For those of us who, perversely, spend our days studying climate and then go home and spend our leisure time reading about climate, there is no doubt that David Randall’s *Atmosphere, Clouds, and Climate* is a great read. It is a whirlwind tour of grad-school topics, with sprinklings of historical context, related fields, and advanced topics that keep the pages turning. This book is part of the *Princeton Primers in Climate*, though, so we are not the intended audience. Instead, this book is aimed at college undergraduates according to the preface, and at “students, researchers, and scientifically-minded general readers” according to the back cover. Bearing in mind these audiences, how effective is this book?

The breadth of this slim volume is impressive. Basic processes like radiative transfer, condensation, and turbulence are covered, as are climatic features like monsoons. Cumulus convection is covered in detail, and nicely tied to large-scale phenomena like the Hadley-Walker Circulation and ENSO. Climate feedbacks are described, surpassing the expected thumbnail view using the ice-albedo feedback as an example to include more nuanced (and more interesting) effects like the fixed-anvil temperature hypothesis for tropical cirrus longwave effects and the shortwave effects of low-level clouds. Predictability gets its own chapter, as do coupled processes. All this is achieved in just over 200 paperback pages, and with uncommon succinctness and clarity.

Throughout my reading of the book, I tried to channel my past self: an undergraduate physics major who has a vague notion about climate (and/or clouds) being an interesting topic for graduate study. The broad scope of the book provides a survey of topics that could help a prospective graduate student hone their personal statement. More than that, the book opens the door to the climate system by providing physical reasoning for many fundamental atmospheric processes. One clear strength of this book is that its arguments are consistently presented in terms of energy and mass, for which the science or engineering student should have developed some understanding and intuition. Incorporating moist thermodynamics can get messy, but is dealt with deftly here, for example by using moist static energy instead of introducing the arcane “temperatures” that have perplexed more than just graduate students for many years.

The tone is conversational, and the language is kept simple with as little jargon as possible. These are good features for a book aimed at novices. It is terse, though, with jokes and puns averaging about one per chapter (yes, I kept track). A cynic might ask whether, in an age of Twitter and YouTube, today’s undergraduates have the tenacity to reach the end of the book. Those who do, I think, will be well rewarded. They might be drawn toward the field of climate science, too, as there are a few baited hooks within the pages: allusions to using the world’s most powerful computers, the allure of studying chaotic systems, the adventure of wading into the world of big data, and the applicability to important societal issues. These are the lures that climate science has at its disposal for recruitment.

As for researchers and scientifically-minded general readers, the breadth and clarity of the book should satisfy most. For those in other fields looking to better understand climate science, this book will pair well with some of the popular accounts of the field, allowing the reader to gain a deeper appreciation for the physical science. Graduate students in other disciplines, especially those whose work might be related to climate science, will likely reap the greatest benefits from a careful reading. Nonexperts who teach undergraduate courses on climate should cull from this book useful analogies and explanations, and for small classes this would make a terrific supplementary text to complement a course.
The book has some weaknesses, but they probably vary depending on what the reader is expecting. Experts will undoubtedly feel their own topic has been short-changed, but there is no way around that, even across the whole series of primers in climate. Casual readers might think the text is too dry, but this book is not a history lesson, memoir, nor a narrative account, and it makes no claims to be so. There are historical references that help illustrate the concepts being discussed, but there are no stories or personal accounts or biographical sketches of the founders of the field. Some of the end notes, references, and further reading suggestions will guide interested readers to other sources, and both popular and technical literature is included. Given the brevity of most sections, however, readers might need a little more help. An annotated “further reading” section could have provided that extra nudge toward the most appropriate reading on each topic. Similarly, the final chapter, “Frontiers,” could have been expanded. After the expeditious survey of the first eight chapters, it would have felt better to slow down and ruminate on future directions and challenges. The last chapter is only a fleeting glance toward the wider world of current and future research.

I have never read a book like *Atmosphere, Clouds, and Climate*. At the level presented, there is no better description, to my knowledge, of the role that clouds play in the climate system. The clarity and authority that Randall brings to the work are obvious in every chapter. A wide spectrum of readers will be satisfied by this book, but hopefully not so satisfied that they stop here. This book is, as a primer should be, an initiation to a vast field, providing the tools and motivation necessary to take the next steps.

—Brian Medeiros

*Brian Medeiros is a project scientist at the National Center for Atmospheric Research in Boulder, Colorado.*

**A HANDS-ON INTRODUCTION TO USING PYTHON IN THE ATMOSPHERIC AND OCEANIC SCIENCES**

The Python programming language has gained support and use within the atmospheric and oceanic sciences over the last several years, and rightly so. The language allows for a powerful, modern programming framework for many different applications. With the growing use of Python in meteorology, the AMS has offered short courses, included symposia at Annual Meetings, and published brief articles in the *Bulletin*. However, Python resources for researchers in the atmospheric and oceanic sciences remain scarce. Johnny Wei-Bing Lin, the author and a large proponent of using Python in the field, is specifically targeting this void with *A Hands-On Introduction to Using Python in the Atmospheric and Oceanic Sciences*.

