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Environmental Sciences Division

**Carbon Dioxide Information Analysis Center and
World Data Center-A for Atmospheric Trace Gases:
FY 1993 Activities**

Robert M. Cushman
and
Frederick W. Stoss*
Carbon Dioxide Information Analysis Center

Environmental Sciences Division
Publication No. 4169

Date Published: January 1994

*Energy, Environment, and Resources Center
The University of Tennessee-Knoxville

Prepared for the
Global Change Research Program
Environmental Sciences Division
Office of Health and Environmental Research
U.S. Department of Energy
Budget Activity Number KP 05 00 00 0

Prepared by the
Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6335
managed by
Martin Marietta Energy Systems, Inc.
for the
U.S. Department of Energy
under contract DE-AC05-84OR21400

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The Environmental Sciences Division's (ESD's) Carbon Dioxide Information Analysis Center (CDIAC) received an Exceptional Public Service Award from the U.S. Department of Energy (DOE) during the center's annual review. Thomas J. Gross of the DOE Global Change Research Program presented the prestigious award, which was signed by DOE Secretary Hazel O'Leary.

According to the Office of Public Affairs at DOE Headquarters, the award recognizes significant achievement by an individual or organization in support of departmental missions or goals. The DOE Office of Energy Research has given two other such awards this year. Only one was given last year.

United States
Department of Energy

Exceptional Public Service Award

Presented to

Carbon Dioxide Information Analysis Center

For exceptional service to the global change research community worldwide, creative innovations in the field of numerical data and information exchange, development of a model data center, achievement of international acclaim and recognition in the area of atmospheric trace gases, and significant contribution to the success of the Department of Energy's Global Change Research Program.

A handwritten signature in cursive script, reading "Hazel R. O'Leary", written over a horizontal line.

Hazel R. O'Leary
Secretary

September 1993

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Acronyms and Initialisms

AAAS	American Association for the Advancement of Science
AAG	American Association of Geographers
AID	(U.S.) Agency for International Development
ALA	American Library Association
ALE/GAGE	Atmospheric Lifetime Experiment/Global Atmospheric Gases Experiment
ARM	Atmospheric Radiation Measurement (DOE)
BNL	Brookhaven National Laboratory
CAS	Chinese Academy of Science
CCCN	CDIAC Computing System Network
CDIAC	Carbon Dioxide Information Analysis Center (DOE/ORNL)
CD-ROM	compact disc-read only memory
CFC	chlorofluorocarbon
CGED	Committee on Geophysical and Environmental Data
CH ₄	methane
CIESIN	Consortium for International Earth Science Information Network
CIRES	Cooperative Institute for Research in Environmental Science
CIS	CDIAC Information System
CMDL	Climate Monitoring and Diagnostics Laboratory
CMP	computer model package
CO ₂	carbon dioxide
CODATA	Committee on Data for Science and Technology
CPS	Certified Professional Secretary
DAAC	Distributed Active Archive Center
DHHS	U.S. Department of Health and Human Services
DOE	U.S. Department of Energy
DPR	development planning review
ENRIC	Environment and Natural Resources Information Center
EPA	U.S. Environmental Protection Agency
EROS	Earth Resources Observation Satellite
ESD	Environmental Sciences Division
ESRI	Environmental Systems Research Institute
FAO	Food and Agricultural Organization
FTP	file transfer protocol
FY	fiscal year
GCRP	Global Change Research Program
GEIA	Global Emissions Inventory Activity
GEMS	Global Environmental Monitoring System
GHCN	Global Historical Climatology Network
GIS	geographic information system
HAZWRAP	Hazardous Waste Remedial Action Program
HCFC	hydrochlorofluorocarbon
HCN	Historical Climatology Network
HEM	Harmonizations of Environmental Measurement (Program)
IAEA	International Atomic Energy Agency
IAMAP-IAHS	International Association of Meteorology and Atmospheric Physics/International Association of Hydrological Sciences
IAP	Institute of Atmospheric Physics
IEA	International Energy Agency
IG	Institute of Geography
IGAC	International Global Atmospheric Chemistry
IGBP	International Geosphere-Biosphere Programme
INC	International Negotiating Convention
IPCC	Intergovernmental Panel on Climate Change

JGOFS	Joint Global Ocean Flux Study
LDEO	Lamont-Doherty Earth Observatory
MMES	Martin Marietta Energy Systems, Inc.
NAL	National Agricultural Library
NARA	National Archives and Records Administration
NAS	National Academy of Sciences
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NDP	numeric data package
NOAA	National Aeronautics and Space Administration
NO ₂	nitrous oxide
NSF	National Science Foundation
NWS	National Weather Service
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science Education
ORNL	Oak Ridge National Laboratory
OSTI	Office of Scientific and Technical Information (DOE)
PEMD	Personalized Educational Materials Development
PRC	People's Republic of China
R&D	research and development
RAM	random-access memory
RGB	red-green-blue
RIHMI-WDC	All-Russian Research Institute of Hydrometeorological Information—World Data Center
RIVM	Netherlands National Institute of Public Health and Environmental Protection
SAIC	Science Applications International Corporation
SIG-WAIS	Special Interest Group-Wide Area Information Server
SIO	Scripps Institution of Oceanography
SIR	Scientific Information and Retrieval (system)
TIGER	Terrestrial Initiative in Global Environmental Research
TREES	Tropical Ecosystem Environment Observations by Satellite
TVA	Tennessee Valley Authority
U.K.	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USJGOFS	U.S. Joint Global Ocean Flux Study
U.S.S.R.	(former) Union of Soviet Socialist Republics
WDC	World Data Center
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWF	World Wildlife Fund

Acknowledgments

As with any collective effort, this report has been prepared with the help of many people. CDIAC's greatest debt is to the contributing investigators and researchers whose data compose the core of CDIAC's information analysis and data packaging. We also extend our thanks to the laboratories, data centers, agencies, institutions, and organizations that have supported the efforts of this research community. Were it not for the voluntary cooperation and dedication of this group of researchers, CDIAC, as well as its derived information products, comprehensive information services, and specialty publications, could not exist.

Our thanks are also extended to the thousands of people from around the world who have sought assistance from CDIAC over the past year. CDIAC was founded with the intent of providing broad information services to a multidisciplinary audience with divergent interests and needs. We continue to be delighted not only with the response received from the research community for these services but also by the increase in requests for CDIAC services by policy and social scientists, educators, and others interested in various aspects of global environmental issues, including climate change.

We would like to express our gratitude to the following personnel in CDIAC at Oak Ridge National Laboratory and Martin Marietta Energy Systems, Inc. Their collective efforts have brought this report into being. Our deepest thanks go to Sonja Jones, Laura Morris, Debbie Shepherd, and Tim Stamm, who handle information requests and respond to requests for CDIAC's publications, numeric data packages, and computer model packages, and whose record keeping serves as the core for producing the statistics reported in this document. We also thank Marvel Burtis for her specialized desktop publishing, design, and production skills. We acknowledge the work of Rich Daniels, Dale Kaiser, Bob Sepanski, Russ Vose, and Tammy White, who, under the supervision of Tom Boden, are responsible for the detailed information analysis and packaging of numeric data. We thank Gregg Marland and Bob Andres, who—with Tom Boden—annually synthesize the data from various sources into the global and country-by-country CO₂ emissions data base that is so important to the global-change community. And we thank Don Lue and Jim Simmons, who maintain CDIAC's computing system, under Tommy Nelson's direction. Finally, we thank Patty Crabtree, CDIAC secretary, and Penny Sullenberger, CDIAC telephone receptionist, for keeping the office paperwork and telephone traffic flowing smoothly.

We express also our thanks to Thomas J. Gross, program manager with the U.S. Department of Energy's (DOE's) Office of Health and Environmental Research, Environmental Sciences Division, Global Change Research Program. Tom has long supported the international exchange of scientific information among an audience with multidisciplinary interests. His visionary promotion of the value-added process of providing information has been a mainstay in developing CDIAC's services and derived-information products. We thank Ari Patrinos, director of the DOE Environmental Sciences Division, and program managers Roger C. Dahlman and Michael R. Riches for their continued support of CDIAC activities.

We also thank Paul Kanciruk, former CDIAC director and currently manager of the Environmental Information Analysis Program in the Environmental Sciences Division (ESD) at Oak Ridge National Laboratory (ORNL); Fran Sharples, head of the ORNL ESD Environmental Analyses Section; and Steve Hildebrand, acting director of ORNL ESD, for their constant encouragement.

CDIAC is supported by the U.S. Department of Energy's Office of Health and Environmental Research, Environmental Sciences Division, Global Change Research Program. CDIAC is housed in the Environmental Sciences Division at Oak Ridge National Laboratory, which is managed by Martin Marietta Energy Systems, Inc., for the U.S. Department of Energy under Contract DE-AC05-84OR21400. *Carbon Dioxide Information Analysis Center and World Data Center-A for Atmospheric Trace Gases: FY 1993 Activities* is ORNL Publication No. ORNL/CDIAC-67 and is ESD Publication No. 4169.

Abstract

CUSHMAN, R. M., and F. W. STOSS. 1993. Carbon Dioxide Information Analysis Center and World Data Center—A for Atmospheric Trace Gases: FY 1993 Activities, ORNL/CDIAC-67, Oak Ridge National Laboratory, Oak Ridge, Tennessee. 105 pp.

During the course of a fiscal year, Oak Ridge National Laboratory's Carbon Dioxide Information Analysis Center (CDIAC) distributes thousands of specialty publications—numeric data packages (NDPs), computer model packages (CMPs), technical reports, public communication publications, newsletters, article reprints, and reference books—in response to requests for information related to global environmental issues, primarily those pertaining to climate change. CDIAC's staff also provide technical responses to specific inquiries related to carbon dioxide (CO₂), other trace gases, and climate. Hundreds of referrals to other researchers, policy analysts, information specialists, or organizations are also facilitated by CDIAC's staff.

This report provides an account of the activities accomplished by CDIAC (including World Data Center—A for Atmospheric Trace Gases) during the period October 1, 1992, to September 30, 1993. An organizational overview of CDIAC and its staff is supplemented by a detailed description of inquiries received and CDIAC's response to those inquiries. An analysis and description of the preparation and distribution of NDPs, CMPs, technical reports, newsletters, fact sheets, specialty publications, and reprints are provided. Comments and descriptions of CDIAC's information management systems, professional networking, and special bilateral agreements are also presented.

Keywords: air pollution, ambient temperature, atmospheric chemistry, carbon cycle, carbon dioxide, climate, climate change, data analysis, data exchange, data management, earth atmosphere, emissions, fossil fuels, environmental effects, geophysical surveys, global aspects, global warming, greenhouse effect, information analysis, information management, meteorology, methane, monitoring, regional analysis, temperature monitoring, temperature surveys, trace gases

Introduction

The Carbon Dioxide Information Analysis Center (CDIAC) was established by the U.S. Department of Energy (DOE) in 1982 to support its Carbon Dioxide Research Program, now the Global Change Research Program (GCRP). GCRP's role within DOE has been to study how atmospheric concentrations of carbon dioxide (CO₂) change in response to fossil-fuel emissions and other sources of CO₂ and what the response of the earth's climate system might be. Initially, CDIAC's mission was to provide identification, collection, quality-assurance, documentation, and distribution for information on the biogeochemistry of CO₂ and the effects of CO₂ on the earth's climate. As this research area matured, so did the scope of CDIAC to include related global-change topics (e.g., other greenhouse gases and the effects of climate change on the environment). The flow of information into and out of CDIAC—numeric data, journal articles, agency reports, bibliographic data—has paralleled the increasing interest in the "greenhouse" issue.

The World Data Center—A for Atmospheric Trace Gases was established at CDIAC. This new component of the World Data Centers was established in response to the need of the international research community for a central data resource for information related to trace gas cycling.

Such a broad research program, involving many scientists not only in the United States but also around the world, could succeed only if there was an explicit recognition of the value of information, in all its forms, and if measures were taken to ensure that this information would be freely exchanged. CDIAC's mission goes beyond supporting the research community. The education community—teachers, professors, students, and administrators from elementary schools to university graduate departments—also has to be involved in this information exchange if tomorrow's scientists are to be prepared to work on this long-term issue.

This report summarizes CDIAC's and WDC-A's activities in collecting and distributing information during FY 1993, its twelfth year of existence.

For more information about CDIAC or to request information products from CDIAC, contact the Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6335 U.S.A.; telephone 615-574-0390, FAX 615-574-2232; electronic mail CDP@ORNLSTC (Bitnet), CDP@ORNL.GOV (Internet), or CDIAC (Omnet).

Highlights

- The U.S. National Academy of Sciences (NAS) announced that the World Data Center-A (WDC-A) for Atmospheric Trace Gases has been established at Oak Ridge National Laboratory (ORNL). The new data center will be integrated into CDIAC at ORNL. Paul Kanciruk is the director of CDIAC's WDC, and Tom Boden assumes the directorship in FY 1994. WDC-A for Atmospheric Trace Gases is the newest addition to the international Council of Scientific Unions' WDC-A complex, comprising the WDCs located in the United States. This center was created in response to the international scientific community's need for a center to manage critical data related to trace gas cycling. This new center will acquire, quality-assure, document, archive, and distribute data and information on the study of atmospheric trace gases, particularly those important to the analysis of global change issues.
- CDIAC was able to alert 85 researchers in developing regions to the availability of funds from the United States under the U.S. Country Studies Initiative, which is coordinated by the U.S. Department of State's Office of Global Change.
- CDIAC, in collaboration with the All-Russian Research Institute of Hydrometeorological Information—World Data Center (RIHMI-WDC) in Obninsk, has produced the first in a series of four dual-language bibliographies of important Russian climate-change literature, *Selected Translated Abstracts of Russian-Language Climate-Change Publications: I. Surface Energy Budget* (ORNL/CDIAC-57; Proceedings of RIHMI-WDC, Issue 158). This report, which features side-by-side Russian and English abstracts, results from a seven-month guest assignment of Carolina B. Ravina at CDIAC. CDIAC and RIHMI-WDC (Obninsk, Russia) have also compiled the second volume in the series, which covers clouds (ORNL/CDIAC-64; Proceedings of RIHMI-WDC, Issue 159). Volumes three and four are planned to cover aerosols and general circulation models, respectively. The first two volumes in the series were compiled by CDIAC's Marvel D. Burtis on the basis of abstracts translated into English by RIHMI-WDC's Ravina. The series opens up to Western researchers a wealth of climate-change literature previously available only in Russian. This translation project was conducted under the auspices of a 1972 U.S.–U.S.S.R. agreement on protection of the environment.
- CDIAC, in collaboration with the Scripps Institution of Oceanography (SIO), has compiled, quality-assured, and documented an extensive data base of oceanic measurements important to global-change studies. *Surface Water and Atmospheric Carbon Dioxide and Nitrous Oxide Observations by Shipboard Automated Gas Chromatography: Results from Expeditions Between 1977 and 1990*, compiled by CDIAC's Robert J. Sepanski on the basis of data contributed by SIO's R. F. Weiss, F. A. Van Woy, and P. K. Salameh, presents measurements that will be useful for understanding exchanges of two important greenhouse gases between the oceans and the atmosphere.

- CDIAC, in collaboration with the Institute of Atmospheric Physics (Beijing), the State University of New York-Albany, and the National Climatic Data Center (NCDC; Asheville, North Carolina), has published Climatic Data Bases of the People's Republic of China, 1841-1988 (DOE/NBB-0091T). CDIAC's Dale Kaiser, with Shiyan Tao, Congbin Fu, Zhaomei Zeng, Qingyun Zhang, Wei-Chyung Wang, and Thomas Karl, produced this data base under a joint research agreement between DOE and the Chinese Academy of Sciences (CAS). The data base consists of records from 296 stations and includes barometric pressure, surface air temperature, precipitation amount, relative humidity, sunshine duration, cloud amount, wind direction and speed, and number of days with snow cover. For 16 stations, the period of record begins before 1900. These data sets represent the most comprehensive, long-term instrumental Chinese climate data currently available and will be useful for studies of global and regional climate change.
- CDIAC participated in ORNL's Community Day by demonstrating a personal-computer-based model for predicting emissions of CO₂ and methane (CH₄), two important greenhouse gases, over the next century. On Community Day the public was invited for the first time to tour ORNL. CDIAC's Marvel Burtis demonstrated the Edmonds-Reilly model, one of CDIAC's most popular products, and interested visitors were able to observe how changes in demographic, technologic, and economic factors could drastically alter greenhouse-gas emissions.
- CDIAC, in collaboration with the RIHMI and NCDC, has completed quality assurance and documentation of the data base *Daily Temperature and Precipitation Data for 223 U.S.S.R. Stations*. This data base is being published as CDIAC numeric data package NDP-040. CDIAC's Russell Vose, with RIHMI's V. N. Razuvayev, E. G. Apasova, and R. A. Martuganov, documented this data base as part of CDIAC's participation in a 1972 bilateral agreement on environmental protection. The data base, covering the years 1881-1989, includes data on minimum, mean, and daily temperatures; daily precipitation amount; and extensive station-inventory, station-history, and quality assurance information.
- CDIAC has published its *CDIAC Catalog of Numeric Data Packages and Computer Model Packages* (ORNL/CDIAC-62). This catalog, authored by Thomas A. Boden, Frederick M. O'Hara, Jr., and Frederick W. Stoss, provides a summary of the 45 data and model packages produced and distributed by CDIAC (data contributors, data description, file size, and illustrative figure), describes how CDIAC develops its data and model packages, and offers detailed instructions on how to obtain the packages from CDIAC, including the use of file transfer protocol (FTP) electronic transmission. The *CDIAC Catalog of Numeric Data Packages and Computer Model Packages* should greatly expand CDIAC's information outreach functions, thereby enhancing the distribution of DOE's global change data.

- CDIAC participated by invitation in a workshop on Data Management for Global Environmental Studies as part of the International Association of Meteorology and Atmospheric Physics/International Association of Hydrological Sciences (IAMAP-IAHS) '93 meeting in Yokohama, Japan. CDIAC director Robert M. Cushman presented the paper "The Role of CDIAC in Providing Information for the Global Climate-Change Issue." Other presentations were from research and data centers in Japan, China, India, Germany, and Switzerland.
- CDIAC published on behalf of the U.S. Committee on Earth and Environmental Sciences *A Report from the Second U.S./Japan Workshop on Global Change Research: Environmental Response Technologies (Mitigation and Adaptation)* (CONF-930285). The report presents the proceedings of a workshop held in Honolulu in February 1993 under the auspices of the U.S.-Japan Science and Technology Agreement.

- CDIAC was cited in the report *The National Laboratories of the U.S. Department of Energy* in the chapter, "Enhancing Environmental Quality." Specifically, CDIAC was mentioned for becoming a WDC and for its efforts to provide "... extensive information and value-added data to the worldwide research communities."

