



CDIAC

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

Environmental Sciences Division
Oak Ridge National Laboratory

March 1998

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

Fiscal Year 1997 Annual Report

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Carbon Dioxide Information Analysis Center

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Introduction

Fiscal year (FY) 1997 was another exciting and productive one for the Carbon Dioxide Information Analysis Center at Oak Ridge National Laboratory. As you will see in the "FY 1997 in Review" section in this report, we published quite a few new and updated data and information products; I hope you find them useful. And, as you will see in the "What's Coming in FY 1998" section, we hope to do the same in this new fiscal year.

During FY 1997, CDIAC launched the Quality Systems Science Center (QSSC) for the North American Research Strategy for Tropospheric Ozone (NARSTO). The purpose of NARSTO—a United States-Canada-Mexico initiative of government agencies, industry, and the academic research community—is to improve our understanding of the formation and transport of tropospheric ozone, a serious air pollutant. QSSC provides the communications, critical oversight, and constructive assistance necessary for maintaining consistency and quality in all NARSTO products. I invite you to check out the QSSC home page (<http://cdiac.esd.ornl.gov/programs/NARSTO/narsto.html>); it provides access to the Quality Systems Management Plan (QSMP), which establishes NARSTO's quality assurance and data management requirements, standards, specifications, and guidelines. To staff QSSC, we welcomed aboard environmental chemist Les Hook and atmospheric scientist Meng-Dawn Cheng. Les is the QSSC director and is also responsible for NARSTO quality assurance coordination, and Meng-Dawn serves as the QSSC chief scientist; Tom Boden is responsible for data management coordination.

Tom Boden will also continue in his role as director of CDIAC's World Data Center-A for Atmospheric Trace Gases. But to allow him to focus on his ongoing World Data Center and data packaging work as well as his new QSSC tasks, Tom is succeeded as CDIAC's deputy director by Dale Kaiser (who continues as leader of CDIAC's Global Change Data group).

I invite you to see what we have done this past year, and what our plans are for FY 1998.

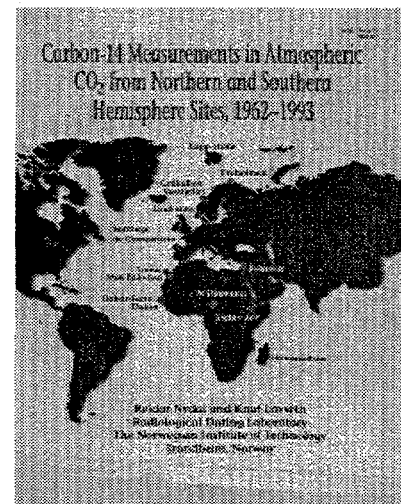
Robert M. Cushman

FY 1997 in Review

New Numeric Data Packages (NDPs)

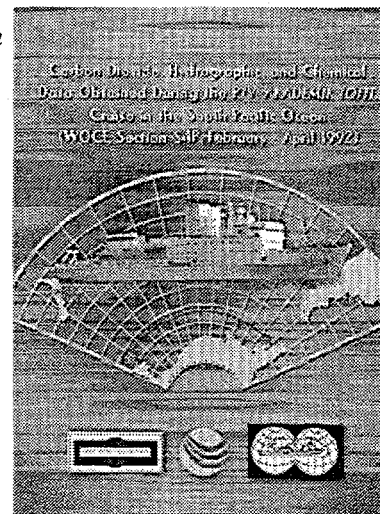
During fiscal year (FY) 1997, the Carbon Dioxide Information Analysis Center (CDIAC) at Oak Ridge National Laboratory (ORNL) published six numeric data packages (NDPs) under the auspices of the U.S. Department of Energy (DOE). The data and descriptive files are available via the Internet from CDIAC's anonymous file transfer protocol (FTP) area (cdiac.esd.ornl.gov) and from CDIAC's World Wide Web site (<http://cdiac.esd.ornl.gov>). Printed reports and data on magnetic media are available from CDIAC on request.

- ***Carbon-14 Measurements in Atmospheric CO₂ from Northern and Southern Hemisphere Sites, 1962-1993*** (ORNL/CDIAC-93, NDP-057), by Reidar Nydal and Knut Lövseth (Radiation Dating Laboratory, Trondheim, Norway) and prepared by CDIAC summer intern Virgene Zumbrunn (Princeton University) and CDIAC's Tom Boden. NDP-057 includes carbon-14 data from 1962 to 1993 collected at 14 surface stations spanning latitudes from 78° N to 21° S, supplemented with high-altitude air samples collected in 1965. These data contribute to a greater understanding of the dynamic carbon reservoir and a crude picture of anomalous sources and sinks at different latitudes.
(<http://cdiac.esd.ornl.gov/epubs/ndp/ndp057/ndp057.htm>)



- ***Geographic Patterns of Carbon Dioxide Emissions from Fossil-Fuel Burning, Hydraulic Cement Production, and Gas Flaring on a One Degree by One Degree Grid Cell Basis: 1950 to 1990*** (ORNL/CDIAC-97, NDP-058), by Robert Andres (University of Alaska, Fairbanks), Gregg Marland (ORNL), Inez Fung (University of Victoria, British Columbia; previously at the NASA Goddard Institute for Space Studies), and Elaine Matthews (Columbia University and NASA Goddard Institute for Space Studies), and prepared by CDIAC's Antoinette Brenkert. NDP-058 includes gridded (1° latitude by 1° longitude) data sets of CO₂ emissions from anthropogenic sources for 1950, 1960, 1970, 1980, and 1990. National estimates of emissions were combined with gridded data on political units and population distribution to create this gridded emissions database; population distribution was used as a proxy for the distribution of within-country emissions. Detailed geographic information on CO₂ emissions can be critical in understanding the pattern of the atmospheric and biospheric response to these emissions. (<http://cdiac.esd.ornl.gov/epubs/ndp/ndp058/ndp058.html>)
- ***Daily Snow Depth Measurements from 195 Stations in the United States*** (ORNL/CDIAC-95, NDP-059), by David Easterling, Paul Jamason, David Bowman, Pamela Hughes, and Elaine Mason [National Climatic Data Center (NCDC)] and prepared by CDIAC's Linda Allison. NDP-059 contains records of daily snow depth extending through 1992 from stations in 48 states (there are no records from Hawaii or Delaware). Some records extend as far back as 1893. The snow depth data have undergone extensive manual and automated quality assurance checks at NCDC and CDIAC. The century-scale periods of record at many stations should prove valuable to climate change researchers. (<http://cdiac.esd.ornl.gov/ndps/ndp059.html>)

- **Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V Thomas Washington Cruise TUNES-3 in the Equatorial Pacific Ocean (WOCE Section P16C)** (ORNL/CDIAC-96, NDP-060), by Catherine Goyet [Woods Hole Oceanographic Institution (WHOI)] and Peter Guenther, Charles Keeling, and Lynne Talley [Scripps Institution of Oceanography (SIO)] and prepared by CDIAC's Alex Kozyr. NDP-060 includes data on total CO₂ and total alkalinity (plus accompanying hydrographic and chemical data) during the 1991 cruise of the Research Vessel *Thomas Washington*, conducted as part of the World Ocean Circulation Experiment (WOCE). The cruise began at Papeete, Tahiti, on 31 August and ended at Honolulu, Hawaii, on 1 October. This database will contribute to the estimation of the meridional transport of inorganic carbon in the Pacific Ocean, an important piece in our understanding of the role of the world ocean in the global carbon cycle. (http://cdiac.esd.ornl.gov/oceans/ndp_060/ndp060.html)
- **Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V Thomas Washington Cruise TUNES-1 in the Equatorial Pacific Ocean (WOCE Section P17C)** (ORNL/CDIAC-99, NDP-062), by Catherine Goyet (WHOI), Robert Key (Princeton University), Kevin Sullivan (Rosensteil School of Marine and Atmospheric Sciences), and Mizuki Tsuchiya (SIO) and prepared by CDIAC's Alex Kozyr. NDP-062 discusses the procedures and methods used to obtain measurements of total CO₂, total alkalinity, and radiocarbon as well as hydrographic and chemical data during the 1991 cruise of the Research Vessel *Thomas Washington*, conducted as part of WOCE. The cruise began at San Diego, California, on May 31 and ended at Papeete, Tahiti, on July 11. (http://cdiac.esd.ornl.gov/oceans/ndp_062/ndp062.html)
- **Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V Akademik Ioffe Cruise in the South Pacific Ocean (WOCE Section S4P, February–April 1992)** (ORNL/CDIAC-100, NDP-063), by David Chipman, Taro Takahashi, Stephany Rubin, and Stewart Sutherland (Lamont-Doherty Earth Observatory), and Mikhail Koshlyakov (Shirshov Institute) and prepared by CDIAC's Alex Kozyr. NDP-063 includes data on total CO₂ and partial pressure of CO₂ (plus accompanying hydrographic and chemical data) during the 1992 cruise of the Research Vessel *Akademik Ioffe*, conducted as part of WOCE. The cruise began at Montevideo, Uruguay, on 14 February and ended at Wellington, New Zealand, on 6 April. This database will help resolve whether the Southern Ocean is a net source or a sink of carbon dioxide, an important piece in our understanding of the global carbon cycle. (http://cdiac.esd.ornl.gov/oceans/ndp_063/ndp063.html)



New Databases (DBs)

During FY 1997, CDIAC published two databases. The data and descriptive files are available via CDIAC's anonymous FTP area (cdiac.esd.ornl.gov) and from CDIAC's Web site (<http://cdiac.esd.ornl.gov>), as well as on a variety of magnetic media.

- **Northern Hemisphere Biome- and Process-Specific Forest Areas and Gross Merchantable Volumes: 1890–1990** (DB1017). Contributors: Allan Auclair, J. A. Bedford, and Carmen Revenga (Science and Policy Associates, Inc., Washington, D.C.) This database was prepared by CDIAC's Antoinette Brenkert. The database quantifies depletion and accrual processes in Alaska, Canada, Europe, the former Soviet Union, non-Soviet temperate Asia, and the contiguous 48 United States.

