The world's oceans act as a reservoir, with the capacity to absorb and retain carbon dioxide. The air–sea exchange of carbon is driven by physico-chemical forces, photosynthesis and respiration, and has an important influence on atmospheric composition. Variability in the ocean carbon cycle could therefore exert significant feedback effects during conditions of climate change. The Joint Global Ocean Flux Study (JGOFS) is the first multidisciplinary programme to directly address the interactions between the biology, chemistry and physics of marine systems, with emphasis on the transport and transformations of carbon within the ocean and across its boundaries. This unique volume, written by an international panel of scientists, provides a synthesis of JGOFS science and its achievements to date. It will therefore appeal to all those seeking a recent overview of the role of ocean processes in Earth system science and their wider implications on climate change.

Roger Hanson is the Executive Officer of the JGOFS at the International Project Office in Bergen, Norway. He was previously the Associated Program Director in Geosciences and Office of Polar Programs at the US National Science Foundation.

Hugh Ducklow is Professor of Marine Science at the School of Marine Science at the College of William and Mary in Virginia and is currently Chair of the US Joint Global Ocean Flux Study.

John Field is Professor of Zoology at the University of Cape Town. He is currently SCOR President and has served both as a member of the IGBP Scientific Committee and as Chair of the JGOFS Scientific Steering Committee.
The International Geosphere–Biosphere Programme was established in 1986 by the International Council of Scientific Unions, with the stated aim

*To describe and understand the interactive physical, chemical and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human activities.*

A wide-ranging and multi-disciplinary project of this kind is unlikely to be effective unless it identifies priorities and goals, and the IGBP defined six key questions that it seeks to answer. These are:

- How is the chemistry of the global atmosphere regulated, and what is the role of biological processes in producing and consuming trace gases?
- How will global changes affect terrestrial ecosystems?
- How does vegetation interact with physical processes of the hydrological cycle?
- How will changes in land-use, sea level and climate alter coastal ecosystems, and what are the wider consequences?
- How do ocean biogeochemical processes influence and respond to climate change?
- What significant climatic and environmental changes occurred in the past, and what were their causes?

The International Geosphere–Biosphere Programme Book Series bring new work on topics within these themes to the attention of the wider scientific audience.
The Changing Ocean Carbon Cycle
A midterm synthesis of the Joint Global Ocean Flux Study

Edited by

Roger B. Hanson
University of Bergen

Hugh W. Ducklow
Virginia Institute of Marine Science
The College of William and Mary

John G. Field
University of Cape Town
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Contributors

R. T. Barber  
Duke University Nicholas School of the Environment Marine Laboratory, 135 Duke Marine Lab Road, Beaufort, NC 28516–0721, USA

U. Bathmann  
Alfred-Wegener Institute for Polar and Marine Research, 27515 Bremerhaven, Germany

P. W. Boyd  
NIWA Centre for Chemical and Physical Oceanography, Department of Chemistry, University of Otago, Dunedin, New Zealand

F. Chai  
School of Marine Sciences, University of Maine, Orono, ME 04469–5741, USA

S.-Y. Chao  
Horn Point Laboratory, Center for Environmental Science, University of Maryland, Cambridge, MD 21613–0775, USA

H. J. W. de Baar  
Netherlands Institute for Sea Research, P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands

K. L. Denman  
Institute of Ocean Sciences, 9860 West Saanich Road, P.O. Box 6000, Sidney, British Columbia V8L 4N2, Canada

S. C. Doney  
National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO 80307–3000, USA

H. W. Ducklow  
Virginia Institute of Marine Science, The College of William and Mary, PO Box 1346, Gloucester Point, VA 23062–1346, USA
x CONTRIBUTORS

G. T. Evans
Department of Fisheries and Oceans, Northwest Atlantic Fisheries Centre, PO Box 5667, St. John’s, Newfoundland A1C 5X1, Canada

M. J. R. Fasham
Southampton Oceanography Centre, European Way, Empress Dock, Southampton SO14 3ZB, UK

J. G. Field
Zoology Department, University of Cape Town, 7700 Rondebosch, Cape Town, South Africa

W. D. Gardner
Department of Oceanography, Texas A&M University, College Station, TX 77843, USA

J. Hall
NIWA-Ecosystems, National Institute of Water and Atmospheric Research, 100 Aurora Terrace, PO Box 11–115, Hamilton, New Zealand

R. B. Hanson
JGOFS International Project Office, Center for the Study of Environment and Resources, University of Bergen, High Technology Center, N–5020 Bergen, Norway

K. Iseki
National Research Institute of Fisheries Science, 12–4, Fukuura 2–chome, Kanazawa-ku, Yokohama 236, Japan

D. M. Karl
Department of Oceanography, University of Hawaii, Honolulu, HI 96822, USA

A. H. Knap
Bermuda Biological Station for Research, Inc., 17 Biological Station Lane, Ferry Reach, St. George’s, Bermuda GE 01

