Baroclinic Tides Theoretical Modeling And Observational Evidence

This comprehensive text is a major synthesis on ecological change in the Gulf of Alaska. It encompasses the structural and annual changes, forces of change, long-ecological changes in the atmosphere and ocean, plankton, fish, birds and mammals, and the effects of the 1989 Exxon Valdez Oil Spill. With 5 major sections, Long-term Ecological Change in the Northern Gulf of Alaska first describes the physical features, the atmosphere and physical oceanography, the annual production cycle, the forage base for higher animals and trophic transfer, and the adaptations for survival in this changing environment for 9 portal species. Then, the major forces of change are introduced: climate, geophysics, fisheries and harvesting, species interactions, disease and contaminants. Next, the long-term records of change in physical factors and biological populations are presented, as well as the potential reasons for the biological changes. Following is the history of the Exxon Valdez oil spill and its long-term effects. And, finally, the emergent properties of the ecosystem are discussed and an attempt is made to weigh the importance of the major forcing factors in terms of their temporal and spatial scales of influence. * Examines important data on long-term change in the ecosystem and the forcing factors that are responsible for it * Provides an account of the 1989 Exxon Valdez oil spill with emphasis on the long-term effects * Describes the effects of climate change, geophysical change, species interactions, harvesting, disease, the 1989 oil spill, and marine contaminants on key populations of marine organisms

A self-contained introduction to tides, explaining the origin of tidal constituents and their wave propagation in oceans and coastal seas.

Rapid development of Earth observation satellite using remote sensing techniques enables observations of the oceanic processes by sea and airborne study to be carried out over vast areas in a short time. This first book written by Russian and Norwegian scientists is an analysis of studies of the Kara Sea and presents a unique catalogue of environmental and pollution data of the joint Norwegian and Russian oceanographic expedition studies of the Kara Sea spanning three decades.

The new level of precision and global coverage provided by satellite altimetry is rapidly advancing studies of ocean circulation. It allows for new insights into marine geodesy, ice sheet movements, plate tectonics, and for the first time provides high-resolution bathymetry for previously unmapped regions of our watery planet and crucial information on the large-scale ocean features on intra-season to interannual time scales. Satellite Altimetry and Earth Sciences has integrated the expertise of the leading international researchers to demonstrate the techniques, missions, and accuracy of satellite altimetry, including altimeter measurements, orbit determination, and ocean circulation models. Satellite altimetry is helping to advance studies of ocean circulation, tides, sea level, surface waves and allowing new insights into marine geodesy. Satellite Altimetry and Earth Sciences provides high resolution bathymetry for previously unmapped regions of our watery planet. Satellite Altimetry and Earth Sciences is for a very broad spectrum of academics, graduate students, and researchers in geophysics, oceanography, and the space and earth sciences. International agencies that fund satellite-based research will also appreciate the handy reference on the applications of satellite altimetry.

This Special Issue is a collection of papers addressing the scientific use of data acquired in the course of the TerraSAR-X mission 10 years after launch. The articles deal with the mission itself, the accuracy of the products, with differential interferometry, and with applications in the domains cryosphere, oceans, wetlands, and urban areas.

This book covers the areas of fundamentals in energy conservation and its

applications in selected industries. There are nine chapters in this book which have been written by leading experts in energy from all over the world. The topics range from energy fundamentals from cosmic radiation, tidal waves and dams. The chapters examine the potential of utilizing energy from sustainable resources and how energy consumption may be conserved from various new technologies. The contents of this book include space energy, barotropic and baroclinic tidal energy, understanding energy conservation in biological context, Earth shelters, hydro power, biofuel from groundnut oil and low energy consumption in industrial production. This book is suitable as a reference for students, educators, researchers, scientists, engineers and energy practitioners. It will also be a useful for the understanding of energy fundamentals, design and applications.