Depletion processes (source terms for atmospheric CO₂) include forest pests, diebacks, fires, harvests, and land use changes; accrual processes (sink terms for atmospheric CO₂) include fire exclusion and suppression and afforestation/crop abandonment. These data are valuable for determining the role of fluxes between the terrestrial biosphere and the atmosphere in the global carbon cycle. (<http://cdiac.esd.ornl.gov/epubs/db/db1017/db1017.html>)

- ***A Comprehensive Database of Woody Vegetation Responses to Elevated Atmospheric CO₂*** (DB1018). Contributor: Peter Curtis (Ohio State University). This database was prepared by CDIAC's Antoinette Brenkert. The multiparameter database, developed to support a statistically rigorous meta-analytical synthesis of research results on the response of vegetation to increased atmospheric CO₂ levels, was extracted from 84 independent CO₂-enrichment studies. (<http://cdiac.esd.ornl.gov/epubs/db/db1018/db1018.html>)

Updated NDPs and DBs

- ***Atmospheric CO₂ Concentrations—Mauna Loa Observatory, Hawaii, 1958–1996*** (NDP-001/R7), by Charles Keeling and Timothy Whorf (SIO). This update contains Keeling's Mauna Loa (Hawaii) monthly and annual atmospheric CO₂ record, to include data through 1996. This update was prepared by CDIAC's Tom Boden. These data represent the longest continuous record of atmospheric CO₂ concentrations in the world. This precise data series is a reliable indicator of the regional trend in the concentration of atmospheric CO₂ in the middle layers of the troposphere and is critical to CO₂-related research. (<http://cdiac.esd.ornl.gov/ndps/ndp001r5.html>)
- ***Annual and Seasonal Global Temperature Anomalies in the Troposphere and Low Stratosphere, 1958–1996*** (CDIAC/NDP-008/R4), by James Angell (Air Resources Laboratory, National Oceanic and Atmospheric Administration); prepared by CDIAC's Dale Kaiser and Tom Boden. Surface temperatures and thickness-derived temperatures from a global network of 63 radiosonde stations have been used to estimate annual and seasonal temperature anomalies over the globe and several zonal regions from 1958 through 1996. These estimates are calculated relative to a 1958–77 reference period mean, and pertain to the surface and the following atmospheric layers: troposphere (850–300 mb), tropopause (300–100 mb), low stratosphere (100–50 and 100–30 mb), and from the surface up to 100 mb.

Individual data sets containing the above measurements are provided for the globe, the Northern and Southern Hemispheres, and the following latitudinal zones: North (60–90° N) and South (60–90° S) Polar; North (30–60° N) and South (30–60° S) Temperate; North (10–30° N) and South (10–30° S) Subtropical; Tropical (30° N–30° S); and Equatorial (10° N–10° S). Most of the values are column-mean temperatures obtained from the differences in height between constant-pressure surfaces at individual radiosonde stations. The pressure-height data before 1980 were obtained from published values in Monthly Climatic Data for the World. These temperature anomalies may be used to analyze long-term temperature trends for a layer of the atmosphere (i.e., surface, troposphere, tropopause, and low stratosphere), a region (i.e., polar, temperate, subtropical, and equatorial), a hemisphere, or the globe. (<http://cdiac.esd.ornl.gov/ndps/ndp008r4.html>)

- ***Estimates of Global, Regional, and National Annual CO₂ Emissions from Fossil-Fuel Burning, Hydraulic Cement Production, and Gas Flaring: 1950–1994*** (NDP-030/R7), by Tom Boden and Gregg Marland (CDIAC), and Robert J. Andres (University of Alaska, Fairbanks). These data extend the period of record through 1994. Since 1992, global total emissions have climbed from 6093 million metric tons of carbon to 6200 million metric tons, the highest global total yet recorded. The United

States continues to be the single greatest carbon-emitting nation, responsible for 23% of the global total. [Updated CO₂ emission estimates extending from 1751 through 1995 are now available as NDP-030/R8 (January 1998). (<http://cdiac.esd.ornl.gov/ndps/ndp030.html>).]

- **The ALE/GAGE/AGAGE Network** (DB1001/R3). Contributors: Ronald Prinn (Massachusetts Institute of Technology), Derek Cunnold (Georgia Institute of Technology), Paul Fraser [Commonwealth Scientific and Industrial Research Organisation (CSIRO)], Ray Weiss (SIO), P. Simmonds (University of Bristol, UK), Fred Alyea (Georgia Institute of Technology), L. Paul Steele (CSIRO), and Dana Hartley (Georgia Institute of Technology). This database includes continuous measurements of the greenhouse gases methane; nitrous oxide; the chlorofluorocarbons CFC_{1,2}, CF₂Cl₂, and CF₂ClCFC_{1,2}; chloroform; methyl chloroform; and carbon tetrachloride. The data were compiled by CDIAC's Tom Boden. The program, which began in 1978, is divided into three parts associated with changes in instrumentation: the Atmospheric Lifetime Experiment (ALE), the Global Atmospheric Gases Experiment (GAGE), and the recently initiated Advanced GAGE (AGAGE). The current station locations are Cape Grim, Tasmania; Point Matatula, American Samoa; Ragged Point, Barbados; Mace Head, Ireland; and Trinidad Head, California. (Stations also previously existed at Cape Meares, Oregon, and Adrigole, Ireland.) Data through portions of 1996 are available for all five existing sites. (<http://cdiac.esd.ornl.gov/ndps/alegagage.html>)

Publications

- **Trends Online**, the electronic version of CDIAC's flagship data publication, now has a new user-friendly format for the CO₂ emissions section, thanks to a redesign performed by Dana Griffith, Tommy Nelson, and Tom Boden. This section, updated in FY 1997, provides global, regional, and national estimates of CO₂ emissions from fossil-fuel combustion and cement production for 1950–94 (data through 1995 was added in 1998)(from Boden and Marland) and global historical CO₂ emissions for 1860–49 (from Keeling). (http://cdiac.esd.ornl.gov/trends/emis/em_cont.htm)

The atmospheric CO₂ section in *Trends Online* also has the user-friendly format of the CO₂ emissions section. (<http://cdiac.esd.ornl.gov/trends/co2/contents.htm>)

- **Summaries of Research in FY 1996**. This report, published by DOE, was compiled and edited by Frederick M. O'Hara, Jr. It includes summaries of about 300 research projects by about 500 researchers funded by the DOE Environmental Sciences Division. Specific program areas in Global Change Research include Atmospheric Radiation Measurement, Unmanned Aerial Vehicles, Atmospheric Science, Climate Modeling, Education, Information and Integration, Integrated Assessment, National Institute for Global Environmental Change, Ocean Margins Program, Ocean Research, Program on Ecosystem Research, Quantitative Links, and Terrestrial Carbon Processes. Specific program areas in Environmental Remediation include Subsurface Science Program, Microbial Genome, and Environmental Radon. (<http://www.doe.gov/waisgate/er.html>)
- **Selected Translated Abstracts of Russian-Language Climate-Change Publications: IV. General Circulation Models** (ORNL/CDIAC-94; Proceedings of RIHMI-WDC, Issue 165), by Vyacheslav Razuvaev and Sergej Sivachok [All-Russian Research Institute of Hydrometeorological Information—World Data Center (RIHMI-WDC), Obninsk, Russia]. This report, compiled by CDIAC's Marvel Burtis, includes 118 side-by-side Russian and English abstracts relevant to general circulation models as they relate to climate change. The first three volumes in the series were on the topics of the surface energy budget, clouds, and aerosols. The series, produced under the auspices of a

1972 U.S.-U.S.S.R. agreement on protection of the environment, opens up to Western researchers a wealth of climate-change literature that has previously been available only in Russian.

- ***Fiscal Year 1996 Annual Report*** (ORNL/CDIAC-98), by CDIAC's Bob Cushman, Tom Boden, Sonja Jones, Dale Kaiser, and Tommy Nelson (with input from the other CDIAC staff) and compiled by Marvel Burtis. This report documents highlights from the fiscal year (new data products and other publications); provides statistics on the number of requests for global-change data and information from CDIAC; lists citations in the published literature of data obtained from CDIAC; alerts users to new data products that CDIAC hoped to release in FY 1997; lists awards received by CDIAC; lists publications and presentations of its staff; and lists the many organizations with which CDIAC collaborated to produce the data and information products it released in FY 1996. (<http://cdiac.esd.ornl.gov/epubs/cdiac/cdiac98/1996ann.htm>)
- ***Catalog of Databases and Reports*** (ORNL/CDIAC-34/R7) compiled by CDIAC's Marvel Burtis. The catalog provides information about the many reports and materials made available by CDIAC. The catalog indicates the databases and reports that are available in enhanced format (e.g., with hyperlinks and graphics) from CDIAC's Web site. (<http://cdiac.esd.ornl.gov/epubs/catalog/index.htm>)
- ***DOE Research Summary***, "Historical Variations in Terrestrial Biospheric Carbon Storage," by Mac Post, Anthony King, Stan Wullschleger, and Forrest Hoffman of ORNL's Environmental Sciences Division. Issue number 34, the final issue in the *DOE Research Summary* series, describes analyses of the balance between net primary production and respiration performed with a transient global terrestrial carbon cycle model. The model's carbon sink for the period 1900–88 accounts for almost 70% of the estimated total "missing sink" (required to balance the historical global carbon budget). The model also suggests that climate change, and especially CO₂ fertilization, accounts for almost half of the missing sink for the period 1950–88. This *DOE Research Summary* is available electronically. (<http://cdiac.esd.ornl.gov/pns/doers/doer34/doer34.htm>)
- ***Publications, Presentations, and Awards of the Carbon Dioxide Information Analysis Center and World Data Center-A for Atmospheric Trace Gases*** (ORNL/CDIAC-101), 1997, compiled by CDIAC's Bob Cushman. This document lists CDIAC's journal articles, book and proceedings chapters, data publications and online databases, other reports, presentations, and awards since its establishment in 1982. Available online only. (<http://cdiac.esd.ornl.gov/epubs/cdiac/cdiac101/publist.htm>)
- ***CDIAC Communications***, Number 23, Spring 1997, edited by Frederick O'Hara, Jr. This issue features a lead story about the new FACE (Free-Air CO₂ Exposure) facility constructed at ORNL; describes five NDPs, other new and revised DBs, and reports available from CDIAC; and announces other publications and events related to global change. *CDIAC Communications* is available electronically from CDIAC's Web site or in hard copy; however, future issues of *CDIAC Communications* will be mailed only to those who specifically request printed copies. (<http://cdiac.esd.ornl.gov/newsletr/spring97/spr97.htm>)

New Additions to Online Publications

- ***Atmospheric Carbon Dioxide Mixing Ratios from the NOAA Climate Monitoring and Diagnostics Laboratory Cooperative Flask Sampling Network, 1967–1993*** (ORNL/CDIAC-73, NDP-005/R3), 1996, by T. J. Conway and P. P. Tans. (prepared by CDIAC's Tom Boden; electronic publishing by Sonja Jones) (<http://cdiac.esd.ornl.gov/epubs/ndp/ndp005/ndp005r3.htm>)