S. T. Lindley
Southwest Fisheries Science Center, 3150 Paradise Drive, Tiburon, CA 94920, USA

P. S. Liss
School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, UK

K.-K. Liu
Institute of Oceanography, National Taiwan University, P.O. Box 23–13, Taipei, Taiwan, Republic of China

A. Longhurst
Department of Oceanography, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada
CONTRIBUTORS

M. Lucas
Zoology Department, University of Cape Town, 7700 Rondebosch, Cape Town, South Africa

J. J. McCarthy
Museum of Comparative Zoology, 26 Oxford Street, Harvard University, Cambridge, MA 02138, USA

A. F. Michaels
Wrigley Institute for Environmental Studies, University of Southern California, Los Angeles, CA 90089–0971, USA

A. Morel
Laboratoire de Physique et Chimie Marines, Université Pierre et Marie Curie et CNRS, F-06238 Villefranche-sur-Mer, Cédex, France

J. Parslow
Antarctic Program, CSIRO Division of Fisheries, GPO Box 1538, Hobart, Tasmania 7001, Australia

M. A. Peña
Institute of Ocean Sciences, 9860 West Saanich Road, P.O. Box 6000, Sidney, British Columbia, Canada V8L 4N2 (present address: Virginia Institute of Marine Science, The College of William and Mary, PO Box 1346, Gloucester Point, VA 23062–1346, USA)

T. Platt
Biological Oceanography Division, Bedford Institute of Oceanography, Box 1006, Dartmouth, Nova Scotia B2V 4A2, Canada

J. Priddle
British Antarctic Survey, NERC, Madingly Road, Cambridge, Cambridge CB3 0ET, UK

E. Sakshaug
Trondheim Biological Station, Norwegian University of Science and Technology, N-7034 Trondheim, Norway

S. Sathyendranath
Department of Oceanography, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada; Biological Oceanography Division, Bedford Institute of Oceanography, Dartmouth, Nova Scotia B2V 4A2, Canada

D. Slagstad
SENTEF Civil and Environmental, Engineering, N-7034 Trondheim, Norway
xii CONTRIBUTORS

K. Tangen
OCEANOR ASA, Pirsentret, N-7005 Trondheim, Norway

J. R. Toggweiler
GFDL/NOAA, Princeton University, P.O. Box 308, Princeton, NJ 08542, USA

P. Tréguer
URA CNRS 1513, Institut Universitaire Européen de la Mer, Université de Bretagne Occidental, BP 809, F-29285 Brest, Cédex, France

S. M. Turner
School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, UK

D. W. R. Wallace
Oceanographic & Atmospheric Sciences Division, Brookhaven National Laboratory, Building 318, Upton, NY 11973, USA

P. J. le B. Williams
School of Ocean Sciences, University of Wales-Bangor, Menai Bridge, Gwynedd LL59 3EU, UK
International studies are essential to obtain global-scale understanding of ocean processes. The Joint Global Ocean Flux Study (JGOFS, jointly sponsored by the International Geosphere–Biosphere Programme, IGBP, and the Scientific Committee on Oceanic Research, SCOR) is the first international ocean project to directly address the interactions between the biology, chemistry and physics of marine systems. Its emphasis is on carbon exchange, cycling and export within the ocean and across the ocean’s boundaries, with the atmosphere, the sea floor and coastal waters. The air–sea exchange of carbon is driven by physico-chemical forces, photosynthesis and respiration, and has an important influence on atmospheric composition. The temporal and spatial variability of these biogeochemical processes in the ocean carbon cycle could therefore exert significant feedback effects during conditions of climate change.

The first JGOFS Scientific Symposium held at Villefranche-sur-Mer, France, in May 1995, in which some 150 ocean scientists participated, inspired this book. The editors selected and re-structured some of the invited plenary presentations from the Symposium to provide a balanced synthesis of our understanding of ocean biogeochemistry towards the end of the twentieth century, as advanced by JGOFS since its inception.

Many organisations and people have worked together to make this publication possible. The Symposium was organised by the French National JGOFS Committee and financed under SCOR, IGBP, US National Science Foundation, the International Council of Scientific Unions (ICSU), Observatoire Oceanologique de Villefranche-sur-Mer, and several JGOFS National Committees. The Organising Committee comprised: Liliane Merlivat (Chair), Arthur C. T. Chen, Hugh Ducklow, John Field, Elizabeth Gross, Guy Jacques, André Morel, Paul Nival, Trevor Platt, Jarl-Ove Strömberg, and Neil Swanberg.

Roger B. Hanson
Hugh W. Ducklow
John G. Field

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