

~Welcome~

Welcome to NCAR's FY1997 Annual Scientific Report. This website contains information about the scientific and technologic activities of the National Center for Atmospheric Research over the past fiscal year. In addition to descriptions of all the research activities NCAR scientists pursue, we have included a message from our Director, listings of the publications written by NCAR staff and their collaborators over the past year, and the educational and community outreach activities in which NCAR staff participate. Several scientific highlights have also been selected to introduce you to the breadth of our programs. We encourage you to follow the many links to our divisions and programs to learn more about our work in the atmospheric and related sciences.

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NATIONAL CENTER FOR ATMOSPHERIC RESEARCH
Annual Scientific Report 1997

Director's
Message

NCAR Director's Message

Dear Friends and Colleagues



I am pleased to introduce NCAR's 1997 Annual Scientific Report on the World Wide Web. This website contains descriptions of NCAR's research and facility development activities over the past fiscal year, including text, graphics, and access to some of our community facilities such as data sets and models. I encourage you to explore this report and follow the many links found here.

It is NCAR's mission to plan, organize, and conduct atmospheric and related research programs generally beyond the capability of single university research programs, to provide state-of-the-art research tools and facilities to the entire atmospheric sciences community, to support and enhance university atmospheric research education, and to facilitate the transfer of technology to both the public and private sectors. You will find activities supporting each of these areas throughout the document, and in every division and program.

In FY1997, NCAR's divisions and programs completed the development of long range strategic plans. These forward-looking documents provide blueprints of the scientific and technological emphases for the coming decade, and identify the opportunities for advancing our understanding of the Earth system. These plans were developed with the advice and assistance of a large number of NCAR senior scientific and technical staff within each division, and were reviewed by the entire senior management, scientific and technical staff at a one-day retreat held this past summer. Developed in response to the recommendations of the National Science Foundation's review of NCAR programs in 1996, these descriptions of NCAR's science and technology programs for the future provide the connections among NCAR's broad and diverse activities.

Taken together, the plans describe the extensive research goals of the national center for the coming decade. The plans are available on the web through the divisional links and I encourage you to read them in addition to this year's report.

Sincerely,

Robert J. Serafin
Director

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ACD Atmospheric Chemistry	ASP Advanced Study Program	ATD Atmospheric Technology Division
CGD Climate and Global Dynamics Division	ESIG Environmental and Societal Impacts Group	HAO High Altitude Observatory
MMM Mesoscale and Microscale Meteorology Division	RAP Research Applications Program	SCD Scientific Computing Division

Atmospheric Chemistry Division

Peer-Reviewed Publications

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Advanced Study Program

Peer-Reviewed Publications

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Thompson, G., T.F. Lee, and J. Vivekanandan, 1997: Comparisons of satellite-based aircraft icing diagnoses. *Preprints, 7th Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 132-137.

Vivekanandan, J., 1997: Aircraft icing detection using satellite and radar observations. *Preprints, Seventh Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 146-151.

Wilson, J.W., A. Crook and C.K. Mueller, 1997: State-of-the-art nowcasting/forecasting convective weather. *Preprints, Seventh Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 236-237.

Wilson, J.W., T.D. Keenan and R.E. Carbone, 1997: Hector initiation: is it a breeze? *Preprints, 28th Conf. on Radar Meteorology*, Long Beach, CA, 7-12 September. Amer. Meteor. Soc., Boston, 267-268.

Wolfson, M.M., C.K. Mueller and M. Eilts, 1997: Convective weather forecasting for FAA applications. *Preprints, Seventh Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 238-243.

Wuertele, M.G. and R.D. Sharman, 1997: Propagation and breakdown of gravity-inertia waves. *Preprints, Seventh Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 181-186.

Wurtele, M.G., A. Datta and R.D. Sharman, 1997: Propagation and breakdown of gravity-inertia waves Part II. Continuous spectrum (lee waves). *Preprints, Seventh Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 217-218.

Scientific Computing Division

Peer-Reviewed Publications

Adams, W. Brainerd, Martin, Smith and Wagener: "Fortran 95 Handbook" MIT Press, Cambridge, Mass., 1997.

Adams, John C. and Swarztrauber, Paul N.: "SPEREPACK 2.0: A Model Development Facility", NCAR Technical Note NCAR/TN-436-STR, September 1997.

Hammond, S.W., Loft, R.D., Tannenbaum, P.D.: "Architecture and Application: The Performance of the NEC

SX-4 on the NCAR Benchmark Suite," presented at Supercomputing '96, Pittsburgh, PA., November 17-22, 1996.

Woodruff, S.D. et. al. (including S.J. Worley), 1997, "COADS Release 2 Data and Metadata Enhancements for Improvements of Marine Surface Flux Fields," presented at European Geophysical Society (EGS) XXII General Assembly, Vienna, Austria, April 21-25, 1997. Publication in "Physics and Chemistry of the Earth (and Solar System)."

Non-refereed

Buzbee, Bill: "Trends in Performance per Unit of Cost of High Speed Computers," presented at International Symposium on Parallel Computing in Engineering and Science (ISPCES'97), Tokyo, Japan, January 27-28, 1997.

Merrill, John: "Cray Connectivity to ESCON-attached Storage Devices at NCAR." Proceedings, Thirty-Eighth Semi-Annual Cray User Group Meeting, pp. 91-94. October 1996.

[NCAR](#) | [UCAR](#) | [NSF](#) | [NCAR FY96 ASR](#) | [NCAR FY97 ASR](#)



NCAR Educational Activities

Education Overview

NCAR's educational activities include programs that reach groups at a variety of educational levels. Scientific visitor programs, graduate research assistantships, postdoctoral appointments, colloquia, seminars and workshops support university programs to educate the next generations of scientists, engineers, and scholars in general. Many of these are highlighted in division chapters elsewhere in this report. For example, the [Advanced Study Program](#) (ASP) provides students and graduates the opportunity to explore their educational and scientific interests in the laboratory setting. The Scientific Computing Division's (SCD) [Classroom Computing Grants](#) provide faculty and students access to high performance computing technologies in their classrooms.

NCAR also places a high priority on K-12 educational outreach, as well as on other educational programs that increase public awareness and understanding of atmospheric science issues. Because climate, pollution, and the environment are part of the everyday awareness of young people, the atmospheric sciences offer an unusual opportunity to teach science in engaging, relevant ways. NCAR's [Education and Tour Program](#) and [Visual Communications](#) and [LEARN](#) (Laboratory Experience in Atmospheric Research at NCAR) help teachers exploit this opportunity as well as reach out to students and the general public. SCD's [Colorado Computational Science Fair](#) encourages high school students to utilize computing resources beyond the capabilities of secondary schools.

This chapter documents formally organized programs. In addition, individual staff throughout NCAR serve as graduate advisors or adjunct faculty at universities, make presentations to classes and public groups, write textbooks or textbook chapters, judge science fairs, or tutor elementary through secondary school students in math and science.

 Table of Contents	FY 97 Publications 
 FY 97 Education Highlights	Community Service 
 Educational Statistics	Staff, Visitors & Collaborators 



Community Service

[Editorships](#) [Committee Service](#) [Awards and Honors](#)

Editorships

Atmospheric Technology Division

Mike Hardesty, Associate Editor, *Journal of Atmospheric and Oceanic Technology*, (1994-present).

Mike Hardesty, Associate Editor, *Applied Optics*, (1996-present).

Dave Parsons, Editor, *Journal of Atmospheric Science* (November 1994-present).

Climate and Global Dynamics Division

Mark Berliner, Associate Editor, *Journal of the American Statistical Association*, 1996.

Gordon Bonan, Editor, *Climatic Change*, 1992; Associate Editor, *Global Change Biology*, 1994.

Grant Branstator, Associate Editor, *Journal of the Atmospheric Sciences*, 1994.

Scott Doney, Associate Editor, *Reviews of Geophysics*, 1997.

Peter Gent, Associate Editor, *Journal of Physical Oceanography*, 1992.

Filippo Giorgi, Editorial Advisor, *Journal of Climate Research*, 1990.

Jeffrey Kiehl, Board of Reviewing Editors, *Science*, 1997.

William Large, Associate Editor, *Journal of Physical Oceanography*, 1992.

Gerald Meehl, Lead Author *IPCC Special Report on the Regional Impacts of Climate Change*, 1997; Contributor to revised version of "Glossary of Meteorology," T. Broccoli, Ed., January 25, 1997.

Ralph Milliff, Guest Editor, *Theoretical and Computational Fluid Dynamics*, 1996.

Doug Nychka, Associate Editor, *Technometrics*.

Bette Otto-Bliesner, Associate Editor, *Paleoclimates*, 1992.

Philip Rasch, Associate Editor, *Monthly Weather Review*, 1994; Editorial Panel Member, *Tellus*, 1992.

Dave Schimel, Consulting Editor, *Biogeochemistry*, *Ecological Applications* *Global Change Biology*.

Kevin Trenberth, Editor, *Earth Interactions*, 1996.

Joseph Tribbia, Editor, *Journal of the Atmospheric Sciences*, 1993.

Warren Washington, Editor, *Climate Dynamics*, 1986.

Tom M.L. Wigley, Editorial Board, *Climate Dynamics*, 1994; *Global Climate Change Digest*, 1989; *Mitigation and Adaptation Strategies for Global Change*, 1995; Editorial Advisory Board, *Encyclopedia of Climate & Weather*, 1996.

Robert L. Wilby, Co-Editor with A. J. Baird, *Contemporary Hydrology*, 1997; *Eco-hydrology: Plants and Water in Terrestrial and Aquatic Environments*, 1997.

Environmental and Societal Impacts Group

- Michael Glantz, Editorial Board, *Global Environmental Change* (1990-present).
- Michael Glantz, Editorial Board, *Colorado Journal of International Environmental Law* (1989-present).
- Michael Glantz, Editorial Board, *Reports to the Nation* (1997-present).
- Richard Katz, Editorial Board, *Extremes: Statistical Theory and Applications in Science, Engineering and Economics*.
- Richard Katz, Editorial Board, *Climatic Change* (1985-present).
- Linda Mearns, Editorial Board, *Climatic Change* (1990-present).
- Linda Mearns, Editorial Board, *Climate Research* (1989-present).

High Altitude Observatory

Peter Fox is an Associate Editor of *Fundamentals of Cosmic Physics*, 1993-present.

Thomas Holzer is an Associate Editor of *Journal of Geophysical Research*, *Space Physics*, 1995-1998.

Boon Chye Low is a member of the Board of Editors of *Solar Physics*, 1992-1998.

Arthur Richmond is a member of the Editorial Board of the *Journal of Geomagnetism and Geoelectricity*, 1993-1997.

Mesoscale and Microscale Meteorology Division

Christopher Davis, Associate Editor, *Monthly Weather Review*, 1994-present.

Andrew Heymsfield, Editorial Board, *Atmospheric Research*, 1992-present.

Margaret LeMone, Co-Editor, *Bulletin of the American Meteorological Society*, 1994-present.

Donald Lenschow, Editorial Board, *Journal of Atmospheric Chemistry*, 1990-present; Editorial Board, *Boundary-Layer Meteorology*, 1994-present.

Chin-Hoh Moeng, Associate Editor, *Journal of Atmospheric Science*, 1992-present.

Mitchell Moncrieff, Associate Editor, *Quarterly Journal of the Royal Meteorological Society*, 1994-present.

Richard Rotunno, Associate Editor, *Monthly Weather Review*, 1991-present.

Piotr Smolarkiewicz, Associate Editor, *Journal of Computational Physics*, 1997-present; Editorial Board, *Applied Mathematics and Computational Science*, 1997-present; Editor, *Monthly Weather Review*, 1994-1997.

Research Applications Program

Marcia Politovich served as associate editor of *The Journal of Applied Meteorology*.

Committee Service

Atmospheric Technology Division

Mike Hardesty, Chair, External Review Panel for Assessment of Edge-Technique Research, Laboratory for Atmospheres, NASA/Goddard Space Flight Center.

Mike Hardesty, Member, International Committee on Laser Atmospheric Studies.

Mike Hardesty, Fellow, Cooperative Institute for Research in Environmental Sciences (CIRES).

Mike Hardesty, Member, NOAA Working Group on Space-based Winds.

Peter Hildebrand, Member, U.S. Science Steering Committee, Mesoscale Alpine Project (MAP).

Peter Hildebrand, Member, Scientific Planning Group, Fronts and Atlantic Storm Track Experiment (FASTEX).

Peter Hildebrand, Member, AMS Committee on Radar Meteorology.

Tom Horst, Member, National Research Council Panel on Modernization of the Cooperative Observer Network (1996 – present).

Greg Kok, Member, American Chemical Society

Greg Kok, Member, American Geophysical Union

Greg Kok, Member, American Meteorological Society

Greg Kok, Member, American Society for Mass Spectroscopy

Steven Oncley, Member, NCAR Geophysical Turbulence Program (GTP).