- CDIAC has revised its compact disc, read-only memory (CD-ROM) product, which contains selected data sets related to global environmental change. This two-volume CD-ROM provides data files, retrieval codes, and descriptive files for selected NDPs, computer model packages (CMPs), data from selected technical reports, and the data from *Trends '91: A Compendium of Data on Global Change*. The CDs' data bases are arranged as subdirectories, each subdirectory corresponding to an NDP number (e.g., NDP-001R3). The first CD-ROM of this two-volume set contains all subdirectories except NDP-041, NDP-042, NDP-043A, and NDP-044; these subdirectories are provided on the second volume.

- The Notable Documents Panel of the American Library Association (ALA) coordinates activities to identify and promote the availability of documents produced by the federal government that, because of their uniqueness, topical coverage, or other characteristics, may be deemed notable and acceptable for listing in the ALA periodical *Library Journal*. CDIAC has been asked to submit several titles for consideration in this year's select listing. *CDIAC Communications*, *Glossary: Carbon Dioxide and Climate*, and CDIAC's *Catalog of Numeric Data Packages and Computer Model Packages* will be submitted. *Trends '93* will be submitted for next year's review.
- The World Wildlife Fund (WWF) has established a special project to assist libraries and environmental information centers in central eastern Europe. CDIAC was contacted by Barbara Rodes, director of Information Services for WWF, and Chair of one of the Special Libraries Association's International Affairs Committees to assist in this project. Rodes is compiling a directory of these libraries and environmental information centers and will eventually be contacting U.S.-based information centers to assist these libraries in building collections in areas critical to their respective environmental needs. Climate change is a topic of universal interest, and CDIAC will be able to provide a tremendous service to these libraries as they develop their environmental collections.

Organization and Staff

Carbon Dioxide Information Analysis Center and World Data Center-A for Atmospheric Trace Gases

Fig. 1. CDIAC organization (September 30, 1993).

Table 1. CDIAC staff FY 1993

Staff	Title
Thomas A. Boden	Ecologist and Task Leader, Data Systems
Marvel D. Burtis	Editorial Assistant
Patricia J. Crabtree	Secretary
Robert M. Cushman	Director, CDIAC
Richard C. Daniels*	Geographic Information Systems Specialist, Data Systems
Penny L. Harmon	Secretary/Telephone Receptionist
Sonja B. Jones	Request-Response Coordinator
Dale P. Kaiser*	Meteorologist, Data Systems
Paul Kanciruk	Director, WDC-A for Atmospheric Trace Gases
Alexander V. Kozyr	Oceanographer, Data Systems
Donald L. Lue*	Personal Computing Specialist
Gregg Marland	Senior Scientist
Laura J. Morris	Technical Information Assistant
Tommy R. Nelson**	Task Leader, Computer Systems
Robert J. Sepanski*	Ecologist, Data Systems
Deborah E. Shepherd	Technical Information Assistant
James W. Simmons***	Workstation Specialist
Timothy W. Stamm*	Request-Response Associate
Frederick W. Stoss*	Task Leader, Information Systems
Russell S. Vose*	Climatologist, Data Systems
Tammy W. White	Geographic Information Systems Specialist, Data Systems

*Energy, Environment, and Resources Center, The University of Tennessee, Knoxville.

**Computing Applications Division, ORNL.

***Computing and Telecommunications Services, ORNL.

Professional Development

During the year CDIAC staff are encouraged to attend various workshops and training programs. These opportunities allow staff to gain new skills and improve their expertise in areas related to CDIAC's operations. The following is a list of CDIAC staff professional development activities for the first half of FY 1993.

Training

- Debbie Shepherd and Laura Morris took an *Introduction to UNIX* course held October 12–14, in-house training.
- Tammy White completed the Franklin Time Management course at Energy Systems Training and Development on October 27, 1992; Debbie Shepherd completed the course on December 8, 1992; Patty Crabtree completed the course on January 13, 1993; and Fred Stoss, Sonja Jones and Laura Morris completed the course on January 22, 1993.
- Debbie Shepherd attended the seminar "How to Make It Work" on November 19, 1992; Rebecca Rice, consultant; in-house training [co-sponsored by the Honors and Awards Office, Martin Marietta Energy Systems, Inc., and the Oak Ridge Chapter of Professional Secretaries International in recognition of those at Energy Systems holding the Certified Professional Secretary (CPS) designation]
- Rich Daniels attended the *Introduction to ARC/INFO* training course in Redlands, California, January 1993.
- Sonja Jones completed the *End User FoxPro 2.0 Level 1* course at Training Systems, Inc., Oak Ridge, Tennessee, January 5–6, 1993, and the *End User FoxPro 2.0 Level 2* course on January 11–12, 1993.
- Sonja Jones, Laura Morris, and Debbie Shepherd attended the *High-Impact Communication Skills* seminar held January 13, 1993, offered by CareerTrack, in Knoxville, Tennessee.
- Patty Crabtree completed *Desktop Publishing with WordPerfect* on February 24, 1993, offered by Energy Systems Training and Development.
- Tom Boden attended four required in-house supervisor training courses at the Energy Systems training facility in Oak Ridge from April 14–15. The courses covered affirmative action legalities, environmental compliance regulations, the new development planning review (DPR) process being piloted in the Environmental Sciences Division (ESD), and tips for being a better leader.
- Patty Crabtree, Sonja Jones, and Penny Sullenberger attended a seminar "Professional Telephone Skills" on May 19, 1993.
- Sonja Jones completed the Career Planning Workshop on August 27, 1993.
- Tom Boden took the in-house *Introduction to Unix* course held September 28–30 at the Oak Ridge Y-12 Plant.

Publications and Presentations

- Rich Daniels' paper *Coastal Erosion and Inundation from Future Increases in Sea Level: Nags Head, North Carolina* (partially based on NDP-43A) was accepted by the *Journal of Coastal Research* (in press).
- Tom Boden presented a talk entitled "Metadata Compiled and Distributed by the Carbon Dioxide Information Analysis Center for Global Climate Change and Greenhouse Gas-Related Data Bases" at the DOE/EPA-sponsored Scientific Data Management workshop held in Salt Lake City on November 4–5, 1992.

- Dale Kaiser presented *Cloud Amount and Sunshine Duration in the People's Republic of China, 1954-88* at a poster session of the 8th Conference on Applied Climatology, January 1993, Anaheim, California. The paper is published in the preprint volume of the conference.
- Fred Stoss presented a paper, *The Carbon Dioxide Information Analysis Center: Providing Support for DOE's Global Change Research Program*, at the DOE Office of Scientific and Technical Information (DOE/OSTI) annual technical information meeting, INFOTech, held in October at OSTI's facilities in Oak Ridge.
- Fred Stoss gave a presentation on the proposed National Institutes for the Environment including the National Library for the Environment before a joint meeting of the Southern Appalachian chapter of Special Libraries Association and the East Tennessee chapter of American Society for Information Science.
- Fred Stoss had a manuscript, "The Carbon Dioxide Information Analysis Center: Responding to Changing Information Needs," published in the *Green Library Journal* 1(3):199.
- Bob Cushman and Fred Stoss had a manuscript, "Institutions: CDIAC," published in *Environment* 34(4):5, 45.
- Final copy of the technical report *Climate Data Bases of the People's Republic of China, 1841-1988* was published in January 1993 as DOE/NBB-0091T, TR055. Its contents have been described in the previous semiannual report.
- Bob Andres, Gregg Marland, Tom Boden, and Steve Bischof submitted *Carbon Dioxide Emissions from Fossil Fuel Consumption and Cement Manufacture, 1751-1991*; and *An Estimate of Their Isotopic Composition and Latitudinal Distribution* for publication in a book to be published by Cambridge University Press. Marland presented this paper at the 1993 Global Change Institute in Snowmass, Colorado (July).
- Vivien Gornitz, Rich Daniels, Tammy White, and Kevin Birdwell have an article "The Development of a Coastal Risk Assessment Database for the U.S. Southeast" in the *Journal of Coastal Research* being published.
- Tammy White presented *An Introduction to GIS* to Environmental Sciences Division, October 1992.
- Tammy White presented *An overview of the ESD GIS Team Facilities and GIS* for Martin Marietta Energy Systems, Inc., Special Task Force for Self-Directed Work Teams, November 1992.
- Thomas C. Peterson (NCDC) and Russ Vose (CDIAC) had a manuscript, "The Global Historical Climatology Network: Present and Future" published in the Proceedings of the Seventeenth Annual Climate Diagnostics Workshop, which was held in Norman, Oklahoma, in October 1992.
- Russ Vose had a manuscript, "The Global Historical Climatology Network: Long-Term Monthly Temperature, Precipitation, and Pressure Data" published in the Proceedings of the Fourth Symposium on Global Change Studies, which took place in January 1993 in Anaheim, California.
- Thomas C. Peterson (NCDC), David R. Easterling (NCDC), Russ Vose (CDIAC), and Jon K. Eischeid [Cooperative Institute for Research in Environmental Science (CIRES)] had a manuscript, "The Global Historical Climatology Network Precipitation Data", published in the Proceedings of the Symposium on Precipitation and Evaporation, which was held in Bratislava, Slovakia, in September 1993.
- Thomas C. Peterson (NCDC), David R. Easterling (NCDC), Russ Vose (CDIAC), and Jon K. Eischeid (CIRES) submitted a manuscript to the American Meteorological Society 1994 Annual Meeting, which will be held in Nashville, Tennessee, in January 1994. The paper is entitled "Homogeneous Global Mean Temperature Time Series."

- Tom Boden was invited by the National Research Council to speak at a panel meeting (i.e., Study on the Long-Term Retention of Selected Scientific and Technical Records) held in Irvine, California, from July 7–9. The purpose of this study was to advise the National Archives and Records Administration (NARA) and the National Oceanic and Atmospheric Administration (NOAA) regarding the long-term retention of selected scientific and technical records of the federal government. Boden's talk described CDIAC's approach to selecting, documenting, archiving, and distributing data.
- Tom Boden traveled to Beijing from September 20–23 for the Sixth Science Team Meeting and presented a talk entitled *Data Archival, Documentation, and Distribution Activities Performed by the Carbon Dioxide Information Analysis Center in Support of the US/DOE–PRC/CAS Bilateral agreement*.
- Debbie Shepherd presented *CDIAC's PC-Based Information Management System* by Sonja Jones, Laura Morris, Debbie Shepherd, and Timothy Stamm at the 10th Office Information Technology Conference, Holiday Inn-World's Fair Site, Knoxville, Tennessee, July 14 (July 13–15, 1993). Proceedings were published in the form of a multimedia CD.
- Tom Boden and Fred Stoss had an abstract accepted for a presentation to be given at the Second Annual Consortium for International Earth Science Information Network (CIESIN) Users Group Workshop held in Atlanta in October 1992. Their presentation will discuss CDIAC's role in providing information support to DOE and the international efforts related to Global Change Research.
- Fred Stoss and Sonja Jones had an abstract accepted for presentation at the 1993 DOE and the Office of Scientific and Technical Information INFOTech meetings to be held in Oak Ridge in October 1992. Their paper, "Performance of the Carbon Dioxide Information Analysis Center," will summarize CDIAC's document and NDP/CMP distribution, examine CDIAC's user community, and describe other measures of performance.
- Dale Kaiser and Russ Vose submitted an abstract for the presentation *Climatic Variability in Eastern China During the Twentieth Century*, to be given at the 90th Annual Meeting of the Association of American Geographers, San Francisco, March 29–April 2, 1994. Prior to the meeting, Dale and Russ will submit a paper on this subject to an appropriate journal.
- CDIAC provided text files from its *Glossary: Carbon Dioxide and Climate* to the Deutsche Forschungsanstalt für Luft-und Raumfahrt (Oberpfaffenhofen, Germany) for incorporation into its electronic thesaurus system.
- Bob Cushman presented the paper "The Role of CDIAC in Providing Information for the Global Climate-Change Issue" at the International Association of Meteorology and Atmospheric Physics/International Association of Hydrological Sciences (IAMAP-IAHS) '93 meeting (Yokohama, Japan).
- Tom Boden presented a talk entitled "*Experiences and Lessons Learned Providing Data from the Carbon Dioxide Information Analysis Center*" at the NEXRAD WSR-88D workshop held in Norman, Oklahoma, on February 1–3, 1993.

Meetings Attended

- Tom Boden and Rich Daniels attended a meeting at the Goddard Institute for Space Studies, in New York City. The meeting was designed to coordinate the research efforts of the DOE land-use research team consisting of I. Fung, S. Brown, J. Richards, E. Flint, D. Skole, C. Hall, R. Houghton, and R. Dahlman (DOE). The data being compiled for NDP-46 was produced for/by this team.
- Bob Cushman attended the National Academy of Sciences Committee on Geophysical and Environmental Data (CGED) meeting in Washington, D.C., in November 1992.

- Bob Cushman attended the U.S. Joint Global Ocean Flux Study (USJGOFS) Science Steering Committee meeting in Miami and provided an update on CDIAC's activities quality-assuring, documenting, archiving, and distributing oceanic CO₂ data.
- Tom Boden and Bob Cushman attended the DOE Science Team meeting and concurrent JGOFS steering committee meeting held in Seattle on November 4–6, 1992, and presented talks concerning CDIAC's plans to archive CO₂ measurements made aboard WOCE and JGOFS cruises.
- Tom Boden and Rich Daniels attended the DOE land-use group meeting hosted by Inez Fung at Goddard Institute of Space Studies on January 6–7, 1993, to discuss data archival and distribution of data generated by that group.
- Tom Boden and Bob Sepanski attended the NOAA/CMDL annual meeting in Boulder, Colorado on March 3–4, 1993.
- Bob Sepanski attended the annual meeting of the NOAA Climate Monitoring and Diagnostics Laboratory (CMDL) March 3–4, in Boulder, Colorado. He obtained a number of new data sets to be included in *Trends* or as NDPs. These include data from the NOAA/CMDL halocarbon flask network, the halocarbon continuous monitoring network, and the atmospheric aerosol data from the NOAA/CMDL continuous monitoring sites.
- Tom Boden attended the DOE Science Team meeting in Miami, March 18–19, 1993, and discussed the status and details of CDIAC's data management plan for the oceanographic CO₂ measurements.
- Fred Stoss attended the inaugural Special Interest Group-Wide Area Information Server (SIG-WAIS) interface to the Internet meeting hosted by the U.S. Geological Survey (USGS) in Reston, Virginia. More than 250 people met to hear the latest on WAIS technologies and the development and implementation of electronic networking.
- Gregg Marland attended a workshop on Inventories of Net Anthropogenic Emissions of Greenhouse Gases in São José dos Campos, Brazil, March 9–11.
- Gregg Marland attended the advisory group meeting on Assessment of Data Bases on Energy Demand and Supply in Terms of their Adequacy for Use in Studies of Greenhouse Gas Emissions in Vienna, April 5–7.
- Bob Andres attended NASA Earth Science summer school, Processes of Global Change in Pasadena, California, August 9–13.
- Tammy White attended the American Association of Geographers (AAG) in Atlanta, April 4–7.
- Tammy White attended the Annual Environmental Systems Research Institute (ESRI) User Conference in Palm Springs, California, May 22–28.
- Russ Vose attended the annual meeting of the American Meteorological Society in Anaheim, California, January 1993. While at the meeting, he presented a paper, "The Global Historical Climatology Network: Long-Term Monthly Temperature, Precipitation, and Pressure Data."
- Russ Vose attended the annual meeting of the AAG, in Atlanta, April 1993. Contacts with several users of the Global Historical Climatology Network (GHCN) data base (i.e., NDP-041) were made.
- Dale Kaiser attended the National Science Foundation (NSF)-sponsored symposium *Environmental Information Management and Analysis: Ecosystem to Global Scales* held at the University of New Mexico, in Albuquerque, May 20–22, 1993. The main objectives of the meeting were to (1) identify state-of-the-art technologies for managing and analyzing environmental data collected at ecosystem to global scales and

(2) facilitate future long-term and broad-scale research efforts. Kaiser provided a synopsis of this meeting to Tom Gross in correspondence dated May 28, 1993.

- Tom Boden, Bob Cushman, and Paul Kanciruk attended the joint U.S. national and WDC data centers meeting at the Earth Resources Observation Satellite (EROS) data center in Sioux Falls, South Dakota, from July 22–23.
- Fred Stoss attended a demonstration and workshop at DOE's OSTI in Oak Ridge, where the ConQuest software was displayed. ConQuest is a Windows-based software combining natural language processing and semantic networks for extracting information from multiple sources. The software has implications for use of the Internet and may become the standard for accessing information from the global Change Master Directory.
- Bob Sepanski attended the annual meeting of the NOAA/CMDL in Boulder, Colorado, March 1993. See *Trends* in Communications section.
- Bob Andres and Gregg Marland attended a presentation on CO₂ trading at the University of Tennessee, delivered by D. J. Dudek of the Environmental Defense Fund.

Committees and Appointments

- Fred Stoss was named as cochair of the Committee for National Institutes of the Environment Steering Committee for the National Library for the Environment. He joins Carol Watts (NOAA) and Bruce Gritton (Monterey Bay Aquarium Research Institute) in this position.
- Fred Stoss was asked to serve a fifth year as a member of the Advisory Board of Environment Abstracts, which is published by A & I Bowker, a division of R. R. Bowker Publishers.
- Tammy White served a third term as cochair of the ESD Geographical Information System (GIS) Operations Committee and User Team.
- Tammy White was a member of the ESD GIS Team Hiring committee that hired their Team Facilities Manager, Pat Scarbrough.
- Tom Boden was named to succeed Paul Kanciruk as director of the WDC–A for Atmospheric Trace Gases effective October 1, 1993.
- Debbie Shepherd chaired the ORNL ESD's Electronic Communication Committee, a volunteer group of staff and guests working to make information more available.
- Tom Boden was asked to serve on a NSF panel to review proposals submitted for the Research on Scientific Databases initiative announcement. The review was held April 12–13, 1993, in Washington, D.C.

Awards and Honors

- Three CDIAC products received awards from the 1993 competition of the East Tennessee Chapter of the Society for Technical Communication. *ARM Outreach* (Fred O'Hara; Fred Stoss; and Lawrence Livermore National Laboratory's Marv Dickerson) received an award for Achievement in Promotional Materials; *Trends '91: A Compendium of Data on Global Change* (Tom Boden, Bob Sepanski, and Fred Stoss) was awarded Merit in Technical Reports; and *DOE Research Summary* (Marvel Burtis, Bob Cushman, and Fred Stoss) was awarded Achievement in Whole Periodicals. Additionally, CDIAC's Laura Morris (with the ORNL Publications Division's Gay Marie Logsdon and ESD's Monty Ross) received an award for Achievement in House Documents for *the ESD Orientation Handbook*.

