



Director's Message
Highlights
Publications
Educational Activities
Community Service

Annual Scientific Report 1999



Director's Message

Dear Colleagues

It is with pleasure that I present the Fiscal Year 1999 Annual Scientific Report of the National Center for Atmospheric Research. FY 1999 represents my last, full fiscal year as Director of NCAR, as I have announced my decision to step down early in calendar year 2000. For this report, I have prepared a brief overview of the activities and accomplishments of NCAR's scientists during this, my tenth year, as Director. I hope that you will find this summary and the entire website informative as well as indicative of the outstanding work done at our Center over the past 12 months.

Fundamental Research

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Fundamental research provides the foundation for understanding the physical, dynamical, chemical and biological mechanisms that govern atmospheric and related processes. NCAR's base program is sufficiently broad and flexible to respond to research opportunities and enable discovery. In 1999, five areas of emphasis were pursued:

Precipitation Physics Focussing on two themes, testing theories of how precipitation forms through warm-rain processes and, determining how ice forms and grows to precipitation, NCAR will improve our representations of precipitation in weather and climate models. This year saw an emphasis on the microphysics of ice processes.

Natural variability of the Earth System: It is well known that the earth's physical climate system, coupled atmosphere, ocean, sea ice and land surface is variable on a variety of time scales from seasonal to centennial. This is the result of changes in ocean and atmosphere circulations and their interactions with sea ice and land surface moisture. To achieve a better understanding of this variability NCAR undertook analysis of physical observations and improvements to our climate system model.

Atmospheric Kinetics and Photochemistry: Studies undertaken this year include determination of the rate coefficients and products of atmospheric chemical reactions and reactions of inorganic chlorine and bromine compounds to quantify impacts of their chemistry on ozone levels in the stratosphere and the marine boundary layer. The study of aerosols, which are a key factor in the Earth's climate system, was another continuing area of emphasis.

Solar Magnetism: Understanding the structure and behavior of the solar magnetic field is a scientific prerequisite for developing reliable forecasts of variations in solar output that cause changes in our terrestrial and space environments. Two main research thrusts at NCAR include studies of the magnetic sun and its intrinsic variability and a solar magnetism initiative to construct a full understanding of the solar magnetism from the deep solar interior through the solar corona.

Dynamical and Turbulent Systems: NCAR has maintained an active program in fundamental geophysical turbulence research and astrophysical fluid dynamics. Current research includes investigations into Clear Air turbulence and how to parameterize physics at small scales in weather and climate models.

Understanding and Predicting the Earth System

Predicting Weather on short time and space scales: NCAR continued its activities in the focused science program of the US Weather Research Program. To better coordinate the scientific foci of the USWRP with the NSF Grants program and other agency-sponsored activities, NCAR modified its funding cycle to coordinate the two, two-year project cycles. NCAR also received special funding for from NSF to conduct USWRP-related activities in ESIG.

Separating natural variability and anthropogenic climate change: In addition to natural variability, climate can change due to human activity. Separating these two is an important scientific problem with major societal and economic implications. Studies aimed at this problem included simulations of the climate of the 20th century with the Climate System Model (CSM), research into tropical ocean seasonal-to-interannual variability, and the impact of mesoscale and microscale systems on larger scale systems.

Atmospheric chemistry and air quality: Changes in emissions of chemicals associated with evolving land use and industrial development are becoming major causes of global changes in the Earth system. NCAR has planned two major research programs for deployment in FY2000 to address tropospheric ozone production (TOPSE) and the physical processes that produce and control urban pollutants (MIRAGE). Both TOPSE and MIRAGE will involve significant participation of university researchers.

Solar-terrestrial coupling with an emphasis on the upper atmosphere: Two activities were initiated to study the coupled earth system and its response to the variable sun and to better understand solar-induced space weather These investigations will eventually provide a better understanding of solar emissions, enabling the coupling of the TIME-GCM model with the Climate System model.

Advanced Scientific Facilities

Computing and data handling facilities: The Scientific Computing Division provides high performance computing facilities to support the NCAR scientific program and the supercomputing needs of the community. The facilities include a substantial infrastructure of computer servers, networking, visualization, data communications and user services to support the development and execution of large, long-running models and the manipulation, analysis and archiving of extremely large datasets. Current facilities include the Climates Simulation Laboratory, a national, special use, dedicated computing facility for climate system modeling. The CSL is a multi-agency, USGCRP facility. A the end of the fiscal year, SCD acquired a new distributed shared memory supercomputer, named blackforest, which represents the culmination of a process of identifying the best next-generation supercomputing system for

Atmospheric observing systems: NCAR develops and operates observing facilities and provides data manipulation and analysis tools to researches throughout the university community. The acquisition of a High-Performance Instrumented Airborne Platform for Environmental Research) HIAPER aircraft proceeded on target with the approval of the Systems Acquisition and Integration plan by NSF> Preparations for an FY2001 airframe contract remain on schedule.

Solar observing systems: Advances in solar observing systems availaable to the community were made with the continuation of the Mauna Loa Observatory observations made with the Precision Solar Photometric Telescope. Other facilities currently in use include the Advanced Coronal Observing System (ACOS) comprised of three instruments, the Mark IV Solar white light coronagraph, the March III coronagraph and the Chromospheric Helium I Imaging Photometre.

Community models, datasets and networking: NCAR develops and supports several complex models, many of which are used broadly by the community. Services that may be provided to users include cooperative research runs on NCAR computers, transfer of code to universities for research by individuals or groups outside of NCAR, tutorials, workshops, user groups and collaboration on evaluation and improvments. Current models include the Climate System Model (CSM), Model of Ozone and Related Species in the Troposphere (MOZART) and the Mesoscale Model Version 5 (MMS)

NCAR provides cost-effective local area network capability for UCAR and NCAR users, metropolitan area networking to support work between campuses and other local users and wide area networking that meets the research community's needs for national and international connectivity. This year also saw the development and construction of the Boulder Research and Administrative Network (BRAN), a local fiber-optic network to connect some of Boulder's national labs with the University of Colorado and City of Boulder.

NCAR also makes available to the university research community a wide variety of datasets from model runs, field programs and special activities such as the NCEP data reanalysis project.

Human Dimensions and Societal Impacts

NCAR's research program on human dimensions promotes the use of atmospheric science information in service to society and is designed to improve understanding of the complex interactions among human societies, natural resource systems, and atmospheric processes. The Environmental and Societal Impact Group is the institutional foci for much of this research.

Education and Training

NCAR places a very high priority on education and training activities through specific science and facility programs, as well as through individual contributions of our staff. Extensive visitor programs exist in each NCAR division, and the Advanced Study Program recruits and appoints approximately 20 postdoctoral fellows each year.





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Atmospheric Chemistry Division

Watch this space!

Advanced Study Program

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ASP and the Mesoscale and Microscale Meteorology Division (MMM) hosted a summer colloquium in June 1999 on "Ice formation in the Atmosphere." Charles Knight (MMM) coordinated the sessions which were held at NCAR. ASP concurrently used Web delivery to record and display the lectures of 20 people from 13 institutions of the U.S. and Canada. The 21 student participants represented 14 institutions from 4 foreign countries and the U.S. The colloquium addressed the microphysical processes involved in ice formation, the current status of observations of ice in various types of clouds, and the links between ice formation and chemical, electrical, and radiative properties of clouds as well as the current status of laboratory and theoretical evidence pertaining to ice formation and ice effects in models at various scales. (See http://www.asp.ucar.edu/colloquium/1999)

Atmospheric Technology Division

TOGA COARE Soundings Corrections

In the winter of 1992/93, nearly 12,000 radiosonde soundings were launched from 36 Priority Sounding Stations during the TOGA COARE Intensive Observing Period. Sounding systems provided by NCAR/ATD, including the Integrated Sounding Systems (ISS) of the central Intensive Flux Array (IFA), launched more than one third of those radiosondes. The combined sounding data set represents an unprecedented look at the atmosphere over and near the Western Pacific oceanic warm pool, allowing investigators to explore such issues as diurnal boundary layer variations, convective processes, dry intrusions, atmospheric heat and moisture budgets, synoptic-scale low-level westerly and upper-level easterly bursts and 30-40 day waves. Analysis, reanalysis, and modeling efforts worldwide have used and continue to rely on the TOGA COARE sounding data set.



During initial processing of the TOGA COARE sounding data, analysts suggested that radiosonde temperature and humidity measurements seemed too warm and too dry respectively in the lowest levels, at least during daytime soundings. ATD engineers attributed this warm dry bias to radiational heating of the temperature and humidity sensors and sensor arm just prior to balloon launch. NCAR then developed an algorithm and methodology to correct near-surface temperature and humidity data for this so-called sensor-arm heating and the corrections were applied to the COARE data set.

Further analyses of the TOGA COARE data indicated a residual dry bias not resolved by application of the sensor-arm heating correction. Some of these analyses showed large horizontal gradients of humidity and of derived parameters such as Convective Available Potential Energy (CAPE) despite the relatively uniform sea surface temperatures in the COARE IFA.

Scientists and engineers from ATD and from Vaisala (Helsinki, Finland), the manufacturer of most sondes used during TOGA COARE, confirmed the dry bias and identified its cause: contamination of the capacitance humidity sensor by various gaseous plastic and Styroform components. Based on extensive Vaisala testing, ATD and Vaisala developed a prototype correction algorithm based on physical characteristics of the humidity sensors. With additional funding from NSF and NOAA, the correction algorithm was further developed and has now been applied to almost all IFA soundings from TOGA COARE.

Vaisala has taken corrective actions since the problem has been discovered. A new desiccant, made of a mixture of silica gel and activated carbon, has replaced the clay-based drying agent. A protective sensor arm cover as added to the new sondes as well, which isolates the sensor from contaminants eliminating the bias.

The work on the TOGA COARE data set has been carried out by H. Cole, E. Miller, J.-H. Wang, D. Parsons, F. Guichard and K. Beierle, all ATD/SSSF.

Climate and Global Dynamics Division

For the first time climate change experiments have been carried out with a fully coupled climate model that employs no flux adjustments and shows no surface climate drift. These simulations also included interactive chemical effects that have previously been ignored or prescribed.

CSM simulations (30 K) of the 20th and 21st centuries have been carried out. For the 20th century, a control simulation, a transient simulation, a solar variability simulation including the reconstructed solar variation, and a

greenhouse-gases only simulation were completed. The project involved many participants and was led by J. T. Kiehl (NCAR), S. Solomon (NOAA Aeronomy Lab), T. M. L. Wigley (NCAR), and B. A. Boville (NCAR) with significant contributions from L. Buia (NCAR).

A system for forecasting aerosols has been developed by members of the CGD Climate Modeling Section (William Collins, Philip Rasch, and Brian Eaton) and the Atmospheric Chemistry Division (Boris Khattatov, Jean-Francois Lamarque, and Charles Zender). The system, the first of its kind, combines a chemical transport model and an assimilation of satellite aerosol retrievals. The model simulates the three-dimensional distribution of atmospheric aerosols. The forecast system was used to plan aircraft missions during the recent Indian Ocean Experiment (INDOEX). The CGD scientists are extending the methodology to produce global aerosol analyses (See Figures, 34 K). For more information, click here.

Recent analyses of the global carbon cycle suggest a significant role for terrestrial uptake of CO₂ in the overall budget. Analyses of atmospheric CO₂ have persistently suggested that this terrestrial uptake is largest in the Northern Hemisphere, and spatial analyses suggest that the U.S. may play a disproportionate role.

Environmental and Societal Impacts Group

New Developments and Applications with the NCAR Regional Climate Model (RegCM) (Journal of Geophysical Research, 104, March 1999)

The following set of three related professional papers introduced further developments in an innovative approach for understanding how climate variability and change may influence various resource systems, including future food production in the United States and worldwide. The fundamental issue addressed by the papers concerns the development of high-resolution climate scenarios for use in impacts assessments. The need for more regional detail in climate scenarios has been pressing for more than a decade. The methodologies developed by this multidisciplinary team of researchers, led by Linda Mearns, will significantly advance capabilities for constructing such scenarios that assist nations in being better prepared for how to anticipate future weather and climate impacts on world food supplies. This special issue of the Journal of Geophysical Research efforts.

In the overview paper, Giorgi and Mearns discuss outstanding issues in state-of-the-art regional climate modeling (e.g., boundary conditions, model physics, two-way nesting, variable resolution approaches) and introduce the papers in the issue, which range in subject matter from the development of new physics for the model to various applications of the model, including its use for developing high spatial resolution climate scenarios for use in impacts assessments. These papers illustrate a wide range of applications over the United States, East Asia, Central Asia, and Eastern Africa. (Glorgi., F., and L.O. Mearns, 1999: Introduction to special section: Regional climate modeling revisited. Journal of Geophysical Research, 104(bb), 6335-6352.

The second paper analyzes the difference in high resolution climate change scenarios formed using two different methods of regionalization: statistical downscaling and regional climate modeling. Boundary conditions from the same general circulation model (GCM), were used in both methods. The authors found that the two methods generated significantly different changes in climate when applied to a region of western Nebraska, including opposite directions of change in precipitation. This paper thus further elucidates very important uncertainties in the application of downscaling techniques. [Comparison of downscaling methods] (Mearns, L.O., I. Bogardi, F. Giorgi, I. Matyasovszky, and M. Palecki, 1999: Comparison of climate change scenarios generated from regional climate models experiments and statistical downscaling. *Journal of Geophysical Research*, 104(D6), 6603-6621).

The third paper examines two different types of uncertainty in agricultural impacts assessments: the spatial scale of climate change scenarios, and the choice of crop model type. It is the first paper ever to demonstrate clearly the importance of these uncertainties. The authors developed a coarse-scale climate change scenario from a GCM used to drive the regional climate model and a high-resolution scenario generated from control and 2xCO2 results of the Regional Climate Model (RegCM2) for a region in the central Great Plains. They then applied the two different scenarios to two different crop model types (EPIC and CERES) for both corn and wheat. They found that substantial differences in percentage change in the simulated yields were calculated based both on the scale of the scenarios and the choice of crop model type. This paper convincingly demonstrates that these uncertainties in climate change impacts are complex and interactive. [regional climate change scenario] (Mearns, L.O., T. Mavromatis, and E. Tsvetsinskaya, 1999: Comparative responses of EPIC and CERES crop models to high and low spatial resolution climate change scenarios. Journal of Geophysical Research. 104(NO), 663-664).

Creeping Environmental Problems and Sustainable Development in the Aral Sea Basin (Cambridge University Press, 1999)

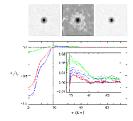
Multifaceted environmental degradation in the Aral Sea basin has been a touchstone for increasing public awareness of environmental change issues. The Aral crisis has been touted as a "quiet Chernoby!" and is one of the worst human-made environmental catastrophes of the twentieth century. Just a few decades ago, it was the fourth largest inland body of water in the world. Today, it has fallen to sixth place, and it continues to shrink.

This book, edited by Glantz, represents the culmination of five years of research begun in FY95 for the Water Unit of the UN Environment Programme (UNEP), with some initial support from the Water Unit. Twelve key environmental changes in the Aral Sea Basin were identified for assessment in terms of the thresholds of creeping environmental problems associated with them. Each member of a team of twelve Russian, Uzbek, Turkmen, and Kazak experts focused on one of these changes. Each expert had a decade or more of researching a specific environmental problem. Support was provided to them to prepare their chapters. Glantz initiated the development of a theoretical framework in a UNEP/NCAR workshop on Creeping Environmental Problems in 1994. This was organized to identify thresholds of problem awareness, crisis, and policy action for their respective problems. Glantz traveled to Russia several times on trips of opportunity during the FY95-99 period to discuss translation problems and to edit the manuscripts for clarity. The book presents these case studies as lessons to be learned for other areas undergoing creeping environmental change, especially for terminal inland seas. It provides an important multidisciplinary example of how to approach such environmental disasters for students and researchers of environmental studies, global change, political science, and history.



High Altitude Observatory

- Discovery of the first <u>extrasolar planetary system</u> around <u>Upsilon Andromedae</u> by a team from HAO, the University of California at San Francisco, and the Harvard-Smithsonian Center for Astrophysics. Three planets were detected in that system through their signature in the motion of the center of gravity as observed with precision spectroscopy developed at HAO in the context of solar and stellar seismoloov.
- Evidence for bright rings around sunspots from data gathered with the <u>Precision Solar Photometric Telescope (PSPT)</u> operated at HAO's Mauna Loa Observatory as part of NSF's Radiative Inputs
 from Sun to Earth (RISE) Program. The bright rings bear the signature of the redistribution of energy transported in and around big magnetic flux structures in the upper solar convection zone.
 The relation of such bright rings to the field distribution in and around sunspots was identified using data from the HAO/NSO Advanced Stokes Polarimeter (ASP) at Sacramento Peak Observatory.



Mesoscale and Microscale Meteorology

Surface Energy Bias in Climate Models (W. Pacific Warm Pool)

The cause of bias in the surface energy budget, and the attendant climate drift problem in coupled atmosphere-ocean general circulation models (GCMs), is a key uncertainty in climate modeling. Xiaoqing Wu (joint appointment with CGD) and Mitchell Moncrieff investigated this issue using a CRM (cloud-resolving model wherein convection and clouds are explicit), a single-column model (SCM) of the NCAR Community (Climate Model (CCM, convection and clouds parameterized), and observations from the Tropical Ocean and Global Atmosphere Program Coupled Ocean-Atmosphere Response Exper-ment (TOGA COARE). They showed that top-of-atmosphere radiative fluxes and sur-face energy budgets derived from the CRM simultaneously agree with observations, while the SCM (run with the same prescribed forcing) is strongly biased. An accurate horizontal and vertical distribution of condensate and its effect on radiative transfer is crucial [see Figure 1 at bottom left]. This result shows convectively driven cloud systems must be param-eterized accurately before ocean-atmosphere coupling can be accurately realized, at least over the warm pool [see Figure 2 at bottom right].

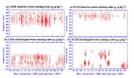


Figure 1:

Left panel: 30-day evolution of 6-hourly vertical profiles of (a) cloud ice water mixing ratio (g kg-1) and (b) cloud liquid water mixing ratio (g kg-1) from the CRM. Right panel: Same as left panel but from the SCM. Click on image to view larger figure.



Figure 2

The SST derived from the ocean model (dashed line) agreed very well with observations (solid line). On the other hand, a relatively poor prediction of SST was obtained when the ocean model was forced by surface conditions obtained from the single-column model (dotted line). Click on image to view larger figure.

Convection Initiation over Tropical Islands

Using a linear model and fully nonlinear numerical simulations, N. Andrew Crook (joint appointment with RAP) showed that radiative heating on the island scale is at least as important as sea breezes in initiating strong thunderstorms (known as Hectors) over the Tiwi Islands north of Darwin, Australia. In a greement with observations made during the Maritime Continent Thunderstorm Experiment (MCTEX), Figure 3 at the right shows the sea breezes from the north and south coastline converged to within 10 km of each other but did not collide, yet a Hector formed. This result raises the question of how convection over tropical islands should be initiated ('triggered') in parameterization schemes, and whether the sea-breeze collision mechanism is truly prevalent.

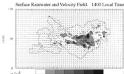


Figure 3:

Surface rainwater and velocity vector field at 1400 Local Time from a simulation of flow over the Tiwi Islands. An intense thunderstorm, locally known as a `Hector' has developed over the center of Melville Island (island to the east). Click on image above to view a larger version.

Research Applications Program

Mount Washington Icing Sensors Project (MWISP)

The detection of aircraft icing conditions (e.g., supercooled liquid water [SLW], freezing drizzle) is a major goal of the FAA-funded aircraft icing work at RAP. Current remote sensing systems operationally deployed such as the National Weather Service WSR-88D radars are not able to detect supercooled liquid water in the form of cloud droplets, nor are they able to tell whether radar backscatter is due to snow or freezing drizzle. A number of recently developed systems, however, show promise of being able to unambiguously detect supercooled liquid water and freezing drizzle. In order to evaluate their potential, the Mount Washington Icing Sensors Project was conducted during the month of April in the vicinity of Mt. Washington in New Hampshire, a region with significant amounts of icing and freezing drizzle. This was the first major field program ever conducted to test the ability of remote sensing devices to measure SLW and freezing drizzle. The program was organized and managed by RAP and included participants from government agencies, universities, and other research institutions.

Development and Implementation of Aviation Digital Data System (ADDS)

The National Weather Service's Aviation Weather Center in Kansas City provides pilots and other aviation users Airmets (6 hour forecasts) and Sigmets (current conditions) of icing and turbulence every 4 hours. This Information is provided in text form as a series of waypoints. While allowing rapid transmission of the information, it also requires aviation users to spend a great deal of time decoding the message. The Aviation Digital Data System (ADDS) has recently been developed by RAP and NOAA/FSL to provide the above weather information, as well as experimental weather products developed by RAP, in a user-friendly graphical manner over the Internet. The system was transferred to the Aviation Weather Center in Kansas City in 1999, and it has proven to be very robust and extremely popular with users. RAP's work in developing this system recently won NCAR's Outstanding Scientific and Technological Accomplishment Award.

Transfer of Weather Support to Deicing Decision Making (WSDDM) System to ARINC

The Weather Support to Deicing Decision Making (WSDDM) system is designed to provide airlines and airports current weather information and nowcasts of snowfall. A key aspect to the WSDDM system is the use of snow gauges to measure the liquid equivalent snowfall rate. Research conducted at RAP has shown that the current operationally available snowfall intensity based on visibility can be misleading to deicing operators in many instances. The WSDDM system overcomes this problem by providing real-time measurements and nowcasts of liquid equivalent snowfall rates. This technology was successfully transferred to ARINC during the past year, and is currently available commercially to airlines and airports. It is currently operational at LaGuardia, JFK, and Newark airports in the New York City area. The system was awarded the U.S. Government's Technology Leadership Award in December 1999.

Scientific Computing Division

New computational hardware roadmap



One of SCD's highlights for FY1999 was developing a new computational hardware roadmap and taking the first steps on the path it defines. This is a significant step forward in our plan to identify, acquire, and operate a new generation of computing hardware architectures for NCAR and our university community.

This roadmap and our implementation of it are so significant because NCAR and SCD must adapt to major changes in both the technologies and the market forces now driving the development and availability of computing engines in the United States. This change in supercomputing fundamentally affects how scientists perform numerical simulations for geosciences research, and it has profound ramifications for model design and production.

SCD must provide platforms that allow the science to adjust to these new computing engines in a way that advances scientific output and avoids disruptions or delays. SCD's computational hardware roadmap presents options that could allow SCD to provide Teraflop computing capabilities in FY2000. This roadmap is fundamental to ensuring that NCAR's scientific research community will have access to the most potent computing resources available.

Acquisition, installation, and acceptance of blackforest

The acquisition and installation of the IBM RS/6000 SP computing system, "blackforest." This is a significant accomplishment for the division because it represents the culmination of a process of identifying the best next generation supercomputing system for NCAR.

SCD has a sterling reputation for testing the most advanced computing engines and aims to acquire the very best in computing technology to meet the demanding needs of the scientists we serve, both now and into the future. Our evolving partnership with IBM is an important ingredient for increasing the computing power supporting that science.

Educational Activity Highlights

Twenty-four students from the U.S. and Puerto Rico participated in the fourth summer of Significant Opportunities in Atmospheric Research and Science (SOARSÓ). These SOARS protégés worked with scientific mentors from seven NCAR divisions, Argonne National Laboratory, Goddard Space Flight Center, the Universidad Nacional Autónoma de México, and the University of Colorado (Aerospace Engineering Sciences, Cooperative Institute for Research in Environmental Sciences, Laboratory for Atmospheric and Space Physics).

LEARN: Atmospheric Science Explorers, a four-year project that provides atmospheric science training for rural Colorado teachers completed its third year of funding with intensive training for 38 teachers at NCAR during June 1999. An additional 162 teachers and 915 students participated in in-district training in the rural areas during the 1998-99 academic year.







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NCAR | UCAR | NSF | ASR 1998

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Educational Activities

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Publications

Atmospheric Chemistry Division

Aumont, B., S. Madronich, M. Ammann, M. Kalberer*, U. Baltensperger*, **D. Hauglustaine*** and F. Brocheton*, 1999: On the NO2 + soot reaction in the atmosphere. *J. Geophys. Res.*, **104**, 1729-1736.

Brasseur, G., J. Klehl, J-F. Müller*, T. Schneider, C. Granier*, X Tie, and D. Hauglustaine*, 1998: Past and future changes in global tropospheric ozone: Impact on radiative forcing. *Geophys. Res. Letts.*, 25, 3807-3810.

Cantrell, C., 1998: NOx in the atmosphere. Chapter 11 in N-Centered Radicals, Z. B. Alfassi (ed), John Wiley & Sons Ltd., 371-391.

Coffey, M., A. Goldman, J. Hannigan, W. Mankin, W. Schoenfeld*, C. Rinsland*, C. Bernardo*, and D. Griffith*, 1998: Improved vibration-rotation (0-1) HBr line parameters for validating high resolution infrared atmospheric spectra measurements. J. Quant. Spectrosc. Radiat. Transfer, 60, 863-867.

Edwards, D., C. Halvorson, and J. Gille, 1999: Radiative transfer modeling for the EOS Terra satellite Measurement of Pollution in the Troposphere (MOPITT) instrument. J. Geophys. Res., 104, 16,755-16,775.

Fried, A., B. Wert, B. Henry, and J. Drummond*, 1999: Airborne tunable diode laser measurements of formaldehyde. Spectrochimica Acta Part A, 55, 20097-2110.

Garcia, R., and F. Sassi, 1999: Modulation of the mesospheric semiannual oscillation by the quasibiennial oscillation. Earth Planets Space, 51, 563-569.

Greenberg, J., A. Guenther, **P. Zimmerman***, W. Baugh, C. Geron*, K. Davis*, **D. Helmig***, and L. Klinger, 1999: Tethered balloon measurements of biogenic VOCs in the atmospheric boundary layer. *Atmos. Environ.*, 33, 855-867.

Guenther, A., 1999: Modeling biogenic volatile organic compound emissions to the atmosphere. Chapter 3 in *Reactive Hydrocarbons in the Atmosphere*, C. N. Hewitt (ed), Academic Press, 97-118.

_____, S. Archer*, J. Greenberg, P. Harley, D. Helmig*, L. Klinger, L. Vierling*, M. Wildermuth*, P. Zimmerman*, and S. Zitzer*, 1999: Biogenic hydrocarbon emissions and landcover/climate change in a subtropical Savanna. *Phys. Chem. Earth (B)*, 24, 659-667.

Harley, P., R. Monson*, and M. Lerdan*, 1999: Ecological and evolutionary aspects of isoprene emission from plants. Oecologia, 118, 109-123.

_____, V. Fridd-Stroud, J. Greenberg, A. Guenther, and **P. Vasconcellos***, 1998: Emission of 2-methyl-3-buten-2-ol by pines: A potentially large natural source of reactive carbon to the atmosphere. *J. Geophys. Res.*, **103**, 25,479-25,486.

*Isebrands, J., A. Guenther, P. Harley, **D. Helmig***, L. Klinger, **L. Vierling***, **P. Zimmerman***, and C. Geron*, 1999: Volatile organic compound emission rates from mixed deciduous and coniferous forests in Northern Wisconsin. *Atmos. Environ.*, 33, 2527-2536.

Khattatov, B., J. Gille, L. Lyjak, G. Brasseur, V. Dvortsov*, A. Roche*, and J. Waters*, 1999: Assimilation of photochemically active species and a case analysis of UARS data. *J. Geophys. Res.*, 104, 18,715-18,737.

Madronich, S., 1999: Stratospheric ozone and its effects on the biosphere. Chap. 12 in *Reactive Oxygen Species in Biological Systems*, 317-334 (eds.) Gilbert & Colton, Kluwer Academic/Plenum Publishers, New York.

_____, and **S. Flocke***, 1999: The role of solar radiation in atmospheric chemistry. In *The Handbook of Environmental Chemistry, Vol. 2*, Part I. Environmental Photochemistry (ed. by P. Boule), Springer Verlag.

_____, R. McKenzie*, L. Björn*, and M. Caldwell*, 1998: Changes in biologically active ultraviolet radiation reaching the Earth's surface. *J. Photochem. Photobiol. B: Biology*, 46, 5-19.

*Mayer, B., C. Fischer, and S. Madronich, 1998: Estimation of surface actinic flux from satellite (TOMS) ozone and cloud reflectivity measurements. *Geophys. Res. Letts.*, 25, 4321-4324.

Orlando, J., G. Tyndall, and S. Paulson*, 1999: Mechanism of the OH-initiated oxidation of methacrolein. Geophys. Res. Lett., 26, 2191-2194.

_____, G. Tyndall, J-M. Fracheboud*, E. Estupiñan*, S. Haberkorn*, and A. Zimmer*, 1999: The rate and mechanism of the gas-phase oxidation of hydroxyacetone. *Atmos. Environ.*, 33, 1621-1629.

Pan, L., J. Gille, D. Edwards, P. Bailey, and C. Rodgers*, 1998: Retrieval of tropospheric carbon monoxide for the MOPITT experiment. *J. Geophys. Res.*, 103, 32,277-32,290.

Randel, W., and P. Newman*, 1999: The stratosphere in the southern hemisphere. Chapter 6 in *Meteorology of the Southern Hemisphere, Vol.* 27 (eds.) D. Karolyn and D. Vincent, *Am. Met. Soc.*, 243-282.

_____, F. Wu, J. Russell III*, and J. Waters*, 1999: Space-time patterns of trends in stratospheric constituents derived from UARS measurements. *J. Geophys. Res.*, 104, 3711-3727.

____, F. Wu, R. Swinbank*, J. Nash*, and A. O'Neill*, 1999: Global QBO circulation derived from UKMO stratospheric analyses. *J. Atmos. Sci.*, 56, 457-474.

, R. Stolarski*, **D. Cunnold***, **J. Logan***, **M. Newchurch***, and J. Zawodny*, 1998: Trends in the vertical distribution of ozone. *Science*, 285, 1689-1692.

Schauffler, S., E. Atlas, **D. Blake***, F. Flocke, R. Lueb, J. Lee-Taylor, V. Stroud, and **W. Travnicek***, 1999: Distributions of brominated organic compounds in the troposphere and lower stratosphere. *J. Geophys. Res.*, 104, 21,513-21,535.

Smith, A., 1999: Observation of low frequency Kelvin waves in the mesosphere. Earth Planets Space, 51, 649-656.

_____ and M. Riese*, 1999: Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere (CRISTA) observations of tracer transport by inertially unstable circulations. J. Geophys. Res., 104, 19,171-19,182.

Wang, J., J. Gille, P. Bailey, **J. Drummond***, and L. Pan, 1999: Instrument sensitivity and error analysis for the remote sensing of tropospheric carbon monoxide by MOPITT. *J. Atmos. & Oceanic Tech.*, **16**, 465-474.

____, J. Gille, P. Bailey, L. Pan, D. Edwards, and J. **Drummond***, 1999: Retrieval of tropospheric carbon monoxide profiles from high-resolution interferometer observations: A new digital gas correlation (DGC) method and applications. *J. Atmos. Sci.*, **56**, 219-232.

Weinheimer, A., T. Campo, and B. Ridley, 1998: The in-flight sensitivity of gold-tube NOy converters to HCN. Geophys. Res. Letts., 25, 3943-3946.

