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Modelling of Marine Systems

ELSEVIER OCEANOGRAPHY SERIES

Elsevier Oceanography Series, 10

MODELLING OF MARINE SYSTEMS

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ELSEVIER SCIENTIFIC PUBLISHING COMPANY
Amsterdam - Oxford - New York 1975

ELSEVIER SCIENTIFIC PUBLISHING COMPANY
335 Jan van Galenstraat
P.O. Box 211, Amsterdam, The Netherlands

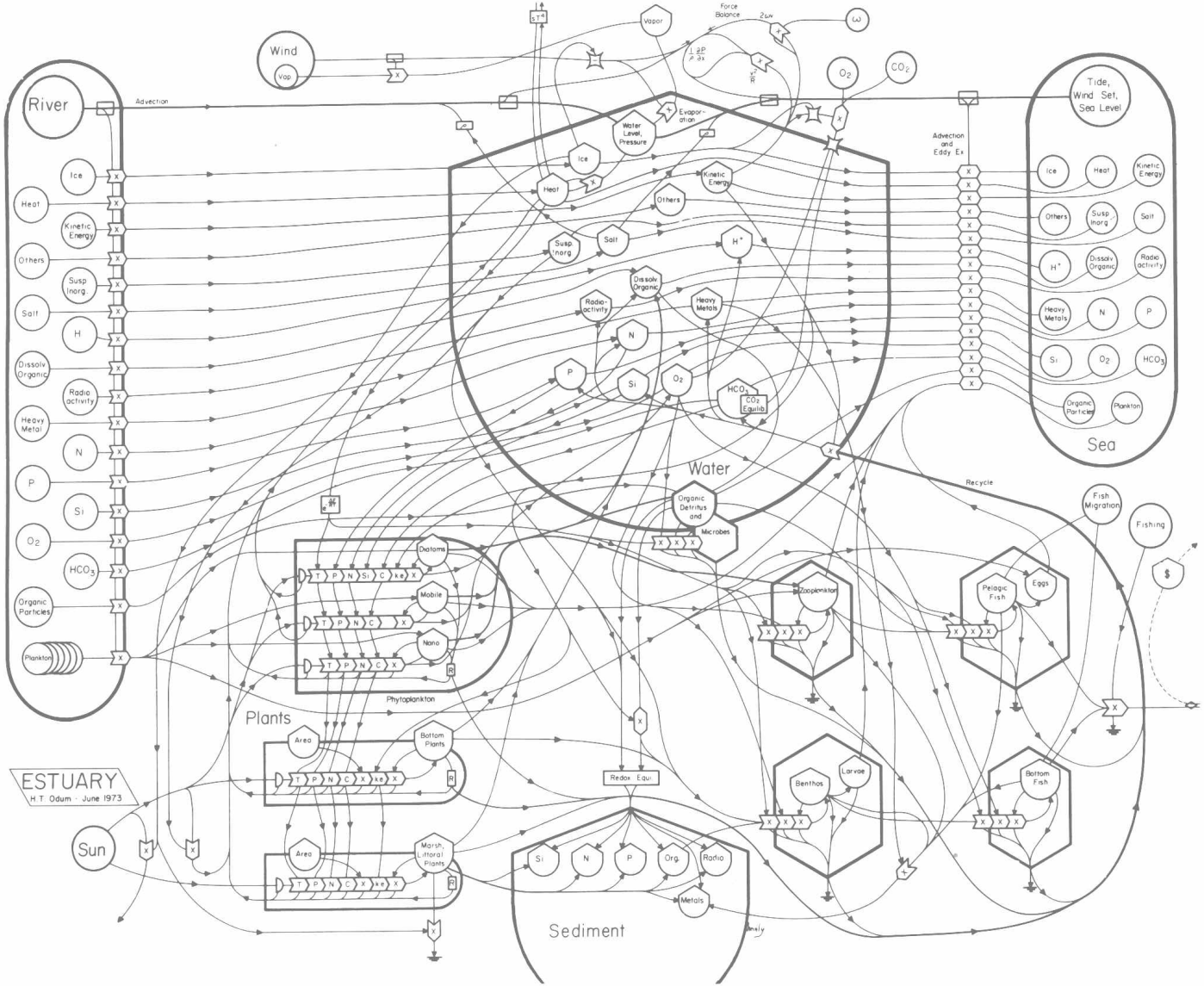
AMERICAN ELSEVIER PUBLISHING COMPANY, INC.
52 Vanderbilt Avenue
New York, New York 10017

Library of Congress Card Number: 74-77585

ISBN: 0-444-41232-8

With 74 illustrations and 13 tables

Printed in The Netherlands



Model for an estuarine system translated into energy circuit language.

PREFACE

The present book emerged from the Conference on Modelling of Marine Systems held in Ofir (Portugal) in June 1973. The conference was organized under the auspices of the NATO Science Committee as part of its continuing effort to promote the useful progress of science through international cooperation.

The Science Committee Conferences are deliberately designed and structured to focus expert attention on what is not known, rather than what is known. The participants are carefully selected to bring together a variety of complementary viewpoints. Through intensive group discussion, they seek to reach agreement on conclusions and recommendations for future research which will be of value to the scientific community.

