

Preface

The aim of this book is to present for non-specialist researchers and experts a comprehensive overview of the background, key ideas, basic methods, implementation details and a selection of solutions offered by the novel technology for the optimization of the location of dangerous offshore activities in terms of environmental criteria that was developed in the framework of the BONUS cooperation.

The first part of the collection introduces the basic principles of ocean modelling and depicts the long way from the generic principles to the practical modelling of oil spills and propagation of other adverse impacts. The second part focuses on the techniques for solving the inverse problem of quantification of offshore areas with respect to their ability to serve as a source of environmental danger to vulnerable regions.

The book first presents an overview of the essential features of the hydrography, the functioning and the key properties of the dynamics of circulation and currents of the major implementation area—the Baltic Sea and the Gulf of Finland. The basic principles of Eulerian modelling of 3D currents are introduced in terms of both generic concepts and specific implementation for the circulation modelling. This is complemented by an overview of the differences in circulation model implementations for other potential target areas (such as the Mediterranean or the Black Sea) and of the limitations of circulation models when it comes to operational modelling of adverse impacts, e.g., oil spills, and specific features of operational and/or oil spill modelling.

The basic element of the technology—Lagrangian trajectories of adverse impacts in the marine environment—is presented mostly from the viewpoint of their calculation from Eulerian information about marine currents. The relevant modelling efforts are complemented with results from the very first long-term experiments with Lagrangian drifters in the surface and subsurface layers of the Baltic Sea and the Gulf of Finland. Statistical analysis of properties of large pools of data about Lagrangian transport is applied for approximately solving the inverse problem of pollution propagation. This approach is a feasible way for a systematic quantification of the offshore areas in terms of the potential of current-induced transport of adverse impacts (released in these areas) to vulnerable domains. The maps charac-

terizing this potential are used for the construction of optimal fairways and the best locations of potentially dangerous activities. Finally, applications of the developed technology for solving certain problems of maritime spatial planning are discussed together with new possibilities for express methods for testing the vulnerability of a particular sea area, the applicability of the entire approach and direct estimates of the potential benefit from the new fairway designs.

The chapters are written in a tutorial style; they are mostly self-contained and understandable for non-specialist researchers and students. The goal was to highlight all key steps, methods, models and data sets necessary to be combined in order to produce the practically usable technology and/or decision support system for a particular sea domain. The book was designed not only as a description and a manual of the particular technology but also as a roadmap highlighting complicated technical issues of ocean modelling for practical purposes that are frequently hidden deep in model manuals.

To ensure the scientific quality of the contributions, each chapter was carefully reviewed by two to four independent experts, with at least one from outside the Baltic Sea science community. Special thanks go to all authors and referees, without whom the making of this book would not have been possible. Finally, financial and mental support by the BONUS initiative during all phases of the preparation of this book is warmly acknowledged.

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