Outside

- *Bryant, D., E. Holland, T. Seastedt*, and M. Walker*, 1998: Analysis of litter decomposition in an alpine tundra. Can. J. Bot., 76, 1295-1304.
- *Burkholder, J., and J. Orlando, 1998: Rate coefficient upper limits for the BrONO2 and CIONO2 + O3 reactions. Geophys. Res. Letts., 25, 3567-
- *Clarke, A., **D. Davis***, V. Kapustin*, F. Eisele et al., 1998: Particle nucleation in the tropical boundary layer and its coupling to marine sulfur sources. *Science*, 282, 89-92.
- V. Kapustin*, F. Eisele, R. Weber*, and **P. McMurry***, 1999: Particle production near marine clouds: Sulfuric acid and predictions from classical binary nucleation. *Geophys. Res. Lett.*, **26**, 2425-2428.
- *Constable, J., A. Guenther, D. Schimel, and **R. Monson***, 1999: Modelling changes in VOC emission in response to climate change in the continental United States. *Global Change Biology*, 5, 791-806.
- *Dvortsov, V., M. Geller*, S. Solomon*, S. Schauffler, E. Atlas, and D. Blake*, 1999: Rethinking reactive halogen budgets in the midlatitude lower stratosphere. *Geophys. Res. Lett.*, 26, 1699-1702.
- *Helmig, D., J. Greenberg, A. Guenther, P. Zimmerman*, and C. Geron*, 1998: Volatile organic compounds and isoprene oxidation products at a temperate deciduous forest site. J. Geophys. Res., 103, 22,397-22,414.
- ____, L. Klinger, A. Guenther, **L. Vierling***, C. Geron*, and **P. Zimmerman***, 1999: Biogenic volatile organic compound emissions (BVOCs) I. Identifications from three continental sites in the U.S. *Chem.*, **38**, 2163-2187.
- _____, L. Klinger, A. Guenther, **L. Vierling***, C. Geron*, and **P. Zimmerman***, 1999: Biogenic volatile organic compound emissions (BVOCs) II. Landscape flux potentials from three continental sites in the U.S. *Chem.*, **38**, 2189-2204.
- *Katul, G., C. Geron*, C. Hsieh*, B. Vidakovic*, and A. Guenther, 1998: Active turbulence and scalar transport near the forest-atmosphere interface. J. Appl. Meteor., 37, 1533-1546.
- *Levelt, P., B. Khattatov, J. Gille, G. Brasseur, X. Tie, and J. Waters*, 1998: Assimilation of MLS ozone measurements in the global three-dimensional chemistry transport model ROSE. *Geophys. Res. Lett.*, 25, 4493-4496.
- *McKenzie, R., K. Paulin*, and S. Madronich, 1998: Effects of snow cover on UV irradiance and surface albedo: A case study. J. Geophys Res., 103, 28,785-28,791.
- *Mertens, C., M. Mlynczak*, R. Garcia, and R. Portmann*, 1999: A detailed evaluation of the stratospheric heat budget 1. Radiation transfer. J. Geophys. Res., 104, 6021-6038.
- *Mlynczak, M., C. Mertens*, R. Garcia, and R. Portmann*, 1999: A detailed evaluation of the stratospheric heat budget 2. Global radiation balance and diabatic circulations. *J. Geophys. Res.*, **104**, 6039-6066.
- *Müller, J-F., and G. Brasseur, 1999: Sources of upper tropospheric HOx: A three-dimensional study. J. Geophys. Res., 104, 1705-1715.
- *Nagato, K., D. Tanner, H. Friedli, and F. Eisele, 1999: Field measurement of positive ion mobility and mass spectra at a Colorado site in winter. J. Geophys. Res., 104, 3471-3482.
- *Phillips, J., J. Orlando, G. Tyndall, and V. Vaida*, 1998: Integrated intensities of OH vibrational overtones in alcohols. Chem. Phys. Letts., 296, 377-383
- *Pierce, T., C. Geron*, L. Bender*, R. Dennis*, G. Tonnesen*, and A. Guenther, 1998: Influence of increased isoprene emissions on regional ozone modeling. *J. Geophys. Res.*, 103, 25,611-25,629.
- *Riemer, D., et al., 1998: Observations of nonmethane hydrocarbons and oxygenated volatile organic compounds at a rural site in the southeastern United States, J. Geophys. Res., 103, 28,111-28,128.
- *Stolarski, R., W. Randel et al., 1998: Ozone change as a function of altitude. Chapter 3 in SPARC Report No. 1, Assessment of Trends in the Vertical Distribution of Ozone.
- *Wallington, T., K. Jucks*, and G. Tyndall, 1998: Upper limits for the gas-phase reaction of H2O2 with O3 and NO. Atmospheric implications. Int. J. Chem. Kinet., 30, 707-709.
- *Weber, R., P. McMurry*, R. Mauldin III, D. Tanner, F. Eisele, A. Clarke*, and V. Kapustin*, 1999: New particle formation in the remote troposphere: A comparison of observations at various sites. Geophys. Res. Lett., 26, 307-310.

Advanced Study Program

REFEREED

- Fournier, A., 1999: Transfers and fluxes of wind kinetic energy between orthogonal wavelet components during atmospheric blocking. Wavelets in Physics. J.C. van den Berg, Ed., Cambridge, 263-298.
- Galand, M., and A. D. Richmond, 1999: Magnetic mirroring in an incident proton beam. J. Geophys. Res., 104, 4447-4455.
- ----, J. Lilensten*, W. Kofman*, and D. Lummerzheim*, 1998: Proton transport model in the ionosphere: 2. Influence of magnetic miroring and collisions of the angular redistribution in a proton beam. *Ann. Geophys.*, **16**, 1308-1321.
- -----, D. Toublanc*, and S. Maurice*, 1999: The ionosphere of Titan: idean diurnal and nocturnal cases. *Icarus*, 140, 92-105.
- Gettelman, A. and S. L. Baughcum*, 1999: Direct deposition of subsonic aircraft emissions into the stratosphere. *J. Geophys. Res.*, **104(D7)**, 8317-8327.
- Hamill, T. M., 1999: Hypothesis tests for evaluating numerical precipitation forecasts. Wea. Forecasting, 14, 155-167
- ----, 1998: Comments on "Short-range ensemble forecasting of explosive Australian east-coast cyclogenesis." Wea. Forecasting, 13, 1205-1207.
- Judge*, P. G., and H. Peter, 1998: The structure of the chromosphere. Space Sci. Rev., 85, 187-202.
- Lilensten*, J., and M. Galand: 1998: Proton/electron precipitation effects on the electron production and density above EISCAT and ESR. Ann. Geophys., 16, 1299-1307.
- Norris, J. R., 1999: On trends and possible artifacts in global ocean cloud cover between 1952 and 1995. J. Climate, 12, 1864-1870.
- -----, Y. Zhang, and J. M. Wallace, 1998: Role of low clouds in summertime atmosphere-ocean interactions over the North Pacific. J. Climate, 11, 2482-2490.
- Peter, H., 1999: The chromosphere in coronal holes and the quet sun network: A He I (584 A) full-disk scan by SUMER/SOHO. Astrophys. J., 522, L77-L80.

- -----, 1999: Analysis of transition-region emission line profiles from full-disk scans of the sun using the SUMER instrument on SOHO. Astrophys. J., 516, 490-504.
- ----, 1998: Element separation in the chromosphere. Space Sci. Rev., 85, 253-260.
- ---- and P. G. Judge*, 1999: On the doppler shifts of solar UV emission lines. Astrophys. J., 522, 1148-1166.

Torrence, C. and P. J. Webster*, 1999: Interdecadal changs in the ENSO-Monsoon System. J. Clim., 12, 2679-2690.

Welch, W., and K. Tung*, 1998: Nonlinear baroclinic adjustment and wavenumber selection in a simple case. J. Atmos. Sci., 55, 1285-1302.

----, and ----, 1998: On the equilibrium spectrum of transient waves in the atmosphere. J. Atmos. Sci., 55, 2833-2851.

Wheeler, M. and G. N. Kiladis*, 1999: Convectively coupled equatorial waves: Analysis of clouds and temperature in the wavenumber-frequency domain. *J. Atmos. Sci.*, **56**, 374-399.

Zhang*, Y., J. R. Norris, and J. M. Wallace*, 1998: Seasonality of large scale atmosphere-ocean interaction over the North Pacific. *J. Climate*, 11, 2473-2481.

UNREFEREED:

Berner, J., 1999: Weather regimes and transitions in a General Circulation Model. Diplomarbeir, Meteorological Institute, Univ. of Bonn. 138 pp.

Peter, H., 1999: Doppler shifts of solar UV emission lines and the source region of the (fast) solar wind. Proc. AIP Conf. on the Ninth Intl. Solar Wind, CIP-471, 281-284.

Torrence, C., 1999: Wavelet coherency for time series analysis. Amer. Soc. Civil Eng., Intl. Water Resources Eng. Conference, Seattle, WA.

Wheeler, M., G. N. Kiladis*, and P. J. Webster*, 1999: Convectively coupled equatorial waves. Preprints, 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, 356-359.

----, K. M. Weickmann*, and K. A. Harris*, 1999: Real-time monitoring of modes of coherent synoptic to intraseasonal tropical variability. Preprints, 8th Conference on Climate Variations, Denver, CO, 24-29. Atmospheric Technology Division

Refereed (Peer-Reviewed Publications)

*Bowling, D. R., A. C. Delany, *A. A. Turnipseed, *D. D. Baldocchi, and *R. K. Monson, 1999: Modification of the relaxed eddy accumulation technique to maximize measured scalar mixing ratio differences in updrafts and downdrafts. *J. Geophys. Res.*, **104**, 9121-9133.

Brandes, E. A., J. Vivekanandan, and J. W. Wilson, 1999: Notes and Correspondence. A comparison of radar reflectivity estimates of rainfall from collocated radars. *J. Atmos. and Ocean. Tech.*, 16, 1264-1272.

Clark. T. L., L. Radke, J. Coen, and D. Middleton, 1999: Analysis of small-scale convective dynamics in a crown fire using infrared video camera imagery. J. Appl. Meteor., 38, 1401-1420.

Dai, A., and J. Wang, 1999: Diurnal and semidiurnal tides in global surface pressure fields. J. Atmos. Sci., 56, 3814-3891.

Guichard, F., D. Parsons, and E. Miller, 1999: Thermodynamical and radiative impact of the correction of sounding humidity bias in the tropics. *J. Clim.*, accepted.

Hildebrand, P. H., "D. Acheson, "R. Barth, "D. Hinsman, J. Keeler, "C. Kummerow, "K. Gage, "D. McGinnis, "S. Rutledge, "R. Schlapia, "J. Schmetz, "W. Shaw, and "S. Zevin, 1999: American Meteorological Society Policy Statement: Radio Frequency Allocations for Meteorological Operations and Research. Bull. Amer. Meteor. Soc., 80, 689-692.

Horst, T. W., 1999: The footprint for estimation of atmosphere-surface exchange fluxes by profile techniques. Bound. -Layer Meteor., 90, 171-188.

Horst, T. W., 1999: On frequency response corrections for eddy covariance flux measurements. Bound. -Layer Meteor. accepted

Lee, W.-C., *B. J.-D. Jou, *P.-L. Chang, and *S.-M. Deng, 1999: Tropical cyclone kinematic structure retrieved from single-doppler radar observations. Part I: Interpretation of Doppler velocity patterns and the GBTVD technique. *Mon. Wea. Rev.*, 127, 2419-2439.

*Michelsen, H. A., *G. L. Manney, C. R. Webster, *R. D. May, *M. R. Gunson, D. Baumgardner, *K. K. Kelly, *M. Loewenstein, *J. R. Podolske, *M. H. Profitt, *S. C. Wolfsy, and *G. R. Yue, 1999: Intercomparison of ATMOS, SAGE II, and ER-2 Observations in Arctic vortex and extra-vortex air masses during spring 1993. Geophys. Res. Lettr., 26, 291-294.

*Muschinski, A., P. Sullivan, *D. Wuertz, S. A. Cohn, D. H. Lenschow, and *R. J. Doviak, 1999: First synthesis of wind profiler signals on the basis of large eddy simulation data. *Radio Sci.*, **34**, 1437-1460.

Radke, L. F., T. L. Clark, J. L. Coen, C. Walther, *P. J. Riggan, *J. Brass, and *R. Higgans, 1999: Airborne remote sensors look at wildfires. *Proc. of the 4th Int. Airborne Remote Sens. Conference and Exhibition/21st Canadian Symposium on Remote Sens.*, 11, 885-890.

—, D. Ward, and *P. Riggan, 1999: A prescription for controlling the air pollution resulting from the use of prescribed biomass fire: Clouds. Int. J. Wildland Fire.

*Raga, G. B., D. Baumgardner, G. Kok, *A. Baez, and *I. Rosas, 1999: Evidence for volcanic influence on Mexico City aerosols. *Geophys. Res. Lettr.*, 26, 1149-1152.

Stith, J., J. Dye, B. Ridley, *P. Laroche, *E. Defer, *K. Baumann, *G. Hübler, *R. Zerr, and M. Venticinque, 1999: NO signatures from lightning flashes. *J. Geophys. Res.*, **104(D13)**, 16081-16089.

Vivekanandan, J., *D. S. Zrnic, S. M. Ellis, R. Oye, *A. V. Ryzhkov, and *J. Straka, 1999: Cloud microphysics retrieval using S-band dual polarization radar measurements. *Bull. Amer. Meteor. Soc.*, **80**, 381-388.

Walther, C., B. Lewis, R. Neitzel, and *J. Haggerty, 1999: Refurbishment of the airborne imaging microwave radiometer at NCAR. Proc. of the 4th Int. Airborne Remote Sens. Conference and Exhibition/21st Canadian Symposium on Remote Sens., 1, 502-508.

Wang, J., *W. B. Rossow, *T. Uttal, and *M. Rozendaal, 1999: Variability of cloud vertical structure during ASTEX observed from a combination of rawinsonde, radar, cellometer, and satellite. Mon. Wea. Rev., 127, 2484-2502.

*Wang, Q., D. H. Lenschow, *P. Linlin, R. D. Schillawski, G. L. Kok, A. S. H. Prévot, K. Laursen, *L. M. Russell, *A. R. Bandy, *D. C. Thornton, and *K. Suhre, 1999: Characteristics of the marine boundary layers during two Lagrangian measurement periods: 2. Turbulence structure. *J. Geophys. Res.*, 104(D17), 21767-21784.

Weckwerth, T. M., T. W. Horst, and J. W. Wilson, 1999: An observational study of the evolution of horizontal convective rolls. *Mon. Wea. Rev.*, 127, 2160-2179.

—, V. Wulfmeyer, *R. M. Wakimoto, *R. M. Hardesty, J. W. Wilson, and *R. M. Banta, 1999: NCAR/NOAA lower tropospheric water vapor workshop. *Bull. Amer. Meteor. Soc.*, 80(11), 2339-2357.

Wilson, J. W., N. A. Crook, C. K. Mueller, J. Sun, and M. Dixon, 1998: Nowcasting thunderstorms: A status report. Bull. Amer. Meteor. Soc., 79, 2079-2099.

Wulfmeyer, V., 1999: Investigations of humidity skewness and variance profiles in the convective boundary layer and comparison of the latter with large eddy simulation results. *J. Atmos. Sci.*, **56**, 1077-1087.

---. 1999: Investigation of turbulent processes in the lower troposphere with water-vapor DIAL and Radar-RASS, J. Atmos. Sci., 56, 1055-1076.

*Yoneyama, K., and D. B. Parsons, 1999: A proposed mechanism for the intrusion of dry air into the tropical western Pacific. J. Atmos. Sci., 11 1524-1546

Non-Refereed

Baumgardner, D., 1999: Ice in clouds: In situ measurement techniques. Preprints, NCAR Summer Colloquium, Boulder, CO.

—, and D. Powers, 1999: Small scale fluctuations in Arctic stratus clouds and their impact on radiative fluxes. Preprints, *Int. Union Geophys.*, Birmingham. England.

----, *C. Twohy, *P. Lawson, *A. Korolev, and *H. Gerber, 1999: In situ sensing of clouds. Preprints, Int. Congress on Radio Sciences, Toronto, Ontario, Canada

—, and *G. B. Raga, 1999: A conceptual model for the formation and growth of Mexico City aerosols. Preprints, Annual Meeting of the American Assoc. for Aerosols, Tacoma, WA.

Brown, W. O. J., S. A. Cohn, C. Martin, G. Maclean, M. Susedik, and D. Parsons, 1999: Clear air wind profiling with MAPR. Preprints, Proc. 9th Atmospheric Radiation Measurement-ARM Science Team Meeting, San Antonio, TX.

—, —, —, —, 1999: NCAR's multiple antenna profiler radar. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 815-818.

---, ---, M. Susedik, C. L. Martin, G. Maclean, and D. B. Parsons, 1999: The NCAR/ARM multiple antenna profiler. Preprints, *Proc. 9th Atmospheric Radiation Measurement-ARM Sci. Team Meeting*, San Antonio, TX.

Carbone, R. E., *T. D. Keenan, *J. Hacker, and J. Wilson, 1999: Tropical island convection in the absence of significant topography. Preprints, 8th Conf. on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc..

—, —, and —, 1999: Tropical island convection in the absence of significant topography. Preprints, 23rd Conf. on Hurricanes and Tropical Meteor., Dallas, TX, Amer. Meteor. Soc., 503-533.

—, J. D. Tuttle, L. J. Miller, R. Oye, and S. B. Trier, 1999: Large domain studies of warm season precipitation episodes. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 596-599.

Cohn, S. A., and *W. M. Angevine, 1999: Convective boundary layer heights and entrainment zone thickness measured by lidars and radar wind profilers. Preprints, *Proc. 13th Symp. on Boundary Layers and Turbulence*, Dallas, TX, 102-105.

—, W. O. J. Brown, and D. Parsons, 1999: Preliminary analysis of the ARM TOCS cruise. Preprints, Proc. 9th Atmospheric Radiation Measurement-ARM Sci. Team Meeting, San Antonio, TX.

—, *J. Jordan, and L. Cornman, 1999: Recent developments in boundary layer radar wind profiling. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 819-822.

*Dabas, A., *Ph. Drobinski, *R. M. Hardesty, *A. Brewer, and V. Wulfmeyer, 1999: Measuring turbulence parameters with coherent lidars. Preprints. 10th Coherent Laser Radar Conf., Mount Hood, Oregon.

*Dodge, P., *S. Houston, W.-C. Lee, *J. Gamache, and *F. D. Marks, Jr., 1999: Windfields in hurricane Danny (1997) at landfall from combined WSR-88D and airborne doppler radar data, Preprints, 23rd Conf. on Hurricanes and Tropical Meteor., Dallas, TX, Amer. Meteor. Soc., I. 61-62.

*Doviak, R. J., C. Frush, *M. Sachidananda, and *D. S. Zrinic, 1999: Implementation and fire tests of a systematic phase code to separate overland weather echoes. Preprints. *Indiana Radar Conf.*. Indiana. IN

Durlak, S., D. Baumgardner, and *G. B. Raga, 1999: Examination of the evolution of Mexico City aerosols using an aerosol and photochemical box model. Preprints, *Annual Meeting of the American Assoc. for Aerosol Research*, Tacoma, WA.

Ellis, S., 1999: Compensating Reflectivity for Clutter Filter Bias. Preprints, 15th Conf. on Interactive Information and Processing Systems (IIPS), Dallas, TX, Amer. Meteor. Soc., 4.

____, C. L. Frush, 1999: Compensating reflectivity estimates biased by ground clutter filters. Preprints, URSI Nat. Radio Sci. Meeting, Boulder, CO, 299.

—, F. Pratte, and C. Frush, 1999: Compensating reflectivity for clutter filter bias in the WSR-88D. Preprints, 15th Conf. on Interactive Information and Processing Systems (IIPS), Dallas, TX, Amer. Meteor. Soc., 306-309.

—, —, and —, 1999: Compensating reflectivity for clutter filter bias in the WSR-88D. Preprints, 29th Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 572-575.

----, and ----, 1999: Compensating reflectivity for clutter filter bias in the WSR-88D. Preprints, URSI Nat. Conf. on Radio Sci., Boulder, CO.

—, J. Vivekanandan, and E. A. Brandes, 1999: Verification of polarimetric radar based cloud microphysical results using aircraft observations. Preprints, 29th Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 180-183.

*Forbes, G., *A. Chiu, W.-C. Lee, and *P. Dodge, 1999: Super typhoon paka's (1997) surface winds. Preprints, 23rd Conf. on Hurricanes and Tropical Meteor., Dallas, TX, Amer. Meteor. Soc., I, 1032-1033.

Frush, C., 1999: Reduction of radar range ambiguity using SA (8/64) coded phase transmit sequence. Preprints, 15th Conf. on Interactive Information and Processing Systems (IIPS), Dallas, TX, Amer. Meteor. Soc., 4.

—, and J. Daughenbaugh, 1999: Range/Velocity ambiguity reduction: Evaluation of the SZ(8/64) phase code on a WSR-88D radar. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 513-515.

—, and —, 1999: Reduction of radar range ambiguity: Performance evaluation using phase coded transmissions on a NEXRAD radar. Preprints, URSI Nat. Radio Sci. Meeting, Boulder, CO, 302.

Guichard, F., J. Dudhia, and D. Parsons, 1999: Improvement of MM5 surface fields with the RRTM longwave radiative scheme. Preprints, MM5 Workshop, Boulder, CO.

—, D. Parsons, and J. Dudhia, 1999: Evaluation d'un modele de meso-echelle a l'echelle saisonniere. Preprints, Atelier de Modélisation de l'atmosphère, Toulouse, France.

---, ---, and ---, 1999: Evaluating mesoscale model predictions and parameterizations agains SCP ARM data on a seasonal time scale. Preprints, 9th ARM Sci. Team Meeting, San Antonio, TX.

---, ---, and E. Miller, 1999: Impact thermodynamique et radiatif d'un biais sec dansles mesures d'humidite par radiosondes. Preprints, Atelier de Modé lisation de l'atmosphère, Toulouse, France.

—, —, and —, 1999: The radiative impact of a correction for a sonde humidity bias over the tropical western Pacific. Preprints, 9th ARM Sci. Team Meeting, San Antonio, TX.

*Guo, Y.-R., *Y.-H. Kuo, J. Dudhia, and D. B. Parsons, 1999: Assimilation of ARM WVIOP-96 data for Oklahoma. Preprints, 9th ARM Sci. Team Meeting, San Antonio, TX.

- *Hagen, M., *P. Meischner, , *Wurman, M. Randall, and C. Burghart, 1999: A C-band bistatic doppler radar system at DLR Oberpfaffenhofen Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 813-814.
- *Hanssen, R. F., and T. M. Weckwerth, 1999: Evaluation of spatial moisture distribution during CLARA 96 using spaceborne radar interferometry Preprints, Remote Sensing of Cloud Parameter: Retrieval and Validation Symposium, Delft, The Netherlands, 15-20.
- Hildebrand, P., 1999: Observation of narrow cold-frontal rainbands and gravity currents in FASTEX. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 549-552.
- *Jou, B. J.-D., *P.-L. Chang, and W.-C. Lee, 1999: Radar analysis of a typhoon spiral rainband. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 362-363.
- Keeler, R. J., J. C. Kessinger, S. M. Ellis, and J. Van Andel, 1999: AP clutter detection and mitigation: NEXRAD implementation plan. Preprints, 29th Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 580-581.
- ---, ---, and ---, 1999: NEXRAD AP clutter recognition and suppression. Preprints, URSI Nat. Radio Sci. Meeting, Boulder, CO, 301
- —, —, J. Van Andel, and S. M. Ellis, 1999: Implementation of NEXRAD AP clutter processing. Preprints, 15th Conf. on Interactive Information and Processing Systems (IIPS) for Meteor., Dallas, TX, Amer. Meteor. Soc., 304-305.
- ---, ---, and ---, 1999: Implementation of NEXRAD AP clutter processing. Preprints, URSI Conf. on Radio Sci., Boulder, CO.
- —, *D. S. Zrnic, and C. L. Frush, 1999: Review of range velocity ambiguity mitigation techniques. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 158-163.
- Kessinger, C., S. M. Ellis, and J. Van Andel, 1999: An algorithm to detect anomalously propagated ground clutter for the WSR-88D. Preprints, 15th Conf. on Interactive Information and Processing Systems, Dallas, TX, Amer. Meteor. Soc., 310-311.
- ——, ——, and ——, 1999: A fuzzy logic, radar echo-classification scheme for the WSR-88D. Preprints, 29th Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 576-579.
- —, —, and —, 1999: An algorithm to detect anomalously propagated ground clutter for the WSR-88D. Preprints, *URSI Conf. on Radio Sci.*, Boulder, CO.
- ---, ---, and ---, 1999: Detection of anomalously-propagated ground clutter using fuzzy logic. Preprints, *URSI Nat. Radio Sci. Meeting*, Boulder, CO, 300.
- —, —, S. M. Ellis, 1999: Preliminary experiments with AP clutter recognition using WSR-88D data collected with the AIDA time-series recorder Preprints, 15th Conf. on Interactive Information and Processing Systems, Dallas, TX, Amer. Meteor. Soc., 314-317.
- Lee, W.-C., *B. J.-D. Jou, *P.-L. Chang, 1999: Evolution and structure of typhoon Alex (1987) from single doppler radar observations. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 358-361.
- —, *F. D. Marks, Jr., and *P. Dodge, 1999: Structure of Hurricane Danny (1997) from WSR-88D data. Preprints, 23rd Conf. on Hurricanes and Tropical Meteor., Dallas, TX, Amer. Meteor. Soc., 1, 959-960.
- *Liu, Y., *J. W. Conway, E. A. Brandes, *A. V. Ryzhkov, J. Vivekanandan, *D. S. Zrnic, and R. Oye, 1999: The use of polarization data in the operational identification of hydrometeor and non-hydrometeor targets. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc. 192-194.
- Miller, E. R., J. Wang, and H. L. Cole, 1999: Correction for dry bias in Vaisala radiosonde RH data. Preprints, ARM Sci. Team Meeting, San Antonio,
- Mueller, C. K., and J. W. Wilson, 1999: Preliminary efforts toward 1-2 hr national thunderstorm initiation forecasts. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 13-20.
- *Murillo, S. T., W.-C. Lee, *P. Dodge, and *F. D. Marks, Jr., 1999: Using the GBVTD technique in nowcasting hurricane wind fields using the WSR-88D. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 276-277.
- *—, —, *K. Hondl, *P. Dodge, *C. McAdie, and *F. D. Marks, Jr., 1999: Implementation of the GBVTD technique in nowcasting hurricane wind fields using the WSR-88D. Preprints, 23rd Conf. on Hurricanes and Tropical Meteor., Dallas, TX, Amer. Meteor. Soc., I, 311-312.
- Parsons, D. B., W. O. J. Brown, and S. A. Cohn, 1999: High resolution structure of cold fronts observed in Colorado by in situ instrumentation and a spaced antenna wind profiling system. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 557-560.
- *Raga, G. B., D. Baumgardner, *A. Baez, and *1. Rosas, 1999: Evidence for volcanic influence on Mexico City aerosols. Preprints, Int. Union of Geophysics and Geodesy, Birmingham, England.
- —, —, 1999: Size spectral evolution of Mexico City aerosols. Preprints, Annual Meeting of the American Assoc. for Aerosol Research, Tacoma, WA.
- Randall, M., 1999: PIRAQII: PC based radar digital receiver/processor offers more than MIPS. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 525-528.
- Roberts, R. D., D. W. Breed, and *P. C. Kennedy, 1999: Multiparameter radar, aircraft, and satellite signatures associated with precipitation formation in Colorado convective clouds. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 896-899.
- —, T. Saxen, C. Mueller, J. Wilson, A. Crook, J. Sun, and S. Henry, 1999: Operational application and use of NCAR's thunderstorm nowcasting system. Preprints, 15th Int. Conf. on Interactive Information and Processing Systems (IIPS), Dallas, Texas, Amer. Meteor. Soc., 158-161.
- Saxen, T. R., C. K. Mueller, *T. C. Jameson, and *E. Hatfield, 1999: Determining key parameters for forecasting thunderstorms at White Sands Missile Range. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 9-12.
- Serafin, R. J., and J. W. Wilson, 1999: Operational weather radar in the U.S.: Progress and Opportunity. Preprints, COST-75 Advanced Weather Radar System, Int. Seminar, Locarno, Switzerland, 35-61, ISBN 92-828-4907-4.
- *Smith, P. L., and R. J. Keeler, 1999: Why horizontal polarization? Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 201-202.
- *Steiner, M., *J. A. Smith, C. Kessinger, and *B. S. Ferrier, 1999: Evaluation of algorithm parameters for radar data quality control. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 582-585.
- Van Andel, J., C. Kessinger, and *D. Ecoff, 1999: APCAT: An AP clutter analysis tool. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 267-269.
- Vivekanandan, J., S. M. Ellis, E. A. Brandes, and R. A. Rilling, 1999: Absolute calibration of radar reflectivity using polarimetric radar observations. Preprints, 1st USWRP Science Symposium, Boulder, CO.
- —, G. Zhang, and M. K. Politovich, 1999: Estimate of droplet size and liquid water content using dual-frequency radar measurements for aircraft icing detection. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 872-875.
- —, —, and *A. V. Ryzhkov, 1999: Estimation of canting angle distribution of raindrop spectra using radar measurements. Preprints, *Int. Radar Symposium*, Bangalore, India, 1R S1-99.
- ----, *D. S. Zrnic, S. M. Ellis, R. Oye, *A. V. Ryzhkov, and *J. Straka, 1999: Cloud microphysics retrieval using S-band dual- polarization radar

measurement. Preprints, 15th Int. Conf. on Interactive Information and Processing Systems (IIPS), Dallas, TX, Amer. Meteor. Soc., 287-290.

*Wang, J.-J., *R. M. Rauber, *H. T. Ochs, III, and R. E. Carbone, 1999: A radar study of the effects of the island of Hawaii on offshore rainband evolution. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 422-425.

Weckwerth, T. M., 1999: The effect of small-scale moisture variability on thunderstorm initiation. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 17-20.

Wilson, J., 1999: Evolution of radar and other variables for the 0-2 hr forecast of thunderstorms. Preprints, 29th Int. Conf. on Radar Meteorology, Montreal, Quebec, Canada, Amer. Meteor. Soc., 4.

—, 1999: Tropical island convection in the absence of significant topography: Part II: Evolution of the mesoscale convective systems. Preprints, 15th Int. Conf. on Interactive Information and Processing Systems (IIPS), Dallas, TX, Amer. Meteor. Soc., 4.

—, *T. D. Keenan, and R. E. Carbone, 1999: Tropical island convection in the absence of significant topography part II: evolution of mesoscale

convective systems. Preprints, 8th Conf. on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 534-537.

—, —, and —, 1999: Tropical island convection in the absence of significant topography part II: evolution of mesoscale convective systems. Preprints, 23rd Conf. on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 534-537.

_____, and R. D. Roberts, 1999: Evaluation of radar and other variables for the 0-2 hr. forecast of thunderstorms. Preprints, 29th Int. Conf. on Radar Meteor., Montreal, Quebec, Canada, Amer. Meteor. Soc., 5-8.

Wulfmeyer, V., 1999: Water vapor differential absorption lidar: A reference standard for water vapor profiling in the atmosphere. Chapman Conference on water vapor in the climate system, Potomac, Maryland, 24.

Climate and Global Dynamics Division

Bold face denotes university collaborators and * denotes non-NCAR collaborators

*Achatz, U., and G. W. Branstator, 1999: A two-layer model with empirical linear corrections and reduced order for studies of internal climate variability. *J. Atmos. Sci.*, **56**, 3140-3160.

*Alexander, M., C. Deser, and *M. Timlin, 1998: The re-emergence of SST anomalies in the North Pacific Ocean. J. Climate, 12, 2419-2431.

Asner, G. P., C. A. Wessman, and D. S. Schimel, 1998: Heterogeneity of savanna canopy structure and function from imaging spectrometry and inverse modeling. *Ecological Applications* 8, 1022-1036.

Baird, A. J., and R. L. Wilby, Eds., 1999: Eco-Hydrology: Plants and Water in Terrestrial and Aquatic Environments. Routledge, 402 pp.

Barnett, T. P., D. W. Pierce, R. Saravanan, N. Schneider, *D. Dommenget, and *M. Latif, 1999: Origins of the midlatitude Pacific decadal variability. *Geophys. Res. Lett.*, 26, 1453-1456.

Barnett, T. P., D. W. Pierce, *M. Latif, *D. Dommenget, and R. Saravanan, 1999: Interdecadal interactions between the tropics and midlatitudes in the Pacific basin. *Geophys. Res. Lett.*, 26, 615-618.

Baron, J. S., M. D. Hartman, T. G. F. Kittel, L. E. Band, D. S. Ojima, *R. B. Lammers, 1998: Effects of land cover, water redistribution, and temperature on ecosystem processes in the South Platte Basin. Ecological Applications, 8, 1037-1051.

Berloff, P. S., and J. C. McWilliams, 1998: Large-scale, low-frequency variability in wind-driven ocean gyres. J. Phys. Oceanogr., 29, 1925-1949.

Berloff, P. S., and J. C. McWilliams, 1999: Quasigeostrophic dynamics of the western boundary current. J. Phys. Oceanogr., in press

Bonan, G. B., and L. M. Stillwell-Soller, 1998: Soil water and the persistence of floods and droughts in the Mississippi River Basin. Water Resour. Res., 34, 2693-2701.

Brady, E. C., R. M. DeConto, and S. L. Thompson, 1998: Deep water formation and poleward ocean heat transport in the warm climate extreme of the Cretaceous (80 Ma). *Geophys. Res. Lett.*, **25**, 4205-4208.

Branstator, G., and S. E. Haupt, 1998: An empirical model of barotropic atmospheric dynamics and its response to tropical forcing. *J. Climate*, 11, 2645-2667.

Brasseur, G. P., J. T. Kiehl, *J. -F. Muller, T. Schneider, *C. Granier, *X. X. Tie, and *D. Hauglustaine, 1998: Past and future changes in global tropospheric ozone: Impact on radiative forcing. *Geophys. Res. Lett.*, **25**, 3807-3810.

Celaya, M., J. Wahr, and F. O. Bryan, 1999: Climate driven polar motion. J. Geophys. Res., 104, 12 813-12 829.

Chang, P., R. Saravanan, L. Ji, and G. C. Hegerl, 1999: The effect of local sea-surface temperatures on atmospheric circulation over the tropical Atlantic sector. I. Climate in press

Chase, T. N., R. A. Pielke, Sr., T. G. F. Kittel, J. S. Baron, and T. J. Stohlgren, 1999: Potential impacts on Colorado Rocky Mountain weather due to land use changes on the adjacent Great Plains. *J. Geophys. Res.*, 104, 16 673-16 690.

Chase, T. N., R. A. Pielke, Sr., T. G. F. Kittel, *R. R. Nemani, and S. W. Running, 1999: Simulated impacts of historical land cover changes on global climate in northern winter. Clim. Dyn., in press.

*Ciais, P., *P. Friedlingstein, D. S. Schimel, and *P. P. Tans, 1999: A global calculation of the d¹³C of soil respired carbon: Implications for the biospheric uptake of anthropogenic CO₂. Global Biogeochem. Cycles, **13**, 519-530.

Cleveland, C. C., A. R. Townsend, D. S. Schimel, H. Fisher, R. W. Howarth, L. O. Hedin, S. S. Perakis, E. F. Latty, J. C. Von Fischer, A. Elseroad, and M. F. Wasson, 1999: Global patterns of terrestrial biological nitrogen (N₂) fixation in natural ecosystems. *Global Biogeochem. Cycles*, 13, 623-645.

Collins, W. D., 1998: A global signature of enhanced shortwave absorption by clouds. J. Geophys. Res. 103, 31 669-31 679.

Colucci, S. J., D. P. Baumhefner, and *C. E. Konrad II, 1999: Numerical prediction of a cold-air outbreak: A case study with ensemble forecasts. Mon. Wea. Rev., 127, 1538-1550.