Mixing processes in the ocean play a key role in controlling the large-scale circulation and energy distribution of the ocean. Internal tide-driven mixing is most important among the processes to mix the ocean interior. In the past decade, significant efforts have been made to understand tidal mixing processes. However, more details and better understanding are still required for some fundamental problems, such as the mechanisms that govern internal tide generation, radiation, and dissipation processes and the associated energy partitioning. This research aims to understand the energetics and dynamics of tidal mixing processes through both theoretical analysis and numerical simulations. The complete form of barotropic and baroclinic energy equations are derived and employed as the theoretical framework for analyzing the tidal energy budget. These equations provide a more accurate and detailed energy analysis because they include the full nonlinear and nonhydrostatic energy flux contributions as well as an improved evaluation of the available potential energy. This approach has been implemented in the hydrodynamic SUNTANS model, which is being employed to study the energetics of barotropic-to-baroclinic tidal conversion over complex bathymetry in the real ocean. Three-dimensional, high-resolution simulations of the barotropic and baroclinic tides in the Monterey Bay area are conducted using the SUNTANS model. A detailed analysis of the energy budget is performed to address the question of how the barotropic tidal energy is partitioned between local barotropic dissipation and local generation of baroclinic energy. After that, we then assess how much of this generated baroclinic energy is lost locally versus how much is radiated away and made available for open-ocean mixing. The mechanism of internal tide generation is investigated by examining the dependence of barotropic-to-baroclinic energy conversion on three nondimensional parameters, namely the steepness parameter, the tidal excursion parameter, and the Froude number. Finally, a simple parametric model is presented to estimate the barotropic-to-baroclinic energy conversion.

Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database.

Internal wave dynamics in lakes (and oceans) is an important physical

component of geophysical fluid mechanics of ‘quiescent’ water bodies of the Globe. The formation of internal waves requires seasonal stratification of the water bodies and generation by (primarily) wind forces. Because they propagate in basins of variable depth, a generated wave field often experiences transformation from large basin-wide scales to smaller scales. As long as this fission is hydrodynamically stable, nothing dramatic will happen. However, if vertical density gradients and shearing of the horizontal currents in the metalimnion combine to a Richardson number sufficiently small (

Published by the American Geophysical Union as part of the Coastal and Estuarine Sciences, Volume 3. The AGU Monograph Series on Coastal and Estuarine Regimes provides timely summaries and reviews of major process and regional studies, both observational and theoretical, and of theoretical and numerical models. It grew out of an IAPSO/SCOR/ECOR working group initiative several years ago intended to enhance scientific communications on this topic. The series' authors and editors are drawn from the international community. The ultimate goal is to stimulate bringing the theory, observations, and modeling of coastal and estuarine regimes together on the global scale.

Shipboard ADCP and CTD measurements were conducted in Monterey Submarine Canyon in April and October 1994 to determine the propagation characteristics and energy levels of the semidiurnal internal tide. The measurements reveal a bottom intensified internal tide propagating energy up canyon. The region of strongest motion is in a beam 150-200 m thick, centered approximately 150 m above the Canyon floor. Along canyon baroclinic M2 currents are typically 15-20 cm/s, an order of magnitude larger than the estimated barotropic tidal currents. In April 1994, the internal tidal beam is well described by a progressive wave, while in October 1994, the signal is standing along and perpendicular to the beam. The Princeton Ocean Model was used to study the generation and propagation of semidiurnal internal tides in submarine canyons and to investigate their sensitivity to canyon shape.

Edited by R.H.J. Grimshaw, this book covers the topic of solitary waves in fluids.

Baroclinic TidesTheoretical Modeling and Observational EvidenceCambridge University Press

Coral reefs are the largest landforms built by plants and animals. Their study therefore incorporates a wide range of disciplines. This encyclopedia approaches coral reefs from an earth science perspective, concentrating especially on modern reefs. Currently coral reefs are under high stress, most prominently from climate change with changes to water temperature, sea level and ocean acidification particularly damaging. Modern reefs have evolved through the massive environmental changes of the Quaternary with long periods of exposure during glacially lowered sea level periods and short periods of interglacial growth. The entries in this encyclopedia condense the large amount of work carried out since Charles Darwin first attempted to understand reef evolution. Leading authorities from many countries have contributed to the entries covering areas of geology, geography and ecology, providing comprehensive access to the most up-to-date research on the structure, form and processes operating on Quaternary coral reefs.

This first volume in the treatise on the Physics of Lakes deals with the formulation of the

mathematical and physical background. A large number of lakes on Earth are described, presenting their morphology as well as the causes of their response to the driving environment. Because the physics of lakes cannot be described without the language used in mathematics, these subjects are introduced first by using the simplest approach and with utmost care, assuming only a limited college knowledge of classical Newtonian physics, and continues with increasing complexity and elegance, starting with the fundamental equations of Lake Hydrodynamics in the form of 'primitive equations' and leading to a detailed treatment of angular momentum and vorticity. Following the presentation of these fundamentals turbulence modeling is introduced with Reynolds, Favre and other non-ergodic filters. The derivation of averaged field equations is presented with different closure schemes, including the k-? model for a Boussinesq fluid and early anisotropic closure schemes. This is followed by expositions of surface gravity waves without rotation and an analysis of the role played by the distribution of mass within water bodies on the Earth, leading to a study of internal waves. The vertical structure of wind-induced currents in homogeneous and stratified waters and the Ekman theory and some of its extensions close this first volume of Physics of Lakes. The last chapter collects formulas for the phenomenological coefficients of water.

