

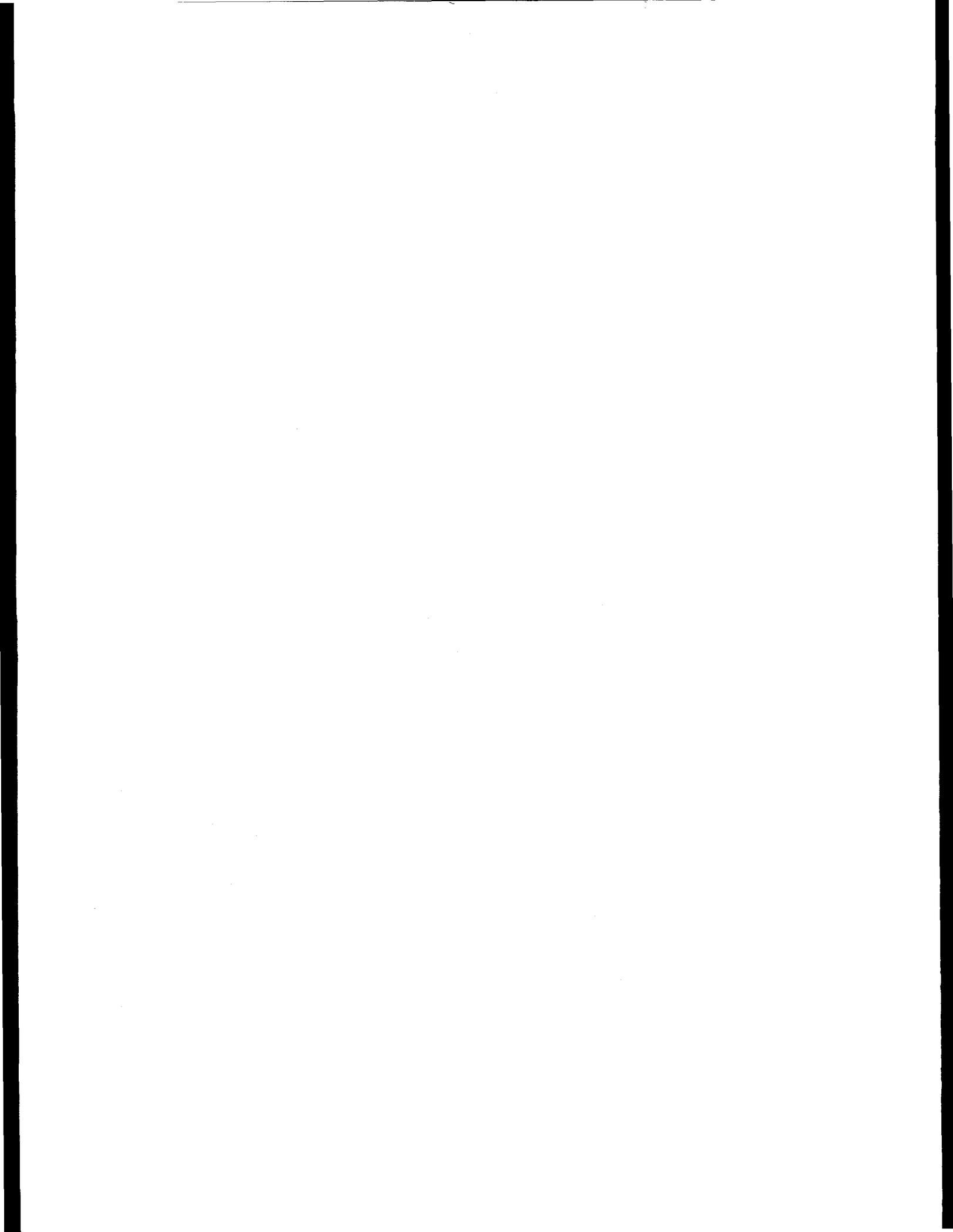
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Carbon Dioxide Information Analysis Center  
World Data Center-A for Atmospheric Trace Gases

Environmental Sciences Division  
Oak Ridge National Laboratory

January 1996



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

**Fiscal Year 1995  
Annual Report**

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Carbon Dioxide Information Analysis Center

Compiled by Marvel D. Burtis

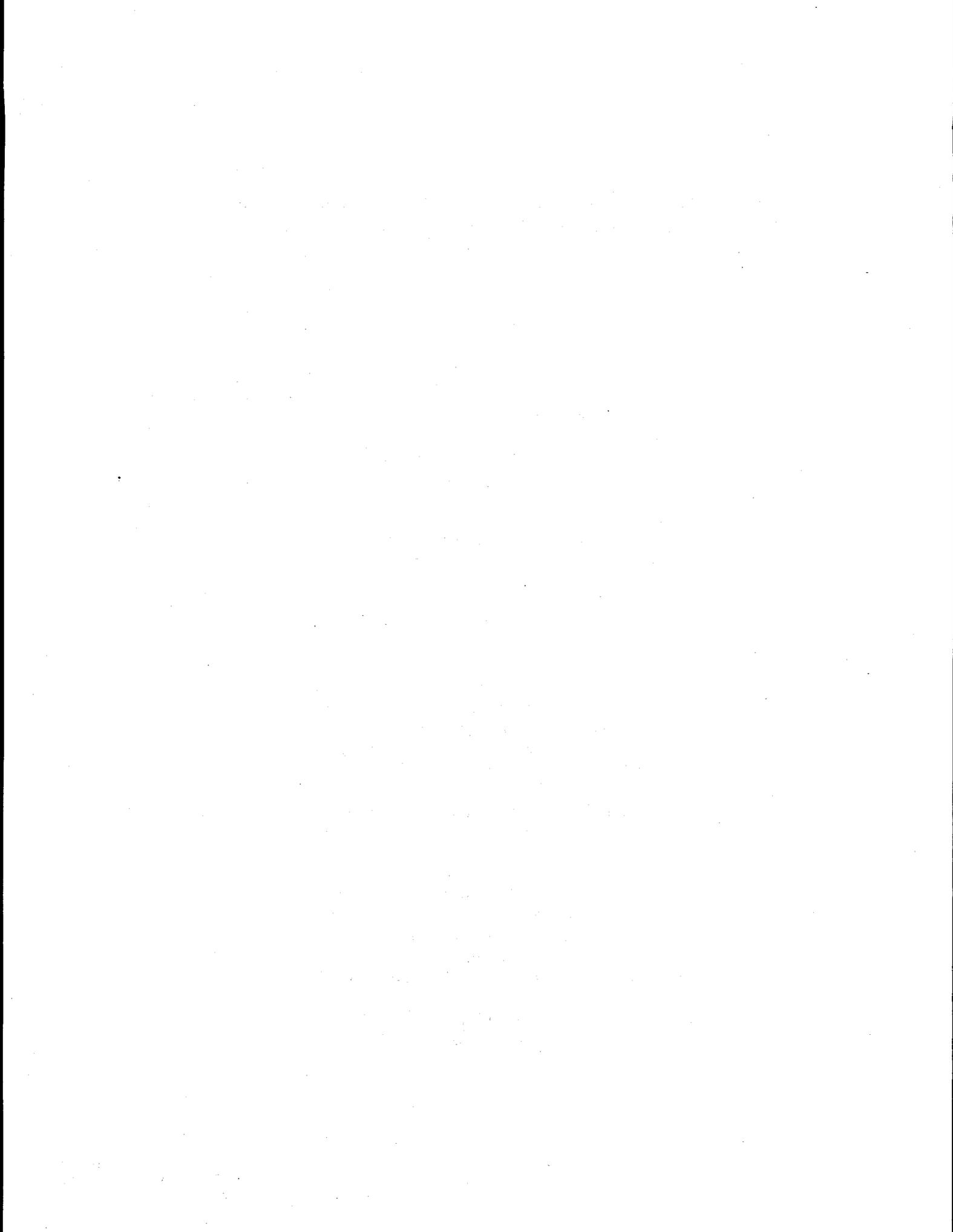
Environmental Sciences Division  
Publication No. 4489

Date Published: January 1996

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 02 00 0

Prepared by the  
Carbon Dioxide Information Analysis Center  
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Oak Ridge, Tennessee 37831-6335  
managed by  
LOCKHEED MARTIN ENERGY RESEARCH CORP.  
for the  
U.S. DEPARTMENT OF ENERGY  
under contract DE-AC05-96OR22464

