere and Ocean

Early Earth Systems provides a complete history of the Earth from its beginnings to the end of the Archaean. This journey through the Earth's early history begins with the Earth's origin, then examines the evolution of the mantle, the origin of the continental crust, the origin and evolution of the Earth's atmosphere and oceans, and ends with the origin of life. Looks at the evidence for the Earth's very early differentiation into core, mantle, crust, atmosphere and oceans and how this

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differentiation saw extreme interactions within the Earth system. Discusses Archaean Earth processes within the framework of the Earth System Science paradigm, providing a qualitative assessment of the principal reservoirs and fluxes in the early Earth. "The book would be perfect for a graduate-level or upper level undergraduate course on the early Earth. It will also serve as a great starting point for researchers in solid-Earth geochemistry who want to know more about the Earth's early atmosphere and biosphere, and vice versa for low temperature geochemists who want to get a modern overview of the Earth's interior." Geological Magazine, 2008

Comets and the Origin and Evolution of Life

Earth as an Evolving Planetary System, Second Edition, examines the various subsystems that play a role in the evolution of the Earth. These subsystems include such components as the crust, mantle, core, atmosphere, oceans, and life. The book contains 10 chapters that discuss the structure of the Earth and plate tectonics; the origin and evolution of the crust; the processes that leave tectonic imprints in rocks and modern processes responsible for these imprints; and the structure of the mantle and the core. The book also covers the Earth's atmosphere, hydrosphere, and biosphere; crustal and mantle evolution; the supercontinent cycle; great events in Earth history; and the Earth in comparison to other planets. This book is meant for advanced undergraduate and graduate students in Earth

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Sciences, with a basic knowledge of geology, biology, chemistry, and physics. It also may serve as a reference tool for specialists in the geologic sciences who want to keep abreast of scientific advances in this field. Kent Condie's corresponding interactive CD, *Plate Tectonics and How the Earth Works*, can be purchased from Tasa Graphic Arts here: <http://www.tasagraphicarts.com/progptearth.html> Two new chapters on the Supercontinent Cycle and on Great Events in Earth history New and updated sections on Earth's thermal history, planetary volcanism, planetary crusts, the onset of plate tectonics, changing composition of the oceans and atmosphere, and paleoclimatic regimes Also new in this Second Edition: the lower mantle and the role of the post-perovskite transition, the role of water in the mantle, new tomographic data tracking plume tails into the deep mantle, Euxinia in Proterozoic oceans, The Hadean, A crustal age gap at 2.4-2.2 Ga, and continental growth

Climate and the Oceans

Explores climate and oceans, providing a look at the basics of climate, a descriptive overview of the oceans, a brief introduction to dynamics, and coverage of other related topics.

Earth as an Evolving Planetary System

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Earth's Oldest Rocks provides a comprehensive overview of all aspects of early Earth, from planetary accretion through to development of protocratons with depleted lithospheric keels by c. 3.2 Ga, in a series of papers written by over 50 of the world's leading experts. The book is divided into two chapters on early Earth history, ten chapters on the geology of specific cratons, and two chapters on early Earth analogues and the tectonic framework of early Earth. Individual contributions address topics that range from planetary accretion, a review of Earth meteorites, significance and composition of Hadean protocrust, composition of Archaean mantle and deep crust, all aspects of the geology of Paleoproterozoic cratons, composition of Archean oceans and hydrothermal environments, evidence and geological settings of early life, early Earth analogues from Venus and New Zealand, and a tectonic framework for early Earth. * Contains comprehensive reviews of areas of ancient lithosphere on Earth, of planetary accretion processes, and of meteorites * Focuses on specific aspects of early Earth, including oldest putative life forms, evidence of the composition of the ancient atmosphere-hydrosphere, and the oldest evidence for subduction-accretion * Presents an overview of geological processes and model of the tectonic framework on early Earth

Physical Geology

Updated throughout with the latest data and findings, the Second Edition of

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Essentials of Geochemistry provides students with a solid understanding of the fundamentals of and approaches to modern geochemical analysis. The text uses a concepts of chemical equilibrium approach, which considers the reactions that occur as a result of changes in heat production and pressure within the Earth to introduce students to the basic geochemical principles. This text is for those who want a quantitative treatment that integrates the principles of thermodynamics, solution chemistry, and kinetics into the study of earth processes. This timely text contains numerous examples and problems sets which use SUPCRT92 to allow students to test their understanding of thermodynamic theory and maximize their comprehension of this prominent field. New sections introduce current “hot” topics such as global geochemical change with the short and long term carbon cycle, carbon isotopes and the Permo-Triassic extinction event, kinetics and the origin of life and the use of boron and nitrogen isotopes.