Steven Oncley, Member, Organizing Committee for GTP Workshop "Physical Reality and Numerical Simulation", Boulder, CO, 3 - 5 September 1997.

Steven Oncley, Member, Committee on Boundary Layers and Turbulence, American Meteorological Society.

Steven Oncley, Member, Organizing Committee for 12th Symposium on Boundary Layers and Turbulence, American Meteorological Society, Vancouver, BC, 28 July - 1 August 1997.

David Parsons, Co-Chair, International Committee on Tropospheric Profiling.

David Parsons, Technical Advisor, Working group on Profilers, Office of the Federal Coordinator.

David Parsons, Chair, Review Panel for Mesoscale Processes, Severe Storms Monograph, American Meteorological Society.

David Parsons, Member, ARM Open Ocean Advisory Group.

Jeffrey Keeler, Member, NEXRAD Open RDA Advisory Panel.

Larry Radke, Member, Expert Review Panel of Gulf War Health Effects (sponsored by DoD, CIA).

Ron Ruth, Member, American Meteorological Society.

Jim Wilson, Member, NOAA/NWS NEXRAD Technical Advisory Committee.

Jim Wilson, Member, NSF Facilities Advisory Council.

Jim Wilson, Chair, Review Panel for Severe Convective Systems Monograph.

Jim Wilson, Member, USWRP Quantitative Precipitation Forecasting Working Group.

Volker Wulfmeyer, Member, Working Group on Science and Data, Global Water Vapor Project of the WMO.

Climate and Global Dynamics Division

Mark Berliner, Member, American Meteorological Society Ad Hoc Committee for Statistical Education in the Atmospheric Sciences; Elected Member, International Board of Advisors to the International Society for Bayesian Analysis.

Maurice Blackmon, Member, Climate Research Committee, National Research Council, 1997; Chair, NCAR Climate System Model (CSM) Scientific Steering Committee, 1996; Chair, Board of Governors, Colorado Alliance for Science, 1995; Science Team Member, NASA's Clouds and the Earth's Radiant Energy System (CERES); Co-Chair, Scientific Working Group, Atlantic Climate Change Project, 1993; Chair, Working Group on Natural Variability, Model Validation and Climate Diagnostics, Climate System Modeling Program; Member, AMS Committee on Climate Variations, 1991; Member, International Commission on Dynamical Meteorology; Member, IAMAP, Working Group D, Medium and Large-Scale Dynamics.

Gordon Bonan, Co-Chair, Land Modeling Working Group for the NCAR Climate System Model, 1996.

Byron Boville, Co-Chair, Climate System Model (CSM) Project at NCAR, 1993; Member, IAMAS Commission on the Meteorology of the Upper Atmosphere, 1991; Member, IAMAS Commission on the Meteorology of the Upper Atmosphere (ICMUA) Working Group on Modeling of the Middle Atmosphere, 1988; Member, Organizaing Committee for the NATO Advanced Study Institute on Climate Modeling, 1996; Member, CSM Scientific Steering Committee, 1996.

Grant Branstator, Member, National Research Council's U.S. Global Ocean-Atmosphere-Land System (GOALS) Panel, 1994; Member, Ad Hoc Research Priorities Review Panel of NOAA's GOALS Panel Program, 1994; Lead Convenor, Symposium on Natural Variability, IAMAS/IAPSO Joint Assembly, 1-9 July 1997.

Frank Bryan, Member, International Association of Geodesy Special Study Group 5.173, 1995.

Scott Doney, Member, U.S. JGOFS Steering Committee, 1993; Member, U.S. WOCE Scientific Steering Committee, 1997.

Ronald Errico, Member, Organizing Committee for 3rd Adjoint Workshop; Member, Organizing Committee for Workshop on Use of Satellite Observations in Data Assimilation.

Peter Gent, Member, CSM Scientific Steering Committee, 1996; Member, CLIVAR Ocean Panel, 1996; Member, International WOCE Modeling Committee, 1997.

Filippo Giorgi, Co-Chair, START Committee for the Temperate East Asia region (TEACOM), 1996.

James Hack, Member, DOE Computer Hardware, Advanced Mathematics and Model Physics (CHAMMP) Science Team, 1991; Member, DOE Computational Science Graduate Fellowship Program Advisory Panel, 1990; Member, NASA FIRE-III Science Team, 1995; Member, DOE Atmospheric Radiation Measurements (ARM) Science Team, 1991; Member, NSF

Partnership for Advanced Computational Infrastructure (PACI) Review Panel, 1996; Co-Chair, Atmospheric Modeling Working Group for the Climate Model System Project, 1997.

James Hurrell, Member, Great Plains Regional Center of the National Institute for Global Environmental Change; Advisory Panel, NCEP CDAS/Reanalysis Project; Member, AMS Committee on Meteorology and Oceanography of the Southern Hemisphere, 1995; Member, GPS/Meteorology Advisory Committee, 1995; Member, Atlantic Climate Change Advisory Committee, 1997; Co-Chair, CSM Decadal-to-Centennial Natural Variability Working Group, 1997; Member, National Research Council Panel on the Global Energy and Water Cycle Experiment, 1997.

Akira Kasahara, Member, Next-generation Polar-orbiting Operational Environmental Satellite System (NPOESS) Observing System Simulation Experiment Project Advisory Committee, 1997.

Jeffrey Kiehl, Member, International Global Aerosol Chemistry Committee on Aerosol Forcing, 1993; Member, DOE Atmospheric Radiation Measurements (ARM) Science Team, 1991; Co-Director, NSF Science and Technology Center for Clouds, Chemistry and Climate (C4), 1997; Chairman, General Circulation Model (GCM) Validation Working Group at the Center for Clouds, Chemistry and Climate (C4), 1994; Member, CSM Scientific Steering Committee, 1996; Co-Chair, Anthropogenic Biogeochemistry Working Group for the Climate System Model Project, 1997; Member, Indian Ocean Experiment (INDOEX) International Scientific Steering Committee, 1996; Member, NCAR Aerosol Panel, 1997.

Tim Kittel, Member, National Technical Advisory Committee, National Institute for Global Environmental Change (NIGEC), Department of Energy (DOE), 1996; Member, National Science Foundation Long-Term Ecological Research (LTER) Program Climate Committee, 1990; Science Team Member, Vegetation/Ecosystem Modeling and Analysis Project, 1993; Member, Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) User Working Group, 1997.

William Large, Chairman, International WOCE Science Steering Group, 1997; Member, NASA Scatterometer Science Working Team, 1988; Member, NCAR CSM Principal Investigator Group, 1994; Member, NSF's Ocean-Atmosphere-Ice Interaction (OAI) SHEBA Advisory Committee, 1996; Member, NSF Proposal Review Panel, 1997; Member, AMS Committee on Southern Hemisphere Meteorology, 1997; Member, Weddell Sea Polyna U.S. Confirmation Committee, 1997.

Roland Madden, Member, Advisory Board for Meteorologische Zeitschrift, 1995; Committee Member, 7th International Meeting on Statistical Climatology, 1997.

James C. McWilliams, Member, Scientific Advisory Council of NSF Climate Modeling, Prediction, and Analysis Program, 1990; Member, U.S. World Ocean Circulation Experiment Scientific Steering Committee, 1994; Member, MIT Corporation Visiting Committee for the Department of Earth, Atmospheric, and Planetary Sciences, 1995; Member, U.S. Ocean CLIVAR Planning Committee for NSF, 1995; Member, Jet Propulsion Laboratory Earth Science Advisory Council, 1997.

Gerald Meehl, Member, Climate System Model Investigators Group, 1994; Member, Climate Variability and Predictability Numerical Experimentation, WCRP/CLIVAR NEG-2, 1995-97; Member, Climate Simulation Laboratory (CSL) Allocation Panel, 1995; Visiting Senior Fellow, University of Hawaii Joint Institute for Marine and Atmospheric Research, 1995; Member, Climate Variability and Predictability Working Group on Coupled Models (CLIVAR WGCM), World Climate Research Programme, 1997; Member, International Program Committee, Mission Earth: Modeling and Simulation for a Sustainable Global System, SCS Western MultiConference, 1996-97; Member, Japan/U.S. Scientific Advisory Committee, International Pacific Research Center, University of Hawaii, 1997.

Doug Nychka, Cascadia Tropospheric Ozone Peer Review Panel, 1997.

Bette Otto-Bliesner, Co-Chair, CSM Paleoclimate Working Group, 1996; Member, Paleoclimate Modeling Intercomparison Project (PMIP), 1995.

Philip Rasch, Member, NSF Science and Technology Center for Clouds, Chemistry and Climate (C4), 1990; Head, Chemistry Modeling Group at the NSF Science and Technology Center for Clouds, Chemistry, and Climate (C4), 1994; Member, AMS Committee on the Middle Atmosphere, 1995; Member, NCAR Aerosol Panel, 1997.

Dave Schimel, Convening Lead Author, Intergovernmental Panel on Climate Change (IPCC), 1994 and 1995 Reports; Visiting Member, Graduate Faculty of Texas A&M University; Member, U.S. National Academy Committee on Global Change Research; Member, National Research Council Committee on Global Change Research; Member, University of Colorado's Global Change and Environmental Quality Program Committee; Member, International Geosphere-Biosphere Program: Task Force on Global Analysis, Interpretation and Modeling; Member, U.S. National Academy Ecosystems Panel; Member, Governing Board, National Center for Ecological Synthesis and Analysis.

Dennis Shea, Committee Member, 7th International Meeting on Statistical Climatology, 1997; Committee Member, 14th Conference on Probability and Statistics in the Atmospheric Sciences, 1997; Member, AMS Probability and Statistics Committee, 1997.

Starley Thompson, Smithsonian National Museum of Natural History, "Forces of Change" Exhibit, 1995; Member, Circumpolar Arctic Paleo Environments (CAPE) Steering Committee, 1995; Member, Project GLOBE Focus Group on Scientific Visualization, 1995; Member, Committee on Transportation and a Sustainable Environment, Transportation Research Board, National Research Council, 1994; Member, Committee on Global Environmental Change, American Geophysical Union, 1993; Member, Electorate Nominating Committee, Section on Atmospheric and Hydrospheric Sciences, American Association for the Advancement of Science, 1993; Member, National Science Foundation Paleoclimate of Arctic Lakes and Estuaries (PALE) Steering Committee, 1993; Member, Committee on Glaciology of the U.S. National Academy of Sciences Polar Research Board, 1988; Advisor, Atmospheric Sciences Guild of Sandia National Laboratory, 1992.

Kevin Trenberth, Member, NOAA Panel on Climate and Global Change, 1987, and Member, Executive Committee, 1991; Member, ECMWF ReAnalysis (ERA) Project Advisory Group, 1993; Member, Climate Modeling Analysis and Prediction (CMAP) Science Advisory Council, 1993; Member, Atmospheric Observation Panel for the Global Climate Observing System, 1994; Member, COLA (Center for Ocean-Land-Atmosphere Studies) Scientific Advisory Committee, 1994, and Chair, 1995; Council Delegate, American Association for the Advancement of Science, Section on Atmospheric and Hydrospheric Sciences, 1993; Member, Global Ocean-Atmosphere-Land System (GOALS) Panel, 1994; Member, International CLIVAR Scientific Steering Group, 1995, and Co-Chair, 1996; Member, Drafting group to define the International Research Institute for seasonal to interannual climate prediction Network Consultative Group (INCG), 1997.

Harry van Loon, Member, STEP (Solar Terrestrial Energy Program) of ICSU, Working Group No. 5, Project Leader of Solar Terrestrial Oscillation Project, 1995.

Warren Washington, Member, National Science Board, 1995; Member, Secretary of Energy's Biological and Environmental Research Advisory Committee, 1990; Chair, Secretary of Energy's Health and Environmental Research Subcommittee on Biological and Environment Research Program in the U.S. Global Change Research Program, 1995; Member, Modernization Transition Committee of the National Weather Service, U.S. Department of Commerce, 1993; Past President, American Meteorological Society, 1994; Member, Executive Committee, American Meteorological Society Council, 1995; Chair, Fellows Committee, American Meteorological Society, 1995; Member, Board on Sustainable Development, National Research Council, 1995; Member, Advisory Panel, National Centers for Environmental Prediction, 1995; Member, The National Committee, American Association for the Advancement of Science Center for Science and Engineering, 1994; Member, National Science Board Programs and Plans Committees: CPP Task Force on the Environment; CPP Task Force on Polar Issues; and Chair, Merit Review Criteria Task Force, 1996.

John Weatherly, Co-Chair, CSM Polar Climate Working Group, 1996; Member, NSF Arctic System Science Advisory Committee, 1997.

