

# Book reviews

**Decadal Climate Variability: Dynamics and Predictability** edited by David L.T. Anderson and Jürgen Willebrand, NATO ASI Series. Series 1: Global Environmental Change, Vol. 44 (Springer-Verlag, 1996). ISBN 3-540-614459-1. vi+493 pp. DM298.00

Decadal climate variability is a field attracting increasing attention by the community so a book concerned with the modelling, analysis and understanding of decadal-scale ocean-atmosphere interactions, and their potential predictability, is most welcome. With that focus in mind, the NATO Advanced Study Institute organised a series of lectures at Les Houches, France, in February 1995 in order to introduce young scientists to the current state of knowledge of decadal climate variability. Arising from these lectures is the book under review.

The book begins with a general discussion of temporal patterns in the climate record, and some of the statistical techniques available to analyse them. Climate time series and associated techniques are conveniently grouped by the author into periodic and quasi-periodic phenomena, aperiodic and random variability, low-frequency trends, and distinctive features such as discrete jumps. At the end of this exercise, the message one is left with by the author is that the climate system is so complex that highly ordered modes of evolution are likely to be the exception, and that the techniques which are most likely to lead to robust and useful insights are those that involve a minimum of processing and computation of the original data.

Following this, the same author considers spatial structures from the perspective of basic dynamical constraints, the projection of three-dimensional data onto the appropriate geometric plane for analysis, and the availability of the data before dealing in some detail with patterns associated with, for example, the North Atlantic Oscillation, the Pacific/North America pattern, ENSO and the so-called ENSO-like interdecadal variability. An important aspect of this chapter concerns interpretation of surface temperature records in relation to increasing concentrations of greenhouse gases and aerosols, and to interdecadal scale variability.

Questions of predictability of the atmosphere and ocean on scales ranging from days to decades are next

considered, the basic premise being that the phenomena of interest are fundamentally chaotic. Full appreciation of the material in this chapter requires some fairly advanced mathematics; however, the author presents a number of applications and takes pains to make the discussion accessible to non-specialists. In conclusion, the thorny question (for funding agencies and research managers) is raised as to whether the required level of model accuracy for reliable climate prediction can be achieved through development of a diverse range of models at individual institutions, or whether resources would be more usefully focussed towards a smaller subset of proven models.

A review of the various mechanisms potentially associated with decadal to centennial climate variability forms the subject of the fourth contribution. The material is clearly presented, and well supported with discussion of various such signals in the observational record and the results of coupled and stand-alone GCM simulations.

Most of the remaining contributions in the book are more specific in nature, dealing either with variability in particular regions, or with particular mechanisms and processes of variability. Having read the preceding contributions, the reader is then well placed to appreciate the more detailed discussions of such topics as variability in convective activity in the North Atlantic, feedbacks in the ocean global thermohaline circulation, the dynamics of the Antarctic Circumpolar Current and its variability, and mid-latitude North Pacific and North Atlantic coupled modes. Intermingled with these more specific sections is a contribution concerned with the climate response to changing greenhouse gas concentrations with an analysis of a recent transient coupled model run, and one presenting an overview of the observational and model evidence for centennial variability in the North Atlantic region. The final contribution deals with the application of spectral methods to climatic time series, in particular to the Southern Oscillation Index. Connections between time series analysis and non-linear dynamics, the question of signal to noise enhancement, and the advantages and disadvantages of the various spectral methods are some of the topics in this very useful part of the book.

In summary, the book contains a wide range of topics in decadal climate variability at a level that is useful to both the wider meteorological and oceanographic community, and to the specialist. However, a disadvantage for southern hemisphere readers is that the great

majority of examples of decadal variability in the book are from the northern hemisphere and particularly the North Atlantic region - indeed, there has been considerable research into southern hemisphere decadal variability since the Les Houches meeting, and the lack of any discussion of this work is one of the ways in which many contributions in the book may date. Also, there were several editorial aspects of the book that could have been improved (including some fairly obvious typographic errors). Most notably, the order of some of the contributions seemed a bit haphazard in places and could have been more conveniently grouped so that those dealing with internal variability in the ocean followed on from each other, and the final contribution placed with the general sections at the beginning of the book. At DM 298 (around AUD 220 at the exchange rate of early May), the book may be beyond the budget of many individuals or institutions. However, for those that can afford it, I think that the investment would be worthwhile.