The Chemical Evolution of the Atmosphere and Oceans

In this first full-scale attempt to reconstruct the chemical evolution of the Earth's atmosphere and oceans, Heinrich Holland assembles data from a wide spectrum of fields to trace the history of the ocean-atmosphere system. A pioneer in an increasingly important area of scholarship, he presents a comprehensive treatment of knowledge on this subject, provides an extensive bibliography, and outlines problems and approaches for further research. The first four chapters deal with the

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turbulent first half billion years of Earth history. The next four chapters, devoted largely to the Earth from 3.9 to 0.6 b.y.b.p., demonstrate that changes in the atmosphere and oceans during this period were not dramatic. The last chapter of the book deals with the Phanerozoic Eon; although the isotopic composition of sulfur and strontium in seawater varied greatly during this period of Earth history, the chemical composition of seawater did not.

The Story of Earth

This volume considers the role comets may have played in the origins and evolution of life. This is the only book dealing in depth with this subject. It is particularly relevant in light of recent investigations of Halley's comet, of new insights into organic synthesis in meteorites and comets, and of new results of numerical simulations of cometary orbits and impacts on Earth. The book is intended as a comprehensive review of current research.

Encyclopedia of Earth and Space Science

This concise, sophisticated introduction to planetary climates explains the global physical and chemical processes that determine climate on any planet or major planetary satellite--from Mercury to Neptune and even large moons such as

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Saturn's Titan. Although the climates of other worlds are extremely diverse, the chemical and physical processes that shape their dynamics are the same. As this book makes clear, the better we can understand how various planetary climates formed and evolved, the better we can understand Earth's climate history and future.

Sustaining Ocean Observations to Understand Future Changes in Earth's Climate

The interdisciplinary field of Astrobiology constitutes a joint arena where provocative discoveries are coalescing concerning, e.g. the prevalence of exoplanets, the diversity and hardiness of life, and its increasingly likely chances for its emergence. Biologists, astrophysicists, biochemists, geoscientists and space scientists share this exciting mission of revealing the origin and commonality of life in the Universe. The members of the different disciplines are used to their own terminology and technical language. In the interdisciplinary environment many terms either have redundant meanings or are completely unfamiliar to members of other disciplines. The Encyclopedia of Astrobiology serves as the key to a common understanding. Each new or experienced researcher and graduate student in adjacent fields of astrobiology will appreciate this reference work in the quest to understand the big picture. The carefully selected group of active researchers

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contributing to this work and the expert field editors intend for their contributions, from an internationally comprehensive perspective, to accelerate the interdisciplinary advance of astrobiology.

Atmospheric Evolution on Inhabited and Lifeless Worlds

A new edition of Freeman's briefest astronomy text providing just the essentials at a student-friendly price.

Introductory Biophysics: Perspectives on the Living State

The 4.4-billion-year history of the oceans and their role in Earth's climate system It has often been said that we know more about the moon than we do about our own oceans. In fact, we know a great deal more about the oceans than many people realize. Scientists know that our actions today are shaping the oceans and climate of tomorrow—and that if we continue to act recklessly, the consequences will be dire. Eelco Rohling traces the 4.4-billion-year history of Earth's oceans while also shedding light on the critical role they play in our planet's climate system. This timely and accessible book explores the close interrelationships of the oceans, climate, solid Earth processes, and life, using the context of Earth and ocean history to provide perspective on humankind's impacts on the health and

habitability of our planet.

Planetary Climates

This book presents a unique and comprehensive view of the fundamental dynamical and thermodynamic principles underlying the large circulations of the coupled ocean-atmosphere system. Dynamics of The Tropical Atmosphere and Oceans provides a detailed description of macroscale tropical circulation systems such as the monsoon, the Hadley and Walker Circulations, El Niño, and the tropical ocean warm pool. These macroscale circulations interact with a myriad of higher frequency systems, ranging from convective cloud systems to migrating equatorial waves that attend the low-frequency background flow. Towards understanding and predicting these circulation systems. A comprehensive overview of the dynamics and thermodynamics of large-scale tropical atmosphere and oceans is presented using both a “reductionist” and “holistic” perspectives of the coupled tropical system. The reductionist perspective provides a detailed description of the individual elements of the ocean and atmospheric circulations. The physical nature of each component of the tropical circulation such as the Hadley and Walker circulations, the monsoon, the incursion of extratropical phenomena into the tropics, precipitation distributions, equatorial waves and disturbances described in detail. The holistic perspective provides a physical description of how the collection of the individual components produces the observed tropical weather and climate.

