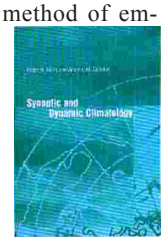
SYNOPTIC AND DYNAMIC CLIMATOLOGY

Roger G. Barry and Andrew M. Carleton, 2001, 620 pp., $165.00, paperbound, Routledge, ISBN 0-425-03116-8

This book could be considered an extenslvely revised and updated edition of the 1973 book, *Synoptic Climatology: Methods and Applications,* which was written byRoger G. Barry and Allen H. Perry. The latter has actually also contributed to this new book by coauthoring the last chapter, "Synoptic Climatology and its Application," with Barry .

The book comprises three parts. Part I, "The Climate System and its Study," documents the data sources for large-scale climatological studies from conventional weather maps, geopotential height data and remote sensing products, and data analysis techniques. Also offered is a brief introduction into some statistical concepts, in particular a number of different probability distributions and the method of empirical orthogonal functions (EOFs) or, as called in other quarters, principal component analysis. Also, methods of time series analysis, such as wavelet analysis and the maximum entropy method, are discussed.Analytical tools for spatial data are covered in detail, with a discussion about synoptic maps and the quality of hemispheric and global maps. Methods to derive kinematic properties are presented, as are methods to derive horizontal derivatives and streamfunction from gridded data. Other topics in this section are vertical velocity, isentropic charts, and trajectories.



In part II, "Dynamical Climatology," chapter 3 encompasses about 150 pages, including 20 pages of references, concerning "Global Climate and the General Circulation." After having introduced a number of basic concepts, such as orbital variations and the energy balance, the classical analyses of energy , heat, and moisture budgets are considered. Other topics explored are the global circulations cells and the influence of the Earth's geography on the global circulation. Also presented is the making of global circulation models and their success in reproducing the large-scale features of the atmospheric circulation.The global circulation, with its subtropical high pressure systems, low-latitude circulation, monsoons, extratropical circulation, and centers of action on both hemispheres, are described in a broad manner, and various explanatory conceptual models for their dy-namics are presented. Chapter 4, titled "Large-Scale Circulation and Climatic Characteristics" is also rather long with almost 100 pages, including 11 pages of references. Again, a variety of aspects is presented and discussed, with many references to the original literature: time averaged circulation, jet streams, plan etary waves, zonal index, zonal and blocking flow modes, blocking mechanism, low-frequency circula-tion variability , and intraseasonal variations. The last chapter in part II is on "Global Teleconnections" and covers all the (by now) famous modes, ranging from ENSO and zonally symmetric modes like the Arctic and Antarctic Oscillation, to wave trains emanating from the Tropics, to the more recently described interdecadal oscillations.

Part III, "Synoptic Climatology ," has two chapters, on "Synoptic Systems" and "Synoptic Climatology and its Applications." After a historical review of the science of synoptic systems, the theory behind it is reviewed. About two-thirds of the chapter about syn-optic systems deals with satellite-based climatology and synoptic-scale systems in the Tropics. The last chapter reviews the different methods of classifying (or weather typing), ranging from subjective and ob-jective methods to van den Dool's analogues. Also outlined is the application of the idea of reducing the complex weather stream into a sequence of relatively few discrete weather states in air pollution problems and climate change.

This book is rich in information. An example of this is the sheer length of the bibliography, which makes up one-sixth of the total book. Quite often original papers are referenced that I had thought to be long forgotten; most of these references relate to works done in the Anglo-Saxon and Germanic language world. In many scientific fields, achievements of our colleagues just a few decades ago are all too often forgotten; placing their work in the context of contemporary knowledge is certainly a most valuable service to the climate research community.

The main strength of the book is its broad coverage of very many aspects of atmospheric climatology. However, that is also its main weakness. Written not as a reference book but as a textbook, it fails to guide the reader through the maze of information. Too little effort is made to synthesize the bits and pieces into consistent chunks of consolidated knowledge about the dynamics of atmospheric climate and weather phenomena. Also, too few attempts were made to guard the reader against the pitfalls of the seductive persuasion of the «magic bullet" type of fashionable but inadequately used statistical methods. Examples include claims about the bimodality of the extratropical flow and the existence of an Antarctic circumpolar wave.

The book is logically constructed and richly illustrated with manyinteresting and relevant diagrams. However, cross-referencing is not always done effectively; for instance, the concept of EOFs is repeated in the final chapter even though it had been explained in some detail in chapter 2. Sometimes, complex concepts are mentioned without introducing them-as with data assimilation on p. 41 or the concept of de-grees of freedom on p. 63. In fact, the concept of de-grees of freedom is not a well-defined one, even though it is useful in many applications [e.g., in con-junction with the Bonferoni approach (p. 539)]. Another example of such unwanted surprises is on p. 551, when the authors speak about using objective methods for weather-typing and offer without any explanation a quote about the usefulness of orthogonality.

I would not recommend the book for beginners because of the sheer overwhelming amount of detail; for introductory purposes, books like Peixoto and Oort (1992), on the physics of climate, or Washing-ton and Parkinson (1986), on the art and potential of climate modeling, or Wilks (1995), on statistical analysis, may be more appropriate. However, for some what experienced scholars as well as advanced Ph.D. students and postdocs, the book may be a valuable source of detailed knowledge, information, and reference.

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REFERENCES

Peixoto, J. P., andA. H. Oort, 1992: *Physics of Climate.* American Institute of Physics, 520 pp.

Washington, W. M., and c. L. Parkinson, 1986: *An Introduction to Three-Dimensional Climate Modelling.* University Science Books, 422 pp.

Wilks, D. S., 1995: *Statistical Methods in the Atmospheric Sciences: An Introduction.* Academic Press, 467 pp.