- Rich Daniels and Tammy White, as members of the ESD GIS team, received World-Class Teamwork awards from the ORNL Values Committee (April).
- The ESD Electronics Communications Committee was the recipient of the "ESD Team Award," September 14, 1993, with Debbie Shepherd serving as chairman.
- Fred Stoss was elected to serve as president-elect of the Southern Appalachian Chapter of the Special Libraries Association, taking the office of chapter president in 1994–95.
- Fred Stoss was presented the first Outstanding Member Award by the Special Libraries Association's Environment and Resource Management Division. Fred was cited for his long-term involvement with the division and his efforts related to the merger of the Natural Resources Division and the Environmental Information Division in creating the current body. He has been a column editor for the division's newsletter for 10 years, chaired many committees, and served as division chair in 1987–89.

Request-Response Records (R³) System

When CDIAC began in 1982, greenhouse warming was a topic still primarily in the research arena, and CDIAC's role was, for the most part, one of taking data *from* researchers and distributing data *to* researchers. By 1990, however, when greenhouse warming was front-page news and the subject of newsmagazine lead stories, congressional attention, and international conferences, CDIAC's role—and its user community—had broadened considerably. CDIAC has been fielding information requests from congressional staffers drafting or evaluating legislation, from public-school students working on science fair projects, and from science reporters compiling data for stories, as well as from research scientists. Table 2 is a summary of CDIAC request/response activities for FY 1993.

Table 2. Request/response activities

Category	Number of requests			Total FY 1985 to date
	Fiscal Year 1993			
	Qtrs 1-2	Qtrs 3-4	Total	
Requesters ^a	1,260	1,603	2,863	19,640
Response Activities				
Technical discussions ^b	151	76	227	
DOE reports	211	370	581	6,001
CDIAC reports	651	673	1,324	7,800
Other reports	61	59	120	945
Data processing	7	8	15	297
Articles	37	25	62	513
NDPs ^c	395	291	686	3,075
CMPs	40	43	83	539
<i>Trends</i> (on diskette)	79	112	191	308
Directory searches	715	508	1,223	5,148
Miscellaneous	126	141	267	360
Networking	38	24	62	67
General inquiries	1,109	1,527	2,636	19,640
Total	3,620	3,857	7,477	44,693

^aRequesters include all correspondence pertaining to DOE deliverables and other global change related matters (does not include administrative day to day operations).

^bSubstantive exchange related to global change information/data management, and other areas of CDIAC expertise.

^cRequests for CD-ROM included.

- CDIAC responded to 7,477 requests from 2,863 individuals for CDIAC products and services from 74 countries: Algeria, Antigua/Barbuda, Argentina, Australia, Austria, Bahrain, Bangladesh, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cuba, Cyprus, Denmark, Egypt, Ethiopia, Fiji, Finland, France, Germany, Greece, Guyana, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kenya, Kuwait, Lesotho, Lithuania, Luxembourg, Malaysia, Mexico, Monaco, Mongolia, Namibia, Netherlands, New Zealand, Niger, Nigeria, Norway, People's Republic of China, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Trinidad/Tobago, Turkey, United Kingdom, United States, Vietnam, Yemen, and Zimbabwe (Fig. 2).

- During FY 1993 CDIAC received a total of 2,025 requests for reports (Fig. 3). These requests for reports include

DOE reports

581 requests
2,282 copies distributed

CDIAC reports

1,324 requests
9,204 copies distributed

Other reports

120 requests
192 copies distributed

Total reports distributed: 11,678

- A total of 44,690 requests from 108 countries have been filled from FY 1985 to date (Fig. 4).
- Since 1985, requests represent a variety of responses from CDIAC staff, the largest being discussions, distribution of CDIAC reports, and distribution of DOE reports (Fig. 5).
- CDIAC responded to 8 requests for the data presented in the technical report *A Comprehensive Precipitation Data Set for Global Land Areas* (TR051, DOE/ER-69017T-H1, April 1991, 82 pp.) and to 7 requests for the data presented in the technical report *Climate Data Bases of the People's Republic of China, 1841-1988* (TR055, DOE/NBB-0091T, January 1993); one 8-mm tape, 11 floppy diskettes, and 7 FTP transfers were generated in filling these requests.
- In those years when *Trends* was produced (1990 and 1991) the following year's activities increased in response to that publication. There may be additional inquiries when people learn about CDIAC for the first time. (Fig. 6).
- The Spring 1993 issue of *CDIAC Communications* was distributed to over 8,600 individuals.

7,477 requests for CDIAC services and products from 74 countries

Fig. 2. Request/response activities world map for FY 1993 .

Fig. 3. Request/response activities pie chart for 1993.

Fig. 4. Request/response activities world map for FY 1985 through FY 1993.

44,693 requests for CDIA services and products from 108 countries

Fig. 5. Request/response activities pie chart FY 1985 through FY 1993.

Fig. 6. Request/response activities graph for FY 1985 through FY 1993.

Table 3. DOE reports distribution

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
001	Workshop on the Global Effects of Carbon Dioxide From Fossil Fuels, May 1979				26	N/A
002	Summary of the Carbon Dioxide Effects and Assessment Program				12	N/A
003	The Role of Temperate Zone Forests in the World Carbon Cycle, February 1980				25	N/A
004	The Role of Organic Soils in the World Carbon Cycle, February 1980				25	N/A
005	Carbon Dioxide Research Progress Report, April 1980				49	N/A
006	Environmental Control Technology for Atmospheric Carbon Dioxide, May 1980	1		1	19	7
007	The Role of Tropical Forests in the World Carbon Cycle, August 1980				58	N/A
008	A Comprehensive Plan for Effects Research and Assessment, Part 1: The Global Carbon Cycle and Climatic Effects of Increasing Carbon Dioxide				44	N/A
009	Workshop on Environmental and Societal Consequences of a Possible CO ₂ -Induced Climate Change, September 1980	2		2	98	46
010	Measurement of Changes in Terrestrial Carbon Using Remote Sensing				13	10
011	Proceedings of the Carbon Dioxide and Climate Research Program Conference, December 1980	1	2	3	53	22

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
012	Proceedings of the International Meeting on Stable Isotopes in Tree-Ring Research, December 1980		1	1	44	N/A
013	Environmental and Societal Consequences of a Possible CO ₂ -Induced Climate Change - A Research Agenda, Volume I (December 1980). Volume II (Various Dates for 16 Parts, December 1980)		1	1	24	N/A
	Part 1				4	N/A
	Part 2				1	N/A
	Part 3				50	N/A
	Part 4				58	0
	Part 5				62	N/A
	Part 6				82	53
	Part 7				69	114
	Part 8				82	82
	Part 9				63	19
	Part 10				66	105
	Part 11				57	104
	Part 12				64	82
	Part 13				74	86
	Part 14				58	105
	Part 16				63	94
	Part 17				76	0
014	Some Aspects of the Role of the Shallow Ocean in Global Carbon Dioxide Uptake, January 1981				86	N/A

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
015	Carbon Balance in Northern Ecosystems and the Potential Effect of Carbon Dioxide-Induced Climatic Change, January 1981				21	N/A
016	Flux of Organic Carbon by Rivers to the Oceans, April 1981	2	2	4	59	41
017	Workshop on Oceanic CO ₂ Standardization, February 1982	1	1	2	63	194
018	Proceedings of the Workshop on First Detection of Carbon Dioxide Effects, May 1982				56	N/A
019	Global Dynamics of Biospheric Carbon, July 1982				15	N/A
020	Effect of CO ₂ on Mammalian Organisms, December 1982				19	N/A
021	Proceedings: Carbon Dioxide Research Conference: Carbon Dioxide, Science and Consensus, February 1983				43	N/A
022	Conf 8608144—Proceedings of the International Symposium of Ecological Aspects of Tree Ring Analysis	3	4	7	64	0
023	Conf 8708252—Proceedings from the 2nd Annual Science Meeting of the USDOE and PRCAS Joint Research Program				40	N/A
024	Workshop on Sea Level Rise and Coastal Processes, March 1989	2	5	7	182	46
CONF-890525	Proceedings of the International Conference on Global and Regional Environmental Atmospheric Chemistry, Beijing, China, May 3-10, 1989				46	N/A

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
CONF-930285	A Report from the Second U.S./Japan Workshop on Global Change Research: Environmental Response Technologies (Mitigation and Adaptation)		3	3	3	
CONF-9006134	Global Climate Feedbacks: Proceedings of the Brookhaven National Laboratory Workshop June 3-6, 1990	11	6	17	129	273
CONF-9110336	Proceedings of the Second Atmospheric Radiation Measurement (ARM) Science Team Meeting		27	27	27	
TR001	On Possible Changes in Global Sea Level and Their Potential Causes, March 1983	2	5	7	157	20
TR002	Effects of Approximate Radiation Treatments Used in the Climate Models on the Clear Sky Thermal Radiation Flux: Its Perturbation Due to CO ₂ Increase, January 1983	2	1	3	96	40
TR003	Carbon Dioxide Emissions from Fossil Fuels: A Procedure for Estimation and Results for 1950-1981, June 1983	6	5	11	206	39
TR004	Carbon in Live Vegetation of Major World Ecosystems, June 1983	5	9	14	222	153
TR005	Deforestation Measured by LANDSAT: Steps Toward a Method June 1983	5	3	8	214	38
TR006	Response of the North American Corn Belt to Climate Warming, August 1983	2	3	5	146	33
TR007	An Analysis of Concepts for Controlling Atmospheric Carbon Dioxide	5	10	15	308	24
TR008	Carbonate Chemistry of the Weddell Sea		1	1	112	44

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
TR009	Response of Unmanaged Forests to CO ₂ -Induced Climate Change: Available Information, Initial Tests, and Data Requirements	2	2	4	167	38
TR010	Computer Implementation of a Globally Averaged Model of the World Carbon Cycle	6	2	8	208	154
TR011	Historical Carbon Dioxide: Abundances Derived from the Smithsonian Spectrobolograms	1	2	3	135	17
TR012	Seasonal Climate Scenario for Europe and North America in the High-CO ₂ , Warmer World	1	3	4	145	22
TR013	An Analysis of Possible Future Atmospheric Retention of Fossil Fuel CO ₂	3	1	4	206	32
TR014	The Changing Pattern of Fossil Fuel CO ₂ Emissions	3	3	6	207	39
TR015	A Proposed Reference Set of Scenarios for Radiatively Active Atmospheric Constituents	4	1	5	150	49
TR016	A Systems Study for the Removal, Recovery and Disposal of Carbon Dioxide from Fossil Fuel Power Plants in the U.S.	4	8	12	251	75
TR017	A Climatic Data Bank for Northern Hemisphere Land Areas, 1851-1980	7	3	10	227	87
TR018	A Global Paleoclimatic Data Base for 6000 Year B.P.	5	3	8	167	46
TR019	Carbon Dynamics of Northern Hardwood Forests: Gas Exchange Characteristics	2	4	6	116	57

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
TR020	Reconstruction of Past Atmospheric CO ₂ Contents from the Chemistry of the Contemporary Ocean: An Evaluation	3	6	9	132	1
TR021	A Two Dimensional CO ₂ -Ocean Model Including the Biological Processes	2	7	9	127	42
TR022	A Grid Point Surface Air Temperature Data Set for the Northern Hemisphere	5	4	9	142	43
TR023	The Effect of Elevated Atmospheric CO ₂ on Plant Communities	6	5	11	209	37
TR024	Methods of Uncertainty Analysis for a Global Carbon Dioxide Model	5	2	7	142	45
TR025	The Stability of Low-Altitude Sea Surface Temperatures: An Evaluation of the CLIMAP Reconstruction with Emphasis on the Positive SST Anomalies	2		2	79	46
TR026	Carbonate Chemistry of the Bering Sea		3	3	64	33
TR027	A Grid Point Surface Air Temperature Data Set for the Southern Hemisphere	3	3	6	145	44
TR028	Definition and Characterization of Data Needs to Describe the Potential Effects of Increased Atmospheric CO ₂ on Marine Fisheries from the Northeast Pacific Ocean	2	1	3	69	100
TR029	Preliminary Data Report for the INDIGO1/INDIVAT 3 Cruises in the Indian Ocean		2	2	50	88

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
TR030	Effects of Energy Technology on Global CO ₂ Emissions	7	9	16	370	77
TR031	Impact of Climate Change from Increased Atmospheric Carbon Dioxide on American Agriculture	4	7	11	343	36
TR032	A Comparison of Tropical Forest Surveys	1	3	4	153	68
TR033	High Accuracy Standards and Reference Methodology for Carbon Dioxide in Air		3	3	78	95
TR034	Carbonate Chemistry of the North Pacific Ocean	1	3	4	83	60
TR035	An Annotated Inventory of Climatic Indices and Data Sets	8	6	14	223	5
TR036	Uncertainty in Future Global Energy Use and Fossil Fuel CO ₂ Emissions 1975 to 2075	4	7	11	321	204
	Appendices for TR036		12	12	70	12
TR037	Monthly Mean Pressure Reconstructions for Europe (Back to 1780) and North America (to 1958)	5	5	10	111	42
TR038	Data Bank of Antarctic Surface Temperature and Pressure Data	2	2	4	63	112
TR039	The Prospect of Solving the CO ₂ Problem Through Global Reforestation	8	12	20	525	15
TR040	A Primer on Greenhouse Gases	13	17	30	1112	49
TR041	Regional Intercomparisons of General Circulation Model Predictions and Historical Climate Data	9	3	12	451	179

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
TR042	Surface Energy Balance of Three General Circulation Models: Current Climate and Response to Increasing CO ₂	3	3	6	189	40
TR043	The Use of Statistical Climate Crop Models for Simulating Yield to Project the Impacts of CO ₂ Induced Climate Change	8	4	12	155	223
TR044	Documentation of IAP Two-Level Atmospheric General Circulation Model	2	4	6	64	19
TR045	A Preliminary Analysis of U.S. CO ₂ Emissions Reduction Potential from Energy Conservation and the Substitution of Natural Gas for Coal in the Period to 2010	6	9	15	592	527
TR046	Global Lake-Level Variations from 18,000 to 0 Years Ago: A Paleoclimatic Analysis	8	5	13	124	181
TR047	An Evaluation of the Relationship Between the Production and Use of Energy and Atmospheric Methane Emissions	8	6	14	176	90
TR048	Effects of Air Temperature on Atmospheric CO ₂ Plant Growth Relationships	17	7	24	178	21
TR049	Simulating Climate with Two Different Numerical Schemes	3	3	6	65	114
TR050	Modeling pCO ₂ in the Upper Ocean: A Review of Relevant Physical, Chemical, and Biological Processes	6	4	10	125	19
TR051	A Comprehensive Precipitation Data Set for Global Land Areas	16	19	35	166	35

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
TR052	Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO ₂ and Climate Change—The MINK Project. This document is in eight volumes (TR052A-TR052H)	23	8	31	60	59 Sets
TR053	The Determination of Total Dissolved Inorganic Carbon in Sea Water Using Extraction/ Coulometry: The First Stage of a Collaborative Study	1	6	7	8	88
TR054	Modeling the Response of Plants and Ecosystems to Elevated CO ₂ and Climate Change	48	23	71	120	10
TR055	Climate Data Bases of the People's Republic of China 1841-1988	3	20	23	23	256
DOE/ER-0094P	Global Climate Trends and Greenhouse Gas Data: Federal Activities in Data Collection, Archiving, and Dissemination	7	4	11	104	39
DOE/ER-0178	Carbon Dioxide Research Plan—Summary		1	1	329	16
DOE/ER-0186	CO ₂ Climate Research Plan		2	2	159	15
DOE/ER-0187	Vegetable Response Carbon Dioxide	1	2	3	177	10
DOE/ER-0188	Carbon Cycle Research Plan		1	1	109	12
DOE/ER-0235	Detecting the Climatic Effects of Increasing Carbon Dioxide (Hardbound = HB)				521	2
DOE/ER-0235	Detecting the Climatic Effects of Increasing Carbon Dioxide (Softbound = SB)	10	8	18	1616	175

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DOE/ER-0236	Characterization of Information Requirements for Studies of CO ₂ Effects: Water Resources, Agriculture, Fisheries, Forests and Human Health (HB)	10	8	18	555	62
DOE/ER-0236	Characterization of Information Requirements for Studies of CO ₂ Effects: Water Resources, Agriculture, Fisheries, Forests and Human Health (SB)				1680	N/A
DOE/ER-0237	Projecting the Climatic Effects of Increasing Carbon Dioxide (HB)				521	N/A
DOE/ER-0237	Projecting the Climatic Effects of Increasing Carbon Dioxide (SB)	10	7	17	1644	98
DOE/ER-0238	Direct Effects of Increasing Carbon Dioxide on Vegetation (HB)	4		4	526	8
DOE/ER-0238	Direct Effects of Increasing Carbon Dioxide on Vegetation (SB)	13	12	25	1707	67
DOE/ER-0239	Atmospheric Carbon Dioxide and the Global Carbon Cycle (HB)				516	N/A
DOE/ER-0239	Atmospheric Carbon Dioxide and the Global Carbon Cycle (SB)	16	11	27	1720	53
DOE/ER-0299	Carbon Dioxide Summaries of Research in FY 1986		1	1	60	18
DOE/ER-0316	Master Index of the Carbon Dioxide Research State-of-the-Art Report Series (HB)				566	52
DOE/ER-0316	Master Index of the Carbon Dioxide Research State-of-the-Art Report Series (SB)	9	5	14	778	193

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DOE/ER-0347	Carbon Dioxide & Climate: Summaries of Research in FY 1987				190	13
DOE/ER-0385	Carbon Dioxide & Climate: Summaries of Research in FY 1988				144	N/A
DOE/ER-0406	Global Distribution of Total Cloud Cover and Cloud Type Amounts Over the Ocean	7	5	12	94	77
DOE/ER-0411	Atmospheric Carbon Dioxide and the Greenhouse Effect				7248	N/A
DOE/ER-0425	Carbon Dioxide and Climate: Summaries of Research in FY 1989		1	1	220	18
DOE/ER-0441	Atmospheric Radiation Measurement Program Plan	1	76	77	1015	171
DOE/ER-0442	Atmospheric Radiation Measurement Program Plan (Executive Summary)	2	101	103	1099	536
DOE/ER-0470T	Carbon Dioxide and Climate: Summaries of Research in FY 1990	1	1	2	231	33
DOE/ER-0479T	Building an Advanced Climate Model Program Plan for the CHAMMP Climate Modeling Program	2	3	5	223	129
DOE/ER-0494T	Identification, Recommendation, and Justification of Potential Locales for ARM Sites (Exec. Sum.)	4	13	17	119	87
DOE/ER-0495T	Identification, Recommendation, and Justification of Potential Locales for ARM Sites	4	13	17	134	87

