

JOINT GLOBAL OCEAN FLUX STUDY— SCIENCE SYMPOSIUM

By S.E. Calvert

THE JOINT GLOBAL OCEAN FLUX STUDY (JGOFS) has been responsible for a recent upsurge in international cooperation in ocean science and for some notable advances in biological and chemical oceanography. These advances have included the collaborative study of the northward progress of the spring bloom in the North Atlantic in 1989–90, during which the role of primary producers in drawing down mixed layer PCO_2 was demonstrated for the first time; the establishment of a series of time-series stations in the Atlantic and Pacific where upper water column processes and the settling flux of particular organic matter are being monitored; the 1992–93 Equatorial Pacific Study which showed that the magnitude of CO_2 outgassing from this vast area changes substantially between El Niño and La Niña conditions; the ongoing Arabian Sea program that is looking at the response of the ocean carbon pumps to monsoon forcing; and the formulation of an invaluable set of new international standards and method protocols. Planning for an extensive Southern Ocean program is actively underway.

The first comprehensive JGOFS Science Symposium was held 9–12 May 1995 in Villefranche-sur-Mer, France, and was hosted by Liliane Merlivat of the Université Pierre et Marie Curie, Paris, and Andre Morel and Paul Nival of the Observatoire Oceanologique, Villefranche. The symposium was designed to serve both as a midlife review of the accomplishments of the international program over its first seven years and as part of a formal scientific evaluation of IGBP, performed under the auspices of ICSU and the International Group of Funding Agencies for Global Change Research (IGFA) during

the past year. An evaluation team chaired by Devendra Lal of Scripps Institution of Oceanography, U.S., and including Wajih Naqvi of the National Institute of Oceanography in Goa, India and Kenneth Mann of Bedford Institute of Oceanography, Canada, was present. More than 130 participants from 20 countries attended the symposium, which was held in the magnificent lecture hall of La Citadelle, a fortress of the crusaders that dominates the Villefranche waterfront.

Keynote talks reviewing JGOFS achievements in time series programs, process studies, global surveys, and modeling were presented during morning and late afternoon sessions. More than 80 investigators contributed posters that were presented in the early afternoon at the Station Zoologique in the gardens and in what had once been a galley slaves dungeon.

James McCarthy of Harvard University, U.S., began with an overview of the paradigms developed in the 1950s and 1960s that led to the development of several JGOFS. Several talks highlighted the progress in topics fundamental to the success of JGOFS. Anthony Michaels of the Bermuda Biological Station for Research compared results from the Bermuda and Hawaii time-series sites. Hugh Ducklow, filling in for Richard Barber of Duke University, U.S., and Peter Liss, of the University of East Anglia, U.K., reviewed the results of the first iron fertilization experiment just as ships were returning once again to the waters off the Galápagos Islands in the equatorial Pacific, and Hein de Baar of the Netherlands Institute for Sea Research, Texel, presented results of the iron fertilization experiments in the Southern Ocean. Peter Williams of the School of Ocean Sciences, University of Wales, Bangor, U.K., discussed problems inherent to the determination of

primary and community production and respiration, and N. Handa of Nagoya University, Japan, examined the problems of determining primary and new production. Liliane Merlivat reviewed the status of the JGOFS CO_2 survey. Trevor Platt of Bedford Institute of Oceanography, Canada, and Shubha Sathyendranath of Dalhousie University, Halifax, Canada, presented results of studies of ocean color and basin-scale production from satellite remote sensing. Graham Shimmield of Edinburgh University, U.K., and Steve Calvert of the University of British Columbia, Canada, assessed the current understanding of particle export, sedimentation, and burial in the sea floor.

The results of the various JGOFS regional process studies were presented throughout the week. Hugh Ducklow reviewed the results of the successful JGOFS North Atlantic Bloom Experiment and Truls Johannessen of the University of Bergen, Norway, and Egil Sakshaug of the Trondheim Biological Station, Norway, gave accounts of carbon cycling in the high latitude North Atlantic. Ulrich Bathmann of the Alfred Wegener Institut, Bremerhaven, Germany, and Paul Treguer of the Université de Bretagne Occidentale, Brest, France, summarized the diverse and numerous observations from the first phase of the Southern Ocean studies. Margaret Leinen of the University of Rhode Island, U.S., reviewed the JGOFS Equatorial Pacific Process Study, Bernt Zeitzschel of the Institut Meereskunde, Kiel, Germany, gave an account of the development of the Arabian Sea Process Study, including results which were only a few days old. Kon-Keo Liu of the National Taiwan University, Taipei, emphasized the importance of ocean margins in the global carbon cycle.

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The presentations included talks on modeling by Robbie Toggweiler of Princeton University, John Parslow of the CSIRO Division of Fisheries, Hobart, Australia, and Michael Fasham of the James Rennell Centre, Southampton, U.K. Jean-Francois Minister of the Centre National d'Etudes Spatiale, Toulouse, France, discussed the problem of data assimilation in global models.

The Symposium ended with a free-ranging discussion of the successes and

shortcomings of the program and the prospects for ocean biogeochemical research beyond JGOFS chaired by the President of SCOR, Nick McCave of Cambridge University, U.K., and the Chairman of IGBP, Peter Liss of the University of East Anglia, U.K.

The Villefranche symposium served to highlight the important results so far obtained, the very wide range of research currently underway and also, importantly, provided a glimpse of the magnitude of

the effort needed to reach JGOFS goals. This is a daunting task but the participants left the symposium with a sense of renewed excitement about the final achievements of the program.

Some copies of the book of abstracts for the symposium are still available from the SCOR Secretariat (e-mail: seor@jhu.edu, Fax: 410-516-4019). The keynote lectures will be published in a book by Cambridge University Press in its new IGBP Global Change series. □