Tom M. L. Wigley, Member, United Nations Environment Program (UNEP) Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility (GEF), 1995; Member, CSM Working Group on Anthropogenic Biogeochemistry, 1996; Member, American Geophysical Union, Atmospheric Sciences Section; Member, Climate and Paleoclimate Committee, 1996; Member, NCAR Appointments Review Group, 1997; Member, NCAR Aerosols Project (NAP) Steering Committee, 1997.

Robert L. Wilby, Advisor, Swedish Climate Change Research Programme (SWECLIM), 1997; Member, British Hydrological Society, 1991.

David Williamson, Chairman, CAS/JSC Working Group for Numerical Experimentation (WGNE), 1991; Member, DOE

Computer Hardware, Advanced Mathematics and Model Physics (CHAMMP) Science Team, 1991.

Professional Society Memberships

Barbara Bailey, American Statistical Association

Gary Bates, American Meteorological Society

Mark Berliner, American Statistical Association; American Association for the Advancement of Science; Institute of Mathematical Statistics; International Society for Bayesian Analysis

Thomas Bettge, American Meteorological Society

Maurice Blackmon, American Meteorological Society

David Blankinship, American Meteorological Society

Gordon Bonan, American Geophysical Union

Byron Boville, American Geophysical Union; American Meteorological Society; Canadian Meteorological and Oceanographic Society

Esther Brady, American Geophysical Union; The Oceanography Society

Frank Bryan, American Meteorological Society; American Geophysical Union; The Oceanography Society; IEEE Computer Society

Robert Chervin, American Association for the Advancement of Science; American Meteorological Society; American Physical Society; New York Academy of Sciences; The Oceanography Society

Anthony Craig, American Geophysical Union

William Collins, American Geophysical Union; American Meteorological Society; American Physical Society; American Association for the Advancement of Science

Scott Doney, American Geophysical Union; The Oceanography Society; American Meteorological Society

Benjamin Felzer, American Geophysical Union; American Meteorological Society; Geological Society of America; Society of Sigma Xi

Peter Gent, American Meteorological Society; American Geophysical Union

Filippo Giorgi, American Geophysical Union

Christian Guillemot, American Geophysical Union

James Hack, American Meteorological Society

Tim Hoar, American Statistical Association; American Meteorological Society; American Geophysical Union

Jim Hurrell, American Meteorological Society; American Geophysical Union

Jeffrey Kiehl, American Geophysical Union; American Meteorological Society

Tim Kittel, American Geophysical Union; American Meteorological Society; Ecological Society of America; International Association for Vegetation Science

Erik Kluzek, European Geophysical Society

Roland Madden, American Meteorological Society; American Geophysical Union

Wendy Meiring, American Statistical Association; Institute of Mathematical Statistics

Chester Newton, American Meteorological Society; American Association for the Advancement of Science; American Geophysical Union

Bette Otto-Bliesner, American Association for the Advancement of Science; American Geophysical Union; American Meteorological Society; Geological Society of America; New York Academy of Sciences

David Pollard, American Geophysical Union

Jian-Hua Joshua Qian, American Geophysical Union; American Meteorological Society

Andrew Royle, American Statistical Association; Institute of Mathematical Statistics; Biometrics Society; Institute of Mathematical Applications of Grenoble

Dave Schimel, American Geophysical Union; Ecological Society of America

Dennis Shea, American Meteorological Society

Christine Shields, American Meteorological Society

Lana Soller, Association for Women Geoscientists; American Geophysical Union; American Meteorological Society

Starley Thompson, American Association for the Advancement of Science; American Geophysical Union; American Meteorological Society

Kevin Trenberth, American Meteorological Society; American Association for the Advancement of Science; Royal Meteorological Society of New Zealand

Warren Washington, American Association for the Advancement of Science; American Geophysical Union; American Meteorological Society

John Weatherly, American Geophysical Union

David Williamson, American Meteorological Society

Environmental and Societal Impacts Group

- John Firor, Fellow of the American Meteorological Society (AMS).
- John Firor, Fellow, American Association for the Advancement of Science (AAAS).
- Michael Glantz, Chairman, Steering Committee for the Global Terrestrial Observing System (GTOS) of the FAO/UNEP/WMO/ICSU (June 1996-present).
- Michael Glantz, Honorary Editorial Advisory Board, Encyclopedia of Life Support Systems (EOLSS) (February 1996-present).
- Michael Glantz, Nominated Expert in support of the UN Framework Convention on Climate Change (UNFCCC) (January 1997-present).
- Michael Glantz, US Representative, Trade Convergency Climate Complex International Network (TC3Net). Also on Regional Coordinating Committee of TC3Net (January 1997-present).

- Michael Glantz, Advisor, Indochina Global Change Network (IGCN) (1997-2000).
- Michael Glantz, Organizing Committee, international conference on Environmental Indices: Systems Approach and Applications, held July 1997 in St. Petersburg, Russia.
- Michael Glantz, Member of the Independent Commission on Environmental Education, a program of the George C. Marshall Institute (1996-1997).
- Michael Glantz, Member of the Scientific Advisory Panel, Southeast Asian Regional Committee for START (Global Change System for Analysis, Research and Training (1996-present).
- Michael Glantz, member of the Scientific Advisory Committee (SAC) for the World Climate Impact Assessment and Response Strategies Programme (WCIRP) of the UN Environment Programme.
- Michael Glantz, Steering Committee, Center for Environmental Journalism, University of Colorado (1992-present).
- Linda Mearns, IPCC Task Force on Climate Change Scenarios (1996-present).
- Linda Mearns, Member, NOAA Human Dimensions Program Proposal Review Panel (1996-present).
- Linda Mearns, Member NOAA/NASA Proposal Review Panel (1995-present).
- Kathleen Miller, Member of National Academy of Sciences/National Research Council Panel on the Human Dimensions of Seasonal-to-Interannual Climate Variability (1997).
- Roger Pielke, Jr., Member of the Committee on Societal Impacts, American Meteorological Society (1996-present).
- Roger Pielke, Jr., Member, Panel on Risk, Vulnerability, and the True Costs of Coastal Hazards, The H. John Heinz III Center for Science, Economics, and the Environment (1997-present).
- Roger Pielke, Jr., Member, Task Committee on Mitigating Hydrological Disasters, American Society of Civil Engineers (1997-present).
- Roger Pielke, Jr., Member, Science Steering Committee, U.S. Weather Research Program (1997-present).
- Roger Pielke, Jr., Member, Workshop Organizing Team, U.S. Weather Research Program, Workshop on Hurricane Landfall (June 1997).
- Roger Pielke, Jr., Member, National Weather Service Disaster Survey Team on Flooding of the Red River of the North (May 1977).
- Roger Pielke, Jr., Member, Program Committee, Southeast Regional Workshop on Climate Variability and Water Resources (March 1977).

High Altitude Observatory

Tom Bogdan is a member of the Solar Magnetism Initiative (SMI) Steering Committee; 1996-present.

Tim Brown serves on the Big Bear Solar Observatory Users Committee, 1997.

Tim Brown serves on the NSO Users Committee, 1997-2000

Barbara Emery serves on the Information Systems and Science Operations (ISSO) Management Operations Working Group (MOWG), NASA, 1997-present.

Barbara Emery is an ex-officio member of CEDAR Science Steering Committee, 1987-present.

Barbara Emery serves on the Ionosphere-Thermosphere-Mesosphere-Stratosphere Subgroup of the NASA Space Physics Data System (SPDS), 1994-present.

Peter Fox serves on the SunRISE Scientific Steering Committee, 1994-present.

Peter Gilman serves on the GONG Scientific Advisory Committee, 1985-present.

Peter Gilman serves on the SOLIS Advisory Committee, 1997-present.

Peter Gilman serves on the Solar Magnetism Initiative (SMI) Steering Committee, 1996-present.

Maura Hagan serves on the NASA/NRC Committee of Solar Terrestrial Research, 1996-1999.

Maura Hagan serves on the CEDAR Science Steering Committee, 1997-2000.

Maura Hagan is a co-chair of the Scientific Committee on Solar-Terrestrial Physics subgroup for Planetary Scale Mesopause Observing System (PSMOS), 1996-1997.

Thomas Holzer serves on the Scientific Advisory Committee of the Max-Planck-Institut für Aeronomie in Lindau, Germany, 1996-1998.

Thomas Holzer serves as chair of the Cosmic and Heliospheric SR & T Review Panel at NASA, 1997.

Thomas Holzer is a member of the Scientific Advisory Committee of the Max-Planck-Institut für Aeronomie in Lindau, Germany, 1996-1999.

Thomas Holzer serves as a member of the Council of the Solar Physics Division of the American Astronomical Society, 1996-1997.

Michael Knölker is a member of the Association of Universities for Research in Astronomy (AURA) Observatory Visiting Committee (OVC), 1996-present.

Michael Knölker is a member of the Solar Magnetism Initiative (SMI) Steering Committee, 1995-present.

Bruce Lites is a member of the NASA Solar-B Science Definition Team, 1994-1997.

Bruce Lites is a member of the Solar Magnetism Initiative (SMI) Steering Committee, 1995-present.

Boon Chye Low is a member of the Solar Magnetism Initiative (SMI) Steering Committee, 1995-present.

Gang Lu is an Associate of the Center for Integrated Plasma Studies at the University of Colorado; 1996-present.

Keith MacGregor is Chairman of the Scientific Organizing Committee for the European Southern Observatory, 1996-1997.

Arthur Richmond is a member of the Groupe International de Recherche en Geophysique Europe Afrique (GIRGEA), 1995-present.

Arthur Richmond is a member of the Scientific Advisory Committee at Oersted Satellite, 1995-present.

Raymond Roble serves on the Advisory Board at the Geophysical Institute at the University of Alaska, 1985-present.

Oran Dick White serves on the SunRISE Precision Solar Photometric Telescope (PSPT) Steering Committee, 1992-present.

Oran Dick White serves on the NOAA Solar Prediction Panel, 10 Sep. 1997.

Mesoscale and Microscale Meteorology Division

N. Andrew Crook, External Advisory Panel for the Center for Analysis and Prediction (CAPS), 1996-present.

Christopher Davis, U.S. Weather Research Program Prospectus Development Team #8, 1996; Chair, AMS Mesoscale Committee, 1993-1996.

James Dye, AGU Committee for Atmospheric and Space Electricity, 1993-present.

Robert Gall, Fronts and Atlantic Storm Track Experiment (FASTEX) Science Steering Group, 1995-1997.

Wojciech Grabowski, AMS Cloud Physics Committee, 1995-1998.

Jackson Herring, American Physical Society Fellowship Committee, 1996-1999.

Andrew Heymsfield, Indian Ocean Field Experiment (INDOEX) U.S. Steering Committee, 1997-present.

Joseph Klemp, AMS Publications Commission, 1987-1998; AMS Information Systems Committee, 1994-1998; Comparison of Mesoscale Prediction and Research Experiment (COMPARE) Planning Committee, 1990-1997; U. S. Weather Research Program Scientific Advisory Committee, 1995-present; COMET Scientific Review Panel, 1995-1998.

Margaret LeMone, National Academy of Sciences, Board of Atmospheric Sciences and Climate (BASC), 1992-1996; U. S. Weather Research Program Scientific Advisory Committee, 1997-present.

Donald Lenschow, AMS Committee on Laser Atmospheric Studies, 1997-present.

Mitchell Moncrieff, Atmospheric Radiation Measurement (ARM) Tropical Western Pacific Advisory Committee, 1993-present; Maritime Continent Thunderstorm Experiment (MCTEX) Steering Committee, 1993-present; Cloud Sat Science Team, 1995-present; World Climate Research Program (WCRP)/Global Energy and Water Cycle Experiment (GEWEX) Scientific Steering Group, 1997-present; Cooperative Institute for Mesoscale Meteorological Studies (CIMMS) Advisory Board, 1997; COARE98 Conference Organizing Committee, 1997; IUGG99 Conference Co-Convener, 1997-1999.

Chris Snyder, AMS Committee on Atmospheric and Ocean Fluid Dynamics, 1995-present; Fronts and Atlantic Storm Track Experiment (FASTEX) Science Steering Group, 1995-1997; NSF/NASA Review Panel for USWRP Proposals, 1997.

Research Applications Program

Dan Breed, served as manager of the Program for the Augmentation of Rainfall in Coahuila, Mexico.

Barbara Brown, served as chairman of the American Meteorological Society Committee on Probability and Statistics in the Atmospheric Sciences. She also chaired the Program Committee for the 14th Conference on Probability and Statistics in the Atmospheric Sciences, and was a member of the Program Committee for the 7th International Meeting on Statistical Climatology. In addition, Barbara was scientific mentor for UCAR SOARS student Lacey Holland during the summer of 1997.

Michael Dixon, was a reviewer for the manuscript "The Storm Cell Identification and Tracking (SCIT) Algorithm" for *Weather and Forecasting*.