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DOE/ER-0508T	Carbon Dioxide and Climate: Summaries of Research in FY 1991	3	2	5	299	8
DOE/ER-0541T	Computer Hardware, Advanced Mathematics and Model Physics (CHAMMP) Pilot Project Final Report	1	1	2	2	116
DOE/ER-0549T	Multi-Year Strategic Plan for the Atmospheric Studies in Complex Terrain (ASCOT) Program		76	76	78	100
DOE/ER-0565T	Global Change Research: Summaries of Research in FY 1992	48	115	163	163	275
DOE/ER-0568T	Atmospheric Sciences Program Summaries of Research in FY 1992	4	23	27	27	220
DOE/ER-0575T	Overview of the DOE Atmospheric Chemistry Program's Ozone Project		112	112	112	90
DOE/ER-0585T	The Possible Direct Use of Satellite Radiance Measurements by the Atmospheric Radiation Measurement Program		29	29	29	132
DOE/ER-0586T	Atmospheric Chemistry Program Program Operation Plan		202	202	202	
DOE/ER-60085-H1	Global Distribution of Total Cloud Cover and Cloud Type Amounts Over Land	8	7	15	176	129
DOE/ER-60197-H1	On the Surging Potential of Polar Ice Streams FY 1987 Amounts Over Land	4	2	6	47	177
DOE/EV-0129	Research Issues and Supporting Research of the National Program on Carbon Dioxide, Environment and Society—FY 1980					5

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DOE/EV-0202	Carbon Dioxide and Climate: Summaries of Research in FY 1983 and FY 1984				153	16
DOE/EV-0202/1	Carbon Dioxide and Climate: Summaries of Research in FY 1985				113	16
DOE/EV-60235-1	Glaciers, Ice Sheets, and Sea Level: Effect of a CO ₂ -Induced Climatic Change (HB)				521	98
DOE/EV-60235-1	Glaciers, Ice Sheets, and Sea Level: Effect of a CO ₂ -Induced Climatic Change (SB)	10	7	17	1121	90
PNL-4384	An Analysis of Methods and Models for Assessing the Direct and Indirect Economic Impacts of CO ₂ -Induced Environmental Changes in the Agricultural Sector of the U.S. Economy				38	N/A
PNL-4709	Identification and Preliminary Characterization of Global Water Resource Issues Which May Be Affected by CO ₂ -Induced Climate Change				51	N/A
BERN	Bern CO ₂ Symposium	1	3	4	93	5
DOE/NBB-0039	International Carbon Dioxide-Related Activities: The International Organizations Involved and U.S. Bilateral Arrangements				37	N/A
DOE/NBB-0068	Review of Carbon Dioxide Research Staffing and Academic Support	1		1	43	63
DOE/NBB-0092	Quantifying and Minimizing Uncertainty of Climate Forcing by Anthropogenic Aerosols		541	541	541	

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DA001	Field Studies of Plant Responses to Elevated Carbon Dioxide Levels, 1980	3	2	5	53	1
DA002	The Soybean Crop Simulator, Glycim: Model Documentation, 1982				13	15
DA003	Effects of Increased Carbon Dioxide on Photosynthesis and Agricultural Productivity of Soybeans, 1981	2	2	4	48	2
DA004	Soybean Responses to Carbon Dioxide: Measurement and Simulation, 1981				14	14
DA005	Field Studies of Plant Responses to Elevated Carbon Dioxide Levels, 1981				12	12
DA006	Effects of Carbon Dioxide Enrichment on Nitrogen Fixation in Soybeans, 1981				9	9
DA007	Effects of Increased Carbon Dioxide on Photosynthesis, Transpiration, Water-Use Efficiency, and Productivity of Soybeans, 1982				10	N/A
DA008	Soybean Responses to Carbon Dioxide: Measurement and Simulation, 1982				14	N/A
DA009	Field Studies of Plant Responses to Elevated Carbon Dioxide Levels, 1982				7	N/A
DA010	Effects of Carbon Dioxide Enrichment on Nitrogen Fixation in Soybeans, 1982				9	N/A
DA011	The Simulation, with GLYCIM, of Soybean Crops Grown in the Field and at Various CO ₂ Concentrations in Open-Top Chambers During 1982				8	N/A

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DA012	Field Studies of Plant Responses to Elevated Carbon Dioxide Levels, 1983				12	N/A
DA014	Effects of Increased Carbon Dioxide and Water Stress Interactions on Photosynthesis, Transpiration, and Productivity of Soybeans, 1983				4	N/A
DA019	The Response of Arctic Ecosystems to Elevated Carbon Dioxide Regimes, 1984				15	6
DA020	Radiation Densitometry in Tree-Ring Analysis: A Review and Procedure Manual, 1985				44	13
DA021	Effects of Increasing Atmospheric CO ₂ on the Yield and Water Use of Crops, 1983				9	N/A
DA022	Field Studies of Sweet Potatoes and Cowpeas in Response to Elevated Carbon Dioxide, 1985	2	1	3	52	8
DA023	Effects of Increasing Atmospheric CO ₂ on the Yield and Water Use of Crops, 1984				13	15
DA024	Sorghum at Elevated Levels of CO ₂				12	N/A
DA025	Preliminary Ring-Width and Ring-Density Data for Deriving Wood Mass Chronologies of Coniferous Species from the Northwest U.S. and Canada				5	16
DA026	Western U.S. Tree-Ring Index Chronology Data for Detection of Arboreal Response to Increasing Carbon Dioxide				10	N/A

Table 3. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
DA027	Western U.S. Tree-Ring Index Chronology Data for Detection of Arboreal Response to Increasing Carbon Dioxide				6	N/A
DA028	Assessing the Effects of Elevated Carbon Dioxide on Plants: Towards the Development of a Generic Plant Growth Model				18	31
DA033	Influence of Nutrition on Vegetation Response to Carbon Dioxide. I. Interactions of Nitrogen and Phosphorus Supply on Soybean Growth and Nutritional Parameters, 1986				6	N/A
DA034	Effects of Elevated Carbon Dioxide on Chesapeake Bay Wetlands. I. Description of the Study Site				4	N/A
DA040	Effect of Elevated Levels of CO ₂ on Winter Wheat Under Two Moisture Regimes				1	N/A
DA041	SERECO: A Model for the Simulation of Ecosystem Response to Elevated CO ₂ Parts I-III				1	N/A
DA042	PRECO: A Model for the Simulation of Plant Response to Elevated CO ₂ Parts I-III				7	N/A
Total		518	1,764	2,282	41,086	

N/A - No longer available from CDIAC

Table 4. CDIAC reports distribution

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
CDIAC-13	Direct Effects of Atmospheric CO ₂ Enrichment on Plants and Ecosystems: A Bibliography with Abstracts, June 1986	2	5	7	25	18
CDIAC-21	Graduate Student Theses Supported by Carbon Dioxide Research Division Office of Basic Energy Sciences, U.S. Department of Energy, September 1987	3		3	29	6
CDIAC-23	Preliminary Development of a Seashore-Effects Analysis System, February 1989				38	6
CDIAC-24/V1	Bibliography on Tropical Rain Forests and the Global Carbon Cycle. Vol. 1. An Introduction to the Literature, May 1988	3	6	9	100	50
CDIAC-24/V2	Bibliography on Tropical Rain Forests and the Global Carbon Cycle. Vol. 2. South Asia, February 1989	2	4	6	94	101
CDIAC-28	Environmental Consequences of CO ₂ -Climate Interactions: The Need for Integrated Resource Analysis, January 1989	2	2	4	82	10
CDIAC-32	A Plan for Intermodel Comparison of Atmospheric CO ₂ Projections with Uncertainty Analysis, June 1990	4	1	5	50	52
CDIAC-33	Environmental Atlas of the Iowa-Kansas-Missouri-Nebraska Climate-Change Study Region, March 1990	1	3	4	16	38
CDIAC-34	Catalog of Data Bases and Reports				4376	N/A

Table 4. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
CDIAC-34/R2	Catalog of Data Bases and Reports	638	327	965	1374	*
CDIAC-34/R3	1993		64	64	64	*
CDIAC-36	<i>Trends '90: A Compendium of Data on Global Change</i> , August 1990	12	1	13	8215	N/A
CDIAC-38	Documentation and Analysis of a Global CO ₂ Model. Developed by Peng et al. (1983), June 1990	8	2	10	60	60
CDIAC-39	Glossary: Carbon Dioxide and Climate, August 1990	541	526	1067	4430	562
CDIAC-46	<i>Trends '91: A Compendium of Data on Global Change</i> , December 1991	656	281	937	2628	278
CDIAC-48	Carbon Dioxide Information Analysis Center: FY 1991 Activities	3	1	4	107	N/A
CDIAC-49	<i>Trends '91: A Compendium of Data on Global Change</i> , Highlights	88	103	191	430	138
CDIAC-52	Climate Change and Water Supply, Management and Use: A Literature Review	1		1	3	37
CDIAC-54	Adapting to Sea Level Rise in the U.S. Southeast	6	3	9	9	100
CDIAC-57	Selected Translated Abstracts of Russian-Language Climate-Change Publications	20	27	47	47	625
CDIAC-58	Carbon Dioxide Information Analysis Center: FY 1992 Activities		7	7	7	
CDIAC-62	CDIAC Catalog Numeric Data Packages and Computer Model Packages		190	190	190	

Table 4. (continued)

Report number	Title and contents	FY 1993		Total	Total FY 1985 to date	Remaining copies
		Qtrs 1-2	Qtrs 3-4			
	<i>CDIAC Communications</i>	745	602	1347	7230	^b
	<i>ARM Outreach</i> newsletter	404	332	736	890	
	CDIAC Factsheets	479	529	1008	7134	^a
	DOE Research Summaries	1453	1117	2570	5281	
	Total	5,071	4,133	9,204	42,909	

^aThese documents are updated periodically and reprinted to satisfy requests

^bNew issues produced several times a year, the number here represents distribution beyond the mailing to subscribers.

World Directory of Global Change Researchers and Policymakers

Developing and maintaining an active inventory of researchers, policy scientists, administrators, officials, educators, librarians and communications specialists are essential activities for the successful dissemination of CDIAC's derived-information products, publications, and other services. Over the course of six years' efforts, CDIAC has compiled such an inventory in its *World Directory of Global Change Researchers and Policymakers*. This inventory consists of 8,673 individuals in 152 countries (Fig. 7). Table 5 details activities in CDIAC's World Directory. Universities (29%) and government agencies (32%) comprise the two largest categories in the World Directory (Fig. 8). Names were added to the directory from key national and international climate-change committees and working groups, lists of conference and seminar attendees (not only from the traditional scientific communities but also, as the topic is rapidly expanding, from the social sciences and humanities disciplines), and other directories of potential CDIAC users (e.g., state environmental agency staff, electric utility managers, special libraries, environmental media specialists and reporters, special and public interest groups). This directory is used primarily as an in-house reference by program managers and sponsors. Special, limited arrangements have been made for sharing directory information with persons and organizations outside CDIAC or DOE.

Total participants for FY 1993 = 8,673

Table 5. Participants activity

Category	Quarter FY 1993		Total
	Qtrs 1-2	Qtrs 3-4	
U.S. members	408	519	927
Foreign embassies (in United States)	2	0	2
Foreign members (143 countries)	301	242	543
Total additions	711	761	1,472
Total deletions	165	118	283
Net additions	546	643	1,189

The format of the World Directory was changed to reduce the costs of publication and distribution. The directory was produced as a single volume with U.S. and foreign entries identified in Appendixes A and B, respectively. All phone numbers, FAX numbers, and E-mail addresses, when available, are included with each name and address entry. The foreign and telephone directories previously produced are now combined in one comprehensive directory.

Table 6. Alphabetical listing of countries and their outlying territories^a and the number of participants listed in the World Directory of Researchers and Policymakers

		September 1993			
No.	Country	No.	Country	No.	Country
1	Afghanistan	9	Greece	1	Panama
1	Albania	2	Guatemala	4	Papua New Guinea
6	Algeria	1	Guinea	2	Paraguay
1	Angola	1	Guinea-Bissau	4	Peru
19	Argentina	2	Guyana	21	Philippines
367	Australia	1	Haiti	25	Poland
54	Austria	2	Honduras	2	Portugal
1	Bahamas	5	Hong Kong	1	Qatar
1	Bahrain	12	Hungary	7	Romania
6	Bangladesh	4	Iceland	110	Russia
3	Barbados	93	India	1	Rwanda
102	Belgium	11	Indonesia	1	St. Lucia
1	Belize	1	Iran	1	Sao Tome & Principe
1	Benin	19	Ireland	10	Saudi Arabia
4	Bolivia	26	Israel	5	Senegal
2	Botswana	61	Italy	1	Seychelles
38	Brazil	1	Ivory Coast	1	Sierra Leone
2	Brunei	2	Jamaica	7	Singapore
8	Bulgaria	125	Japan	1	Solomon Islands
2	Burkina Faso	6	Jordan	17	South Africa
2	Burma	35	Kenya	14	South Korea
1	Burundi	1	Laos	27	Spain
1	Byelorussia	1	Lebanon	11	Sri Lanka
1	Cameroon	1	Lesotho	4	Sudan
260	Canada	1	Libya	1	Suriname
2	Cape Verde	2	Lithuania	1	Swaziland
2	Central African Republic	3	Luxembourg	52	Sweden
1	Chad	1	Madagascar	88	Switzerland
10	Chile	2	Malawi	1	Syria
99	China, People's Republic of	63	Malaysia	13	Taiwan
5	Colombia	1	Maldives	6	Tanzania
1	Congo	1	Mali	20	Thailand
8	Costa Rica	4	Malta	2	Togo
8	Cuba	1	Marshall Islands	4	Trinidad/Tobago
3	Cyprus	1	Mauritania	1	Tunisia
4	Czechoslovakia	2	Mauritius	4	Turkey
19	Denmark	11	Mexico	4	Uganda
1	Djibouti	3	Monaco	4	Ukraine
1	Dominican Republic	2	Mongolia	241	United Kingdom
3	Ecuador	1	Morocco	5795	United States
17	Egypt	1	Mozambique	3	Uruguay
2	El Salvador	4	Nepal	1	Uzbek
3	Estonia	2	Netherland Antilles	7	Venezuela
7	Ethiopia	93	Netherlands	2	Vietnam
7	Fiji	31	New Zealand	5	Western Samoa
18	Finland	1	Nicaragua	3	Yemen
110	France	5	Niger	3	Yugoslavia
1	Gabon	18	Nigeria	1	Zaire
1	Gambia	2	North Korea	3	Zambia
184	Germany	31	Norway	5	Zimbabwe
7	Ghana	7	Pakistan		

^aAs defined in *The Statesmen's Year-Book*, John Paxton, ed., 1985.

Fig. 7. Countries represented in the World Directory.

Fig. 8. World Directory affiliations for FY 1993.

Systems

CDIAC relies heavily on computers to carry out our duties as an information center. Data acquisition, data validation, data distribution, data archival, maintaining customer data bases, and filling customer requests are but a few of the routine operations that require the use of various computer systems. Over the years we have developed a number of computer systems to assist us in our daily operations. The past year has been a busy period for computer systems development at CDIAC.

CDIAC Computing System Network (CCSN)

- The CCSN has been improved through the addition of several new pieces of hardware and software. These improvements are consistent with our goal of independence from reliance on ORNL hardware resources and the associated lack of control over increasing operating costs. Improvements to the CCSN during the past 6 months include the following:
- The CDIAC central server was upgraded from a SPARCstation 1+ to a SPARCstation 2. This upgrade provides a 45% increase in CPU speed.
- An additional 1.2 gigabytes of disk storage space has been added to the CDIAC server.
- All workstations have been upgraded to at least 20Mbytes of random-access memory (RAM). This additional memory increases the performance of the SAS products and ARC/INFO GIS software. After the optical jukebox's early software problems were remedied, the jukebox was experiencing heavy usage. This heavy usage unfortunately led to a hardware failure within the jukebox. The hardware was under a maintenance agreement, and the repairs were at no cost to CDIAC. Our reliance on optical storage has brought to our attention the need for a backup optical device capable of reading the ISO compliant platters written by our jukebox. We hope to procure a manual single-drive optical unit as funding permits. We are also conducting a review of our ever-changing storage needs in order to develop a long-range hardware acquisition plan consistent with our needs.

CDIAC Information System (CIS)

- Request-Response Record System (R³)/World Directory

Design specifications for Phase II of the CIS were developed and reviewed, and the contract for development of Phase II of the CIS was awarded to Science Applications International Corporation (SAIC).

Meetings to detail the requirements of the CIS were held with SAIC representatives, and work on Phase II was initiated.

Optimization of the use of CIS indices led to startling performance improvements. For example, the time required to do a customer name search was reduced by more than a factor of 10. These performance improvements greatly enhance our ability to query historical CIS records. Upon receiving a telephone call from a CDIAC customer, we will be able to search for the person's name and display all information on all orders ever placed by the caller in a matter of seconds.

CDIAC Anonymous FTP

- The CCSN anonymous FTP server has proved popular with CDIAC customers and was heavily utilized during this, its first year of operation. In fact, with all NDP data freely accessible worldwide to customers who are on Internet, we sometimes find it difficult to keep track of who is requesting our data. Routines have been written to track anonymous FTP requestors to the extent possible. We are investigating alternatives for better identifying FTP requestors. We seek to strike a balance between ease of accessibility for our customers and accountability for the products we distribute.

Communications

- **Trends '93**

Work is in progress on the document *Trends '93: A Compendium of Data on Global Change*. As in *Trends '91*, *Trends '93* will include the generation of the introductory and time series graphics for each chapter and the compilation and writing of the chapter "Other Trace Gases," to be renamed "Other Trace Gases and Atmospheric Aerosols." In *Trends '93*, for the CO₂ chapter, there will be significant new inclusions in addition to the extensions to each of the time series presented in *Trends '91* and the inclusion of isotopic records. In the atmospheric CH₄ chapter, additions will be two new ice core records, three or more new independent in situ monitoring programs, one new global record, and a significant expansion in the number of sites included for an existing monitoring network (the NOAA/CMDL flask monitoring network). A new chapter of precipitation records will be developed.

For the "other trace gases" chapter, new material will include two N₂O ice core records, two additional sets of CFC emissions estimates, atmospheric concentration data from two globally distributed monitoring networks (the NOAA/CMDL halocarbon flask sampling network and the NOAA/CMDL halocarbon continuous monitoring network), and data on atmospheric aerosols (transmission and optical density) from four globally distributed sites. Besides including new data sets and new monitoring sites, the chapter will also expand by presenting data for additional trace gas species not featured in *Trends '91*. These new gases will include methyl chloroform, HCFC-22, and two halons (H-1301 and H-1211).

Bob Sepanski's contribution to the *Trends '93* document included writing the chapters "Atmospheric CH₄" and "Other Trace Gases and Atmospheric Aerosols." In each of these chapters he included a significant amount of new information in addition to the extensions to each of the time series presented in *Trends '91*. New features of *Trends '93* include CH₄ and N₂O data from new ice cores, modern atmospheric CH₄ and halocarbon measurements from new collection sites and new monitoring networks, and atmospheric aerosol transmittance and optical depth data from a number of globally distributed sites.