The author clearly outlines his intended audience and purpose for the book early in the text. The book gives an overview of how to transition to the Python programming language or, at a minimum, how to implement Python into existing research workflows. The author targets individuals in the meteorological field who have had no exposure to Python but have familiarity with another programming language such as MATLAB, IDL, and modern releases of FORTRAN. Individuals with a working knowledge of how to program in Python will find this text of little use except to see the author’s approach to using Python. Because the text is designed as a short course in Python, it does not work well as a resource or reference text, nor does it teach how to program. The author uses a course-like structure and an informal tone that makes for an easy, fast read for individuals hoping to try or switch to Python. For teaching purposes, instructors may want to use the text to help outline a course or as a reference for the basics of the Python programming language in an atmospheric and oceanic sciences context. The exercises provided in the book lack the depth needed for course assignments at an undergraduate or graduate level, but instructors could build upon the concepts presented in the book to design assignments for a programming course.

The book is available in three formats: a black-and-white print version (used for this review), a PDF version with color and hyperlinks for navigation, and a free PDF version. A more complete description of the three formats is included at the beginning of the book and on the book’s website ([www.johnny-lin.com/pyintro/](http://www.johnny-lin.com/pyintro/)). In addition to information about the book, example code and data files may be downloaded, allowing readers to use and follow the text with ease—at least in theory. One problem associated with the example code quickly becomes evident. If the example uses data in the netCDF format, some individuals may encounter issues based on
their system’s Python configuration. The author provides a fix in the addenda, in the errata, and on the book’s website. With minimal effort, all of the examples run. It would be beneficial to provide two stable versions of the code to aid novice Python users and limit frustration.

The author organized the book into five sections. In chapters 1–2, he addresses why to use Python, how others currently use Python, and how to install Python and associated scientific tools. He covers the basics of programming in Python in chapters 3–5. The author follows the basics with practical examples of implementing Python to research through fundamental data processing and visualization in chapters 6 and 9. He introduces the object-oriented programming paradigm in chapters 7–8. In chapter 10, the author directs the reader to additional Python resources for more advanced features and application-specific tools.

Of the various sections within the book, the practical examples in chapters 6 and 9 are the most useful. Chapter 6 highlights different approaches to solving the same problem using Python. This is important because it demonstrates how easy it is to transition from another language while showing that code can maintain a similar feel to the reader’s existing coding practices. This chapter also demonstrates that adopting a more Python-like approach exploits more of the features offered by the language, enhances maintainability, enlarges expandability, and increases versatility of the user’s code. Chapter 9 is a short primer on data visualization via Python, but the chapter contains great atmospheric and oceanic sciences examples.

Even to readers with formal object-oriented programming training, the section related to this programming paradigm may be initially confusing and abstract. In fairness, most of the ambiguity stems from the lexicon associated with object-oriented programming rather than the author’s explanations of the topic. The examples in this section prove essential to grasping the programming paradigm. The atmospheric and oceanic sciences framework of the examples displays how to use object-oriented programming in the field. As a result, the examples salvage what feels like a weaker section of the book.

A Hands-On Introduction to Using Python in the Atmospheric and Oceanic Sciences is an excellent introduction for any researcher in these fields seeking to transition to the Python programming language. Programming examples included throughout the book are effective, clear, and to the point while maintaining relevance to the reader. Johnny Wei-Bing Lin’s tone and the structure of the book allow readers to move efficiently through the material and reach the ultimate goal of the book—learning to program in Python.

—Christopher Slocum

Christopher Slocum is a graduate research assistant in the Department of Atmospheric Science at Colorado State University.

NEW PUBLICATIONS

SECRETS OF THE ICE: ANTARCTICA’S CLUES TO CLIMATE, THE UNIVERSE, AND THE LIMITS OF LIFE

Each year hundreds of scientists travel to Antarctica to investigate the climate, examine the continent’s life forms, and seek answers to far-reaching questions about the universe. In this book, the author shares the scientists’ stories and explains their discoveries. Meduna provides firsthand accounts of the wide range of scientific activity in Antarctica today along with portraits of the men and women conducting it. More than 150 color photographs are included in the text.

STORM KINGS: THE UNTOLD HISTORY OF AMERICA’S FIRST TORNADO CHASERS

The author of this title explores America’s fascination with and relationship to tornadoes—what the early settlers of the central plains called “storm kings.” Drawing on memoirs, letters, eyewitness testimonies, and archives, the book recreates descriptions of some of the most devastating storms in America’s history, including the Tri-state Tornado of 1925 and the Peshtigo “fire tornado,” and brings to life scientists such as James Espy, America’s first meteorologist. It also details the history of the National Weather Service.

THE EARTH’S CRYOSPHERE AND SEA LEVEL CHANGE

This text provides a comprehensive overview of our present understanding of the Earth’s cryosphere, its changes, and their consequences for mean sea level changes. Since the middle of the nineteenth century, there has been an increase in sea level height of 20–25 centimeters—about 10 centimeters due to net losses from glaciers and the remainder due to mass losses from land ice and thermal expansion of the oceans. The book gives an up-to-date survey of the present knowledge of this increase.
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