

Book reviews

International Weather Radar Networking: final seminar of the COST Project 73 edited by C.G. Collier (Kluwer Academic Publishers, 1992) ISBN 0 7923 1706 8. 332 pp. Stg£66.00.

International Weather Radar Networking is the record of the final seminar of COST Project 73, held in June 1991 at Ljubljana, Slovenia, in what was then the Republic of Yugoslavia. COST is a framework for Cooperation in Scientific and Technical research among European countries, which embraces a number of fields including transport, telecommunications, environmental protection, oceanography and meteorology. Although COST had its origins in the mid-sixties within the six member states of the European Community, it came into formal existence in 1971 as an organisation open to all the countries of Europe. Because of its inherently transnational nature, Meteorology fits comfortably into the COST framework and a number of specific projects have been undertaken in that field in addition to the current topic, notably COST-70: The European Centre for Medium-range Forecasting and COST-72: Measurement of Precipitation by Radar.

As the published record of the COST-73 seminar, the book has a structure which reflects the conference's program of seven sessions, covering Introduction; Radar Systems and Precipitation Measurement; Telecommunications and Displays; Networking; Nowcasting, Weather Modification and Other Radar Uses; Advanced Radar Systems; and concluding with, Weather Radar in Europe. As might be expected, there are wide variations in the style and quality of individual contributions, as well as in typeface and layout. The text is generally well supported by a variety of illustrations which range from hand sketches to colour images of high quality.

In many ways the book is reminiscent of the Proceedings of the AMS Weather Radar Conferences, and has something of interest for everyone working in that field. The seminar's organisers have clearly taken a broad view of what material is relevant to the theme of international radar networking, with the result that the book contains many contributions of more general interest than might be expected from the title. Examples

of this include papers on Noise Figure, Dual-polarisation, Doppler and Weather Modification, to cite but a few. Nonetheless, the main theme of networking is solidly addressed, and the book contains useful and interesting descriptions of a number of national radar networks, data integration techniques, displays and data transmission systems. Of particular importance is a comprehensive description of the adaptation of the WMO FM 94 BUFR code (binary universal form for the representation of data) to render it suitable for encoding weather radar data. Acceptance of this unified encoding approach is seen as an important prerequisite to international radar networking on a wide scale.

There are papers which address the application of radar to hydrology and the accuracy of radar-derived rainfall estimation. The UK Frontiers system is described and the results of particular case studies are discussed with a view to assessing its likely potential for improving the accuracy of flood forecasting. Polarimetric radar is also discussed in the context of improving radar accuracy by detecting 'bright band' effects near the freezing layer, by generally better hydrometeor classification and by identifying and removing contamination from anomalous propagation returns. The potential for commercial exploitation of radar data is addressed in a number of papers and one particular writer stresses the need to apply soundly based marketing strategies which recognise the need to educate potential customers so they can make more informed requests about services which might benefit their operations.

For readers in Australia, who have long taken for granted the existence of a large national weather radar network with uniform technical standards, on-demand access to data from any radar site and the display of wide-area radar mosaics at the press of a button, the COST 73 proceedings give an interesting view of the more diverse and compartmentalised situation to be found in Europe, and the achievements being made in facilitating the exchange and productive application of radar data among its numerous states.

Alfred West

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Regional Oceanography: An Introduction by Matthias Tomczak and Stuart Godfrey (Pergamon Press, 1994) ISBN 0 08041 021 9. Hard cover, Stg£75.00. Soft cover, Stg£23.00.

It is over half a century since Sverdrup, Johnson and Fleming (1942) published their seminal text *The oceans: their physics, chemistry and general biology*. Despite the numerous advances in oceanography since that publication, many scientists still regard it as the ultimate reference for a description of the world's oceans and its marginal seas. With the publication of *Regional Oceanography: An Introduction*, by Matthias Tomczak and Stuart Godfrey, the teachers and students of physical oceanography, at least, now have a text that is comparable in descriptive detail and comprehensiveness, yet also brings the reader up to date with the progress of ocean science and advances in knowledge over the intervening years. It is an excellent text for both students and researchers seeking a description of ocean physics and I have no hesitation in recommending it.