Bob Sepanski attended the annual meeting of the NOAA/CMDL in Boulder, Colorado, March 1993. As an outcome, several new trace gas and atmospheric aerosol data sets were obtained by CDIAC. For example, two new data sets related to atmospheric aerosols were obtained from Dr. Ellsworth Dutton of NOAA/CMDL. These data will appear in *Trends '93* and constitute a significant expansion of CDIAC data holdings in the area of atmospheric aerosols. As another example, several new data sets related to atmospheric halocarbons were obtained from Dr. James Elkins and his colleagues at NOAA/CMDL. Some of these data will also appear in *Trends '93* and possibly in one or more NDPs. The data sets will present atmospheric mixing ratios of chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, and nitrous oxide (N₂O) from a network of globally distributed sites.

- **DOE Research Summaries**

The popularity of this research and development (R&D) series continues to grow. By the close of the second quarter of FY 1993, a total of 1957 names were on the *DOE Research Summary* distribution list (1414 U.S., 543 foreign).

Titles in the series produced in the first half of FY 1993 are as follows:

No. 20	October 1992	<i>SEAHUNT: A Study of Marine Stratocumulus Cloud Sensitivity to Climate Parameters Using Ship-Trail Clouds.</i> William M. Porch
No. 21	November 1992	<i>Concurrent Aircraft-Based Measurement of Oceanic Whitecap Coverage and Microwave Brightness Temperature.</i> William E. Asher, Peter M. Smith, and Edward C. Monahan

- No. 22 December 1992 *Isotopic Estimation of Inputs of Carbon to Cotton Soils Under FACE CO₂ Enrichment*. Steven W. Leavitt, Bruce A. Kimball, Eldor A. Paul, and George R. Hendrey
- No. 23 January 1993 *Measurement of Bubble Size Spectra in a Whitecap Simulation Tank Using Phased-Doppler Anemometry*. William E. Asher and Paul J. Farley
- No. 24 July 1993 *Deep Oceanic Convection: Two-Dimensional Model Validation and Numerical Experiments*. Donald W. Denbo and Eric D. Skyllingstad
- No. 25 August 1993 *Recent Changes in Arctic Temperature Inversions*. Raymond S. Bradley, Frank T. Keimig, and Henry F. Diaz

Several authors of this series have expressed their thanks with the production of their research in the format of the series. Sandra Brown and her coauthors requested extra copies of DOERS No. 18 to use as handouts for various programs and correspondence. The authors were extremely pleased with CDIAC's treatment of the map of India and surrounding countries. The production of this map was the first electronic transfer of GIS files in the SUN Sparc work stations. Tammy White played a pivotal role in the successful transfer of the map and the subsequent redefining of the coverages to facilitate the monochromatic printing of the map as it appeared.

Dr. James Hudson (DOERS No. 15) requested figures redrawn by ORNL's ESD Graphics group for use as camera-ready illustrations for a manuscript submitted for publication.

Several newsletter editors have included reviews or further condensations of these summaries in their publications, and DOE's Office of Scientific and Technical Information (OSTI) now includes these titles in the DOE-supported bibliographic data base, *Energy Science and Technology Online*, and in the DOE current awareness data base, *Research in Progress*.

- CDIAC produced a new document, *Catalog of Numeric Data Packages and Computer Model Packages*, ORNL/CDIAC-62, ESD Publication No. 4008. This catalog provides a detailed description of each NDP and CMP. The entries are accompanied by a representative illustration. An introduction to the catalog is a comprehensive review of the process by which these specialized numeric data are evaluated and compiled for distribution to a broad constituent of users. A matrix lists the media types (floppy diskette, magnetic tape, CD-ROM, FTP) in which the data packages are available, and the number of data files and largest size available are included.
- Production of *CDIAC Communications*, No. 18, Spring 1993, was completed. This issue continues the series of articles on data management related to the U.S. Global Change Research Program and features a lead article on CDIAC's becoming a world data center.
- CDIAC's publications are gaining considerable attention and respect in the professional literature of the life, physical, and policy sciences. CDIAC's documents, in particular *Trends '90* and *Trends '91*, are being cited as primary sources of data. The following scholarly sources have either cited as a primary source of information or acknowledged the *Trends* reports, CDIAC's NDPs or CMPs, or the DOE Technical Reports distributed by CDIAC:

Indexes and Abstracts

Global Climate Change Digest
Greenhouse Gases Bulletin
Energy Science and Technology
Environment Abstracts
Environment/Energy Abstracts on CD-ROM
EPRINet
ISI Focus on Global Change

Meteorological and Geostrophysical Abstracts
National Technical Information Service
Research in Progress
Science Citation Index
Social Science Citation Index

Books and Reports

Climate Change—IPCC Response Strategies
Data: Where It Is and How To Get It—The 1993 Directory of Business, Environment and Energy Data Sources (Coleman/Morse Associates)
Earth in the Balance (Sen. Albert Gore)
Emissions of Greenhouse Gases in the United States 1985–1990 (U.S. DOE)
Encyclopedia of Environmental Information Sources (Gale Research)
Environmental Almanac (World Resources Institute)
The Environmental Source Book (Edith C. Stein)
Environmental Quality (U.S. Council on Environmental Quality)
Estimates of Carbon Dioxide Emissions from Fossil Fuels Combustion in the Main Sectors of Selected Countries 1971–1990 (Germany)
A Guide to Selected National Environmental Statistics in the U.S. Government
National Action Plan for Global Climate Change (U.S. Department of State)
Policy Implications for Greenhouse Warming (NAS)
Research to Protect, Restore, and Manage the Environment (NRC/NAS)
State of the World (Worldwatch Institute)
A State of the Environment Report (Environment Canada)
Vital Signs (Worldwatch Institute)

Newsletters

Delta
Global Change Newsletter [International Geosphere-Biosphere Programme (IGBP)]
Global Climate Change Digest
The GCC Newsletter (Global Climate Change Information Programme)
Global Warming Network Online Today
U.S. JGOFS Newsletter

Journals

<i>Ambio</i>	<i>Futurist</i>
<i>Annals of Botany</i>	<i>Geochimica et Cosmochemica Acta</i>
<i>Annual Review of Energy and the Environment</i>	<i>Geophysical Research Letters</i>
<i>Australian Journal of Plant Physiology</i>	<i>Global Biogeochemical Cycles</i>
<i>Bulletin of the American Meteorological Society</i>	<i>IEE Proceedings-A</i> (Science Measurement and Technology)
<i>Canadian Journal of Forest Research</i>	<i>International Journal of Climatology</i>
<i>Chemosphere</i>	<i>Journal of Climate</i>
<i>Climatic Change</i>	<i>Journal of Experimental Botany</i>
<i>Doklady Akademii Nauk SSSR</i>	<i>Journal of Geophysical Research</i>
<i>Ecological Modeling</i>	<i>Journal of the Iron and Steel Industry of Japan</i>
<i>Ecology</i>	<i>Limnology and Oceanography</i>
<i>The Economist</i>	<i>Marine Chemistry</i>
<i>Energy</i>	<i>Nature</i>
<i>Environment</i>	<i>Oecologia</i>
<i>Environmental Conservation</i>	<i>Progress in Energy and Combustion Science</i>
<i>Environmental Management</i>	<i>Radiocarbon</i>
<i>Environmental Science and Toxicology</i>	<i>Science</i>
<i>Environmental Technology</i>	<i>Science of the Total Environment</i>
<i>Environmental Toxicology and Chemistry</i>	<i>Water, Air, and Soil Pollution</i>
<i>Forest Ecology and Management</i>	

- **New at the Energy Library (DOE)**

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ENVIRONews

E.R.M.D. Newsletter (Environmental and Resource Management Division of the Special Libraries Association)

- CDIAC was cited in the report *The National Laboratories of the U.S. Department of Energy* in the chapter, "Enhancing Environmental Quality." Specifically, CDIAC was mentioned for becoming a WDC, and for its efforts to provide "... extensive information and value-added data to the worldwide research communities."
- An updated version of CDIAC's factsheet, *Specialty Newsletters: Global Studies and Climate Change*, was requested by Linda Musser, librarian in the Earth and Minerals Library at Pennsylvania State University. The contents of the factsheet are being used as a sidebar to an article Musser has submitted for publication (in *Serials Review*) describing the periodic literature related to earth systems science.
- The factsheet, *Specialty Newsletters: Global Studies and Climate Change*, was revised. This factsheet is revised frequently and now contains nearly 150 titles of newsletters frequently or solely providing coverage of the issues related to global environmental change, including climate change. The section on newsletter information now available online has expanded, and those newsletters now available through FTP access on the Internet have been noted.
- The Notable Documents Panel of the American Library Association coordinates activities to identify and promote the availability of documents produced by the federal government that because of their uniqueness, topical coverage, or other characteristics may be deemed notable and acceptable for listing in the ALA periodical the *Library Journal*. CDIAC has been asked to submit several titles for consideration in this year's select listing. *CDIAC Communications, Glossary: Carbon Dioxide and Climate* and CDIAC's *Catalog of Numeric Data Packages and Computer Model Packages* will be submitted. *Trends '93* will be submitted for next year's review.
- CDIAC continued sending its reports and periodicals to the DOE Energy Library in Germantown, Maryland, and is receiving the library's monthly bulletin *New at the Energy Library*.
- The DOE Office of Scientific and Technical Information has undergone several administrative changes and has been asked to increase its efforts in identifying sources of global change-related information from developing countries. This information will be incorporated into DOE's bibliographic system. CDIAC continues to work with OSTI staff in identifying materials for this effort and also assists with the ongoing international activities of the Energy Technology Data Exchange.

Collaborative Efforts with China

DOE and the People's Republic of China's (PRC-CAS) Academy of Sciences signed an agreement on August 19, 1987, to carry out a joint research program on the study of global warming as a result of enhanced greenhouse effect. The joint program has four tasks—analysis of general circulation models (GCMs), preparation and analysis of proxy and instrumental data, the study of the relationship between large- and regional-scale climates, and measuring and analyzing CH₄ emissions from rice paddy fields in China.

In the early years of the agreement, CDIAC provided computer hardware and software support to the Institutes of Atmospheric Physics and Geography and developed protocols for data exchange. During the ensuing years as data collection and compilation efforts intensified and progressed, CDIAC's principal role became one of archiving, documenting, and distributing data sets generated under the U.S.-DOE/PRC-CAS bilateral agreement. To date, CDIAC has archived ~20 data bases, fully documented 8 U.S. and PRC instrumental climate data bases, and distributed ~1000 copies of these documented data bases and DOE technical reports to individuals in more than 100 countries. More recently, as data collection and compilation efforts have eased, CDIAC has focused on data analysis and larger data compilation efforts.

- CDIAC did not receive any new data bases or updates to existing data bases from the PRC's Institutes of Geography (IG) or Atmospheric Physics (IAP).
- CDIAC received preliminary long-term climate data for ~40 stations in Alaska from the NCDC (Asheville, North Carolina). This data base is intended to extend the coverage of the Historical Climatology Network (HCN) beyond the contiguous United States and provide good data for a northerly region that may be susceptible to climate change. CDIAC performed various checks on the data and discovered very few suspicious or erroneous values. This data base will be made available from CDIAC during FY 1994.
- Dale Kaiser published a DOE technical report (TR055) that describes five PRC instrumental data sets compiled by IAP. The data base includes records from 296 stations and presents information on barometric pressure, surface air temperature, precipitation amount, relative humidity, sunshine duration, cloud amount, wind direction and speed, and number of days with snow cover. For 16 stations, the period of record begins before 1900. These data sets represent the most comprehensive, long-term instrumental Chinese climate data currently available and will be useful for studies of global and regional climate change. Two of these data sets, a 60- and 205-station data set, were documented fully in an NDP (NDP-039) published during FY 1992.
- Tom Boden traveled to Beijing, from September 20–23 for the Sixth Science Team Meeting and presented a talk entitled "Data Archival, Documentation, and Distribution Activities Performed by the Carbon Dioxide Information Analysis Center in Support of the US/DOE—PRC/CAS Bilateral Agreement." At this meeting, it was decided that during the next 3-year-funding period CDIAC's role would be essentially unchanged and entail archiving, documenting, and distributing the CH₄ flux measurements from Tu Zu, the updates to the climate data bases prepared by NCDC, and the updates to the 60-station network prepared by PRC's IAP.

Numeric Data Documentation and Distribution

Requests for NDPs and CMPs

- CDIAC filled 960 requests from 59 countries for 1888 copies of NDPs, 85 copies of the PC version of the Institute of Energy Analysis/Oak Ridge Associated Universities Long-Term Global Energy CO₂ Model (plus two copies of the mainframe version), and 262 copies of *Trends '91* data on diskette (total = 2237 numeric data types). These requests continue to demonstrate the worldwide distribution of CDIAC's data products (Figs. 9 and 10). In filling these requests for machine-readable files, 301 9-track magnetic tapes, 1172 floppy diskettes, 2 QIC 1/4 in. tapes, and 5 8-mm Exabyte® tapes were generated. CDIAC also had requests for 23 copies of its CD-ROM during FY 1993. Distribution of CDIAC's NDPs continues to grow (Fig. 11).
- During FY 1993 ~1155 individuals accessed CDIAC's anonymous FTP area and retrieved over 1800 data and computer model files. In CDIAC's follow-up with these individuals, over half accepted our offer to send the NDP and CMP documentation that accompanies the files they retrieved from our anonymous FTP area.

Extraordinary Request

- The Global Historical Climatology Network: Long-Term Monthly Temperature, Precipitation, Sea Level Pressure, and Station Pressure Data (NDP-041) was subsetting and reformatted for Dr. Ernest Rosenberg at PEMD Education Group, Ltd. (Cloverdale, California) by Debbie Shepherd and Russell Vose. The programming effort and time commitment were undertaken in part because of PEMD's support of the educational community at the elementary and high school levels. The work was also done as support of a "user" with limited computing capabilities.

New NDPs

- NDP-43A *A Coastal Hazards Data Base for the U.S. East Coast*

This NDP describes the contents of a digital data base that may be used by raster or vector GISs and non-GIS data bases to access the risks of coastlines to erosion or sea level rise. Each U.S. East Coast grid cell contains data on geology, geomorphology, elevation, wave heights, tidal ranges, shoreline displacement (erosion), and sea level trends. Documentation for this NDP contains information on the methods used in calculating each variable, detailed descriptions of file contents and formats, and a discussion of the sources, restrictions, and limitations of the data.

- NDP-044 *Surface Water and Atmospheric Carbon Dioxide and Nitrous Oxide Observations by Shipboard Automated Gas Chromatography: Results from Expeditions between 1977 and 1990.*

This NDP presents the results of surface water and atmospheric CO₂ and N₂O measurements carried out by shipboard gas chromatography over the period 1977–1990. These data comprise measurements taken from 11 different oceanic surveys for a total of 41 expedition legs. The measurements were made by an automated high-precision shipboard gas chromatographic system developed by R. F. Weiss during the late 1970s and used extensively over the intervening years. This instrument measures CO₂ by flame ionization after quantitative reaction to CH₄ in a stream of hydrogen. Nitrous oxide is measured by a separate electron capture detector. The chromatographic system measures 196 dry-gas samples a day, divided equally among the atmosphere, gas equilibrated with surface water, a low-range gas standard, and a high-range gas standard.

These data constitute one of the most extensive records available of CO₂ and, particularly, N₂O concentrations in marine air and surface seawater. The data are valuable in modeling applications dealing with the ocean's role in the global cycles of carbon and nitrogen, in studies of ocean-atmosphere dynamics, and in studies evaluating other methodologies for determining pCO₂.

There were 960 requests for 2237 numeric data types from 59 countries.

Fig. 9. Numeric data requests world map for FY 1993.

There were 3922 requests for CDIAC services and products from 73 Countries

Fig. 10. Numeric data distribution world map FY 1985 through FY 1993.

Fig. 11. Numeric data distribution graph FY 1985 through FY 1993.

Updates to Existing NDPs

- CDIAC is updating documentation (NDP-001/R3) that presents the atmospheric CO₂ concentration records from Mauna Loa, Hawaii compiled by Dave Keeling and his colleagues at Scripps Institution of Oceanography. This update will offer daily, monthly, and annual atmospheric CO₂ mixing ratios through 1992. The last version of the NDP presented only monthly and annual data through 1988.
- CDIAC delayed updating the documentation (NDP-005) for the NOAA/CMDL atmospheric CO₂ concentration records from their flask and in situ sampling networks at the request of the principal investigator, Tom Conway, to allow sufficient time for inclusion of the 1991 data and recalibration of standard gases (and possible revisions to earlier portions of the data base). The update will be completed in 1994.
- Documentation (NDP-017) that presents Jerry Olson's gridded, global ecosystem complexes data base is being modified to reflect the newer versions of the data base presently available. The version distributed by CDIAC documents Olson's map and is the most frequently used.
- Mac Post (ESD, Earth Systems Modeling Group) is coordinating efforts to improve Zinke et al.'s organic soil carbon and nitrogen profile data base (NDP-018). This data base, which contains data from over 3500 soil profiles taken around the world, is one of the best and most frequently used data bases for studies attempting to determine the amount of carbon sequestered in the soil. The previous NDP contains only 1-m summary profiles for select variables. Inclusion of other profiles (~1200), addition of cation measurements, and assignment of Food and Agriculture Organization (FAO) soil taxonomy classifications to each soil profile would greatly enhance the utility of the data base (e.g., studies of the soil carbon dynamics in tropical forests). CDIAC's role in this project will probably entail reformatting and merging data sets and documenting the enhanced data set.
- CDIAC is updating the documentation (NDP-030/R5) for Gregg Marland's global, regional, and national CO₂ emission estimates through 1991. The most important addition to the updated documentation, beyond expanding the time series, is a detailed explanation of how the CO₂ emission estimates from gas flaring are calculated. No previous Marland and Rotty papers or NDPs described the supplemental gas flaring data used in generating the estimates, described how the global estimates were generated, or explained the derivation of the carbon coefficients.
- NDP-038/R1 *Atmospheric Methane Mixing Ratios—The NOAA/CMDL Global Cooperative Air Sampling Network, 1983–1992.*

This NDP is an updated package that will present monthly averages of atmospheric CH₄ mixing ratios from the NOAA Climate Monitoring and Diagnostics Laboratory (NOAA/CMDL) global cooperative air sampling network from 1983 through 1992. The data are derived from a network of 46 stations, which include 32 land-based sites and 14 Pacific Ocean shipboard "sites" (each of which actually comprises two or more longitudinally separated sampling locations at a fixed latitude). At each location, air samples were collected in flasks approximately once per week for measurement of CH₄ and other trace gases. The samples were analyzed for atmospheric CH₄ on a gas chromatograph (fitted with a flame ionization detector) at the NOAA/CMDL laboratory in Boulder, Colorado. These data represent the most spatially comprehensive atmospheric CH₄ record in the world.