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How the collective tropical processes determine the tropical circulation and their role in global weather and climate is provided in a series of overlapping theoretical and modelling constructs. The structure of the book follows a graduated framework. Following a detailed description of tropical phenomenology, the reader is introduced to dynamical and thermodynamical constraints that guide the planetary climate and establish a critical role for the tropics. Equatorial wave theory is developed for simple and complex background flows, including the critical role played by moist processes. The manner in which the tropics and the extratropics interact is then described, followed by a discussion of the physics behind the subtropical and near-equatorial precipitation including arid regions. The El Niño phenomena and the monsoon circulations are discussed, including their covariance and predictability. Finally, the changing structure of the tropics is discussed in terms of the extent of the tropical ocean warm pool and its relationship to the intensity of global convection and climate change. Dynamics of the Tropical Atmosphere and Oceans is aimed at advanced undergraduate and early career graduate students. It also serves as an excellent general reference book for scientists interested in tropical circulations and their relationship with the broader climate system.

Earth's Oldest Rocks

Boundaries of Evolution describes the unlikelihood of evolutionary theory to

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explain how it is supposed to scale three major biological cliffs. The first cliff is the need for a logical explanation of how random chemical reactions could produce the first living cell from the primordial soup. The second is the problem of explaining how the first single-celled eukaryote evolved from a prokaryote. Mathematical improbabilities of evolutionary theory to scale the first two cliffs, in the time available, are demonstrated. The third insurmountable cliff is the necessity for a reasonable explanation of how millions of different kinds of multi-celled eukaryotes could have quickly evolved from single-celled eukaryotes. Random mutations occurring in DNA, accepted or rejected by natural selection, are hailed as the source of advancement for the increase in biotic complexity. The most common time for mutations to occur in the DNA is during replication. Therefore, evolutionary advancement should occur faster in biota with the most frequent replication cycles. If both evolutionary theory and the fossil record are correct, prokaryotes, which replicate in as little as 20 minutes took 2 billion years to evolve the first single-celled eukaryote. Single-celled eukaryotes, generally having shorter reproductive times than multi-celled eukaryotes, took another billion years to evolve the first multi-celled eukaryote. Then during Cambrian times, the multi-celled eukaryotes with the longest reproductive cycles literally exploded in diversity in a comparatively short time. How could this be? Other inadequacies of Darwin's theory are presented for everyone to see.

Earth's Early Atmosphere and Oceans, and The Origin of Life

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Basic Concepts: Composition, Structure, and State. First and Second Laws of Thermodynamics. Transfer Processes. Thermodynamics of Water. Nucleation and Diffusional Growth. Moist Thermodynamics Processes in the Atmosphere. Static Stability of the Atmosphere and Ocean. Cloud Characteristics and Processes. Ocean Surface Exchanges of Heat and Freshwater. Sea, Ice, Snow, and Glaciers. Thermohaline Processes in the Ocean. Special Topics: Global Energy and Entropy Balances. Thermodynamics Feedbacks in the Climate System. Planetary Atmospheres and Surface Ice. Appendices. Subject Index.

Archean Crustal Evolution

Provides a comprehensive reference for Earth and space sciences, including entries on climate change, stellar evolution, tsunamis, renewable energy options, and mass wasting.

The Oceans

The Atmosphere and Ocean is a fully revised and updated student friendly physical introduction to the atmosphere and ocean. Now in its Third Edition, the book continues to provide students with an accessible description of the atmosphere and ocean with emphasis on their physical properties and inter-dependence.

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Clearly structured throughout, the book demonstrates that the atmosphere and ocean are both subject to the influence of the earth's rotation and therefore they have a common dynamical basis. The author clearly demonstrates the fundamental differences between the two environments and provides the reader with a much better understanding of the atmosphere and the ocean and an appreciation of their closest interactive relationship. There have been many developments in the field over the past ten years and this latest edition of a highly successful textbook brings together new material on the ocean-atmosphere system and climate, the observed circulation of the atmosphere and ocean and radiation in the atmosphere and ocean. Fully revised and updated 3rd Edition of student friendly physical introduction to the atmosphere and ocean. Now includes new chapters on observed circulation of the atmosphere and ocean, energy flows in the ocean atmosphere system, modeling the ocean and atmosphere, the ocean atmosphere system and climate. Well structured and written in an authoritative yet accessible style suitable for 2nd and 3rd year students taking courses in meteorology, oceanography and related Earth Sciences or as an introduction for graduate students. Emphasis placed on physical properties and inter-dependence of the ocean and climate. Part of the RMetS (Royal Meteorological Society) book series, Advancing Weather and Climate Science

Early Earth Systems

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This 199 book reviews discoveries in astronomy, paleontology, biology and chemistry to help us to understand the likely origin of life on Earth.