The attractiveness of this format was confirmed in the present case. Some twenty-eight papers, often specially written reviews, were contributed by the participants for advance circulation, to outline the state-of-the-art in the areas of physical, chemical and biological modelling, and to focus attention on key problems. The availability of this background material precluded the need for lengthy introductory presentations and permitted rapid initiation of interdisciplinary discussions. All participants gave generously and enthusiastically of their expertise and effort during the week of the meeting, and we extend to them our deep gratitude.

We are pleased to have this opportunity to record our special thanks to Prof. Jacques C.J. Nihoul for his diligent efforts as Chairman of the meeting, to his colleagues on the Organizing Committee — Prof. I. Elskens, Prof. D. Garfinkel, Prof. E.D. Goldberg, Dr. R.F. Henry, Prof. J. Pinto Peixoto, Dr. J.H. Steele, Prof. J.W. Stewart — for their wise guidance, and to the leaders and rapporteurs of the Working Groups, as listed, for their indispensable dedication.

We also wish to record our appreciation to the U.S. Office of Naval Research, whose provision of travel support contributed significantly to the success of the meeting.

EUGENE G. KOVACH

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FOREWORD

Mathematical models of marine systems have been extensively developed in the recent years. These models were either research models, aiming at a better understanding of the systems' dynamics, or management models designed to assist the administration of water resources and the fight against pollution. At first, the models concentrated on physical, chemical or biological processes according to their particular concerns. Then, the increased threat on the environment requiring a more thorough understanding of ecosystems, the models were extended, in an effort to overlap the frontiers between the disciplines and include imperatives from other fields. Exhaustive multidisciplinary models were conceived which were sometimes praised sometimes criticized for their ambition.

The prodigious development of numerical techniques and computing facilities, recently, supported the idea that such ambitious models were not unrealistic and could provide a convenient framework for the rational assemblage of the so far dispersed partial models.

The time had come for scientists of different fields or different concerns to compare their different approaches to modelling and set up a common language, promoting interdisciplinary research and combined action.

Although rapid progress in modelling of marine systems was evident, it was also obvious that significant developments within any speciality had not always been recognized for their pertinence to the others. The separate evolutions of the different types of models had furthermore concealed many problems which were progressively exposed as the more exhaustive interdisciplinary models stumbled over them.

The desirability of bringing together specialists from all fields of marine modelling became apparent to many within the scientific community. The members of the Organizing Committee were all fully aware of this necessity and they proposed therefore to hold a conference with the intention of assembling a group of active scientists from different countries, to foster a mutually beneficial exchange of information. Such communication, attempting to assort different points of view, was expected to disclose interdisciplinary problems and interdisciplinary solutions unperceived sofar and to identify simultaneously subjects for further research and new paths to further achievement.

To enhance the degree of interaction — after an indispensable plenary introduction to acquaint all participants with the semantics and present status of research within the different fields — small working groups were formed to discuss specialized topics chosen for their ability to provoke a maximum overlap between the different approaches. To prepare and nourish the discussions, all participants were asked to submit in advance a paper (original contribution, review or recently published work) and the selected papers assembled in a pre-Conference volume were made available to everyone before the Conference.

After the Conference, it was recommended that a book be written.

The intention of this book is not the publication of the Conference's proceedings or the reproduction of the informal pre-Conference volume, many papers of which were in the process of being published in specialized journals or were in a preliminary form suitable only to workshop's discussion. The purpose of the book is, beside the diffusion of the conclusions and recommendations of the working group, — providing guide-lines for further theoretical, experimental and applied work — , the survey, through specially commissioned papers, of the state-of-the-art in interdisciplinary modelling of marine systems. The invited papers contributing to this survey are based on the most recent publications and in particular on the content of the pre-Conference volume which had stimulated the discussions. Due reference to the participants' work is given in the text and a detailed list of addresses is included to enable the reader to get directly in touch with any specialist he may wish to consult.

The group reports and the commissionned papers have tried to be accessible to readers of all backgrounds and all disciplines in marine modelling. The intention was more to inform as accurately and clearly as possible specialists of other fields of important developments in one's own domain than to provide fellow scientists with advanced reviews. If mathematical equations have been mentioned in Part I for the sake of assorting the notations between specialists, they are, in most cases, not essential to the general philosophy of the text, which means to be understood without going into the details of them.

The purpose of the present book is thus to assemble the elements of a first manual on modelling of marine systems.

Such a manual could only emerge with the right degree of simplicity and sophistication from such an enthusiastic mixing of active scientists from related but not identical disciplines and concerns.

It is a pleasure, as the Chairman of the Organizing Scientific Committee, to thank all the persons who made that meeting possible; to the Nato Scientific Committee for its generous support, to Dr. Kovach and Miss Austin for their gentle efficiency, to Prof. Peixoto, Prof. Juerra and Dr. Meira for their noteworthy hospitality, to the members of the Organizing Committee for

their dedicated work in preparing and animating the Conference, to all participants finally for their valuable and enthusiastic contributions.

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