The data consist of station identification code, year, and mean monthly CH₄ mixing ratio. The package differs from the original version, NDP-038, in three ways: (1) the end of the record period has been extended from 1988 in the original to 1992 in the updated version; (2) the network has been expanded from 31 stations to 46 stations and now includes shipboard as well as land-based sites; (3) the method by which the mean monthly mixing ratios were derived from individual measurements has been changed, and sampling statistics (i.e., number of samples and standard deviations) are no longer provided.

New NDPs in Progress

- NDP-040 *Daily Temperature and Precipitation Data for 223 U.S.S.R. Stations*

Under an international agreement, the NCDC is exchanging climatological information with the RIHMI. To expedite the dissemination of these data, CDIAC, with funding provided by NCDC, is distributing one of the more useful archives acquired through this exchange: a 223-station daily data set covering the years from 1881 to 1989. The data set contains (1) minimum, mean, and maximum daily temperatures; (2) daily precipitation; (3) station inventory information [i.e., World Meteorological Organization (WMO) number, name, coordinates, and elevation]; (4) station history (i.e., station relocation and rain-gage replacement information); and (5) quality-assurance information (i.e., flag codes that were assigned as a result of various data checks.). The data are in 18 files.

- NDP-43B *A Coastal Hazards Data Base for the U.S. Gulf Coast.*

This document describes the contents of a digital data base that may be used to identify coastlines along the U.S. Gulf Coast at risk to sea-level rise. The data base integrates point, line, and polygon data for the U.S. Gulf Coast into 0.25° latitude by 0.25° longitude grid cells and into 1:2,000,000 digitized line segments that can be used by raster or vector GIS as well as by non-GIS data base systems. Each coastal grid cell and/or line segment contains data on elevations, geology, geomorphology, sea-level trends, shoreline displacement (erosion/accretion), tidal ranges, and wave heights. To allow for the identification of coastlines at risk from sea-level rise, 7 of the 22 original data variables in this data base were classified by vulnerability and used to create 7 relative risk variables. These relative risk variables range in value from 1 to 5 and may be used to calculate a coastal vulnerability index for each grid cell and/or line segment.

This data base and the corresponding coastal vulnerability indices (CVIs) may be used to identify coastal zones that are at risk from coastal erosion or possible changes in relative sea level.

- NDP-045 *Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the METEOR Expedition 11/5 in the South Atlantic and Northern Weddell Sea Areas.*

This document provides and describes CO₂, hydrographic, and chemical data obtained by the F/S METEOR Expedition 11/5 in the south Atlantic Ocean and Northern Weddell Sea. This cruise was conducted as part of the World Ocean Circulation Experiment (WOCE), which is an attempt to collect oceanographic data that will enable a better understanding of ocean processes and the global carbon cycle.

The cruise started from Ushuaia, Argentina, on January 21, 1990, and ended at Capetown, South Africa, on March 7, 1990. Seventy-seven stations were sampled which covered the Drake Passage (56°S - 63°S), the Northern Weddell Sea (45°W - 35°W), a section along the 58°W parallel (25°W - prime meridian), and two segmented S-N sections between the Northern Weddell Sea and Capetown, South Africa. Measurements taken at each station included pressure, depth, temperature, salinity, PO₄, oxygen, SiO₃, TCO₂, pCO₂, NO₃, and NO₂. In addition, potential densities at 0, 2000, and 4000 decibars, potential temperature, apparent oxygen utilization, and total alkalinity were all calculated from the measured variable. The information will yield a better understanding of the oceans, particularly the depth and geographic distribution of the total CO₂ concentration and pCO₂ in seawater over high-latitude areas of the South Atlantic Ocean, as well as how it relates to global climate change.

- NDP-046 *Historic Land Use and Carbon Estimates for South and Southeast Asia: 1880–1980.*

This document describes the contents of a digital data base containing estimates of land-use change and the carbon content of vegetation for South and Southeast Asia for the years 1880, 1920, 1950, 1970, and 1980. These data were originally collected so that climate modelers could reduce the uncertainty associated with the estimation of the magnitude and time course of carbon release related to historic land-use change. For this data base, South and Southeast Asia are defined as encompassing nearly 8×10^6 km² of the world's land surface and including the countries of India, Sri Lanka, Bangladesh, Myanmar (Burma), Thailand, Laos, Kampuchea (Cambodia), Vietnam, Malaysia, Brunei, Singapore, Indonesia, and the Philippines.

The most important change in land use over the 100-year period was the conversion of 111×10^6 ha of forest land to other low biomass categories. Land thus transformed accounted for 13.8% of the total area of the study region. The estimated total carbon content of live vegetation in South and Southeast Asia has dropped progressively from 59×10^9 Mg in 1880 to 27×10^9 Mg in 1980—almost half of the initial 1880 value. Throughout the study period, the carbon stock in forest was greater than the carbon content in all other categories combined, although its share of the total declined progressively from 81% in 1880 to 73% in 1980.

The data base itself was developed in Lotus 1-2-3™ using a sequential bookkeeping model. The source data were obtained at the local and regional levels for each country from official agricultural and economic statistics (e.g., the UN FAO); from historic geographic and demographic texts, reports, and articles; and from any other available source. Because of boundary changes through time and disparities between the validity, availability, and scale of the data for each country, the data were aggregated into 94 ecological zones. The resulting data base contains land-use and carbon information for 94 ecological zones and national totals for 13 countries.

These data are available as an NDP from CDIAC. The NDP includes this document and a set of data files consisting of 90 Lotus 1-2-3™ files, 3 ARC/INFO™ export files, and 5 flat ASCII data files (provided to extend the use of the data to non-Lotus 1-2-3™ and non-ARC/INFO™ users). The documentation contains information on the methods used in calculating each variable, detailed descriptions of file contents and formats, and a discussion of the sources, restrictions, and limitations of the data. The data files are available on a variety of media and through the INTERNET. The ARC/INFO™ files contain digitized outlines of each nation and zone within the data base. Also provided are FORTRAN and SAS™ retrieval programs for use with the flat ASCII data files and a descriptive file that explains the contents and format of each data file.

- NDP-047 *Rattlesnake Mountain Observatory: Multispectral Ground-Based Radiometric Measurements for the Period 1979–1993.*

To obtain measurements of solar irradiance of the atmosphere a multipurpose computer-controlled scanning photometer was developed by Pacific Northwest Laboratory and put into operation at the Rattlesnake Mountain Observatory in eastern Washington. The observatory is located at 46.4N, 119.6W at an elevation of 1088 m above mean sea level. The instrument can measure the attenuation of direct solar radiation at 12 different wavelengths. Five of these wavelengths (i.e., 486.1 nm, 427.8 nm, 535 nm, 785 nm, and 1010 nm) are suitable for monitoring variations in the total optical depth of the atmosphere.

Total optical depths were derived from the solar irradiance measurements taken by the Rattlesnake Mountain Observatory from August 1979 to June 1993 and are distributed with this NDP. The total optical depth measurements are for the total air column above the observation site. To determine the contribution of stratospheric aerosols to the total stratospheric aerosol load and to correct for the effects of ozone, molecular, and Rayleigh scattering the normal annual fluxuation in the atmospheric optical depth must be accounted for. This was accomplished by calculating a mean background optical depth (tropospheric component) for each wavelength and month using data obtained during periods of low stratospheric loading. By subtracting the background optical depth from the total optical depth for each wavelength a residual aerosol optical depth was obtained. The three data items described above (i.e., total, background, and residual aerosol optical depths) have been placed into three data files and are distributed with this NDP.

1. Total optical depth for each wavelength (i.e., 486.1 nm, 427.8 nm, 535 nm, 785 nm, and 1010 nm).
2. Estimated background aerosol optical depth for each wavelength (i.e., the contribution of the troposphere to the total optical depth).
3. Residual aerosol optical depth obtained by subtraction of the background aerosol optical depth from the total optical depth for each wavelength (a.k.a., estimated stratospheric aerosol optical depth).

Files 1 and 3 above consist of observations obtained on cloud-free days from sunrise to sunset when the atmosphere was stable.

This NDP is available from CDIAC and consists of this document and a set of computerized data files. The documentation contains information on the methods used in acquiring each variable, detailed descriptions of file contents and formats, and a discussion of the restrictions and limitations of the data. The data files are available on magnetic tape, on floppy diskette, and through INTERNET. The data base consists of three flat ASCII data files, FORTRAN and SAS™ retrieval files, and a descriptive "read me" file.

- NDP-048, *Carbon-13 Isotopic Abundance and Concentration of Atmospheric Methane for Background Air in the Southern and Northern Hemispheres from 1978 to 1989*.

This NDP will present atmospheric concentrations and $\delta^{13}\text{C}$ values of CH_4 from background air collected in 24 rural or marine sites (16 in the Northern Hemisphere and 8 in the Southern Hemisphere) over the period 1978–1989. The information on the isotopic composition of atmospheric CH_4 in each hemisphere provided by these data will be a very useful aid in estimating the fluxes of the various natural and anthropogenic sources and in elucidating the causes of the seasonal cycle and the interhemispheric gradient of atmospheric CH_4 .

- Dale Kaiser continues to work on the NDP containing weather data obtained every 3 h from 223 stations in the former U.S.S.R. All data files (~1.4 gigabytes) have been converted to the NCDC standard element file format prescribed in the Work for Others agreement CDIAC has with NCDC. This reformatting was expedited by CDIAC's acquisition of much more disk storage in the second half of FY 1993. The reformatted data files have been transferred to NCDC, and the actual CDIAC NDP will be completed during the first half of FY 1994.
- The NDP, *Atmospheric Methane Concentrations from In Situ Measurements at Cape Meares, 1979–1991*, will present data for more than 120,000 individual CH_4 measurements made at Cape Meares, Oregon, between 1979 and 1991. The location of Cape Meares (45°N, 120°W) is representative for CH_4 concentrations in the northern latitudes (from 30°N to 90°N). Measurements were carried out in situ using an automated system by which air samples were pumped into the apparatus at regular intervals and injected onto the column of a gas chromatograph equipped with a flame ionization detector (FID). At the beginning of the record period (January 1979), 72 measurements of ambient air were taken per day. This frequency was reduced to 24 per day in 1984 and to 12 per day in 1986. In addition to the individual measurements, this data package will also present daily and monthly averages of the Cape Meares CH_4 measurements.

The atmospheric monitoring facility at Cape Meares was the first station to carry out continuous automated measurements of CH_4 . This data set represents the most extensive continuous CH_4 data set available for a single monitoring site.

Future NDPs

- NDP-43C, *A Coastal Hazards Data Base for the U.S. West Coast*, will be compiled by Tammy White and should be available in the latter portion of FY 1994.
- CDIAC learned from Derrek Cunnold and Fred Alyea (Georgia Institute of Technology), Ron Prinn (Massachusetts Institute of Technology), and Ray Weiss (Scripps Institution of Oceanography) that CDIAC will become the repository for the Atmospheric Lifetime Experiment/Global Atmospheric Gases Experiment (ALE/GAGE) atmospheric trace gas measurements. This data base dates back to the mid-1970s and documents the growth (and recent growth rate declines in some instances) of species such as CFC-11, CFC-12, CH_4 , and N_2O . These data will probably be documented as a series of NDPs beginning in FY 1994.
- CDIAC will document Richard A. Houghton's (The Woods Hole Research Center) land-use changes and corresponding carbon emission estimates.
- CDIAC will document Wallace S. Broecker (Lamont-Doherty Earth Observatory) and T.-H. Peng's (ORNL) C-14 measurements.

- CDIAC will document as an NDP the CFC, N₂O, HCFC (e.g., HCFC-22), and halon (e.g., H-1301 and H-1211) measurements made by Jim Elkins and his group at NOAA/CMDL. This package will probably be completed during FY 1994.
- Discussions with Drs. Sherry Rowland and Don Blake (University of California-Irvine) lead CDIAC to believe that during FY 1994 the center may be documenting and distributing the numerous trace gas measurements made by the group at UC-Irvine. These measurements date back to the late 1970s.
- CDIAC will be documenting Jim Butler's (NOAA/CMDL) shipboard nitrous oxide (N₂O) measurements. These measurements cover a number of years and cruises and will complement Ray Weiss's shipboard N₂O measurements (documented as NDP-044). These data will be very useful in attempts to elucidate the N₂O cycle. This package will be compiled during FY 1994.

Data Sets Archived and Distributed by CDIAC But Not Fully Documented as NDPs

- CDIAC is being asked to archive and distribute more data sets than it can possibly document as NDPs, given the level of effort required to quality-assure data sets and fully document them. CDIAC will be archiving some data sets and computer models, advertising them, and distributing them just as it would an NDP or CMP, except that the documentation distributed with the data set will be that provided by the contributor. Data sets that will be offered in this manner in the near future will include.
 - Ray Bradley (University of Massachusetts) et al. gridded temperature and pressure anomalies
 - Extensions of the Historical Climatology Network to Alaska
 - Bill Ridgway (NASA/Goddard Laboratory for Atmospheres) et al. model intercomparisons

Fossil Fuel Data Base

- Bob Andres [an Oak Ridge Institute for Science Education (ORISE) postdoctoral fellow working with Gregg Marland] is working on a 1° x 1° gridded CO₂ emission inventory. Andres is using Inez Fung's GISS gridding scheme, Jennifer Logan's (Harvard University) gridded population data base, and Marland's 1990 national CO₂ emission estimates in compiling the gridded inventory.
- Bob Andres, Tom Boden and Gregg Marland traveled to New York to visit the UN Energy Statistics Unit staff on February 16, 1993. The purpose of the visit was to (1) express CDIAC's gratitude for their cooperation over the years, (2) resolve CDIAC questions about data conversions, heating values, and UN ties to other data bases, (3) determine what impacts recent world developments like the unification of Germany, disbandment of the U.S.S.R., and present Yugoslavian conflict will have on the continuity and future of the data base, and (4) offer help in checking their data base. The three visitors left the meeting with a greater understanding of the data base, impressed by the level of effort the UN staff exerts in verifying numbers provided on UN questionnaires and in making estimates themselves when numbers are not provided, confident that the data base will be continued, and reassured that national problems like those posed by the U.S.S.R. are not insurmountable.
- Tom Boden is updating the documentation for the emission estimates (see "NDPs in Progress" section).
- Global total CO₂ emissions reached 6.19 gigatons of carbon in 1991, which marks the eighth consecutive year that global emissions have increased. The 1991 estimate is the highest emission estimate since the record began in 1950 and represents a 1.5% growth over 1990, continuing a recent decline in the global emission growth rate and roughly half the growth rates of the mid-1980s. Were it not for the Kuwait oil field fires, which accounted for 130 million metric tons of carbon emitted to the atmosphere, global emissions would have declined during 1990-91. The United States continues to be the world's largest emitter: 1.35 gigatons of carbon in 1991. The top three emitters, the U.S., the former U.S.S.R., and the People's Republic of China, were responsible for 48.8% of the world emissions from fossil-fuel burning in 1991.

CMPs

- The Edmonds/Reilly CO₂ model remains the most popular numeric data product distributed by CDIAC (Fig. 12).

Fig. 12. Numeric data most frequently requested since 1985.

Table 7. Numeric data requests by country

Country	FY 1993			Total FY 1985 to date
	Qtrs. 1-2	Qtrs. 3-4	Total	
Algeria	1	0	1	2
Argentina	2	0	2	15
Australia	15	7	22	110
Austria	1	1	2	26
Belgium	5	2	7	22
Belize	0	0	0	1
Botswana	0	0	0	3
Brazil	2	3	5	19
Bulgaria	1	0	1	3
Canada	24	21	45	182
Cape Verde	0	0	0	1
Chile	0	0	0	2
China, People's Republic of	10	8	18	62
Colombia	1	0	1	1
Costa Rica	1	0	1	4
Cuba	3	1	4	13
Cyprus	0	1	1	1
Czechoslovakia	0	0	0	1
Denmark	0	0	0	4
Egypt	2	3	5	7
Fiji	0	1	1	1
Finland	0	2	2	6
France	7	5	12	46
Germany ^a	18	21	39	139
Ghana	0	0	0	1
Greece	1	0	1	6
Guyana	1	0	1	2
Hong Kong	0	2	2	3
Hungary	0	2	2	3
Iceland	2	1	3	3
India	6	7	13	54
Indonesia	2	2	4	13
Ireland	3	2	5	9
Israel	0	2	2	13
Italy	3	7	10	31
Japan	14	11	25	73
Jordan	0	1	1	1
Kenya	4	3	7	10
Kuwait	0	1	1	1
Luxembourg	1	0	1	3
Malaysia	0	2	2	7
Malta	0	0	0	1
Mexico	2	2	4	4
Monaco	1	0	1	2
Morocco	0	0	0	1
Netherlands	4	2	6	39
New Zealand	1	0	1	12
Niger	1	1	2	3
Nigeria	1	2	3	10
North Korea	0	0	0	2
Norway	3	3	6	15

Table 7. (continued)

Country	FY 1993			Total FY 1985 to date
	Qtrs. 1-2	Qtrs. 3-4	Total	
Pakistan	0	0	0	2
Philippines	0	1	1	2
Poland	1	2	3	10
Portugal	0	1	1	1
Romania	0	1	1	6
Russia	5	8	13	42
Saudi Arabia	0	1	1	1
Singapore	2	1	3	6
South Africa	3	0	3	10
South Korea	1	2	3	10
Spain	6	2	8	18
Sri Lanka	0	0	0	2
Sweden	2	1	3	14
Switzerland	6	5	11	38
Taiwan	4	2	6	9
Thailand	0	0	0	2
Turkey	1	0	1	4
United Kingdom	17	13	30	142
United States	321	275	596	2,604
Uruguay	0	0	0	1
Vietnam	1	2	3	5
Zimbabwe	1	0	1	1
Total	514	446	960	3,922

*Includes both German Democratic Republic and Federal Republic of Germany before FY 1991.