#### Chris Reason

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**Boundary Layer Meteorology** edited by John R. Garratt and P.A. Taylor (Kluwer Academic Publishers, 1996). ISBN 0792341910. US\$75.00.

This book was prepared to commemorate the 25th anniversary of Boundary Layer Meteorology (BLM). There are 16 papers and a book review of *The Climate Near the Ground* (authors R. Geiger, R.H. Aron and P. Todhunter) by R.E. Munn, founding Editor of the journal.

The book begins with an insightful mini-biography of Ted Munn, completed by Peter Taylor, Morley Thomas, Ed Truhlar and Doug Whelpdale. While only five and a half pages long, it does provide very interesting reading, and is a fine and appropriate keynote to the book.

The first paper in the book, by J.R. Garratt, G.D. Hess, W.L. Physick and P. Bougeault, provides an effective short review of the accomplishments over the 25 years of the publication of BLM. This summary is

very valuable for scientists who want an overview of major achievements during this time period. The reader is referred to other peer-reviewed papers and selected textbooks for more in-depth information. One reference that I would like to have seen added (which I am alerting the reader to) is C.H. Moeng and M.A. LeMone: 'Atmospheric planetary boundary-layer research in the U.S.: 1991-1994' in *Reviews of Geophysics*, pages 923-931, July 1995. A summary list of all boundary-layer books and micro-meteorological texts published during the past 25 years would also have been a useful addition.

There are other review papers in this special BLM volume. A.P. van Ulden and J. Wieringa overview the wide variety of boundary-layer related studies at the Cabauw, the Netherlands, observational facility since its establishment in 1973. S.D. Smith, K.B. Katsaros, W.A. Oost and P.G. Mestayer overview the Humidity Exchanges over the Sea (HEXOS) program.

J.D. Wilson and B.L. Sawford review the use of Lagrangian particle dispersion models to represent pollution movement in the boundary layer. T.K. Fleisch describes how the Lagrangian particle dispersion method can be applied to evaluate the region of the atmosphere that directly affects an observation site. U. Höglström reviews aspects of the atmospheric surface layer which he correctly does not refer to as the 'constant flux' layer (this latter terminology is in wide and incorrect use, particularly in the wind engineering community).

S.D. Smith, C.W. Fairall, G.L. Geernaert and L. Hasse review the progress over the last 25 years of our understanding of air-sea fluxes. J.L. Walmsley and P.A. Taylor review the increase in knowledge of boundary-layer flow over topography achieved during the Askervein Hill (Scotland) project. J.M. Wilczak, E.E. Gossard, W.D. Neff and W.L. Eberhard summarise gains in understanding of boundary-layer processes over the last 25 years from ground-based remote-sensing tools.

Several papers present perspectives on selected topics in boundary-layer meteorology by internationally recognised experts. J.C. Myngaard and L.J. Peltier discuss how boundary-layer experimentalists and modellers can more effectively collaborate as computational models evolve into specific modelled realisations of boundary-layer flow. L. Mahrt reviews aspects of our understanding as to the representation of turbulent fluxes over heterogeneous land surfaces. X.-M. Cai and D.G. Steyn describe the use of large-eddy model simulations to determine values of the von Karman constant.

A. Becker, H. Kraus and C.M. Ewenz present model results on the structure of the boundary layer associated with cold fronts. M.R. Raupach, J.J. Finnigan and Y.

Brunet discuss turbulent mixing associated with vegetation canopies. O.V. Perestenko and L.K.H. Ingel describe a boundary-layer instability mechanism associated with stably stratified air moving over a moistened surface. S.-E. Gryning and E. Batchvarova present a model for determining internal boundary-layer height for a region with an irregular coastline.

This book serves as a useful reference resource for researchers in boundary-layer meteorology. It represents a continuation of the excellent papers that are routinely published in *Boundary Layer Meteorology*. Of

particular value to the more general reader are the excellent set of review papers that are published in this Volume, as well as the perspectives in specific topics that are represented by experts in the field.

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