**MASTER**



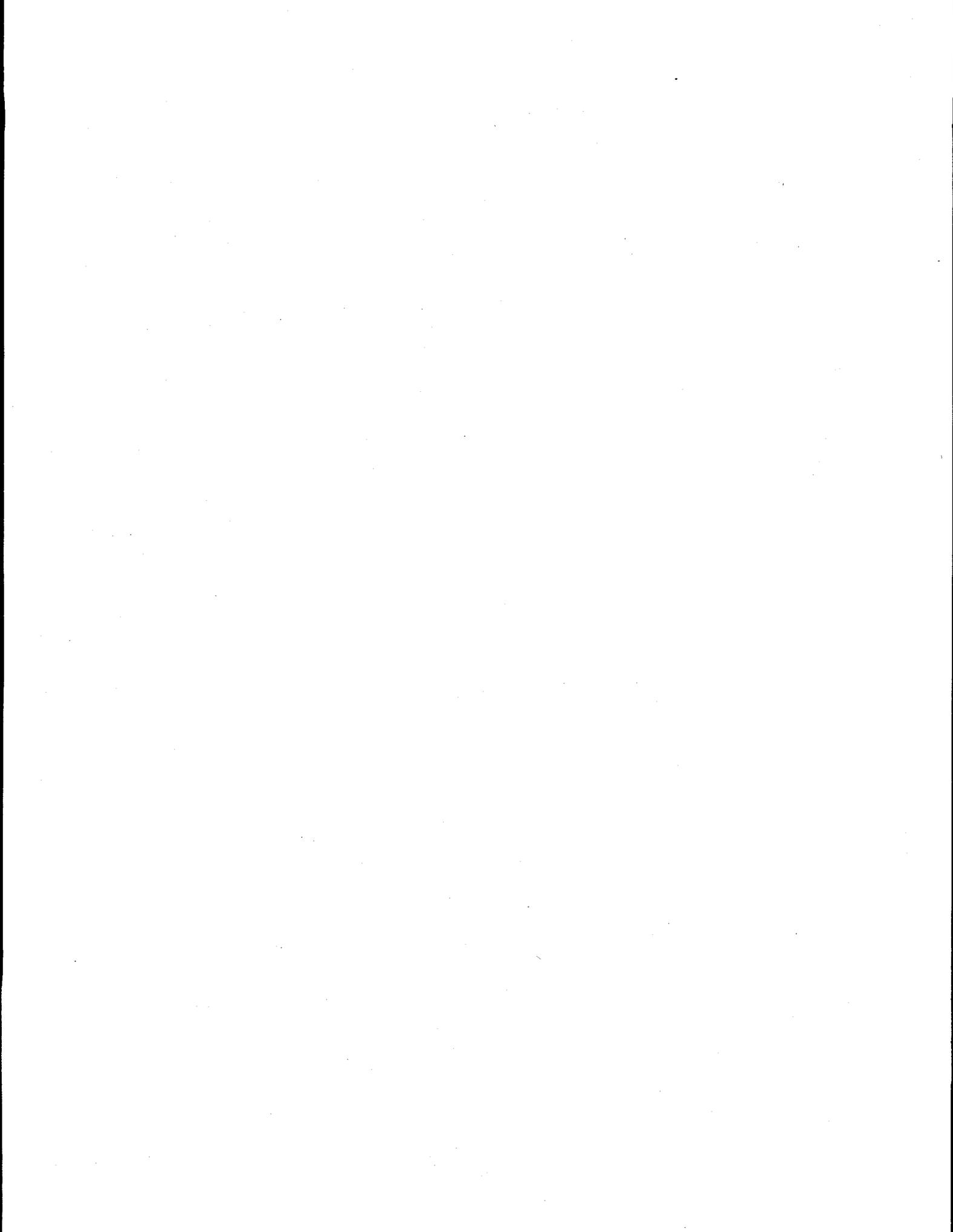
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## DISCLAIMER

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## Introduction

Fiscal year 1995 was both a very productive year for the Carbon Dioxide Information Analysis Center (CDIAC) at Oak Ridge National Laboratory (ORNL) and a year marked by significant change. The "Highlights" section in this report captures some of CDIAC's most notable accomplishments during the year.

As for change, I refer to both internal and external change. The issue of global climate change is still very much on the "front burner" in a scientific and policy setting: countries are still negotiating the details of adherence to the goals of the United Nations Framework Convention on Climate Change, and the latest findings of the Intergovernmental Panel on Climate Change underscore the gravity of the issue. At the same time, there is greater demand within the United States that agencies spending tax dollars on global-change matters provide the most focused, cost-effective research and services possible. CDIAC is constantly striving to deliver the best global-change data and information to a diverse user community in the most efficient manner. During the past year, we redoubled efforts to take advantage of the Internet (World Wide Web, file transfer protocol, and electronic mail) to respond to requests, advertise our products and services, and deliver data and information; that trend will surely continue. At the same time, we try not to leave behind those users who still prefer hardcopy to electronic products, who prefer to interact with us through telephone, fax, or "snail mail."

If you look over the organization chart and staff listing in this report, you will notice that some familiar names are missing. During the year, Tammy Beaty, Laura Morris, Bob Sepanski, Penny Sullenberger, and Russ Vose left CDIAC. Tammy became the geographic information systems coordinator for the ORNL Environmental Sciences Division (ESD). Laura left CDIAC for the Atmospheric Radiation Measurement (ARM) Archive at ORNL, and subsequently moved to South Dakota. Bob stayed in ESD but began to work in the area of local environmental restoration. Penny took another job in the Knoxville area. And Russ went to Arizona State University for a position in the State Climatologist's office. At the end of the fiscal year, CDIAC also lost Don Lue, Debbie Shepherd, and Fred Stoss. Don is now in charge of computer system development for a local real-estate company. Debbie moved to the ARM Archive. And Fred returned to The University of Tennessee's Energy, Environment and Resources Center. We will miss them all. None of them can be "replaced," but we hope that, as new staff members join CDIAC, we can redefine what all of us do here at CDIAC to provide the best possible service to our user community.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and processing, thereby improving efficiency and accuracy.

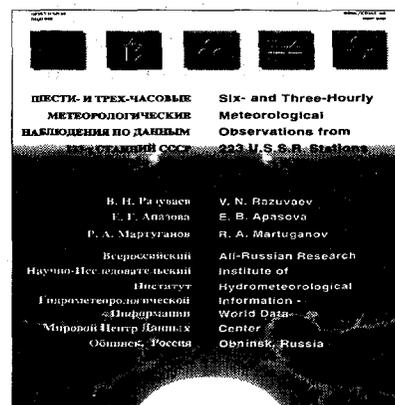
4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that the data remains reliable and secure throughout its lifecycle.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that the data management processes remain effective and aligned with the organization's goals.

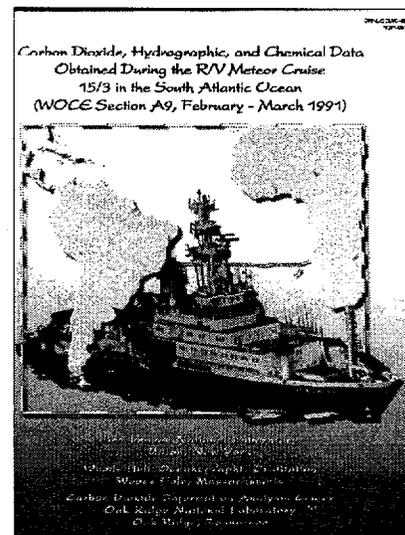
## Highlights

The Carbon Dioxide Information Analysis Center (CDIAC) at Oak Ridge National Laboratory (ORNL) published seven numeric data packages (NDPs):

- *Climatological Data for Clouds Over the Globe from Surface Observations, 1982–1991: The Total Cloud Edition* (ORNL/CDIAC-72, NDP-026A). This NDP, contributed by Carole Hahn (University of Colorado), Stephen Warren (University of Washington), and Julius London (University of Colorado), presents data on total cloud cover and the frequencies of occurrence of clear sky, precipitation, and sky-obscured conditions caused by fog, based on reports from ships and land stations over the entire globe from December 1981 through November 1991.
- *Carbon Dioxide Concentrations in Surface Water and the Atmosphere During 1986–1989 NOAA/PMEL Cruises in the Pacific and Indian Oceans* (ORNL/CDIAC-75, NDP-047). This NDP, contributed by Paulette Murphy of the National Oceanic and Atmospheric Administration's (NOAA's) Pacific Marine Environmental Laboratory (PMEL) and colleagues at PMEL and the University of Washington and prepared by CDIAC's Alex Kozyr, presents data on carbon dioxide concentrations measured quasi-continuously on 5 PMEL expeditions (12 legs) in the Pacific and Indian oceans.
- *Six- and Three-Hourly Meteorological Observations from 223 U.S.S.R. Stations* (ORNL/CDIAC-66, NDP-048). The data were contributed by V. N. Razuvaev, E. B. Apasova, and R. A. Martuganov of the All-Russian Research Institute of Hydrometeorological Information– World Data Center, and the NDP was prepared by CDIAC's Dale Kaiser. This NDP includes observations of 24 meteorological variables (including temperature, weather type, precipitation amount, cloud amount and type, sea-level pressure, relative humidity, wind direction and speed); the 6-hourly observations are from 1936 to 1965, and the 3-hourly observations are from 1966 through the mid-1980s.
- *Carbon-13 Isotopic Abundance and Concentration of Atmospheric Methane for Background Air in the Southern and Northern Hemispheres from 1978 to 1989* (ORNL/CDIAC-80, NDP-049). This NDP was contributed by C. M. Stevens of Argonne National Laboratory and prepared by CDIAC's Bob Sepanski and Laura Morris. It contains 201 records (166 from the Northern Hemisphere, 35 from the Southern Hemisphere), mostly from clean air sites (remote rural or marine locations) far from large sources of methane. The data are considered representative of tropospheric background conditions.
- *Continental Scale Estimates of the Biotic Carbon Flux from Land Cover Change: 1850 to 1980* (ORNL/CDIAC-79, NDP-050). This NDP, contributed by Richard Houghton and Joseph Hackler of the Woods Hole Research Center and prepared by CDIAC's Rich Daniels, contains annual estimates of the rate of land-cover change in nine regions of the world (North America, Europe, the former Soviet Union, Pacific Developed Region, China, South and Central America, North Africa–Middle East, Tropical Africa, and South and Southeast Asia), as well as regional and ecosystem-specific soil and vegetation response curves.



