BOOK REVIEW

B. Cushman-Roisin and *J.-M. Beckers*: **Introduction to Geophysical Fluid Dynamics - Physical and Numerical Aspects** (second edition). Academic Press, 2011, 828 pages, 22 chapters.

Almost twenty years after the praiseful first edition, Academic Press published the enlarged and updated new edition of the Introduction to Geophysical Fluid Dynamics. B. Cushman-Roisin, the author of the first edition was joined by J.-M. Beckers as coauthor. The aim of the book is to introduce readers, first of all students and scientists in the fields of dynamical meteorology and physical oceanography, to the principles governing air and water flow on large terrestrial scales and to the basic numerical methods and simple models by which these flows can be simulated.

The book is organized into five parts. The introductory part reviews the fundamentals of fluid motion and geophysical flows, as well as diffusion and advection processes. The next two parts are devoted to the effects of rotation and stratification, respectively. Geostrophic flows, vorticity dynamics, Ekman layers, barotropic waves, and barotropic instability are described, turbulence in stratified fluids and internal waves are analyzed. The fourth part is dedicated to the combined effects of rotation and stratification, which play a very important role in the simulation of geophysical fluid processes. The final part is focused on the general circulation of the atmosphere and ocean, equatorial dynamics, and data assimilation. The authors close with a recapitulation of the elements of fluid mechanics, wave kinematics, and a survey of numerical schemes in the appendix.

Extending the content of the first edition with subjects such as turbulence closure techniques and data assimilation, and supplementing it with numerical topics, the text is written easy to understand. Each part is divided into well-organized chapters which conclude with short biographic notes of notable scientists putting science into a historical perspective. The chapters are accompanied by a set of analytical problems and numerical exercises. Useful Matlab codes necessary for some of the numerical exercises are available on the publisher's website related to the book. Unfortunately, the numerical solutions of the analytical problems are not provided. Contrary to the first edition, short descriptions of the suggested laboratory demonstrations are left out. It is very laudable that during the preparation of the book, the actual manuscript was attainable on B. Cushman-Roisin's website.

Outshining the first edition, the authors cover a broad range of topics providing an introduction to the physical principles of geophysical fluid mechanics and computational methods necessary for numerical modeling. This is an excellent textbook, the pearl of GFD literature.

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