Martha Limber, was a member of a career workshop panel for the University of Colorado, Boulder Mathematics Department.

Tenny Lindholm, organized and led a turbulence workshop in February which included about 110 participants from all corners of the aviation industry, national and international.

Marcia Politovich, served on the COMET Advisory Panel and on the organizing committee for the American Meteorological Society Cloud Physics Committee and Cloud Physics Conference. She was an advisor for the FAA InFlight Icing Steering Committee and participated in the FAA InFlight Icing Steering Committee Task 1B Working Group, as well as the WMO World Weather Research Program InFlight Icing Advisory Group. Marcia also served as co-mentor for UCAR SOARS program student Lacey Holland from the University of Oklahoma.

Thomas T. Warner, served as member of the University of Oklahoma CAPS external advisory committee.

James Wilson, served as member of the NEXRAD Technical Advisory Committee, the National Science Foundation Facilities Advisory Committee, the USWRP Quantitative Precipitation Forecasting Working Group, and the NCAR Appointment Review Group (ARG). He also was chairman of the Chapter Review Panel for the Severe Storms Monograph.

Scientific Computing Division

Brian Bevirt is a member of the Association for the Advancement of Computing in Education. He teaches Technical Writing at the University of Colorado Division of Continuing Education. He also gave an invited presentation to the Rocky Mountain Chapter of the Society for Technical Communication (STC).

Bill Buzbee, Ph.D, serves on the Minnesota Supercomputing Institute's External Advisory Board. He is on the review team for the National Centers for Environmental Protection (NCEP), Central Operations (NCO). He is a member of ACM, IEEE and the IEEE subcommittee on Supercomputing (SIAM), and the American Meteorological Society (AMS). He is also on the advisory board of RCI, Ltd., an international consortium of leading-edge users and vendors of High Performance Computing. He is listed in Who's Who in Science and Engineering and is currently listed in American Men and Women of Science.

Ginger Caldwell is a Member of the Association of Computing Machinery (ACM) and the American Management Association. She is also a member of the Supercomputing '97 Education Program Committee.

Fred Clare is a member of the ACM, SIGGRAPH, and the IEEE Computer Society.

Rachelle Daily serves as Secretary, Executive Board, IEEE Computer Society, Mass Storage Technical Committee.

Sally Haerer served on: Supercomputing '96 Executive Committee - Technical Papers and Invited Speakers Chair; Parallel Tools Consortium Steering Committee; Cray User Group Board of Directors and Advisory Council - Vice President; is a member of IEEE Computer Society; and is a Program Committee Member of IAI Workshop, Boulder.

Roy Jenne continues to serve on the following advisory panels: Academy CES satellite committee; Advisory Panel for Goddard DAAC (Data System); and the Science Council for Earth Sciences for USRA (University Space Research Association) (through November 1999). He also chaired Negotiations on Working Group VIII Data Exchange, August 1996; is Head of US side of US-Russia data exchange under Working Group VIII bilateral (1980-1996).

Jeff Kuehn is Chair, Special Interest Committee for Performance and Evaluation, Cray User Group, Inc. (elected); Advisory Council Member, Cray User Group, Inc. (appointed); Steering Committee Member, Parallel Tools Consortium (appointed); (Association for Computing Machinery) Usenix Association.

Lynda Lester is the Editor of "CUG.log," the international newsletter of the Cray User Group (CUG), and is secretary of the CUG Advisory Board. She gave an invited presentation at Colorado State University on how to edit and manage publications on the web. She is a member of the Society for Technical Communication (STC), for whom she hosted two chapter meetings and gave one presentation at NCAR. She also won an STC "Award of Merit" for SCD's web newsletter, "SCDzine."

Bernie T. O'Lear was chair of the Mass Storage Systems Technical Committee for the IEEE Computer Society until August 1997. He received the IEEE Computer Society's "Golden Core Member" Award. The Golden Core Members consist of approximately 500 people who have served the society in significant ways throughout its 50 years. Bernie O'Lear has also participated in the First IEEE Metadata conference as a member of the conference committee and Registration Chair. He has also been appointed to the 1997 UCAR Grievance Panel.

The Network Engineering and Technology Section (NETS) participated in the vBNS Technical Coordination Committee and the Westnet Steering Committee.

Awards and Honors

Atmospheric Technology Division

Mitch Randall, Eric Loew, and Joe Vinson received the 1996 NCAR Technology Advancement Award for their development of the PIRAQ and VIRAQ Radar Signal Processing Systems.

Mitch Randall and Eric Loew were awarded a U.S. Patent in FY 1997 on their PIRAQ radar signal processor card for use in personal computers.

Larry Radke received a group achievement award for First ISCCP Regional Experiment Phase II (FIRE-II) Science and Operations Team from NASA Langley Research Center.

Climate and Global Dynamics Division

Mark Berliner, Elected Fellow of the American Statistical Association

James Hurrell, Winner, UCAR Outstanding Publication Award, 1997.

Warren Washington, Inducted into the National Academy of Sciences Portrait Collection of African Americans in Science, Engineering, and Medicine, 1997

Warren Washington, Department of Energy Biological and Environmental Research Program Exceptional Service Award for Atmospheric Sciences, 1997

Research Applications Program

Jeffrey Cole, received an NCAR/RAP Incentive Award for implementation and installation of Weather Support to Deicing Decision Making (WSDDM) system snowgauge network at LaGuardia, JFK, Newark, and Chicago airports.

Mesoscale and Microscale Meteorology Division

N. Andrew Crook, UCAR Outstanding Performance Awards: Outstanding Publication Award, Nomination.

Andrew Heymsfield, UCAR Outstanding Performance Awards: Outstanding Publication Award, Nomination.

Margaret LeMone, elected to the National Academy of Engineering.

Larry Miloshevich, UCAR Outstanding Performance Awards: Outstanding Publication Award, Nomination.

Chin-Hoh Moeng, Meisinger Award, AMS.

Piotr Smolarkiewicz, Excellent Editor, Monthly Weather Review.

Juanzhen Sun, UCAR Outstanding Performance Awards: Outstanding Publication Award, Nomination.

Morris Weisman, UCAR Outstanding Performance Awards: Education Award, Nomination.

[NCAR](#) | [UCAR](#) | [NSF](#) | [NCAR FY96 ASR](#) | [NCAR FY97 ASR](#)



NCAR Science Highlights

Below are selected highlights from the NCAR divisions and programs. For a full description of NCAR's FY1997 science highlights, please follow the divisional links.

Atmospheric Chemistry Division

EXPRESSO

ACD, in cooperation with scientists from several other American and European institutions (including the Aerology Laboratory of CNRS, Toulouse, France), successfully completed the EXPRESSO field campaign in the Congo and the Central African Republic. Ground based and airborne instrumentation provided unique information on the chemical composition of the lower atmosphere in this tropical region. High ozone production rates were recorded during the biomass burning season. The meteorological situation showed to be more complex than believed earlier, with strong mixing between the Harmattan and the monsoon layers. Field data are being analyzed.

MOZART Model

ACD completed the first version of a global three-dimensional chemical transport model (called MOZART). This model provides the global distribution and budget of approximately 50 chemical compounds involved in the chemistry of tropospheric ozone. A regional model, using a similar chemical scheme, is being developed and the first version will soon be completed.

Atmospheric Technology Division

GPS Dropsonde Development

In 1997 ATD's Surface and Sounding Systems Facility (SSSF) completed the development and testing of an advanced, lightweight, high-resolution dropsonde using Global Positioning System (GPS) wind-finding technology and state-of-the-art sensors. The new GPS Dropsonde was used operationally for the first time in two major research roles: in the Fronts and Storm Track Experiment (FASTEX) conducted over the North Atlantic in winter 1997, and in hurricane field studies carried out by NOAA. The development of the new system was funded jointly by ATD, NOAA, and the German Aerospace Research Establishment (DLR).

The task of developing the GPS Dropsonde was especially challenging. The specifications required, among other things, that the new sonde be capable of being launched from high-altitude, fast, jet aircraft, and that the system be able to acquire data from four sondes in the air at the same time. The requirements demanded high accuracy, precision, and resolution in the measurements under extreme environmental conditions of shock, vibration, and cold. The sonde had to be small, extremely light, and, most importantly, cheap, since it is expendable and is used in large quantities.

In its first field application, the FASTEX program (see below), the new GPS Dropsonde demonstrated that it offers the atmospheric science community unprecedented accuracy and resolution in vertical profiles of wind and PTH (pressure, temperature, and humidity). Measurements are obtained at intervals of 0.5 s, which corresponds to an average vertical resolution of 7 m (even better at lower altitudes close to the surface). This high resolution compares with the 60-s (LORAN) and up to 240-s (Omega) resolutions of the older LD2 sonde. Furthermore, the new system allows highly detailed measurements all the way down through the boundary layer to the surface.

The use of the new GPS Dropsonde in NOAA's hurricane research and reconnaissance operations has dramatically improved observing capabilities. The old NOAA Omega dropwindsonde (ODW) system had serious limitations (low vertical resolution, no winds in the boundary layer, and poor performance in bad weather) which restricted the use of the system to providing information only on the large-scale synoptic environment of the storm. The new GPS Dropsonde not only solves these problems, but for the first time allows measurements in the highly turbulent eyewall environments of hurricanes. Drops during August-September 1997 into the eyewall regions of Hurricanes Guillermo and Erika resulted in detailed wind and PTH profiles all the way to the surface. Maximum wind speeds of almost 150 knots were measured. These new capabilities are having a major impact on NOAA's hurricane research and reconnaissance programs, and are expected to lead to more accurate hurricane advisories and warnings.

Fronts and Atlantic Storm Track Experiment (FASTEX)

This international program was by far ATD's most challenging field deployment during the year. FASTEX was focused on studying the mesoscale structure of winter cyclones developing over the North Atlantic ocean and the relationship between cyclone intensification and upstream precursors embedded in the large-scale flow. ATD's role in the program was extensive: it supported both the airborne and surface portions of FASTEX observing operations, as well as computing network and communications activities at the main control center in Shannon, Ireland. The newly developed NCAR GPS Dropsonde was used for the first time on two NOAA aircraft (the G-IV and a WP-3D) as well as on an NCAR-leased Lear 36 aircraft. A total of 750 sondes were dropped during the experiment, with a data-capture rate of over 90% being achieved by the end of the program. The high-resolution, highly mobile vertical soundings from the airborne GPS Dropsondes allowed PIs to study target areas where small analysis errors were expected to most significantly affect predictions, or where cyclones were in early development stages.

ATD also operated an Integrated Sounding System (ISS) on board each of two research ships. The two ISS systems provided wind, temperature, and humidity profiles and surface meteorological measurements to document atmospheric boundary-layer structure and to help characterize surface fluxes on both sides of fronts at the surface.

The NCAR/NSF Electra aircraft, equipped with the ELDORA Doppler radar and a variety of microphysical and other sensors, was used by a group of NCAR, university, and French PIs to map mesoscale structures of mature or deepening cyclone systems. The rapid-scanning abilities of ELDORA helped document the turbulent ascent and descent of air in shallow rain showers associated with cold and warm frontal systems.

Also flown on the Electra during FASTEX was the Weather Avoidance Radar Data System (WARDS), newly developed by ATD. The WARDS surveillance display allowed investigators to see convective bands ahead of the aircraft, and thus helped them to design and refine flight patterns for optimal ELDORA data collection.

Climate and Global Dynamics Division



Completion of a 300-year simulation with the initial version of the Climate System Model (CSM), in which there are no significant drifts in the surface temperatures.



Analysis of Nimbus-7 earth radiation budget data has shown that there is a global signature for enhanced shortwave cloud absorption. This signature appears in the ratio of the visible to near infrared cloud albedo. Analysis of the Atmospheric Radiation Measurement (ARM) program data confirms the existence of enhanced shortwave cloud absorption.

Environmental and Societal Impacts Group

Katz and the late Allan Murphy (University of Oregon) (editors) had their book published in FY97 on the *Economic Value of Weather and Climate Forecasts* (Cambridge University Press). This book is the first unified treatment of the economic value of weather and climate forecasts. It is a unique resource and provides a comprehensive synthesis of the literature on this subject. The individual chapters present detailed analyses of weather prediction (from a few hours to seasons ahead), forecast verification, and various approaches to assessment of forecast value. A wide range of value assessment methods, from descriptive to prescriptive, are also treated. The project was multidisciplinary in nature, including authors from meteorology, statistics, psychology, and economics.



Glantz organized and convened the ASP Summer Colloquium: *A Systems Approach on ENSO: Oceanic, Atmospheric, Societal, Environmental, and Policy Perspectives* 20 July - 1 August 1997 in Boulder. The colloquium merged disciplinary expertise with multidisciplinary interests to provide a broad understanding of ENSO as a system. The colloquium gathered together approximately 30 graduate students and a team of ENSO experts from around the world for this two-week event. It addressed the history, theory, modeling, observational aspects, ecological and societal impacts, and forecasting related to ENSO events.