- *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). This NDP was contributed by Kenneth Johnson, Douglas Wallace, and Richard Wilke of Brookhaven National Laboratory and Catherine Goyet of the Woods Hole Oceanographic Institution (WHOI); and prepared by CDIAC's Alex Kozyr. NDP-051 includes data on total carbon dioxide, total alkalinity, and partial pressure of carbon dioxide taken during the World Ocean Circulation Experiment (WOCE) cruise that began in Vitoria, Brazil, on 10 February 1991 and ended in Pointe-Noire, Congo, on 23 March 1991. Samples were collected at 28 stations along the 19th parallel and at 3 diversions north and south of the 19th parallel.



- *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). This NDP was published in cooperation with NOAA and was contributed by Marilyn Lamb and Richard Feely of NOAA's PMEL and Lloyd Moore and Donald Atwood of the NOAA Atlantic Oceanographic and Meteorological Laboratory; it was prepared by CDIAC's Alex Kozyr. It includes data on total carbon dioxide, salinity, temperature, and nitrate taken at 63 Pacific Ocean stations during the CGC-90 Cruise of the Research Vessel *Malcolm Baldrige* in the austral autumn of 1990.

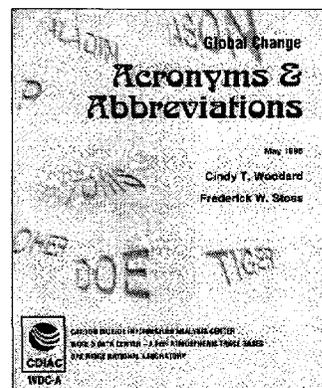
In addition to the aforementioned NDPs, CDIAC made available the following six on-line databases (DBs):

- *Atmospheric Methane at Cape Mearns, Oregon, U.S.A.: A High-Resolution Database for the Period 1979–1992* (DB-1007), provided to CDIAC by M. A. K. Khalil and R. A. Rasmussen (Oregon Graduate Institute of Science and Technology);
- *Atmospheric Methane Mixing Ratios: The NOAA/CMDL Global Cooperative Air-Sampling Network, 1983–1993* (DB-1008), contributed by E. J. Dlugokencky, P. M. Lang, and K. A. Masarie [NOAA Climate Monitoring and Diagnostics Laboratory (CMDL)];
- *Intergovernmental Panel on Climate Change (IPCC), Working Group I, 1994: Modelling Results Relating Future Atmospheric CO<sub>2</sub> Concentrations to Industrial Emissions* (DB-1009), contributed by I. G. Enting (Commonwealth Scientific and Industrial Research Organisation, Australia), T. M. L. Wigley (University Corporation for Atmospheric Research), and M. Heimann (Max Planck Institute für Meteorologie, Germany);
- *Globally Averaged Atmospheric CFC-11 Concentrations: Monthly and Annual Data for 1975–1992* (DB-1010), provided by M. A. K. Khalil and R. A. Rasmussen (Oregon Graduate Institute of Science and Technology);

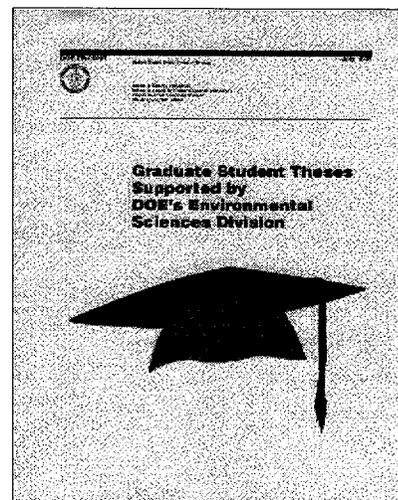
- *Atmospheric Carbon Monoxide Mixing Ratios, NOAA Climate Monitoring and Diagnostics Laboratory Cooperative Air Sampling Network, 1988 to 1993* (DB-1011), contributed by P. C. Novelli and K. A. Masarie (NOAA CMDL and University of Colorado, Cooperative Institute for Research in Environmental Sciences)
- *A Global Model for Present-Day Atmospheric Soil CO<sub>2</sub> Consumption by the Chemical Erosion of Continental Rocks (GEM-CO<sub>2</sub>)* (DB-1012), provided by P. A. Suchet and J.-L. Probst (Centre National de la Recherche Scientifique, France).

CDIAC published four global-change reports:

- *Report of the International Workshop on Quality Control of Monthly Climate Data* (NCDC Global Climate Laboratory Monograph, ORNL/CDIAC-69). This report, published in collaboration with the National Climatic Data Center (NCDC) and the World Meteorological Organization (WMO), presents the findings of the October 1993 workshop in Asheville, North Carolina, which was coordinated by NCDC's Tom Peterson. The purpose of the workshop was to recommend and implement techniques for improving the quality of data published in the NCDC/WMO *Monthly Climatic Data for the World* series.
- *Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Sea Water, Vol. 2* (ORNL/CDIAC-74), published in collaboration with the Scripps Institution of Oceanography (SIO) and WHOI. This report, edited by SIO's Andrew G. Dickson and WHOI's Catherine Goyet, presents the current state of the art for shipboard measurements of carbon chemistry (dissolved inorganic carbon, total alkalinity, partial pressure of carbon dioxide (CO<sub>2</sub>), and pH). The documentation of standardized methods for analyzing the carbon dioxide system in sea water is an especially important quality-assurance measure as international research groups such as the Joint Global Ocean Flux Study and the WOCE survey the carbon chemistry of the world's oceans and attempt to quantify the role of the oceans in the global carbon cycle.
- *Global Change Acronyms and Abbreviations* (ORNL/CDIAC-83), compiled by CDIAC's Cindy Woodard and Fred Stoss. The list will help the user decipher the many linguistic initialisms and abridgements encountered in global-change literature. The terms included in this list were selected from a wide variety of sources: technical reports, policy documents, global change program announcements, newsletters, and other periodicals. The disciplinary interests covered by this document include agriculture, atmospheric science, ecology, environmental science, oceanography, policy science, and other fields.



- *Graduate student theses supported by DOE's Environmental Sciences Division (DOE/ER-0649T)*, produced in collaboration with the U.S. Department of Energy (DOE). This report, which was compiled by CDIAC's Bob Cushman and DOE's Bobbi Parra, provides complete bibliographic citations, abstracts, and keywords for 212 doctoral and master's theses supported fully or partly by DOE's Environmental Sciences Division (and its predecessors) in the following areas: atmospheric sciences; marine transport; terrestrial transport; ecosystems function and response; carbon, climate, and vegetation; information; Computer Hardware, Advanced Mathematics, and Model Physics; Atmospheric Radiation Measurement; oceans; National Institute for Global Environmental Change; unmanned aerial vehicles; integrated assessment; graduate fellowships for global change; and quantitative links.

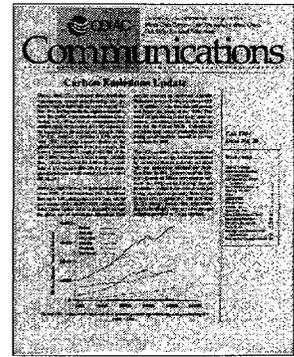


CDIAC published two issues in the *DOE Research Summary* series:

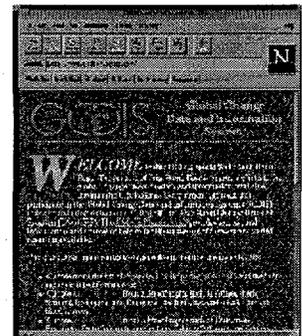
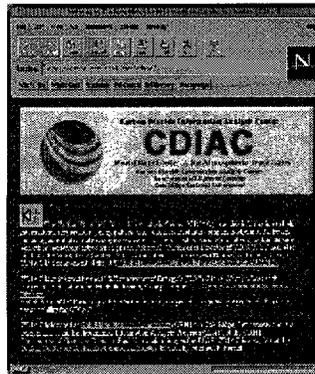
- “High-Resolution Model for Tropospheric Sulfate Driven by Observation-Derived Meteorology” by Carmen Benkovitz of Brookhaven National Laboratory (BNL) and colleagues at BNL and Pacific Northwest Laboratory (No. 30 in the *DOE Research Summary* series). Sulfate aerosols, especially those caused by fossil-fuel sulfur emissions, are of interest because they may offset global warming. This issue describes a model that Benkovitz and colleagues developed to trace sulfur emissions from their sources; to account for their transport by meteorological processes and their transformation by chemical reactions in the atmosphere; and to predict the resulting aerosol burdens as a function of latitude, longitude, height, and time.
- “Spatially Explicit Models of Land Use Change and Their Application to the Tropics” by Charles A. S. Hall, Hanqin Tian, Ye Qi, Gil Pontius, Joseph Cornell, and James Uhlig of the State University of New York, Syracuse (No. 31 in the *DOE Research Summary* series). In attempts to “balance” the global carbon cycle (which controls the atmospheric concentration of carbon dioxide, an important greenhouse gas), quantifying the role of tropical forests as sources or sinks of carbon is important. This issue describes the GEOMOD models, which simulate carbon fluxes from changing land use, and demonstrates the use of GEOMOD in sub-Saharan Africa, Central America, and Southeast Asia.