Cressie, N., and C. K. Wikle, 1998: The variance-based cross-variogram: You can add apples and oranges. Mathematical Geology, 30, 789-799.

Dai, A., 1999: Recent changes in the diurnal cycle of precipitation over the United States. Geophys. Res. Lett., 26, 341-344.

Dai, A., K. E. Trenberth and *T. R. Karl, 1999: Effects of clouds, soil moisture, precipitation and water vapor on diurnal temperature range. *J. Climate*, 12, 2451–2473.

Dai, A., and C. Deser, 1999: Diurnal and semidiurnal variations in global surface wind and divergence fields. J. Geophys. Res., in press.

Dai, A., F. Giorgi, and K. E. Trenberth, 1999: Observed and model simulated precipitation diurnal cycles over the contiguous United States. *J. Geophys. Res.*, **104**, 6377-6402.

Dai, A., and *J. Wang, 1999: Diurnal and semidiurnal tides in global surface pressure fields. J. Atmos. Sci., 56, 3874-3891

Dawson, C. W., and R. L. Wilby, 1999: A comparison of artifical neural networks used for rainfall-runoff modelling. *Hydrology and Earth Systems Science*, in press.

Deser, C., 1999: On the annularity of the Arctic Oscillation. J. Geophys. Res., in press.

Deser, C., *M. A. Alexander, and *M. S. Timlin, 1999: Evidence for a wind-driven intensification of the Kuroshio Current Extension from the 1970s to the 1980s. J. Climate, 12, 1697-1706.

Deser, C., J. E. Walsh, and *M. S. Timlin, 1999: Arctic sea ice variability in the context of recent atmospheric circulation trends. J. Climate, in press.

Doney, S. C., 1999: Major challenges confronting marine biogeochemical modeling. Global Biogeochem. Cycles, 13, 705-714.

Doney, S. C., D. W. R. Wallace, and H. W. Ducklow, 1999: The North Atlantic Carbon Cycle: New Perspectives from JGOFS and WOCE. The Dynamic Ocean Carbon Cycle: A Midterm Synthesis of the Joint Global Ocean Flux Study, R. Hanson, H. Ducklow, and J. Field, Eds., Cambridge University Press, in press.

Ehrendorfer, M., R. M. Errico, and K. D. Raeder, 1999: Singular vector perturbation growth in a primitive equation model with moist physics. *J. Atmos. Sci.*, **56**, 1627-1648.

Errico, R. M., 1999: Workshop on assimilation of satellite data. Bull. Amer. Meteor. Soc., 80, 463-471.

Errico, R. M., 1999: Report of the workshop on assimilation of satellite data held at NASA/GSFC 21-23 April 1998. Bull. Amer. Meteor. Soc., 80, 463-471.

Errico, R. M., and K. D. Raeder, 1999: An examination of the accuracy of the linearization of a mesoscale model with moist physics. *Quart. J. Roy. Meteor. Soc.*, in press.

Errico, R. M., and *R. Langland, 1999: Notes on the appropriateness of "bred modes" for generating initial perturbations used in ensemble prediction. *Tellus*, **51A**, 431-441.

Errico, R. M., and *R. Langland, 1999: Response to comments by Toth et al. Tellus, 51A, 450-451.

Eugster W., W. R. Rouse, R. A. Pielke, Sr., J. P. McFadden, *D. D. Baldocchi, T. G. F. Kittel, F. S. Chapin, 111, G. E. Liston, P. L. Vidale, *E. Vaganov, and S. Chambers, 1999: Land-atmosphere energy exchange in arctic tundra and boreal forest: available data and feedbacks to climate. Global Change Biology, in press.

Fuentes, M., 1999: Predicting integrals of diffusion processes with unknown diffusion parameters. Stochastics, in press.

Fuentes, M., S. C. Doney, *D. M. Glover, and *S. J. McCue, 1999: Spatial structure of the SeaWiFS ocean color data for the North Atlantic Ocean. Statistics for Understanding the Atmosphere, Mark Berliner, Ed., in press.

Fung, I. Y., *S. K. Meyn, *I. Tegen, S. C. Doney, J. G. John, and *J. K. B. Bishop, 1999: Iron supply and demand in the upper ocean. Global Biogeochem. Cycles, in press.

Giorgi, F., G. A. Meehl, *A. Kattenberg, *H. Grass, *J. F. B. Mitchell, *R. J. Stouffer, *T. Tokioka, *A. J. Weaver, and T. M. L. Wigley, 1998: Simulation of climate change with global coupled climate models and regional modeling techniques. (Annex B to) *The Regional Impacts of Climate Change: An Assessment of Vulnerability. A Special Report of IPCC Working Group II*, R. T. Watson, M. C. Zinyowera, and R. H. Moss, Eds., cambridge University Press, 427–437.

*Gould, J., and K. E. Trenberth, 1999: The WCRP Joint Scientific Committee - 20th Meeting (JSC XX). Exchanges, 4, 2, 7.

Grunwald, G. K., and R. H. Jones, 1999: Markov models for time series with mixed distribution. Envirometrics, in press.

*Hassan, H., **A. Aramaki, K. Hanaki, T. Matsuo**, and R. L. Wilby, 1999: Lake stratification and temperature profiles simulated using downscaled GCM output. *Wat. Sci. Tech.*, **38**, 217–226.

Hoffert, M. I., *A. K. Caldeira, A. K. Jain, *E. F. Haites, L. D. D. Harvey, S. D. Potter, M. E. Schlesinger, S. H. Schneider, R. G. Watts, T. M. L. Wigley, and D. J. Wuebbles, 1999: Energy implications of CO₂ stabilization. *Nature*, **395**, 881-884.

*Hua, B. L., J. C. McWilliams, and *P. Klein, 1998: Lagrangian acceleration and dispersion in geostrophic turbulence. J. Fluid Mech., 366, 87-108.

Hurrell, J. W., 1998: Relationships among recent atmospheric circulation changes, global warming, and satellite temperatures. Sci. Progress, 81, 205-224.

Hurrell, J. W., H. van Loon, and D. J. Shea, 1998: The mean state of the troposphere. *Meteorology of the Southern Hemisphere*, D. Karoly and D. Vincent, Eds., Amer. Meteor. Soc., 1-46.

Hurrell, J. W., and K. E. Trenberth, 1999: Global sea surface temperature analyses: multiple problems and their implications for climate analysis, modeling and reanalysis. *Bull. Amer. Met. Soc.*, in press.

*Joyce, T., C. Deser, and *M. Spall, 1999: Decadal variability of subtropical mode water in the North Atlantic and large-scale patterns of air-sea forcing. *J. Climate*, in press.

Julien, K., *S. Legg, J. C. McWilliams, and J. Werne, 1998: Plumes in rotating convection. Part 1: Ensemble statistics and dynamical balances. *J. Fluid Mech.*, 391, 151-187.

*Karl, T., and K. E. Trenberth, 1999: The human impact on climate. Scientific American, 98-103.

Kasahara, A., 1999: On the origin of cumulus parameterization for numerical prediction model. *General Circulation Model Development: Past, Present and Future,* D. Randall, Ed., Academic Press, in press.

Kinney, R. M., and J. C. McWilliams, 1998: Turbulent cascades in anisotropic magnetohydrodynamics. Phys. Rev. E, 57, 7111-7121.

Kinney, R. M., F. Coroniti, J. C. McWilliams, and *P. Pritchett, 1999: Mechanisms for discrete auroral arc breakup by nonlinear Alfven wave interaction. J. Geophys. Res., in press.

Kinney, R. M., and J. C. McWilliams, 1999: Reduced dynamical equations for the high-latitude thermosphere: Ion drag balance. *J. Geophys. Res.*, 104, 6805-6812.

Kleypas, J. A., R. R. Buddemeier, D. Archer, *J.-P. Gattuso, C. Langdon, and B. N. Opdyke, 1999: Geochemical consequences of increased atmospheric CO₂ on coral reefs. *Science*, **284**, 118-120.

Kleypas, J. A., J. McManus, and L. Menez, 1999: Using environmental data to define reef habitat: Where do we draw the line? Amer. Zool., 39, 146-159.

Kittel, T. G. F., 1998: Effects of climatic variability on herbaceous phenology and observed species richness in temperate montane habitats, Lake Tahoe Basin, Nevada. *Madrono*, **45**, 75-84.

Kittel, T. G. F., *W. L. Steffen, and F. S. Chapin, III, 1999: Global and regional modeling of arctic-boreal vegetation distribution and its sensitivity to altered forcing. Global Change Biology, in press.

Labitzke, K. G., and H. van Loon, 1999: The Stratosphere Phenomena, History, and Relevance. Springer-Verlag, 179 pp.

Large, W. G., and P. R. Gent, 1999: Validation of vertical mixing in an equatorial ocean model using large eddy simulations and observations. *J. Phys. Oceanogr.*, **29**, 449-464.

*Lee, K., *R. Wanninkhof, T. Takahashi, S. C. Doney, and *R. A. Feely, 1998: Low interannual variability in recent oceanic uptake of atmospheric

carbon dioxide. Nature, 396, 155-159

*Lee, K., *R. Wanninkhof, **T. Takahashi**, S. C. Doney, and *R. A. Feely, 1999: No evidence for large interannual variations in oceanic carbon uptake. *Nature*, in press.

*Legg, S., J. C. McWilliams, and *J. Gao, 1998: Localization of deep ocean convection by a geostrophic eddy. J. Phys. Oceanogr., 48, 944-970.

*Legg, S., and J. C. McWilliams, 1999: Temperature and salinity variability in heterogeneous oceanic convection. J. Phys. Oceanogr., in press.

Lejenäs, H., and R. A. Madden, 1999: Mountain torques caused by normal-mode global Rossby waves and the impact on atmospheric angular momentum. *J. Atmos. Sci.*, in press.

Levine, R. A., and L. M. Berliner, 1999: Statistical principles for climate change studies. J. Climate, 12, 564-574.

Lietzke, C. E., C. Deser, and T. H. Vonder Haar, 1999: Evolutionary structure of the eastern Pacific doubled ITCZ based on satellite moisture profile retrievals. *J. Climate*, in press.

*Liu, S., W. A. Reiners, *M. Keller, and D. S. Schimel, 1999: Model simulation of changes in N₂O and NO emissions with conversion of tropical rain forests to pastures in the Costa Rican Atlantic Zone. *Global Biogeochem. Cycles*, **13**, 663-677.

*Lu, Z-Q., and L. M. Berliner, 1999: Markov switching time series models with application to daily runoff series. Water Resour. Res., 35, 523–534

Madden, R. A., T. J. Hoar, and R. F. Milliff, 1998: Scatterometer winds composited according to the phase of the Tropical Intraseasonal Oscillation. Tellus, 51A, 263-272.

Madden, R. A., D. J. Shea, R. W. Katz, and *J. W. Kidson, 1998: The potential for long-range predictability of precipitation over New Zealand. Int. J. Climate, 19, 405-421.

Madden, R. A., H. Lejenäs, and J. J. Hack, 1998: Semi-diurnal variations in the budget of angular momentum in a general circulation model and in the real atmosphere. J. Atmos. Sci., 55, 2561-2575.

Madden, R. A., and D. J. Shea, 1999: To potential for long-range predictability of temperature and precipitation over Japan. *J. Japanese Meteor. Soc.*, in press.

Magnusdottir, G., and R. Saravanan, 1999: The response of atmospheric heat transport to zonally averaged SST trends. Tellus, in press.

Marshall, J., "F. Dobson, K. Moore, P. Rhines, "M. Visbeck, E. d'Asaro, K. Bumke, "S. Chang, R. Davis, "K. Fischer, "R. Garwood, "P. Guest, "R. Harcourt, C. Herbaut, "T. Holt, "J. Lazier, "S. Legg, J. McWilliams, "R. Pickart, M. Prater, I. Renfrew, F. Schott, U. Send, and "W. Smethie, 1998: The Labrador Sea deep convection experiment. Bull. Amer. Meteor. Soc., 79, 2033-2058.

McWilliams, J. C., 1998: Oceanic general circulation models. Ocean Modeling and Parameterization, E. Chassignet, Ed., Kluwer Academic Publishers, 1.44

McWilliams, J. C., and I. Yavneh, 1998: Fluctuation growth and instability associated with a singularity of the balance equations. *Physics of Fluids*, 10, 2587-2596

McWilliams, J. C., I. Yavneh, *M. J. P. Cullen, and P. R. Gent, 1998: The breakdown of large-scale flows in rotating, stratified fluids. *Physics of Fluids*, 10, 3178-3184.

McWilliams, J. C., 1999: The formulation of oceanic general circulation models. General Circulation Model Development: Past, Present, and Future: Proceedings of a Symposium in honor of Professor Akio Arakawa, D. Randall, Ed., Academic Press, in press.

McWilliams, J. C., and J. M. Restrepo, 1999: The wave-driven ocean circulation. J. Phys. Oceanogr., 29, 2523-2540.

McWilliams, J. C., I. Yavneh, *M. J. P. Cullen, and P. R. Gent, 1999: Limits of balance, loss of stability, and a conjecture about turbulent cascade and dissipation rates. *Physics of Fluids*, **10**, 2587-2596.

McWilliams, J. C., J. B. Weiss, and I. Yavneh, 1999: The vortices of homogeneous geostrophic turbulence. J. Fluid Mech., in press.

McWilliams, J. C., C. -H. Moeng, and P. P. Sullivan, 1999: Turbulent fluxes and coherent structures in marine boundary layers: Investigations by large-eddy simulation. Air-Sea Exchange: Physics, Chemistry, Dynamics, and Statistics, G. Geernaert, Ed., Kluwer Academic Publishers, in press.

McWilliams, J. C., and P. P. Sullivan, 1999: Surface-wave effects on winds and currents in marine boundary layers. *Environmental Fluid Dynamics*, J. Lumley, Ed., Sringer-Verlag, in press.

Meehl, G. A., 1998: Climate modeling. Meteorology of the Southern Hemisphere, D. Karoly and D. Vincent, Eds., American Meteorological Society, 365-410.

Meehl, G. A., 1998: Scale interactions in atmosphere, ocean and coupled models. Climatic Impact of Scale Interactions for the Tropical Ocean-Atmosphere System, J. Slingo, P. Delecluse, and G. Komen, Eds., Euroclivar Publication, 13, 44–45.

Meehl, G. A., J. W. Hurrell, and H. van Loon, 1998: A modulation of the mechanism of the semiannual oscillation in the Southern Hemisphere. *Tellus*, **50A**, 442-450.

Meehl, G. A., J. M. Arblaster, and W. G. Strand Jr., 1998: Global scale decadal climate variability, Geophys. Res. Lett., 25, 3983-3986.

Meehl, G. A., W. Collins, B. Boville, J. T. Kiehl, T. M. L. Wigley, and J. M. Arblaster, 1999: Response of the NCAR Climate System Model to increased CO₂ and the role of physical processes. *J. Climate* (in press).

Meiring, W., P. Guttorp, and P. D. Sampson, 1999: Space-time estimation of grid-cell hourly ozone levels for assessment of a deterministic model. *Environmental and Ecological Statistics*, 5, 197-222.

Milliff, R. F., W. G. Large, J. Morzel, and G. Danabasoglu, 1999: Ocean general circulation model sensitivity to forcing from scatterometer winds. *J. Geophys. Res.*, **104**, 11 337-11 358.

Milliff, R. F., T. J. Hoar, H. van Loon, and M. Raphael, 1999: Quasi-stationary wave variability in NSCAT winds. J. Geophys. Res., 104, 11 425–11 436.

Murphy, S. J., *H. E. Hurlburt, and J. J. O'Brien, 1999: The connectivity of mesoscale variability in the Caribbean Sea, the Gulf of Mexico, and the Atlantic Ocean, J. Geophys. Res., 104, 1431–1453.

Newton, C. W., and *H. R. Newton, 1999: The life cycles of extratropical cyclones. *The Bergen School Concepts Comes to America*, M. Shapiro and S. Gronas, Eds., Amer. Meteor. Soc., 41–59.

Ojima, D., L. Garcia, E. Elgaali, K. Miller, T. Kittel, and J. Lackett, 1999: Potential climate change impacts on water resources in the Great Plains. J. Amer. Water Resources Assoc., in press.

Otto-Bliesner, B. L., 1999: El Nino/La Nina and Sahel precipitation during the middle Holocene. Geophs. Res. Lett., 26, 87-90.

Prather, M., *R. Sausen, *A. S. Grossman, *J. M. Haywood, *D. Rind, *B. H. Subbaraya, P. Forster, A. Jain, *M. Ponater, U. Schumann, W.-C. Wang, T. M. L. Wigley, and D. J. Wuebbles, 1999: Potential climate change from a

*Reynolds, C., and R. M. Errico, 1999: Convergence of singular vectors toward Lyapunov vectors. Mon. Wea Rev., 127, 2309-2323

*Royle, J. A., L. M. Berliner, C. K. Wikle, and R. F. Milliff, 1998: A hierarchical spatial model for constructing wind fields from scatterometer data in the Labrador Sea. Case Studies in *Bayesian Statistics IV*, C. Gatsonis, R. E. Kass, B. Carlin, A. Carriquiry, A.Gelman, I. Verdinelli, and M. West, Eds., Springer-Verlag, 367-382.

*Royle, J. A., and L. M. Berliner, 1999: A hierarchical approach to multivariate spatial modeling and prediction. *J. Agricultural, Biological, and Environmental Statistics*, **4**, 29–56.

*Santer, B. D., *J. J Hnilo, T. M. L Wigley, *J. S. Boyle, *C. Doutriaux, *M. Fiorino, *D. E. Parker, and *K. E. Taylor, 1999: Uncertainties in observationally based estimates of temperature change in the free atmosphere. *J. Geophys. Res.*, **104**, 6305–6333.

Saravanan, R., and P. Chang, 1999: Oceanic mixed layer feedback and tropical Atlantic variability. Geophys. Res. Lett., in press.

Saravanan, R., and P. Chang, 1999: Interaction between tropical Atlantic variability and El Nino-Southern Oscillation. J. Climate, in press.

Saravanan, R., G. Danabasoglu, S. C. Doney, and J. C. McWilliams, 1999: Decadal variability and predictability in the midlatitude ocean-atmosphere system. *J. Climate*, in press.

Schimel, D. S., and *N. S. Panikov, 1999: Simulation models of terrestrial trace gas fluxes at soil microsites to global scales. *Approaches to Scaling of Trace Gas Fluxes in Ecosystems*, L. Bouwman, Ed., Elsevier Science, 185-202.

*Schneider, N., *A. J. Miller, *M. A. Alexander, and C. Deser, 1998: Subduction of decadal North Pacific temperature anomalies: Observations and dynamics. J. Phys. Oceanogr., 29, 1056-1070.

Schneider, T., *C. Granier, X. X. Tie, *D. Hauglustaine, G. B. Bonan, and *L. M. Stillwell-Soller, 1998: Soil water and the persistence of floods and droughts in the Mississippi River Basin. *Water Resour. Res.*, **34**, 2693-2701.

*Schneider, N., *S. Venzke, *A. J. Miller, *D. W. Pierce, *T. P. Barnett, C. Deser, and *M. Latif, 1999: Pacific thermocline bridge revisited. Geophys. Res. Lett., 26, 1329–1332.

*Seth, A., and F. Giorgi, 1999: The effects of domain choice on summer precipitation simulation and sensitivity in a regional climate model. J. Climate, in press.

Shchepetkin, A., and J. C. McWilliams, 1998: Quasi-monotone advection schemes based on explicit locally adaptive dissipation. *Mon. Wea. Rev.*, 126, 1541-1580

*Smith, R. D., *M. E. Maltrud, F. O. Bryan, and M. W. Hecht, 1999: Numerical simulation of the North Atlantic Ocean at 1/10°. J. Phys. Oceanogr., in press

Smith, S. J., and T. M. L. Wigley, 1999: Global warming potentials: 1. Climatic implications of emissions reductions. Climatic Change, 44, in press.

Smith, S. J., and T. M. L. Wigley, 1999: Global warming potentials: 2. Accuracy. Climatic Change, 44, in press.

Sneddon, G., 1999: Smoothing in an underdetermined linear model with random explanatory variables. Canadian Journal of Statistics, 27, 63-79.

Sullivan, P. P., J. C. McWilliams, and C. -H. Moeng, 1999: Simulation of turbulent flow over idealized water waves. J. Fluid Mech., in press.

Tailleux, R., and J. C. McWilliams, 1999: Acceleration, creation, and depletion of wind-driven, baroclinic Rossby waves over an ocean ridge. *J. Phys. Oceanogr.*, in press.

Trenberth, K. E., 1998: Atmospheric moisture residence times and cycling: Implications for rainfall rates with climate. Clim. Change, 39, 667-694.

Trenberth, K. E., and C. J. Guillemot, 1998: Estimating evaporation-minus-precipitation as a residual of the atmospheric water budget. *Global Energy and Water Cycles*, K. Browning and R. Gurney, Eds., Cambridge University Press, 236–246.

Trenberth, K. E., 1999: Short-term climate variations. *Recent Accomplishments and Issues for Future Progress. Storms.* Vol. 1. R. Pielke, Sr. and R. Pielke, Jr., Eds., Routledge Press, 126-141.

Trenberth, K. E., 1999: Earth system processes and interactions. Encyclopedia of Global Environmental Change. Vol. 1. John Wiley & Sons Ltd., in press

Trenberth, K. E., 1999: Global climate project shows early promise. Eos, 80, 274-275.

Trenberth, K. E., 1999: A perspective on the weather events of 1997 and 1998. Consequences, 4, in press.

Trenberth, K. E., 1999: Atmospheric moisture recycling: Role of advection and local evaporation. J. Climate, 12, 1368–1381.

Trenberth, K. E., 1999: Conceptual framework for changes of extremes of the hydrological cycle with climate change. Clim. Change, 42, 327–339.

Trenberth, K. E., and J. W. Hurrell, 1999: Reply to Rajagopalan, Lall and Cane's comment about "The interpretation of short climate records with comments on the North Atlantic and Southern Oscillations." *Bull. Amer. Met. Soc.*, in press.

Trenberth, K. E., and J. W. Hurrell, 1999: Comment on "The interpretation of short climate records with comments on the North Atlantic and Southern Oscillations." *Bull. Amer. Met. Soc.*, in press.

Trenberth, K. E., and *T. Owen, 1999: Workshop on indices and indicators for climate extremes. Breakout Group A: Storms. Clim. Change, 42, 9-21.

*Upchurch, G. R., B. L. Otto-Bliesner, and *C. Scotese, 1998; Vegetation-atmosphere interactions and their role in global warming during the latest Cretaceous. *Phil. Trans. R. Soc. Lond. B*, 353, 1-17.

*Upchurch, G. R., B. L. Otto-Bilesner and *C. R. Scotese, 1999: Terrestrial vegetation and its effects on climate during the latest Cretaceous. Evolution of the Cretaceous Ocean-Climate System, E. Barrera and C. Johnson, Eds., The Geological Society of America, 407-426.

*Upchurch, G. R., B. L. Otto-Bliesner and *C. R. Scotese, 1999: Terrestrial vegetation and its effects on climate during the latest Cretaceous, in *Geological Society of American*, Special Paper 332, E. Barrera and C. Johnson, Eds., The Geological Society of America, 407-426.

*van Hees, R. M., *J. Lelieveld, and W. D. Collins, 1999: Detecting tropical convection using AVHRR satellite data. *J. Geophys. Res.*, **104**, 9213-9228.

van Loon, H., G. A. Meehl, and J. M. Arblaster, 1998: Global scale decadal climate variability. Geophys. Res. Lett., 25, 3983.

van Loon, H., and K. Labitzke, 1999: The signal of the 11-year solar cycle in the global stratosphere. J. Atmos. Terr. Phys., 61, 53-61.

von Hardenberg, J., J. C. McWilliams, A. Provenzale, A. Shchepetkin, and J. B. Weiss, 1999: Vortex merging in quasigeostrophic flows. J. Fluid Mech., in press.

Wahr, J., M. Molenaar, and F. Bryan, 1998: Time variability of the Earth's gravity field: Hydrological and oceanic effects and their possible detection using GRACE. J. Geophys. Res., 103, 30 205-30 229.

Wainer, I., F. O. Bryan, and J. Soares, 1999: Dynamics of the equatorial undercurrent in a high-resolution ocean model. J. Geophys. Res., 104, 23 327-23 335.

Walko, R. L., L. E. Band, J. Baron, T. G. F. Kittel, *R. Lammers, *T. J. Lee, R. A. Pielke, Sr., *C. Taylor, C. Tague, C. J. Tremback, and P. L. Vidale, 1999: Coupled atmosphere-biophysics-hydrology models for environmental modeling. *Journal of Applied Meteorology*, in press.

*Wanninkhof, R., S. C. Doney, *T.-H. Peng, *J. Bullister, *K. Lee, and *R. A. Feely, 1998: Comparison of methods to determine the anthropogenic CO₂ invasion into the Atlantic Coast. *Tellus*, **51B**, 511-530.

Weiss, J. B., A. Provenzale, and J. C. McWilliams, 1998: Lagrangian dynamics in high-dimensional point-vortex systems. *Phys. Fluids*, 10, 1929-1941.

Wigley, T. M. L., *R. L. Smith, and *B. D. Santer, 1998: Anthropogenic influence on the autocorrelation structure of hemispheric-mean temperatures. *Science*, **282**,1676-1679.

Wigley, T. M. L., *P. J. Jaumann, *B. D. Santer, and *K. E. Taylor, 1998: Relative detectability of greenhouse-gas and aerosol climate change signals. Climate Dyn., in press.

Wigley, T. M. L., 1999: Stabilization of CO₂ concentration levels. *The Carbon Cycle*, T. M. L. Wigley and D. S. Schimel, Eds., Cambridge University Press, in press.

Wigley, T. M. L., 1999: The Science of Climate of Climate Change: Global and U.S. Perspectives. Pew Center on Global Climate Change, 48 pp.

Wigley, T. M. L., *P. J. Jaumann, *B. D. Santer, and *K. E. Taylor, 1999: Relative detectability of greenhouse-gas and aerosol climate change signals. Climate Dyn., 14, 781-790.

Wigley, T. M. L., and D. S. Schimel, Eds., 1999: The Carbon Cycle. Cambridge University Press, in press.

Wigley, T.M.L., *R. L. Smith, and *B. D. Santer, 1999: The autocorrelation function and human influences on climate (response to comment by Tsonis and Elsner). Science, 285 (Technical Comment), 495a.

Wikle, C. K., R. F. Milliff, and W. G. Large, 1999: Surface wind variability on spatial scales from 1 to 1000 km observed during TOGA COARE. J. Atmos. Sci. 56, 2222-2231

Wikle, C. K., L. M. Berliner, and N. Cressie, 1999: Hierarchical Bayesian space-time models. Environmental and Ecological Statistics, in press.

Wilby, R. L., 1998: Modelling extreme rainfall using weather pattern and frontal frequencies. J. Hydrol., 212-213, 380-392.

Wilby, R. L., 1998: Statistical downscaling of daily precipitation using daily airflow and seasonal teleconnection indices. Climate Research, 10, 163–179.

Wilby, R. L., 1998: The hydrology of drought. Rivers Handbook Volume III: Drought in the Humid Temperate Zone, G. E. Petts and G. McGregor, Eds.. Blackwell Science Ltd.. in press.

Wilby, R. L., T. M. L. Wigley, **D. Conway**, **P. D. Jones**, **B. C. Hewitson**, **J. Main**, and **D. S. Wilks**, 1998: Statistical downscaling of general circulation model output: A comparison of methods, *Water Resour*, *Res.*, **34**, 2995-3008.

Wilby, R. L., 1999: The future of eco-hydrology. Eco-Hydrology: Plants and Water in Terrestrial and Aquatic Environments, A. Baird and R. L. Wilby, Eds., Routledge, 346–374.

Wilby, R. L., and D. S. Schimel, 1999: Scales of interaction in eco-hydrological relations. *Eco-Hydrology: Plants and Water in Terrestrial and Aquatic Environments*, A. Baird and R. L. Wilby, Eds., Routledge, 39–77.

Wilby, R. L., and T. M. L. Wigley, 1999: Precipitation predictors for downscaling: Observed and general circulation model relationships. *Inter. J. Clim.* in press

Wilby, R. L., *L. E. Hay, and *G. H. Leavesley, 1999: A comparison of downscaled and raw GCM output: implications for climate change scenarios in the San Juan River basin, Colorado. *Journal of Hydrology*, in press.

Wilby, R. L., and O. J. Tomlinson, 1999: The "Sunday Effect" and weekly cycles of Winter weather in the UK. Weather, in press.

Williamson, D. L., 1999: Numerical approximations for global atmospheric models. *Global Energy and Water Cycles*, K. Browning and R. J. Gurney, Eds., Cambridge University Press, 33-43.

Wilks, D. S., and R. L. Wilby, 1999: The weather generation game: a review of stochastic weather models. *Progress in Physical Geography*, 23, 320, 357

*Yates, D. N., T. G. F. Kittel, and **R. F. Cannon**, 1999: Comparing the correlative Holdridge model to mechanistic biogeographical models for assessing vegetation distribution response to climatic change. *Climatic Change*, in press.

*Zhang, G. J., J. T. Kiehl, and P. J. Rasch, 1998: Response of climate simulation to a new convective paramaterization in the National Center for Atmospheric Research Community Climate Model (CCM3). J. Climate, 11, 2097-2115.

OTHER

Berliner, L. M., *J. A. Royle, C. K. Wikle, and R. F. Milliff, 1998: Bayesian methods in the atmospheric sciences. *Bayesian Statistics 6*, J. M. Bernardo, J. O. Berger, A. P. Dawid, and F. M. Smith, Eds., Oxford University Press, 83-100.

Berliner, L. M., C. K. Wikle, and R. F. Milliff, 1999: Multiresolution wavelet analysis in hierarchical Bayesian turbulence models. Bayesian Inference in Wavelet Based Models, P. Muller and B. Vidakovic, Eds., Springer-Verlag, 341-360.

Dai, A., 1999: Changes in the diurnal cycle of precipitation over the U.S. Proc. 10th Symposium on Global Change Studies, Dallas, TX, Amer. Meteor. Soc., 129-130.

Daly, C., T. G. F. Kittel, *A. McNabb, *J. A. Royle, W. P. Gibson, T. Parzybok, N. Rosenbloom, G. H. Taylor, and H. Fisher, 1999: Development of a 102-year high-resolution spatial climate data set for the conterminous United States. *Proc. 11th Symposium on Applied Climatology, Dallas, TX.* Amer. Meteor. Soc., 480-483.

Deser, C., 1998: Evidence for a wind-driven intensification of the Kuroshio current extension from the 1970s to the 1980s. Extended Abstracts, Rossby-100 Symposium, Stockholm, Sweden, The International Meteorological Institute in Stockholm, The Swedish Geophysical Society, The Swedish Meteorological and Hydrological Institute, the Swedish Natural Science Research Council, The Swedish National Committee for IGBP and WCRP, the Foundations for Wenner-Gren Center, and Henrik Granholms Stiffelse, 87-89.

Deser, C., J. E. Walsh, and *M. S. Timlin, 1998: Arctic sea ice variability in the context of recent wintertime atmospheric circulation trends. Extended Abstracts, Decadal Climate Variability, Williamsburg, VA, in press.

Fuentes, M., S. C. Doney, "David M. Glover, and "Scott McCue, 1999: Spatial structure of satellite ocean color data. *Proc. Joint Statistical Meeting*, Baltimore, MD, American Statistical Association, The International Biometric Society (ENAR and WNAR), the Institute of Mathematical Statistics, and the Statistical Society of Canada, in press.

Hurrell, J. W., and K. E. Trenberth, 1999: A comparison of different global SST data sets. *Proc. 10th Symposium on Global Change Studies*, Dallas, TX. Amer. Meteor. Soc.. 89-90.

Julien, K., J. Werne, *S. Legg, and J. C. McWilliams, 1999: The effects of rotation on the global dynamics of turbulent convection. Solar Convection and Oscillations, J. Christensen-Dalsgaard and F. P. Pipjers, Eds., Kluwer Academic Publishers, in press.

*Keen, T. M., and S. J. Murphy, 1999: Developing a relocatable coastal ocean forecast model. *Proc. Oceanology International 99 Pacific Rim Conf.*, Singapore, Spearhead Exhibitions Ltd., 47–57.

Kittel, T., D. Schimel, N. Rosenbloom, and H. Fisher, 1998: U.S. climate and ecological data available on CD-ROM and on-line. Eos, 79, 47.

Kittel, T., D. Schimel, N. Rosenbloom, and H. Fisher, 1998: VEMAP U.S. climate, vegetation, and soils dataset available on CD ROM and on-line. The Biogeographer, 55, 2.

Madden, R. A., and **H. Lejenäs**, 1998: Semidiurnal fluctuations in mountain torque. *Extended Abstracts, Rossby-100 Symposium*, Stockholm, Sweden, The International Meteorological Institute in Stockholm, The Swedish Geophysical Society, The Swedish Meteorological and Hydrological Institute, the Swedish Natural Science Research Council, The Swedish National Committee for IGBP and WCRP, the Foundations for Wenner-Gren Center, and Henrik Granholms Stiflelse, 225-227.

Meehl, G. A., J. M. Arblaster, and W. G. Strand, 1998: High latitude processes and global decadal time-scale variability in a global coupled GCM. Second ACSYS Conf. Proc., Orcas Island, WA, WCRP-106, WMO/TD 908 162-163.

Milliff, R. F., M. H. Frielich, *W. T. Liu, *R. Atlas, and W.G. Large, 1999: Global ocean surface vector wind observations from space. *Proc. OCEANOBS-99*. St. Raphael, France, Available on-line from: http://www.bom.gov.au/OceanObs99/Program.html.