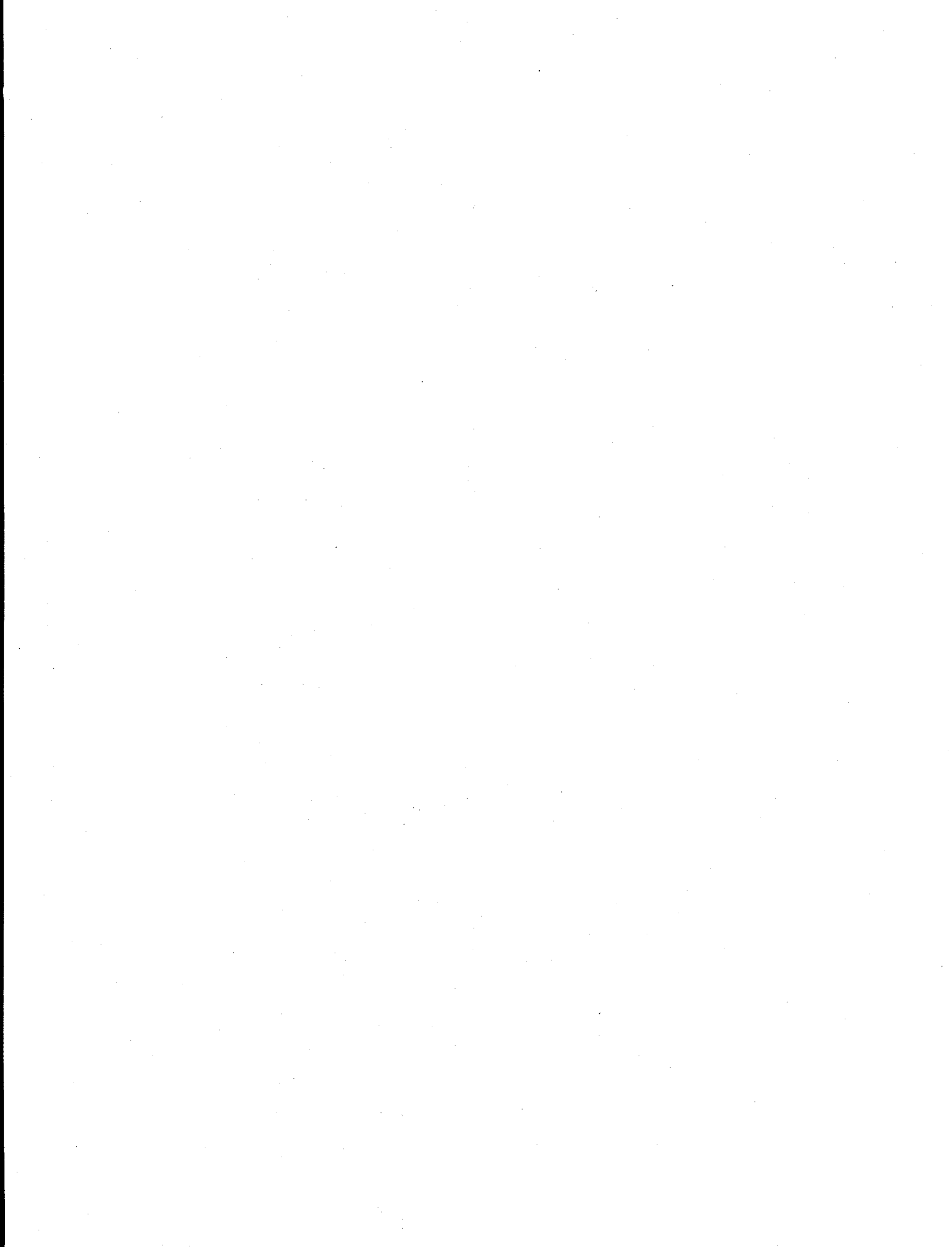
- *Carbon Dioxide Concentrations in Surface Water and the Atmosphere During 1986–1989 PMEL Cruises in the Pacific and Indian Oceans* (ORNL/CDIAC-75, NDP-047), 1995, P. K. Murphy, K. C. Kelly, R. A. Feely, and R. H. Gammon (preparation and electronic publishing by CDIAC's Alex Kozyr) (<http://cdiac.esd.ornl.gov/oceans/ndp047.html>)
- *Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V Meteor Cruise 11/5 in the South Atlantic and Northern Weddell Sea Areas (WOCE Sections A-12 and A-21)* (ORNL/CDIAC-55, NDP-045), 1994, by D. W. Chipman, T. Takahashi, D. Breger, and S. C. Sutherland (preparation and electronic publishing by CDIAC's Alex Kozyr) (http://cdiac.esd.ornl.gov/oceans/ndp_045/ndp045.html)
- *Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V Meteor Cruise 15/3 in the South Atlantic Ocean (WOCE Section A9, February–March 1991)* (ORNL/CDIAC-82, NDP-051), 1995, by K. M. Johnson, D. W. R. Wallace, R. J. Wilke, and C. Goyet. (preparation and electronic publishing by CDIAC's Alex Kozyr) (http://cdiac.esd.ornl.gov/oceans/ndp_051/ndp051.html)
- *Carbon-14 Measurements in Atmospheric CO₂ from Northern and Southern Hemisphere Sites, 1962–1993* (ORNL/CDIAC-93, NDP-057), 1996, by R. Nydal, and K. Lövseth. [prepared by CDIAC's Tom Boden and Virgene Zumbrunn (Oak Ridge Institute for Science Education); electronic publishing by Karen Gibson] (<http://cdiac.esd.ornl.gov/epubs/ndp/ndp057/ndp057.htm>)
- *Direct Effects of Atmospheric CO₂ Enrichment on Plants and Ecosystems: An Updated Bibliographic Data Base* (ORNL/CDIAC-70), 1994, by B. R. Strain, and J. D. Cure. (prepared by CDIAC's Bob Cushman; electronic publishing by Karen Gibson) (<http://cdiac.esd.ornl.gov/ndps/cdiac70.htm>)
- *Edited Synoptic Clouds Report from Ships and Land Stations Over the Globe, 1983–1991* (ORNL/CDIAC-93, NDP-026B), 1997 by C. J. Hahn, S. G. Warren, and J. London. (prepared by CDIAC's Tom Boden; electronic publishing by Karen Gibson) (<http://cdiac.esd.ornl.gov/epubs/ndp/ndp026b/ndp026b.htm>)
- *Graduate Student Theses Supported by DOE's Environmental Sciences Division* (DOE/ER-0649T), 1995, by R. M. Cushman (ORNL) and B. Parra (DOE/OBER). (preparation and electronic publishing by CDIAC's Bob Cushman) (<http://cdiac.esd.ornl.gov/epubs/doe/er0649t/er0649t.htm>)
- *Total Carbon Dioxide, Hydrographic, and Nitrate Measurements in the southwest Pacific During Austral Autumn, 1990: Results from NOAA/PMEL CGC-90 Cruise* (ORNL/CDIAC-84, NDP-052), 1995, by M. R. Lamb, R. A. Feely, L. Moore, and D. K. Atwood. (preparation and electronic publishing by CDIAC's Alex Kozyr) (http://cdiac.esd.ornl.gov/oceans/ndp_052/ndp052.html)

New Focus Areas

- CDIAC has created a World Wide Web home page for the AmeriFlux Network, the North American network of field research projects quantifying the exchange of CO₂, the most important greenhouse gas, between terrestrial ecosystems and the atmosphere. The home page provides descriptions of, and links to, the various CO₂ flux projects, which are funded by several agencies, including DOE; this will facilitate the AmeriFlux objectives to control and ensure quality in data collection, and to coordinate data information with other carbon flux networks, such as EuroFlux. The AmeriFlux home page,

which was designed and produced by CDIAC's Antoinette Brenkert, can be accessed from the *CDIAC Focus Area* page at CDIAC's Web site. (http://cdiac.esd.ornl.gov/cdiac/focus/focus_intro.html)

- CDIAC, which operates the Quality Systems Science Center (QSSC) for the North American Research Strategy for Tropospheric Ozone (NARSTO), has developed a QSSC home page (<http://cdiac.esd.ornl.gov/programs/NARSTO/narsto.html>). The purpose of NARSTO—a United States-Canada-Mexico initiative of government agencies, industry, and the academic research community—is to improve our understanding of the formation and transport of tropospheric ozone, a serious air pollutant. QSSC provides the communications, critical oversight, and constructive assistance necessary for maintaining consistency and quality in all NARSTO products. The QSSC home page provides access to the Quality Systems Management Plan (QSMP), which establishes NARSTO's quality assurance and data management requirements, standards, specifications, and guidelines. Les Hook is the QSSC director and is also responsible for NARSTO Quality Assurance Coordination, Meng-Dawn Cheng serves as the QSSC chief scientist, and Tom Boden is responsible for data management coordination.



CDIAC Presentations and Awards

Presentations

Boden, T. A. 1997. The Carbon Dioxide Information Analysis Center: Supporting the science and data needs of NARSTO. First NARSTO Ad Hoc Committee on Quality Systems and Data Management Meeting with the ORNL Quality Systems Science Center (QSSC). Oak Ridge, Tenn., February.

Boden, T. A. 1997. Magnitude and distribution of CO₂ emissions from fossil-fuel burning, cement production, and gas flaring: 1950–1994. Conference on Global Measurements of Atmospheric Chemistry. Toronto, May.

Boden, T. A. 1997. Data and information Activities by the Carbon Dioxide Information Analysis Center (CDIAC) in support of the CO₂ Experts Group. 9th WMO CO₂ and Isotopic Measurement Experts Meeting. Aspendale, Australia, August.

Boden, T. A., and R. M. Cushman. 1997. Restrictions on data distribution. Data Center Directors Meeting. Oak Ridge, Tenn., May.

Cushman, R. M. 1996. Global change data at ORNL: It's not just CO₂ anymore. A Forum for Integrating Multidisciplinary Research to Advance the Science of Global Change. Oak Ridge, Tenn., October.

Cushman, R. M. 1996. The role of CDIAC in data management for FACE. FACE Science Meeting. Durham, N.C., November.

Kaiser, D. P. 1997. Analysis of monthly mean cloud amount for China: 1951–1994. Third Meeting of the U.S. DOE-China Meteorological Administration Agreement on the Joint Study of Regional Climate, and at the Ninth Science Team Meeting of the U.S. DOE-Chinese Academy of Sciences Joint Study on the Greenhouse Effect. Seattle, Wash., September.

Kaiser, D. P., and R. S. Vose. 1997. Changes in monthly mean cloud amount over China: A closer look. Proceedings of the Eighth Symposium on Global Change Studies. Long Beach, Calif., February.

Kozyr, A. 1997. CDIAC's inventory of pCO₂ data. Seventh Session of the IOC-JGOFS CO₂ Advisory Panel. Warnemunde, Germany, June.

Kozyr, A. 1997. Status of the CO₂ and hydrographic data at CDIAC. 14th DOE CO₂ Survey Science Team Meeting. Durham, N.H., August.

Marland, G. 1997. CO₂ from fossil fuel burning: Updates on the magnitude, distribution, and uncertainty of emissions estimates. Fifth International Carbon Dioxide Conference. Cairns, Australia, August.

Awards

- East Tennessee Chapter of the Society for Technical Communications (STC) 1996 Competition. Conferred in February 1997.