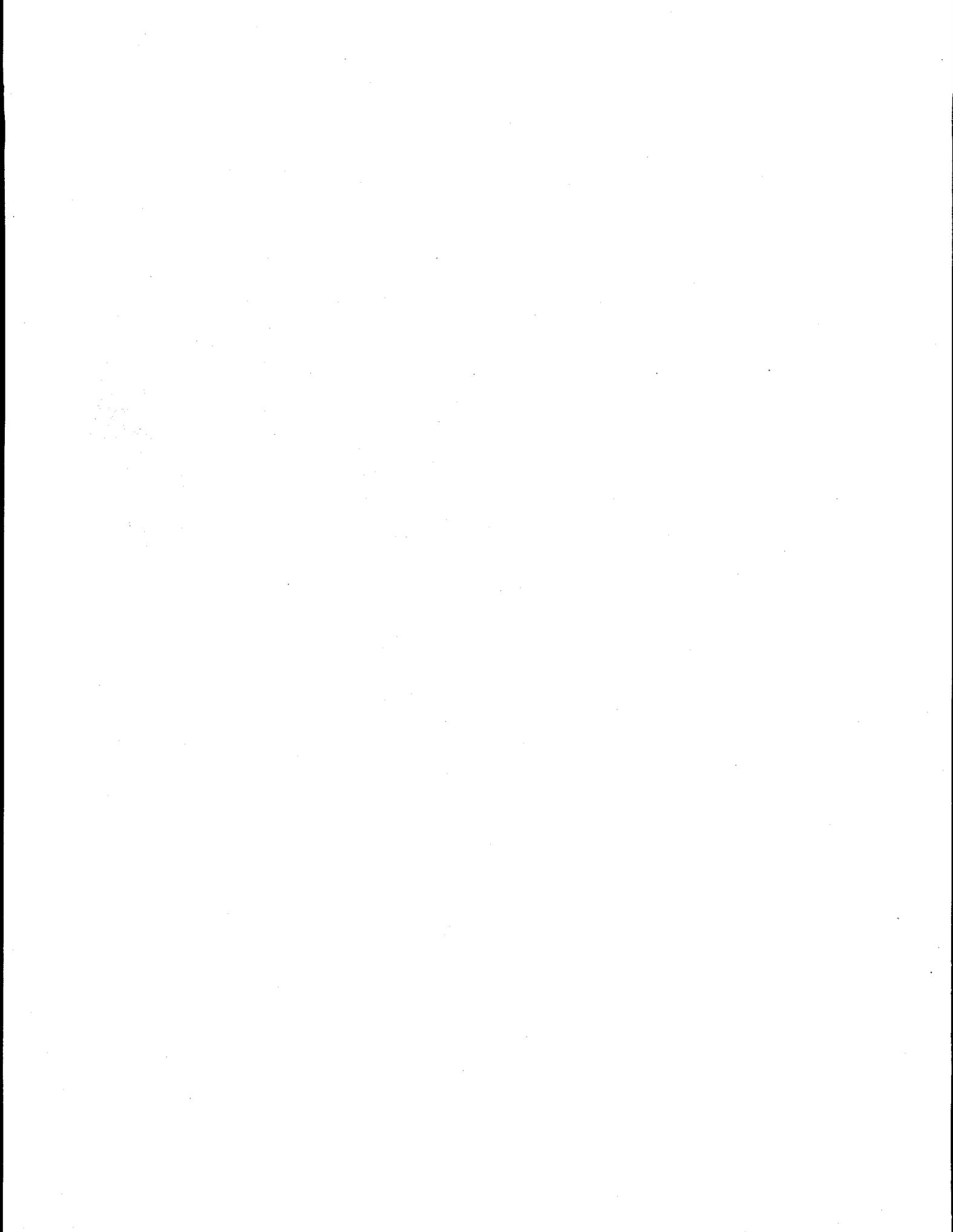


CDIAC published issue number 20 of its newsletter *CDIAC Communications*. This issue features a lead story about new estimates of 1991 carbon dioxide emissions; highlights a recent issue of the *DOE Research Summary* series concerning the heating and cooling effects of fossil-fuel combustion; describes two new numeric data packages, three other new data sets, and two new reports available from CDIAC; and announces the availability of other services and publications related to global change. *CDIAC Communications* is now mailed to approximately 10,000 recipients in more than 150 countries.



CDIAC developed two home pages on the World Wide Web: one for CDIAC (the URL is <http://cdiac.esd.ornl.gov>), which provides access to all of CDIAC's data and information services and highlights its newest products; the other for the U.S. Global Change Data and Information System (GCDIS) (the URL is <http://www.gcdis.usgcrp.gov>), which provides access to the multiagency resources of GCDIS, the data and information component of the U.S. Global Change Research Program.