Otto-Bliesner, B. L., 1999: ENSO and NAO: Present and 6000 years before present as simulated by the NCAR Climate System Model. In 10th Symposium on Global Change Studies, Dallas, TX, Amer. Meteor. Soc., 313-316.

*Tsutsui, J., A. Kasahara, and *H. Hirakuchi, 1999: The impacts of global warming on tropical cyclones-A numerical experiment with the T42 version of NCAR CCM2, *Proc. 23rd Conf. on Hurricanes and Tropical Meteorology*, Dallas, TX, Amer. Meteor. Soc., 1077-1080.

Trenberth, K. E., 1998: A case for slowing the pace of climate change. SOLAR '98 - "Creating the Right Climate." *Proc. 36th Annual Conf. of the Australian and New Zealand Solar Energy Society*, Christchurch New Zealand, Solahart and Canterbury Regional Council, 200-207.

Trenberth, K. E., 1998: Implementation of CLIVAR. Proc. Conf. on the TOGA Coupled Ocean-Atmosphere Response Experiment (COARE), Boulder, CO, World Meteorological Office, 148-149.

Trenberth, K. E., 1998: Forecasts of the development of the 1997-98 El Niño event. *Proc. Second Hayes Symposium on Seasonal to Interannual Climate Variability—The 1997/1998 ENSO Cycle*, Dallas, TX, Amer. Meteor. Soc., 51-54.

Trenberth, K. E., 1998: Forecasts of the development of the 1997-98 El Niño event. Proc. International Symposium Triangle '98, Kyoto, Japan, Japan Marine Science and Technology, Frontier Research System for Global Change, International Pacific Research Center, 14-20.

Trenberth, K. E., 1999: Future ENSO diagnostics. Proc. Second Hayes Symposium on Seasonal to Interannual Climate Variability—The 1997/1998 ENSO Cycle, Dallas, TX, Amer. Meteor. Soc., 110-113.

Trenberth, K. E., 1999: Implementing CLIVAR. Proc. 10th Symposium on Global Change Studies, Dallas, TX, Amer. Meteor. Soc., 1-3.

Trenberth, K. E., 1999: El Nino and global warming. Proc. 10th Symposium on Global Change Studies, Dallas, TX, Amer. Meteor. Soc., 258-260.

Trenberth K. E., 1999: Perspectives on implementing CLIVAR. Exchanges, 4, 5-6.

Trenberth, K. E., 1999: Global climate system change and observations. NASA Scientific Forum on Climate Variability and Global Change, UNISPACE III, Vienna, Austria, NASA/CP-1999-20924, 15-29.

Trenberth, K. E., 1999: The evolution of CLIVAR science. Proc. International. CLIVAR Conf., Paris, France, World Climate Research Project, WCRP-108, WMO/TD 954, IPCO 27, 17–18.

Trenberth, K. E., and *R. A. Clarke, 1999: Preface. Proc. International CLIVAR Conf., Paris, France, World Climate Research Project, WCRP-10, WMO/TD 954, IPCO 27, p iii.

Trenberth, K. E., D. P. Stepaniak, and J. M. Caron, 1999: The global monsoon. *Proc. Second International Conf. on Reanalyses*, Reading, England, World Climate Research Project, in press.

Trenberth, K. E., D. P. Stepaniak, and J. M. Caron, 1999: Global energy and moisture budgets of the atmosphere. *Proc. Second International Conf. on Reanalyses*, Reading, England, World Climate Research Project, in press.

Washington, W. M., J. W. Weatherly, *A. Semtner, G. A. Meehl, *Y. Zhang, T. Bettge, W. Strand, A. Craig, V. Wayland, and *R. James, 1998: Climate simulations with the DOE Parallel Climate Model (PCM). 10th Symposium on Global Change Studies, Dallas, TX, Amer. Meteor. Soc., 365-368.

Wilby, R.L., 1998: Review of "Global Hydrology" by J.A.A. Jones. Transactions of the Institute of British Geographers, 23, 536-537.

Wilby, R. L., 1998: Review of "Regional Climates of the British Isles" by D. Wheeler and J. Mayes, Eds. Bull. Amer. Meteor. Soc., 79, 2880–2881.

Wilby, R. L., 1999: Constructing regional climate scenarios by means of statistical downscaling: A comparison of methods. Proc. Air and Waste Management Association's Second International Specialty Conference. Global Climate Change: Science, Policy and Mitigation/Adaptation Strategies, VIP-89, Volume II, J. Kinsman, C. V. Mathai, M. Baer, E. Holt, and M. Trexler. Eds., Air and Waste Management Association, 942-950.

*Wood, S., *F. Nachtergaele, *D. Nielsen, A. Dai, and *K. Sebastian, 1999: Spatial aspects of the design and targeting of development strategies for fragile lands. Proc. International Conference on Strategies for Poverty Alleviation and Sustainable Resource Management in the Fragile Land of Sub-Saharan Africa, Entebbe, Uganda, National Agricultural Research Organization (Uganda), International Food Policy Research Institute, German Foundation for International Development, and European Commission, in press.

Environmental and Societal Impacts Group

Refereed

*Barnston, A.G., M.H. Glantz, and *Y. He, 1999: Predictive skill of statistical and dynamical climate models in SST forecasts during the 1997-98 El Nino episode and the 1998 La Nina onset. Bulletin of the American Meteorological Society, 80, 2, 217-242.

Betsill, M.M. and R.A. Pielke, Jr., 1998: Blurring the boundaries: Domestic and international ozone politics and lessons for climate change. International Environmental Affairs, 10, 3, 147-172.

Firor, J., 1999: Response to "Rolling the Climate Dice." Bulletin of the American Meteorological Society, 80, 6, 1149-50.

Giorgi, F., and L.O. Mearns, 1999: Introduction to special section: Regional climate modeling revisited. *Journal of Geophysical Research*, **104**, D6, 6335-6352.

Glantz, M.H. (ed.), 1999: <u>Creeping Environmental Problems and Sustainable Development in the Aral Sea Basin</u>. Cambridge University Press. 291 pp.

Glantz, M.H., 1999: Sustainable development and creeping environmental problems in the Aral Sea region. In: M.H. Glantz (ed.), Creeping Environmental Problems and Sustainable Development in the Aral Sea Basin. Cambridge, UK: Cambridge University Press, 1-25.

Glantz, M.H., 1999: El Niño as a hazard-spawner. In: J. Ingleton (ed.), The Nature of Hazards: Commemorative Volume to Celebrate Achievements of International Decade for Natural Disaster Reduction. Leicester, UK: Tudor Rose Publishers, 78-79.

Glantz, M.H., *D.G. Streets, *T.R. Stewart, *N. Bhatti, C.M. Moore, and *C.H. Ros 1999: Exploring the Concept of Climate Surprises: A Review of the Literature on the Concept of Surprise and How It is Related to Climate Change. Second printing redesigned to be distributed at COP4 Conference in Buenos Aires. ESIG/NCAR and Argonne National Labs. 85 pp.

Katz, R.W., 1999: Moments of power transformed time series. Environmetrics, 10, 301-307.

Katz, R.W. and *X. Zheng, 1999: Mixture model for overdispersion of precipitation. Journal of Climate, 12, 2528-2537.

*Kunkel, K.E., R.A. Pielke Jr., and *S.A. Changnon, 1999: <u>Temporal fluctuations in weather and climate extremes that cause economic and human health impacts: A review.</u> Bulletin of the American Meteorological Society, **80**, 6, 1077-1098.

Landsea, C.W., R.A. Pielke Jr., A. Mestas-Nunez, and J. Knaff, 1999: Atlantic basin hurricanes: Indices of climate changes. Climatic Change, 42, 89-129.

Madden, R.A., D.J. Shea, R.W. Katz, and J.W. Kidson, 1999: The potential long-range predictability of precipitation over New Zealand. *International Journal of Climatology*, 19, 405-421.

Mearns, L.O., *I. Bogardi, F. Giorgi, *I. Matyasovszky, and *M. Palecki, 1999: Comparison of climate change scenarios generated from regional climate model experiments and statistical downscaling. *Journal of Geophysical Research*, **104**, D6, 6603-6621.

Mearns, L.O., T. Mavromatis, and E. Tsvetsinskaya, 1999: Compative responses of EPIC and CERES crop models to high and low spatial resolution climate change scenarios. *Journal of Geophysical Research*, **104**, D6, 6623-6646.

Miller, K.M. (Panel Member), Panel on the Human Dimensions of Seasonal-to-Interannual Climate Variability, 1999: <u>Making Climate Forecasts Matter</u>. P.C. Stern and W. Easterling (eds.). Washington, DC: National Academy Press. 192 pp.

*Pfaff, A., *K. Broad, and M.H. Glantz, 1999: Who benefits from climate forecasts? Pielke, R.A. Jr., 1999: Who decides? Forecasts and responsibilities in the 1997 Red River flood. American Behaviorial Science Review, 7, 2, 1-19.

Pielke, R.A. Jr., 1999: Nine fallacies of floods. Climatic Change, 42, 413-438

Pielke, R.A. Jr., 1999: Prediction in the earth sciences and environmental policy making. Eos<u>La Niña, El Niño, and Atlantic hurricane damages in the United States</u>. Bulletin of the American Meteorological Society, 80, 10, 2027-2033.

*Sarewitz, D., and R.A. Pielke Jr., 1999: Prediction in science and policy. Technology in Society, 21, 121-133.

Tsvetsinskaya, E., L.O. Mearns, and *W.E. Easterling, 1999: Investigating the effect of seasonal plant growth and development in 3-dimensional atmospheric simulations. Proceedings of the Ninth International Offshore and Polar Engineering Conference, Brest, France, 30 May-4 June 1999. San Francisco, CA: The International Society of Offshore and Polar Engineers.

< b>Non-Refereed

Doherty, R., and L.O. Mearns, 1999: <u>A Comparison of Simulations of Current Climate from Two Coupled Atmosphere-Ocean Global Climate Models Against Observations and Evaluation of Their Future Climates.</u> Report to NIGEC. Boulder, CO: ESIG/NCAR.

Glantz, M.H., 1999: The language of global warming. Tiempo, 31, 20-22.

Glantz, M.H., 1999: The dying Aral Sea. Public Affairs Section, Work in Progress: A Review of Research Activities of the United Nations University, 15, 2, 12-17.

Glantz, M.H., 1999: Aral Sea: Going, going... almost gone. Calypso Log, Journal of The Cousteau Society, Paris, France, 20-21.

Glantz, M.H., 1999: What we know and don't know about El Niño: A discussion paper. School of Marine Affairs 25th Anniversary: Proceedings of Public Program. Seattle, WA: School of Marine Affairs, 85-89.

Katz, R.W., 1999: Techniques for estimating uncertainty in climate change scenarios and impact studies. In: T.R. Carter, M. Holme, and D. Viner (eds.), Representing Uncertainty in Climate Change Scenarios and Impact Studies. Proceedings of ECLAT-2 Helsinki Workshop. Climatic Research Unit: Norwich, UK, 38-53.

Katz, R.W., 1999: Review of Computational Statistics in Climatology by I. Polyak. Climatic Change, 41, 127-130.

Magistro, J., 1999: Book review of Famine Crimes: Politics and the Disaster Relief Industry in Africa by A. De Waal. American Anthropologist, 100, 3, 844-845.

Magistro, J., 1998: <u>Book review of Living Under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa</u> by P.D. Little and M.J. Watts (eds.). Journal of Political Ecology, 6.

*McKelvey, R., and K. Miller, 1998: Cooperative management of transboundary shared stocks: Some principles drawn from the theory of games.

Abstracts, Ecosystem Considerations in Fisheries Management, Sixteenth Lowell Wakefield Fisheries Symposium. Fairbanks, AK: University of Alaska

Pielke, R.A. Jr., M. Betsill, M. Downton, J. Firor, *D. Jamieson, R. Katz, M. Lahsen, J. Magistro, L. Mearns and K. Miller, 1999: Book review of Human Choice and Climate Change, S. Rayner and E. Malone, eds. Bulletin of the American Meteorological Society, 80, 7, 1441-1443.

Pielke, R.A. Jr., C. Simonpietri, and J. Oxelson, 1999: Thirty Years After Hurricane Camille: Lessons Learned, Lessons Lost. ESIG/NCAR. Boulder, CO.

Pielke, R.A. Jr., B. Enosh, A. Gutierrez, and *M. Mercer, 1999: Extreme Weather Sourcebook: An Educational Report on Damages in the United States Related to Tornadoes, Floods, and Hurricanes. ESIG/NCAR.

*Sarewitz, D., R.A. Pielke Jr., and *R. Byerly Jr., 1999: Prediction: A process, not a product. Geotimes, 44, 4, 29-31.

High Altitude Observatory

Peer Reviewed Publications

Ahn, B.H., B.A. Emery, H.W. Kroehl, and Y. Kamide, 1999: Climatological characteristics of the auroral ionosphere in terms of electric field and ionospheric conductance, J. Geophys. Res., 104 (A5), 10,031-10,040.

Barnes, G., and K.B. MacGregor, 1999: On the magnetohydrodynamics of a conducting fluid between two flat plates, Physics of Plasmas, 6 (8), 3030-3046.

Barnes, G., P. Charbonneau, and K.B. MacGregor, 1999: Angular momentum transport in magnetized stellar radiative zones. III. The solar light-element abundances, Astrophys. J., 511, 466-480.

Biesecker, D.A., B.J. Thompson, S.E. Gibson, D. Alexander, A. Fludra, N. Gopalswamy, J.T. Hoeksema, A. Lecinski, and L. Strachan, 1999: Synoptic Sun during the first Whole Sun Month Campaign: August 10 to September 8, 1996, J. Geophys. Res., 104 (A5), 9679-9689.

Bogdan, T.J., 1999: An Expansion Method for Computing Axisymmetric Sunspot Oscillations, Astrophys. J., 512, 471-483.

Bougher, S.W., S. Engel, R.G. Roble, and B. Foster, 1999: Comparative terrestrial planet thermospheres 2. Solar cycle variation of global structure and winds at equinox, J. Geophys. Res., 104, 16,591-16,611.

Braun, D.C., and Y. Fan, 1998: Helioseismic measurements of the subsurface meridional flow, Astrophys. J., 508, L105-L108

Braun, D.C., and C. Lindsey, 1999: Helioseismic Images of an Active Region Complex, Astrophys. J., 513, L79-L82.

Buonsanto, M. J., S.A. Gonzalez, G. Lu, B.W. Reinisch, and J.P. Thayer, 1999: Coordinated incoherent scatter radar study of the January, 1997 storm, J. Geophys. Res., 104, 24,625-24,637.

Casini, R., and P.G. Judge, 1999: Spectral lines for polarization measurements of the coronal magnetic field. II. Consistent treatment of the Stokes vector for magnetic-dipole transitions, Astrophy. J., 522, 524-539.

Choudhuri, A.R., and M. Dikpati, 1999: On the large-scale diffuse magnetic field of the Sun, Solar Physics, 184, 61-76.

Chun, F. K., D. J. Knipp, M. G. McHarg, G. Lu, B. A. Emery, O.A. Troshichev, and S. Vennerstrom, 1999: Polar cap index as a proxy for hemispheric Joule heating, Geophys. Res. Lett., 26, 1101.

Complex magnetohydrodyamic bow shock topology in field-aligned low- flow around a perfectly conducting cylinder, Physics of Plasmas, 5 (11), 4015-4027.

DeSterck, H., B.C. Low, and S. Poedts, 1999: Characteristic analysis of a complex two-dimensional Magnetohydrodynamic bow shock flow with steady compound shocks, Physics of Plasmas, 6 (3), 954-969.

Dikpati, M., and P. Charbonneau, 1999: A Babcock-Leighton flux transport dynamo with solar-like differential rotation, Astrophys. J., 518, 508-520.

Dikpati, M., and P. Gilman, 1999: Joint instability of latitudinal differential rotation and concentrated toroidal fields below the solar convection zone, Astrophys. J., 512, 417-441.

Donea, A.-C., D.C. Braun, and C. Lindsey, 1999: Seismic images of a solar flare, Astrophys. J., 513, L143-L146.

Emery, B. A., C. Lathuillere, P. G. Richards, R. G. Roble, M. J. Buonsanto, D. J. Knipp, P. Wilkinson, D. P. Sipler, and R. Niciejewski, 1999: Time dependent thermospheric neutral response to the 2-11 November 1993 storm period, J. Atmos. Solar Terr. Phys., 61, 329-350.

Fan, Y., E.G. Zweibel, M.G. Linton, and G.H. Fisher, 1999: The rise of kink-unstable magnetic flux tubes and the origin of configuration sunspots, Astrophys. J., 521, 460-477.

Fontenia, J., O.R. White, P.A. Fox, E.H. Avrett, and R.L. Kurucz, 1999: Calculation of solar irradiances. I. Synthesis of the solar spectrum, Astrophys. J., 518, 480-499.

Galand, M., and A.D. Richmond, 1999: Magnetic mirroring in an incident proton beam, J. Geophys. Res., 104 (A3), 4447-4455.

Galand M., J. Lilensten, W. Kofman, and D. Lummerzheim, 1998: Proton transport model in the ionosphere: 2. Influence of magnetic mirroring and collisions on the angular redistribution in a proton beam, Ann. Geophys., 16, 1308-1321.

Gilman, P.A., and P.A. Fox, 1999: Joint instability of latitudinal differential rotation and toroidal magnetic fields below the solar convection zone. II. Instability for toroidal fields that have a node between the equator and pole, Astrophys. J., 510, 1018-1044.

Gilman, P.A., and P.A. Fox, 1999: Joint instability of latitudinal differential rotation and toroidal magnetic fields below the solar convection zone. III. Unstable disturbance phenomenology and the solar cycle, Astrophys. J., 522, 1167-1189.

Hagan, M.E., M.D. Burrage, J.M. Forbes, J. Hackney, W.J. Randel, and X. Zhang, 1999: GSWM-98: Results for migrating solar tides, J.Geophys. Res., 104 (A4), 6813-6827.

Hagan, M. E., M. D. Burrage, J. M. Forbes, J. Hackney, W. J. Randel, and X. Zhang, 1999: QBO effects on the diurnal tide in the upper atmosphere, Earth, Planets and Space, 51, 571-578.

Harvey, K.L., and O.R. White, 1999: Magnetic and radiative variability of solar surface structures. I. Image decomposition and magnetic-intensity mapping, Astrophys. J., 515, 812-831.

Judge, P.G., P. Charbonneau, S.W. McIntosh, D.A. Diver, J. Ireland, and J.C. Brown, 1998: Spectral decomposition by genetic forward modelling, Astron. Astrophys. Suppl. Ser., 132, 145-153.

Kerr, R.M., and A. Brandenburg, 1998: Evidence for a singularity in ideal magnetohydrodynamics: Implications for fast reconnection, Physical Review Letters, 83 (6), 1155-1158.

Kim, E.J., 1999: Nonlinear dynamo in a simplified statistical model, Physics Letters A, 259, 232-239.

Kuhn, J.R., R.M. MacQueen, J. Streete, G. Tansey, I. Mann, P. Hillebrand, R. Coulter, H. Lin, D. Edmunds, and P. Judge, 1999: Probable detection of a bright infrared coronal emission line of Si IX near 3.93 microns, Astrophys. J., 521, 478-482.

Lantz, S.R., and Y. Fan, 1999: Anelastic magnetohydrodynamic equations for modeling solar and stellar convection zones, Astrophys. J. Supp., 121, 247-264.

Leka, K.D., and A. Skumanich, 1998: The evolution of pores and the development of penumbrae, Astrophys. J., 507, 454-469.

Li, X., D.N. Baker, M. Temerin, T.E. Cayton, G.D. Reeves, R.S. Selesnick, J.B. Blake, G. Lu, S.G. Kenekal, and H.J. Singer, 1999: Rapid enhancements of relativistic electrons deep in the magnetosphere during the May 15, 1997 magnetic storm, J. Geophys. Res., 104, 4467-4476.

Lilensten J., and M. Galand, 1998: Proton/electron precipitation effects on the electron production and density above EISCAT and ESR, Ann. Geophys., 16, 1299-1307.

Lindsey, C., and D.C. Braun, 1998: Acoustic signatures of subphotospheric structure underlying sunspots, Astrophys. J., 509, L129-L132.

Lindsey, C., and D.C. Braun, 1999: Chromatic holography of the sunspot acoustic environment, Astrophys. J., 510, 494-504.

Liner, J.A., Z. Mikic, D.A. Biesecker, R.J. Forsyth, S.E. Gibson, A.J. Lazarus, A. Lecinski, P. Riley, A. Szabo, and B.J. Thompson, 1999: Magnetohydrodynamic modeling of the solar corona during Whole Sun Month, J. Geophys. Res., 104 (A5), 9809-9830.

Linton, M.G., D.H. Fisher, R.B. Dahlburg, and Y. Fan, 1999: Relationship of the multimode kink instability to delta-spot formation, Astrophys. J., 522, 1190-1205.

Lites, B.W., R.J. Rutten, and T.E. Berger, 1999: Dynamics of the solar chromosphere. II Call H_{2v} and k_{2v} Grains Versus Internetwork Fields, Astrophys. J., 517, 1013-1033.

Liu, H.L., P.B. Hays, and R.G. Roble, 1998: A numerical study of gravity wave breaking and impacts on turbulence and mean state, J. Atmospheric Sciences, 56, 2152-2177.

Lu,G., N.A. Tsyganenko, A.T.Y. Lui, H.J. Singer, T. Nagai, and S. Kokubun, 1999: Modeling of time-evolving magnetic fields during substorms, J. Geophys. Res., 104 (A6), 12,327-12,337.

MacGregor, K.B., and P. Charbonneau, 1999: Angular momentum transport in magnetized stellar radiative zones. IV. Ferroro's theorem and the solar tachocline, Astrophys. J., 519, 911-917.

MacQueen, R.M., J.G. Blankner, D.F. Elmore, A.R. Lecinski, and O.R. White, 1998: Initial CHIP He I observations of solar limb activity, Solar Phys., 182, 97-105.

Manson, A. H., C. E. Meek, M. Hagan, C. Hall, W. Hocking, J. MacDougall, S.J. Franke, D. Riggin, D.C. Fritts, R.A. Vincent, and M. D. Burrage, 1999: Seasonal variations of the semi-diurnal and diurnal tides in the MLT: Multi-year MF radar observations from 2 to 70° N and the GSWM tidal model, J. Almos. Solar Terr. Phys., 61, 809-828.

Meyer, C.K., 1999: Gravity wave interactions with the diurnal propagating tide, J. Geophys. Res., 104 (4), 4223-4239.

Palo, S.E., R.G. Roble, and M.E. Hagan, 1999: Middle atmosphere effects of the quasi-two-day wave determined from a general circulation model, Earth, Planets, and Space, 51, 629-647.

Peter, H., 1999: The chromosphere in coronal holes and the quiet sun network: A He I (584 A) full-disk scan by SUMER/SOHO, Astrophys. J., 522, L77-L80.

Peter, H., 1999: Analysis of transition-region emission-line profiles from full-disk scans of the Sun using the SUMER instrument of SOHO, Astrophys. J., 516, 490-504.

Peter, H., and P.G. Judge, 1999: On the doppler shifts of solar ultraviolet emission lines, Astrophys. J., 522, 1148-1166.

Pinnock, M., A.S. Rodger, K.B. Baker, G. Lu, and M. Hairston, 1999: Conjugate observations of the day side reconnection electric field: A GEM boundary layer campaign, Ann. Geophys., 17, 443-454.

Rast, M.P., 1998: The thermal starting plume as an acoustic source, Astrophys. J., 524, 462-468.

Ridley, A. J., G. Lu, C. R. Clauer, and V. O. Papitashvili, 1999: Reply to "Comment on "A statistical study of the ionospheric convection response to changing interplanetary magnetic field conditions using the assimilative mapping of ionospheric electrodynamics technique" by Ridley et al." by M. Lockwood and S. W. H. Cowley, J. Geophys. Res., 104, 4393-4396.

Riley, P., J.T. Gosling, D.J. McComas, V.J. Pizzo, J.G. Luhmann, D. Biesecker, R.J. Forsyth, J.T. Hoeksema, A. Lecinski, and B.J. Thompson, 1999: Relationship between Ulysses plasma observations and solar observations during the Whole Sun Month campaign, J. Geophys. Res., 105 (A5), 0271 0270

Shepherd, M.G., W.E. Ward, B. Prawirosoehardjo, R.G. Roble, S.-P. Zhang, and D.Y. Wang, 1999: Planetary scale and tidal perturbations in mesospheric temperature observed by WINDII, Earth, Planets and Space, 51, 593-610.

Sigwarth M., K.S. Balasubramaniam, M. Knölker, and W. Schmidt, 1999: Dynamics of solar magnetic elements, Astron. & Astrophys., 349, 941.

Skumanich, A., 1999: The evolution of photospheric magnetic structures in terms of the size-flux relationship, Astrophys. J., 512, 975-984.

Sofia, S., P.A. Fox, and K. Schatten, 1999: Forecast update for activity cycle 23 from a dynamo-based method, Geophys. Res. Letters, 25 (22), 4149-4152.

St. Cyr, O.C., J.T. Burkepile, A.J. Hundhausen, and A.R. Lecinski, 1999: A comparison of ground-based and spacecraft observations of coronal mass ejections from 1980-1989, J. Geophys. Res., 104 (A6), 12,493-12,506.

Stening, R.J., A.D. Richmond, and R.G. Roble, 1999: Lunar tides in the Thermosphere-Ionosphere-Electrodynamics General Circulation Model, J. Geophys. Res., 104, 1-13.

Zheligovsky V.A., and D.J. Galloway, 1998: Dynamo action in Christopherson hexagonal flow, Geophys. Astrophys. Fluid Dynamics, 88, 277-293.

Other Publications

Ahn, B.H., B.A. Emery, H.W. Kroehl, and Y. Kamide, 1998: The average characteristics of the electric field and ionosphere conductance distributions over the auroral region. Substorms-4: Proc. of the 4th International Conference on Substorms, Lake Hamana, Japan, Astrophysics and Space Science Library. 695-698.

Bogdan, T.J., I. Ruedi, S.K. Solanki, and P. Cally, 1999: Sunspot magnetic oscillations: Comparison between observations and models, in Proceedings of the Second Solar Polarization Workshop: Solar Polarization, Bangalore, India, Indian Institute of Astrophysics, 337-347.

Galand M., J. Lilensten, D. Toublanc, and S. Maurice, 1999: The ionosphere of Titan: Ideal diurnal and nocturnal cases, Icarus, 140, 92-105.

Gilman, P.A., and P. Charbonneau, 1999: Creation of twist at the core-convection zone interface, Magnetic Helicity in Space and Laboratory Plasmas, Geophysical Union, Geophysical Monograph 111, 75-82.

Lindsey, C., and D.C. Braun, 1998: Helioseismic signatures of subphotospheric structure beneath active regions, in Proceedings of the SOHO6/GONG 98 Workshop (ESA SP-418), October 1998.

Low, B.C., 1999: Magnetic energy and helicity in open space, Magnetic Helicity in Space and Laboratory Plasmas, Geophysical Union, Geophysical Monograph 111, 25-32.

Low, B.C., 1999: Coronal mass ejections, flares and prominences. Proc. Nineth International Solar Wind Conference, Washington, D. C., AIP, 109-

Lu, G., A. D. Richmond, Y. Kamide, D. Lummerzheim, M. Brittnacher, and G. Parks, 1998: Global ionospheric convection during substorm expansion. Substorms-4: Proc. of the 4th International Conference on Substorms, Lake Hamana, Japan, Astrophysics and Space Science Library, 617-622.

Peter, H., 1999: Doppler shifts of solar UV emission lines and the source region of the (fast) solar wind, in Solar Wind 9, edited by S.R. Habbal, R. Esser, J.V. Hollweg, and P.H. Isenberg, AIP CP471, 281-284.

Rast, M.P., 1999: Thermal starting plumes, solar granulation, and the excitation of solar acoustic oscillations. Proc. 19th Sacrameto Peak Summer Workshop: High Resolution Solar Physics: Theory, Observations, and Techniques, Sunspot, New Mexico, Astron. Soc. Pac., 443–455.

Rutten, R. J., B. de Pontieu, and B. W. Lites, 1999: Internetwork grains with TRACE. Proc. 19th Sacrameto Peak Summer Workshop: High Resolution Solar Physics: Theory. Observations. and Techniques. Sunspot. New Mexico. Astron. Soc. Pac., 383-388.

Mesoscale and Microscale Meteorology

1. Refereed

Barth, M. C., and A. T. Church, 1999: The regional and global influence of sulfate aerosols from Mexico City and southeast China. J. Geophys. Res., In Press

Barth, M. C., P. J. Rasch, J. Kiehl, C. Benkovitz, and S. Schwartz, 1999: Sulfur chemistry in the National Center for Atmospheric Research Community Climate Model: Description, evaluation, features and sensitivity to aqueous chemistry. J. Geophys. Res., In Press.

Bretherton, C. S., M. K. Macvean, P. Bechtold, A. Chlond, W. R. Cotton, J. Cuxart, H. Cuijpers, M. Khairoutdinov, B. Kosovic, D. Lewellen, C.-H. Moeng, P. Slebesma, B. Stevens, I. Sykes, and M. C. Wyant, 1999: An intercomparison of radiatively-driven entrainment and turbulence in a smoke cloud, as simulated by different numerical models. Ouart J. Roy. Meteor. Soc., 125, 391-423.

Bruintjes, R. T., 1999: A review of cloud seeding experiments to enhance precipitation and some new prospects. Bull. Amer. Meteor. Soc., 80, 805-820.

Bunkers, M. J., B. Klimowski, J. W. Zeitler, G. Thompson, and M. L. Weisman, 1999: Predicting supercell motion using a new hodograph technique. Wea. Forcasting, In Press.

Carbone, R. E., J. Tuttle, W. A. Cooper, V. Grubisic, and W. -C. Lee, 1998: Tradewind rainfall near the windward coast of Hawaii. Mon. Wea. Rev., 126(11), 2847-2863.

Carbone, R. E., 1999: Atmospheric observation in weather prediction. Hazards and Disasters: A Series of Definitive Major Works, A. Keller, Ed., Routledge Press, In Press.

Cherington, M., D. Breed, P. R. Yarnell, and W. E. Smith, 1998: Lightning injuries during snowy conditions. British Journal of Sports Medicine, 32, 333-335.

Clark, T. L., L. Radke, J. L. Coen, and D. Middleton, 1999: Analysis of small-scale convective dynamics in a crown fire using infrared video camera imagery. J. Appl. Meteor., 38, 1401-1420.

Clarke, A., D. Davis, V. N. Kapustin, F. Eisele, G. Chen, I. R. Paluch, D. H. Lenschow, A. R. Bandy, D. C. Thornton, J. Moore, L. Mauldin, D. Tanner, M. Litchy, J. Collins, and G. Albercook, 1998: Particle nucleation in the tropical boundary layer and its coupling to marine sulfur sources. Science, 282, 39-92.

Costen, R. C., and L. J. Miller, 1998: Pulsing inertial oscillation, supercell storms, and surface mesonetwork data. J. Engineering Mathematics, 34, 277-299.

Crook, N. A., and J. B. Klemp, 1999: Lifting at convergence lines. J. Atmos. Sci., In Press.

Davis, C. A., and F. Carr, 1999: Summary of the 1998 Workshop on Mesoscale Model Verification. Bull. Amer. Meteor. Soc., In Press.

Davis, C. A., and M. T. Stoelinga, 1999: Interpretation of the effect of mountains on synoptic-scale baroclinic waves. J. Atmos. Sci., 56, 3303-3320.

Davis, C. A., and M. T. Stoelinga, 1999: The transition to topographic normal modes. J. Atmos. Sci., 56, 3321-3330.

Davis, C. A., S. Low-Nam, M. A. Shapiro, X. Zou, and S. K. Krueger, 1999: Direct retrieval of wind from total ozone mapping spectrometer (TOMS) data: Examples from FASTEX. Quart. J. Roy. Meteor. Soc., In Press.

Davis, C. A., T. Warner, and E. Astling, 1999: Development and application of an operational, relocatable, mesogamma-scale weather analysis and forecast system. Tellus, In Press.

Doyle, J. D., and M. A. Shapiro, 1999: Flow response to large-scale topography: The Greenland tip jet. Tellus, 51(A), In Press.

Ferretti, R., S. Low-Nam, and R. Rotunno, 1999: Numerical simulations of the Piedmont flood of 4-6 November 1994. Tellus, In Press.

Giez, A., G. Ehret, R. L. Schwiesow, K. J. Davis, and D. H. Lenschow, 1999: Water vapor flux measurements from ground-based vertically-pointed water vapor differential absorption and Doppler lidars. J. Atmos. Oceanic Technol., 16, 237-250.

Grabowski, W. W., and P. A. Vaillancourt, 1999: Comments on "Preferential concentration of cloud droplets by turbulence: Effects on the early evolution of cumulus cloud droplet spectra" by Shaw et al. J. Atmos. Sci., 56, 1433-1436.

Grabowski, W. W., and P. K. Smolarkiewicz, 1999: CRCP: A cloud resolving convection parameterization for modeling the tropical convecting atmosphere. Physica D, 133, 171-178.

Grabowski, W. W., 1999: Dynamics of cumulus entrainment. Geophysical and Astrophysical Convection, R. Kerr and P. Fox, Eds., In Press.

Grabowski, W. W., 1999: A parameterization of cloud microphysics for long-term cloud-resolving modeling of tropical convection. Atmos. Res., 52, 17-41.