Tomczak and Godfrey aim the text at undergraduate students of physical oceanography. Like many who have attempted to teach the fundamental principals of physical oceanography while alerting the student to the excitement and potential of recent research, the authors have been frustrated by the lack of a suitable text. Many undergraduate courses are populated by students who have little grounding or interest in mathematics (but keen interest in oceanography). One can bemoan this deficiency but it is a reality. Texts which are suitable for such students tend to be pitched at an elementary level and fail to bring the student up to date with recent research and the wealth of knowledge that has been accumulated on the oceans. Tomczak and Godfrey present a description of the oceans which is built on a minimum, yet sufficient, set of simple physical and mathematical rules. The authors describe the circulation and hydrology of the oceans and marginal seas at a scientific level which satisfies the interests of students and scientists alike.

A distinguishing characteristic of this book is captured nicely in the preface to the book: 'In writing this book we have been surprised to learn how much of the ocean's behaviour as a component of climate — the particular reasons why it absorbs heat in one region, or, restores it to the atmosphere in another — can be understood by

combining an understanding of simple physical principles with knowledge of the ocean's geographical features.' Many of us derived our first knowledge of physical oceanography through geophysical fluid dynamics where mathematics and physics, and simple box models, provided the basis. The geometry and topography of the oceans were grossly simplified or ignored altogether. Tomczak and Godfrey's text is constructed around a detailed knowledge of bathymetry, and a basic knowledge of surface wind stress and of surface heat and freshwater exchange, a powerful reminder of the importance of geometric constraints in oceanography.

The book begins with an introduction on the principal driving mechanisms for ocean circulation — surface wind and pressure, surface temperature and surface heat flux, and surface salinity and surface freshwater exchange (precipitation and evaporation). Tomczak and Godfrey emphasise the fundamental importance of these forces for inferring the movement and thermohaline structure of the oceans. This chapter is followed by a discussion of the ocean pressure field and its relation to temperature, salinity and density. Dynamic height and surfaces of no motion often confuse students who have little intuitive feel for the subtleties of ocean structure. The second chapter is an excellent introduction to these aspects.

The third chapter introduces the effects of rotation, geostrophy and the beta effect. For perhaps the only time in this book, I was not fully satisfied with the qualitative explanations. The essential points (as encapsulated in a series of rules) are there and the reader is left with an adequate background of the basic dynamical principles. These principles are developed further for the discussion of Ekman flow and Sverdrup balance in Chapter 4. These simple results provide the backbone for much of the discussion in later chapters. Chapter 5 concentrates on the direct consequences of heat and freshwater forcing at the surface. The different water masses of the ocean derive their characteristics mainly as a consequence of such effects. The way these properties are transported into deeper waters (subduction) and the fundamental role of the oceans in transporting heat over the globe are discussed.

Chapters 6 through sixteen provide the heart of the text, discussing the circulation and hydrography of each of the major ocean basins and their adjacent seas. Tomczak and Godfrey choose to discuss the Antarctic and Arctic regions first (Chapters 6 and 7), reasoning that knowledge of these waters is essential before discussing the temperate and tropical waters. This is certainly logical if one thinks in terms of the thermohaline circulation and water masses: the source regions for the deep waters are in high latitudes. In contrast to the following chapters, the discussion of circulation,

hydrology and water masses are grouped together here, but the pattern of the discussion is the same: use the wind and geometry to infer the wind-driven response; use the surface thermohaline conditions to infer the hydrological response; combine this information and knowledge of adjacent waters and bathymetry to infer water mass movement and formation. I found the Arctic chapter particularly useful. As an occasional scientist in Antarctic oceanography I would have liked to have seen a little more on the adjacent seas of the Antarctic: the Weddell and Ross Seas and Prydz Bay/Amery Sea regions. The final discussion in Chapter 7 on the fate of bottom and deep waters is perhaps the major negative consequence of this particular ordering of the book. Such a discussion fits better after the discussion of the three major ocean basins.