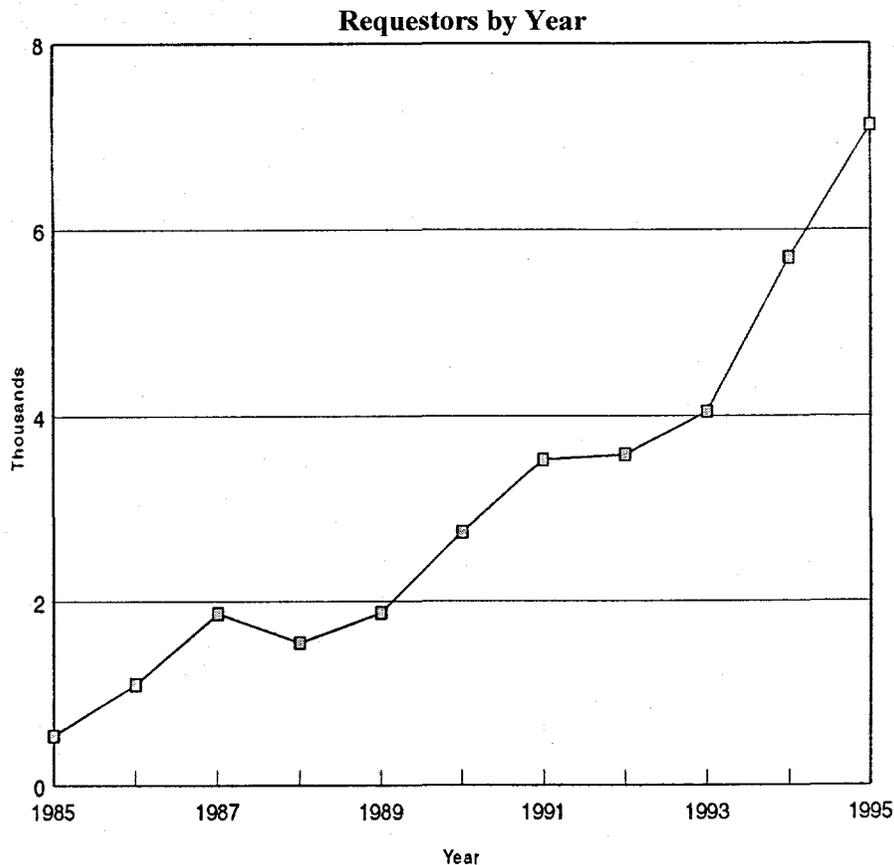




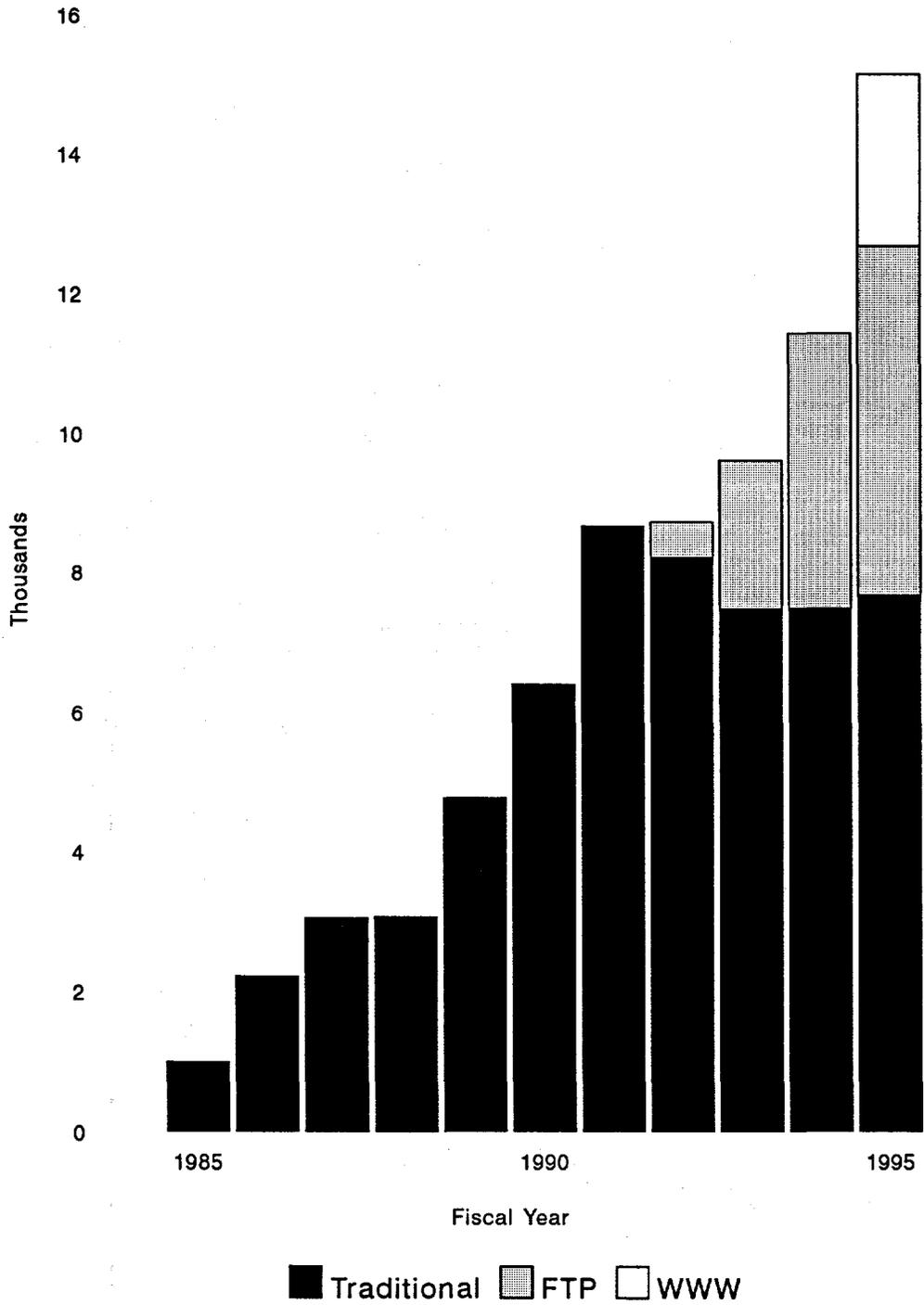
## Statistics

### Fiscal Year (FY) 1995

- CDIAC responded to 7665 traditional requests for CDIAC products and services from 2704 individuals in 95 countries.
- CDIAC filled 1119 requests for data products from 55 countries, distributing approximately 1900 data products on a variety of media. A total of 823 floppy diskettes, 31 magnetic tapes, thirty-nine 8-mm tapes, and five 150-MB QIC tapes were distributed in filling these data requests. Also distributed were 248 CD-ROMs, 119 databases, and 314 miscellaneous data responses.
- CDIAC distributed over 9200 NDPs, computer model packages (CMPs), databases, DOE reports, CDIAC reports, and other materials.
- CDIAC's anonymous file transfer protocol (FTP) area was accessed by approximately 3,500 systems, retrieving over 49,100 files from some 5,000 datasets.
- Since May 1995, 915 systems from 33 countries have accessed CDIAC's home page, via the World Wide Web, retrieving over 2470 dataset files.
- More than 10,100 individuals representing 159 countries are listed in CDIAC's World Directory of Global Change Researchers and Policymakers.



**Total of 67,535 requests from  
FY 1985 through FY 1995!**



## Coming in 1996

CDIAC is working on the following new or updated NDPs and hopes to have them available (both in printed format and on-line) in FY 1996:

### New NDPs

- NDP-026B/R1 **Edited Synoptic Cloud Reports from Ships and Land Stations over the Globe, 1982–1991** (contributed by Carole Hahn, Steve Warren, and Julius London). This NDP will document cloud-related information, including present weather information, extracted from surface synoptic weather reports covering the entire globe for the 10-year period from December 1981 through November 1991. The resulting database contains 124 million reports from land stations and 15 million reports from ships. With this database, a user can develop a climatology for any particular cloud type or group of types, for any geographic region, and at any spatial and temporal resolution.
- NDP043C **A Coastal Hazards Data Base for the U.S. West Coast.** This is the third (and last) of a series of NDPs that document the coastal hazards database developed by CDIAC in cooperation with Vivien Gornitz, Goddard Institute for Space Studies. The data in this NDP are currently undergoing final formatting and quality-assurance tests.
- NDP-XX **Tropical Africa: Land Cover and Biomass-Carbon Estimates for 1980.** This is the third database to be documented from the DOE Global Carbon Cycle Project, managed by Roger Dahlman; it was developed by Sandra Brown, University of Illinois, and Greg Gaston, U.S. Environmental Protection Agency.
- NDP-XX **Tropical Asia: Land Cover and Biomass-Carbon Estimates for 1980.** This is the fourth database to be documented from the DOE Global Carbon Cycle Project, managed by Roger Dahlman; it was developed by Sandra Brown, University of Illinois; Greg Gaston, U.S. Environmental Protection Agency; and Anantha Prasad, University of Illinois.
- NDP-XX **Gridded CO<sub>2</sub> Emissions from Global Land Areas.** These data are being contributed by Bob Andres (University of Alaska, Fairbanks) and Gregg Marland and Tom Boden (CDIAC). They have been assembled in connection with the Global Emissions Inventory Activity, a component of International Global Atmospheric Chemistry/International Geosphere-Biosphere Programme. Country-level CO<sub>2</sub> emissions (NDP-030/R6) data for 1950, 1960, 1970, 1980, and 1990 have been distributed on a 1° × 1° latitude/longitude grid within countries on the basis of a 1° matrix of population data from the Goddard Institute for Space Studies.
- NDP-XX **United States Daily Snow Depth Measurements.** This NDP will contain daily snow depth measurements from 187 U.S. stations. The data have been made available by NCDC. The earliest observations date back to 1893, and data for most stations extend through 1992.

- NDP-XX **Meta-analytic Review and Synthesis of Vegetation Responses to Elevated Atmospheric CO<sub>2</sub>.** This database is being compiled and contributed by Peter Curtis of Ohio State University. It will be a comprehensive digital database of all vegetation CO<sub>2</sub>- response results published to date. The results will be integrated and synthesized by using meta-analytic methods, and will focus on two general lines of inquiry: (1) the determination of the magnitude and significance of the CO<sub>2</sub> response for a number of physiological and growth parameters and (2) analysis of how environmental factors or partitioning among functional groups affects the magnitude of physiological and growth responses to elevated levels of CO<sub>2</sub>.

#### Updated NDPs

- NDP-005/R3 **Atmospheric Carbon Dioxide Mixing Ratios from the NOAA Climate Monitoring and Diagnostics Laboratory Cooperative Flask Sampling Network, 1967–1993** (contributed by Tom Conway and Pieter Tans). This NDP will document the most geographically extensive, carefully calibrated, internally consistent atmospheric-CO<sub>2</sub> data set available. The database will contain monthly atmospheric-CO<sub>2</sub> mixing ratios and CO<sub>2</sub> measurements obtained by analyzing individual flask air samples from the NOAA/CMDL global cooperative flask sampling network. Records through 1993 from 40 land-based sites and from shipboard measurements covering 14 latitude bands in the Pacific Ocean and South China Sea will be provided.
- NDP-019/R3 **United States Historical Climatology Network (U.S. HCN) Serial Temperature and Precipitation Data** (updated by Rich Daniels and Tom Boden). The U.S. HCN database has been revised and will be available by February 1996. The new version (Rev. 3) contains monthly temperature and precipitation data for 1221 stations in the contiguous United States. This database was compiled by NCDC and represents the best available data for the United States for analyzing long-term climate trends on regional scales. The data for most stations extend through December 31, 1994, and a majority of the station records are serially complete for at least 80 years. Unlike many climate data sets, these data have been adjusted to remove biases introduced by station moves, instrument changes, time-of-observation differences, and urbanization effects.
- NDP-030/R7 **Estimates of Global, Regional, and National Annual CO<sub>2</sub>-Emissions from Fossil-Fuel Burning, Hydraulic Cement Production, and Gas Flaring: 1950–1992** (contributed by Bob Andres, Tom Boden, and Gregg Marland). This NDP will document the most comprehensive CO<sub>2</sub>-emissions data set available. The database includes global, regional, and national annual estimates of CO<sub>2</sub> emissions resulting from fossil-fuel burning, cement manufacturing, and gas flaring in oil fields for 1950–1993 as well as the energy production, consumption, and trade data used for these estimates.
- NDP-042/R1 **The U.S. Historical Climatology Network (HCN) Daily Temperature and Precipitation.** The data in this NDP will be updated through 1994 and will be expanded to include not only the 138 stations present in the original NDP, but also the remaining stations in the HCN, for a total of 1221 stations. This database is sure to be one of the most valuable climate resources available for the United States.

We also hope to have the following databases in the CDIAC DB series on-line in FY 1996:

