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Regional Oceanography of the South China Sea

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Preface

The South China Sea is the largest, almost enclosed marginal sea of the northwestern Pacific Ocean. Its western boundary consists of the lands, while eastern and southern boundaries consist of the islands. Its water body is connected to the adjacent oceans and seas through plenty of narrow straits and passages: the East China Sea through the Taiwan Strait, the Pacific through the Luzon Strait, the Sulu Sea through the Balabac Strait, the Java Sea through the Karimata Strait and the Indian Ocean through the Malacca Strait, respectively. The South China Sea is surrounded by nine countries: China, the Philippines, Indonesia, Brunei, Malaysia, Singapore, Thailand, Cambodia and Vietnam, which account for over 2.0 billion human inhabitants (in 2018), or about 26.3% of the world population.

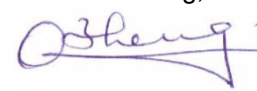
Since ancient times, the South China Sea has served as a convenient navigation waterway for the East Asian and Southeast Asian nations to communicate with each other and with other nations of the world. Even today, the South China Sea is among the busiest waterways in the world because of the size and the high growth rates of the region in the world's economy and trade. The South China Sea is rich in fishery and biomass resources which feed millions of people, as well as reserves huge amount of fossil energy resources which are of strategic significance for regional and world economic development. Thus, systematic and in-depth studies of this important marginal sea are of significance not only regionally, but also globally.

In the past decades, oceanographers from surrounding countries and regions have dedicated continuous efforts to the research of the South China Sea. This book collects updated understanding and knowledge in the regional oceanography of the South China Sea. The book consists of 16 chapters, which may be summed up in the following groups according to the contents: Overview (Chapter 1), Marine geology and oil and gas resources (Chapter 2), General hydrology and circulation (Chapters 3, 4, 12 and 16), Mesoscale and submesoscale processes (Chapters 5, 6, 11,

14 and 15), Coupling of the South China Sea with the Pacific (Chapters 7, 8 and 10) and Coupling of the SCS with the atmosphere (Chapters 9 and 13).

The editors appreciate contributions of the authors of each chapter. It is impossible to publish this book without their cooperation. The National Natural Science Foundation of China project (U1405233), "A study of water exchanges and interaction between the Taiwan Strait and the Luzon Strait", provided partial support to cooperative research and academic exchanges, some results of which are collected in this book. The publishing of this book is also supported by the National Natural Science Foundation of China (91958203).

Quanan Zheng, Ph.D.



Research Scientist Emeritus

About the Editors

Jianyu Hu received his Ph.D. in Physical Oceanography from the Tohoku University of Japan in 2001 and a Ph.D. in Engineering in Environmental Science from the Xiamen University of China in 2002. He is currently a Professor at the State Key Laboratory of Marine Environmental Science, College of Ocean and Earth Sciences, Xiamen University, China. His main research interest is in regional environmental oceanography, especially in the South China Sea and the Taiwan Strait.

Chung-Ru Ho received his Ph.D. in Applied Ocean Science from the University of Delaware, USA, in 1994. He was Deputy Director General of the National Museum of Marine Science and Technology. He is now a Professor with the National Taiwan Ocean University. His research interests include eddy current interaction, typhoon–ocean interaction, global change and ocean renewable energy. Dr. Ho is currently serving as a member of the Committee on Space Research (COSPAR) and is Taiwan's representative for the International Association for the Physical Sciences of the Oceans (IAPSO), one of the eight associations of the International Union of Geodesy and Geophysics (IUGG). He served as the Editor-in-Chief for the *Journal of Marine Science and Technology* and as a Guest Editor for *Advances in Meteorology, Atmospheric Research*, *Journal of Photogrammetry and Remote Sensing* and *Remote Sensing*. He now serves as a member on the editorial board for *Remote Sensing* and for the *Journal of Marine Science and Technology*.

Lingling Xie obtained her Ph.D. in Physical Oceanography from the Ocean University of China in 2009. She is a Professor of Physical Oceanography in the College of Ocean and Meteorology, Guangdong Ocean University. Her research interests include ocean circulation, mixing and interaction of multiscale processes. Dr. Xie has published more than 45 papers in internationally circulated journals such as the *Journal of Physical Oceanography*, *Journal of Oceanography* and *Journal of Marine Systems*. She is an editorial board member for the *Journal of Atmospheric Science Research* and has been serving as a reviewer for several journals.