Awards of Achievement in the 1996 Technical Publications Category

Atmospheric Carbon Dioxide Mixing Ratios from the NOAA Climate Monitoring and Diagnostics Laboratory Cooperative Flask Sampling Network, 1967–1993, by T. J. Conway and P. P. Tans (ORNL/CDIAC-73, NDP-005/R3)

Estimates of Global, Regional, and National Annual CO₂ Emissions from Fossil-Fuel Burning, Hydraulic Cement Production, and Gas Flaring: 1950–1992, by T. A. Boden et al. (ORNL/CDIAC-90, NDP-030/R6)

Managing Global Change Information, by F. W. Stoss, Oak Ridge National Laboratory *Review*, 28:30–39

Award of Merit in the 1996 Newsletters Category

DOE Research Summary Series

- Atlanta Chapter of the Society for Technical Communications 1996 Online Competition. Conferred in March 1997.

Award of Achievement in online newsletters

CDIAC Communications

- Additional Awards

Certificate of Appreciation for Continued Service, Organization for the Advancement of Environmental Concerns, presented to Tom Boden.

Selected CDIAC Citations

Data from CDIAC publications were cited in a number of journal articles, magazine articles, and newsletters. The following publications are representative of works that have been cited.

- DB1001, *The ALE/GAGE/AGAGE Network*

Cited in Kaufmann, R. K., and D. I. Stern. 1997. Evidence for human influence on climate from hemispheric temperature relations. *Nature* 388:39–44.

- DB1015, *Global Patterns of Carbon Dioxide Emissions from Soils on a 0.5 Degree Grid Cell Basis*

Cited in Breuer, G. 1997. CO₂-Emissionen des Bodens. *Naturwissenschaftliche Rundschau* 50. Jahrgang 1:29.

- NDP-019, *United States Historical Climatology Network (U.S. HCN) Monthly Temperature and Precipitation Data*

Cited in Harris, R. N., and D. S. Chapman. 1997. Borehole temperatures and a baseline for 20th-century global warming estimates. *Science* 275:1618–21.

- NDP-026, *Climatological Data for Clouds over the Globe from Surface Observations*

Cited in Dai, A., A. D. Del Genio, and I. Y. Fung. 1997. Clouds, precipitation and temperature range. *Nature* 386:665–66.

- NDP-030, *Global, Regional, and National Annual CO₂ Emission Estimates from Fossil-Fuel Burning, Hydraulic Cement Production, and Gas Flaring: 1950–1994*

Cited in Flavin, C. 1997. The legacy of Rio, in Linda Starke, (ed.), *State of the World 1997*. Norton, New York.

- NDP-039, *Two Long-Term Instrumental Climatic Data Bases of the People's Republic of China*

Cited in Dai, A., A. D. Del Genio, and I. Y. Fung. 1997. Clouds, precipitation and temperature range. *Nature* 386:665–66.

- NDP-041, *The Global Historical Climatology Network: Long-Term Monthly Temperature, Precipitation, Sea Level Pressure, and Station Pressure Data*

Cited in Green, P. M., D. M. Legler, C. J. Miranda, and J. J. O'Brien. 1997. *The North American Climate Patterns Associated with El Niño–Southern Oscillation*. COAPS Project Report Series 97–1, Center for Ocean-Atmospheric Prediction Studies. Florida State University, Tallahassee.

Cited in *Multi-Hazard Identification and Risk Assessment Report*. 1997. Federal Emergency Management Agency, Washington, D.C.

- NDP-043B, *A Coastal Hazards Data Base for the U.S. Gulf Coast*

Cited in *Multi-Hazard Identification and Risk Assessment Report*. 1997. Federal Emergency Management Agency, Washington, D.C.

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

Cited in Takahashi, T., R. A. Feely, R. F. Weiss, R. H. Wanninkhof, D. W. Chipman, S. C. Sutherland, and T. T. Takahashi. 1997. Global air-sea flux of CO₂: An estimate based on measurements of sea-air pCO₂ difference. *Proceedings of the National Academy of Sciences* 94:8292-99.

- NDP-047, *Carbon Dioxide Concentrations in Surface Water and the Atmosphere during 1986-1989 NOAA/PMEL Cruises in the Pacific and Indian Oceans*

Cited in Takahashi, T., R. A. Feely, R. F. Weiss, R. H. Wanninkhof, D. W. Chipman, S. C. Sutherland, and T. T. Takahashi. 1997. Global air-sea flux of CO₂: An estimate based on measurements of sea-air pCO₂ difference. *Proceedings of the National Academy of Sciences* 94:8292-99.

- NDP-048, *Six- and Three-Hourly Meteorological Observations from 223 U.S.S.R. Stations*

Cited in Groisman, P. Ya., and E. L. Genikhovich. 1997. Assessing surface-atmosphere interactions using former Soviet Union standard meteorological network data. Part I: Method. *Journal of Climate* 19(9):2154-83.

Cited in Groisman, P. Ya., E. L. Genikhovich, R. S. Bradley, and B. M. Ilyin. 1977. Assessing surface-atmosphere interactions using former Soviet Union standard meteorological network data. Part II: Cloud and snow cover effects. *Journal of Climate* 19(9):2184-99.

Cited in Yang, Z. -L., R. E. Dickinson, A. Robock, and K. Ya. Vinnikov. 1997. Validation of the snow submodel of the Biosphere-Atmosphere Transfer Scheme with Russian snow cover and meteorological observational data. *Journal of Climate* 10:353-73.

- ORNL/CDIAC-54, *Adapting to Sea-Level Rise in the U.S. Southeast: The Influence of Built Infrastructure and Biophysical Factors on the Inundation of Coastal Areas*

Cited in *Multi-Hazard Identification and Risk Assessment Report*. 1997. Federal Emergency Management Agency. Washington, D.C.

- ORNL/CDIAC-65, *Trends '93: A Compendium of Data on Global Change and Trends Online*

Cited in Craig, S., K. Holmén, and A. Björkström. 1997. Net terrestrial carbon exchange from mass balance calculations: An uncertainty estimate. *Tellus* 49B:136-48.

Cited in Flavin, C. 1997. The legacy of Rio, in Linda Starke, (ed.), *State of the World 1997*. Norton, New York.

Cited in Harris, R. N., and D. S. Chapman. 1997. Borehole temperatures and a baseline for 20th-century global warming estimates. *Science* 275:1618–21.

Cited in Kaufmann, R. K., and D. I. Stern. 1997. Evidence for human influence on climate from hemispheric temperature relations. *Nature* 388:39–44.

Cited in Nicholls, N. 1997. Increased Australian wheat yield due to recent climate trends. *Nature* 387:484–85.

Cited in Sabine, C. L., D. W. R. Wallace, and F. J. Millero. 1997. Survey of CO₂ in the oceans reveals clues about global carbon cycle. *EOS* 78:49ff.

Cited in Takahashi, T., R. A. Feely, R. F. Weiss, R. H. Wanninkhof, D. W. Chipman, S. C. Sutherland, and T. T. Takahashi. 1997. Global air-sea flux of CO₂: An estimate based on measurements of sea-air pCO₂ difference. *Proceedings of the National Academy of Sciences* 94:8292–99.

Cited in United Nations Environment Programme. 1997. *Global Environment Outlook (GEO-1)*. Nairobi, Kenya.

Cited in Wigley, T. M. L. 1997. Implications of recent CO₂ emission-limitation proposals for stabilization of atmospheric concentrations. *Nature* 390:267–70.

- *The Development of a Coastal Risk Assessment Database: Vulnerability to Sea-Level Rise in the U.S. Southeast*

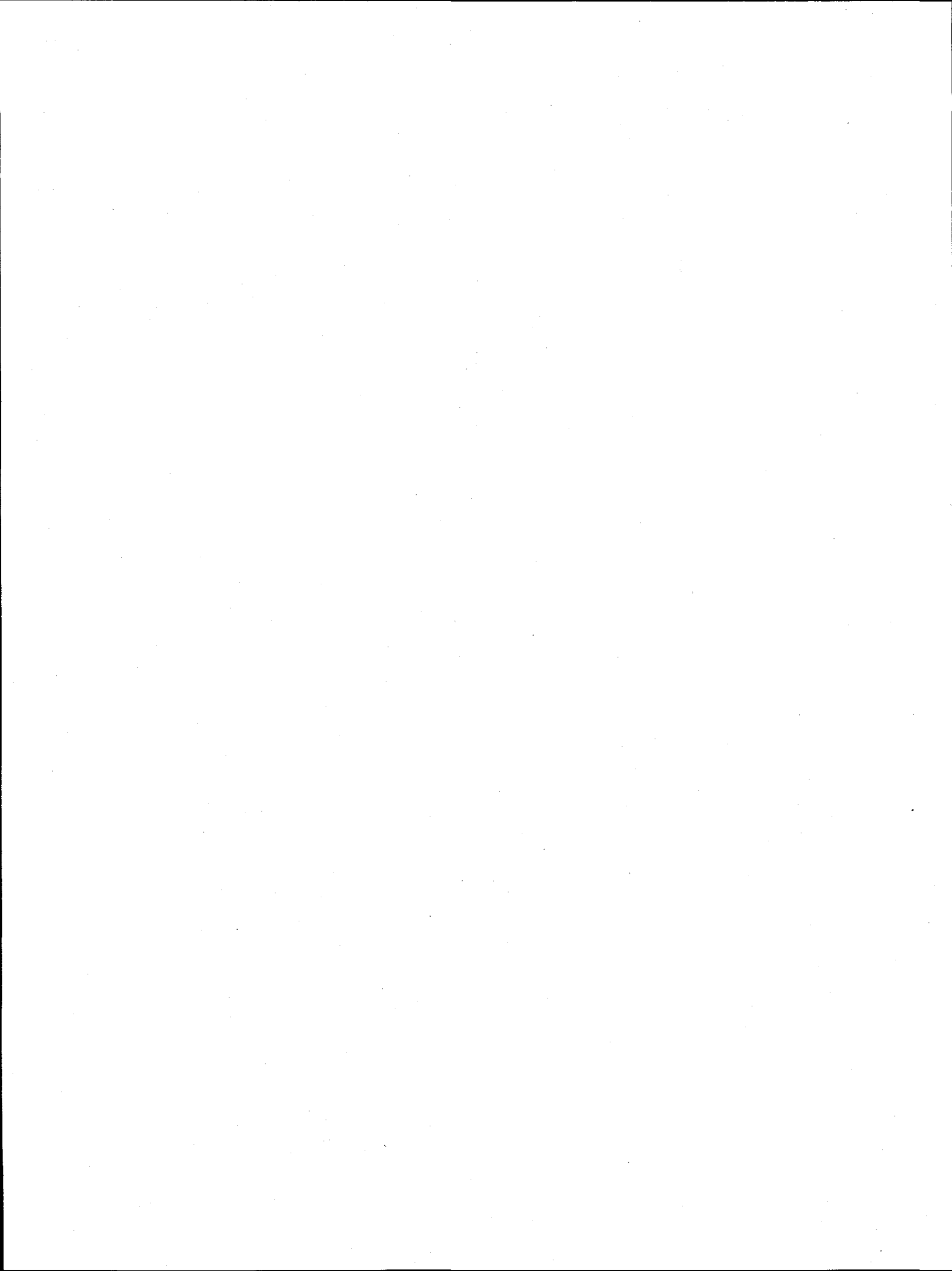
Cited in *Multi-Hazard Identification and Risk Assessment Report*. 1997. Federal Emergency Management Agency, Washington, D.C.