Grabowski, W. W., X. Wu, and M. W. Moncrieff, 1999: Cloud resolving modeling of tropical cloud systems during Phase II of GATE. Part III: Effects of microphysical parameterizations. J. Atmos. Sci., 56, 2384-2402.

Guo, Y.-R., Y.-H. Kuo, J. Dudhia, D. B. Parsons, and C. Rocken, 1999: Four-dimensional variational data assimilation of heterogeneous mesoscale observations for a strong convective case. Mon. Wea. Rev., In Press.

Haymet, A. D. J., L. G. Ward, M. M. Harding, and C. A. Knight, 1998: Valine substituted winter flounder "antifreeze:" Preservation of ice growth hysteresis. FEBS Letters, 430, 301-306.

Heymsfield, A. J., and G. M. McFarquhar, 1999: Mid-latitude and tropical cirrus microphysical properties. Cirrus, In Press.

Heymsfield, A. J., and J. Iaquinta, 1999: Cirrus crystal terminal velocities. J. Atmos. Sci., In Press.

Howell, J. F., and J. Sun, 1999: Surface layer fluxes in stable conditions. Bound.-Layer Meteor., 90, 495-520.

Igau, R. C., M. A. LeMone, and D. Wei, 1999: Updraft and downdraft cores in TOGA COARE: Why so many buoyant downdraft cores? J. Atmos. Sci., 56, 2232-2245.

Kiehl, J., T. L. Schneider, P. J. Rasch, M. C. Barth, and J. Wong, 1999: Radiative forcing due to sulfate aerosols from simulations with the NCAR community climate model (CCM3). J. Geophys. Res., In Press.

Knight, C. A., 1999: On frozen pond. Weatherwise, 52(1), 35-40.

Larsen, R., C. A. Knight, K. T. Rider, and E. D. Sloan, 1999: Melt growth and inhibition of ethylene oxide clathrate hydrate. J. of Crystal Growth, 204, 376-381.

LeMone, M. A., E. Zipser, and S. B. Trier, 1998: The role of environmental shear and thermodynamic conditions in determining the structure and evolution of mesoscale convective systems during TOGA COARE. J. Atmos. Sci., 55, 3493-3518.

LeMone, M. A., M. Zhou, C.-H. Moeng, D. H. Lenschow, L. J. Miller, and R. L. Grossman, 1999: An observational study of wind profiles in the baroclinic convective mixed layer. Bound. -Layer Meteor., 90, 47-82.

Lenschow, D. H., I. R. Paluch, A. R. Bandy, D. C. Thornton, D. R. Blake, and I. Simpson, 1999: Use of a mixed-layer model to estimate dimethyl sulfide flux and application to other trace gas species. J. Geophys. Res., In Press.

Lenschow, D. H., P. Krummel, and S. Siems, 1999: Measuring entrainment, divergence and vorticity on the mesoscale from aircraft. J. Atmos. Oceanic Technol., 16(10), 1384-1400.

Margolin, L. G., M. Shaskov, and P. K. Smolarkiewicz, 1999: A discrete operator calculus for finite difference approximations. Computer Methods in Applied Mechanics and Engineering, In Press.

Margolin, L. G., P. K. Smolarkiewicz, and Z. Sorbjan, 1999: Large-eddy simulations of convective boundary layers using nonoscillatory differencing. Physica-D, 133, 390-397.

Maruyama, M., T. Ashida, and C. A. Knight, 1999: Disc crystals of ice grown in air-free water: No effect of dissolved air on the morphology. J. of Crystal Growth, 205, 391-394.

McFarquhar, G. M., A. J. Heymsfield, A. Macke, J. Iaquinta, and S. M. Aulenbach, 1999: Use of observed ice crystal sizes and shapes to calculate mean scattering properties and multi-spectral radiances: CEPEX 4 April 1993 case study. J. Geophys. Res., In Press.

McFarquhar, G. M., A. J. Heymsfield, J. Spinhirne, and W. Hart, 1999: Subvisual tropopause tropical cirrus: Observations and radiative impacts. J. Atmos. Sci., In Press.

McWilliams, J. C., C.-H. Moeng, and P. P. Sullivan, 1999: Turbulent fluxes and coherent structures in marine boundary layers: Investigations by large-eddy simulation. Air-Sea Exchange: Physics, Chemistry, Dynamics, and Statistics, G. Geernaert, Ed., Kluwer Academic Publishers, In Press

Moeng, C.-H., and B. Stevens, 1999: Marine stratocumulus and its representation in GCMs. General Circulation Model Development: Past, Present, and Future, Proceedings of a Symposium in Honor of Professor Akio Arakawa, D. A. Randall, Ed., Academic Press, In Press.

Moeng, C.-H., P. P. Sullivan, and B. Stevens, 1999: Including radiative effects in an entrainment-rate formula for buoyancy-driven PBLs. J. Atmos. Sci., 56, 1031-1049.

Moncrieff, M. W., and C. Liu, 1999: Convection initiation by atmospheric density currents: Role of convergence, shear and dynamical organization. Mon. Wea. Rev., 127, 2655-2664.

Moncrieff, M. W., and W. -K. Tao, 1999: Cloud resolving modeling. Global Water and Energy Cycles, Browning and Gurney, Eds., Cambridge University Press, 200-212.

Muraki, D. J., C. Snyder, and R. Rotunno, 1999: The next-order corrections to quasi-geostrophic theory. J. Atmos. Sci, 56, 1547-1560.

Muschinski, A., P. P. Sullivan, D. B. Wuertz, R. J. Hill, S. A. Cohn, D. H. Lenschow, and R. J. Doviak, 1999: First large-eddy simulation of clear-air wind-profiler signals. Radio Sci., In Press.

Naveau, P., M. W. Moncrieff, J. -I. Yano, and X. Wu, 1999: Exploratory statistical analysis of tropical oceanic cloud systems using discrete wavelet transforms. Statistics for Understanding the Atmosphere, Springer-Verlag, In Press.

Powers, J. G., and M. T. Stoelinga, 1999: A coupled air-sea mesoscale model: Experiments in atmospheric sensitivity to marine roughness. Mon. Wea. Rev., 127. In Press.

Rasch, P. J., M. C. Barth, J. Kiehl, S. Schwartz, and C. Benkovitz, 1999: A description of the global sulfur cycle and its controlling processes in the National Center for Atmospheric Research Community Climate Model. J. Geophys. Res. In Press.

Reinking, R. F., R. T. Bruintjes, B. W. Bartram, B. W. Orr, and B. E. Martner, 1999: Chaff tagging for tracking the evolution of cloud parcels. J. Wea. Modification, 31, 119-133.

Rotunno, R., V. Grubisic, and P. K. Smolarkiewicz, 1999: Vorticity and potential vorticity in mountain wakes. J. Atmos. Sci., 56, 2796-2810.

Saiki, E. M., C.-H. Moeng, and P. P. Sullivan, 1999: Large-eddy simulation of the stably stratified planetary boundary layer. Bound.-Layer Meteor., In Press.

Skamarock, W. C., R. Rotunno, and J. B. Klemp, 1999: Models of coastally trapped disturbances. J. Atmos. Sci., 56, 3349-3365.

Snyder, C., 1998: Error growth in flows with finite-amplitude waves or other coherent structures. J. Atmos. Sci., 56, 500-506.

Sommerfeld, R. A., C. A. Knight, and N. F. Laird, 1998: Reply. Geophys. Res. Lett., 25 (23), 4391-4392.

Stevens, B., C.-H. Moeng, and P. P. Sullivan, 1999: Large-eddy simulations of radiatively driven convection: Sensitivities to the representation of small scales. J. Atmos. Sci., In Press.

Stith, J., J. E. Dye, B. A. Ridley, P. Laroche, E. Defer, K. Baumann, G. Hubler, and R. Zerr, 1999: NOx signatures from lightning flashes. J. Geophys. Res., 104, 16,081-16,089.

Sullivan, P. P., J. C. McWilliams, and C.-H. Moeng, 1999: Simulation of turbulent flow over idealized water waves. J. Fluid Mech., In Press.

Sun, J., 1999: Thermal and momentum roughness lengths. Bound. -Layer Meteor., In Press.

Sun, J., and W. J. Massman, 1999: Ozone transport in California Ozone Deposition Experiment. J. Geophys. Res., 104, 11939-11948.

Sun, J., W. J. Massman, and D. Grantz, 1999: Aerodynamic variables in the bulk formulation of turbulence fluxes. Bound.-Layer Meteor., 91, 109-125.

Szunyogh, I., Z. Toth, K. Emanuel, C. Snyder, J. Woolen, W.-S. Wu, T. Marchok, R. E. Morss, and C. Bishop, 1999: Ensemble-based targeted observations during FASTEX. Quart. J. Roy. Meteor. Soc., In Press.

Tucker, D. F., and N. A. Crook, 1999: The generation of a mesoscale convective system from mountain convection. Mon. Wea. Rev., 127, 1259-1273.

Tuttle, J., R. E. Carbone, and J. -J. Wang, 1999: Tradewind rainfall near the windward coast of Hawaii: Corrected data yield improved results. Mon. Wea. Rev., In Press.

Weisman, M. L., and R. Rotunno, 1999: On the use of vertical wind shear versus helicity in interpreting supercell dynamics. J. Atmos. Sci., In Press.

Wilson, J. W., N. A. Crook, C. K. Mueller, and J. Sun, 1998: Nowcasting thunderstorms: A review and current status. Bull. Amer. Meteor. Soc., 79, 2079-2099.

Wu, X., and M. W. Moncrieff, 1999: Effects of sea surface temperature and large-scale dynamics on the thermodynamic equilibrium state and convection over the tropical western Pacific. J. Geophys. Res., 104, 6093-6100.

Wu, X., W. D. Hall, W. W. Grabowski, M. W. Moncrieff, W. D. Collins, and J. Kiehl, 1999: Long-term behavior of cloud systems in TOGA COARE and their interactions with radiative and surface processes. Part II: Effects of ice microphysics on cloud-radiation interaction. J. Atmos. Sci., 56, 3177-3105.

Zou, X., F. Vandenberghe, B. Wang, M. Gorbunov, Y. -H. Kuo, S. Sokolovskiy, J. C. Chang, J. G. Sela, and R. A. Anthes, 1999: A raytracing operator and its adjoint for the use of GPS/MET refraction angle measurements. J. Geophys. Res., 104 (D18), 22.301-22.318.

2. Non-Refereed

Barth, M. C., N. Patton, and K. J. Davis, 1999: Large eddy simulations with chemistry. AGU Spring Meeting, Boston, MA, AGU, S48.

Breed, D., R. T. Bruintjes, V. Salazar, and H. Ramirez-Rodriguez, 1999: Microphysical characteristics of convective clouds in northern Mexico. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 57-59.

Bruintjes, R. T., D. Breed, B. Foote, M. J. Dixon, B. G. Brown, V. Salazar, and H. Ramirez-Rodriguez, 1999: Program for the augmentation of rainfall in Coahuila (PARC): Overview and design. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 53-56.

Bruintjes, R. T., G. L. Kok, D. Breed, and V. Salazar, 1999: Hygroscopic seeding: Theory and practice. 7th WMO Scientific Conference on Weather Modification, Chang Mai, Thailand, WMO, 65-68.

Bruintjes, R. T., 1999: Variations of cloud condensation nuclei (CCN) and aerosol particles over Thailand and the possible impacts on precipitation formation in clouds. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 33-36.

Bruintjes, R. T., R. M. Rasmussen, W. Sukarnjanaset, P. Sudhikoses, N. Tantipubthong, and M. Karmini, 1999: The effects of the smoke and haze from the Indonesian fires on cloud microstructure and precipitation development. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 533-536.

Carbone, R. E., J. Tuttle, L. J. Miller, and S. B. Trier, cited 1999: Warm season precipitation episodes in central North America. 22nd General Assembly of the IUGG, Birmingham, UK, IUGG. [Available on-line from http://www.bham.ac.uk/IUGG99/.]

Carbone, R. E., J. Tuttle, K. Miller, R. Oye, and S. B. Trier, 1999: Large domain studies of warm season precipitation episodes. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 596-599.

Carbone, R. E., T. D. Keenan, J. M. Hacker, and J. W. Wilson, 1999: Tropical island convection in the absence of significant topography. Part I: Sea breezes and early convection. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 49-54.

Chen, F., T. Warner, and K. W. Manning, 1999: Simulation of the 1996 Buffalo Creek flash flood event and its sensitivity to land surface variability Workshop on Land-Surface Modeling and Applications to Mesoscale Models, Boulder, CO, NCAR, 5-9.

Clark, T. L., J. L. Coen, L. Radke, M. Reeder, and D. R. Packham, 1998: Coupled atmosphere-fire dynamics. 3rd International Conference on Forest

Fire Research, Coimbra, Portugal, 67-82.

Crook, N. A., and J. B. Klemp, 1999: Lifting at convergence lines. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 32-37.

Dudhia, J., and F. Chen, cited 1999: Using a mesoscale model coupled to a land-surface model to simulate surface fluxes at high resolution. 9th Annual ARM Science Team Meeting, San Antonio, TX, DOE/ARM. [Available on-line from high-www.arm.gov/docs/documents/technical/conf_9903/author.html.]

Dudhia, J., 1999: Recent development in MM5. 9th Annual PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 3-5.

Dudhia, J., 1999: WRF: Physics and community issues. 9th Annual PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 35-38.

Dudhia, J., Y.-R. Guo, Y. -H. Kuo, and D. B. Parsons, 1999: Assimilation of diverse mesoscale data in simulations of an Oklahoma mesoscale convective system using 4DVAR methods. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 332-337.

Dye, J. E., T. Matejka, P. Laroche, E. Defer, G. Hubler, and S. A. Rutledge, 1999: Lightning discharge locations relative to reflectivity and updraft/downdraft structures in a Colorado thunderstorm. 11th International Conference on Atmospheric Electricity, Guntersville, AL, International Commission on Atmospheric Electricity, 530-533.

Grabowski, W. W., and P. K. Smolarkiewicz, 1999: Cloud-resolving convection parameterization (CRCP): A novel approach for modeling convecting atmospheres. 12th Conference on Atmospheric and Oceanic Fluid Dynamics, New York, NY, Amer. Meteor. Soc., 48-49.

Grabowski, W. W., and P. K. Smolarkiewicz, 1999: Toward cloud-resolving modelling of large-scale tropical circulations: Cloud-resolving convection parameterization. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 879-880.

Grubisic, V. and M. Moncrieff, 1999: Parameterization of momentum transport by organized convection. 8th Conference on Mesoscale Processes, Boulder, CO. Amer. Meteor. Soc., 14-17.

Guichard, F., J. Dudhia, and D. B. Parsons, 1999: Improvement of MM5 surface fields with the RRTM longwave radiation scheme. 9th Annual PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 124-126.

Guo, Y.-R., J. Dudhia, and Y. -H. Kuo, 1999: Impact of different moist physics on 4DVAR: A case study. 9th PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 65-67.

Guo, Y.-R., J.-W. Bao, and Y. -H. Kuo, 1999: A comparison of mesoscale adjoint models used for targeted observation planning: The perspective of sensitivity analysis. 3rd Symposium on Integrated Observing Systems, Dallas, TX, Amer. Meteor. Soc., 162-163.

Guo, Y.-R., Y.-H. Kuo, J. Dudhia, and D. B. Parsons, 1998: Assimilation of ARM WVIOP-96 data with MM5-4DVAR system. 8th Atmospheric Radiation Measurement (ARM) Science Team Meeting, Tucson, AZ, DOE/ARM, 295-301.

Guo, Y.-R., Y.-H. Kuo, J. Dudhia, and D. B. Parsons, cited 1999: Assimilation of ARM WVIOP-96 data for an Oklahoma mesoscale convective system. 9th Atmospheric Radiation Measurement (ARM) Science Team Meeting, San Antonio, TX, DOE/ARM. [Available on-line from http://www.arm.gov/docs/documents/technical/conf_9903/author.html.]

Huang, W., and J. G. Powers, 1999: Verification of MM5 real-time forecasts at NCAR. 9th PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 131-136.

Huebert, B., and D. H. Lenschow, 1999: What have Lagrangian experiments accomplished? IGACtivities Newsletter, 4-8

LeMone, M. A., and R. L. Grossman, 1999: Evolution of potential temperature and moisture during the morning: CASES-97. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 500-503.

LeMone, M. A., and R. L. Grossman, 1999: Evolution of potential temperature and moisture during the morning: CASES-97. 14th Conference on Hydrology, Dallas, TX, Amer. Meteor. Soc., 446-449.

LeMone, M. A., 1999: The fair weather boundary layer in GATE. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 7-11.

LeMone, M. A., W. T. Pennell, and R. L. Grossman, 1999: The fair weather boundary layer in GATE. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 8-11.

Lenschow, D. H., A. S. Frisch, B. E. Martner, B. W. Orr, and D. Fitzjarrald, 1999: On the change in the vertical velocity structure through the PBL during the daylime development of cumulus clouds over a boreal forest. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 3-32.

Lewis, S. A., M. A. LeMone, and D. P. Jorgensen, 1999: Three dimensional structure and surface fluxes associated with the late-stage squall-line MCS. Conference on the TOGA Coupled Ocean-Atmosphere Response Experiment (COARE), Boulder, CO, WMO, 256-257.

Matsumura, T., J. C. Derber, J. G. Yoe, F. Vandenberghe, and X. Zou, 1999: The inclusion of GPS limb sounding into NCEP's global data assimilation system. Office Note 426, NOAA/NWS/NCEP, 95 pp.

McFarquhar, G. M., A. J. Heymsfield, and G. G. Melvin, 1999: Upper level vertical air velocities deduced from TOGA COARE data and their relationship to cloud radiative properties. Conference on the TOGA Coupled Ocean-Atmosphere Response Experiment (COARE), WMO/TD No. 940, Boulder. CO. WMO. 217-218.

McWilliams, J. C., and P. P. Sullivan, 1999: Surface-wave effects on marine boundary layers, The Fluid Dynamics of the Environment: A Symposium Honoring Sidney Leibovich, J. Lumley, Ed., Springer-Verlag, In Press.

Michalakes, J., J. Dudhia, D. Gill, J. B. Klemp, and W. C. Skamarock, 1999: Design of a next-generation weather research and forecast model. 8th ECMWF Workshop on the Use of Parallel Processors in Meteorology, Reading, UK, European Center for Medium Range Weather Forecasting, 117-124.

Moeng, C.-H., and P. P. Sullivan, 1999: The role of cloud-top radiative cooling in stratocumulus-topped PBL. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 441-444.

Moncrieff, M., 1999: Dynamical models of momentum transport by organized convection. IUGG XXII General Assembly, Birmingham, UK, IUGG, B270.

Moncrieff, M. W., 1999: Legacy of TOGA COARE for GEWEX. WMO/WCRP Publication Series, Boulder, CO, WMO, 80-94.

Moncrieff, M. W., and C. Liu, 1999: Convection initiation by density currents: Effect of shear on convergence. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 219-220.

Naveau, P. and M. Moncrieff, 1999: Statistical analysis of the maximum vertical wind velocity in the western Pacific. IUGG XXII General Assembly, Birmingham, UK, IUGG, B269.

Ochs III, H. T., N. F. Laird, R. M. Rauber, K. Beard, and L. J. Miller, 1999: Radar/model comparison of precipitation initiation in tropical cumulus clouds. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 337-342.

Roberts, R., D. Breed, and P. C. Kennedy, 1999: Multi-parameter radar, aircraft, and satellite signatures associated with precipitation formation in Colorado convective clouds. 29th Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 896-899.

Roberts, R., T. Saxon, C. K. Mueller, C. Wilson, N. A. Crook, J. Sun, and S. Henry, 1999: Operational application and use of NCAR's published thunderstorm nowcasting system. 15th Conference on Interactive Information on Processing Systems, Dallas, TX, Amer. Met. Soc., 158-161.

Rotunno, R., 1999: Unstable baroclinic waves beyond quasigeostrophic theory. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 184-189.

Saiki, E. M., C.-H. Moeng, and P. P. Sullivan, 1999: Large-eddy simulation of the stably stratified planetary boundary layer. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 221-214.

Schlatter, T., F. Carr, R Langland, R. E. Carbone, N. A. Crook, R. W. Daley, J. C. Derber, and S. L. Mullen, 1999: A five year plan for research related to the assimilation of meteorological data. UCAR Technical Report #443, 41 pp., In Press.

Senff, C. J., K. J. Davis, D. H. Lenschow, E. V. Browell, and S. Ismail, 1999: Evaluation of terms in the water vapor budget using airborne DIAL and in situ measurements from the Southern Great Plains Experiment. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 516-518.

Shapiro, M. A., D. Bartels, J. Franklin, A Marroquin, C. Girt, J. D. Doyle, J. Schmidt, T. L. Clark, and R. Gall, 1999: On the laminar structure of the atmosphere: Edwin Danielsen's (1959) perspective of the tropopause. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 213-217.

Skamarock, W. C., R. Rotunno, and J. B. Klemp, 1999: Dynamical models of coastally trapped disturbances and Catalina eddies. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 422-427.

Smolarkiewicz, P. K., and L. G. Margolin, 1999: MPDATA--a multipass donor cell solver for geophysical flows. International Conference on Godunov Methods, Theory and Applications, Oxford, 65.

Smolarkiewicz, P. K., V. Grubisic, L. G. Margolin, and A. A. Wyszogrodski, 1999: Forward-in-time differencing for fluids: Nonhydrostatic modeling of fluid motions on a sphere. Recent Developments in Numerical Methods for Atmospheric Modeling, Reading, UK, ECMWF, 21-43.

Sullivan, P. P., J. C. McWilliams, and C.-H. Moeng, 1999: Turbulent shear flow over moving sinusoidal boundaries. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 241-244.

Sullivan, P. P., J. C. McWilliams, and C.-H. Moeng, 1999: Turbulent shear flow over moving sinusoidal boundaries. Turbulence and Shear Flow-1, S. Banerjee and J. K. Eaton, Eds., Begell House, 577-582.

Sun, J., 1999: Thermal and momentum roughness lengths. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 330-342

Sun, J., and N. A. Crook, 1999: Real-time boundary layer wind and temperature analysis using WSR-88D observations. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 44-47.

Sun, J., and W. J. Massman, 1999: Ozone transport in California ozone deposition velocity. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 167-170.

Sun, J., L. Mahrt, D. Vickers, J. I. Macpherson, R. J. Dobosy, B. Kustas, and J. Prueger, 1999: Spatial variation of moisture flux in SGP. 14th Conference on Hydrology, Dallas, TX, Amer. Meteor. Soc., 160-162.

Sun, J., L. Mahrt, D. Vickers, J. Wong, T. L. Crawford, C. Vogel, E. Dumas, P. Munrad, and D. Vandemark, 1999: Air-sea interaction in the coastal shoaling zone. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 343-346.

Sun, J., N. O. Jensen, P. Hummelshoej, H. Jorgensen, L. Mahrt, and Z. Chen, 1998: Study of forest-atmospheric interaction over a beech forest. 23rd Conference on Agricultural and Forest, Albuquerque, NM, Amer. Meteor. Soc., 47-50.

Sun, J., R. L. Desjardins, L. Mahrt, and J. I. Macpherson, 1999: Transport of carbon dioxide, water vapor, and ozone by turbulence and local circulations. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 179-182.

Thompson, G., R. M. Rasmussen, K. W. Manning, and J. Brown, 1999: Status update on MM5's Reisner2 microphysics scheme. 9th PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 157-160.

Wang, J. -J., R. M. Rauber, H. T. Ochs III, and R. E. Carbone, 1999: The effects of the island of Hawaii on offshore rainband evolution. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 422-425.

Wang, J. -J., R. M. Rauber, H. T. Ochs III, and R. E. Carbone, 1999: The effects of the island of Hawaii on offshore rainband evolution. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 450-453.

Wilson, J. W., T. D. Keenan, and R. E. Carbone, 1999: Tropical island convection in the absence of significant topography. Part II: Evolution of mesoscale convective systems. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 55-60.

Wu, X., 1999: Radiation and surface energy budgets simulated by NCAR cloud-resolving model and community climate model. IUGG XXII General Assembly, Birmingham, UK, IUGG, B268.

Wu, X., and M. W. Moncrieff, 1999: Long-term three-dimensional cloud-resolving modeling of tropical cloud systems. GEWEX, Beijing, China, GEWEX, 101.

Wu, X., and M. W. Moncrieff, 1999: Surface energy budget and warm pool response during TOGA COARE. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 289-290.

Xu, M., J. Sun, and N. A. Crook, 1999: Retrieval and forecasting of the boundary layer flow in the absence of the upper-level radar data. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 40-43.

Research Applications Program

Scientific Computing Division

1. Refereed

Barth, M. C., and A. T. Church, 1999: The regional and global influence of sulfate aerosols from Mexico City and southeast China. J. Geophys. Res., In Press.

Barth, M. C., P. J. Rasch, J. Kiehl, C. Benkovitz, and S. Schwartz, 1999: Sulfur chemistry in the National Center for Atmospheric Research Community Climate Model: Description, evaluation, features and sensitivity to aqueous chemistry. J. Geophys. Res., In Press.

Bretherton, C. S., M. K. Macvean, P. Bechtold, A. Chlond, W. R. Cotton, J. Cuxart, H. Cuijpers, M. Khairoutdinov, B. Kosovic, D. Lewellen, C.-H. Moeng, P. Siebesma, B. Stevens, I. Sykes, and M. C. Wyant, 1999: An intercomparison of radiatively-driven entrainment and turbulence in a smoke cloud, as simulated by different numerical models. Ouart. J. Roy. Meteor. Soc., 125, 391-423.

Bruintjes, R. T., 1999: A review of cloud seeding experiments to enhance precipitation and some new prospects. Bull. Amer. Meteor. Soc., 80, 805-820.

Bunkers, M. J., B. Klimowski, J. W. Zeitler, G. Thompson, and M. L. Weisman, 1999: Predicting supercell motion using a new hodograph technique. Wea. Forcasting, In Press.

Carbone, R. E., J. Tuttle, W. A. Cooper, V. Grubisic, and W. -C. Lee, 1998: Tradewind rainfall near the windward coast of Hawaii. Mon. Wea. Rev., 126(11), 2847-2863.

Carbone, R. E., 1999: Atmospheric observation in weather prediction. Hazards and Disasters: A Series of Definitive Major Works, A. Keller, Ed., Routledge Press, In Press.

Cherington, M., D. Breed, P. R. Yarnell, and W. E. Smith, 1998: Lightning injuries during snowy conditions. British Journal of Sports Medicine, 32, 333-335.

Clark, T. L., L. Radke, J. L. Coen, and D. Middleton, 1999: Analysis of small-scale convective dynamics in a crown fire using infrared video camera imagery. J. Appl. Meteor., 38, 1401-1420.

Clarke, A., D. Davis, V. N. Kapustin, F. Eisele, G. Chen, I. R. Paluch, D. H. Lenschow, A. R. Bandy, D. C. Thornton, J. Moore, L. Mauldin, D. Tanner, M. Litchy, J. Collins, and G. Albercook, 1998: Particle nucleation in the tropical boundary layer and its coupling to marine sulfur sources. Science, 282, 89-92.

Costen, R. C., and L. J. Miller, 1998: Pulsing inertial oscillation, supercell storms, and surface mesonetwork data. J. Engineering Mathematics, 34, 277-299.

Crook, N. A., and J. B. Klemp, 1999: Lifting at convergence lines. J. Atmos. Sci., In Press.

Davis, C. A., and F. Carr, 1999: Summary of the 1998 Workshop on Mesoscale Model Verification. Bull. Amer. Meteor. Soc., In Press.

Davis, C. A., and M. T. Stoelinga, 1999: Interpretation of the effect of mountains on synoptic-scale baroclinic waves. J. Atmos. Sci., 56, 3303-3320.

Davis, C. A., and M. T. Stoelinga, 1999: The transition to topographic normal modes. J. Atmos. Sci., 56, 3321-3330.

Davis, C. A., S. Low-Nam, M. A. Shapiro, X. Zou, and S. K. Krueger, 1999: Direct retrieval of wind from total ozone mapping spectrometer (TOMS) data: Examples from FASTEX. Quart. J. Roy. Meteor. Soc., In Press.

Davis, C. A., T. Warner, and E. Astling, 1999: Development and application of an operational, relocatable, mesogamma-scale weather analysis and forecast system. Tellus, In Press.

Doyle, J. D., and M. A. Shapiro, 1999: Flow response to large-scale topography: The Greenland tip jet. Tellus, 51(A), In Press.

Ferretti, R., S. Low-Nam, and R. Rotunno, 1999: Numerical simulations of the Piedmont flood of 4-6 November 1994. Tellus, In Press.

Giez, A., G. Ehret, R. L. Schwiesow, K. J. Davis, and D. H. Lenschow, 1999: Water vapor flux measurements from ground-based vertically-pointed water vapor differential absorption and Doppler lidars. J. Atmos. Oceanic Technol., 16, 237-250.

Grabowski, W. W., and P. A. Vaillancourt, 1999: Comments on "Preferential concentration of cloud droplets by turbulence: Effects on the early evolution of cumulus cloud droplet spectra" by Shaw et al. J. Atmos. Sci., 56, 1433-1436.

Grabowski, W. W., and P. K. Smolarkiewicz, 1999: CRCP: A cloud resolving convection parameterization for modeling the tropical convecting atmosphere. Physica D, 133, 171-178.

Grabowski, W. W., 1999: Dynamics of cumulus entrainment. Geophysical and Astrophysical Convection, R. Kerr and P. Fox, Eds., In Press.

Grabowski, W. W., 1999: A parameterization of cloud microphysics for long-term cloud-resolving modeling of tropical convection. Atmos. Res., 52, 17-41.

Grabowski, W. W., X. Wu, and M. W. Moncrieff, 1999: Cloud resolving modeling of tropical cloud systems during Phase II of GATE. Part III: Effects of microphysical parameterizations. J. Atmos. Sci., 56, 2384-2402.

Guo, Y.-R., Y. -H. Kuo, J. Dudhia, D. B. Parsons, and C. Rocken, 1999: Four-dimensional variational data assimilation of heterogeneous mesoscale observations for a strong convective case. Mon. Wea. Rev., In Press.

Haymet, A. D. J., L. G. Ward, M. M. Harding, and C. A. Knight, 1998: Valine substituted winter flounder "antifreeze:" Preservation of ice growth hysteresis. FEBS Letters, 430, 301-306.

Heymsfield, A. J., and G. M. McFarquhar, 1999: Mid-latitude and tropical cirrus microphysical properties. Cirrus, In Press.

Heymsfield, A. J., and J. Iaquinta, 1999: Cirrus crystal terminal velocities. J. Atmos. Sci., In Press.

Howell, J. F., and J. Sun, 1999: Surface layer fluxes in stable conditions. Bound.-Layer Meteor., 90, 495-520.

Igau, R. C., M. A. LeMone, and D. Wei, 1999: Updraft and downdraft cores in TOGA COARE: Why so many buoyant downdraft cores? J. Atmos. Sci., 56, 2232-2245.

Kiehl, J., T. L. Schneider, P. J. Rasch, M. C. Barth, and J. Wong, 1999: Radiative forcing due to sulfate aerosols from simulations with the NCAR community climate model (CCM3). J. Geophys. Res., In Press.

Knight, C. A., 1999: On frozen pond. Weatherwise, 52(1), 35-40.

Larsen, R., C. A. Knight, K. T. Rider, and E. D. Sloan, 1999: Melt growth and inhibition of ethylene oxide clathrate hydrate. J. of Crystal Growth, 204, 376-381.

LeMone, M. A., E. Zipser, and S. B. Trier, 1998: The role of environmental shear and thermodynamic conditions in determining the structure and evolution of mesoscale convective systems during TOGA COARE. J. Atmos. Sci., 55, 3493-3518.

LeMone, M. A., M. Zhou, C.-H. Moeng, D. H. Lenschow, L. J. Miller, and R. L. Grossman, 1999: An observational study of wind profiles in the baroclinic convective mixed layer. Bound. -Layer Meteor., 90, 47-82.

Lenschow, D. H., I. R. Paluch, A. R. Bandy, D. C. Thornton, D. R. Blake, and I. Simpson, 1999: Use of a mixed-layer model to estimate dimethyl sulfide flux and application to other trace gas species. J. Geophys. Res., In Press.

Lenschow, D. H., P. Krummel, and S. Siems, 1999: Measuring entrainment, divergence and vorticity on the mesoscale from aircraft. J. Atmos. Oceanic Technol., 16(10), 1384-1400.

Margolin, L. G., M. Shaskov, and P. K. Smolarkiewicz, 1999: A discrete operator calculus for finite difference approximations. Computer Methods in Applied Mechanics and Engineering, In Press.

Margolin, L. G., P. K. Smolarkiewicz, and Z. Sorbjan, 1999: Large-eddy simulations of convective boundary layers using nonoscillatory differencing. Physica-D, 133, 390-397.

Maruyama, M., T. Ashida, and C. A. Knight, 1999: Disc crystals of ice grown in air-free water: No effect of dissolved air on the morphology. J. of Crystal Growth, 205, 391-394.

McFarquhar, G. M., A. J. Heymsfield, A. Macke, J. Iaquinta, and S. M. Aulenbach, 1999: Use of observed ice crystal sizes and shapes to calculate mean scattering properties and multi-spectral radiances: CEPEX 4 April 1993 case study. J. Geophys. Res., In Press.

McFarquhar, G. M., A. J. Heymsfield, J. Spinhirne, and W. Hart, 1999: Subvisual tropopause tropical cirrus: Observations and radiative impacts. J. Atmos. Sci., In Press.