Quanan Zheng received a Diploma in Physics from Jilin University, China in 1966 and a Ph.D. in Physical Oceanography from the Institute of Oceanology, Chinese Academy of Sciences in 1987. He is a Research Scientist Emeritus at the Department of Atmospheric and Oceanic Science, University of Maryland, College Park, MD, USA. Dr. Zheng is an Honorary Professor of the First Institute of Oceanography, Ministry of Natural Resources and a Guest Chair Professor of Guangdong Ocean University, China. He is an Associate Editor-in-Chief on the editorial board of *Acta Oceanologica Sinica* and the *Journal of Ocean University of China*, an Associate Editor for *Advances in Data Science and Adaptive Analysis* and a member of the editorial board for the *Journal of Oceanology and Limnology*. Dr. Zheng is a member of the American Geophysical Union. As of 13 February 2019, Dr. Zheng has 181 publications, 14,952 citations, 25,074 reads, an RG Score of 39.95 and an h-index of 31 to his credit.

About the Contributors

Chengzhu Xu received his B.Sc. degree from McMaster University, Hamilton, Canada, in 2013, and his master's degree and Ph.D. in Mathematics from the University of Waterloo, Waterloo, Ontario, in 2015 and 2019, respectively. He has a research background in geophysical fluid dynamics, and his current research focuses on internal solitary waves. By means of numerical simulations performed on high-performance computing clusters, his research findings contribute to the understanding of the onset and growth of shear instability in ISWs and the breaking of ISWs over topographical features.

Ching-Yuan Lu received his master's degree in Marine Environmental Informatics from the National Taiwan Ocean University in 2017. He is at present a Ph.D. candidate. His research focuses on satellite and physical oceanography, oceanic eddy and trapped waves.

Haibin Song is a Professor at the School of Ocean and Earth Science, Tongji University, China. He majored in marine geophysics. He received his Ph.D. in 1996 from Tongji University. His main research interest is in the reflection seismic study of the continental margin system, including seismic oceanography, cold seep system and marine gas hydrates. He has published three books, namely *Introduction to Seismic Oceanography* (2012), *Geophysical Researches on Gas Hydrates* (2003) and *Inversion Research on Elastic Parameters of Stratified Media* (2002), and has been the lead or corresponding author for more than 60 journal papers. He won the first national-wide 100 excellent Ph.D. dissertations award from the State Council in 1999 and the Fu Chengyi prize from the Chinese Geophysical Society in 1998.

Hanbang Peng received his master's degree and graduated from the College of Ocean and Earth Sciences, Xiamen University in 2017. He majored in Physical Oceanography. He has been mainly engaged in marine hydrological forecasting since 2017.

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Jiuxing Xing received his Ph.D. in Physical Oceanography from the University of Reading in 1992. He worked at the National Oceanography Centre (Liverpool, UK, formerly the Proudman Oceanographic Laboratory) from 1992 to 2013. He is currently working at the Graduate School at Shenzhen of Tsinghua University. He mainly uses numerical simulations to investigate the dynamics of shelf seas, such as internal tides, fronts, near-inertial motions and their interactions.

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Nan-Jung Kuo received his Ph.D. from the University of Delaware. He is a Professor with the National Taiwan Ocean University. His research interests include remote sensing, satellite oceanography and regional ocean dynamics.

Peigen Lin is a postdoctoral investigator at the Woods Hole Oceanography Institution (WHOI). He got his Ph.D. in Physical Oceanography from Xiamen University, China, where he focused on coastal upwelling in the northern South China Sea, particularly on the east coast of Hainan and in the Taiwan Strait. He also worked at WHOI as a guest student for the last 2 years of his Ph.D. program, when he started to explore the then-upcoming field on high-latitude processes, e.g., upwelling in the Beaufort Sea. Other than his studies in this field, he currently works on the circulation in the Chukchi Sea and boundary currents in the Arctic, the Denmark Strait overflow water and the linkage to Atlantic meridional overturning circulation. To collect data, he has been on over 10 cruises in the South China Sea, the Arctic and the North Atlantic.

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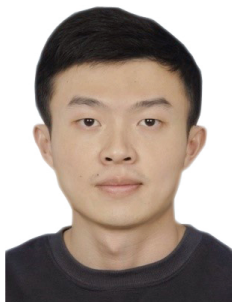

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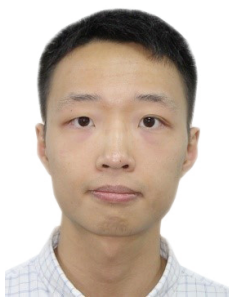

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