### New Databases

- **Carbon Isotopes in Atmospheric Carbon Dioxide from Schauinsland, Germany and Vermunt, Austria** (contributor Ingeborg Levin). This database will offer long-term delta  $^{13}\text{C}$  and  $^{14}\text{C}$  records from Schauinsland, Germany and Vermunt, Austria. These records date back to 1959 for Vermunt and back to 1976 for Schauinsland, thus providing two of the longest continuous carbon isotope records from Europe.
- **Carbon Isotopes in Atmospheric Carbon Dioxide** (contributors Reidar Nydal and Knut Ljvseth). This database will offer roughly 20 years of  $^{13}\text{C}$  and  $^{14}\text{C}$  measurements from Dakar, Senegal; Debre Zeit, Ethiopia; Frholmen, Grjkallen, Kapp Linn, Lindesnes, and Vassfjellet, Norway; Fianarantsoa, Madagascar; Izana and Mas Palomas, Canary Islands; Rehwoth, Israel; Santiago de Compostela, Spain; and N'Djamena, Chad. This database represents the most geographically extensive atmospheric carbon isotope data set available.
- **Carbon Isotopes in Atmospheric Carbon Dioxide from Wellington, New Zealand** (contributor Martin Manning). This database will offer  $^{14}\text{C}$  and delta  $^{14}\text{C}$  measurements dating back to 1954 from Wellington, New Zealand. This database constitutes the longest isotopic carbon record in the Southern Hemisphere.
- **Carbon 13 and Oxygen 18 Isotopes from Cape Grim, Tasmania** (contributor Roger J. Francey). This database will offer  $^{13}\text{C}$  and  $\text{O}^{18}$  isotope measurements from 1982 to 1993 from Cape Grim, Tasmania. These measurements are made through in situ extraction of  $\text{CO}_2$  following cryogenic drying. The database offers records that may be compared to similar records from Cape Grim that were made by other monitoring groups.
- **Atmospheric Halocarbon Records from the NOAA/CMDL Flask Sampling Program** (contributors Jim Elkins and colleagues). This database will offer chlorofluorocarbon (CFC-11 and CFC-12) and halocarbon (HCFC-22, H-1301, and H-1211) records from seven NOAA/CMDL flask sampling sites. The sites will include 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 1994, including monthly values and measurements from individual flask samples.
- **Carbon Flux Database on Temperate and Boreal Forests**. These data are available through Allan Auclair of Science Policy Associates of Washington, D.C. They were compiled under a contract with the U.S. Environmental Protection Agency. The database includes estimates on the area, volume, and gross carbon source, gross carbon sink, and net carbon flux for ten different processes in the temperate and boreal forests across the Northern Hemisphere for the period 1890 to 1990.
- **Global Model Estimates of Carbon Dioxide Emissions from Soils**. James W. Raich (Iowa State University) and Christopher S. Potter (National Aeronautics and Space Administration Ames Research Center) have derived statistic-based estimates of soil  $\text{CO}_2$  emissions at a  $0.5^\circ$  latitude by  $0.5^\circ$  longitude spatial and monthly temporal resolution. They characterize this database as representing the best-resolved estimate of global  $\text{CO}_2$  fluxes from soils to date. These estimates should facilitate investigations of net carbon exchanges between the atmosphere and the terrestrial biosphere.

## Updated DBs

- Measurements from the ALE/GAGE/AGAGE Network (contributors Ron Prinn and colleagues). This database will offer continuous high-frequency gas chromatographic measurements, dating back to 1978, of two biogenic/anthropogenic gases (methane, CH<sub>4</sub>; nitrous oxide, N<sub>2</sub>O) and five anthropogenic gases (chlorofluorocarbons CFCl<sub>3</sub>, CF<sub>2</sub>Cl<sub>2</sub>, and CF<sub>2</sub>CICFCl<sub>2</sub>; methyl chloroform, CH<sub>3</sub>CCl<sub>3</sub>; carbon tetrachloride, CCl<sub>4</sub>) from globally distributed sites dating back to 1978. The current station locations are Cape Grim, Tasmania, Point Matatula, American Samoa, Ragged Point, Barbados, and Mace Head, Ireland. Stations also previously existed at Cape Meares, Oregon and Adrigole, Ireland.

## Trends Update

Although CDIAC probably will not be printing a hard-copy version of *Trends* during FY 1996, we hope to have the following chapters on-line:

- **Temperature** (updated). This initial on-line version of the *Trends* chapter on temperature will contain updates (through 1994 or 1995, in most cases) of all the historical temperature records contained in *Trends '93*. This chapter and those described below will contain the full suite of information (text descriptions, maps, graphical time series, tabular time series, references, etc.) presented previously in hard-copy form. One certain addition will be a temperature time series dating back to the early 1900s from a network of South Pacific stations. These data will be provided by Jim Salinger of the National Institute of Water and Atmospheric Research in Auckland, New Zealand. If other new, noteworthy analyses of near-surface, tropospheric, or stratospheric temperatures are obtained from the research community (e.g., if a more recent analysis of temperature data from the Global Historical Climatology Network is available from the compilers of this database), they will also be included.
- **Precipitation** (updated). This initial on-line version of the *Trends* chapter on precipitation will contain updates (through 1994 or 1995, in most cases) of all the historical precipitation records contained in *Trends '93*, plus at least two (probably more) additional time series: monthly and annual South Pacific precipitation dating back to the early 1900s (see Jim Salinger contribution above) and gridded, monthly estimates (1987–present) of global precipitation derived from the Special Sensor Microwave/Imager aboard the Defense Meteorological Satellite Program satellites. The satellite estimates will be provided by Ralph Ferraro of the NOAA/National Environmental Satellite Data and Information Service Satellite Research Laboratory, Camp Springs, Maryland.
- **Clouds** (new). This chapter on cloudiness will focus mainly on monthly and annual time series of surface- and satellite-based observations of total cloud amount. Surface-based data are expected to include (1) global observations compiled by Steve Warren and colleagues (University of Washington) et al. covering the period 1971–1992, (2) U.S. observations compiled by Jim Angell (NOAA) extending from the mid-1950s through the early 1990s, (3) Canadian observations from 1953–1991 contributed by Environment Canada, (4) Chinese observations covering the period 1951–1988 as analyzed by Dale Kaiser (CDIAC), (5) former USSR observations covering the period 1936–1990 as analyzed by Dale Kaiser (CDIAC), and perhaps (6) data for Europe. Satellite-based data will hopefully include at least those from the International Satellite Cloud Climatology Project and the Research Vessel *Meteor* cloud data sets (former USSR).

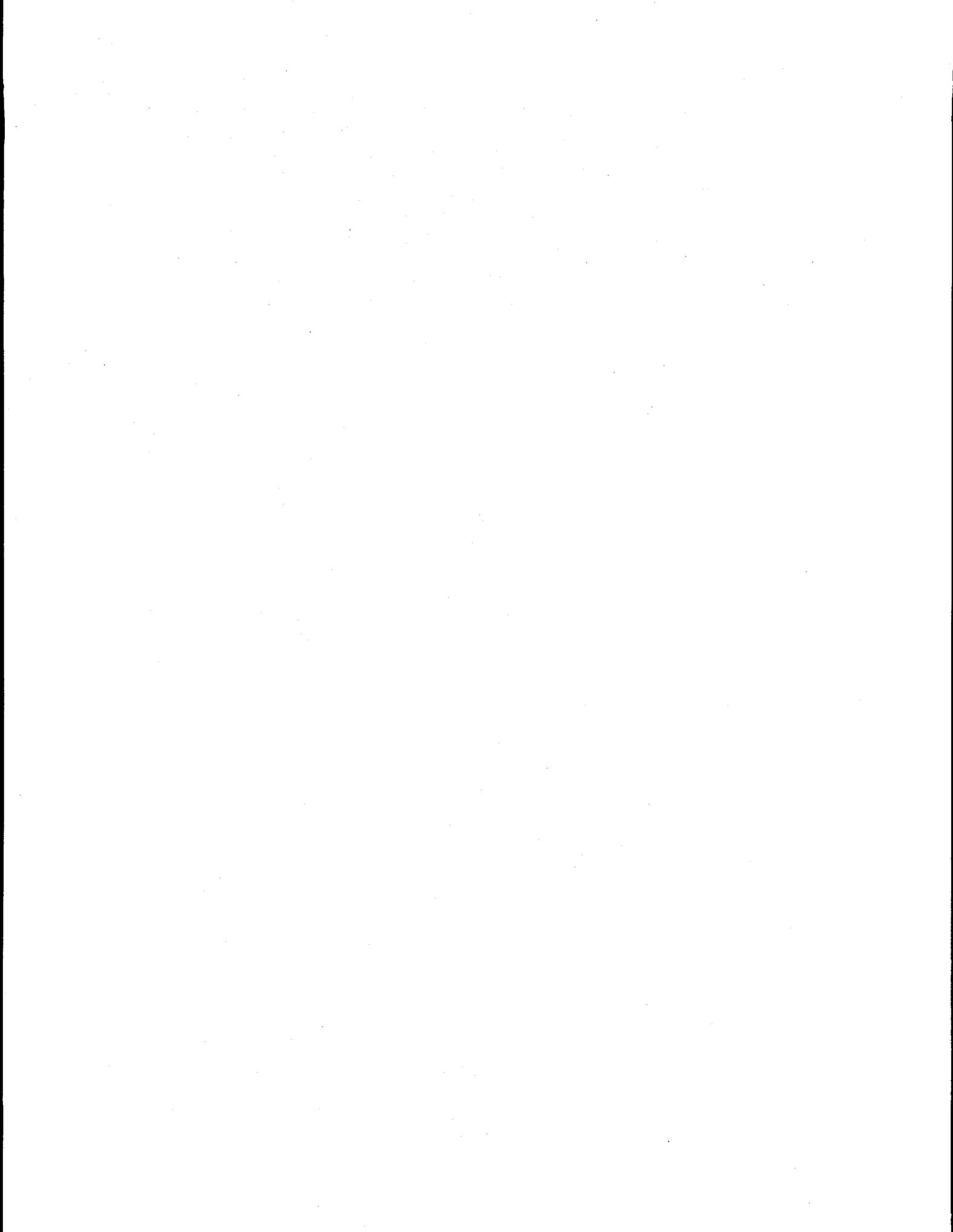
- **Carbon Emissions from Land-Cover Change** (new). This chapter will document carbon emissions from land cover change. Data will be presented for the globe by continent (Olson et al. 1983<sup>1</sup>; Houghton and Hackler 1995<sup>2</sup>) and for the three regions of the world that are currently the primary terrestrial sources of carbon (i.e., tropical South-Central America, tropical Africa, South and Southeast Asia). The region data will be provided as regional totals and by country.

We are also planning to have new issues of our newsletter, *CDIAC Communications*, and new issues in the *DOE Research Summary* series available on-line during FY 1996. Look for these on the CDIAC Home Page (request printed copies if you prefer and are not already on our mailing list) and look for enhancements in both appearance and functionality of the CDIAC and GCDIS home pages.

