Atmosphere, Ocean and Climate Dynamics - An Introductory Text

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 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.
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**Atmosphere-Ocean Dynamics**

A systematic, unifying approach to the dynamics of the ocean and atmosphere is given in this book, with emphasis on the larger-scale motions (from a few kilometers to global scale). The foundations of the subject (the equations of state and dynamical equations) are covered in some detail, so that students with training in mathematics should find it a self-contained text. Knowledge of fluid mechanics is helpful but not essential. Simple mathematical models are used to demonstrate the fundamental dynamical principles with plentiful illustrations from field and laboratory.

**Atmospheric and Oceanic Fluid Dynamics - Fundamentals and Large-scale Circulation**

Fluid dynamics is fundamental to our understanding of the atmosphere and oceans. Although many of the same principles of fluid dynamics apply to both the atmosphere and oceans, textbooks tend to concentrate on the atmosphere, the ocean, or the theory of geophysical fluid dynamics (GFD). This textbook provides a comprehensive unified treatment of atmospheric and oceanic fluid dynamics. The book introduces the fundamentals of geophysical fluid dynamics, including rotation and stratification, vorticity and potential vorticity, and scaling and approximations. It discusses baroclinic and barotropic instabilities, wave-mean flow interactions and turbulence, and the general circulation of the atmosphere and ocean. Student problems and exercises are included at the end of each chapter. Atmospheric and Oceanic Fluid Dynamics: Fundamentals and Large-Scale Circulation will be an invaluable graduate textbook on advanced courses in GFD, meteorology, atmospheric science and oceanography, and an excellent review volume for researchers. Additional resources are available at www.cambridge.org/9780521849692.

**Continental Drift**

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 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.
Theory of Planetary Atmospheres - An Introduction to Their Physics and Chemistry

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 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.

Climate Dynamics

A concise introduction to climate system dynamics Climate Dynamics is an advanced undergraduate-level textbook that provides an essential foundation in the physical understanding of the earth's climate system. The book assumes no background in atmospheric or ocean sciences and is appropriate for any science or engineering student who has completed two semesters of calculus and one semester of calculus-based physics. Describing the climate system based on observations of the mean climate state and its variability, the first section of the book introduces the vocabulary of the field, the dependent variables that characterize the climate system, and the typical approaches taken to display these variables. The second section of the book gives a quantitative understanding of the processes that determine the climate state—radiation, heat balances, and the basics of fluid dynamics. Applications for the atmosphere, ocean, and hydrological cycle are developed in the next section, and the last three chapters of the book directly address global climate change. Throughout, the textbook makes connections between mathematics and physics in order to illustrate the usefulness of mathematics, particularly first-year calculus, for predicting changes in the physical world. Climate change will impact every aspect of life in the coming decades. This book supports and broadens understanding of the dynamics of the climate system by offering a much-needed introduction that is accessible to any science, math, or engineering student. Makes a physically based, quantitative understanding of climate change accessible to all science, engineering, and mathematics undergraduates Explains how the climate system works and why the climate is changing Reinforces, applies, and connects the basic ideas of calculus and physics Emphasizes fundamental observations and understanding An online illustration package and solutions manual for professors is available

Dynamics of The Tropical Atmosphere and Oceans

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. 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.

**A Mathematical Theory of Large-Scale Atmosphere/Ocean Flow**

This book counteracts the current fashion for theories of “chaos” and unpredictability by describing a theory that underpins the surprising accuracy of current deterministic weather forecasts, and it suggests that further improvements are possible. The book does this by making a unique link between an exciting new branch of mathematics called “optimal transportation” and existing classical theories of the large-scale atmosphere and ocean circulation. It is then possible to solve a set of simple equations proposed many years ago by Hoskins which are asymptotically valid on large scales, and use them to derive quantitative predictions about many large-scale atmospheric and oceanic phenomena. A particular feature is that the simple equations used have highly predictable solutions, thus suggesting that the limits of deterministic predictability of the weather may not yet have been reached. It is also possible to make rigorous statements about the large-scale behaviour of the atmosphere and ocean by proving results using these simple equations and applying them to the real system allowing for the errors in the
approximation. There are a number of other titles in this field, but they do not treat this large-scale regime. Contents: The Governing Equations and Asymptotic Approximations to Them Solution of the Semi-Geostrophic Equations in Plane Geometry Solution of the Semi-Geostrophic Equations in More General Cases Properties of Semi-Geostrophic Solutions Application of Semi-Geostrophic Theory to the Predictability of atmospheric Flows

Readership: Researchers and graduate students in atmosphere/ocean dynamics with some mathematical background. Keywords: Semi-Geostrophic; Optimal Transportation; Convexity; Rearrangements; Potential Vorticity; Balance; Predictability

Reviews: “This book could appeal to applied mathematicians or very mathematically inclined A&O scientists interested in A&O predictability in general, as well as in certain of its aspects … Overall, the exposition is clear, careful, and thorough.” American Meteorological Society

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**The Arctic Ocean began warming decades earlier than previously thought, new research shows**

The Arctic Ocean has been warming since the onset of the 20th century, decades earlier than instrument observations would suggest, according to new research.

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**Science and the Rapidly Changing Arctic**

Arctic expert Joel Clement is back with an update on federal science in the region, and how Alaska Natives are adapting to the changing landscape.

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**CLIMATE IDEAS BLOG: Research, technology and opinions to help solve the global climate crisis**

California and the European Institute of Innovation & Technology’s (EIT) climate community have signed a deal to better collaborate and share knowledge on green research and innovation. Over the past ...

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**Speaking of Water: “How Do We Consider Mass Resettlement Of The World Population?” With Parag Khanna**

To mitigate climate change. To decarbonize industries. To invest massively in alternative and renewable energy potentially. To undertake geoengineering initiatives that could be carbon sequestration.

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**Climate change arrives in Connecticut, imperiling coastal towns like Groton**

Climate change has already arrived in Connecticut, as shown this summer by scorching temperatures and punishing storms. In the coming decades, its effects will only accelerate.

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**SURF Program 2021: Student Profiles**

This past summer Arellano worked in Jennifer Haase’s lab, investigating ice-ocean-atmospheric interactions of to hydroxyl radical and nitric oxide in the atmosphere, which affects climate and air ...

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**Hospital waste, not masks, are plastic threat of pandemic: study**

Just a few weeks after the first cases hit the city, face masks started appearing in the ocean and washing onto beaches ... increase the] microfibers seen in the atmosphere.” Plastic is also known to ...

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**‘Utter betrayal’: civil society groups furious at Cop26 outcome – live updates**

Agreement arrived at on Saturday night made progress in some important areas but poor countries say it is not nearly enough. Follow reaction here ...

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**Algae blooms, which can threaten drinking water and human health, pop up regularly and may increase**

The rise of blooms appears to be connected to human-caused climate change ... according to National Oceanic and Atmospheric Administration data. “It was a drought year, a lot of the nutrients ...
Nigeria’s Household Food Security Under Threat - World Bank

“There is no time like the present for the country to prepare for future climate and conflict shocks ... to school or by finding low-tech remote solutions that work for the poor; as well as ...