Barotropic Waves - 10: Barotropic Instability - III Stratification Effects - 11: Stratification - 12: Layered Models - 13: Internal Waves - 14: Turbulence in Stratified Fluids - IV Combined Rotation and Stratification Effects - 15: Dynamics of Stratified Rotating Flows - 16: Quasi-Geostrophic Dynamics - 17: Instabilities of Rotating Stratified Flows - 18: Fronts, Jets and Vortices - Special Topics - 19: Atmospheric General Circulation - 20: Oceanic General Circulation - 21: Equatorial Dynamics - 22: Data Assimilation - VI Web-site information Appendix A: Elements of Fluid Mechanics - Appendix B: Wave Kinematics - Appendix C: Recapitulation of Numerical Schemes - References - CD-ROM - Lectures on Geophysical Fluid Dynamics offers an introduction to several topics in geophysical fluid dynamics, including the theory of large-scale ocean circulation, geostrophic turbulence, and Hamiltonian fluid dynamics. Since each chapter is a self-contained introduction to its particular topic, the book will be useful to students and researchers in diverse scientific fields. An introduction to the Mathematical Theory of Geophysical Fluid Dynamics - This book grew out of lectures on geophysical fluid dynamics delivered over many years at the Moscow Institute of Physics and Technology by the author (and, with regard to some parts of the book, by his colleagues). During these lectures the students were advised to read many books, and sometimes individual articles, in order to acquaint themselves with the necessary material, since there was no single book available which provided a sufficiently complete and systematic account (except, perhaps, the volumes on Hydrophysics of the Ocean, Hydrodynamics of the Ocean, and Geodynamics in the ten-volume Oceanology series published by Nauka Press in 1978-1979; these refer, however, specifically to the ocean, and anyway they are much too massive to be convenient for study by students). As far as we know, no text corresponding to our understanding of geophysical fluid dynamics has as yet been published outside the Soviet Union. The present book is designed to fill this gap. Since it is customary to write the preface after the entire book has been completed, the author has an opportunity there to raise some points of possible criticism by the reviewers and readers. First of all, note that this work presents the theoretical fundamentals of geophysical fluid dynamics, and that observational and experimental data (which in the natural sciences are always very copious) are referred to only rarely and briefly. Helioseismology has enabled us to probe the internal structure and dynamics of the Sun, including how its rotation varies in the solar interior. The unexpected discovery of an abrupt transition - the tachocline - between the differentially rotating convection zone and the uniformly rotating radiative interior has generated considerable interest and raised many fundamental issues. This volume contains invited reviews from distinguished speakers at the first meeting devoted to the tachocline, held at the Isaac Newton Institute. It provides a comprehensive account of the understanding of the properties and dynamics of the tachocline, including both observational results and major theoretical issues, involving both hydrodynamic and magnetohydrodynamic behaviour. The Solar Tachocline is a valuable reference for researchers and graduate students in astrophysics, heliospheric physics and geophysics, and the dynamics of fluids and plasmas. For over twenty years, the Joint Program in Physical Oceanography of MIT and the Woods Hole Oceanographic Institution has based its education program on a series of core courses in Geophysical Fluid Dynamics and Physical Oceanography. One of the central courses in the Core is one on wave theory, tailored to meet the needs of both physical oceanography and meteorology students. I have had the pleasure of teaching of years, and I have particularly enjoyed the response of the the course for a number students to their exposure to the fascination of wave phenomena and theory. This book is a reworking of course notes that I have prepared for the students, and I was encouraged by their enthusiastic response to the notes to reach a larger audience with this material. The emphasis, both in the course and in this text, is twofold: the development of the basic ideas of wave theory and the description of specific types of waves of special interest to oceanographers and meteorologists. Throughout the course, each wave type is introduced both for its own intrinsic interest and importance and as a vehicle for illustrating some general concept in the theory of waves. Topics covered range from small-scale surface gravity waves to large-scale planetary vorticity waves. This book presents selected mathematical problems involving the dynamics of a two-dimensional viscous and ideal incompressible fluid on a rotating sphere. In this case, the fluid motion is completely governed by the barotropic vorticity equation (BVE), and the viscosity term in the vorticity equation is taken in its general form, which contains the derivative of real degree of the spherical Laplace operator. This work builds a bridge between basic concepts and concrete outcomes by pursuing a rich combination of theoretical, analytical and numerical approaches, and is recommended for specialists developing mathematical methods for application to problems in physics, hydrodynamics, meteorology and geophysics, as well for upper undergraduate or graduate students in the areas of dynamics of incompressible fluid on a rotating sphere, theory of functions on a sphere, and flow stability.

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