



The Hawaiian Ocean Time-series (HOT) and Bermuda Atlantic Time-series Study (BATS)

PREFACE

A comprehensive understanding of the global carbon cycle is required to address contemporary scientific issues related to the atmospheric accumulation of greenhouse gases and their cumulative effects on global environmental change. Consequently detailed *in situ* investigations of terrestrial and marine ecosystems are necessary prerequisites for developing a predictive capability for environmental variability and the effects of human-induced perturbations. These investigations need to address the interdisciplinary connections between physics, chemistry and biology and, in each ecosystem, address broad questions regarding the distribution, abundance, diversity and control of key plant, animal and microbe populations and interactions with their habitats. Ideally, these field investigations should be conducted at strategic sites that are representative of large biomes or in regions that are likely to exhibit substantial interannual variability over large areas. Furthermore, these studies should be conducted for at least several decades, in order to distinguish natural variability from that induced by human activities.

In spite of their recognized importance, systematic, long-term biogeochemical observations of oceanic habitats are rare. In response to a growing awareness of the ocean's role in climate and global change, and the need for comprehensive oceanic time-series measurements, the International Geosphere-Biosphere Programme: A Study of Global Change (IGBP) was established in 1986. One of the essential core components of this program, the Joint Global Ocean Flux Study (JGOFS) was established in 1987 to improve our understanding of the oceanic carbon cycle and to quantify the exchanges of carbon with the atmosphere, the seafloor and the continental boundaries. To achieve these goals, four separate program elements were defined: (i) process studies to capture key, regular events, (ii) time-series observations at strategic sites, (iii) a global inventory of CO₂, and (iv) vigorous data assimilation and modeling efforts.

At the same time as the development of JGOFS, an independent scientific effort was established to gain a better understanding of the general circulation of the world ocean and to model its present state and predict its evolution in relation to atmospheric forcing and climate variability. The implementation plan for the World Ocean Circulation Experiment (WOCE) program also stressed the importance of ocean observations in order to provide the scientific background necessary for the design and eventual deployment of a long-term ocean observing system.

In 1988, the U.S. National Science Foundation funded the establishment of time-series stations in the North Atlantic Ocean near Bermuda and in the North Pacific Ocean near Hawaii under JGOFS and WOCE auspices. As of 1995, there were at least three other JGOFS time-series studies in progress: A French effort at Kergulen Island in the southern Indian Ocean, a joint German-Spanish measurement program in the eastern North Atlantic Ocean near the Canary Islands and a joint German-Chilean station in the eastern South Pacific Ocean off the coast of Chile. Several additional ocean time-series research efforts

conducted outside the context of the IGBP–JGOFS and WOCE programs are also underway, but few have the physical–biogeochemical focus of the Hawaii Ocean Time-series (HOT) and Bermuda Atlantic Time-series Study (BATS). Collectively, these oceanic time-series research efforts have provided an unprecedented view of oceanic variability on a variety of timescales from days to decades. This volume of *Deep-Sea Research II* presents a partial summary of results obtained at the two U.S. JGOFS–WOCE time-series stations.

Long-term, time-series investigations of ocean climate and ecology provide numerous opportunities and special problems. The successes that we have enjoyed to date are the result of the hard work and dedicated efforts of a large number of individuals. Foremost among them are the programs' past and present co-principal investigators (HOT—JGOFS: C. Winn, L. Tupas, D. Hebel; HOT—WOCE: R. Lukas, E. Firing, S. Chiswell; BATS: A. Knap) and the numerous seagoing scientists, technicians, computer specialists and data managers who are largely responsible for the high quality of our data sets. In particular we acknowledge C. Carrillo, J. Christian, S. DeCarlo, J. Dore, L. Fujieki, T. Houlihan, S. Kennan, R. Letelier, L. Lum, U. Magaard, R. Muller, H. Nolla, C. Nosse, S. Reid, M. Rosen, F. Santiago-Mandujano, J. Snyder, G. Tien and T. Walsh from the HOT program, and F. Bahr, N. Bates, S. Becker, M. Best, L. Caporelli, M. Church, A. Close, P. Countway, A. Doyle, K. Elardo, K. Gundersen, M. Hammer, D. Hansell, F. Howse, R. Johnson, R. Kelly, M. Krasowski, B. Little, C. Michaels, N. Nelson, R. Sherriff-Dow, J. Sorensen, D. Steinberg, S. Stone and T. Waterhouse from the BATS program. We also acknowledge the guidance provided to us by the U.S. JGOFS and WOCE Steering Committees and the Time-series Oversight Committee chaired by S. Emerson and T. Dickey.

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