**Table 8. Requests for numeric data
FY 1993**

		Documents and tape or diskette	Documents only	Media only	Total	FY 1985 to date total
NDP-001	Atmospheric CO ₂ Concentrations, Mauna Loa Observatory, Hawaii, 1958–1983	<i>No longer distributed</i>				68
NDP-001/R1	Atmospheric CO ₂ Concentrations, Mauna Loa Observatory, Hawaii, 1958–1986	1	11		12	353
NDP-001/R2	1958–1989		8		1	99
NDP-001/R3	1958–1991	54		4	58	58
NDP-002	Tree Ring Chronology Indexes and Reconstructions of Precipitation in Central Iowa, U.S.A.	13	7		20	110
NDP-003	Surface Air Temperature Anomalies for the Northern Hemisphere, 1881–1984	<i>No longer distributed</i>				84
NDP-003/R1	Global Surface Air Temperature Variations 1851–1984	47	9		56	304
NDP-004	Transient Tracers in the Oceans (TTO)—Hydrographic Data and Carbon Dioxide Systems	<i>No longer distributed</i>				28
NDP-004/R1	Transient Tracers in the Oceans (TTO)—Hydrographic Data and Carbon Dioxide Systems with Revised Carbon Chemistry Data	15	4		19	109
NDP-005	Atmospheric CO ₂ Concentrations, The NOAA/GMCC Flask and Continuous Sampling Network	2	5		7	163
NDP-005/R1	1971–1988	26	2	2	30	30
NDP-006	Production of CO ₂ from Fossil Fuel Burning by Fuel Type, 1860–1982	43	8		51	312
NDP-007	Atmospheric CO ₂ Concentrations— The CSIRO (Australia) Monitoring Program from Aircraft for 1972–1981	15	5		20	115
NDP-008	Seasonal Tropospheric and Strato- spheric Temperature Anomalies for 1958–1984	<i>No longer distributed</i>				52

Table 8. (continued)

FY 1993

		Documents and tape or diskette	Documents only	Media only	Total	FY 1985 to date total
NDP-008/R1	Annual and Seasonal Global Temperature Anomalies in the Troposphere and Low Stratosphere, 1958–Summer 1986	1	8		9	125
NDP-008/R2	1958–1988	13			13	13
NDP-008/R3	1958–1991	9			9	9
NDP-009	Growth and Chemical Responses to CO ₂ Enrichment—Virginia Pine (<i>Pinus virginiana</i> Mill.)	17	7		24	104
NDP-010	Atmospheric CO ₂ Concentrations— The CSIRO Program: Surface Data for Cape Grim, Tasmania	15	6		21	108
NDP-011	Global Paleoclimatic Data for 6000 Yr B.P.	37	10		47	230
NDP-012	Climatic Data for Northern Hemisphere Land Areas, 1851–1980	33	17		50	267
NDP-013	Volcanic Loading: The Dust Veil Index	29	11		40	190
NDP-014	Solar Records: The Wolf Sunspot Index and Umbral/ Penumbral Ratio	20	8		28	167
NDP-015	Surface Air Temperature Anomalies for the Northern Hemisphere: The Russian Dataset	8	8		16	100
NDP-016	Climatic Data for Selected U.S. and Canadian Stations, 1941–1980	32	10		42	164
NDP-017	Major World Ecosystem Com- plexes Ranked by Carbon in Live Vegetation: A Database	59	18	1	78	387
NDP-018	Worldwide Organic Soil Carbon and Nitrogen Data	43	15	1	59	278

Table 8. (continued)

FY 1993

		Documents and tape or diskette	Documents only	Media only	Total	FY 1985 to date total
NDP-019	United States Historical Climatology Network (HCN) Serial Temperature and Precipitation Data	<i>No longer distributed</i>				170
NDP-019/R1	Data through 1987	42	29	1	72	311
NDP-020	A Global Grid Point Surface Air Temperature Data Set: 1851-1984	<i>No longer distributed</i>				174
NDP-020/R1	An Updated Global Grid Point Surface Air Temperature Anomaly Data Set: 1851-1990	43	27	13	83	201
NDP-021	Historical Sunshine Data in the United States	<i>No longer distributed</i>				93
NDP-021/R1	Historical Sunshine and Cloud Data in the United States	35	10	2	47	143
NDP-022	Global and Hemispheric Annual Temperature Variations Between 1861 and 1984	<i>No longer distributed</i>				56
NDP-022/R1	1861-1988	45	9		54	285
NDP-023	Seasonal and Annual Radiosonde Ozone Deviations, 1958-1985	40	12		52	176
NDP-024	A Global Planktonic Foraminifera Base for Evaluation of the Stability of Low-Latitude Sea Surface Temperatures	<i>No longer distributed</i>				8
NDP-025	Monthly Mean Pressure Reconstructions for Europe (1780-1980) and North America (1858-1980)	15	7		22	99
NDP-026	Climatological Data for Clouds Over the Globe from Surface Observations	18	26	5	49	193
NDP-027	GEOSECS Atlantic, Pacific, Indian, and Mediterranean Radiocarbon Data	12	3		15	79

Table 8. (continued)
FY 1993

		Documents and tape or diskette	Documents only	Media only	Total	FY 1985 to date total
NDP-028	Carbonate Chemistry of the Weddell Sea	8	4		12	57
NDP-029	Carbonate Chemistry of the North Pacific Ocean	13	4		17	70
NDP-030	Estimates of CO ₂ Emissions from Fossil Fuel Burning and Cement Manufacturing Using the United Nations Energy Statistics and the U.S. Bureau of Mines Cement Manufacturing Data		11		11	331
NDP-030/R1	Estimates of CO ₂ Emissions from Fossil Fuel Burning and Cement Production: 1950-1987	<i>No longer distributed</i>				77
NDP-030/R2	1950-1988					97
NDP-030/R3	1950-1989			1	1	1
NDP-030/R4	1950-1990	74		3	77	81
NDP-030/R5	1950-1991	11		1	12	12
NDP-031	Average Total Snowfall Data for Selected U.S. Stations	27	1	6	34	73
NDP-031/R1	Averages Based on Data Through 1990	1			1	1
NDP-032	Antarctic Surface Temperature and Pressure Data	20	4	1	25	107
NDP-033	Atmospheric CO ₂ Concentrations Derived from Flask Samples Collected at U.S.S.R.-Operated Sampling Sites	9	15		24	45
NDP-034	Atmospheric CO ₂ Concentrations—The Canadian Background Air Pollution Monitoring Network	<i>No longer distributed</i>				
		7	2		9	49
NDP-034/R1	Data Through 1990	9	5		14	14
NDP-035	A Global Geographic Information System Data Base of Storm Occurrences and Other Climatic Phenomena Affecting Coastal Zones	36	16	2	54	138

Table 8. (continued)

FY 1993

		Documents and tape or diskette	Documents only	Media only	Total	FY 1985 to date total
NDP-036	Indian Ocean Radiocarbon: Data from the Indigo 1, 2, and 3 Cruises	9	3		12	61
NDP-037	Carbon Dioxide Enrichment: Data on the Response of Cotton to Varying CO ₂ , Irrigation, and Nitrogen	23	13		36	41
NDP-038	Atmospheric Methane Concentrations—The NOAA/CMDL Global Cooperative Flask Sampling Network, 1983–1988	35	11		46	129
NDP-039	Two Long-Term Instrumental Climatic Data Bases of the People's Republic of China	32	18		50	94
NDP-041	The Global Historical Climatology Network: Long-Term Monthly Temperature, Precipitation, Sea Level Pressure, and Station Pressure Data	105	90	3	198	199
NDP-042	United States Historical Climatology Network Daily Temperature and Precipitation Data	39	23		62	122
NDP-043	A Coastal Hazards Data Base for the U.S. East Coast	28	13		41	41
NDP-044	Surface Water and Atmospheric Carbon Dioxide and Nitrous Oxide Observations by Shipboard Automated Gas Chromatography: Results from Expeditions Between 1977 and 1990	21	19		40	40
CMP-002	The IEA/ORAU Long-Term Global Energy CO ₂ Model	2			2	70
CMP-002/ PC	The IEA/ORAU Long-Term Global Energy CO ₂ Model: Personal Computer Version A84PC	<i>No longer distributed</i>				267
CMP-002/ PC/R1	The IEA/ORAU Long-Term Global Energy CO ₂ Model: Personal Computer Version A84PC	81	3	1	85	524

Table 8. (continued)**FY 1993**

		Documents and tape or diskette	Documents only	Media only	Total	FY 1985 to date total
CDIAC-36	Trends '90: A Compendium of Data on Global Change (on diskette)			2	2	74
CDIAC-46	Trends '91: A Compendium of Data on Global Change	259		1	260	551
		—	—	—	—	—
	Total	1,639	547	51	2,237	9,291

Networking

To maintain its proactive position in information management activities, CDIAC strives to keep informed of current research policy and information developments and needs at the international, national, and local levels. In addition to the exchange of data among researchers, CDIAC has taken an active role in the networking of information among government agencies, industries, businesses, special libraries and information/data centers, institutions, organizations, and special and public interest groups. CDIAC maintains close professional contacts with individuals and organizations, and its networking capabilities have included the dissemination of research results, policy initiatives, and education developments; objective technical interpretations and discussions of the technical and information management related to CO₂ and climate change; referrals to other individuals or organizations; and access to resources relevant to individuals' information needs. CDIAC's networking capabilities have been further enhanced by active participation in the programs and organizational administration of professional societies and associations. Through these networking activities CDIAC has been able to monitor the information needs of the broad climate-change community and develop specific information products and services to help meet those needs. In carrying out its networking activities CDIAC staff have done the following:

- Bob Cushman reviewed two research proposals sent to the Great Plains Regional Center for Global Environmental Change.
- Bob Cushman reviewed the revised manuscript "Ecological Indicators of Global Climate Change—A Research Framework" by David Bella, Ruth Jacobs, and Hiram Li for the journal *Environmental Management*.
- Data on CDIAC were submitted, by invitation, to the American Association for the Advancement of Science's (AAAS) Database Project on individuals in the fields of science, technology, and public policy.
- Data on CDIAC were submitted, by invitation, for listing in the directory *Who Is Who: People, Projects, Organizations in Service to the Earth*, 2nd Ed.
- Rich Daniels met with John Richards and Betsy Flint (both of Duke University) in Oak Ridge to discuss data formats and the inclusion of error flags for their land-use change and carbon emission data base for the South and the Southeast being documented as NDP-64.
- Rich Daniels reviewed a paper by Paul Kanciruk and Mike Farrell titled, "Information Analysis Centers in Support of the U.S. Global Change Research Program."
- CDIAC staff attended, by invitation, a presentation by U.S. Representative James Cooper (Fourth District, Tennessee) concerning a bill he introduced in Congress, "Carbon Dioxide Offsets Policy Efficiency Act of 1991."
- CDIAC hosted a visit from the National Coal Association. Richard Lawson (president), Constance Holmes (senior vice-president), and Dolores Kern (director of Research & Development) heard presentations and participated in discussions concerning CDIAC's mission and activities, the CDIAC fossil-fuel CO₂ emissions data base, and the ORNL Fossil Energy Program.
- CDIAC hosted a visit from Simmons Buntin, a DOE intern in the Management Intern Development Program, concerning CDIAC's mission, organization, and activities.
- CDIAC was visited by Yutaka Dote of the National Institute for Resources and Environment's Biomass Laboratory (Tsukuba, Japan). Discussions included the role of CDIAC in the U.S. Global Change Research Program and CDIAC's data of relevance to studies of the carbon cycle and vegetation.
- CDIAC hosted a visit from Hironori Arakawa (National Chemical Laboratory for Industry, Tsukuba, Japan) for discussions concerning CDIAC's CO₂ and CH₄ data and a tour of the ORNL Chemical Technology Division's carbon-related research projects.

- CDIAC was visited by Evelyne Bertel [Planning & Economic Studies Section, International Atomic Energy Agency (IAEA), Vienna] for discussions of CDIAC's data on energy-related emissions of greenhouse gases.
- CDIAC was visited by Harold Jaffe of the DOE International Affairs Office. Discussions focused on CDIAC's mission and projects, and the emphasis was on the center's international data- and information-exchange activities.
- CDIAC was visited by Pierce Riemer and Deborah Norman from the International Energy Agency's (IEA's) Greenhouse Gas Research & Development Programme in the United Kingdom. Information about the Greenhouse Gas R&D Programme has been featured in *CDIAC Communications*. As a result of this meeting, a short article about CDIAC was included in a recent issue of the Greenhouse Gas R&D Programme's newsletter, *Greenhouse Issues*, and copies of the most recent issue of *CDIAC Communications* were given to the Greenhouse Gas R&D Programme for distribution with its bimonthly *Greenhouse Gases Bulletin*.
- Rudolf Husar, director of the Center for Air Pollution Impact and Trend Analysis at Washington University, visited CDIAC on October 14, 1992, to discuss his views on environmental informatics and to present a demonstration of the Voyager Data Delivery System. This system combines data base, GIS, hypertext, and multimedia technologies and has been used by Husar and his colleagues to display various environmental data sets, including many from CDIAC.
- Jau-Inn Huang and Yu-Hua Chu (Columbia University, School of Mines) visited CDIAC on October 30, 1992, to meet with Gregg Marland and Tom Boden to learn more about the methodology used in generating national CO₂ emission estimates from fossil-fuel burning. Huang is being subcontracted by Taiwan's Energy Commission to establish a base-line CO₂ emissions data record for Taiwan and to assist in reformulating Taiwan's energy policies. The former task was undertaken to comply with the mandate for CO₂ emission inventories imposed by the International Panel on Climate Change (IPCC).
- Endre N. Bjordal (Confederation of Norwegian Business and Industry, Oslo) visited ORNL and CDIAC on November 25, 1992. The primary purpose of Bjordal's trip was to visit with those doing risk analysis studies, but his confederation has an interest in global warming and decision-making processes.
- David Lindsey (ORNL Planning and Technology Management, Computing and Telecommunications Division) was provided with a series of slides used at the fourth annual meeting of the Technology & Architecture Forum. Lindsey's presentation dealt with various ORNL plans, strategies, and issues related to computational capacity, technical architecture, and other concerns. CDIAC was used as an example of the type and extent of data management activities at ORNL.
- Johnnie B. Cannon, associate director of ORNL's Energy Division, was given a series of slides and a briefing about CDIAC. Cannon and other senior personnel from ORNL provided a series of presentations on ORNL capabilities. The presentations were given to a senior group from the World Bank and U.S. Agency for International Development (AID). Cannon provided a detailed description of CDIAC and its information products, publications, and specialized information services. All World Bank and AID staff have been placed in CDIAC's World Directory, and each group participant was given a package of CDIAC materials.
- CDIAC established contact with the United Nations Environment Programme's (UNEP's) Harmonizations of Environmental Measurement (HEM) program. HEM is part of UNEP's Earthwatch/Global Environmental Monitoring System (GEMS). HEM serves as one of UNEP's environmental data and information management programs. An exchange of information products and publications was initiated.
- CDIAC assisted Chuck Herrick (associate director, Environmental Trends, Council on Environmental Quality) with the Interagency Committee on Environmental Trends and the 1992 *Environmental Quality* report.

- Libraries with the following affiliations were provided descriptive introductions and copies of relevant publications (*CDIAC Communications*, ARM, DOE Research Summaries, *Trends '91*, *Catalog of Data Bases and Reports*, and the Glossary):

University institutions with curricular accredited by the Society of American Foresters (45)

Society of American Foresters-recognized Technical Forestry Education Programs (24)

All full U.S. Depository Libraries (138)

University-based Sea Grant (NOAA) program (30)

Sea Grant Marine Advisory Service program offices (32)

- Luis M. Rico, director of the Puerto Rico Institute of Environmental Education, was provided with technical assistance in calculating the amount of CO₂ and carbon produced in the use of electric light bulbs.
- CDIAC offered technical assistance to Anne L. Polansky, director of Environmental and Legislative Affairs of the Solar Energy Industries Association. She is compiling a report on energy savings and CO₂ emissions reductions achieved by conversion from fossil fuel-based power generations in the agricultural sector (e.g., diesel fuels and kerosene) to solar and other alternative fuels (including biomass conversion).
- CDIAC established contact and exchanged information materials with Maria Theesen, publishing assistant, and Ron Gravis, project manager, for Bruce Presentations, Inc., a contracting firm for the U.S. EPA's Climate Change Outreach Program.
- CDIAC initiated efforts to examine the feasibility to post announcements of new CDIAC NDPs on the EOSDIS Bulletin Board.
- Listings for CDIAC were updated or prepared for the following directories:
 - Who Is Who: People, Projects, and Organizations in Service to the Earth (VisionLink/Electronic Cottage)
 - Directory of Special Libraries and Information Centers (Gale Research Company)
 - Research Centers Directory
 - Information Industry Directory
 - Pollution Prevention Library Directory
- CDIAC and its information products, publications, and services were introduced to all 49 IGBP regional information centers.
- CDIAC was introduced to all entries under the categories of Climatic Change, Energy, Global Warming, Greenhouse Effect, and Ozone Layer in the World Environmental Research Directory.
- Background materials were given to the Western Fuels Association, Inc.
- Detailed discussions and materials about CDIAC were sent to the following: David Cleden, Earth Observation Sciences, Ltd. (UK); David J. Packer, Jordan & Breach Science Publishers; Richard M. Harn, Predicasts; John S. Quackenboss, Environmental Information; David Rinebolt, U.S. House of Representatives (staffer); Roger Kittaley, U.S. Senate Library; Tina Van Sickle, U.S. House of Representatives staffer; John E. Blodgett, Congressional Research Service; Michael Strauss, AAAS Global Change Program; Paula K. Galbraith, Mary Kay Cosmetics; Herbert Tiedmann, DOE Public Information Officer; Lynn Hodges, Tennessee Valley Authority (TVA), Environmental Education; Douglass Brown, NOAA, Educational Services; Joan Maier McKean, NOAA, Educational Affairs; Hanna King and Jeanne Perrone, DOE Library; Alvetta Pindell, National Agricultural Library (NAL) Public Services; Kenneth Richards, U.S. Department of Agriculture (USDA); Katherine Sibold, EPA Climate Change Division; Anne O'Donnell, NOAA, Environmental Information Services; Peter Campbell, Canadian Ministry of Environment;

Rosanne Fortner and Len Simutics, Ohio State University; Carla Heister, Utah State University Library; Buni Yang, Canadian Ministry of Energy; Harriett Stubbs, North Carolina State University; Bernard Hermanson, Sumner Community School; Elizabeth Pixley, Monroe County (NY) Community College; Fred E. Lohrer, Archibold Biological Station; Karen Bates, Center for the Study of Law and Politics; Sheryl D. Sturges, The AES Corporation; R. Darryl Banks, World Resources Institute; Ralph DeGenaro, Friends of the Earth; Bruce Gritton, Monterey Bay Aquarium Research Institute; Cheryl Barley and Jack Evans, Consortium for International Earth Science Information Network (CIESIN); Richard Klattenberg, New England Utilities (CT); Frances Griffin, Chemical Manufacturers Association; Nick Berenyi, Westuaco; and Jean-Romain Frisch, Electricité de France (Paris).