- Carbon Dioxide Information Analysis Center (CDIAC) World Wide Web home page

Cited in Cable News Network (CNN). 1996. Related sites about global warming. Linked from their online feature *How Hot Is It?*, This online feature accompanied a televised story about global warming. The CDIAC home page was one of only 17 related sites listed by CNN Interactive.

- Graph prepared by CDIAC detailing ice core data and the 40-year Mauna Loa record.

Cited in Subcommittee on Global Change Research, Committee on Environment and Natural Resources. 1997 *Our Changing Planet: The FY 1998 U.S. Global Change Research Program*. National Science and Technology Council, Washington, D.C.

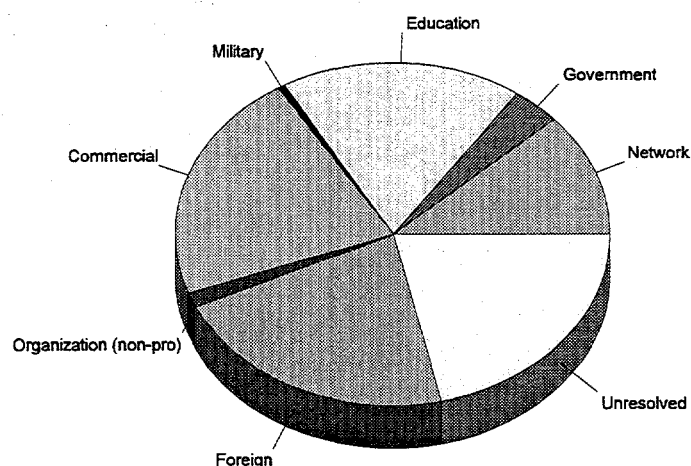


Statistics

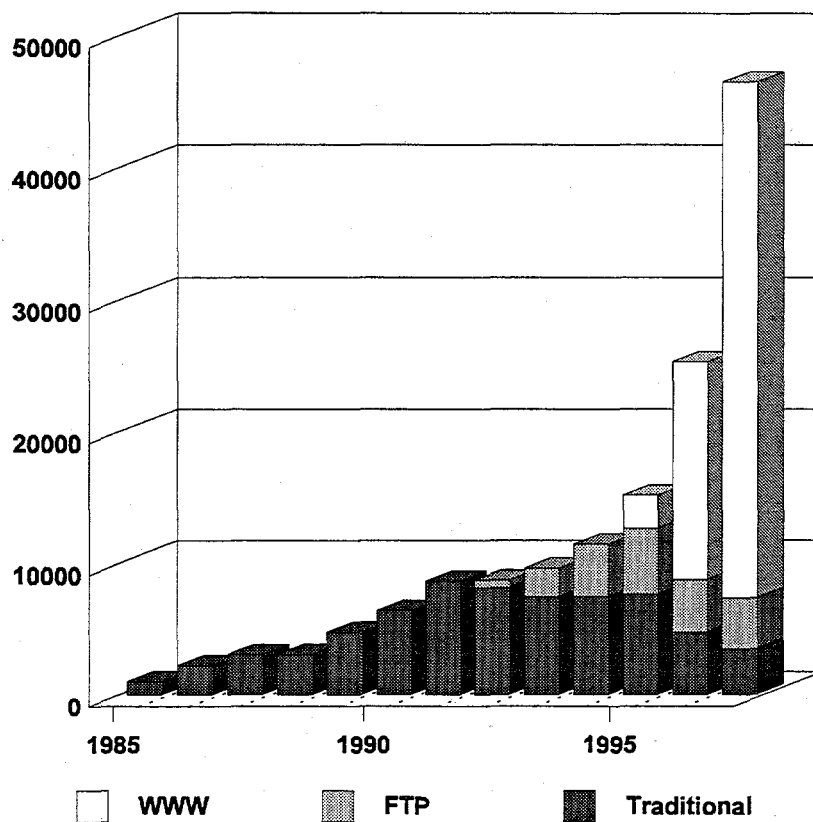
FY 1997

- CDIAAC's web site experienced over 60,000 visits from 39,100 unique hosts (an average of 164 visits per day).
- Over 346,000 web pages were viewed by users to CDIAAC's web site (average number of pages viewed per visit was six, and the number of pages viewed per day was 948).
- More than 90% of the visits to CDIAAC's web site were from nongovernment domains. The Education and International sectors accounted for as much as 50% of the audience.
- The two top keywords which people used to locate CDIAAC via online search engines (e.g., Yahoo, Alta Vista, etc.) were "carbon dioxide" and "cdiac."
- CDIAAC continued to receive traditional requests (i.e., mail, fax, phone, personal communication, and e-mail) for data and information. CDIAAC responded to a total of 3497 requests from 1302 individuals in 70 countries, distributing 3390 copies of NDPs, computer model packages, DBs, CDIAAC reports, DOE reports, and other materials.
- CDIAAC's anonymous file transfer protocol (FTP) area was accessed by over 3,800 unique systems retrieving 5355 datasets.

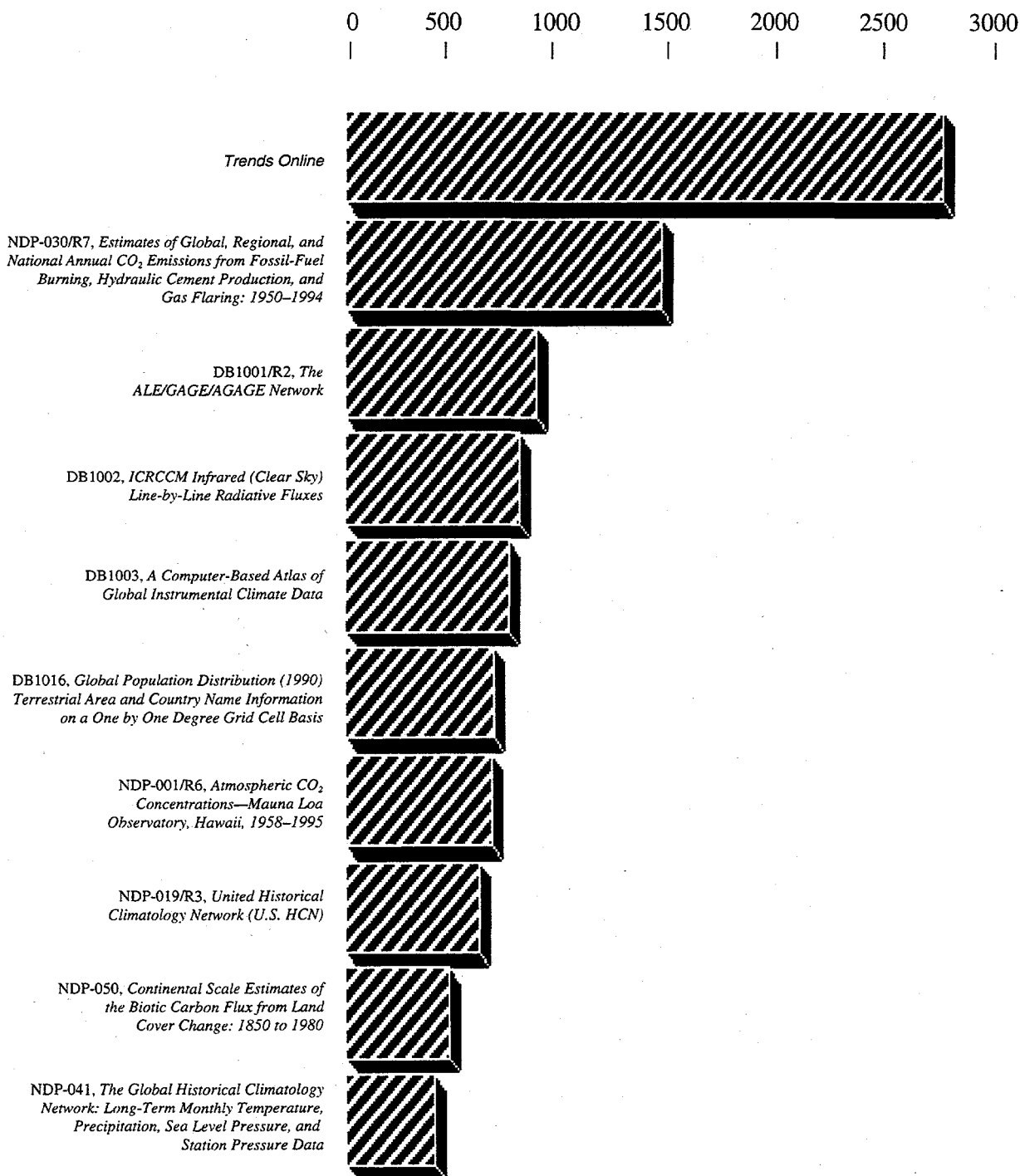
FY 1997 World Wide Web Visits by User Type