Discovering the Essential Universe, Second Edition

"Physical Geology is a comprehensive introductory text on the physical aspects of geology, including rocks and minerals, plate tectonics, earthquakes, volcanoes, glaciation, groundwater, streams, coasts, mass wasting, climate change, planetary geology and much more. It has a strong emphasis on examples from western Canada, especially British Columbia, and also includes a chapter devoted to the geological history of western Canada. The book is a collaboration of faculty from Earth Science departments at Universities and Colleges across British Columbia and elsewhere"--BCcampus website.

Origin and Evolution of Planetary and Satellite Atmospheres

This book provides a comprehensive treatment of the chemical nature of the Earth's early surface environment and how that led to the origin of life. This includes a detailed discussion of the likely process by which life emerged using as much quantitative information as possible. The emergence of life and the prior surface conditions of the Earth have implications for the evolution of Earth's

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surface environment over the following 2-2.5 billion years. The last part of the book discusses how these changes took place and the evidence from the geologic record that supports this particular version of early and evolving conditions.

Encyclopedia of Astrobiology

Nothing provided

Boundaries of Evolution

Designed for biology, physics, and medical students, *Introductory Biophysics: Perspectives on the Living State*, provides a comprehensive overview of the complex subject of biological physics. The companion CD-ROM (eBook version does not include the CD-ROM), with MATLAB examples and the student version of QuickField™, allows the student to perform biophysical simulations and modify the textbook example files. Included in the text are computer simulations of thermodynamics, astrobiology, the response of living cells to external fields, chaos in population dynamics, numerical models of evolution, electrical circuit models of cell suspension, gap junctions, and neuronal action potentials. With this text students will be able to perform biophysical simulations within hours. MATLAB examples include; the Hodgkin Huxley equations; the FitzHugh-Nagumo model of

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action potentials; fractal structures in biology; chaos in population dynamics; the cellular automaton model (the game of life); pattern formation in reaction-diffusion systems. QuickField™ tutorials and examples include; calculation of currents in biological tissue; cells under electrical stimulation; induced membrane potentials; heat transfer and analysis of stress in biomaterials.

Earth's Early Atmosphere and Surface Environment

The air we breathe is twenty-one percent oxygen, an amount higher than on any other known world. While we may take our air for granted, Earth was not always an oxygenated planet. How did it become this way? Donald Canfield—one of the world's leading authorities on geochemistry, earth history, and the early oceans—covers this vast history, emphasizing its relationship to the evolution of life and the evolving chemistry of the Earth. Canfield guides readers through the various lines of scientific evidence, considers some of the wrong turns and dead ends along the way, and highlights the scientists and researchers who have made key discoveries in the field. Showing how Earth's atmosphere developed over time, *Oxygen* takes readers on a remarkable journey through the history of the oxygenation of our planet.

The Earth's Atmosphere

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The author has sought to incorporate in the book some of the fundamental concepts and principles of the physics and dynamics of the atmosphere, a knowledge and understanding of which should help an average student of science to comprehend some of the great complexities of the earth-atmosphere system, in which a three-way interaction between the atmosphere, the land and the ocean tends to maintain an overall mass and energy balance in the system through physical and dynamical processes. The book, divided into two parts and consisting of 19 chapters, introduces only those aspects of the subject that, according to the author, are deemed essential to meet the objective in view. The emphasis is more on clarity and understanding of physical and dynamical principles than on details of complex theories and mathematics. Attempt is made to treat each subject from first principles and trace its development to present state, as far as possible. However, a knowledge of basic calculus and differential equations is sine qua non especially for some of the chapters which appear later in the book.

The Molecular Origins of Life

Atmosphere-Ocean Dynamics deals with a systematic and unified approach to the dynamics of the ocean and atmosphere. The book reviews the relationship of the ocean-atmosphere and how this system functions. The text explains this system through radiative equilibrium models; the book also considers the greenhouse effect, the effects of convection and of horizontal gradients, and the variability in

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radiative driving of the earth. Equations in the book show the properties of a material element, mass conservation, the balance of scalar quantity (such as salinity), and the mathematical behavior of the ocean and atmosphere. The book also addresses how the ocean-atmosphere system tends to adjust to equilibrium, both in the absence and presence of driving forces such as gravity. The text also explains the effect of the earth's rotation on the system, as well as the application of forced motions such as that produced by wind or temperature changes. The book explains tropical dynamics and the effects of variation of the Coriolis parameter with latitude. The text will be appreciated by meteorologists, environmentalists, students studying hydrology, and people working in general earth sciences.

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