Daily events at the [colloquium](#) were placed on the World Wide Web in near real-time. CATHALAC (Centro del Agua del Trópico Húmedo para América Latina y el Caribe) assisted with the [Spanish translations](#) of colloquium abstracts, since information presented at the colloquium were of great interest to researchers in Spanish-speaking countries, many of which are greatly affected by El Niño events.

High Altitude Observatory

Using state-of-the-art observations delivered by the HAO/NSO Advanced Stokes Polarimeter, Bruce Lites, Andrew Skumanich, and Valentin Martinez Pillet (Instituto de Astrofísica de Canarias) recently completed an unprecedented observational study of small-scale emerging magnetic flux. These data provide the most complete and accurate observational description to date of newly emerging vector magnetic fields. Their analysis shows that coherent magnetic field systems erupt through the visible solar surface at equipartition field strengths, oriented parallel to the solar surface. As individual elements of magnetic flux migrate away from the emergence zone, they reorient themselves to lie perpendicular to the solar surface. In so doing their field strength increases into the kiloGauss range, which is more typical of mature small-scale magnetic flux features.

Paul Charbonneau and Steve Tomczyk, together with Jesper Schou (Stanford University) and Michael Thompson (Queen Mary and Westfield College), have analyzed data obtained during the first two years of LOWL observations in order to infer the rotational properties of the deep solar core. By applying the technique of Genetic Forward Modeling (previously developed at HAO by Charbonneau, Tomczyk, and collaborators) to the LOWL p-mode frequency splitting measurements, they have derived the best available picture of how the innermost portion of the Sun's radiative interior rotates. Their results

indicate that the rotation of the solar core can be characterized as uniform (with 20% accuracy) down to a depth of 0.2 solar radii. They can also rule out departures from solid body rotation by a factor of two or more at depths between 0.1 and 0.2 solar radii.

Mesoscale and Microscale Meteorology

Analysis of measurements by Lynn Russell (ASP) and Donald Lenschow from a Lagrangian experiment carried out by the NCAR C-130 aircraft during the Aerosol Characterization Experiment (ACE-1) southwest of Tasmania, Australia, shows that exchange of air can occur in both directions across the top of the boundary layer even in clear air ([see figure](#)). *Figure Legend: Schematic of the two-layered structure observed during ACE-1 with the NCAR C-130 aircraft. Transport (entrainment fluxes) occurred in both directions between the boundary layer and the overlying "buffer layer," even in absence of clouds.* They demonstrated this primarily by using aerosol and dimethyl sulfide as tracers of vertical transport. The air above the boundary layer was intermittently turbulent due to wind shear, but was still distinctly different from the boundary layer. This process has important implications in understanding the evolution of trace constituents in the marine boundary layer.

Scientists within the Mesoscale Prediction Group of the MMM Division are developing a variational data assimilation system based on MM5. During the last year, development of the tangent linear and adjoint of a "dry" version of MM5 was completed; these models were released to the users community. Although still incomplete, this primary version of the MM5 variational data assimilation system already offers the possibility of performing minimization in a twin experiment configuration and carrying out useful sensitivity experiments ([see figure](#)). A tutorial was offered at the time of the release and was attended by more than 30 interested users from NCAR and the university community.

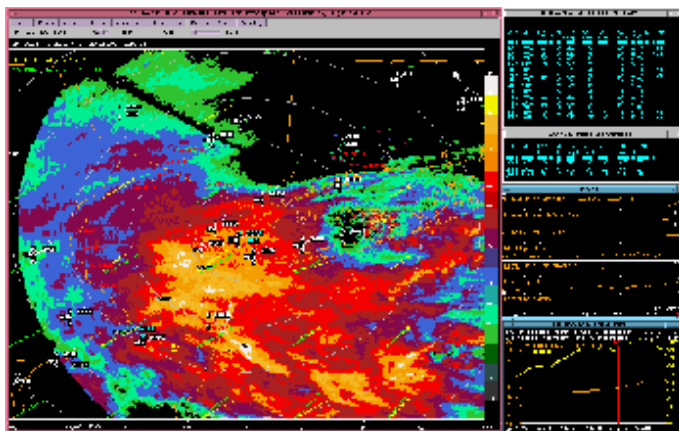
Research Applications Program

- **Completion of Hong Kong Windshear and Turbulence Warning System (WTWS) for Hong Kong's New Airport.**



The WTWS System was accepted by the Hong Kong Government on 17 July 1997, after 44 months of research and development. The \$16 million project included basic and applied research on wind flow over Hong Kong's rugged terrain, a scientific field study, warning system concept and feasibility studies, system design, construction, implementation and training. The program was managed by B. Donaldson, Weather Information and Technologies, Inc. (WITI), R. Wagoner and W. Mahoney, both of NCAR/RAP. See Hong Kong Operational Windshear Warning System (OWWS) Completion, [Section VI](#).

- **The Demonstration of the Weather Support to Deicing Decision Making (WSDDM) at New York LaGuardia and Chicago O'Hare Airports.**



WSDDM is a real-time weather system designed to improve decision making at airports during winter storms. Snowfall and weather information are used by ground personnel conducting aircraft deicing operations, airline station control managers and dispatchers coordinating flights, airport managers coordinating runway plowing activities, and air traffic managers involved with gate hold programs. WSDDM provides decision makers with the information needed to anticipate both the onset and termination of snow at the airport and surrounding regions, its intensity, and water content.

The WSDDM System was demonstrated to a variety of users at LaGuardia Airport in New York, and O'Hare Airport in Chicago. New York users included Delta Airlines, USAIR Airlines, and New York TRACON. In Chicago, United and American Airlines had displays. The system required the use of 25 workstations and displays at 8 user sites. Communications were designed and implemented by T. Hofmeister, F. Hage and R. Tescher and required the use of 56 kB dedicated phone lines and local networks all linked and working together. All the users were able to access workstations independently with no degradation of performance during high weather demand periods.

An important aspect of the system is the ability to rapidly loop the radar data in order to visually examine snowband motions and growth or decay trends. The response of the system to user commands was excellent, with new loops or reflectivity images appearing typically within a second or two of selection.

This network is one of the most complicated ever set up at RAP. The WSDDM System is managed by R. Rasmussen. See Operational Evaluation of the Weather Support to Deicing Decision Makers in Chicago and New York, [Section XIV](#) for more information.

Scientific Computing Division

NCEP/NCAR Global Atmospheric Reanalysis Project

The [NCEP/NCAR Global Atmospheric Reanalysis Project](#) is an effort to reanalyze a long period of historical data using a single state-of-the-art atmospheric model. Previously existing collections of analyzed data result from operational procedures that are scheduled to produce the highest quality forecasts on a fixed near-real-time schedule. Artificial anomalies in the data time series can occur when the models are changed to improve forecast capability. Furthermore, under the time constraints, only rapidly available non-delayed data are used. The Reanalysis Project is a major effort designed to overcome these limitations in the operational analyses.

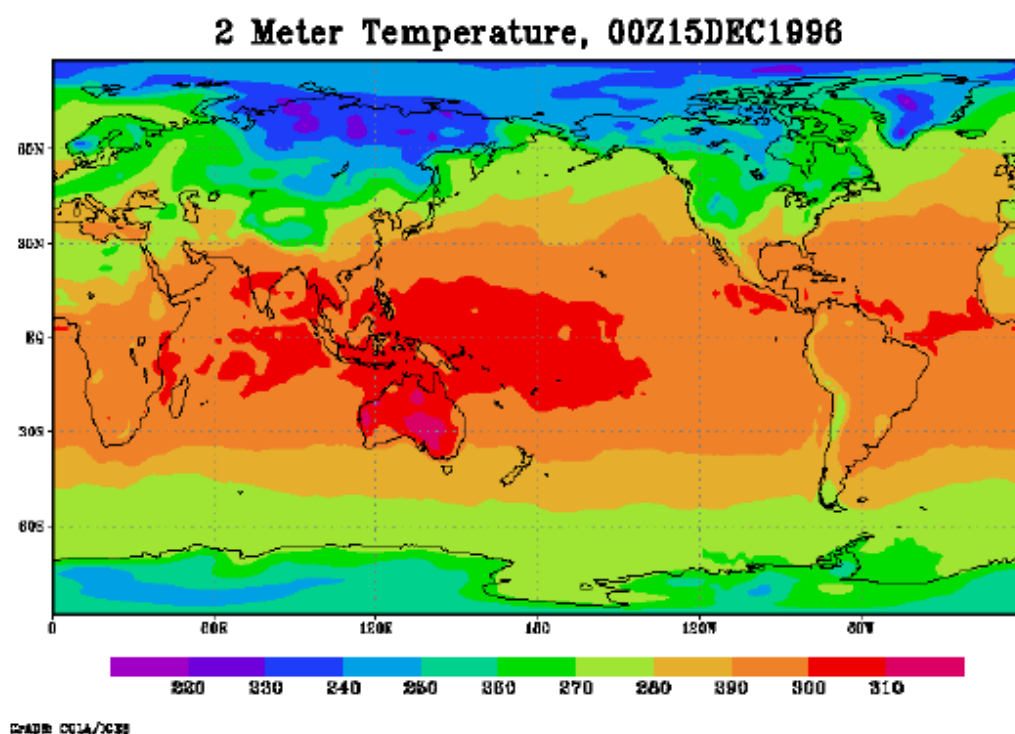
This project is a cooperative effort between NCAR's Data Support Section (DSS) and the National Centers for Environmental Prediction (NCEP) of NOAA. NCEP is responsible for the numerical analyses of the data, while the DSS is responsible for the majority of input data collection and preparation and output data archiving and distribution. This project is a good example of interagency cooperation to achieve a mutually beneficial scientific goal.

In general, the project goal is to reanalyze the previous 50 years of atmospheric data. Over 40 years are now completed. The project is described in the Bulletin of the American Meteorological Society (BAMS), March 1996. A [near final draft of the BAMS article](#) is available online, and less detailed information concerning [the project and model description, and project](#)

[status](#) is also online.

The complete output archive is approximately 54 GB of data per year and contains many subset [data products](#). Various resolutions are also available beginning with 4x daily temporally, approximately 2.0 degrees horizontally, and 28 levels vertically. In many ways this scientific data collection is unmatched by any other at this time.

All reanalysis data products are available from the NCAR MSS for users with NCAR computing accounts at no cost, and they can be provided to other users at the minimal cost of copying the data to magnetic media. [Software to access the data and information on how to order the reanalysis data](#) are available online. The wide distribution of reanalysis data is enhanced by a set of [annual CD-ROMs](#). The CD-ROMs contain the most popular reanalysis data products and necessary software to read and display the data. Below is an example of two-meter-height air temperature (degrees Kelvin) data from 0Z, 15 December, 1996, taken from the CD-ROM and illustrated (with reduced resolution here) using the GrADS display software.



Low-resolution sample of visualized data from reanalysis CD-ROM

The NCEP/NCAR reanalysis dataset is proving to be popular. During 1997, average monthly statistics show that the archive on the NCAR MSS has about 10 unique users, accessing over 1000 files containing about 300 GB of data. Data usage delivered by CD-ROMs and magnetic media are not included in these statistics. Overall, 1150 CD-ROMs have been distributed to fulfill 450 requests, and about 150 orders have been served with magnetic tape media.

Other organizations within NOAA are also distributing the reanalysis data and providing some interesting real-time access and displays using the web. One such site is provided through the NOAA-CIRES Climate Diagnostics Center. Here a [web-based atlas](#) allows anyone to access and visualize many different data products.

Many scientific evaluations of the NCEP/NCAR reanalysis archive have been completed, and many more will take place in coming years. An example of the level of scientific interest was demonstrated at the October 1997 International Workshop on Reanalysis in Silver Spring, MD, sponsored by the International Global Energy and Water Cycle Experiment (GEWEX) Project office. Here the NCEP/NCAR reanalysis was a central topic of many presentations. The workshop agenda emphasizes how reanalyses can be applied to a wide range of scientific investigations.

More information related to the NCEP/NCAR Global Atmospheric Reanalysis Project appears in the [FY97 SCD Research Data report](#).

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Director's Message



FY-1997 was a very busy year for ACD staff. A major field campaign (EXPRESSO) conducted in the Central African Republic and in the Congo, initiated and organized by ACD jointly with CNRS in France, was successfully completed. The purpose of the project was to better characterize and quantify biogenic emissions from the savanna and the tropical forest and their role in the formation of photochemical oxidants. Biosphere-atmosphere fluxes of trace gases were also measured in western US forests as part of the North American Research Strategy on Tropospheric Ozone (NARSTO). ACD staff participated in several other field campaigns including the POLARIS mission organized by NASA to examine chemical and dynamical processes in the Arctic stratosphere, and the NOAA-led North Atlantic Regional Experiment (NARE) to assess the export of tropospheric ozone and its chemical precursors from the North American continent to the Atlantic Ocean.

