

Preface to the First Edition

The science of climatology began to evolve rapidly in the last third of the twentieth century. This rapid development arose from several causes. During this period, the view of Earth from its moon made people more aware of the exceptional nature of their planetary home at about the same time that it became widely understood that humans could alter our global environment. Scientific and technological developments gave us new and quantitative information on past climate variations, global observations of climate parameters from space, and computer models with which we could simulate the global climate system. These new tools together with concern about global environmental change and its consequences for humanity caused an increase in the intensity of scientific research about climate.

Modern study of the Earth's climate system has become an interdisciplinary science incorporating the atmosphere, the ocean, and the land surface, which interact through physical, chemical, and biological processes. A fully general treatment of this system is as yet impossible, because the understanding of it is just beginning to develop. This textbook provides an introduction to the physical interactions in the climate system, viewed from a global perspective. Even this endeavor is a difficult one, since many earth science subdisciplines must be incorporated, such as dynamic meteorology, physical oceanography, radiative transfer, glaciology, hydrology, boundary-layer meteorology, and paleoclimatology. To make a book of manageable size about such a complex topic requires many difficult choices. I have endeavored to provide a sense of the complexity and interconnectedness of the climate problem without going into excessive detail in any one area. Although the modern approach to climatology has arisen out of diverse disciplines, a coherent collection of concepts is emerging that defines a starting point for a distinct science. This textbook is my attempt to present the physical elements of that beginning with occasional references to where the chemical and biological elements are connected.

This book is intended as a text for upper-division undergraduate physical science majors and, especially in the later chapters, graduate students. I have used the first seven chapters as the basis for a 10-week undergraduate course for atmospheric sciences majors. A graduate course can be fashioned by supplementing the text with readings from the current literature. Most climatology textbooks are descriptive and written from the perspective of geographers, but this one is written from the perspective of a physicist. I have attempted to convey an intuition for the workings

of the climate system that is based on physical principles. When faced with a choice between providing easy access to an important concept and providing a rigorous and comprehensive treatment, I have chosen easy access. This approach should allow students to acquire the main ideas without great pain. Instructors may choose to elaborate on the presentation where their personal interests and experience make it desirable to do so.

This book could not have been produced without the assistance of many people. It evolved from 15 years of teaching undergraduate and graduate students, and I thank the ATMS 321 and ATMS 571 students at the University of Washington who have endured my experimentation and provided comments on early drafts of this book. Professor Steve Esbensen and his ATs 630 class at Oregon State University provided commentary on a near final draft of Chapters 1–7 in the spring of 1993. Valuable comments and suggestions on specific chapters were also provided by David S. Battisti, Robert J. Charlson, James R. Holton, Conway B. Leovy, Gary A. Maykut, Stephen G. Porter, Edward S. Sarachik, J. Michael Wallace, and Stephen G. Warren. The encouragement and advice given by James R. Holton were critical for the completion of this book. Many people contributed graphics, and I am particularly grateful for the special efforts given by Otis Brown, Frank Carsey, Jim Coakley, Joey Comiso, Scott Katz, Gary Maykut, Pat McCormick, Robert Pincus, Norbert Untersteiner, and Stephen Warren.

Grace C. Gudmundson applied her professional editorial skills to this project with patience, dedication, and good humor. Her efforts greatly improved the quality of the end product. Similarly, Kay M. Dewar's artistic and computer skills produced some of the more appealing figures. Marc L. Michelsen's genius with the computer extracted data from many digital archives and converted them into attractive and informative computer graphics. Luanna Huynh and Christine Rice were especially helpful with the appendices and tables.

My efforts to understand the climate system have been generously supported over the years by research grants and contracts from the US government. I am particularly happy to acknowledge support from the Climate Dynamics Program in the Atmospheric Sciences Division of the National Science Foundation, and the Earth Radiation Budget Experiment and Earth Observing System programs of the National Aeronautics and Space Administration. I also thank all of my colleagues from whom I have learned, who have shared their ideas with me, and who have given me the respect of serious argument.

This book is dedicated to my family, especially my wife, Lorraine, and my children, Alan and Jennifer, whose love and sacrifice were essential to its completion. I hope this book will help to explain why I spend so many evenings and weekends in my study. I thank my parents, Alfred and Angeline, for a good start in life and support along the way toward happy employment.

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