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<sup>1</sup>Olson, J. S., J. A. Watts, and L. J. Allison. 1983. Carbon in live vegetation of major world ecosystems. Oak Ridge National Laboratory, Oak Ridge, Tenn.

<sup>2</sup>Houghton, R. A., and J. L. Hackler. 1995. Continental scale estimates of the biotic carbon flux from land cover change: 1850 to 1980. ORNL/CDIAC-79. NDP-050. Oak Ridge National Laboratory, Oak Ridge, Tenn.



## Publications, Presentations, and Awards

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- Andres, R. J., T. A. Boden, and G. Marland. 1994. Carbon dioxide emissions from fossil fuel production in 1992. *Transactions, American Geophysical Union* 75:152.
- Andres, R. J., G. Marland, T. Boden, and S. Bischof. 1995. Carbon dioxide emissions from fossil fuel consumption and cement manufacture 1751–1991. An estimate of their isotopic composition and latitudinal distribution. In T. Wigley and D. Schimel (eds.), *Global Change Institute*, Aspen, Colorado. Cambridge University Press, (in press).
- Andres, R. J., G. Marland, I. Fung, and E. Matthews. 1995. A one degree by one degree distribution of carbon dioxide emissions from fossil fuel consumption and cement manufacture. *Global Biogeochemical Cycles* (submitted).
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- Cushman, R. M., and B. M. Parra (comp.). 1995. Graduate student theses supported by DOE's Environmental Sciences Division. DOE/ER-0649T. Washington, D.C.
- Cushman, R. M., T. A. Boden, S. B. Jones, T. R. Nelson, and F. W. Stoss. 1995. Carbon Dioxide Information Analysis Center and World Data Center—A for Atmospheric Trace Gases: Annual progress report, fiscal year 1994. ORNL/CDIAC-76. Oak Ridge National Laboratory, Oak Ridge, Tenn.
- Cushman, J., G. Marland, and B. Schlamadinger. 1995. Biomass fuels, energy, carbon, and global climate change. *Oak Ridge National Laboratory Review* (in press).
- Kaiser, D. P., and V. N. Razuvaev. 1995. Cloud cover and type over the former USSR, 1936–83: Trends derived from the RIHMI-WDC 223-station 6- and 3-hourly meteorological database. pp. 419–42. In *Proceedings of the Sixth International Meeting on Statistical Climatology*. University College, Galway, Ireland.
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- Marland, G., T. Boden, and R. J. Andres. 1995. Carbon dioxide emissions from fossil fuel burning: emissions coefficients and the global contribution of Eastern European countries. *Idojaras* (in press).
- Marland, G., T. Boden, and R. J. Andres. 1995. Fossil fuels and atmospheric carbon dioxide: Past, present, future. *Geological Society of America. Abstracts with Programs*. 27(2):71–72.

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- Boden, T. A. 1995. "CDIAC Data Activities." WMO CO<sub>2</sub> Expert Meeting. Boulder, Colo., July 1995.
- Boden, T. A., and R. M. Cushman. 1995. "Data Activities of the Carbon Dioxide Information Analysis Center and World Data Center-A for Atmospheric Trace Gases." Data Center Directors Meeting. Asheville, N.C., August 1995.
- Cushman, R. M., S. B. Jones, and F. W. Stoss. 1995. "Promotion and Outreach at CDIAC." GCDIS Data Centers Workshop. Oak Ridge, Tenn., September 1995.
- Kaiser, D. P. 1995. "Quality Assurance, Documentation, Analysis, and Archival of Historical Climate Databases by the Carbon Dioxide Information Analysis Center." The U.S. Department of Energy and the People's Republic of China Joint Research on the Greenhouse Effect. San Francisco, July 1995.
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Stoss, F. W. 1995. "The Global Change Data and Information System: An Overview." Global Change Data and Information: The Roles of Libraries. Chicago, June 1995.

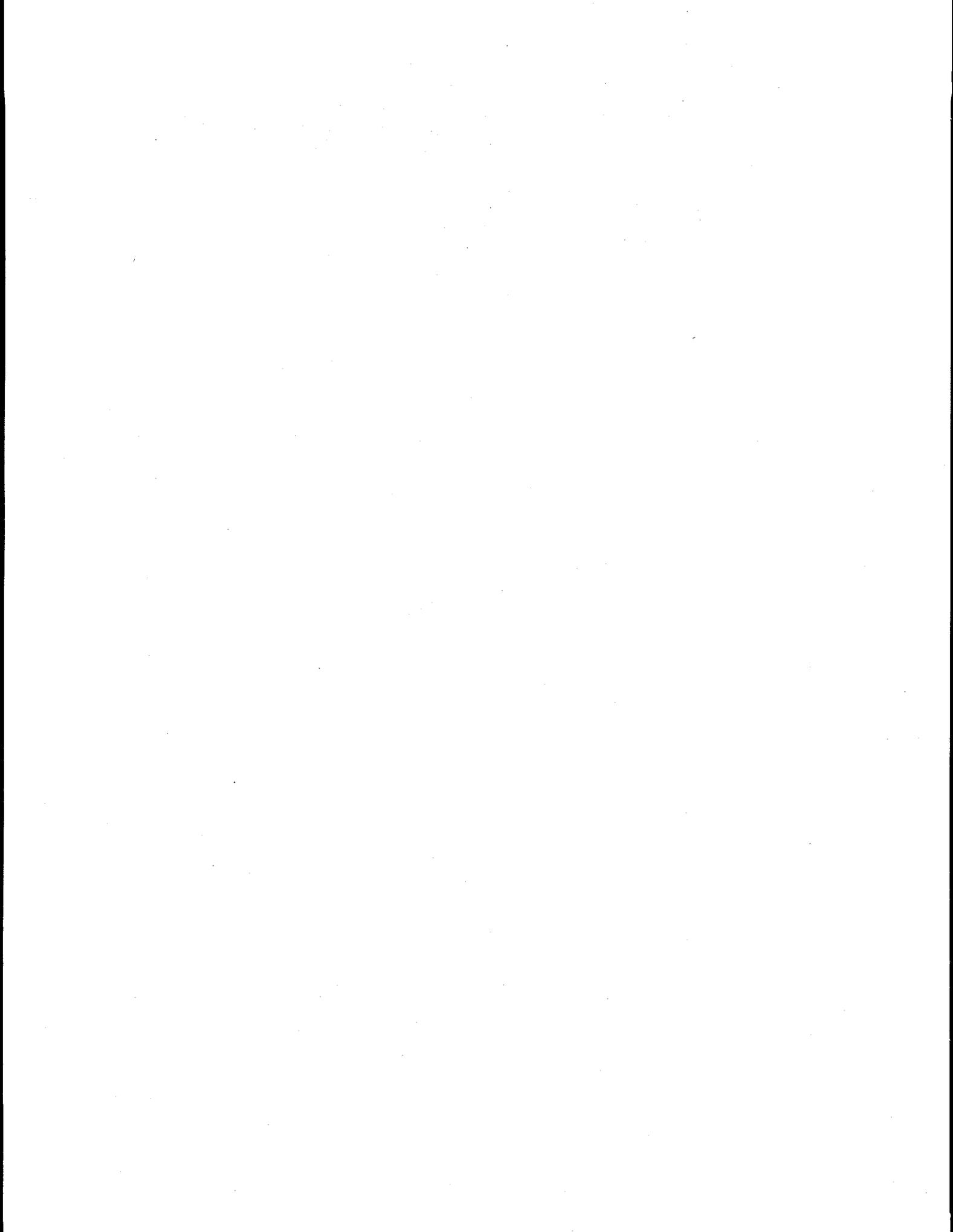
Stoss, F. W., and S. B. Jones. 1995. "Quantification of Data Center Use." GCDIS Data Centers Workshop 1995: User Services. Oak Ridge, Tenn., September 1995.