During the past year, however, emphasis was deliberately placed on the analysis of data collected during previous field campaigns (including the Aerosol Characterization Experiment (ACE-1); the NASA's DC-8 SUCCESS project; the NASA TOTE/VOTE field campaign; the NCAR-led STERAO-A campaign; the PEM-tropics mission; the SOS Formaldehyde Intercomparison Study, etc.). Several exciting results, obtained during these field projects, are highlighted in the following sections of this Annual Scientific Report.

Other accomplishments by ACD staff and visitors include the development of new state-of-the-art instrumentation: for example, an automatic spectrometer is providing high resolution infrared observations from Thule, Greenland, as part of the Network for Detection of Stratospheric Change (NDSC); a tunable diode laser (to measure CO and N₂O), as well as a four-channel instrument (to measure nitrogen oxides and ozone) were developed to fly on high altitude aircraft (NSF/NCAR WB57). The development of an instrument for the measurement of acetone using chemical ionization mass spectrometry has also been initiated. At the same time, the modeling group has completed the development of global and regional chemical transport models, which will be very useful for the interpretation of field measurements.

ACD continues to put emphasis on laboratory kinetics. The focus in 1997 has been on the analysis on oxidation mechanisms for several organic compounds, and on the characterization of several heterogeneous reactions. As a service to the community and as a contribution to the International Global Atmospheric Chemistry (IGAC) Project, ACD is leading a series a planned laboratory experiments to evaluate current analytical methods used to measure hydrocarbons in the atmosphere.

As part of the NASA Earth Observation System, ACD is contributing to the development of a Canadian space-borne instrument (MOPITT) aimed at measuring carbon monoxide and methane in the troposphere. This instrument is expected to be launched on the AM-1 satellite in mid-1998. ACD staff is developing retrieval algorithms, as well as an airborne version

of MOPITT. ACD staff are also directly involved in the design of the HIRDLS instrument aimed at measuring from space various chemical compounds in the stratosphere and upper troposphere.

Finally, during 1997, a large planning effort has been performed by the Division. A three-day retreat as well as several related planning meetings took place, and led to the completion of a strategic and an implementation plan for the next five years. The role of junior scientists in future ACD activities has been emphasized, and several activities are being planned under their leadership and responsibility.

Guy Brasseur

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Director's Message

William A. Cooper



The ASP mission, broadly defined, is to help NCAR (and the scientific communities it serves) prepare for the future. We work in support of other NCAR units to encourage the development of young scientists in the field of atmospheric science, to direct attention to timely scientific areas needing special emphasis, to help organize new science initiatives, to support interactions with universities, and to promote continuing education at NCAR.

The most important component of our program is the postdoctoral fellowship program, which has been a part of NCAR for more than thirty years and has brought more than 340 postdoctoral scientists to NCAR. Each year between 10 and 15 new postdoctoral scientists come to NCAR, usually in two-year appointments. They conduct their research in collaboration with NCAR scientists and work in all areas in which NCAR is involved. NCAR benefits from continuous contact with some of the brightest and most promising young scientists in our field and from the lasting associations that result. The postdoctoral scientists benefit from the opportunity to work with NCAR scientists, from exposure to the breadth of science at NCAR, and from the independence they are encouraged to develop. Many former fellows now occupy prominent positions at UCAR universities or at NCAR, and many present collaborations between NCAR and university scientists derive from associations that developed in the postdoctoral program.

The ASP also promotes the examination of research areas that merit special emphasis, either because they are particularly timely or because they seem under-emphasized relative to their importance. This is accomplished primarily by convening workshops and supporting appropriate visitors. As part of this effort, ASP hosts an annual summertime colloquium that brings graduate students to NCAR for an intensive set of lectures presented by selected scientists from within and outside NCAR. Last summer the topic was *A Systems Approach to El-Niño/Southern Oscillation*; the topic next summer will be *Hurricanes at Landfall*.

Another function of the ASP is to promote new science initiatives and programs that do not have a natural home in any one of the NCAR divisions. The Geophysical Turbulence Program seeks to represent interests in turbulence throughout NCAR. This very active program normally hosts an annual workshop, sponsors a seminar series, and in other ways helps coordinate the active program in turbulence research at NCAR. We have recently been helping promote the NCAR Aerosol Program, a new effort to coordinate and promote aerosol research at NCAR.

The ASP also includes: the [NCAR Graduate Fellowship program](#), which provides a few opportunities for graduate students to conduct Ph.D. research projects at NCAR in collaboration with NCAR scientists; several seminar series including the NCAR-wide "Showcase Seminars" that highlight significant advances at NCAR; a Visiting Scholars Program that supports visits by NCAR scientists to UCAR affiliate universities; and a visitor program.

For more information on the ASP mission and plans, see the [ASP Strategic Plan](#).





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Director's Message

ATD Director's Message



In 1997 ATD again achieved a number of successes in the development and operation of observing facilities for important atmospheric research studies, despite the usual budget stringencies. Notable among these accomplishments were the completion of development and successful deployment of the [GPS Dropsonde system](#), and the deployment and operation of a large variety of ATD observing and data-support facilities during the Fronts and Atlantic Storms Experiment ([FASTEX](#)), conducted over the North Atlantic during January-February. The latter field program required extensive support from every group within ATD.

ATD's overall aim is to provide comprehensive, high-quality observational support for various important atmospheric research studies, especially those conducted under the auspices of named U.S. research programs. The division works closely with NSF, universities, other NCAR divisions and federal agencies to ensure that its current facilities and plans provide for the observing support most needed by the scientific community.

As an important component of the National Center, ATD is the focal point for the more complex platforms and instruments that are needed by many scientists but that can only be developed and operated by a sizeable team of technical staff. ATD's current observing systems include research aircraft, remote sensing systems, atmospheric sounding instruments, automated surface systems, and interactive computing facilities. These facilities are developed, deployed, and operated by ATD's skilled and dedicated staff of scientists, engineers, programmers, and technicians. Joint development programs are routinely undertaken in collaboration with NCAR divisions, universities, and other research organizations.

The ATD technical staff assists facility users in experimental design and planning for field programs, in sampling and measurement techniques, and, in some instances, in the design and fabrication of special equipment. Field data are quality assured before distribution to users. Assistance in data analysis is also frequently provided.

ATD tries to maintain a broad complement of versatile observing systems to better serve atmospheric research studies covering a wide range of topics. Lately, remote sensing and sounding from mobile platforms (mostly aircraft) have received special attention, as has the development of better capabilities for measuring water vapor. Details about these new development thrusts are included in later sections of this report.

More information about ATD and its observing facilities may be found on the ATD Website at <http://www.atd.ucar.edu>, and on-line forms for requesting the use of these facilities are available at http://www.atd.ucar.edu/dir_off/requests.html.

Comments and suggestions from interested readers on this report or on ATD's program are highly welcome. Please address them to Dave Carlson at dcarlson@ucar.edu.

 [ATD Mission and User Community](#)

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 Research Aviation Facility	FY 97 Publications 
 Surface and Sounding Systems Facility	FY 97 Science Highlights 
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Division Director's Message



Maurice Blackmon, Climate and Global Dynamics Division Director

This has been another year of major accomplishment for the Climate and Global Dynamics Division (CGD). CGD scientists have completed a 300-year control run using the first version of the Climate System Model (CSM) and made the data available to the community. CGD scientists have also completed a 125-year run in which carbon dioxide was prescribed to increase at 1% per year. The monthly averaged data from that run is also available to the community. Nearly 20 papers describing the CSM and its simulation characteristics have been submitted to the *Journal of Climate*, and they will hopefully appear in the April or May, 1998, issue.

In the last year, a Scientific Steering Committee has been appointed to guide the development and use of CSM. Eight working groups have been formed with foci ranging from model development for the next version of CSM to diagnostic studies using the present model and datasets. CGD sponsored the second annual CSM Workshop in June, 1997, in Breckenridge, Colorado. This workshop was attended by approximately 150 scientists, and the level of non-NCAR participation has grown substantially. The CSM is rapidly becoming an important, widely-recognized community resource for climate studies.

CGD also developed a Strategic Plan that will be used to focus our research over the next 3 to 5 years. There are 6 major elements, each of which has modeling and diagnostic parts. Most involve people from more than one section within CGD, scientists from other divisions, and collaboration with scientists outside of NCAR.

The first of these projects is Climate of the 20th Century and Future Climate. We are developing the best estimates for concentrations of carbon dioxide, other greenhouse gases, and sulfate aerosols beginning in the late 19th century up to the present. These will be used to change the atmospheric forcing in the CSM in an experiment that will examine how well the model can simulate the climate of this century. We will then continue these runs using plausible scenarios for the evolution of greenhouse gases for the 21st century to see the range of global warming outcomes that CSM predicts.



Scientists in CGD and Atmospheric Chemistry Division (ACD), as well as scientists outside of NCAR, will collaborate on a variety of projects to incorporate chemistry and biogeochemistry into the atmosphere, ocean, and land surface components of CSM. We will expand the capability of the CSM to examine the carbon cycle, the nitrogen cycle, the sulfur cycle, stratospheric and tropospheric ozone, and aerosols. CSM will evolve towards a coupled Earth System Model (ESM).

The study of past climates is also of great interest to CGD scientists, both for its own sake and to test the CSM in climate regimes relatively far from that of the present. If the CSM can in fact simulate some of the previous climates, which are due to different climate forcings than the present, the credibility of the model simulations for the present and the future will be enhanced. We have developed a special lower resolution version of the CSM that will be made available to the paleoclimate community for these investigations. Work has begun on understanding the climate of the past 21,000 years. Attention will be focused on the Last Glacial Maximum (21,000 years ago) and the Climatic Optimum (6000 years ago), as well as the past few centuries.

Two special studies will focus on Variability and Predictability in the North Atlantic and Arctic Regions and Variability of the Tropical Oceans and Global Atmosphere. The North Atlantic/Arctic system is thought to be the source of much of the interdecadal variability of climate. The tropical oceans, especially the Pacific, are involved in seasonal to interannual variability, including the El Niño Southern Oscillation (ENSO). Both of these projects will include modeling and diagnostic studies, and involve atmospheric scientists and oceanographers plus, for the Arctic, studies of the interactions of sea ice with the other two media. These projects will be looking for mechanisms for variability and how these mechanisms depend on the state of the climate. One important question to be examined is whether the presently observed climate variability will change if the mean climate changes due to global warming or other influences.

CGD has a long history of studies of global dynamics with application to dynamical prediction. The beginning of the U.S. Weather Research Program (USWRP) has given CGD the opportunity to refresh its activities in this area. CGD plans to carry experiments to relate the (theoretical) predictability of weather events to the uncertainty of prediction of the events, to develop a better understanding of weather and climate regimes and to develop methods to predict transitions between regimes, and to investigate the influence of various boundary forcings, such as sea surface temperature, land surface moisture, and others, on the predictability of weather extremes, particularly over North America.

I expect the solid accomplishment of the last year to continue as CGD scientists work on the projects outlined above. These projects will enhance our knowledge of phenomena that impact the lives of all of us, such as global warming and the ENSO. The time seems right for substantial progress.

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Director's Message

HAO Director's Message

Michael Knölker

This year's annual scientific report proves once again that HAO is serving the nation's research community through a wide spectrum of basic research, various service functions and educational activities. The list of significant accomplishments ranges from community models like the TIME-GCM being further perfected, instrumentation buildup at Mauna Loa, hosting of new community workshops, exciting new observational analysis based on SOHO and ASP data, to a multitude of extraordinary scientific results gained by HAO scientists in collaboration with researchers enjoying the productive atmosphere at NCAR as part of a strong visitor program.

In FY 1997 the High Altitude Observatory took further steps to strengthen the ground-based observational program to study solar activity. The Mauna Loa Observatory was expanded to host one of the Precision Solar Photometry Telescopes of the SunRISE Program. The buildup of the Advanced Coronal Observing System (ACOS) continued with the installation of a new high quality H alpha instrument. While ACOS serves as an important set of tools for HAO's long-term basic research effort on coronal dynamics, it also contributes important datasets for the National Space Weather Program.

HAO's strong research program in solar seismology continued through activities of many staff scientists and through emphasis on this area in the visitor program. The data on the internal structure of the sun obtained with HAO's LOWL instrument was acknowledged as having made a breakthrough contribution to the solution of the solar neutrino problem. It is now clear that there is nothing wrong with the solar structure models, as they are based on the concepts of stellar evolution theory. Hence, the cause of the missing neutrinos must lie in the regime of particle physics and the nature of the neutrinos themselves. In connection with the most recent seismological results on the solar internal rotation (again from LOWL data, derived with novel genetic algorithm techniques) HAO theoretical physicists work on novel solar dynamo models that focus on the relatively narrow shear layer at the base of the convection zone which is now suspected to host the dynamo process.