McWilliams, J. C., C.-H. Moeng, and P. P. Sullivan, 1999: Turbulent fluxes and coherent structures in marine boundary layers: Investigations by large-eddy simulation. Air-Sea Exchange: Physics, Chemistry, Dynamics, and Statistics, G. Geernaert, Ed., Kluwer Academic Publishers, In Press

Moeng, C.-H., and B. Stevens, 1999: Marine stratocumulus and its representation in GCMs. General Circulation Model Development: Past, Present, and Future, Proceedings of a Symposium in Honor of Professor Akio Arakawa, D. A. Randall, Ed., Academic Press, In Press.

Moeng, C.-H., P. P. Sullivan, and B. Stevens, 1999: Including radiative effects in an entrainment-rate formula for buoyancy-driven PBLs. J. Atmos. Sci., 56, 1031-1049.

Moncrieff, M. W., and C. Liu, 1999: Convection initiation by atmospheric density currents: Role of convergence, shear and dynamical organization. Mon. Wea. Rev., 127, 2655-2664.

Moncrieff, M. W., and W. -K. Tao, 1999: Cloud resolving modeling. Global Water and Energy Cycles, Browning and Gurney, Eds., Cambridge University Press, 200-212.

Muraki, D. J., C. Snyder, and R. Rotunno, 1999: The next-order corrections to quasi-geostrophic theory. J. Atmos. Sci, 56, 1547-1560.

Muschinski, A., P. P. Sullivan, D. B. Wuertz, R. J. Hill, S. A. Cohn, D. H. Lenschow, and R. J. Doviak, 1999: First large-eddy simulation of clear-air wind-profiler signals. Radio Sci., In Press.

Naveau, P., M. W. Moncrieff, J. -I. Yano, and X. Wu, 1999: Exploratory statistical analysis of tropical oceanic cloud systems using discrete wavelet transforms. Statistics for Understanding the Atmosphere, Springer-Verlag, In Press.

Powers, J. G., and M. T. Stoelinga, 1999: A coupled air-sea mesoscale model: Experiments in atmospheric sensitivity to marine roughness. Mon. Wea. Rev., 127, In Press.

Rasch, P. J., M. C. Barth, J. Kiehl, S. Schwartz, and C. Benkovitz, 1999: A description of the global sulfur cycle and its controlling processes in the National Center for Atmospheric Research Community Climate Model. J. Geophys. Res. In Press.

Reinking, R. F., R. T. Bruintjes, B. W. Bartram, B. W. Orr, and B. E. Martner, 1999: Chaff tagging for tracking the evolution of cloud parcels. J. Wea. Modification, 31, 119-133.

Rotunno, R., V. Grubisic, and P. K. Smolarkiewicz, 1999: Vorticity and potential vorticity in mountain wakes. J. Atmos. Sci., 56, 2796-2810.

Saiki, E. M., C.-H. Moeng, and P. P. Sullivan, 1999: Large-eddy simulation of the stably stratified planetary boundary layer. Bound.-Layer Meteor., In Press.

Skamarock, W. C., R. Rotunno, and J. B. Klemp, 1999: Models of coastally trapped disturbances. J. Atmos. Sci., 56, 3349-3365.

Snyder, C., 1998: Error growth in flows with finite-amplitude waves or other coherent structures. J. Atmos. Sci., 56, 500-506.

Sommerfeld, R. A., C. A. Knight, and N. F. Laird, 1998: Reply. Geophys. Res. Lett., 25 (23), 4391-4392.

Stevens, B., C.-H. Moeng, and P. P. Sullivan, 1999: Large-eddy simulations of radiatively driven convection: Sensitivities to the representation of small scales. J. Atmos. Sci., In Press.

Stith, J., J. E. Dye, B. A. Ridley, P. Laroche, E. Defer, K. Baumann, G. Hubler, and R. Zerr, 1999: NOx signatures from lightning flashes. J. Geophys. Res., 104, 16,081-16,089.

Sullivan, P. P., J. C. McWilliams, and C.-H. Moeng, 1999: Simulation of turbulent flow over idealized water waves. J. Fluid Mech., In Press.

Sun, J., 1999: Thermal and momentum roughness lengths. Bound. -Layer Meteor., In Press.

Sun, J., and W. J. Massman, 1999; Ozone transport in California Ozone Deposition Experiment, J. Geophys, Res., 104, 11939-11948

Sun, J., W. J. Massman, and D. Grantz, 1999: Aerodynamic variables in the bulk formulation of turbulence fluxes. Bound.-Layer Meteor., 91, 109-125.

Szunyogh, I., Z. Toth, K. Emanuel, C. Snyder, J. Woolen, W.-S. Wu, T. Marchok, R. E. Morss, and C. Bishop, 1999: Ensemble-based targeted observations during FASTEX. Quart. J. Roy. Meteor. Soc., In Press.

Tucker, D. F., and N. A. Crook, 1999: The generation of a mesoscale convective system from mountain convection. Mon. Wea. Rev., 127, 1259-1273.

Tuttle, J., R. E. Carbone, and J. -J. Wang, 1999: Tradewind rainfall near the windward coast of Hawaii: Corrected data yield improved results. Mon. Wea. Rev., In Press.

Weisman, M. L., and R. Rotunno, 1999: On the use of vertical wind shear versus helicity in interpreting supercell dynamics. J. Atmos. Sci., In Press.

Wilson, J. W., N. A. Crook, C. K. Mueller, and J. Sun, 1998: Nowcasting thunderstorms: A review and current status. Bull. Amer. Meteor. Soc., 79, 2079-2099

Wu, X., and M. W. Moncrieff, 1999: Effects of sea surface temperature and large-scale dynamics on the thermodynamic equilibrium state and convection over the tropical western Pacific. J. Geophys. Res., 104, 6093-6100.

Wu, X., W. D. Hall, W. W. Grabowski, M. W. Moncrieff, W. D. Collins, and J. Kiehl, 1999: Long-term behavior of cloud systems in TOGA COARE and their interactions with radiative and surface processes. Part II: Effects of ice microphysics on cloud-radiation interaction. J. Atmos. Sci., 56, 3177-3105

Zou, X., F. Vandenberghe, B. Wang, M. Gorbunov, Y. -H. Kuo, S. Sokolovskiy, J. C. Chang, J. G. Sela, and R. A. Anthes, 1999: A raytracing operator and its adjoint for the use of GPS/MET refraction angle measurements. J. Geophys. Res., 104 (D18), 22.301-22.318.

2. Non-Refereed

Barth, M. C., N. Patton, and K. J. Davis, 1999: Large eddy simulations with chemistry. AGU Spring Meeting, Boston, MA, AGU, S48.

Breed, D., R. T. Bruintjes, V. Salazar, and H. Ramirez-Rodriguez, 1999: Microphysical characteristics of convective clouds in northern Mexico. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 57-59.

Bruintjes, R. T., D. Breed, B. Foote, M. J. Dixon, B. G. Brown, V. Salazar, and H. Ramirez-Rodriguez, 1999: Program for the augmentation of rainfall in Coahuila (PARC): Overview and design. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 53-56.

Bruintjes, R. T., G. L. Kok, D. Breed, and V. Salazar, 1999: Hygroscopic seeding: Theory and practice. 7th WMO Scientific Conference on Weather Modification, Chang Mai, Thailand, WMO, 65-68.

Bruintjes, R. T., 1999: Variations of cloud condensation nuclei (CCN) and aerosol particles over Thailand and the possible impacts on precipitation formation in clouds. 7th WMO Scientific Conference on Weather Modification, Chaing Mai, Thailand, WMO, 33-36.

Bruintjes, R. T., R. M. Rasmussen, W. Sukarnjanaset, P. Sudhikoses, N. Tantipubthong, and M. Karmini, 1999: The effects of the smoke and haze from the Indonesian fires on cloud microstructure and precipitation development. 7th WMO Scientific Conference on Weather Modification, Chaing Mal, Thailand, WMO, 533-536.

Carbone, R. E., J. Tuttle, L. J. Miller, and S. B. Trier, cited 1999: Warm season precipitation episodes in central North America. 22nd General Assembly of the IUGG, Birmingham, UK, IUGG. [Available on-line from http://www.bham.ac.uk/IUGG99/.]

Carbone, R. E., J. Tuttle, K. Miller, R. Oye, and S. B. Trier, 1999: Large domain studies of warm season precipitation episodes. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 596-599.

Carbone, R. E., T. D. Keenan, J. M. Hacker, and J. W. Wilson, 1999: Tropical island convection in the absence of significant topography. Part I: Sea breezes and early convection. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 49-54.

Chen, F., T. Warner, and K. W. Manning, 1999: Simulation of the 1996 Buffalo Creek flash flood event and its sensitivity to land surface variability.

Workshop on Land-Surface Modeling and Applications to Mesoscale Models, Boulder, CO, NCAR, 5-9.

Clark, T. L., J. L. Coen, L. Radke, M. Reeder, and D. R. Packham, 1998: Coupled atmosphere-fire dynamics. 3rd International Conference on Forest Fire Research, Colmbra, Portugal, 67-82.

Crook, N. A., and J. B. Klemp, 1999: Lifting at convergence lines. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 32-37.

Dudhia, J., and F. Chen, cited 1999: Using a mesoscale model coupled to a land-surface model to simulate surface fluxes at high resolution. 9th Annual ARM Science Team Meeting, San Antonio, TX, Dot-RAM. [Available on-line from http://www.arm.gov/docs/documents/technical/conf_9903/author.html.]

Dudhia, J., 1999: Recent development in MM5. 9th Annual PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 3-5.

Dudhia, J., 1999: WRF: Physics and community issues. 9th Annual PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 35-38.

Dudhia, J., Y.-R. Guo, Y.-H. Kuo, and D. B. Parsons, 1999: Assimilation of diverse mesoscale data in simulations of an Oklahoma mesoscale convective system using 4DVAR methods. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 332-337.

Dye, J. E., T. Matejka, P. Laroche, E. Defer, G. Hubler, and S. A. Rutledge, 1999: Lightning discharge locations relative to reflectivity and updraft/downdraft structures in a Colorado thunderstorm. 11th International Conference on Atmospheric Electricity, Guntersville, AL, International Commission on Atmospheric Electricity, 530-533.

Grabowski, W. W., and P. K. Smolarkiewicz, 1999: Cloud-resolving convection parameterization (CRCP): A novel approach for modeling convecting atmospheres. 12th Conference on Atmospheric and Oceanic Fluid Dynamics. New York, NY, Amer. Meteor. Soc., 48-49.

Grabowski, W. W., and P. K. Smolarkiewicz, 1999: Toward cloud-resolving modeling of large-scale tropical circulations: Cloud-resolving convection parameterization. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 879-880.

Grubisic, V.and M. Moncrieff, 1999: Parameterization of momentum transport by organized convection. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 14-17.

Guichard, F., J. Dudhia, and D. B. Parsons, 1999: Improvement of MM5 surface fields with the RRTM longwave radiation scheme. 9th Annual PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 124-126.

Guo, Y.-R., J. Dudhia, and Y. -H. Kuo, 1999: Impact of different moist physics on 4DVAR: A case study. 9th PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 65-67.

Guo, Y.-R., J.-W. Bao, and Y. -H. Kuo, 1999: A comparison of mesoscale adjoint models used for targeted observation planning: The perspective of sensitivity analysis. 3rd Symposium on Integrated Observing Systems, Dallas, TX, Amer. Meteor. Soc., 162-163.

Guo, Y.-R., Y. -H. Kuo, J. Dudhia, and D. B. Parsons, 1998: Assimilation of ARM WVIOP-96 data with MM5-4DVAR system. 8th Atmospheric Radiation Measurement (ARM) Science Team Meeting, Tucson, AZ, DOE/ARM, 295-301.

Guo, Y.-R., Y.-H. Kuo, J. Dudhia, and D. B. Parsons, cited 1999: Assimilation of ARM WVIOP-96 data for an Oklahoma mesoscale convective system. 9th Atmospheric Radiation Measurement (ARM) Science Team Meeting, San Antonio, TX, DOE/ARM. [Available on-line from http://www.arm.gov/docs/documents/technical/conf_9903/author.html.]

Huang, W., and J. G. Powers, 1999: Verification of MM5 real-time forecasts at NCAR. 9th PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 131-136.

Huebert, B., and D. H. Lenschow, 1999: What have Lagrangian experiments accomplished? IGACtivities Newsletter, 4-8.

LeMone, M. A., and R. L. Grossman, 1999: Evolution of potential temperature and moisture during the morning: CASES-97. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 500-503.

LeMone, M. A., and R. L. Grossman, 1999: Evolution of potential temperature and moisture during the morning: CASES-97. 14th Conference on Hydrology, Dallas, TX, Amer. Meteor. Soc., 446-449.

LeMone, M. A., 1999: The fair weather boundary layer in GATE. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc. 7-11

LeMone, M. A., W. T. Pennell, and R. L. Grossman, 1999: The fair weather boundary layer in GATE. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 8-11.

Lenschow, D. H., A. S. Frisch, B. E. Martner, B. W. Orr, and D. Fitzjarrald, 1999: On the change in the vertical velocity structure through the PBL during the daytime development of cumulus clouds over a boreal forest. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 3-32.

Lewis, S. A., M. A. LeMone, and D. P. Jorgensen, 1999: Three dimensional structure and surface fluxes associated with the late-stage squall-line MCS. Conference on the TOGA Coupled Ocean-Atmosphere Response Experiment (COARE), Boulder, CO, WMO, 256-257.

Matsumura, T., J. C. Derber, J. G. Yoe, F. Vandenberghe, and X. Zou, 1999: The inclusion of GPS limb sounding into NCEP's global data assimilation system. Office Note 426, NOAA/NWS/NCEP, 95 pp.

McFarguhar, G. M., A. J. Heymsfield, and G. G. Melvin, 1999: Upper level vertical air velocities deduced from TOGA COARE data and their relationship to cloud radiative properties. Conference on the TOGA Coupled Ocean-Atmosphere Response Experiment (COARE), WMO/TD No. 940, Boulder, CO, WMO, 217-218.

McWilliams, J. C., and P. P. Sullivan, 1999: Surface-wave effects on marine boundary layers, The Fluid Dynamics of the Environment: A Symposium Honoring Sidney Leibovich, J. Lumley, Ed., Springer-Verlag, In Press.

Michalakes, J., J. Dudhia, D. Gill, J. B. Klemp, and W. C. Skamarock, 1999: Design of a next-generation weather research and forecast model. 8th ECMWF Workshop on the Use of Parallel Processors in Meteorology, Reading, UK, European Center for Medium Range Weather Forecasting, 117-124.

Moeng, C.-H., and P. P. Sullivan, 1999: The role of cloud-top radiative cooling in stratocumulus-topped PBL. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 441-444.

Moncrieff, M., 1999: Dynamical models of momentum transport by organized convection. IUGG XXII General Assembly, Birmingham, UK, IUGG, B270.

Moncrieff, M. W., 1999: Legacy of TOGA COARE for GEWEX. WMO/WCRP Publication Series, Boulder, CO, WMO, 80-94.

Moncrieff, M. W., and C. Liu, 1999: Convection initiation by density currents: Effect of shear on convergence. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 219-220.

Naveau, P. and M. Moncrieff, 1999: Statistical analysis of the maximum vertical wind velocity in the western Pacific. IUGG XXII General Assembly, Birmingham, UK, IUGG, B269.

Ochs III, H. T., N. F. Laird, R. M. Rauber, K. Beard, and L. J. Miller, 1999: Radar/model comparison of precipitation initiation in tropical cumulus clouds. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 337-342.

Roberts, R., D. Breed, and P. C. Kennedy, 1999: Multi-parameter radar, aircraft, and satellite signatures associated with precipitation formation in Colorado convective clouds. 29th Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 896-899.

Roberts, R., T. Saxon, C. K. Mueller, C. Wilson, N. A. Crook, J. Sun, and S. Henry, 1999: Operational application and use of NCAR's published thunderstorm nowcasting system. 15th Conference on Interactive Information on Processing Systems, Dallas, TX, Amer. Met. Soc., 158-161.

Rotunno, R., 1999: Unstable baroclinic waves beyond quasigeostrophic theory. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 184-189

Saiki, E. M., C.-H. Moeng, and P. P. Sullivan, 1999: Large-eddy simulation of the stably stratified planetary boundary layer. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 221-214.

Schlatter, T., F. Carr, R Langland, R. E. Carbone, N. A. Crook, R. W. Daley, J. C. Derber, and S. L. Mullen, 1999: A five year plan for research related to the assimilation of meteorological data. UCAR Technical Report #443, 41 pp., In Press.

Senff, C. J., K. J. Davis, D. H. Lenschow, E. V. Browell, and S. Ismail, 1999: Evaluation of terms in the water vapor budget using airborne DIAL and in situ measurements from the Southern Great Plains Experiment. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 516-518.

Shapiro, M. A., D. Bartels, J. Franklin, A Marroquin, C. Girt, J. D. Doyle, J. Schmidt, T. L. Clark, and R. Gall, 1999: On the laminar structure of the atmosphere: Edwin Danielsen's (1959) perspective of the tropopause. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 212-217

Skamarock, W. C., R. Rotunno, and J. B. Klemp, 1999: Dynamical models of coastally trapped disturbances and Catalina eddles. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 422-427.

Smolarkiewicz, P. K., and L. G. Margolin, 1999: MPDATA--a multipass donor cell solver for geophysical flows. International Conference on Godunov Methods, Theory and Applications, Oxford, 65.

Smolarkiewicz, P. K., V. Grubisic, L. G. Margolin, and A. A. Wyszogrodski, 1999: Forward-in-time differencing for fluids: Nonhydrostatic modeling of fluid motions on a sphere. Recent Developments in Numerical Methods for Atmospheric Modeling, Reading, UK, ECMWF, 21-43.

Sullivan, P. P., J. C. McWilliams, and C.-H. Moeng, 1999: Turbulent shear flow over moving sinusoidal boundaries. 13th Conference on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 241-244.

Sullivan, P. P., J. C. McWilliams, and C.-H. Moeng, 1999: Turbulent shear flow over moving sinusoidal boundaries. Turbulence and Shear Flow-1, S. Banerjee and J. K. Eaton, Eds., Begell House, 577-582.

Sun, J., 1999: Thermal and momentum roughness lengths. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 339-342.

Sun, J., and N. A. Crook, 1999: Real-time boundary layer wind and temperature analysis using WSR-88D observations. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 44-47.

Sun, J., and W. J. Massman, 1999: Ozone transport in California ozone deposition velocity. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 167-170.

Sun, J., L. Mahrt, D. Vickers, J. I. Macpherson, R. J. Dobosy, B. Kustas, and J. Prueger, 1999: Spatial variation of moisture flux in SGP. 14th Conference on Hydrology, Dallas, TX, Amer. Meteor. Soc., 160-162.

Sun, J., L. Mahrt, D. Vickers, J. Wong, T. L. Crawford, C. Vogel, E. Dumas, P. Munrad, and D. Vandemark, 1999: Air-sea interaction in the coastal shoaling zone. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 343-346.

Sun, J., N. O. Jensen, P. Hummelshoej, H. Jorgensen, L. Mahrt, and Z. Chen, 1998: Study of forest-atmospheric interaction over a beech forest. 23rd Conference on Agricultural and Forest, Albuquerque, NM, Amer. Meteor. Soc., 47-50.

Sun, J., R. L. Desjardins, L. Mahrt, and J. I. Macpherson, 1999: Transport of carbon dioxide, water vapor, and ozone by turbulence and local circulations. 13th Symposium on Boundary Layers and Turbulence, Dallas, TX, Amer. Meteor. Soc., 179-182.

Thompson, G., R. M. Rasmussen, K. W. Manning, and J. Brown, 1999: Status update on MM5's Reisner2 microphysics scheme. 9th PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, NCAR, 157-160.

Wang, J. -J., R. M. Rauber, H. T. Ochs III, and R. E. Carbone, 1999: The effects of the island of Hawaii on offshore rainband evolution. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 422-425.

Wang, J. -J., R. M. Rauber, H. T. Ochs III, and R. E. Carbone, 1999: The effects of the island of Hawaii on offshore rainband evolution. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 450-453.

Wilson, J. W., T. D. Keenan, and R. E. Carbone, 1999: Tropical island convection in the absence of significant topography. Part II: Evolution of mesoscale convective systems. 8th Conference on Mesoscale Processes, Boulder, CO, Amer. Meteor. Soc., 55-60.

Wu, X., 1999: Radiation and surface energy budgets simulated by NCAR cloud-resolving model and community climate model. IUGG XXII General Assembly, Birmingham, UK, IUGG, B268.

Wu, X., and M. W. Moncrieff, 1999: Long-term three-dimensional cloud-resolving modeling of tropical cloud systems. GEWEX, Beijing, China, GEWEX. 101.

Wu, X., and M. W. Moncrieff, 1999: Surface energy budget and warm pool response during TOGA COARE. 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX, Amer. Meteor. Soc., 289-290.

Xu, M., J. Sun, and N. A. Crook, 1999: Retrieval and forecasting of the boundary layer flow in the absence of the upper-level radar data. 29th International Conference on Radar Meteorology, Montreal, Canada, Amer. Meteor. Soc., 40-43.

Education Publications

Windham, T. L., 1999: Mentoring, Contemporary Use of a Timeless Resource. Winds of Change, Winter, 16-19.
, 1999: Pair gain scientific, cultural exposure. Daily Camera 29 Aug.,9F.
, 1999: A dearth of Americans in Ph.D. programs. Daily Camera 20 June, 9F.
, 1999: Achievements of African Americans are worth remembering. Daily Camera 21 Feb. 9F.
, 1999: Diversity declining in science. Daily Camera 17 Jan., 12F.
, 1998: Days shorter; Christmas season keeps getting longer. Daily Camera 6 Dec., 12F.
, 1998: Experiments important in education. Daily Camera 11 Oct., 12F.





Annual Scientific Report 1999
National Center for Atmospheric Research

Director's Message
Highlights
Publications
Educational Activities
Community Service

Community Service

Atmospheric Chemistry Division

Editorships of Peer-Reviewed Journals

Mike Coffey, Editor, Rev. Geophys., 1997-Present

Alan Fried, SPIE Conference Proceedings, "Application of Tunable Diode and Other Infrared Sources for Atmospheric Studies and Industrial Processing Monitoring II", Volume 3758, 1999

Alex Guenther, Associate Editor, J. Geophys. Res., 1997-2000

William Randel, Associate Editor, J. Atmos. Atmos. Sci., 1999-2001

NCAR | UCAR | NSF | ASR 1998

William Randel, Associate Editor, Encyclopedia of Atmospheric Sciences, organized by Academic Press, 1999-Present

Brian Ridley, American Editor, J. Atmos. Chem., 1994-Present.

Geoffrey Tyndall, Guest Editor, Special Edition, Physics and Chemistry of the Earth, European Geophysical Society

Service on External Scientific, Policy or Educational Committees or Advisory Panels

Guy Brasseur, Chair, Science Steering Committee of the International Global Atmospheric Chemistry (IGAC), 1994-Present

Guy Brasseur, Member, External Review Panel for proposed Air Quality Research Center, North Carolina State University, Durham, May, 1999

Chris Cantrell, Member, AGU Atmospheric Sciences Nominations Committee, 1995-Present

Chris Cantrell, Member, ACEed Committee, 1999

Chris Cantrell, Aircraft Coordinator, TOPSE, 1998-Presen

Cheryl Craig, Member, "HDF User's Panel", HDF-EOS Workshop III, September, 1999.

Mike Coffey, Panel Member, Advisory Panel on Professorship of Remote Sensing, University of Toronto

Alan Fried, Conference Chair and Organizer for the 1999 SPIE International Conference on Atmospheric Sensing, Applications of Tunable Diode and Other IR Sources for Atmospheric Studies and Industrial Process Monitoring, July, 1999

Alan Fried, Member, Technical Program Committee for the 1999 Conference on Lasers and Electro-Optics/International Electronics Conference, May, 1999.

Alan Fried, Member, Board of Directors of the Rocky Mountain Optical Society

Alan Fried, Member, International Advisory Committee for the TDLS 2001 Conference, Zermatt Switzerland, TDLS-98

Rolando Garcia, Member, AGU Macelwane Award Committee, 1998-2000

Rolando Garcia, Member, IUGG International Committee on the Middle Atmosphere (1999-2003)

John Gille, Member, Scientific Steering Committee, Stratospheric Processes and Their Roles in Climate (SPARC)

John Gille, Member, Executive Committee Panel of Experts/Commission on Atmospheric Sciences Working Group on Environmental Pollution and Atmospheric Chemistry Working Group

John Gille, Member, WMO Global Atmospheric Watch (GAW) Observations Group

John Gille, Member, National Polar Orbiting Environmental Satellite System (NPOESS) Ozone Mapping and Profiling Sensor (OMP) Selection and Review Committee

John Gille, Member, NASA EOS-Terra Executive Committee for Science Outreach

Alex Guenther, Member, IGA-GEIA Natural VOC Committee, Coordinate/synthesize global natural VOC emissions research, 1993-Present

Alex Guenther, Member, IGAC-ACD Education Committee, Develop initiatives for atmospheric chemistry education in developing countries, 1998-Present

Alex Guenther, Member, National Tropospheric Ozone Research Needs Panel, Prioritize U.S. research on tropospheric ozone, 1997-Present

Sasha Madronich, Member, WMO Scientific Advisory Group on UV Monitoring

Sasha Madronich, Member, UNEP Panel of Environmental Effects of Stratospheric Ozone Depletion

Liwen Pan, Member, Committee of Visitors for National Science Foundation Division of International Programs, Feb, 1999

William Randel, Member, SPARC Ozone Trends, Stratospheric Temperature Trends and Reference Climatology Panels

Anne Smith, member of Science Team for TIMED (Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics) Satellite, NASA

Awards

Rolando Garcia, NOAA Outstanding Publication Award (co-authored with Susan Solomon), November, 1998

Sasha Madronich, NOAA Outstanding Publication Award (co-authored with E. Dlugokencky et al., November, 1998.

William Mankin was inducted as a charter member of the Rhodes College Alumni Hall of Fame (largely on the basis of work at NCAR)

Willian Randel, Editor's Citation for Excellence in Reviewing, Geophys. Res. Lett., 1999.

Miscellaneous Service

Louisa Emmons, Science Referee, J. Geophys. Res. and Atmos. Environ

Douglas Kinnison, Lead Author, three international scientific assessment documents: 1) 1999 Chapter 4, Intergovernmental Panel on Climate Change, a Special Report on Aviation and the Global Atmosphere; 2) the 1999 Chapter 12, World Meteorological Organization Scientific Assessment of Ozone Depletion; and 3) the 1999 Chapter 4, NASA Atmospheric Effects of Aviation Project, High Speed Research Program Atmospheric Effects of Stratospheric Aircraft.

Liwen Pan, Co-author, SPARC Water Vapor Assessment, June, 1999.

Xuexi Tie, K.C. Wong Education Foundation Award, 1998.

Atmospheric Technology Division

Editorships

Darrel Baumgardner, Editor, Journal of Atmospheric and Oceanic Technology (JTECH).

Krista Laursen, Associate Editor, Journal of Atmospheric and Oceanic Technology (JTECH).

Dave Parsons, Editor, Journal of Atmospheric Science.

Tammy Weckwerth, Associate Editor, Monthly Weather Review.

External Scientific, Policy, or Educational Committees and Advisory Panels

Steve Cohn

· Member, American Meteor. Soc. (AMS) Committee on Measurements

Charles Frush

- Member, The International Society for Optical Engineering (SPIE)
- . Member, American Association for the Advancement of Science (AAAS)
- Member, Institute for Electrical and Electronic Engineering (IEEE)
 Member, Association for Computer Machinery (ACM)

Peter Hildebrand

- Chair, American Meteor. Soc. Radio Frequency Policy Statement Drafting Committee
- Member, U.S. Science Steering Committee, Mesoscale Alpine Project (MAP)
 Member, American Meteor. Soc. Committee on Radar Meteorology

Terry Hock

· Chair, AVAPS Users Group

Jeff Keeler

· Chair, NEXRAD Open RDA Advisory Panel

Steven Oncley

· Member, American Meteor. Soc. Committee on Boundary Layers and Turbulence

David Parsons

- Chair, AMS Review Panel for Mesoscale Processes, Severe Storms Monograph
 Technical Advisor, Working group on Profilers, Office of the Federal Coordinator
 Member, ARM Open Ocean Advisory Group

Jeffrey Keeler

· Member, NEXRAD Open RDA Advisory Panel

Larry Radke

- . Chair, NASA FIRE Meeting
- Chair, NCAR/NAP Aerosol Program
- Adjunct Professor, Atmospheric Sciences, University of Washington
 Sr. Research Associate, Graduate Faculty of Aerospace Engineering, Univ. of Colorado.

Ron Ruth

· Member, American Meteor. Soc. (AMS)

Jeff Stith

- . Member, American Meteor. Soc. (AMS) Cloud Physics Committee
- Storm penetrating aircraft session chairperson, Boulder, CO, 21-22 October 1999.

Jim Wilson

- · Chair, Review Panel for Severe Convective Systems Monograph
- Member, NOAA/NWS NEXRAD Technical Advisory Committee
- Member, USWRP Quantitative Precipitation Forecasting Working Group

Volker Wulfmeyer

- Member, Global Energy & Water Cycle Exper. (GEWEX), WCRP
 Member, AMS, Scientific and Technical Advisory Committee Laser Atmospheric Studies

Awards

Ned Chamberlain

Technical Achievement Award, December 1998.

Peter Hildebrand

IEEE Elected Senior Member, June 1999.

Peter Hildebrand

Best of Conference & Best of Session Awards for presentation "Measurement of Precipitation in Mountainous Terrain Using Airborne Doppler Weather Rader", 4th Int. Airborne Remote Sensing Conf., Ottawa, Ontario, Canada, 21-24 June 1999.

Jothiram Vivekanandan

Ice Detection Using Radiometers UCAR patent award, December 1999.

Patents

Issued 6/10/97 - Facility for Preparing and Deploying Sounding Devices Inventor(s) - Dean K. Lauritsen, Sigvard J. Stenlund

Description - Modular launch building with wedged eve and overhead hatch that forms part of the wedged eve when fully retracted, and attachable equipment shelter.

Issued 12/31/96 - Radar Acquisition System

Inventor(s) Mitchell A. Randall; Eric Loew

Description - (PIRAQ) Single board processor/converter combination of generally existing technologies never previously combined due to hardware limitations.

Issued 9/10/96 - Portable Intelligent Whole Air Sampling System

Inventor(s) Walter F. Dabberdt; Kenneth D. Norris; Steven R. Semmer; Anthony C. Delany Description – Automated sampler system for field sampling having multiple syringes mounted on a carousel where each syringe can draw an air sample of a predetermined size at a predetermined time and at a predetermined speed. The laboratory apparatus withdraws the sample by reversing the automated process.

Issued 8/20/96 - Integrated Control system for Preparing and Deploying Sounding Devices and Managing Telemetry Therefrom

Inventor - Charles L. Martin

Description - Software control system for pre-launch preparation and scheduling launch. Software also displays raw data received from sonde and manipulates antenna direction.

Issued 1/23/96 - Low Cost Telemetry Receiving System

Inventor – Terrence F. Hock

Description - Directional antenna with shaped beam and one rotating point. (formerly titled "NEXUS Receiver Antenna").

Issued 11/28/95 - Receiver Antenna for Bistatic Doppler Radar Network

Inventor(s) Mitchell A. Randall; Christopher L. Holloway; Joshua M.A.R. Wurman Description – See Receiver for Bistatic Doppler Radar Network

Issued 11/21/95 – Receiver for Bistatic Doppler Radar Network Inventor(s) – Charles L. Frush; Joshua M.A.R. Wurman

Description - See Bistatic Multiple-Doppler Radar Network

Issued 4/25/95 - Bistatic Multiple Doppler Radar Network Inventor(s) - Charles L. Frush; Joshua M.A.R. Wurman

Description - A multiple doppler radar network can be constructed using only one, traditional, transmitting pencil-beam radar and one or more passive, non-transmitting receiving sites. Radiation scattered from the pencil beam of the transmitting radar as it penetrates weather targets can be detected at the receive-only sites as well as the transmitter. In a bistatic system, the location of the targets in Cartesian space can be calculated from the pointing angle of the transmitting antenna and the time between transmission of a radar pulse from the transmitter and detection at a passive receiver site

Issued 2/16/93 - Self-Guided Recoverable Airborne Instrument Module

Description — A reusable radiosonde utilizing the GPS navigation system for tracking of precise location and self-guided landing; the sonde (or other instrument package) is "unpowered" but has wing surfaces and a mechanism for steering ad guidance for precisely landing the sonde(s) at a predetermined location; any airborne "instrument" package can be carried and guided on descent — not limited to radiosonde implementation.

Climate and Global Dynamics Division

Editorships

Gordon Bonan, Editor, Journal of Climate, 1998; Editorial Advisory Board, Global Change Biology, 1994

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

Clara Deser, Associate Editor, Journal of Climate, 1996

Scott Doney, Associate Editor, Reviews of Geophysics, 1997

James Hack, Editor, Journal of Climate, 1998

Matthew Hecht, Associate Editor, Monthly Weather Review, 1998

Jeffrey Kiehl, Board of Reviewing Editors, Science Magazine, 1997

Doug Nychka, Editor, Statistical Science, 1999; Associate Editor, Statistica Sinica, 1999

Bette Otto-Bliesner, Associate Editor, Paleoclimates, 1992

Philip Rasch, Editorial Panel Member, Tellus, 1992

David Schimel, Consulting Editor, Biogeochemistry, Ecological Applications, Global Change Biology, 1989

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

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. Review Editor. Climate Research. 1998

Scientific, Policy, or Education Committees and Advisory/Panels/Boards

Maurice L. Blackmon, Member, Climate Research Committee, National Research Council, 1997; Chair, NCAR Climate System Model (CSM) Scientific Steering Committee, 1996; Science Team Member, NASA's Clouds and the Earth's Radiant Energy System (CERES); Co-Chair, Scientific Working Group, Atlantic Climate Change Project, 1993; Member, American Meteorology Society Committee on Climate Variations, 1991; Member, International Commission on Dynamical Meteorology; Member, IAMAP, Working Group D, Medium and Large-Scale Dynamics; Member, Task Force Diversity Group; Member, Human Resources Advisory Committee (HRAC).