The authors introduce the concept of mediterranean seas (seas which, due to topography, have limited exchange with adjacent waters) at this point, using the Arctic as an example. This usage is not common in the literature I am acquainted with but it serves the authors well in this book. Many of the seas, including those that comprise the Indonesian throughflow region, can be classed as mediterranean seas, thus providing a useful framework for linking what may have been disjointed discussion of the many marginal seas. On this and several other occasions I reflected upon decisions made by the authors in regard to the organisation of the book and the framework used for discussions; invariably, I ended up agreeing with their decision.

Chapters 8, 9 and 10 discuss the circulation, hydrology and adjacent seas, respectively, of the Pacific Ocean. This is the most comprehensive and useful account of the Pacific Ocean general circulation and water masses that I have read. The authors convey a deep appreciation for what makes the circulation of the Pacific Basin unique, how that circulation is intimately connected to the prevailing wind patterns and the geometry of the basin, and how the Pacific Ocean circulation and water masses interact with adjacent oceans. I was continually impressed by their attention to detail. I suspect the descriptive approach, and lack of reference to sophisticated analytical tools (such as inverse models) may not be to everyone's liking, but Tomczak and Godfrey demonstrate that a great deal can be done without recourse to extra complexity.

The Indian Ocean discussion (Chapters 11, 12 and 13) follows the pattern of the Pacific Ocean. Again, I can but recommend these chapters for a thorough background on the Indian Ocean. Perhaps, in view of the authors' backgrounds in Indian Ocean research, we might have expected such excellence. While the observational data base and literature for this region are scant by comparison with the Pacific and Atlantic Ocean,

it still requires considerable effort to synthesise what is known into a coherent picture of the mean and seasonal circulation and the water mass circulation. This they have done very effectively.

The Atlantic Ocean is covered in Chapters 14, 15 and 16, again using the pattern of the Pacific Ocean chapters. These chapters perhaps posed the greatest challenges for the authors as the knowledge and data base for the Atlantic is very rich and the descriptive techniques employed to this point would seem limited (in comparison to the tools that are now used for interpretation and modelling). Nevertheless the authors have managed to maintain the high standard they set in the previous chapters and appear to have achieved an appropriate balance — the complexity and length of these chapters is similar to the preceding chapters and the level of detail versus generality is consistent.

The remaining chapters endeavour to acquaint the reader with more advanced aspects of regional oceanography (Chapter 17) and the role of the oceans in climate through interactions with the atmosphere (Chapters 18, 19 and 20). Personally, I did not derive much from Chapter 17. The preceding chapters provided more than enough pointers to leading edge problems in regional oceanography and the attendant complexities. Providing two or three examples from this range of problems did not appear to serve any great purpose. The role of the oceans in the world's mean climate (Chapter 18), in interannual variability and El Niño (Chapter 19) and long-term climate change (Chapter 20) is the subject of the concluding chapters. These chapters provide a context for the preceding chapters by explaining how the regional oceans together act as moderators for global climate, storing, transporting and releasing heat globally on various spatial and temporal scales. Perhaps I would have preferred to see the authors first discuss some regional modelling and forecasting before expanding the discussion into interannual and long-term climate change, then using these discussions to provide a broader applied and scientific context for regional oceanography.

The standard of presentation and editing is high throughout this book. The addition of an errata sheet might have indicated problems, but it did not. Perhaps some of the figures were too complicated, and I would have preferred the colour panels to be better located and referenced. But none of these minor deficiencies detracted from my enjoyment of reading this book. The authors portray a keen sense for the history and provide numerous asides which lighten the approach while at the same time giving the text a sense of relevance (very important for student consumption). The book is extremely well researched, though I did wonder why Stommel, the acknowledged master of perceptive and intuitive expla-

nation of oceanographic circulation, rated but one brief mention.

In summary, I think Tomczak and Godfrey have produced an excellent text for both undergraduates and practicing/training scientists. It is well priced for this market and I recommend it to all oceanographers interested in the circulation and hydrology of the global ocean and its seas.

Reference

Sverdrup, H.U., Johnson, M.W. and Fleming, R.H. 1942.
The oceans: their physics, chemistry and general biology.
Prentice-Hall, Englewood Cliffs.

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