HAO has engaged strongly in the exploitation of the very successful NASA/ESA SOHO satellite. The quality of the data from SOHO is superb, and it covers wide ranges of otherwise inaccessible data. HAO, as many others in the community, urge NASA and ESA to extend the SOHO mission to cover a solar cycle if that is technically possible.

HAO's upper atmosphere research program centered around the TIME-GCM and TIE-GCM numerical models and around the AMIE procedure to study events in the ionosphere and continues to produce a multitude of scientific results of great value for the CEDAR and GEM communities, for various NASA satellite projects and for space weather research. The history and success of the TIME-GCM is one of many examples where basic research at a national center pursued over a long timescale brings progress on the solution of the toughest problems and benefits the research community as a whole.



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ACD ASP ATD CGD ESIG HAO [?](#) RAP SCD



Robert Gall

Mesoscale and Microscale Meteorology Division Director's Message


The Mesoscale and Microscale Meteorology (MMM) Division is one of nine programs or divisions within the National Center for Atmospheric Research (NCAR). The mission of [MMM](#) is one of basic research to advance fundamental understanding of mesoscale and microscale processes and to improve the modeling, observation, and prediction of these processes. The division's research ranges from basic to applied. However, for the direct transfer of knowledge to benefit society, we rely on collaborative efforts with other NCAR divisions and University Corporation for Atmospheric Research (UCAR) programs whose missions are more directly aligned to technology transfer.

The division is organized into six science groups whose missions relate to their scientific approach (e.g., modeling, analysis of observations), or to the scales considered (e.g., mesoscale, microscale). It consists of 75 staff with 9 project scientists, 29 scientists, including 16 senior scientists. Eleven scientists hold joint appointments with other [NCAR](#) divisions. Colocated with the division is a group of three scientists from the National Oceanic and Atmospheric Administration (NOAA) National Severe Storms Laboratory (NSSL) who specialize in airborne dual-Doppler observations of mesoscale systems. This group augments the [MMM](#) program in mesoscale observations. An external advisory committee assists the division in determining its scientific direction. The committee currently is comprised of four university colleagues and two scientists from [ATD](#) and [CGD](#). The committee is expected to meet once or twice a year.


Research within the division covers a wide range of topics related to mesoscale and microscale meteorology. Generally, we maintain a breadth of expertise so that many of the research areas currently identified (at the national and international levels) as priorities for the atmospheric and related sciences in mesoscale and microscale meteorology are represented within the division. This breadth helps us fulfill our role as a focal point for the weather research community, enables visitors to interact with NCAR scientists and other visitors, and facilitates the development of collaborative research programs with

scientists from many institutions.


In a recent division science planning meeting held November 10 and 11, 1997, two high priority initiatives emerged as goals for the division. They are Prediction of Precipitation and the Role of Clouds in Climate. The goal of the Precipitation Prediction Initiative is


 to reduce the errors associated with the prediction of precipitation to approximately the limits of mesoscale predictability. It will involve research into the dynamics of precipitation mesoscale systems, studies of mesoscale predictability, and the development of advanced numerical prediction and data assimilation systems.


The goal of the Role of Clouds in Climate Initiative is

 to assess the impact of various mesoscale and microscale systems on the larger scales, particularly those that determine climate. It will develop and improve methods to account for those processes in climate models, and will focus on cloud systems with emphasis on oceanic convective systems, stratus-topped boundary layer systems, cirrus clouds, and cloud systems associated with cold air outbreaks.

Other emerging initiatives within the [MMM](#) Division include

 ice microphysics – which will use new observing systems and models to define ice processes in clouds;

 fire weather – designed to develop and verify high resolution coupled models of the atmosphere and forest fire behavior;

 mountain induced turbulence – focused on turbulence generated by mountains through breaking mountain waves or other mechanisms; and

 surface processes – which examine exchanges between the earth's surface and the atmosphere.

A number of research areas within the division cut across the primary scientific thrusts relating directly to weather and climate. Some of these areas have goals that overlap with either climate or weather objectives and often augment the programs described in the earlier high priority initiatives. In addition, there are programs of research defined by individual scientists, many of which are part of the larger initiatives while others represent investigations of fundamental problems in mesoscale and microscale meteorology. Often these independent studies lead to the development of major initiatives, such as those outlined above.

Research conducted during the period 1 October 1996 through 30 September 1997 will, for the most part, become part of the various initiatives outlined above. For a detailed description of the science the division undertook in FY 1997, please refer to the [Table of Contents](#).

In January 1997 several scientists in [MMM](#) were recipients of funding provided through [NCAR](#)'s U.S. Weather Research Program (USWRP) grants program. This competitive program was established through a special increment to [NCAR](#)'s base program funds from [NSF](#) for activities related to the three initial scientific foci of the [USWRP](#): (1) studies related to the importance and mix of observations; (2) studies related to quantitative precipitation forecasting; and (3) studies related to hurricane forecasts near landfall. Descriptions of research underway in this program within [MMM](#) can be found under the following topics:

 [Development of the Weather Research and Forecasting \(WRF\) Model](#)

 [Adaptive-Grid Model Development](#)

 [Hybrid Coordinate Model Development](#)

 [Adaptive Observations in FASTEX](#)

 [Development of MM5 4DVAR System](#)

 [Development of MM5 3DVAR System](#)

 [Lifting at Boundary Layer Convergence Lines](#)

The above research activities have fostered collaboration with [ATD](#), [CGD](#), and [RAP](#) as well as several universities and agencies. Another activity intended to increase interdivisional and/or multidisciplinary research within [NCAR](#) was the creation of an [NCAR](#) Opportunity Fund in FY 1997. One of the four projects awarded funding was the Chemistry-Dynamical Coupling Initiative (CDI), a joint effort between [ACD](#), [CGD](#), and [MMM](#). This project, which commenced late in the fiscal year, is designed to develop a coupled mesoscale dynamical/atmospheric chemical transport modeling system and to conduct investigations into the mesoscale transport and evolution of chemical species in the troposphere. Scientists involved in the [CDI](#) will first study the generation and redistribution of [NO_x](#) in convective systems observed during the [STERAO-A](#) field experiment conducted over northeastern Colorado in June 1996. Preliminary work by Jordan Powers and Peter Hess ([ACD](#)) involves the coupling of the [MM5](#) and a regional chemical transport model developed in [ACD](#). Events from the [STERAO-A](#) campaign are being modeled and analyzed to yield an integrated understanding of their mesoscale meteorology and chemistry.

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Director's Message

The work in the Research Applications Program is dedicated to the transfer of atmospheric research results into the domain of practical application by those who have to make weather-sensitive decisions in government agencies and the private sector. RAP began in 1982 with an emphasis on weather information related to aviation safety, and that emphasis continues to the present. The early windshear work has been followed, for example, by significant endeavors in the warning and prediction of icing conditions, thunderstorm activity, quantitative detection and forecasts of snowfall and freezing drizzle affecting aircraft operations on the ground at airports, and several aspects of atmospheric turbulence. Significant progress has been made in these areas. Successful technology transfers have been accomplished varying all the way from simple education and training, through transfer of advanced weather products to operational agencies, to the delivery of complete, turn-key systems (as in the Hong Kong Windshear and Turbulence Warning System discussed below).

Aviation is only one of a number of sectors of the economy, though, where accurate and timely weather information can play a key role in the safety and efficiency of commerce and the daily activity of humans. Using the same methods of nowcasting, remote sensing, fine-scale numerical modeling, and development of expert systems that have been employed for aviation, RAP is currently pursuing applications in hydrometeorology, public weather forecasts, and range weather. Applications to surface transportation are currently being considered, and in the future RAP hopes to address the needs of other weather-sensitive areas of the economy such as agriculture, energy, and construction.

The RAP staff of scientists and engineers work in close collaboration with universities, government laboratories, and other divisions of NCAR, particularly the Mesoscale and Microscale Meteorology Division and the Atmospheric Technology Division.

The following report summarizes the scientific work undertaken in pursuit of RAP's technology transfer mission. Of equal importance to our overall endeavor, but largely not covered here, is the work accomplished with end-users regarding requirement specification, education, and training, and the engineering developments necessary to actually transfer a capability.



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Science Highlights

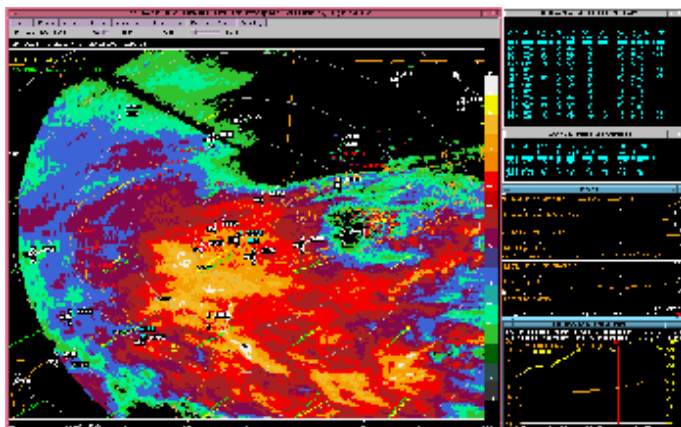
Scientific highlights at RAP during 1997 include:

- **Completion of Hong Kong Windshear and Turbulence Warning System (WTWS) for Hong Kong's New Airport.**



The WTWS System was accepted by the Hong Kong Government on 17 July 1997, after 44 months of research and development. The \$16 million project included basic and applied research on wind flow over Hong Kong's rugged terrain, a scientific field study, warning system concept and feasibility studies, system design, construction, implementation and training. The program was managed by B. Donaldson, Weather Information and Technologies, Inc. (WITI), R. Wagoner and W. Mahoney, both of NCAR/RAP. See Hong Kong Operational Windshear Warning System (OWWS) Completion, [Section V](#).

- **The Demonstration of the Weather Support to Deicing Decision Making (WSDDM) at New York LaGuardia and Chicago O'Hare Airports.**



WSDDM is a real-time weather system designed to improve decision making at airports during winter storms. Snowfall and weather information are used by ground personnel conducting aircraft deicing operations, airline station control managers and dispatchers coordinating flights, airport managers coordinating runway plowing activities, and air traffic managers involved with gate hold programs. WSDDM provides decision makers with the information needed to anticipate both the onset and termination of snow at the airport and surrounding regions, its intensity, and water content.

The WSDDM System was demonstrated to a variety of users at LaGuardia Airport in New York, and O'Hare Airport in Chicago. New York users included Delta Airlines, USAIR Airlines, and New York TRACON. In Chicago, United and American Airlines had displays. The system required the use of 25 workstations and displays at 8 user sites. Communications were designed and implemented by T. Hofmeister, F. Hage and R. Tescher and required the use of 56 kB dedicated phone lines and local networks all linked and working together. All the users were able to access workstations independently with no degradation of performance during high weather demand periods.

An important aspect of the system is the ability to rapidly loop the radar data in order to visually examine snowband motions and growth or decay trends. The response of the system to user commands was excellent, with new loops or reflectivity images appearing typically within a second or two of selection.

This network is one of the most complicated ever set up at RAP. The WSDDM System is managed by R. Rasmussen. See Operational Evaluation of the Weather Support to Deicing Decision Makers in Chicago and New York, [Section XIV](#) for more information.

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RAP Educational Activities

Seminars and Presentations - Technical Audience

Ben Bernstein, gave a joint presentation with Tom Ratvasky of NASA-Lewis on the "Supercooled Large Drop Research Program" at a meeting of the Society of Automotive Engineers AC-9C Meeting. He also presented "A Regional Climatology of Freezing Precipitation for the Contiguous United States" at the American Meteorological Society 10th Conference on Applied Climatology in Reno, Nevada, and presented "A Climatology of Supercooled Large Drop Conditions Based Upon Surface Observations and Pilot Reports of Icing" at the American Meteorological Society 7th Conference on Aviation, Range and Aerospace Meteorology in Long Beach, California.

Barbara Brown, gave a seminar on diagnostic verification titled "Practical Applications of Diagnostic Forecast Verification" with Allan H. Murphy in November of 1996. She also gave a talk on "Diagnostic and Comparative Verification of Algorithms for the Detection and Forecasting of In-Flight Icing" at the 7th Conference on Aviation, Range, and Aerospace Meteorology, Long Beach, California in February of 1997.

