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Preface

This book focuses on the dynamics of the ocean being influence by the Earth's rotation and density stratification. Fluids in motion are a difficul subject of study that traditionally requires advanced knowledge of analytical mathematics, in particularly matrix algebra, differential and integral calculus, and complex analysis. Hence, this fascinating fiel of science, known as *geophysical fluid dynamics*, is accessible only to a limited number of students – those who either are naturally geniusses or those who underwent tough years of intense University study.

Fluid processes are inherently complex and analytical solutions describing flui dynamics exist only in a few instances and only under highly simplifie assumptions. Computer-based numerical models are required to approximate flui behavior in more realistic situations. Because of its complexity, universities tend to offer subjects in computational modelling of flui dynamics only at postgraduate level. This is a pity given that flui processes are truly fascinating in nature and given that the oceans play a significan role in shaping life on Earth.

The approach I pursue in this book is different from the traditional approach. Here, numerical models are gradually built up and refine with the objective to illustrate and explore various dynamical processes occurring in fluids. Little mathematical background knowledge is required, and the focus is placed where it should be, namely on the physics inherent with fluid in motion. This book is a combination of a textbook and a workbook including more than 20 computer-based exercises, written in FORTRAN 95. Analytical solutions of certain flui phenomena are used as invaluable benchmarks for verificatio of these model simulations. In parallel to this book, the reader is encouraged to consult textbooks by Cushman-Roisin (1994), Pond and Pickard (1983) and Gill (1982).

The modelling-based approach has many advantages over the traditional analytical approach and, in the author's belief, will open the fiel of geophysical flui dynamics to a much broader audience. Obvious advantages are that (a) complex flui processes such as barotropic or baroclinic instabilities, otherwise exclusively reserved to experts, can be studied by a lay person, (b) instead of still pictures of results, the reader can create animations of processes, and (c) the reader can adopt computer codes, provided in this book, in a modifie form for own independent studies. Without doubt, learning is greatly enhanced by playing and this book provides the reader with the tools (or toys) to achieve this.