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

Byron Boville, Co-Chair of the 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, CSM Scientific Steering Committee, 1996.

Grant Branstator, Member, Scientific Advisory Committee for the Center for Atmosphere-Land-Ocean Studies, 1999

Frank Bryan, Member, CSM Science Steering Committee, 1998 and 1999; Member, NCAR Benchmarking Panel, 1999; Member, WCRP Working Group on Ocean Model Development, 1999; Member, Joint IAG/IAPSO Special Study Group on the Geodetic Effects of Non-Tidal Oceanic Processes, 1999.

William Collins, Member, Earth Observing System (EOS) Validation Team, 1997; Member, Scanner for Radiation Budget (ScaRaB) Science Team, 1995; Member, Indian Ocean Experiment (INDOEX) Science Team, 1996.

Aiguo Dai, Contributing Author, IPCC Third Assessment Report (TAR), 1999.

Clara Deser, Member, American Meteorology Society Committee on Climate Variations, 1994

Scott Doney, Member, U.S. JGOFS Steering Committee, 1993; Member, U.S. WOCE Steering Committee, 1997; Coordinator, U.S. JGOFS Synthesis and Modeling Project, 1997; Co-chair, NCAR CSM Biogeochemistry Working Group, 1998; Member, Ocean Carbon Working Group, 1999.

James Hack, Member, DOE Climate Change Prediction Program (CCPP) 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; Oc-Chair, Atmosphere Model Working Group for the Climate Model System Project, 1997; Member, Oak Ridge National Laboratory Computer Science and Mathematics Division Advisory Committee, 1998.

James Hurrell, Member, Great Plains Regional Center of the National Institute for Global Environmental Change, 1994; Member, Advisory Panel for NCEP CDAS/Reanalysis Project, 1994; Member, American Meteorology Society Committee on Meteorology and Oceanography of the Southern Hemisphere, 1995; Member, Atlantic Climate Change Advisory Committee, 1997; Co-chair, CSM Natural Variability Working Group, 1997; Member, National Research Council Panel on the Global Energy and Water Cycle Experiment, 1997; Member, U.S. CLIVAR Scientific Steering Committee, 1998; Co-chair, U.S. CLIVAR Atlantic Implementation Panel, 1999. Member, International CLIVAR Atlantic Implementation Panel, 1999.

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 Work Group at the Center for Clouds, Chemistry and Climate (C4), 1994; Member, Scientific Steering Committee, NSF Climate System Model Project, 1996; Member, Indian Ocean Experiment (INDOEX) International Scientific Steering Committee, 1996; Member, NCAR Aerosol Panel, 1997; Member, Climate Variability (CLIVAR) Scientific Steering Committee, 1998; Member, National Academy of Science Global Change Panel, 1999.

Tim Kittel, Member, National Technical Advisory Committee; National Institute for Global Environmental Change (NIGEC), 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 Distributed Active Archive Center User Working Group, 1997; Member, Central Great Plains Assessment Steering Committee; U.S. National Assessment of the Potential Consequences of Climate Variability and Change, 1998.

Roland Madden, Member, Advisory Board for Meteorologische Zeitschrift, 1995; Member Selection Committee for Fellows of the American Meteorological Society, 2000; Member Organizing Committee of the 8th International Meeting on Statistical Climatology. 1999.

James McWilliams, Member, U.S. WOCE Scientific Steering Committee, 1994; Member, Scientific Advisory Council of the NSF Climate Modeling, Analysis, and Prediction Program, 1990; Member, MIT Corporation Visiting Committee for the Department of Earth, Atmospheric, and Planetary Sciences, 1994; Member, Jet Propulsion Laboratory Earth Science Advisory Council, 1997; Member, San Diego Supercomputer Center User Advisory Committee, 1998; Member, Visiting Committee of the Division of the Geological and Planetary Sciences, California Institute of Technology, 1999.

Gerald Meehl, Member, Climate System Model Investigators Group, 1994; 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, Japan/U.S. Scientific Advisory Committee for the International Pacific Research Center, University of Hawaii, 1997; Chairman, Coupled Model Intercomparison Project (CMIP), 1996; Coordinating Lead Author, IPCC Third Assessment Report, Chapter 9, Projections of Climate Change, 1998.

Ralph Milliff, Member, National Academy of Sciences, Space Studies Board, Committee on Earth Studies, 1999.

Doug Nychka, Cascadia Tropospheric Ozone Peer Review Panel; Program Chair of the Statistical Computing Section American Statistical Association JSM 2001; Member of proposal screening panel NSF/EPA Statistics Program, NSF-DMS, 1999; Panel Member on Uncertainty in Oceanographic Models, American Academy of Sciences, 1999.

Bette Otto-Bliesner, Co-Chair, CSM Paleoclimate Working Group, 1996; Paleoclimate Modeling Intercomparison Project (PMIP), 1995; Paleoenvironmental Arctic Sciences Steering Committee (PARCS), 1999; AGU Paleoclimatology and Paleocceanography Committee, 1998.

Ramalingam Saravanan, Member, NOAA CLIVAR-Atlantic Advisory Panel, 1998; Member, U.S. CLIVAR Pacific Implementation Panel, 1999.

Philip Rasch, Member, NSF Science and Technology Center for Clouds, Chemistry and Climate (C4), 1990; Co-Chair, Chemistry Modeling Group at the NSF Science and Technology Center for Clouds, Chemistry and Climate (C4), 1994; Member NCAR Aerosol Panel, 1997; Member Coordinating Committee of the Internation Global Atmospheric Chemistry (IGAC) Project on Stratospheric and Upper Tropospheric Aerosols (SUTA), 1998.

David Schimel, Member, Advisory Committee, Max-Planck Institute for Chemistry, 1997; Convening Lead Author, Intergovernmental Panel on Climate Change (IPCC) Report, 1994 and 1995; Visiting Member, Graduate Faculty, 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, Member, American Meteorology Society Probability and Statistics Committee, 1997-1999; Model Infrastructure Working Group, 1999.

Kevin Trenberth, Member, ECMWF Reanalysis (ERA) Project Advisory Group, 1993--; Member, Atmospheric Observation Panel for the Global Climate Observing System, 1994--; Member, COLA (Center for Ocean-Land-Atmosphere Studies) Scientific Advisory Committee, 1994--1999 and Chair 1995, 1998-99; Member, International CLIVAR Scientific Steering Group, 1995--, and Co-chair, 1996--; Member, Sox Advisory Board, 1998--; Member, NoA Council on Long-term Monitoring, 1998--; Member Joint Scientific Committee of the World Climate Research Programme, 1999--; Corresponding Member, Panel on Climate Observing System Status, Board on Atmospheric Sciences and Climate, 1998-1999; Member, Climate Research Committee Panel on Reconciling Temperature Observations, Board on Atmospheric Sciences and Climate, 1999--; Member Committee for Sciences and Climate, 1999--; Member Committee on Global Change Research, Board on Sustainable Development, 1999--; Member Scientific Steering Committee for 20th Anniversary of the US-China Bilateral Workshop and Symposium, 1999--; Corresponding Member, NOAA OGP Panel on Climate Observations, 1999--; Author, Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment of Climate Change, WMO/UNEP, 2000 (lead author).

Harry van Loon, Member, Solar Terrestrial Energy Program of ICSU, Working Group No. 5, and Project Leader, 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, 1995; Member, Marional Change, Persident, American Meteorological Society, 1995; Member, 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; Member, NASA Earth Systems Science and Applications Advisory Committee (ESSAAC), 1998; Member, Board of Trustees of the Bermuda Biological Station for Research, 1998; Member, Executive Committee, National Science Board, 1998; Member, American Meteorological Society, History of the Atmospheric Sciences Committee, 1996; Member of Octopation for Woods Hole Oceanographic Institution, 1999; Member of National Energy Research Scientific Computing Center (NERSC) Policy Board of the Lawrence Berkeley National Laboratory 1999; AMS Award Committee,

Tom M. L. Wigley, Member, United Nations Environment Program (UNEP) Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility (GEF), 1995; Member, American Geophysical Union, Atmospheric Sciences Section, Climate and Paleoclimate Committee, 1996; Member, NCAR Aerosols Project (NAP) Steering Committee, 1997; Member, NCAR/ESIG Climate Affairs Module Program Advisory Committee, 1998; Member-at-large, American Association for the Advancement of Science, Atmospheric and Hydrospheric Sciences Section, 1998; Chair, PRESCIENT Steering Committee, Natural Environment Research Council (NERC), Swindon, U.K., 1999

David Williamson, Member of CAS/JSC Working Group for Numerical Experimentation (WGNE), 1991; Member, DOE Climate Change Prediction Program (CCPP) Science Team, 1991; Member, Atmospheric Modeling Inter-comparison Project Panel, 1996; Member, Program Committee for the 8th Workshop on Numerical Solutions of Fluid Flow in Spherical Geometry, 1999; Member, Program Committee for the 2nd AGU Chapman Conference on Water Vapor in the Climate System, 1999; Member, Program Committee for the 2nd World Climate Research Programme (WCRP) Workshop on Systematic Furras, 1999

Professional Society Memberships

Thomas Bettge, American Meteorological Society

Maurice L. Blackmon, American Meteorological Society

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

Esther Brady, American Geophysical Union; The Oceanography Society

Grant Branstator, American Meteorological Society

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

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

Aiguo Dai, American Geophysical Union

Clara Deser, American Geophysical Union; American Meteorological Society

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

James Hack, American Meteorological Society

Matthew Hecht, American Meteorological Society; American Geophysical Union

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

Arlie Huffman, American Geophysical Union; American Meteorological Society

James Hurrell, American Meteorological Society; American Geophysical Union

Jeffrey Kiehl, American Geophysical Union; American Meteorological Society

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

Samuel Levis, American Geophysical Union

Roland Madden, American Meteorological Society; American Geophysical Union

Gerald Meehl, American Meteorological Society; American Geophysical Union; Pacific Science Association

Ralph Milliff, American Meteorological Society; American Geophysical Union; The Oceanography Society

Sylvia Murphy, American Geophysical Union

Philippe Naveau, American Statistical Association; Institute for Mathematical Statistics

Douglas Nychka, American Statistical Association; Institute for Mathematical Statistics; Royal Statistical Society

Keith Oleson, 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

Philip Rasch, American Meteorological Society

Ramalingam Saravanan, American Meteorological Society; American Geophysical Union

David Schimel, American Geophysical Union; Ecological Society of America

Dennis Shea, American Meteorological Society

Christine Shields, American Meteorological Society

Claudia Tebaldi, American Statistical Association

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

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

Tom M. L. Wigley, American Association for the Advancement of Science

Robert L. Wilby, British Hydrological Society; American Geophysical Union; International Association of Hydrological Sciences; Air and Waste Management Association

David Williamson, American Meteorological Society

Honors and Awards

Clara Deser, Meisinger Award, American Meteorological Society, 1999

Joseph Tribbia, University of Michigan, Department of Atmospheric, Oceanic, and Space Sciences, Alumni Society Merit Award

Environmental and Societal Impacts Group

$Scientific, Policy, or\ Educational\ Committees, Advisory\ Panels, Boards$

John Firor, Scientific Advisory Committee, Winslow Foundation (1991-present).

John Firor, Advisory Board, Natural Resources Law Center, University of Colorado (1998-present).

John Firor, Trustee, World Resources Institute (Trustee, 1982-1999; Vice-Chair, 1994-1999).

Michael Glantz, UNU (United Nations University) Project Coordinator, Socioeconomic Impacts of El Niño (1998-2002).

Michael Glantz, Member of Ad Hoc Review Panel for the International Research Institute (1999-present).

Michael Glantz, Organizing Committee for Workshop on Global Change and Protected Areas, held September 1999 in Abruzzo, Italy.

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, Member of Environmental Literacy Council, a program focusing on environmental education K-12 (1998-present).

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 (1980-present).

Michael Glantz, Steering Committee, Center for Environmental Journalism, University of Colorado (1992-present).

Richard Katz, Regional Representative (North America), Board of Directors, International Environmetrics Society (1999-present).

Richard Katz, Member, Program Committee, American Meteorological Society Fifteenth Conference on Probability and Statistics in Atmospheric Sciences (1999-present)

John Magistro, Committee Member of the Political Ecology Society Organization (PESO) (1995-present)

John Magistro, Program Committee Member, 1999 Annual Meeting to be held in Tucson, Arizona, in April 1999, Society for Applied Anthropology (1994-1999).

Linda Mearns, NAS, NRC Panel on Climate, Ecosystems, Infectious Diseases and Human Health (1999-present).

Linda Mearns, Member, NIGEC National Office Committee on Integrated Assessment (1999-present).

Linda Mearns, Member, AMS Committee on the Status of the Bulletin of the AMS (1999-present).

Linda Mearns, Member, Geostatistics Project Internal Advisory Committee, NCAR (1998-present).

 $Linda\ Mearns, Member,\ National\ Agricultural\ Sector\ Team,\ US\ National\ Assessment\ (1998-present).$

Linda Mearns, Member, Climate Change Scenarios Writing Team, US National Assessment (1998-present).

Linda Mearns, Member, Regional Assessment Teams for the Southwest, and Rocky Mountain Basin and Range Regions (1998-present).

Linda Mearns, Member, Land Surface Working Group, Climate System Modeling Project, NCAR (1996-present).

Linda Mearns, Director, Climate Specialty Group, American Association of Geographers (1996-present).

Linda Mearns, Member, 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, Water Cycle Study Group, US Global Change Research Program (1999-present).

Kathleen Miller, Member, National Academy of Sciences/National Research Council Panel on the Human Dimensions of Seasonal-to-Interannual Climate Variability (1997-present).

Kathleen Miller, Member, Steering Committee for the Southwest Region of the US National Assessment Team (1996-present).

Kathleen Miller, Member, Oversight Committee, National Research Council Assessment of Future Roles, Challenges and Opportunities for the U.S. Geological Survey (1996-present).

Roger Pielke, Jr., Member, Committee on Societal Impacts, American Meteorological Society (1996-present; Chair, 1999-present).

Roger Pielke, Jr., Member, Board on Atmospheric Sciences and Climate, National Academy of Sciences (1999-present).

Roger Pielke, Jr., Member, Advisory Panel to the Midwestern Climate Center (1999-present).

Roger Pielke, Jr., Member, Climate and Global Change Review Panel, National Oceanic and Atmospheric Administration (1998-present).

Roger Pielke, Jr., Chair, US Weather Research Program, Weather Impacts and Use Assessment Committee (1998-present).

Roger Pielke, Jr., Member, Science Steering Committee, World Meteorological Organization World Weather Research Program (1998-present).

Roger Pielke, Jr., Member, Science Steering Committee, US Weather Research Program (1997-present).

Roger Pielke, Jr., Member, Scientific Steering Committee, Symposium on Climate, Environmental Change, and Regional Impacts, National Oceanic and Atmospheric Administration and Chinese Meteorology Agency (1998-1999).

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 (1997-1999).

Roger Pielke, Jr., Member, Task Committee on Mitigating Hydrological Disasters, American Society of Civil Engineers (1997-1999).

Roger Pielke, Jr., Member, Committee on Societal Impacts, American Meteorological Society (1996-1999).

Roger Pielke, Jr., Member, Science Steering Committee, Joint US-Chinese Symposium on Climate, Environmental Change, and Regional Impacts, and Workshop on the Impacts of Ocean Variability and Climate, NOAA/CMA/COA (1998-1999).

Roger Pielke, Jr., Member, Program Review Team, Battelle Pacific Northwest National Laboratory Climate and Global Change Program (10-11 June 1999).

Roger Pielke, Jr., Member, National Center for Environmental Prediction/UCAR Research Review Team of the NCEP Storm Prediction Center (24-25 February 1999).

Roger Pielke, Jr., Member, Task Committee on Mitigating Hydrological Disasters, American Society of Civil Engineers (1997-present).

High Altitude Observatory

Editorships of Peer Reviewed Journals

Peter A. Fox is an Associate Editor of Fundamentals of Cosmic Physics, 1993-present. Boon Chye Low is a member of the Board of Editors of Solar Physics, 1992-2002. Arthur D. Richmond is an Associate Editor of Journal of Geophysical Research, Space Physics, 1997-2000.

Scientific, Policy, or Educational Committees and Advisory Panels or Boards

Thomas J. Bogdan is a member of the Solar Magnetism Initiative (SMI) Steering Committee, 1996-present.

Timothy M. Brown serves on the NSO Users Committee, 1997-2000.

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

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

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

Peter A. Fox is a member of the International Solar Cycle Studies (Scientific Committee on Solar Terrestrial Physics), Working Group 1, Subgroups 1 and 3, 1997-present, and co-leader of Subgroup 1, 1999-present.

Peter A. Fox is a member of the Distributed Oceanographic Data System (DODS) Technical Advisory Committee, 1997-present.

Peter A. Gilman serves on the Global Oscillations Network Group (GONG) Scientific Advisory Committee, 1985-present.

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

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

Peter A. Gilman serves on the Council of the Solar Physics Division, American Astronomical Society, 1998-present

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

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

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

Michael T. F. Knölker was a member of the Association of Universities for Research in Astronomy (AURA) Observatory Visiting Committee (OVC), 1996-1999,

Michael T. F. Knölker is a member of the Board of Directors of the Association of Universities for Research in Astronomy (AURA) Observatory Visiting Committee (OVC), 1999-present.

Michael T. F. Knölker serves as co-chair of the Solar Magnetism Initiative (SMI) Steering Committee, 1995-present.

Michael T. F. Knölker served on the Search Committee for the NCAR Director, 1999.

Michael T. F. Knölker served on the NCAR Search Committee for Director of the Environmental and Societal Impacts Group (ESIG), 1999.

Michael T. F. Knölker served as chair of the Panel on Solar Astronomy of the Astronomy and Astrophysics Survey Committee (AASC) for the Decadal Survey, 1998-present.

Bruce W. 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 B. MacGregor was a member of the NSF Panel on Knowledge and Distributed Intelligence, July 1999.

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

Arthur D. Richmond is a member of the Science and Technology Definition Team for the NASA Global Electrodynamics Mission, 1998-present.

Arthur D. Richmond is a member of the Committee on Atmospheric and Space Electricity, American Geophysical Union, 1998-2000.

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

Raymond G. Roble serves on the University of Michigan College of Engineering Alumni Society Board of Governors, 1996-present.

Raymond G. Roble serves on the NSF Arecibo Visiting Committee, Cornell University, 1999-present.

Raymond G. Roble serves as a member of the NSF GEM Global Geospace Circulation Modeling (GGCM) advisory panel, 1999-present.

Steven Tomczyk is a member of the Global Oscillations Network Group (GONG) Data Management and Analysis Center Users Committee, 1995-present.

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

Oran R. (Dick) White serves on the NOAA Solar Prediction Panel, 1997-1999.

Honors

(none)

Awards

Art Hundhausen received the National Academy of Science Arctowski Medal for his "exceptional research in solar and solar-wind physics, particularly in the area of coronal and solar-wind disturbances."

Mesoscale and Microscale Meteorology

Editorships of Peer-Reviewed Journals

- Roelof Bruintjes: Journal of Applied Meteorology, Assistant Editor, January 1999 to present
- Christopher Davis: Monthly Weather Review, Associate Editor, 1996 to 1999

 Vive Hand Party International Property of the Property of the
- Ying-Hwa Kuo and Dave Jorgensen: Monthly Weather Review, Co-Chief Editors, 1998 to present
- . Donald Lenschow: Boundary-Layer Meteorology, Editorial Board, 1995 to present; Journal of Atmospheric Chemistry, Editorial Board, 1993 to present
- Chin-Hoh Moeng: Journal of the Atmospheric Sciences, Associate Editor, 1992 to present
- Richard Rotunno: Quarterly Journal of the Royal Meteorological Society, Associate Editor, January 1999 to present
- Piotr Smolarkiewicz: Journal of Computational Physics, Associate Editor, 1997 to present; Applied Mathematics & Computational Science, Editorial Board, 1997 to present
- Chris Snyder: Journal of Atmospheric Sciences, Associate Editor, January 1999 to present
- Stanley Trier: Monthly Weather Review, Associate Editor, 1998 to present
- Jeffrey Weil: Boundary-Layer Meteorology, Editorial Board, 1998 to present
- Morris Weisman: Monthly Weather Review, Associate Editor, 1998 to present; Encyclopedia of Atmospheric Sciences, Advisory Board, 1999 to present

External Scientific, Policy, or Educational Committees or Advisory Panels

William Bonner

- Chair, National Advisory Panel, Earth Studies Program, Clark Atlanta University, 1994-1999
- Member, National Research Council, National Weather Service Modernization Committee, 1995-1999
- Member, UCAR/NCEP (National Centers for Environmental Predictions) Advisory Panel, 1995-1999
- Chair, National Advisory Panel, Meteorology Program, Jackson State University 1996-1999
- · Chair, NRC Subcommittee, Observer Program/Climate Record, 1998

Richard Carbone

- Member, USWRP (United States Weather Research Program) Science Steering Committee, April 1999 to April 2002
- Vice-President, IUGG/IAMAS (International Union of Geodesy & Geophysics / International Association of Meteorology & Atmospheric Physics), July 1999 to July 2003
- Member, USWRP Interagency Working Group, October 1995 to March 1999
- Member, NSSL (National Severe Storms Laboratory) Science Review Panel, 1999
- Member, National Academy of Sciences, NRC GEWEX (National Research Council Global Energy and Water-cycle Experiment) Panel, 1997 to 2000
- Chair, NCEP (National Centers for Environmental Prediction) / Hydrometeorological Prediction Center Review Panel, October 1998 to June 1999
- Vice Chair, NCEP Advisory Panel, 1996 to 2000
- Chair, WWRP (World Weather Research Program) Science Steering Committee, 1998 to 2002
- . Chair, USWRP Science Steering Committee, 1995 to 1999
- Member, AMS Committee on Weather and Forecasting, 1998 to 2000.
- . Member, NOAA/NAOS (National Oceanic and Atmospheric Administration/North American Observing System) Test and Evaluation Working Group, 1997 to present

Christopher Davis

- Ex-officio Member, AMS (American Meteorological Society) Mesoscale Committee, January 1998 to January 1999
- Chair, Eighth American Meteorological Society (AMS) Conference on Mesoscale Processes, 28 June to 1 July 1999

James Dve

- · Member, American Geophysical Union (AGU) Committee on Atmospheric and Space Electricity, 1994 to present
- Member, Organizing Committee, 11th International Conference on Atmospheric Electricity Gunthersville, AL, June 1999

Joseph Klemp

- · Chair, American Meteorological Society Information Systems Committee, 1995 to present
- Member, American Meteorological Society Publications Commission, 1986 to present
- Member, Naval Research Laboratory Marine Meteorology Review Panel, May 1999

Mitchell Moncrieff

- · Member, WCRP/GEWEX (World Climate Research Program/Global Energy and Water-cycle Experiment) Scientific Steering Group, 1997 to present
- · Member, Department of Energy/ARM (Atmospheric Radiation Measurement program) Tropical Pacific Advisory Committee, 1994 to present
- Member, Scientific Steering Committee, Maritime Continent Thunderstorm Experiment (MCTEX), Darwin, Australia, 1993 to present
- Member, Science Panel, GCSS (GEWEX Cloud System Study), 1992 to present.
- Member, Program Review Panel, Cooperative Institute for Mesoscale Meteorology, University of Oklahoma/NSSL (National Severe Storms Laboratory), Oklahoma, USA, 1991 to present

Richard Rotunno

Member, Scientific Steering Committee/USWRP (U. S. Weather Research Program), April 1998 to present

Peter Sullivan

· Member, Workshop on Air/Sea Interaction, June 1999

Jielun Sur

- . Member, American Meteorological Society Boundary Layer and Turbulence Committee, 1998 to 2000
- Program Chair, 14th American Meteorological Society Boundary Layer and Turbulence Meeting, 1999 to 2000

Jeffrey Trapp

· Member, AMS STAC (Scientific & Technological Activities Committee) on Severe Local Storms, 1999

Jeffrey Weil

- · Chair, American Meteorological Society (AMS) Committee on Meteorological Aspects of Air Pollution, January 1998 to present
- · Chair, AMS/EPA (Environmental Protection Agency) Regulatory Model Improvement Committee, June 1991 to present

Morris Weisman

· Member, American Meteorological Society (AMS) Committee on Severe Local Storms, 1998 to 2000

Honors and Awards

- · David Gill: MMM Division Incentive Award, December 1998
- Kyoko Ikeda: The Stormy Rottman Scholarship, Metropolitan State College of Denver, August 1999
- Charles Knight: UCAR Outstanding Performance Award in Education, December 1998
- Margaret LeMone: Member NAE, 1999; Fellow, American Meteorological Society, 1999; Fellow, AAAS, 1999; Editor's Award, American Meteorological Society 1999
- . Donald Lenschow: UCAR Outstanding Performance Award in Publications, December 1998
- Edward Patton: Research Scholar, Minnesota Supercomputing Institute, July 1999
- Jordan Powers: MMM Division Incentive Award, December 1998
- · Patricia Waukau, MMM Division Incentive Award, December 1998



Above: Senior Scientist Emeritus Jackson Herring at his retirement reception.



Above: MMM Director Robert Gall (center) with Incentive Award recipients Jordan Powers (left) and David Gill (right).

Research Applications Program

Scientific Computing Division

Basil Irwin serves on the Joint Engineering Task Force (JET) and the Westnet Steering Committee.

Marla Meehl serves on the Westnet Steering Committee, the University of Colorado Interdisciplinary Telecommunications Program Advisory Board, participated with a team of NCAR/UCAR technical women staff to meet with junior high women to encourage them to pursue math and science, presented a seminar on centralized Networking Cost Models to the University of Colorado Network Task Force, serves on the VBNS Technical Consulting Committee (vTCC), serves on the GOIN Networking Subgroup, served on NSF High Performance Connection Review Panel, and served on the University of Utah Security Evaluation Team.

Pete Siemsen served as the Denver Cisco User Group (DCUG) secretary.

Jim Van Dyke serves on the Boulder Research and Administration Network (BRAN) Technical Committee.

Ginger Caldwell chaired the SC98 Education Program held November 7-13, 1998 in Orlando. SC98 was sponsored by the IEEE Computer Society and ACM SIGARCH.

Sally Haerer is President of the Cray User Group (CUG), an international, independent, volunteer-organized, corporation of member organizations that own or use Cray or SGI computer systems with emphasis on high-end performance, technical computing, and visualization. She chairs the organization's Board of Directors and Advisory Council. She is a member of the Parallel Tools Consortium (Ptools) Steering Committee, which works to make parallel software more responsive to user needs. Regarding SC (the premier conference series on High-Performance Networking and Computing), Sally was elected to the Steering Committee in November 1998 for a four-year term. She served on the SC98 Tutorials Committee, charged with the review and selection of high-quality tutorials presented to SC98 conference attendees in Orlando. Additionally, she was a member of the SC99 Executive Committee serving in the role of Exhibits Coordinator. She was responsible for the oversight and planning of Industry Exhibits, Research Exhibits, Research Posters, the Exhibitor Forum, HPC Challenge, and Security for SC99 held in Portland, Oregon, November of this year.

Bill Spotz is a member of the American Institute of Aeronautics and Astronautics and has refereed articles for the Journal of Computational Physics and the International Journal for Numerical Methods in

Rachelle Daily serves as Secretary to the Executive Board, Mass Storage Technical Committee, IEEE Computer Society. She provided registration assistance March 15-18, 1999 for the 16th IEEE Mass Storage Symposium on Mass Storage Systems/7th NASA Goddard Conference on Mass Storage Systems and Technologies held in San Diego, CA.

Al Kellie was appointed by UCAR to the NCEP Advisory Panel Special Review Team. He is a member of the External Advisory Board to the IBM Deep Computing Institute. He co-chairs the Computing in

Atmospheric Sciences (CAS) meetings, sponsored by SCD and vendors. The next meeting is tentatively scheduled for Summer, 2001 in Freiborg, Germany.

Bernard T. O'Lear is a member of the IEEE Computer Society Mass Storage Systems Technical Committee Executive Committee. He co-chairs the Computing in Atmospheric Sciences (CAS) meetings, sponsored by SCD and vendors. The next meeting is tentatively scheduled for Summer, 2001 in Freiborg, Germany.

Susan Cross served as a community mentor in the SOARS program.

Pete Peterson served as a community mentor in the SOARS program

Steve Thomas was an editorial reviewer for the Journal of Scientific Programming and Journal of Computational Physics.

Roy Jenne serves as chair of the data exchange project under the US-Russia WG-VIII project. His memberships include the NRC Panel on the US co-op observing net of 8000 stations, the team for US Assessment Studies (for climate model archives), the data committee for GCIP (mesoscale model data), the EOSDIS Review Group (ERG) for NASA Earth Science Data Systems, the study group for the new NASA EOSDIS, the USRA Science Council for Earth Sciences, the ECMWF Re-Analysis External Advisory Group, and the Council on Long-Term Climate Monitoring.

Steve Hammond served as a scientific writing mentor in the SOARS program.

Brian Bevirt served as a scientific writing mentor in the SOARS program.

Juli Rew served as a scientific writing mentor in the SOARS program.

Nancy Dawson served as a scientific writing mentor in the SOARS program

Lynda Lester served as a scientific writing mentor in the SOARS program and offered a class on web design as part of the UCAR Staff Development program. She arranged for NCAR affiliation with WebDad, the Boulder Web Designers and Developers Group, and hosts their monthly meeting at the Mesa Lab. She was an invited speaker on web design at the annual Region 7 Conference of Society for Technical Communication, of which she is a senior member. She is a member of the American Association of Internet Professionals and the Society for Professional Journalists. She also served for the fourth year as managing editor/photographer for CUG.log, the international newsletter of the Cray User Group (CUG), and as secretary of the CUG Advisory Council.

Steve Worley, representing NCAR and NSF, has served on the Global Change Data Information System, Data Management Working Group Workshop steering committee since 1995. The committee organizes semi-annual workshops. Most recently he has assisted in the organization and has chaired a session at the Data Management Working Group Workshop 1999, Data Archiving: Policies and Practice, Laurel, MD, 4-6 November, 1999. He is also an editorial board member for the journal of Oceanic and Atmospheric Data Management (ODAM). ODAM is a new Elsevier Science Ltd. publication. In service to the scientific community he was part of a proposal review panel for NOAA and DOE concerning the Ocean-Atmosphere Carbon Exchange Study (OACES). For this panel three formal presentation and four informal presentation were made in the process of reviewing 22 proposals.

Colorado Computational Science Fair

For the past six years, NCAR's Scientific Computing Division has co-hosted the Colorado Computational Science Fair (CCSF) in conjunction with Colorado State University to encourage high school students to learn more about computational science. The CCSF is intended to serve as a supercomputing/information technology competition for high school students throughout the state of Colorado. In FY1999 the CCSF was held at NCAR on Saturday, May 8, 1998.

Students from Colorado and Wyoming entered 53 projects into the competition. Internet connections were provided for approximately 40 projects. The 112 participating students represented ten high schools and one home-school student.

SCD's website provides a list of the 1999 CCSF winners. Computing grants to classrooms

SCD continues to provide access to its supercomputers for undergraduate and graduate university classes. These computing resources are provided for classes engaged in modeling and simulations requiring high-performance computers. A few high school students have also been granted access for Colorado Computational Science Fair projects.

In FY1999, 41 students in nine classes used SCD's supercomputing resources, accumulating over 200 CPU hours on NCAR's Cray J90s.

SC98 Education Program Ginger Caldwell, SCD, chaired the SC98 Education Program held November 7-13, 1998 in Orlando. SC98 was sponsored by the IEEE Computer Society and by ACM SIGARCH. The focus of the SC98 Education Program was to provide an intensive experience with the tools and methods of computational science and networking presented in the context of classroom reality. The program included a special four-day session for 150 teachers, selected nationally, who attended in Orlando. An additional 100 educators located in Illinois, Iowa, and North Carolina attended remotely for three days using videoconferencing. The Education Program tested the usability of video over IP using NSF's experimental VBNS network interconnected with various state networks. A number of SCD staff provided support for this program in addition to staff from Colorado State University, East Carolina University, University of Alabama at Huntsville, Alabama Supercomputer Center for Supercomputing Applications (NCSA), Krell Institute, Iowa Public Television, Iowa State University, Iowa's Northern Trails Area Education Agency, Public Schools of North Carolina, MCNC in North Carolina, and the Maryland Virtual High School of Science and Mathematics. This experimental program was funded by NSF's Teacher Enhancement Program and by NASA. More information is available at the SC98 site. http://www.supercomp.org/sc98/education/

Increasing girls' interest in math and science The NCAR Scientific Computing Division hosted a half day visit of 30 8th and 9th grade girls on February 22, 1999. The visit was organized jointly by SCD and Wheat Ridge High School in Denver, Colorado, and evolved out of a discussion about the low enrollment of high school girls in Wheat Ridge's computer science classes. The goal of the visit was to encourage these girls to prepare themselves for careers in math and science starting in high school. Seven NCAR/UCAR women representing different areas of computing and science spoke at a roundtable discussion with two groups of 15 girls each. The visit also included a tour of the Mesa Lab's exhibits and SCD's high performance computers. The visit was a success and led to higher enrollment of girls in Wheat Ridge's strong computational science program. The eight secretary as a valiable to them.