Andrew Crook gave presentations on "Utilization of Radar Data in NWP," and "Modelling MCTEX" at a BMRC workshop in Melbourne, Australia. He also gave a talks titled "Sensitivity of Convection Initiation to Boundary Layer Thermodynamics" at the University of Kansas, and "Short-term Forecasting of Summer Precipitation Using Echo Extrapolation, Storm Characteristics and Model Output" at the Aviation Weather Center in Kansas City, "Numerical Prediction of Convection" at the Sigma Xi banquet speech at Northeast Louisiana Unversity, and "Sensitivity of Convection Initiation to Boundary Layer Thermodynamics" at an Advanced Study Program seminar.

Kent Goodrich, gave a talk on "Applications of Fuzzy Logic to Windshear and Turbulence Detection Algorithms" at the Colorado School of Mines, Department of Mathematics in December.

Cathy Kessinger, gave a scientific presentation to the COMET COMAP-97 class, entitled "Microbursts and Downbursts."

William Mahoney, gave a seminar in Guangzhou China on "New Technologies in Aviation Meteorology."

Marcia Politovich, presented a paper on "Progress of the FAA Inflight Icing Product Development Team" at the American Meteorological Society Aviation Weather Conference in Long Beach, California last February. She also gave a presentation on icing forecasting at the COMET Manager's Course in Boulder during March, and a presentation on "Capabilities of Inflight Icing Forecasting" at the NASA/CRREL Remote Sensing for Icing Workshop at Cleveland in April. Marcia made a presentation on the "Current Status of InFlight Icing Forecasts" at a Kansas City Icing Certification Workshop in April, and demonstrated modeling capability for inflight icing forecasting at the Air Force Global Weather Center in Omaha during May. In addition she participated in an SAE meeting at Pittsburgh in September which covered "Issues in Forecasting Icing Type."

Rita Roberts, gave presentations at the SCAN meeting held at National Weather Service Headquarters in February, at the National Weather Service WFO office in Sterling Virginia in August, and at the Radar Conference in September. She also gave a seminar at NASA Goddard Space Center in September.

Gregory Thompson, presented a paper at the Aviation Conference as part of the annual American Meteorological Society Conference in Long Beach, California. He also presented icing research at the Air Force Global Weather Center with other RAP staff.

Thomas T. Warner, is a research professor at the University of Colorado, Boulder.

James Wilson, gave several seminars and presentations last year: two seminars at the Kennedy Space Center - one titled "Forecasting Florida Thunderstorms: CaPE Results," and the other titled "The NCAR Thunderstorm Auto-nowcaster;" an invited presentation on "State-of-the-art of Nowcasting Thunderstorms" at the 7th Aviation Weather Conference; a showcase seminar sponsored by both the Advanced Study Program and Research Applications Program on "Highlights of Thunderstorm Research: Doppler Radar Perspective;" a Trustees Presentation on "S-pol and Polarimetric Radar Estimation of Rainfall;" a 2-day lecture and laboratory course for COMET COMAP on "Non-synoptically Forced Thunderstorm Nowcasting;" a 2-day lecture and laboratory course for COMET Mesoscale Meteorology on "Non-Synoptically Forced Thunderstorm Nowcasting;" seven lectures at the National Weather Service in Sterling, Virginia on "Thunderstorm Forecasting;" and a presentation titled "Hector Initiation: Is it a Breeze?" at the 28th Conference on Radar Meteorology.

Workshops and Colloquia

Dan Breed, gave a presentation to approximately 100 participants of a workshop at the University of Autonoma de Coahuila in Monclova, Coahuila Mexico in October.

Roelof Brientjes participated in workshops in Beri, Italy and Pretoria, South Africa.

Andrew Crook attended the Modelling Workshop at BMRC, Melbourne, Australia.

Brant Foote participated in workshops in Beri, Italy and Pretoria, South Africa.

Corinne Morse, participated in the Wind Profiler workshop at NOAA in April.

Marcia Politovich, was co-chairman of the American Meteorological Society Aviation Weather Conference InFlight Icing Workshop, and Facilitator for the NASA/CRREL Remote Sensing for Icing Workshop Meteorology Working Group in Kansas City. She also was a speaker at the Icing Certification Workshop.

Rita Roberts, attended and made a presentation at the TIMEX workshop at Norman, Oklahoma in November.

Jonathan Smith, attended the USENIX LISA 97 conference on System Administration in San Diego.

James Wilson, did a presentation at the MCTEX Workshop in Melbourne, Australia on hector initiation and evolution and the WMO/COMET International Workshop on Very Short Range Prediction (2-day lecture and laboratory) covering Non-synoptically forced Thunderstorm Nowcasting.

Seminars and Presentations - Non-Technical Audience

Dan Breed, served as NCAR Science Fair judge for the Boulder Valley School District Science Fair which took place at the Crossroads Mall in Boulder, Colorado. He also participated in Lightning Data Center meetings at St. Anthony's Hospital in Denver and gave talks to 3 classes at Mapleton Elementary School and 4 classes at Coal Creek Elementary School in Boulder on weather, lightning, meteorological instruments, clouds and rain.

Barbara Brown, was interviewed by producers of an educational video on careers in statistics.

Jeffrey Cole, gave a talk on "Measuring Weather Parameters" at Crestview Christian Reformed Church VBS in June. He also demonstrated the Atmospheric Sounding System for a Southern Hills 7th Grade Class in May, and presented an instrumentation overview at the Marshall Field Site for Dr. Mark Williams' University of Colorado Snow Hydrology Class. In addition, Jeff worked with two undergraduate students: Donna Scott for the University of Colorado Environmental Studies Internship Program and University of Colorado Independent Studies Program, and Mette Boes for the University of Colorado Environmental Studies Internship Program.

William Mahoney, gave a seminar in Hong Kong titled "Windshear and Turbulence Characteristics at the New Hong Kong Airport."

Rita Roberts, served as Science Fair judge at Sacred Heart of Jesus elementary school in February.

Marcia Politovich, participated in the Project LEARN session on Web Resources for Weather Information for High School Science teachers in Boulder.

Gregory Thompson, did a slide presentation for NCAR's "Super Science Saturday" for K-12 children. He also gave a talk on work activities to the student chapter of the American Meteorological Society at Metropolitan State University in Denver, and participated in NCAR's Project LEARN, tutoring three K-12 teachers, and presented satellite meteorology information.

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XXII. 1997 RAP Publications

Refereed Publications

- Brown, B.G., G. Thompson, R.T. Brientjes, R. Bullock and T. Kane, 1997: Intercomparison of in-flight icing algorithms. Part II: Statistical verification results. In Press. *Wea. and Forecasting*.
- Crum, T., R.E. Saffell and J.W. Wilson, 1997: An update on the NEXRAD program and future WSR-88D support to operations. *Bull. Amer. Meteor. Soc.* Accepted for publication.
- Hamill, T. M. and S. J. Colucci, 1997: Verification of Eta/RSM Short-Range Ensemble Forecasts. *Mon. Wea. Rev.*, **125**, 1312-1327.
- Li, L., J. Vivekanandan, C.H. Chan and L. Tsang, 1997: Microwave radiometer technique to retrieve vapor, liquid and ice, Part I: Development of a neural network-based inversion method. *IEEE Trans. on Geoscience and Remote Sensing*, **35**, 224-236.
- Marwitz, J., M.K. Politovich, B.C. Bernstein, F. Ralph, P. Neiman, R. Ashenden and J. Bresch, 1997: Meteorological conditions associated with the ATR72 Aircraft accident near Roselawn, Indiana on 31 October 1994. *Bull. Amer. Meteor. Soc.*, **78**, 41-52.
- Reisner, J., R.M. Rasmussen and R. Brientjes, 1997: Explicit forecasting of supercooled liquid water in winter storms using the MM5 mesoscale model. Accepted. *Quart. J. Royal Met. Society*.
- Russell, R.W. and J.W. Wilson, 1997: Radar-observed "fine lines" in the optically clear boundary layer: Reflectivity contributions from aerial plankton and its predators. *Boundary Layer Meteorology*, **82**, 235-262.
- Serafin, R.J., J.W. Wilson, J. McCarthy and T.T. Fujita, 1997: Progress in understanding windshear and implications on aviation, *Storms*, editor R. Pielke Sr. and R. Pielke Jr. Accepted for publication.
- Sun J. and N.A. Crook, 1997: Dynamical and microphysical retrieval from Doppler radar observations using a cloud model and its adjoint: Part I. Model development and simulated data experiments. *J. Atmos. Sci.*, **54**, 1642-1661.
- Thompson, G., T. F. Lee, and R. Bullock, 1997: Using satellite data to reduce spatial extent of diagnosed icing. *Wea. and Forecasting*, **12**.
- Vivekanandan, J., L. Li, L. Tsang and C. Chan, 1997: Microwave radiometer retrieval of vapor, liquid and ice using a three-channel radiometer, Part II: Joint studies of radiometer and radar in

winter clouds. *IEEE Trans. on Geoscience and Remote Sensing*, **35**, 237-247.

- Weckwerth, T. M., J.W. Wilson, R.M. Wakimoto and N.A. Crook, 1997: Horizontal convective rolls: determining the environmental conditions supporting their existence and characteristics. *Mon. Wea. Rev.*, **125**, 505-526.
- Wilson, J.W. and D.L. Megenhardt, 1997: Thunderstorm initiation, organization and lifetime associated with Florida boundary layer convergence lines. *Mon. Wea. Rev.*, **125**, 1507-1525.

Unrefereed Publications

- Bernstein, B.C. and B.G. Brown, 1997: A regional climatology of freezing precipitation for the contiguous United States. *Preprints, 10th Conf. on Applied Climatology*, Reno, NV, 20-24 October. Amer. Meteor. Soc., Boston, 176-180.
- Bernstein, B.C. and B.G. Brown, 1997: A climatology of supercooled large drop conditions based upon surface observations and pilot reports of icing. *Preprints, 7th Conf. on Aviation, Range and Aerospace Meteorology*, Long Beach, CA, 2-7 February. Amer. Meteor. Soc., Boston, 82-87.
- Brandes, E.A., J. Vivekanandan and J.W. Wilson, 1997: Radar rainfall estimates of the Buffalo Creek Flash Flood using WSR-88D and polarimetric radar data. *Preprints, 28th Conf. on Radar Meteorology*, Austin, TX, 7-12 September. Amer. Meteor. Soc., Boston, 123-124.
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Community Service Activities

Editorships of Peer Reviewed Journals

Marcia Politovich, served as associate editor of *The Journal of Applied Meteorology*.

Committees/Advisory Boards

Dan Breed, served as manager of the Program for the Augmentation of Rainfall in Coahuila, Mexico.

Barbara Brown, served as chairman of the American Meteorological Society Committee on Probability and Statistics in the Atmospheric Sciences. She also chaired the Program Committee for the 14th Conference on Probability and Statistics in the Atmospheric Sciences, and was a member of the Program Committee for the 7th International Meeting on Statistical Climatology. In addition, Barbara was scientific mentor for UCAR SOARS student Lacey Holland during the summer of 1997.

Michael Dixon, was a reviewer for the manuscript "The Storm Cell Identification and Tracking (SCIT) Algorithm" for *Weather and Forecasting*.

Martha Limber, was a member of a career workshop panel for the University of Colorado, Boulder Mathematics Department.

Tenny Lindholm, organized and led a turbulence workshop in February which included about 110 participants from all corners of the aviation industry, national and international.

Marcia Politovich, served on the COMET Advisory Panel and on the organizing committee for the American Meteorological Society Cloud Physics Committee and Cloud Physics Conference. She was an advisor for the FAA InFlight Icing Steering Committee and participated in the FAA InFlight Icing Steering Committee Task 1B Working Group, as well as the WMO World Weather Research Program InFlight Icing Advisory Group. Marcia also served as co-mentor for UCAR SOARS program student Lacey Holland from the University of Oklahoma.

Thomas T. Warner, served as member of the University of Oklahoma CAPS external advisory committee.

James Wilson, served as member of the NEXRAD Technical Advisory Committee, the National Science Foundation Facilities Advisory Committee, the USWRP Quantitative Precipitation Forecasting Working Group, and the NCAR Appointment Review Group (ARG). He also was chairman of the Chapter Review Panel for the Severe Storms Monograph.

Awards

Jeffrey Cole, received an NCAR/RAP Incentive Award for implementation and installation of Weather Support to Deicing Decision Making (WSDDM) system snowgauge network at LaGuardia, JFK, Newark, and Chicago airports.

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Eric Anderson; White House Staff - Deputy Assistant for Domestic Policy in the Office of the Vice President - RAP Director's Office

Roberto Arpino, Assistant Director - Vaisala, RAP Director's Office

Don Bateman; Allied Signal, RAP Director's Office

Lt. Col. Al Belcher; Air Force Global Weather Center, RAP Director's Office

Al Bedard; National Oceanic and Atmospheric Administration, RAP Director's Office

Troy Benavidez; Deputy Chief of Staff and Legislative Director for Congressman Steven Schiff (R-NM); RAP Director's Office

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