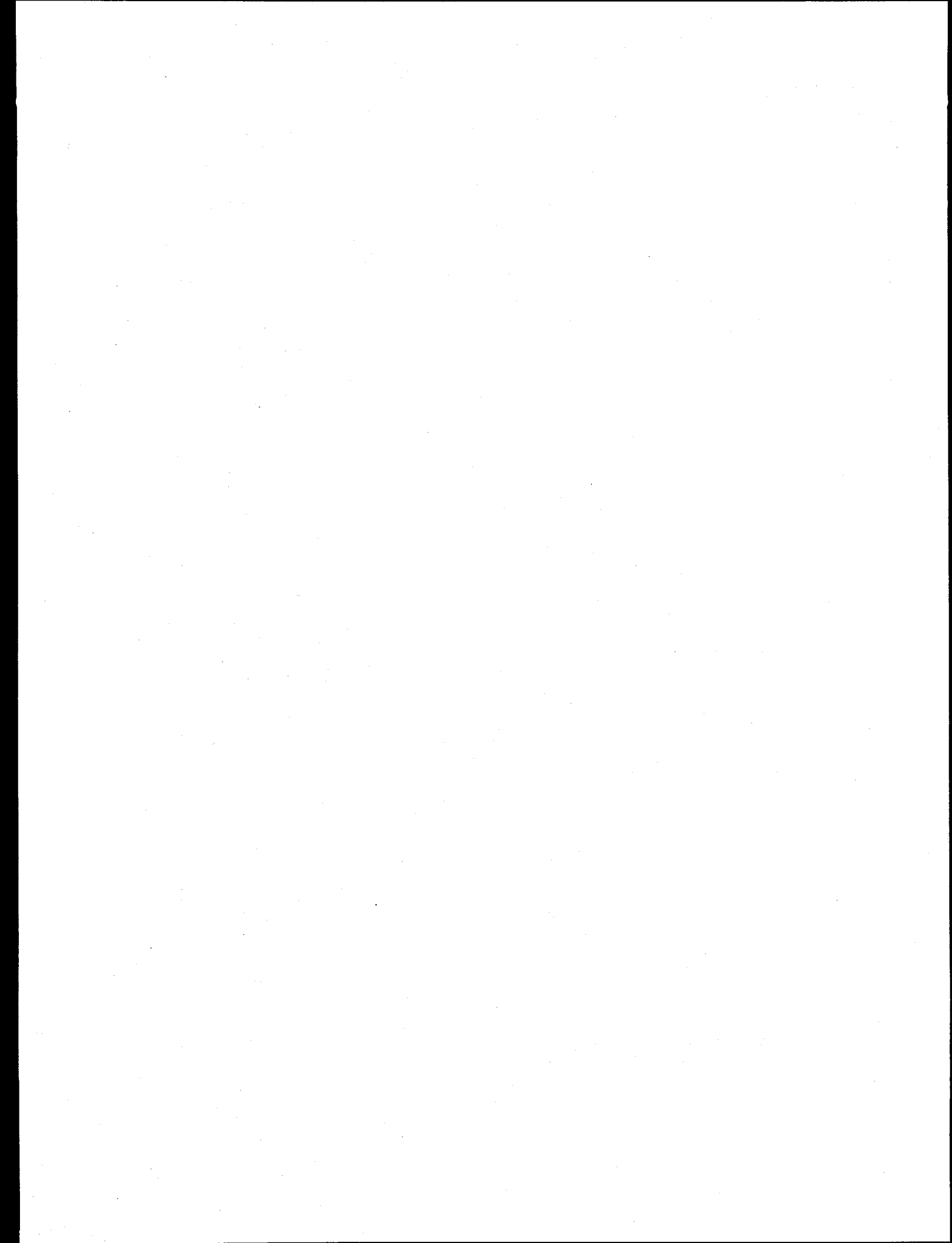


Requests to CDIAC nearly double in FY 1997!



CDIAC's Most Requested World Wide Web Documents





What's Coming in FY 1998

CDIAC is working on the following new or updated NDPs and hopes to have them available (both in printed format and online) in FY 1998. Several have already been completed and are available as noted.

New NDPs

- NDP-043C *A Coastal Hazards Data Base for the U.S. West Coast* (ORNL/CDIAC-81, NDP-043C), by Vivien M. Gornitz (Goddard Institute for Space Studies and Columbia University) and Tammy W. Beaty and Richard C. Daniels (ORNL). The document describes the contents of a digital database that may be used to identify coastlines along the U.S. West Coast that are at risk to sea-level rise. This database integrates point, line, and polygon data for the U.S. West 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 geographic information systems (GISs) as well as by non-GIS databases. Each coastal grid cell and line segment contains data variables from seven data sets: elevation, geology, geomorphology, sea-level trends, shoreline displacement (erosion/accretion), tidal ranges, and wave heights. One variable from each data set was classified according to its susceptibility to sea-level rise and/or erosion to form seven relative risk variables. These risk variables range in value from 1 to 5 and may be used to calculate a Coastal Vulnerability Index (CVI). Algorithms used to calculate several CVIs are listed within this text. The data for these 29 variables (i.e., the 22 original variables and seven risk variables) are available as (1) gridded polygon data for the 22 original data variables with data including elevation, geology, geomorphology, sea-level trends, shoreline displacement (erosion/accretion), tidal ranges, and wave heights; (2) gridded polygon data for the seven classified risk variables (mean coastal elevation, geology, geomorphology, local subsidence trend, mean shoreline displacement, maximum tidal range, and maximum significant wave height); (3) 1:2,000,000 line segment data containing the 29 data variables; (4) supplemental point data for the stations used in calculating the sea-level trend and tidal-range data sets; and (5) supplemental line segment data containing a 1:2,000,000 digitized coastline of the U.S. West Coast.

Completed December 1997. (<http://cdiac.esd.ornl.gov/ndps/ndp043c.html>)

- NDP-057A *Carbon-14 Measurements in Surface Water CO₂ from the Atlantic, Indian, and Pacific Oceans, 1965–1994*, by Reider Nydal (Norwegian Radiological Dating Laboratory); prepared by CDIAC's Antoinette Brenkert. This database for ocean carbon-14 is a parallel to the atmospheric carbon-14 database, NDP-057, and will be available by spring 1998. A total of 950 ocean surface water collections were made from 1965 through 1994. The seawater samples were analyzed for carbon-14 and then corrected for isotopic fractionation and radioactive decay. Measurements were made at 30 stations in the Atlantic Ocean, 14 stations in the Indian Ocean, and 38 stations in the Pacific Ocean, in addition to 32 observations in the Atlantic Ocean during a research cruise.

- NDP-061A *Effects of CO₂ and Nitrogen Fertilization on Growth and Nutrient Content of Juvenile Ponderosa Pine* (ORNL/CDIAC-107, NDP-061A). by Dale Johnson, J. Timothy Ball, and Roger Walker (Desert Research Institute and University of Nevada-Reno); prepared by CDIAC's Bob Cushman. This NDP presents concentration and content measured values for biomass and nutrients (carbon, nitrogen, phosphorus, sulfur, potassium, calcium, magnesium, boron, copper, iron, manganese, and zinc) from a study of the effects of CO₂ and nitrogen fertilization on ponderosa pine conducted in open-top chambers in Placerville, California.

- NDP-064 *Surface Water and Atmospheric Underway Carbon Data Obtained during the World Ocean Circulation Experiment Indian Ocean Survey Cruises (R/V Knorr, December 1994-January 1996)* (ORNL/CDIAC-103, NDP-064), by Christopher Sabine and Robert Key (Princeton University); prepared by CDIAC's Alex Kozyr and Linda Allison. This NDP presents the results of the surface water and atmospheric underway measurements of mole fraction of carbon dioxide, sea surface salinity, and sea surface temperature, obtained during the WOCE Indian Ocean survey cruises of December 1994-January 1996.

Completed January 1998. (http://cdiac.esd.ornl.gov/oceans/ndp_064/ndp064.html)

- NDP-0XX *The Carbonate System in the Atlantic Ocean along 24 ° North*, by Frank Millero (University of Miami). These carbon-related data were obtained during the Spanish R/V *Hesperides* cruise along WOCE Section A5 in the Atlantic Ocean along approximately 24° N.

- NDP-0XX *Tropical Southeast Asia: Land Cover and Biomass-Carbon Estimates for 1980*, by Sandra Brown (Oregon State University) and Anantha Prasad and Louis Iverson (U.S. Forest Service). This is the fourth database to be published by CDIAC concerning carbon fluxes to the atmosphere from tropical land-use changes. The database consists of estimates of geographically referenced carbon densities of forest soils and vegetation in tropical Asia. The vegetation carbon densities are based on potential carbon estimates, which are derived from climatic, edaphic, and geomorphic indices and vegetation and are subsequently modified on the basis of population densities, climate, and vegetation data. The soil organic carbon estimates are calculated from pedon data for tropical forests and mapped to a texture/climate map for all of tropical Asia.

- NDP-0XX *Carbon Dioxide, Hydrographic, and Nutrient Data Obtained during the R/V Meteor Cruise 22/5 in the South Atlantic Ocean (WOCE Section A10, December 1992-January 1993)*, by Ken Johnson and Doug Wallace (Brookhaven National Laboratory) and Bernd Schneider and Ludgar Mintrop (University of Kiel, Germany).

Updated NDPs

- NDP-039/R1 *Two Long-Term Instrumental Climatic Data Bases of the People's Republic of China* (ORNL/CDIAC-102, NDP-039/R1), by Tao Shiyan, Fu Congbin, Zeng Zhaomei, and Zhang Qingyun (Chinese Academy of Sciences); prepared by CDIAC's Dale Kaiser. Two long-term instrumental databases containing meteorological observations from the People's Republic of China (PRC) are presented in this NDP. The first version of this database extended through 1988 and was made available in 1991 as NDP-039. This update of the database includes data through 1993. These data sets were compiled in accordance with a joint research agreement signed by DOE and the PRC Chinese Academy of Sciences (CAS) on August 19, 1987. CAS has provided records from 270 stations, partitioned into two networks of 65 and 205 stations. The data for the 65-station network are monthly means, extremes, or totals of barometric pressure, air temperature, precipitation amount, relative humidity, sunshine duration, cloud amount, dominant wind direction and frequency, wind speed, and number of days with snow cover. Station histories are available from 59 of the 65 stations. Data for the 205-station network are monthly mean temperatures and monthly precipitation totals; however, station histories are not currently available. Sixteen stations from these data sets (13 from the 65-station, 3 from the 205-station) have temperature and/or precipitation records beginning before 1900, whereas the remaining stations began observing in the early to mid-1900s.

This is an online document. Because little has changed pertaining to documentation, a new companion document will not be printed. Completed October 1997.
(<http://cdiac.esd.ornl.gov/ndps/ndp039.html>)

- NDP-042/R1 *U.S. Historical Climatology Network (HCN) Daily Temperature and Precipitation Data*, by David Easterling, Thomas Karl, Elaine Mason, Pamela Hughes, and David Bowman (National Climatic Data Center). The data have been updated through 1994 and expanded to include not only the 138 stations in the original version of NDP-042 but also most of the remaining stations in the HCN, for a total of 1062 stations. This database is sure to be one of the most valuable climate resources available for the United States.
- NDP-048/R1 *Six- and Three-Hourly Meteorological Observations from 223 U.S.S.R. Stations*, by V. N. Razuvaev, E. G. Apasova, and R. A. Martuganov (All-Russian Research Institute of Hydrometeorological Information). CDIAC has been provided with updates of 3-hourly data extending the database's period of record from the mid-1980s through 1990.

New Databases

CDIAC hopes to publish the following databases in the DB series online during FY 1998.

- DB1019 *The Environmental Measurements Laboratory's Stratospheric Radionuclide (RANDAB) and Trace Gas (TRACDAB) Databases* (DB1019). Contributors: Robert Leifer, and Nita Chan [DOE Environmental Measurements Laboratory (EML)]. These databases were prepared by CDIAC's Tom Boden. The databases contain stratospheric radionuclide (RANDAB) and trace gas (TRACDAB)

measurements. RANDAB represents the world's largest collection of stratospheric and upper tropospheric radionuclide data. The database contains results of measurements made from 1957 to 1983 during the ASHCAN, STARDUST, AIRSTREAM, and High Altitude Sampling Program (HASP) projects. More than 20,000 filters were collected during this period and analyzed for approximately 40 different radionuclides. All of the available data characterizing each filter are included in RANDAB. RANDAB offers gas samples characterizing the tritium, radon, and $^{14}\text{CO}_2$ concentration in stratospheric air. Only a limited amount of data is available for radon because of analytical and sampling problems. The tritium data were graciously provided by Dr. Allen Mason (Los Alamos National Laboratory) and Dr. H. Gote Östlund (Tritium Laboratory, University of Miami).