#### Awards

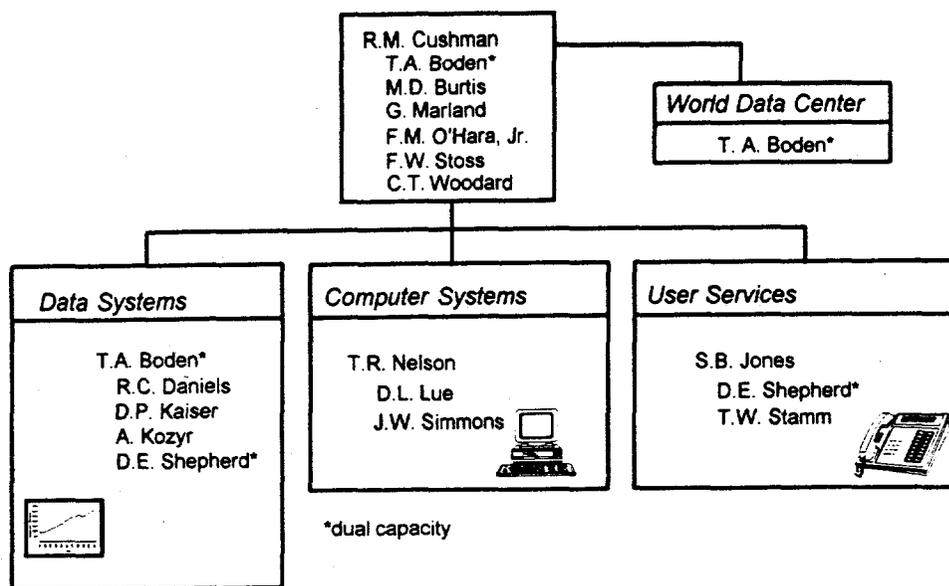
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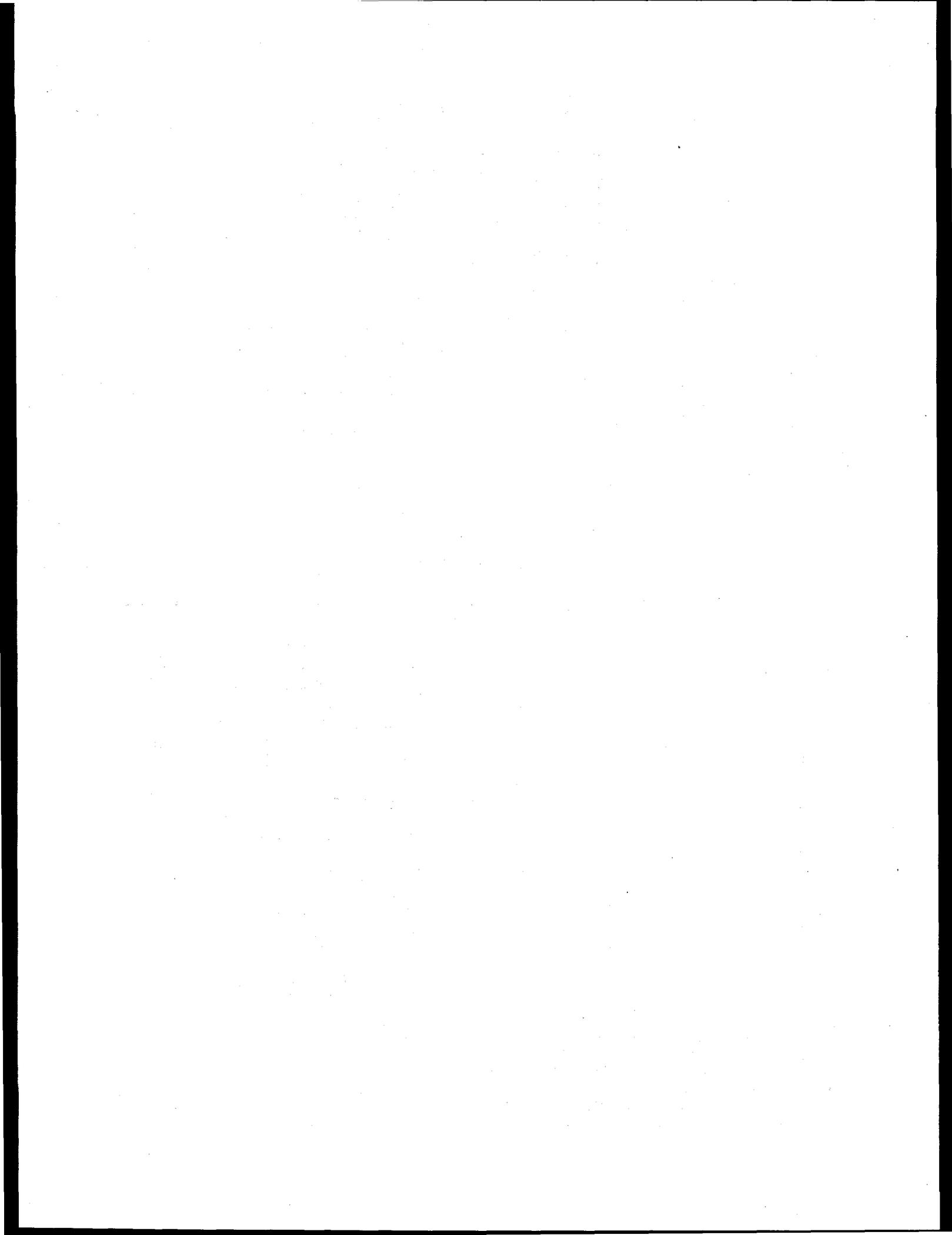
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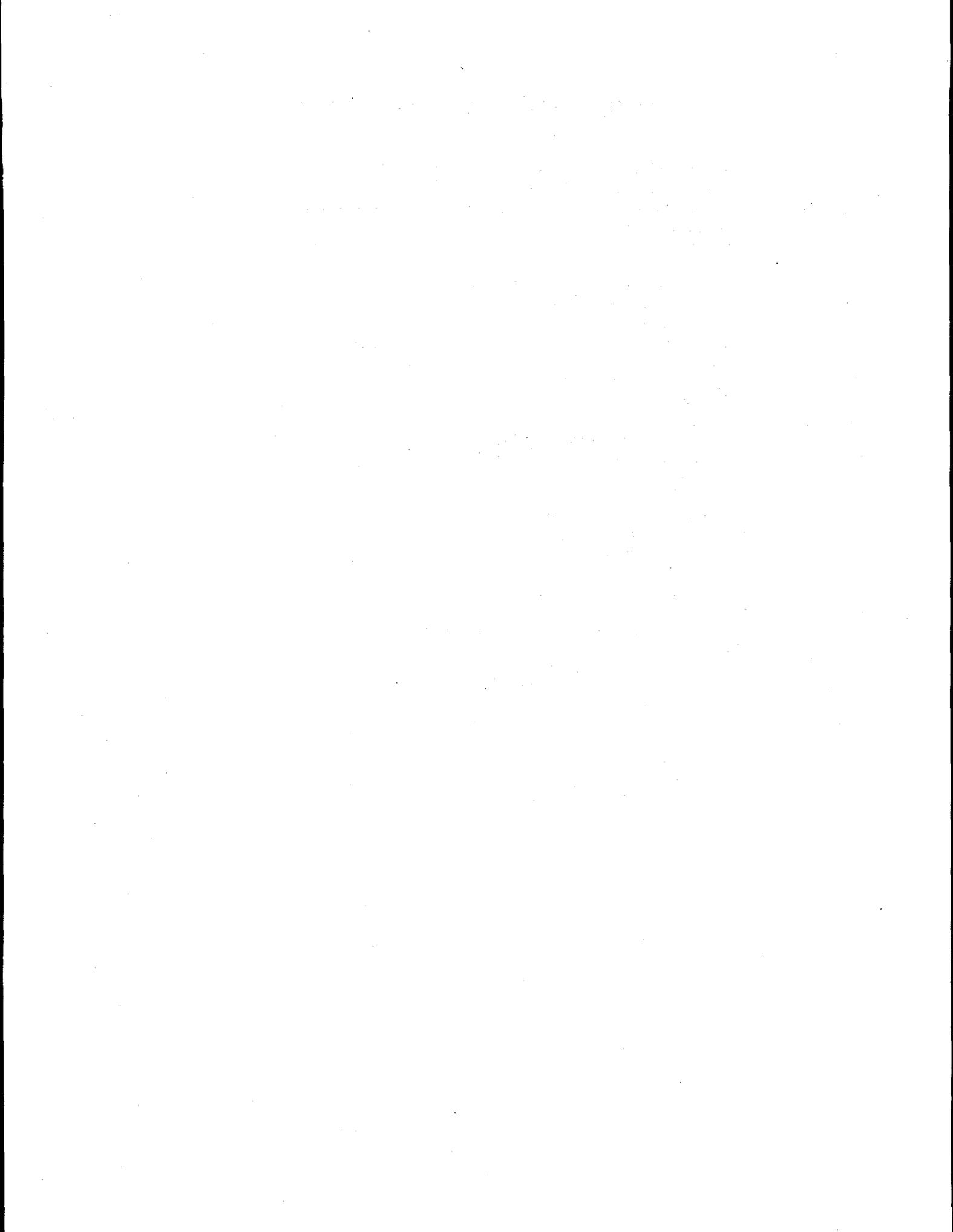
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## Acronyms and Other Abbreviations

AGAGE	Advanced Global Atmospheric Gases Experiment
ALE	Atmospheric Lifetime Experiment (ALE)
ALE/GAGE	Atmospheric Lifetime Experiment/Global Atmospheric Gases Experiment
ARM	Atmospheric Radiation Measurement
<sup>13</sup> C	carbon-13
<sup>14</sup> C	carbon-14
CDIAC	Carbon Dioxide Information Analysis Center
CD-ROM	compact disk, read only memory
CFC	chlorofluorocarbon
CGC	climate global change
CH <sub>4</sub>	methane
CMP	computer modeling package
CO <sub>2</sub>	carbon dioxide
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESD	Environmental Sciences Division (of ORNL)
FTP	File Transfer Protocol
FY	fiscal year
GAGE	Global Atmospheric Gases Experiment
HCN	Historical Climatology Network
MMES	Martin Marietta Energy Systems, Inc.
N <sub>2</sub> O	nitrous oxide
NCDC	National Climatic Data Center
NDP	numeric data package
NOAA	National Oceanic and Atmospheric Administration
ORNL	Oak Ridge National Laboratory
OSTI	Office of Scientific and Technical Information
PMEL	Pacific Marine Environmental Laboratory
PRC	People's Republic of China
SIO	Scripps Institution of Oceanography
U.S.S.R.	Union of Soviet Socialist Republics
WDC-A	World Data Center-A
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment



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161. R. Vose, Arizona State University, Office of Climatology, Box 871508, Tempe, AZ 85287-1508
162. C. Watts, NOAA Central Library, 1315 East-West Highway, 2nd Floor, SSMC 3, Silver Spring, MD 20910
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- 172-173. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831