This book commemorates the 70th birthday of Eugene Morozov, the noted Russian observational oceanographer. It contains many contributions reflecting his fields of interest, including but not limited to tidal internal waves, ocean circulation, deep ocean currents, and Arctic oceanography. Special attention is paid to studies on internal waves and especially those on tidal internal waves in the Global Ocean. These papers describe the most important open problems concerning experimental studies of internal waves and their theoretical, numerical, and laboratory modeling. Further contributions investigate the physics of surface waves and their interaction with internal waves. Here, the focus is on describing interaction processes between internal waves and deep currents in the ocean, especially currents of Antarctic Bottom Water in abyssal fractures. They also touch on the problem of oceanic circulation and related processes in fjords, including those occurring under sea ice. Given its breadth of coverage, the book will appeal to anyone interested in a survey of ocean dynamics, ranging from historic perspectives to modern research topics.

This book presents a detailed study of the structure and variability of internal tides and their geographical distribution in the ocean. Based on experimental analysis of oceanic measurements combined with numerical modeling, it offers a comprehensive overview of the internal wave processes around the globe. In particular, it is based on moored buoys observations in many regions in all oceans (Atlantic, Pacific, Indian, Arctic, and Southern) that have been carried out by researchers from different countries for more than 40 years as part of various oceanographic programs, including WOCE and CLIVAR. However, a significant portion of the data was collected by the author, who is a field oceanographer. The data was processed and interpreted on the basis of the latest knowledge of internal wave motion. The properties of internal waves were analyzed in relation to the bottom topography and mean state of the ocean in specific regions. Internal waves play a major role in the formation of seawater stratification and are responsible for the main processes of ocean dynamics, such as energy transfer and mixing. One of the most significant ideas presented in this book is the generation of internal tides over submarine ridges. Energy fluxes from submarine ridges related to tidal internal waves greatly exceed the fluxes from continental slopes. Submarine ridges form an obstacle to the propagation of tidal currents, which can cause the creation of large amplitude internal tides. Energy fluxes from submarine ridges account for approximately one fourth of the

total energy dissipation of the barotropic tides. Model simulations and moored measurements have been combined to generate a map of global distribution of internal tide amplitudes. This book is of interest to oceanographers, marine biologists, civil engineers, and scientists working in climate research, fluid mechanics, acoustics, and underwater navigation.

Baroclinic tides result from the interaction of barotropic tides with topography in stratified oceans. They play an important role in driving deep ocean mixing. In this research, investigations of the dynamics of baroclinic tides and internal solitary waves (ISWs) in the northern South China Sea (SCS) are conducted, mainly by means of the Massachusetts Institute of Technology general circulation model (MITgcm). Firstly, simulations of internal wave generation at the Luzon Strait (LS) are carried out. By conducting three-dimensional (3D), high-resolution experiments, it was found that the generated wave field features a multi-modal structure: large, pronounced ISWs of first mode (amplitude ~120 m) and second mode (amplitude ~120 m) were reproduced. The two north-south aligned ridges in the LS contribute together to the generation of the second mode ISWs, whereas the easternmost ridge of the two is responsible for the first mode ISWs. It was found that multiple generation mechanisms of internal waves could occur in this region, and overall it belongs to a mixed lee wave regime. A specific type of short internal waves arose during the 3D simulation. These ride on a second mode ISW with similar phase speed, trailing a first mode ISW. The short waves possess wavelengths of ~1.5 km and amplitudes of ~20 m, and only show up in the upper layer up to a depth of ~500 m. Scrutiny of the generation process showed that these short waves appear in two distinct regions and are produced due to two mechanisms, namely, the disintegration of an inclined baroclinic bore near the LS, and the overtaking of a second mode ISW in the deep water by a faster first mode ISW. Robust evidence has been sought from satellite imagery and by solving the theoretical Taylor-Goldstein Equation to verify their existence. The effects of superposition of multiple tidal harmonics (diurnal and semidiurnal) on the resultant ISW generation were investigated. It was first found that, by analyzing historical observational data, the occurrence of ISWs in the far-field always follow strong semidiurnal barotropic tidal peaks in the LS, regardless of whether it is the maximum for the diurnal or total tidal strength. However, modelling results of MITgcm and a linear internal tide generation model demonstrate that the diurnal tidal harmonics modulate the arrival time and amplitude of the propagating ISWs. Specifically, it leads to the emergence of the so-called A and B type ISWs and an alternation and transition between the two. Secondly, the shoaling process of ISWs in the northern SCS slope-shelf area is investigated. A series of two-dimensional (2D) experiments are set up to study the shoaling of a large-amplitude second mode concave ISW over a linear slope that resembles the SCS slope. Modelling results show that a strong transformation of the wave profile starts to take place when the wave is approaching the shelf break. A convex type wave is born at the trailing edge of the incident wave and gradually disintegrates into a group of ISWs due to the steepening of the rear wave profile. The frontal face of the wave gets flatter when travelling on the slope, but forms a steep structure right above the shelf break. However, this steep structure shows no tendency to evolve into an ISW: instead, it gets increasingly flat again while evolving on the shelf. The trailing convex wave packet travels faster and merges with the frontal concave wave. Finally, a wave packet with rank-ordered convex ISWs moves forward steadily on the shelf. Energy transfer to the ambient modes is evident, as both first mode and higher modes are clearly seen during and after the shoaling process. First mode ISW evolution is studied too by performing 3D, high-resolution experiments over the wide northern SCS slope and shelf area. It was found that the wave profiles change drastically near the shelf break and the Dongsha Atoll. In agreement with satellite imagery, the wavefront of the leading ISW becomes more spatially oblique with respect to its original orientation as it progresses westward due to the inclination of the slope in the topography. Wave disintegration is prominent in the shallow water zone, and wave polarity reverses near the turning point (at