The second database, TRACDAB, contains more than 1000 stratospheric trace gas measurements for the period 1974–1983. These samples were collected during Project AIRSTREAM. During the years 1974–1976, the samples were analyzed at EML. Subsequently, Washington State University (1976–1979) and the Oregon Graduate Institute for Science & Technology (formerly the Oregon Graduate Center) (1980–1983) were under contract to EML to analyze AIRSTREAM gas samples. During the period 1974–1983, 980 gas samples were analyzed for one or more of the following gases: CCl_3F , CCl_2F_2 , CCl_4 , CH_3CCl_3 , SF_6 , N_2O , CO_2 , CH_4 , and COS .

Completed October 1997. (<http://cdiac.esd.ornl.gov/epubs/db/db1019/db1019.html>)

- DB1020

Inventories of Anthropogenic Sulfur Emissions for 1985, Gridded Globally.

Contributor: Carmen Benkovitz (Brookhaven National Laboratory). The first part of the sulfur emission database and documentation will be online shortly and will consist of the 1985 anthropogenic sulfur emission data in units of 1000 kg sulfur per year per one° degree grid cell. The data for 1985 were compiled by Benkovitz et al. (1996) for the Global Emission Inventory Activity (GEIA) of the International Geosphere-Biosphere Programme and are available in GEIA format through anonymous FTP (ncardata.ucar.edu). The second part, the data for 1990, will be available after compilation.

- DBXXX

Atmospheric Halocarbon Records from the NOAA/CMDL Flask Sampling Program.

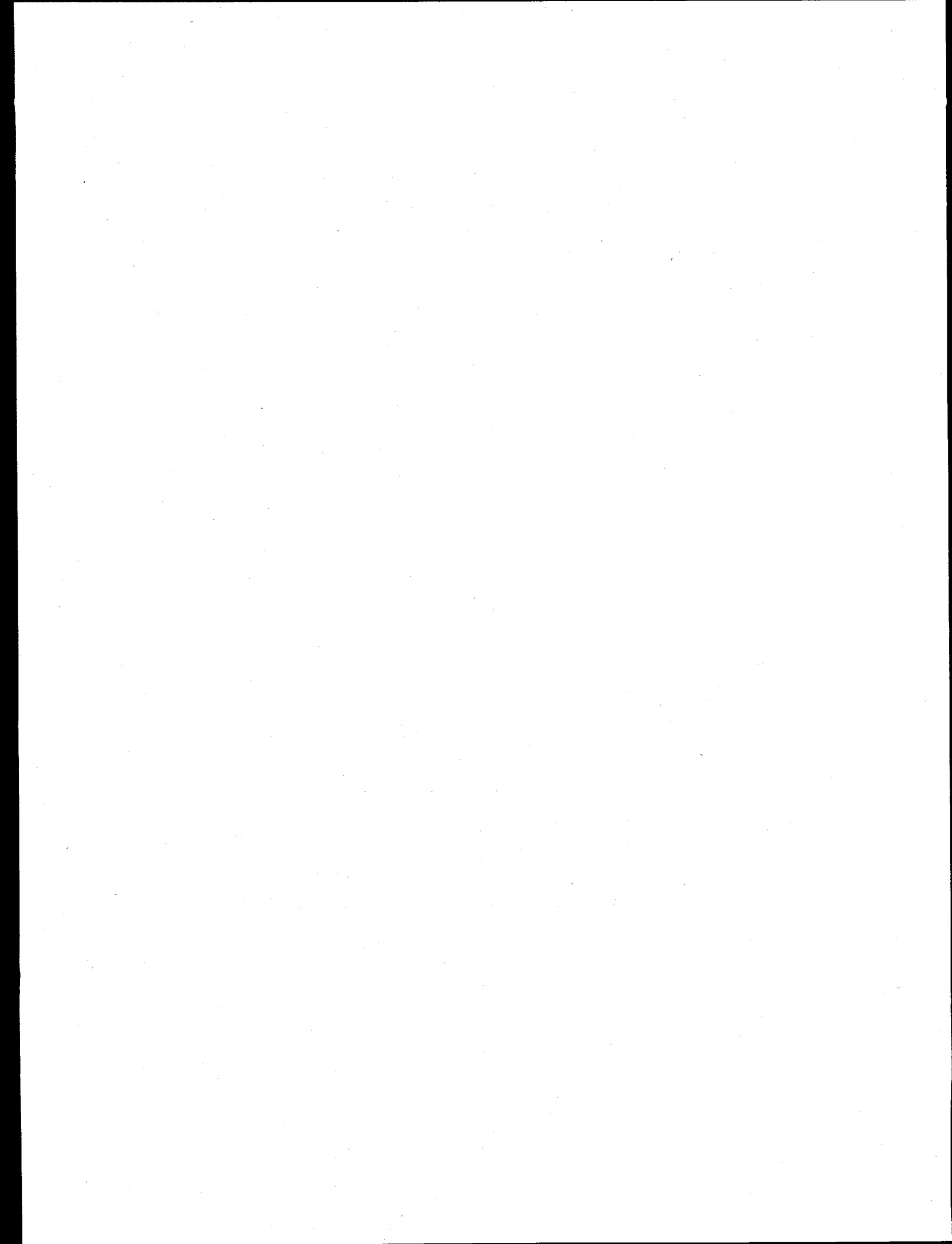
Contributors: James Elkins et al. (Climate Monitoring and Diagnostics Laboratory). This database will offer chlorofluorocarbon (CFC-11 and CFC-12) and halocarbon (HCFC-22, H-1301, and H-1211) records from seven National Oceanic and Atmospheric Administration/Climate Monitoring and Diagnostics Laboratory flask sampling sites: Niwot Ridge, Colorado; Mauna Loa, Hawaii; Point Barrow, Alaska; American Samoa; the South Pole; Alert, Northwest Territories, Canada; and Cape Grim, Tasmania. This database will offer records through 1995, including monthly values and measurements from individual flask samples.

Trends Online Update

Although CDIAC will not print a hard-copy version of *Trends* during FY 1998, we do plan to update and expand the *Trends Online* Atmospheric CO₂ and Fossil-Fuel CO₂ Emissions sections and publish the *Trends Online* Temperature section. The following summarizes the FY 1998 activities planned for each of these sections:

- **Atmospheric CO₂ levels.** During FY 1998 we hope to add (A) or update (U) the following records:
 - U Nostok ice core record (Barnola et al.)
 - A Law Dome ice core record (Etheridge)
 - U Mauna Loa, Barrow, American Samoa, and South Pole records from SIO (Keeling and Whorf)
 - U Baring Head in situ record (Manning et al.)
 - U Mt. Cimone in situ record (Colombo and Santaguida)
 - U Amsterdam Island in situ record (Gaudry et al.)
 - U K-Pushta in situ record (Haszpra)
 - U Lampedusa Island flask record (Ciattoglia and Chamard)
 - U Schauinsland ¹⁴CO₂ data update (Levin et al.)
 - U Wellington ¹⁴CO₂ record (Manning et al.)
 - A Cape Grim $\delta^{13}\text{C}$ record (Francey)
- **Fossil-fuel CO₂ emissions.** This section was redesigned during FY 1997, and we hope to add the following records during FY 1998:
 - A Global, regional, and national CO₂ emission estimates for 1751–1995 (Marland et al.)
- **Temperature.** During FY 1998 we hope to mark up the *Trends Online* Temperature section and offer the following records:
 - U Vostok ice core record (Jauzel et al.)
 - U Global and hemispheric surface records (Jones et al. and Hansen et al.)
 - U Global and hemispheric satellite records (Spencer and Christy)
 - U Global, hemispheric, and zonal radiosonde records (Angell)
 - U National and regional surface records (Karl et al.)
 - U National and regional surface records (Findlay et al.)
 - A National and regional surface records (Salinger et al.)

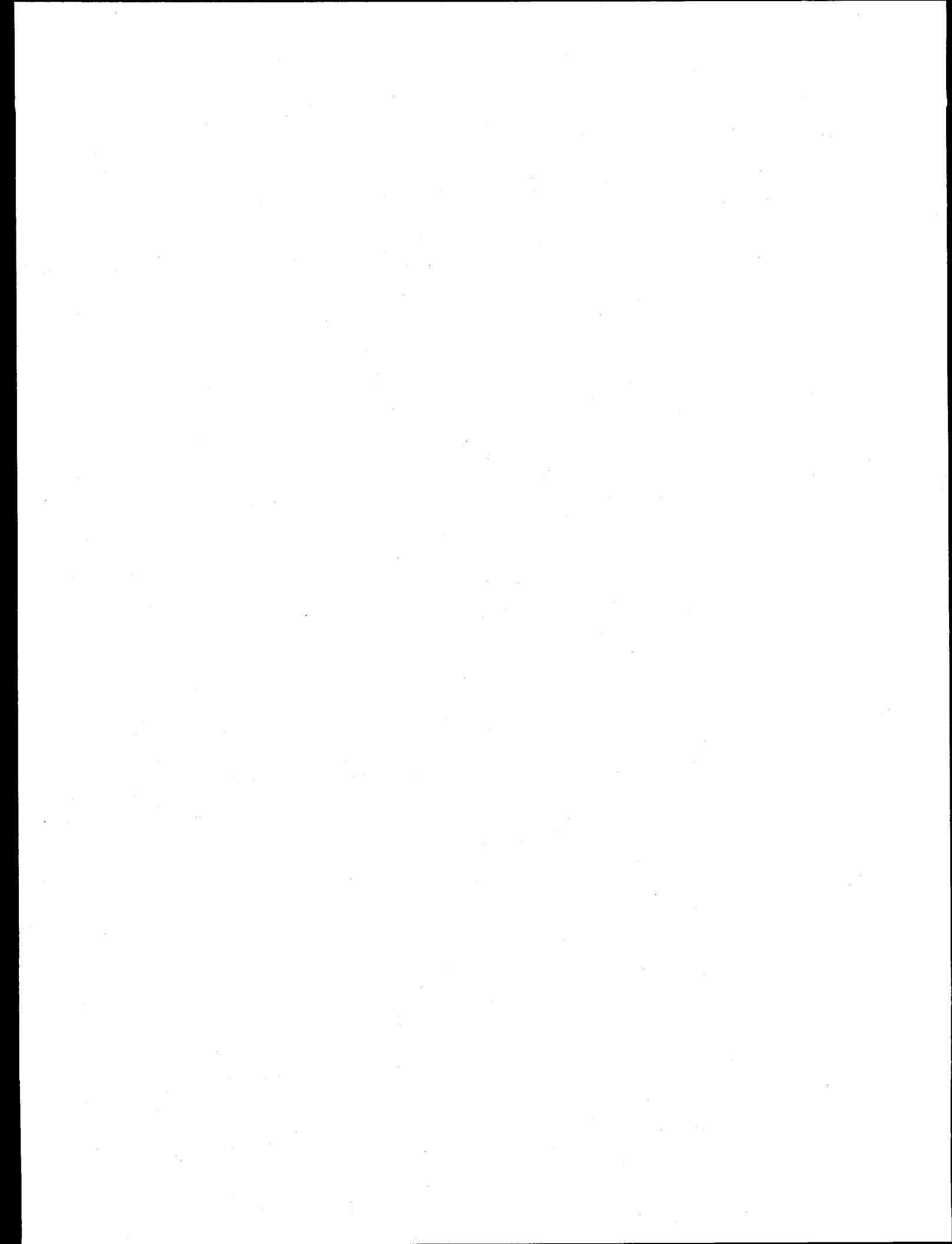
We also plan to have two new issues of our newsletter, *CDIAC Communications*, available during FY 1998. Look for these online (<http://cdiac.esd.ornl.gov/cdiac/newsletr/ccindex.html>); if you let us know, we will be glad to notify you via e-mail when a new issue is online. Printed copies of *CDIAC Communications* are available on request. Remember to check the “new” page on our Web site (<http://cdiac.esd.ornl.gov/cdiac/new/new.html>) for announcements of the latest CDIAC products.



