The layout and figures are generally very clear and the material is well-organised. There are a few serious typographical errors, indicating that the book would have benefited from more careful proofreading. Overall I recommend this book as a very useful reference and guide to the literature. It will undoubtedly be of use to those working in very different areas of nonlinear science.

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The Equations of Oceanic Motions. By P. Müller. Cambridge University Press, 2006. 302 pp. ISBN 9780521855136. £47.00.

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Ocean flows involve hydrodynamic and thermodynamic processes occurring over a vast range of length and time scales. As a consequence many different sets of equations have been employed to investigate various ocean phenomena. For example, fast-timescale acoustic waves, which are relatively unaffected by the Earth's rotation, require hydrodynamic equations incorporating compressibility. In contrast, relatively slow Rossby waves, occurring over large scales, are modelled using equations in which not only is the Coriolis force important but its latitudinal variation plays a fundamental role. Not surprisingly, oceanographic modelling uses many thermodynamic, geometric and dynamic approximations. These include, for example, traditional, quasi-geostrophic, mid-latitude β-plane and reduced-gravity approximations. The large number of these approximations and their related equations and varied notation can make ocean modelling a challenging task.

Müller's book attempts to establish and present the basic equations governing ocean dynamics comprehensively, systematically and rigorously. The starting point is the fundamental equations governing thermodynamics of two-component (heat and salt) systems coupled with the balance equations for mass, momentum and energy for fluid. An early chapter is also devoted to the gravitational potential and how it enters the momentum equation and associated spheroidal coordinate systems. This is an important chapter since it sets the basis for later geometric approximations such as the β-plane. After deriving the basic equations, Müller goes on to derive vorticity-related conservation laws and discusses the dynamic impact of the equation of state. Various models for the vertical structure of the ocean are described such as barotropic and baroclinic modes, isopycnal and sigma coordinates and layer models. Subsequent chapters deal with equations relevant to motions with ever-decreasing horizontal scales. Planetary-geostrophic and then quasi-geostrophic equations are derived. The f-plane approximation is then discussed and equations governing two-dimensional turbulence and internal waves derived. Finally, small-scale motions unaffected by rotation such as sound waves are considered.

The emphasis of the book is very much on deriving governing equations for ocean motions using the frequently used approximations in ocean dynamics. With the exception of a chapter dealing with free wave solutions on a sphere, no solutions to these equations are discussed. This one exception is justified by the author since "the emission of waves is a mechanism by which a fluid adjusts to disturbances, and the assumption of instantaneous adjustment and the elimination of certain types of wave types forms the basis of many approximations." The book covers all the most frequently used approximations and related equations comprehensively and thoroughly. Only a few, less commonly used approximations have been omitted from the book, e.g. frontal geostrophic dynamics (Cushman-Roison 1986) and the Green–Naghdi equations for thin layer fluid flow (which are more general than the shallow water equations since they allow for vertical acceleration – see Green & Naghdi 1976). These are not serious omissions however, and a real strength and unique feature of the book is to gather together all the commonly used equations in one book.

The derivations of the various equations are achieved by either Reynolds averaging or using asymptotic expansions. The derivations are done rigorously and presented clearly. It is perhaps surprising that the book makes no mention of the use of Hamilton's principle in deriving various equations. This method has been particularly successful in recent years in deriving consistent equation sets subject to various approximations in which the conserved quantities are immediately apparent, e.g. Salmon (1998), Dellar & Salmon (2005). Admittedly, however, the use of such techniques requires a degree of technical expertise perhaps beyond the target audience.

The use of relatively simple models to explain features of ocean circulation (e.g. western boundary currents, baroclinic instability) is an exciting aspect of theoretical oceanography. The fact that the emphasis of this book is on presenting the basic equations rather than their solution means this excitement is missing. In the author's words the book is "somewhere between a textbook and a reference book" and as he recognizes, it complements, but does not replace, the range of excellent books on geophysical fluid dynamics now available. Nevertheless, the comprehensive nature of the book in detailing the most commonly used approximations and equations in ocean modelling in a single volume make it very useful and welcome.

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