the 130 m isobath), which is consistent with the predictions of weakly nonlinear theory. A series of 2D experiments were set up to inspect the effects of rotation on the shoaling ISW. The results indicate that under the rotation, upon reaching the continental shelf, one shoaling ISW could disintegrate into one ISW packet and one secondary solibore that contains a number of rank-ordered waves with much shorter wavelength than an ISW. The secondary solibore is very pronounced in the northern portion of the northern SCS slope and shelf, but could hardly be discerned in the southern portion, which is consistent with the outcome of 3D simulations.

This book contains the written versions of invited lectures presented at the Gerhard H. Jirka Memorial Colloquium on Environmental Fluid Mechanics, held June 3-4, 2011, in Karlsruhe, Germany. Professor Jirka was widely known for his outstanding work in Environmental Fluid Mechanics, and 23 eminent world-leading experts in this field contributed to

This book was first published in 2005. When an oceanic tidal wave that is primarily active on the water surface passes an ocean shelf or a region with a seamount, it is split into a less energetic surface wave and other internal modes with different wavelengths and propagation speeds. This cascading process, from the barotropic tides to the baroclinic components, leads to the transformation of tidal energy into turbulence and heat, an important process for the dynamics of the lower ocean. Baroclinic Tides demonstrates the analytical and numerical methods used to study the generation and evolution of baroclinic tides and, by comparison with experiments and observational data, shows how to distinguish and interpret internal waves. Strongly non-linear solitary internal waves, which are generated by internal tidal waves at the final stage of their evolution, are investigated in detail. This book is intended for researchers and graduate students of physical oceanography, geophysical fluid dynamics and hydroacoustics.

In multidisciplinary efforts to understand and manage our planet, contemporary ocean science plays an essential role. Volumes 13 and 14 of The Sea focus on two of the most important components in the field of ocean science today—the coastal ocean and its interactions with the deep sea, and coupled physical-biogeochemical and ecosystem dynamics.

?????????? ????????? ????????? ????? ????? ????????????? ?????? ???????????? ???????? ?????????? ???????????? ????. ? ?????????? ?????????? ???????? ????????????? ??????, ?????????? ???????? ?????????? ? ?????????????? ???????????? ????????????? ????, ???????? ?????????????? ?????? ???????????? ??????? ???????? ?????, ?????????? ?????? ????????????? ???????????? ???????? ???????? ????????? ????, ????????? ? ???????????? ????????? ????????? ??????????, ?????????????? ???????????? ????????????? ???? ? ???? ??????. ????????? ?????????? ?????????? ???????????? ???????? ???????????? ????????????? ???? ??? ???????? ???????????????? ???????. ???????????? ????? ? ?????????? ??????? ????????? ?????????? ???????????? ?????????? ? ??????? ???????? ????????? ????????????? ????? ? ??????. ?????????? ???????????? ??? ???????????? ? ??????? ??????????, ?????????? ??????????, ????????????? ????????????, ????????????, ???????????.