- Materials describing CDIAC were displayed by staff from the Agency for Toxic Substances and Disease Registry [U.S. Department of Health and Human Services (DHHS)], Atlanta, at the 1993 workshop *Empower the Public: The Environmental Connection*, held in Albuquerque, New Mexico.
- CDIAC provided 85 researchers in 28 developing countries by FAX message with information concerning the availability of \$25 million (U.S.) to support countries with "economies in transition" or developing countries in climate-change studies. In subsequent communications CDIAC directed 42 copies of the 23-page "Guidelines and Forms for Requesting Support" to interested parties worldwide. Copies of three submitted proposals were directed to CDIAC with letters of thanks for the center's assistance in identifying potential funding sources. The U.S. Country Studies Initiative is coordinated by the U.S. Department of State's Office of Global Change.
- Bob Andres, Gregg Marland, and Tom Boden met with UN Energy Statistical and Population Statistical Divisions to discuss UN data supplied to CDIAC for estimating CO₂ emissions from fossil-fuel combustion.
- Rich Daniels reviewed a research proposal for the National Geographic Society on the physical and economic impacts of sea level rise in the Caribbean.
- Tammy White reviewed and prepared maps for a paper by Paul Kanciruk and Mike Farrell entitled "Information Analysis Centers in Support of the U.S. Global Change Research Program."
- Tammy White reviewed a paper, "SAS Macros for Converting ARC/INFO Grids into SAS Data Sets," by Barbara Jackson.
- Tammy White reviewed a paper, "SAS Macros for Converting ARC/INFO Coverages into SAS Data Sets," by Barbara Jackson.
- Roberta Balstad Miller, president and CEO of CIESIN visited ORNL and met with CDIAC staff. Discussions centered on the evolving relationships between CIESIN's and CDIAC's information activities.
- Kenneth Marsh [Texas A&M University; member of the U.S. National Committee for Committee on Data for Science and Technology (CODATA)] visited CDIAC and met with Bob Cushman. They discussed CDIAC's data packaging procedure, quality-assurance checks, and nondata information products.
- Richard Lawson (president) and Dolores Kern (director of Research and Development) of the National Coal Association, along with five coal industry representatives, visited CDIAC. CDIAC's international greenhouse-gas emissions activities were discussed, and ORNL staff presented information on the ORNL Fossil Energy Program.
- Dan Balteanu (director of the Institute of Geography, Romanian Academy of Sciences; member of the Romanian National Committee for the International Geosphere-Biosphere Programme) visited ORNL and met with CDIAC staff. Discussions focused on increasing Romania's presence in CDIAC's global network of global-change scientists.
- CDIAC updated its entry in the mailing list of the Centre National de Recherches Meteorologiques (Toulouse, France).

- Anne Tellier (International Programs manager) and Wayne Hardie of Los Alamos National Laboratory visited ORNL and met with CDIAC staff.
- Marvel Burtis participated in ORNL's first Community Day, in which members of the public were allowed on-site for tours and demonstrations. Marvel worked with visitors as they exercised the Edmonds-Reilly PC model of future CO₂ and CH₄ emissions as a function of energy and socioeconomic variables.
- Staff of DOE's Office of Science and Technology Information visited ORNL and discussed activities of CDIAC and other ORNL science/technology data centers.
- CDIAC updated its entry in the data base maintained by the University of Vermont and the Together Foundation for Global Unity. The information in the data base will be available through 1-800-ECOLINE (a nationwide toll-free number) and TOGETHERNET (an electronic information network).
- Barbara Landers (National Photographic Interpretation Center) visited ORNL, and Mike Farrell (director, ORNL Center for Global Environmental Studies) included information on CDIAC in his presentation on "Oak Ridge Environmental Data and Analysis Capabilities."
- CDIAC staff attended a seminar, "Global Climate and Ecological Monitoring in Russia," presented in Oak Ridge at the Atmospheric Turbulence and Diffusion Laboratory by Felix Ya. Rovinsky and Vladimir I. Egorov of the Institute of Global Climate and Ecology, Moscow.
- Bob Cushman met with Marvin Brailsford (president, Metters Industries, Inc., McLean, Virginia) as part of ORNL's Minority Technology Transfer Initiative to discuss CDIAC's and Metters' mutual interest in computing systems and the environment.
- Bob Cushman met with Joy Sutton (manager, Research-in-Progress, CSIRO Information Services, East Melbourne, Australia) concerning CDIAC's global-change data and information services and CDIAC's interactions with the IEA's Energy Technology Data Exchange project.
- Bob Cushman and Fred Stoss met with Andre van Rest and Roger Meyer (DOE Department of Technical Assistance) concerning CDIAC's data and information services and CDIAC's potential role in support of U.S. participation in the IEA's newly launched GREENTIE project, which will promote the distribution of information on technologies for reducing greenhouse-gas emissions.
- CDIAC's listing for the 19th edition of *Research Centers Directory*, to be published by Gale Research, Inc., was updated. *Research Centers Directory* is a guide to university-related and other nonprofit research organizations and support services.
- Bob Cushman met with Lu Yingyun (director, Energy System Analysis Division, Tsinghua University, Beijing) for discussions of CDIAC's data and information products and services, Chinese estimates of current and future emissions of greenhouse gases, and technological policies for reducing greenhouse-gas emissions.
- Bob Cushman, Gregg Marland, and Bob Andres met with Kiyoyuki Minato (senior researcher, Environment Survey Division, Japan Automobile Research Institute, Tusukuba, Japan) for discussions on energy use and greenhouse-gas emissions by the transportation sector and other sectors in Japan in comparison with other developed and developing countries.
- Russ Vose met with Slava Razuvaev at the NCDC in October 1992. They discussed the future release of NDP-040 (*Daily Temperature and Precipitation Data for 223 U.S.S.R. Stations*), which documents a data base compiled by Razuvaev and his fellow researchers at the RIHMI in Obninsk, Russia.
- Russ Vose, in conjunction with Anthony J. Brazel and Sandra Brazel of the Department of Geography, Arizona State University, finalized a draft manuscript on synoptic variability in the Mexican monsoon.

- Russ Vose contacted Wilbur Spangler [National Center for Atmospheric Research (NCAR)] and Mike Hulme (Climatic Research Unit, University of East Anglia) regarding various climatological archives at their respective institutions. Two new data sets for inclusion in the Global Historical Climatology Network (GHCN) were acquired as a result of these contacts.
- Russ Vose met with Frederick L. Wernstedt (Department of Geography, Pennsylvania State University) at Penn State regarding Wernstedt's colossal global temperature and precipitation data base. Future meetings at CDIAC were scheduled to discuss the data base and its possible inclusion in GHCN.
- Dale Kaiser has been assisting T. J. Blasing of the Energy Division, ORNL, in assessing the current state of archived upper air soundings for the Antarctic region. This stems from Blasing's being asked by NSF researchers to help them determine potential environmental effects of spent radiosonde balloons in Antarctica. Dale has discussed the matter with Mel Gelman of the Climate Analysis Center [NOAA/National Weather Service (NOAA/NWS)] and Roy Jenne of NCAR. Jenne has forwarded valuable NCAR documentation on Antarctic upper air soundings to Kaiser and Blasing. Blasing, and probably Kaiser, may undertake a quality assurance project relating to these data.
- Dale Kaiser's contribution to *Trends '93*, a chapter on long-term precipitation data bases, is nearing completion. He has been working with the following individuals in preparing their data bases for inclusion:

Beth Lavery and Neville Nicholls—Bureau of Meteorology Research Centre, Melbourne, Australia

Bruce Findlay and Don Gullett—Climate Change Detection Division, Canadian Climate Centre, Downsview, Ontario, Canada

Phil Jones and Mike Hulme—Climatic Research Unit, University of East Anglia, Norwich, United Kingdom

David Easterling—National Climatic Data Center, Asheville, North Carolina

Pavel Ya. Groisman—State Hydrological Institute, St. Petersburg, Russia (currently at NCDC)

Sharon Nicholson—Department of Meteorology, Florida State University

- Tom Boden met with Sherry Rowland and Don Blasing (University of California-Irvine) on July 10, 1993 in Irvine to discuss the potential future archival of UCI's trace gas measurements at CDIAC.
- CDIAC staff met with Tom Karl and Mike Crowe during their visit to ORNL on August 31, 1993 for the NASA review of the ORNL NASA Distributed Active Archive Center (DAAC).
- Tom Boden, Bob Cushman, and Paul Kanciruk met with EPA staff at Research Triangle Park, in Raleigh, North Carolina, on September 13–14, 1993 to discuss emission inventory work being conducted by both groups and to discuss possible future collaborations and joint proposal submissions.
- CDIAC assisted in making arrangements to have a group of faculty and students from the Environmental Issues Class from Appalachian State University (Boone, North Carolina) visit the Laboratory. Their tour of ORNL included stops at the ESD Aquatic Ecology Laboratory, the Biomass Program, and CDIAC. CDIAC's presentation involved a brief description of information management and, because of the interests of the students in education and general environmental studies, a discussion of various resources available for classroom instruction from middle-school through college-level instruction was held.
- A questionnaire survey was completed for the World Conservation Monitoring Centre (Cambridge, U.K.). This effort was to assist in analyzing user requirements for the Tropical Ecosystem Environment Observations by Satellite (TREES) project. In addition to completing the requested form, CDIAC forwarded materials describing the center.

- EPA is planning an international symposium on Greenhouse Gas Emissions and Mitigation (January 1995, Research Triangle Park, North Carolina). Acurex Environmental has been contracted to assist EPA in updating the mailing lists for the initial call for papers and announcements of the symposium. CDIAC will work with the Acurex staff in the summer of 1994 to assist in identifying specific user communities from which to invite speakers, request papers and posters, and invite to the symposium.
- CDIAC hosted a group of students from Middle Tennessee State University. This general environmental studies group is interested in climate change and how CDIAC operates and keeps the world informed on this issue.
- Upon receiving information from the U.K.'s Terrestrial Initiative in Global Environmental Research (TIGER), CDIAC included the names of researchers working on several of TIGER's global-change-related studies.
- CDIAC established contact and exchanged various materials with the Goddard Space Flight Center Library.
- CDIAC provided visiting high school teachers, working as Hazardous Waste Remedial Action Program (HAZWRAP) summer suests with a lively discussion of global-change and environmental education. A group of 25 teachers heard a brief presentation about CDIAC and its information and data activities and how various CDIAC information products could be used in classroom settings at the junior and senior high school level.
- CDIAC participated in a survey conducted by the Environment and Natural Resources Information Center (ENRIC) to provide U.S. AID and other interested parties with a guide to available information resources. The survey consisted of a series of questions about the familiarity with various environmental reference sources and how specific environmental queries would be addressed.
- World Wildlife Fund (WWF) has established a special project to assist libraries and environmental information centers in central eastern Europe. CDIAC was contacted by Barbara Rodes, director of Information Services for WWF and chair of one of the Special Libraries Association's International Affairs Committees, to assist in this project. Rodes is compiling a directory of these libraries and environmental information centers and will eventually assist U.S.-based information centers in building collections in areas critical to their respective environmental needs. Climate change is a topic having a universal need, and CDIAC will be able to provide a tremendous service to these libraries as they develop their environmental collections.
- Michael Williams from the UNEP Information Unit on Climate Change (Geneva) provided an interesting briefing on the proposed CLIMEX (Country Activities on Climate Change: Information Exchange System). This initiative was proposed at the August 24 meeting of the UN's Intergovernmental Negotiating Convention (INC) on Climate Change. CDIAC received copies of the report, *Information on Documentation Databases* and the companion *Topical Index to the UN Framework Convention on Climate Change*. CDIAC will examine these materials to determine what CDIAC materials are or are not included in these UN information reports.
- CDIAC hosted a visit with Joe Alcamo, head of the Climate Modeling Group of the Netherlands National Institute of Public Health and Environmental Protection (RIVM). He was visiting staff members of the Energy, Environment, and Resources Center at The University of Tennessee, who suggested he stop by and visit CDIAC. He spent an entire day discussing the IMAGE 2.0 climate-change mode! and provided CDIAC staff and other ORNL CO₂ researchers with an enriching experience. In return he discussed his future involvement with CDIAC and ORNL. He may be in a situation to recommend the archiving of data sets relevant to the input and output of the IMAGE 2.0 model, now being run for a variety of CO₂-assessments in Europe. He can also make the IMAGE 2.0 model available for use at ORNL.

Quantitative Links Support

Since FY 1990, CDIAC has received separate funding from the DOE's Environmental Sciences Division to support DOE's Quantitative Links program. Under this project, "Data Base Support to Assist in Quantifying the Link Between Changes in Atmospheric Composition and Climate Change," CDIAC provides quality-assured data sets and other information needed for quantifying the link between atmospheric chemistry, the earth's radiative balance, and climate. This project includes several tasks.

- Global Historical Climatology Network

In response to the rapid growth in the number of data sets related to the study of global change, CDIAC and the National Climatic Data Center (a NOAA-sponsored program) developed the GHCN project. The purpose of this project is to compile an improved global, base-line data set of long-term monthly mean temperature, precipitation, sea-level pressure, and station pressure for a dense network of worldwide meteorologic stations. Specifically, the GHCN project seeks to consolidate the numerous preexisting national-, regional-, and global-scale data sets into a single global climate data base that can be updated, enhanced, and distributed at regular intervals. The first version of the GHCN was completed during the summer of 1992, and distribution began in the new fiscal year. The data base contains 6039 temperature, 7533 precipitation, 1883 sea-level-pressure, and 1873 station-pressure records. Spatial coverage is particularly good for the United States and central Europe, and this data set presents dramatic improvements over South America, Africa, and Asia.

The GHCN data base is available from CDIAC as NDP-041. The NDP consists of a written, 400-page document and two magnetic tapes containing machine-readable data files and accompanying retrieval codes. The written document describes, in detail, both the GHCN data base and the content of the magnetic tapes. During the first half of FY 1993, 131 copies of the first version of this NDP were distributed and a total of 132 copies of the report have been distributed since its release.

In conjunction with the production of this data base, CDIAC and NOAA staff have worked on a quality control workshop to be held in Asheville, North Carolina in October 1993. The intent of this event was to initiate a cooperative effort to develop state-of-the-art quality control software for monthly surface climate data. Several dozen researchers from institutions throughout the world were expected to participate.

Progress continues on the revision of this NDP. Several improvements have been and are being implemented: (1) acquisition of additional data from sparsely covered areas (e.g., the Amazon basin, the Canadian Arctic, and the Sahara desert); (2) improvement of algorithms to eliminate duplicate stations; and (3) in preparation for the quality control workshop in October, development of new quality assurance procedures that identify data processing problems (e.g., keypunch errors, transcription inconsistencies, and artificial discontinuities).

- International data exchange

To obtain additional data for possible inclusion in the GHCN or for distribution as NDPs, CDIAC contacted Brazilian researchers at the Instituto Aeronautica Especial (São José dos Campos), the Departamento Nacional de Meteorologia (Brasília), the Observatorio Nacional (Rio de Janeiro), and the Diretoria de Hidrografia e Navegação (Niterói). These institutions were identified as potential sources of global-change data during CDIAC's participation in the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992. The Diretoria de Hidrografia e Navegação provided CDIAC with a listing of Brazilian climatological stations.

CDIAC also contacted the Institute of Experimental Meteorology (Obninsk, Russia) for data on ground-based spectroscopic measurements of total-column CO₂ at Lake Issik-Kul in Kirghistan, as a follow-up to a CDIAC staff member visit to Russia in October 1991.

- CDIAC, in collaboration with the All-Russian Research Institute of Hydrometeorological Information—World Data Center (RIHMI-WDC) in Obninsk, has produced the first in a series of four dual-language bibliographies of important Russian climate-change literature, *Selected Translated Abstracts of Russian-Language Climate-Change Publications: I. Surface Energy Budget* (ORNL/CDIAC-57; Proceedings of RIHMI-WDC, Issue 158). This report, which features side-by-side Russian and English abstracts, results from a seven-month guest assignment of RIHMI-WDC's Carolina B. Ravina at CDIAC. CDIAC and RIHMI-WDC (Obninsk, Russia) have also compiled the second volume in the series covering clouds (ORNL/CDIAC-64; Proceedings of RIHMI-WDC, Issue 159). Volumes three and four are planned to cover aerosols and general circulation models, respectively. The first two volumes in the series were compiled by CDIAC's Marvel D. Burtis on the basis of abstracts translated into English by Ravina. The series opens up to Western researchers a wealth of climate-change literature previously available only in Russian. This translation project was conducted under the auspices of a 1972 U.S.–U.S.S.R. agreement on protection of the environment.

Ocean Data

- When separate funding from the DOE's Environmental Sciences Division began in FY 1993, CDIAC started emphasizing the quality assurance, documentation, and distribution of oceanic carbon data in support of DOE's Oceans Research Program. The Oceans Research Program was developed to quantify the distribution and transport of CO₂ in the oceans, to understand processes controlling exchange of CO₂ between the oceans and the atmosphere, and to improve parameterizations of oceanic mixing and convection in climate models. DOE funds researchers to collect CO₂ data in the one-time global survey of the Joint Global Ocean Flux Study (JGOFS) and to work aboard research vessels of the World Ocean Circulation Experiment (WOCE). CDIAC is represented on the DOE CO₂ Survey Science Team.
- CDIAC continues to identify WOCE and JGOFS cruises completed to date; to determine the status of hydrographic, nutrient, and carbon data sets; and to compile a list of all information (e.g., instruments, cruise tracks, research vessel, etc.) needed to adequately document an oceanographic data base that focuses on carbon-related measurements.
- The first of these new ocean-carbon NDPs will present total CO₂ and pCO₂ data from the *Meteor 11/5* Expedition in the southern Atlantic Ocean and northern Weddell Sea, January–March 1990 (Wolfgang Roether, University of Bremen, Germany, chief scientist). The *Meteor 11/5* CO₂ data were contributed by Dave Chipman, Taro Takahashi, Dee Breger, and Stew Sutherland of the Lamont-Doherty Earth Observatory of Columbia University.
- CDIAC has received the data report for inorganic carbon analyses of samples collected on the *RV Knorr* as a part of WOCE Cruise P14C. These data were contributed by the Woods Hole Oceanographic Institution. CDIAC has completed quality assurance and transformation of the data into a common consistent format that is compatible with WOCE/JGOFS.
- CDIAC started accessing Brookhaven National Laboratory (BNL) data bases. Hydrographic data bases at BNL are stored in a data base management program called Scientific Information and Retrieval (SIR) and include data bases created for cruises of the DOE Ocean Margins Program, historical data from the Middle Atlantic Bight, data from the Northeast Water polynua cruises in 1992 and 1993, and data from WOCE cruises on which CO₂ measurements have been made by BNL.
- Oceanographer Alex Kozyr joined CDIAC on August 1. Alex will be checking, documenting, and analyzing CO₂-related data collected aboard JGOFS cruises.

ARM Newsletter

- The production and distribution efforts of *ARM Outreach* have received much praise. Several minor editorial adjustments have been noted, and a second issue of the newsletter has been discussed. Like the first issue, the second issue of *ARM Outreach* will be sent to all current subscribers of the *ARM Bulletin* and CDIAC Communications. This approach was suggested to facilitate a better recognition factor for the ARM publication and to introduce *ARM Outreach* to more than 1000 new subscribers to the other CDIAC and ARM publications.
- The back cover of *ARM Outreach* will be redesigned to facilitate the U.S. domestic mailing of the publication by bulk mailing rates. At the close of the second quarter, savings realized for distribution of *ARM Outreach* to CDIAC's distribution lists would amount to ~\$1600 in direct postage costs per issue.

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