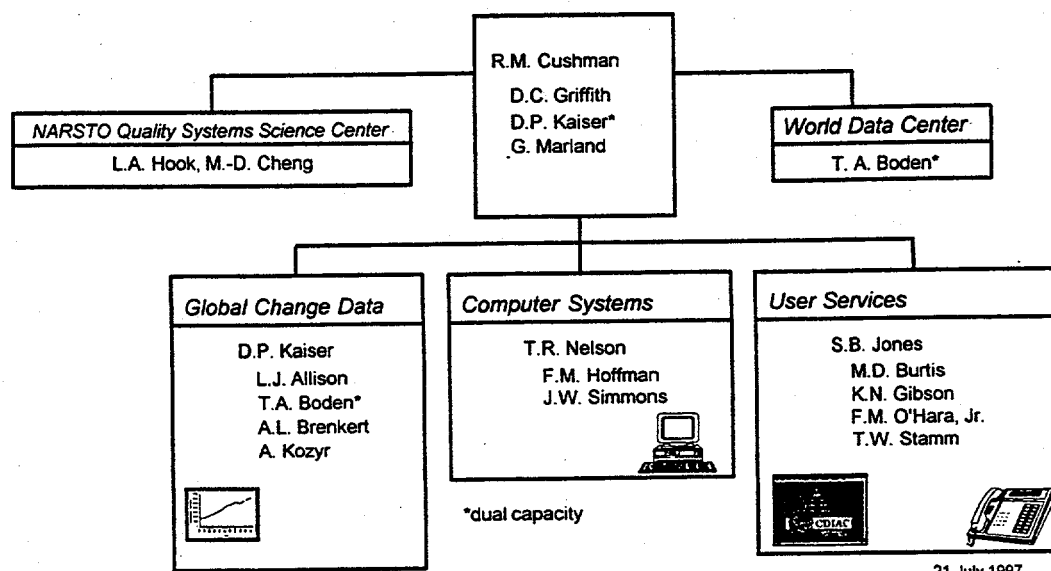
CDIAC Collaborations

CDIAC realizes that it would not be possible to produce global-change data and information products without the generosity and cooperation of researchers at institutions throughout the United States and around the world. In this annual report, we have noted the collaborating individuals and institutions for each product. Below are listed the many institutions that have collaborated with CDIAC in the publication of the databases and other information products described in this report.

- All-Russian Research Institute of Hydrometeorological Information—World Data Center
- Commonwealth Scientific and Industrial Research Organisation, Australia
- Duke University
- Georgia Tech University
- Institute for Atmospheric Physics, Beijing
- Institute for Atmospheric Physics, Hungary
- Lamont-Doherty Earth Observatory of Columbia University
- Massachusetts Institute of Technology
- NASA Goddard Institute for Space Studies
- NOAA Air Resources Laboratory
- NOAA Climate Monitoring and Diagnostics Laboratory
- NOAA National Climatic Data Center
- North American Research Strategy for Tropospheric Ozone (NARSTO)
- Ohio State University
- Princeton University
- Radiological Dating Laboratory, Norwegian Institute of Technology
- Science and Policy Associates, Inc.
- Scripps Institution of Oceanography
- Shirshov Institute of Oceanography (Moscow)
- University of Alaska—Fairbanks
- University of Galway, Ireland
- University of Miami
- University of Victoria, British Columbia
- Woods Hole Oceanographic Institution



Organization and Staff



21 July 1997

CDIAC staff in FY 1996

Staff	Phone no. (area code 423)	Internet address (@ornl.gov, unless stated otherwise)	Job title
Staff Office	574-0390	cdiac	
Linda J. Allison	576-8449	lja	Numeric data analyst
Thomas A. Boden	241-4842	tab	Director, WDC-A for Atmospheric Trace Gases; Ecologist
Antoinette Brenkert	574-7322	azt	Ecologist
Marvel D. Burtis	241-4843	um6	Editorial assistant
Meng-Dawn Cheng	241-5918	ucn	NARSTO QSSC chief scientist
Robert M. Cushman	574-4791	rma	Director, CDIAC
Richard C. Daniels ^{a, e}			
Karen N. Gibson	241-4854	gnk	User Services assistant
Dana C. Griffith	574-0390	xrq	Secretary
Forrest M. Hoffman	576-7680	hof	World Wide Web specialist
Les A. Hook	241-4846	lah	NARSTO QSSC Director
Sonja B. Jones	574-3645	cdp	Task leader, User Services
Dale P. Kaiser	241-4849	d9k	Meteorologist; task leader, Global Change Data
Alexander V. Kozyr ^a	241-4844	akozyr@utk.edu	Oceanographer
Gregg Marland	241-4850	gum	Senior scientist
Tommy R. Nelson ^b	574-0769	trn	Task leader, Computer Systems
Frederick M. O'Hara ^c	482-1447	ffo	Editor, <i>CDIAC Communications</i>
James W. Simmons ^d	574-1060	s4i	Workstation specialist
Timothy W. Stamm ^{a, e}			

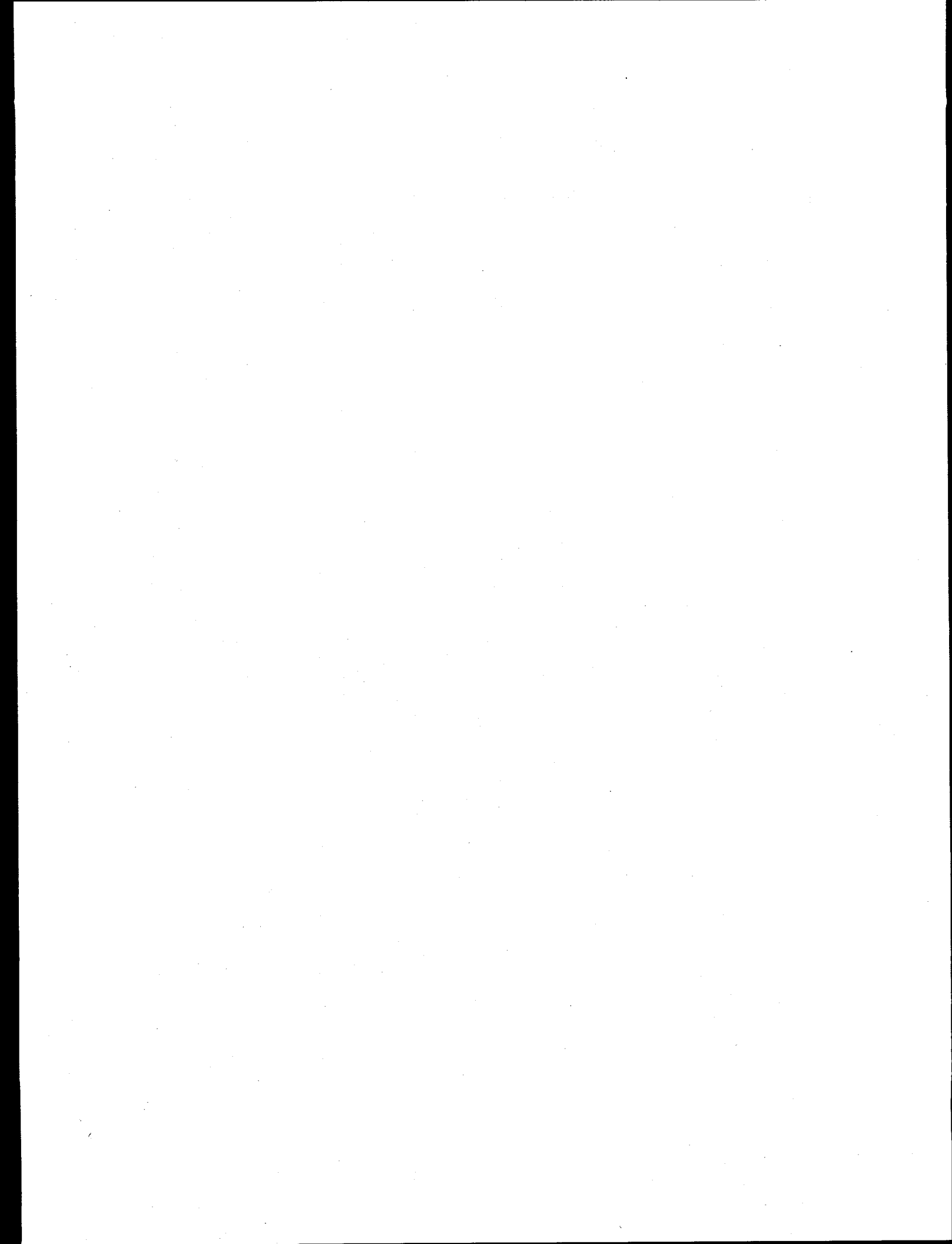
^aEnergy, Environment, and Resources Center, The University of Tennessee, Knoxville.

^bComputational Physics and Engineering Division, ORNL.

^cJAYCOR, Oak Ridge, Tenn.

^dComputing and Telecommunications Services, ORNL.

^eNo longer at CDIAC.



Acronyms and Other Abbreviations

AGAGE	Advanced Global Atmospheric Gases Experiment
ALE	Atmospheric Lifetime Experiment
AmeriFlux	American CO ₂ Flux Network
CDIAC	Carbon Dioxide Information Analysis Center
CFC	chlorofluorocarbon
DB	database
DOE	U.S. Department of Energy
FACE	Free-Air CO ₂ Exposure
FTP	File Transfer Protocol
FY	fiscal year
GAGE	Global Atmospheric Gases Experiment
HCN	Historical Climatology Network
NARSTO	North American Research Strategy for Tropospheric Ozone
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NDP	numeric data package
OBER	Office of Biological and Environmental Research (DOE)
ORNL	Oak Ridge National Laboratory
pCO ₂	partial pressure carbon dioxide
QSSC	Quality Systems Science Center
QSMP	Quality Systems Management Plan
RANDAB	Radionuclide Database
STC	Society for Technical Communications
TCO ₂	total carbon dioxide
TRACDAB	Trace Gas Database
WDC-A	World Data Center-A
WHOI	Woods Hole Oceanographic Institution
WOCE	World Ocean Circulation Experiment

Internal Distribution

- | | |
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