Education

Editorships: Karon Kelly

Meteorological and Geoastrophysical Abstracts, 1992- Membership on Advisory Boards: Linda Carbone Colorado Informal Education Network (CIEN) Steering Committee 1996- Fairview Fields Committee, 1998-Wild Bear Nature School. Inc. Advisory Board1998-

Leslie Forehand

Boulder Area Librarians Network, Coordinator 1995-

Carol McLaren

Colorado Cache of Science Educators

Interactive Learning Center (Crossroads Mall), Steering Committee,

Rocky Mountain Discovery Center, Advisory Board

Nita Razo

Colorado Informal Education Network (CIEN), 1996-

Boulder Historic Society, 1999-

Thomas Windham

University of Colorado, Boulder, Graduate School Advisory Council, 1994-

Community Learning Center Advisory Board, 1999. Awards: 1999 UCAR Outstanding Performance Award for Education: Beverly Lynds (formerly with Unidata) was awarded the 1999 UCAR Outstanding Performance Award for Education for the Surgination of the Skymath teaching modules which have been adopted in many classrooms nationally and internationally. Skymath these advantage of a student's natural interest in scientific discovery as a vehicle for fostering enthusiasm in mathematics.







1999

ACD
ASP
ATD
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HAO
MMM
RAP
SCD

Advanced Study Program

Table of Contents | Highlights | Postdoctoral Research | Educational Activities | Publications | Staff, Visitors & Collaborators

Director's Message



The ASP relation, brandly defined, is to help MCAR (and the scientific communities it serves) prepare for the future. We work in support of other MCAR 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 neteractions with universities, and to promote continuing excitations at 10 MCAR.

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 350 postdoctoral scientists to NCAR. Each year between 10 and 15 new postdoctoral scientists come to NCAR, usually for two year appointments. They conduct their research in collaboration with NCAR scientists and work in all areas in which NCAR is involved. NCAR bearings from the indipendence their pre-entire than the involved in NCAR, and from the indipendence they are encouraged to develop. Many former fellows now occupy prominent positions at UCUR universities or an NCAR, and many pre-entire collaborations between NCAR and university scientifications from the indipendence they are encouraged to develop. Many former fellows now occupy prominent positions at UCUR universities or an NCAR, and many pre-entire collaborations between NCAR and university scientifications.

The ASS does promotes the casesimation of research areas held most special emphasis. Other because they are particularly limps by because they seem under a scromplished primarily by convening workshapes and supporting appropriate visitors. As part of this effort, ASS bends an annual summertime collequium that brings graduate students to NGAR for an intensive set of lectures presented by specieties demonstrate to mention and under the continual an extender of mentional students and for an intensive set of lectures presented by specieties demonstrate to mention and under the continual and area device for mention and under the continual and area device for mention of NGAR.

Another function of the ASP is to promote new sinces initialises and programs that do not have a natural home in any one of the MAR divisions. The Grophysical Turbulence Program seeks to represent interests in turbulence program normally hosts an annual workshop, sponsors a senimar series, and in other ways helps coordinate the active program in turbulence research at MAR. We have receptly been deligated programed for the Coordinate and promote account overage and at MAR. We have receptly been formation and only a promote account overage and promote account overage and the MAR. We have receptly been formation and the program of the service of the program of the program of the MAR. We have receptly been formation and the program of the progra

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For more information on the ASP mission and plans, see the ASP Strategic Plan.

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Advanced Study Program

Table of Contents | Highlights | Postdoctoral Research | Educational Activities | Publications | Staff, Visitors & Collaborators

Highlights

The ASP Postdoctoral Fellowships

In FV 99 A Posted SE postational fellows. Twelve new fellows began their appointments, \$13 continues, and 10 completed their ferms at NGAR. A brief devices projection of this program can be found in the \$42P basics and a Fellows and to a fellow and the postational fellows. The postational fellows and programs in \$44P. Se details of their accomplishments. The postational fellows and programs in \$44P. Se details of their accomplishments from those devictions from those devictions from those devictions and programs. We have interested reflects and programs devictions and programs in \$44P. Set details of their accomplishments.

Summer Colloquium

ASP and the Memorale and Microscale heteorology, Division (MMM) housed a summer colloquium in June 1999 on the formation in the Airmosphere." Sharph (MMM) coordinated the vestions which were held at MARE ASP concurrently used Web delivery to record and disply the lectures of 20 geodesic entertainment of the minimum of t

The Thompson Lecture Series

A new series of visits and lectures was established in FY-98 to foster interaction between prominent scientists and the postdoctoral fellows and other junior scientists at NCAR. Three additional visitors were brought to NCAR this year under the program for meetings and discussions focussed on the research of the ASP postdoctoral fellows.

Geophysical Turbulence Program(GTP)

FY-99 was a busy year for GTP, which hosted two workshops and numerous scientific visitors.

The first workshop on "Mining and Recutive Turbulence" is sus sponsored by CTP and coordinated by a large subset of the CTP membership (see Tribulence" is sus sponsored by CTP and coordinated by a large subset of the CTP membership (see Tribulence" in Annual Property of the CTP membership (see Tribulence"

The second workshop on the topic of "Small-Scale Turbulence" was hosted by GTP in August 1999 and coordinated by Donald Lenschow (MMM/ATD) and Andreas Muschinski (NOAk). The 37 participants represented 15 institutions from the U.S., Japan, Sweden and France.

CIP based 11 seminans which covered measuresh aspects of the following topics: multicoling and intermittency in furbulence: recent developments in Milb Qual furbulence: a new approach to subgrid scale modeling in the stratophene in the following the stratophene in the following the forest competent for the following the stratophene in forest campaigner in forest campaig

NCAR Graduate Fellows

The ASP appointed its Condusia California during TY 6F A Legions appointments. I continued and 1 completed an appointments. Journal for foliar (University of Colorado) in participating in the development of Colorado (Prince) for colorado (Prince) for Colorado) in participating in the development of Colorado (Prince) for Colorado

NCAR Aerosol Program

The ASP also served as host for the NCAR Aerosol Program (NAP) during FY-99.

Charles Brock (University of Demor) helped with the activities of the NZR Aerosol Program and oversaw construction of an aerosol measuring system for use throughout NZAR. Sonia Lasher-Trapp (Texas AAM University) started a long-term visit during which she will work with scientists in MMM on studies of cloud microstructure using data from the Small Cumulus Microphysics Study. At to incorporate Laure Chaumat visit with Sonia's work and add
Herman Severing and Girls McConville's NAP affiliations.

BACK TO TOP

1999

ACD ASP ATD CGD ESIG

MMM RAP

HAO

Advanced Study Program

Table of Contents | Highlights | Postdoctoral Research | Educational Activities | Publications | Staff, Visitors & Collaborators

Postdoctoral Research

Because ASP postdoctoral fellows are involved broadly in the NCAR scientific program, their activities are discussed in depth in the reports from the various divisions and programs at NCAR. However, to show the diversity of their work and their overall influence on NCAR accomplishments, the following presents a brief overview of their activities are discussed in depth in the reports from the various divisions and programs at NCAR. However, to show the diversity of their work and their overall influence on NCAR accomplishments, the following presents a brief overview of their activities are discussed in depth in the reports from the various divisions.

Patrick Y. Chuang Annointment Start Date: April 19, 1999

Subjects of the possible presence of organic films on the surface of almospheric aerosols have been conducted. One potential important effect of such films is the retardation of the condensational growth rate of such particles in environments of changing humidity. If growth rates are sufficiently reduced, such films may alter the microphysics of cloud drople formation, or affect the deposition pattern of inhaled atmospheric aerosols in human respiratory fracts. Organic films could also affect the transfer of species across the airfiguid interface, impacting the partition gives a better operations. The first deployment of the approaches of themisting. On Mexico City, as and cloud film from the films and cloud film from the surface of the films of the deposition of the films o

recontrer collaborates with Dr. Insepts in M.P.A. Contract and College of Computer, Mathematical, and Physicial Sciences, Department of Meteorology, and Dr. William College of Livership of Manyland, College of Computer, Mathematical, and Physicial Sciences, Department of Meteorology, and Dr. William College of M.P.A. College of Computer, Mathematical, and Physicial Sciences, Department of Meteorology, and Dr. William College of Computer (Method Sciences) and Sciences of English College and Sciences (Internal Amendmental College) and Sciences (I

Tom Hamill's
Tom Hamill, Chris Snyder, and Rebecca Morss (MIT) submitted and had accepted a paper entitled, "A Comparison of Probabilistic Forecasts from Bred, Singular Vector, and Perturbed Observation Ensembles." It will appear shortly in Monthly Weather Review.

In this paper, we explored the statistical properties of analysis and forecast errors from commonly used ensemble perturbation methodologies. A quasi-geostrophic channel model was used, coupled with a 3D-variational data assimilation scheme. A perfect model was assumed, whereby synthetic observations were generated by adding noise to another model solution generated from the same forecast model. Three particulation methodologies were considered. The benefity and singular vector (SI) methods approximate the strategies cornerly used a populational content in the LS and Europe, respectively. The printed observation (SI) methodology approximates a random sample from the analysis principles (and as a similar to the method performed at the Caradian Meteorological Centre. Initial condition.

Relative to breeding and SV, the PD method here produced analyses and forecasts with desirable statistical characteristics. These include consistent rank inslogram uniformity for all variables at all lead times, high spreadskill correlations, and calibrated, reduced-enter probabilistic forecasts. It advantages to be a second to be a supplementation of the PD initial conditions were re-centered on the control analysis, and (2) by construction, the perturbed observation entered in the control initial conditions member and as in the proportion of the proportion of the improvement was lost when PD initial conditions were re-centered on the control analysis, and (2) by construction, the perturbed observation entered in the control initial conditions member and as in a special vector perturbations of the control analysis, and (2) by construction, the perturbed observation entered in the control analysis of the proportion of the improvement was lost when PD initial conditions were re-centered on the control analysis, and (2) by construction, the perturbed observation entered in the control initial conditions member and as included in the proportion of the improvement was lost when PD initial conditions were re-centered on the control analysis, and (2) by construction, the perturbed observation entered in the control initial conditions member and as in the proportion of the improvement was lost when PD initial conditions were re-centered on the control analysis, and (2) by construction, the perturbed observation of the improvement was lost when PD initial conditions were re-centered on the control analysis, and (2) by construction, the perturbed observation of the improvement was lost when PD initial conditions were re-centered on the control analysis, and (2) by construction of the improvement was lost when PD initial conditions were re-centered on the control analysis and the perturbed observation of the improvement was lost when PD initial conditions were re-centered on the control analysis and the perturbed observ

These results suggest that in the absence of model error, an ensemble of initial conditions performs better when the initialization method is designed to produce random samples from the analysis pdf. The perturbed observation method did this much more satisfactorily than either the breeding or singular vector methods.

The ability of the perturbed observation ensemble to sample randomly from the analysis pdf also suggests that such an ensemble can provide useful information on forecast covariances and hence improve future data assimilation techniques

Thomas M. Hamill and Chris Snyder also submitted a paper entitled. "A Hybrid Ensemble Kalman Filter / 3D-Variational Analysis Scheme," to Monthly Weather Review, In this paper, a hybrid 3-dimensional variational (3D-Var) / ensemble Kalman filter analysis scheme was demonstrated using a quasiposstrophic model under perfect-model assumption. Four networks with differing observational densilies were tested, including one network with a data woid. The hybrid scheme operated by computing a set of parallel data assimilation cycles, with each member of the set receiving unique perturbed observations. Background error covariances for the data assimilation are estimated from a linear combination of line-invariant 3D-Var covariances and flow-dependent covariances and flow-de

The analysis scheme as good feet of days, in exclusion as an agreement of the analysis corrections, over long distances. The relative improvement of our source is sourced weighting of ensemble based covariances is desirable to reduce the impact of sportious analysis corrections, over long distances. The relative improvement or our 3D-Var analyses was dependent upon the observational data density performs beet when background our covariances are estimated among fully from the ensemble, especially when the consensation are improved for the field and provides are improved for the field as a final conditions generated from the hybrid are generally well-calculated and provides an improved for the field conditions generated from the hybrid are generally well-calculated and provides an improved for the field conditions of ensemble specially well-calculated and provides an improved for the field conditions of ensemble specially well-calculated and provides an improved for the field conditions of ensemble specially well-calculated and provides an improved for the field conditions of ensemble specially well-calculated and provides an improved for the field conditions of ensemble specially well-calculated and provides an improved for the field conditions of ensemble specially well-calculated and provides an improved for the field conditions of the field condition

Sonis Labert-Tags
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nh is work include Dr. William Cooper of NVAR, Chris Webster of NVAR, and more recently, several members of the cloud physics group at the University of Wyoning Almospheric Science Department. Once the data evaluation is complete, the data will be used to quantify the width of the cloud dropplet spectrum in adiabatic cores of the observed curruil, and to compare those values with parcel model predictions of diffusional growth. Dr. William Cooper of NVAR, And Dr. Ed Zisser of the University of Ulhar are collaborations on that predictions of a compare those values with parcel model predictions of diffusional growth. Dr. William Cooper of NVAR and Dr. Ed Zisser of the University of Ulhar are collaborations on the university of Ulhar are collaborations on this hast project include Dr. Terry Clust, Dr. Expel Edurations and Dr. WAR.

The substance of the University of Ulhar are collaborations on this interpretation (about to 10 meters) to study broadening of the cloud dropplet spectrum in adiabatic cores of the observed curruil, and to compare those values with parcel model predictions of diffusional growth.

The substance of the University of Ulhar are collaborations on this interpretation (about to 10 meters) to study broadening of the cloud dropplet spectrum in adiabatic cores of the observed curruil, and to compare those values with parcel model predictions of diffusional growth.

The substance of the University of Ulhar are cellular productions on this production of the cloud dropplet spectrum in adiabatic cores of the observed curruil, and to compare those values with parcel model and the substance of the observed curruil, and to compare the count of the

Daniel Le Roux

Daniel Le Roux is working in collaboration with Prof. Dale Haidwagel, from Rutgers University (New Jersey), on the numerical improvement of the spectral element ocean model (SEOM) developed at Rutgers. The purpose of the project is to device a kind of numerical filter to run SEOM with realistic viscosilies for some non trivial test cases, namely the gravitational adjustment of a density front over a slope. The ultimate goal is now-reform connective fields with the model in the Danemark Stand. Several numerical difficulties have been encountered during the last few months and the project is in progress.

Circle Moyer.

The part of the primary in a developing a new mon-linear time-dependent model to study wave-mean flow interaction in the mesosphere and lower thermosphere (MLT). This model will be used to isolate the mechanistic sepects of planetary wave - mean flow interactions seen in general circulation models and implied by observations. This model will also facilitate studies of lide mean flow interactions and of what reads in the primary interaction is present in the primary interaction in the primary interaction is present in the primary interaction in the primary interaction is presented by the primary interaction in the primary interaction is planetary wave in the primary interaction in the primary interaction in the primary interaction is planetary wave in the primary interaction in t

Jefferson Keith Moore
Since arrining at NCAR in July, Dr. Moore has collaborated with Dr. Scott Doney (NCAR) on the development of a marine ecosystem model that can predict global patterns or primary production and curbon export by phytopiankton. Preliminary results indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem interest indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem interest indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicate that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicates that these global patterns can be reproduced by allowing either light, nitrogen, or iron availability to limit phytopiankton growth rates within the ecosystem indicates that t

Jobel Norms.

One Horm's (Judges University) and secondary collaborators PNI Rasch (CGC) and SDAKS protege Joseph Horn Spatial (S) develop improved techniques for evaluating the simulation of cloudness in the NCAR Community Climate Model. Comparison of model output with observations by compositing on meteorological process rather than using time means revealed protal before the contraction of conditions of of conditions

Scott Michigan
When her all doubt as selectively of fluidenests conditions described by the program of the solar developed (legal and legal and le Scott McIntosh We have set about the unde

Calibborators :

Philip Judge, Thomas Bogdan, Paul Charbonneau &
Brace Liter (NCAR High Altitude Observationy)

Wing Charles (Charles High Altitude Observationy)

Wing Literature (Interestry of Class (Interestry of Class

Branch McDendard (Glasspow)

John Brown (University of Classpow)

Bernhard Teck, Jack Ireland (NASA Goddard Space Flight Center)

Andrew Comany (Gpen Inthrestry)

Horman Supering:
The locus of my eight with ASP has been to facilitate the development of an MCAROSP Aerosol Program, or NVP. The spent several hours per week from January through August visiting with NCAR scientists, discussing large-scale aerosol field projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications and projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications and projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications and projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications and projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications and projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications and projects that might be seen as "NCAROS own", and other communications entenance to help identify a longer-term plan for NAP. A synthesis of these communications are not always and the synthesis of the synth

A second activity during my sabbatical at NCAR, August-Occember, 1999, has been collaboration with NCAR scientists, mostly within the Almospheric Chemistry Division, on field research at the Niwot Ridge, CO, atmosphere-forest exchange study site. Understanding relations between the carbon and nitrogen cycles at this coniferous forest study site has been the focus of this work.

Matthew Wheeler
Matthew Wheeler studied the dynamics and predictability of large-scale way

Mathew Wheelr studied the dynamics and predictability of large-scale waves coupled with connection in the tropical tropophere. It is research showed that such waves are ponly represented in general crisionism models, such as NASA's community climate model (CAII), and thus pose a problem for namerical prediction. His efforts here that surned to the has developed as weap part that slows the world used many community community common transmission of the scale of the common transmission of the common trans



1999

ACD
ASP
ATD
CGD
ESIG
HAO
MMM
RAP
SCD

Advanced Study Program

Table of Contents | Highlights | Postdoctoral Research | Educational Activities | Publications | Staff, Visitors & Collaborators

Educational Activities

Showcase Seminar Series

The ASP continued this series of seminars that are presented joinly by an INCAR division or program and ASP. These seminars, intended for an audience of all NCIAR scientists, feature prominent research results that should be widely known at INCAR. They are intended to promote greater understanding of the range of scientific activities underway at INCAR and to highlight particularly important research results.

Thompson Lectures

The ASP recordly established the "Thompson Lecture Series," named in honor of Phil Thompson, who founded the Advanced Study Program and was NCAR's first associate director. Under this program, prominent scientifists are brought to NCAR for short visits that promote interaction between them and the postdoctoral fellows and other Junior scientifists at NCAR. In addition to presenting formal lectures, the Thompson Lectures is listen to briefings on the research being contacted by ASP Fellows and comment and provided whatever thought to NCAR. Jerry Mahiman (Geophysical Fluid Dynamics Laboratory, NCAR), kerry financial (Rassachuseth is installed or Erchrology) and Tiansa Sombools (University of Indicagon.)

Other Educational Activities

Several ASP Postdoctoral Fellows served as SOARS mentors during the summer months. SOARS is hosted through the Human Resources department of NCAR.

BACK TO TOP

1999

ACD
ASP
ATD
CGD
ESIG
HAO
MMM
RAP



Advanced Study Program

Table of Contents | Highlights | Postdoctoral Research | Educational Activities | Publications | Staff, Visitors & Collaborators

Publications

Fournier, A., 1999: Transfers and fluxes of wind kinetic energy between orthogonal wavelet components during atmospheric blocking. Wavelets in Physics. J.C. van den Berg, Ed., Cambridge, 263-298.

Galand, M., and A. D. Richmond, 1999: Magnetic mirroring in an incident proton beam. J. Geophys. Res., 104, 4447-4455., J. Lilensten*, W. Kofman*, and D. Lummerzheim*, 1998: Proton transport model in the ionosphere: 2. Influence of magnetic mirroring and collisions of the angular redistribution in a proton beam. Ann. Geophys., 16, 1308-1321.

....., D. Toublanc*, and S. Maurice*, 1999: The ionosphere of Titan: idean diurnal and nocturnal cases. Icarus, 140, 92-105.

Gettelman, A. and S. L. Baughcum*, 1999: Direct deposition of subsonic aircraft emissions into the stratosphere. J. Geophys. Res., 104(D7), 8317-8327.

Hamill, T. M., 1999: Hypothesis tests for evaluating numerical precipitation forecasts. Wea. Forecasting, 14, 155-167.

-----, 1998: Comments on "Short-range ensemble forecasting of explosive Australian east-coast cyclogenesis." Wea. Forecasting, 13, 1205-1207.

Judge*, P. G., and H. Peter, 1998: The structure of the chromosphere. Space Sci. Rev., 85, 187-202.

Lilensten*, J., and M. Galand: 1998: Proton/electron precipitation effects on the electron production and density above EISCAT and ESR. Ann. Geophys., 16, 1299-1307.

Norris, J. R., 1999: On trends and possible artifacts in global ocean cloud cover between 1952 and 1995. J. Climate, 12, 1864-1870. ----, Y. Zhang, and J. M. Wallace, 1998: Role of low clouds in summertime atmosphere-ocean interactions over the North Pacific. J. Climate, 11, 2482-2490.

Peter, H., 1999: The chromosphere in coronal holes and the quet sun network: A He I (584 A) full-disk scan by SUMER/SOHO. Astrophys. J., 522, L77-L80.

-----, 1999: Analysis of transition-region emission line profiles from full-disk scans of the sun using the SUMER instrument on SOHO. Astrophys. J., 516, 490-504.

----, 1998: Element separation in the chromosphere. Space Sci. Rev., 85, 253-260.

---- and P. G. Judge*, 1999: On the doppler shifts of solar UV emission lines. Astrophys. J., 522, 1148-1166.

Torrence, C. and P. J. Webster*, 1999: Interdecadal changs in the ENSO-Monsoon System. J. Clim., 12, 2679-2690.

Welch, W., and K. Tung*, 1998: Nonlinear baroclinic adjustment and wavenumber selection in a simple case. J. Atmos. Sci., 55, 1285-1302.

----, and ----, 1998: On the equilibrium spectrum of transient waves in the atmosphere. J. Atmos. Sci., 55, 2833-2851.

Wheeler, M. and G. N. Kiladis*, 1999: Convectively coupled equatorial waves: Analysis of clouds and temperature in the wavenumber-frequency domain. J. Atmos. Sci., 56, 374-399.

Zhang*, Y., J. R. Norris, and J. M. Wallace*, 1998: Seasonality of large scale atmosphere-ocean interaction over the North Pacific. J. Climate, 11, 2473-2481.

Berner, J., 1999: Weather regimes and transitions in a General Circulation Model. Diplomarbeir, Meteorological Institute, Univ. of Bonn. 138 pp.

Peter, H., 1999: Doppler shifts of solar UV emission lines and the source region of the (fast) solar wind. Proc. AIP Conf. on the Ninth Intl. Solar Wind, CIP-471, 281-284.

Torrence, C., 1999: Wavelet coherency for time series analysis. Amer. Soc. Civil Eng., Intl. Water Resources Eng. Conference, Seattle, WA.

Wheeler, M., G. N. Kiladis*, and P. J. Webster*, 1999: Convectively coupled equatorial waves. Preprints, 23rd Conference on Hurricanes and Tropical Meteorology. Dallas, TX, 356-359.

...... K. M. Weickmann*, and K. A. Harris*, 1999: Real-time monitoring of modes of coherent synoptic to intraseasonal tropical variability. Preprints. 8th Conference on Climate Variations. Denver. CO. 24-29.

BACK TO TOP

1999

ACD ASP ATD CGD ESIG

HAO



Advanced Study Program

Table of Contents | Highlights | Postdoctoral Research | Educational Activities | Publications | Staff, Visitors & Collaborators

Staff, Visitors & Collaborators

MMM RAP Staff: SCD

Garth D'Attilo (Student Assistant III) Hans Friedli (SRA) Judy Miller

NGFs:

Judith Berner; University of Bonn; weather regimes and transitions in observations and models.

John Braun: University of Colorado: Global Positioning System for remote sensing

Arun Gopalan; State University of New York, Stony Brook; retrieval algorithms for satellite-based radiometers measuring emissions from the Earth's atmosphere

Jennifer Kolar: University of Colorado: examining a unified ocean circulation theory.

Tomoko Matsuo; State University of New York, Stony Brook; investigation of the upper atmospheric responses to magnetospheric inputs at high-latitudes.

Derek Straub: Colorado State University: aircraft-based instrumentation development and analysis using numerical fluid flow modeling: cloud and aerosol chemistry

Postdocs:

Patrick Chuang; California Institute of Technology; aerosol and cloud microphysics.

Mausumi Dikpati; Indian Institute of Science, Bangalore; the study of solar magnetic fields.

Gregory Duane: University of Colorado: synchronized chaos in the large-scale atmospheric circulation and in other extended dynamical systems

Susan Durlak: University of Cincinnati: impact of aerosols on climate using observations from aircraft platforms to determine global aerosol climatology

Natash Flyer; University of Michigan; adjoint methods for data assimilation and sensitivity studies; numerical analysis of spectral methods; nonlinear waves.

Aime Fournier; Yale University; climate response to regional and subgrid scales with a spectral element atmospheric model (SEAM).

Marina Galand; Institute National Polytechnique de Grenoble, France; energetic particle precipitations in the high latitude ionosphere

Andrew Gettelman; University of Washington; stratosphere-troposphere exchange and the structure of the extratropical tropopause

Gregory Hakim; SUNY-Albany; dynamics of mesoscale tropopause-based disturbances and their importance to extratropical weather and the general circulation

Thomas Hamill; Cornell University; mesoscale forecast predictability and short-range ensemble forecasting; statistical issues related to weather forecast verification.

Marika Holland; University of Victoria, British Columbia; the role of sea ice in climate; high latitude climate variability, and sea ice modeling.

Larry Horowitz; Harvard University; global-scale modeling of tropospheric chemistry including ozone and nitrogen oxides

Andrzej Klonecki; Princeton University; 3-D global and regional modeling of the chemical species in the troposphere.

Myanna Lahsen; Rice University; scientific and political debate about human-induced climate change

Sonia Lasher-Trapp; University of Oklahoma; observations and modeling of warm cloud microphysical proce

Barry Lefer; University of New Hampshire; trace gas and aerosol measurements from aircraft; atmospheric nitrogen deposition

Daniel LeRoux; McGill University; technical improvements to the large-scale spectral element ocean model (SEOM).

John Magistro; SUNY-Binghamton; climatic variability and food security policy in African river basins.

Daniel Marsh: University of Michigan: dynamical influences of the distribution of minor constituents in the middle and upper atmospher

Denise Mauzerall; Harvard University; 3-D modeling of tropospheric ozone.

Scott McIntosh; University of Glasgow, Scotland; modeling of various wave phenomena in the upper solar atmosphere Christian Meyer; University of Colorado; modeling of the middle and upper atmosphere with an emphasis on wave-wave and wave-mean flow interactions

Jefferson Keith Moore; Oregon State University; marine ecosystem modeling, and the role of ocean biota in the global carbon cycle.

Joel Norris; University of Washington; clouds and climate variability.

Barbara Noziere; Bergisch University Gesamthochschule Wuppertal, Germany; laboratory studies of the transformation of biogenic compounds in the troposphere; gas- and condensed-phase processes

Rajul Pandya: University of Washington: influence of gravity waves on the organization of mesoscale convective systems and the propagation of convectively forced gravity waves into the middle atmosphere

Hardi Peter; Max-Planck-Institute for Aeronomy; dynamics of and connections between the solar chromosphere and corona.

Kevin Petty; Ohio State University; exploring the factors which cause the development and intensification of tropical cyclones

Daniel Riemer; University of Miami; chlorine chemistry in the marine boundary layer

Eileen Saiki; University of Colorado; large-eddy simulation of atmospheric boundary layer turbulence.

Raymond Shaw; Pennsylvania State University; influence of fine-scale turbulence on cloud microphysics; surface-kinetic processes on cloud droptets.

Christopher Torrence; University of Colorado; climate variability and predictability; time-series and wavelet analysis.

Wendy Welch; University of Washington; baroclinic heat transport, wavenumber selection and climate dynamics. Matthew Wheeler; University of Colorado; the association of Equatorial waves and organized tropical convection in observations and models

Mark Zondlo; University of Colorado; field measurements of trace gas species important in aerosol particle chemistry.

Other Visitors:

Laure Chaumat, CNRM, Meteo-France; NCAR Aerosol Program.

Sonia Lasher-Trapp; University of Oklahoma; observations and modeling of warm cloud microphysical processes.

Glen McConville; University of Colorado, Denver; study of nitrogen fluxes at Conifer Forest especially the subAlpine Spruce Fir Forest of the Rocky Mount

Patsy Taylor; University of Wyoming; social organization of research organization

Herman Sievering: University of Colorado, Denver; atmospheric aerosols and exchange of gases and particles at air/surface boundary.

GTP Visitors:

GTP Visitions:

Chris Bizen, Colorado Research Associates
Chris Gretherton, University of Washington
Beeregere Dakhilor, USAS, Franze
David Gurrier, Case Western Reserve
Chasper Bizu, Losikian Technical University
Victor S. Livov, Weismann Institute, Israel
Victor S. Livov, Weismann Institute, Israel
Victor S. Livov, Weismann Institute, Israel
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Ice Formation in the Atmosphere Colloquium Participants:

Participants:

Hell Bacon, University of Washington
Matthew Boehn, Periosylomia Salat University
Matthew Boehn, Periosylomia Salat University
Matthew Boehn, Periosylomia Salat University
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Marcia Baker, University of Washington Darrel Baumgardner, NGAR Alsn Blyth, New Mexico Tech Rodold Parunjies, NGAR William Cotton, Colorado State University James Dye, NGAR John Hallett, Desert Research Institute Andrew Heymsfield, NGAR Andrew Heymsheld, NLAN
George Isaac, Atmospheric Environment Service, Canada
Eric Jensen, NASA Ames Research Center
Dennis Lamb, Pennsylvania State University Kuo-Nan Liou, University of California, Los Angeles Brooks Martiner, NOAA John Marvitt, University of Wyoming Roy Ramussen, NCAR Robert Rauber, University of Illinois at Urbana-Champaign David Roges, Colorado State University Margaer Tollert, Liniversity of Colorado Gabor Vall, University of Colorado Gabor Vall, University of Wyoming

Participants of Mixing and Reactive Turbulence Workshop (GTP-hosted) NCAR Coordinators:

Mary Barth, NCAR Scott Doney, NCAR Peter Hess, NCAR Sasha Madronich, NCAR Mark Rast, NCAR Raymond Shaw, NCAR Joseph Tribbia, NCAR

Lecturers:

Accounts:

John Cho, Massachusetts Institute of Technology
Ferry Clark, NCAR
Kerneth Davic, University of Minnesola
Kerneth Davic, University of Minnesola
Kerneth Davic, University of Minnesola
Kerneth Davic, University of Charles
Felf, Massachusetts Institute of Technology
Davic Clark, University of Charles
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Andrew Majda, Couzant Institute
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Participants:

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Participants of Smill Scale Turbulence Workshop
Ben Balley, University of Colorado
William Burners, Uneversity of Colorado
William Burners, University of Colorado
William Cark, KIOAA
SMILL SMI Participants of Small-Scale Turbulence Workshop (GTP-hosted)

BACK TO TOP



1999

Research Applications Program

Table of Contents | Community Service | Highlights | Publications | Staff , Visitors & Collaborators

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. RMP began in 1992 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 warring and prediction of intigo conditions, thunderstorm activity, quantitative detection and forecasts of snowfall and freezing ditzet 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 ample education and attaining, through transfer disabuted evaluated advanced weather products to operational agencies, to the deficient agency of complete, turburkey of complete turburkey.

Addition in only one of a number of societies of the economy, though, where accusal and limely weather information can play a key rate in the badly and thinking. Using the same membrois of resociating, remote sensing, fine-scale numerical modeling, and development of expert systems that have been employed for avisition, RAP is currently pursuing applications in hydrometectoring and paditic weather forecasts. Applications to independ and entering a sensitive state of the concession and experts and exempts of the concession and exempts are designed.

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 RMPs technology transfer mission. Of equal importance to our overall endewor, 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.

1999

Home Community Service

ASP Committees/Advisory Boards

ATD Barbara Brown is a member of the AMS Committee on Probability and Statistics and had been chair of this committee through January of 1999. She is also a member of the Internal Advisory Committee for NCAR's Geophysical Statistics Project

COD Marcia Politovich is a member of the AMS Cloud Physics Committee and the AIAA Atmospheric Environment Committee, and was an advisor to the FAA InFlight Icing Steering Committee. She also served on the COMET Advisory Board.

ESIG Tom Warner served on the CAPS External Advisory Panel.

HAO Educational Activities

NAME

Sel Datton was assistant professor of electrical engineering at the University of Colorado at Denver, and taught a half day course on "Professional Engineering Exam Refresher Course: Digital Hardware" through Continuing Education at CU Denver.

Marcia Politovich finished COMET modules on Aircraft Loing: Assessment using soundings and profilers, Aircraft Loing: Assessment using observations and pilot reports. She worked with Plymouth State College and Lyndonville State College meteorology students for MMISP forecasting and gave a tour at the MMISP site.

Graduate Students

Shel Dalton supervised one PhD student in Mathematics.

Scientific/Technical Presentations

Barbara Brown gave a talk on verification of icing and turbulence forecasts at Northwest Airlines in October and presented lectures on verification of a visition weather forecasts at the Aivation Weather Certer (Kansas Chy), Verification "Summit" meeting in November. She also presented two balks at the AIVS Conference on Aivation, Range and Aerospace Melecorology in Dallas: one on "Evidence of improvements in the quality of in light icing apprishms" and the other on "Probability forecasts of in light icing conditions.

Shel Dalton presented a paper "Fourier coefficients for range identification in FMCW radar systems" at the Radar Sensor Technology IV Conference of AeroSense Bill Mahoney gave a presentation at the Advanced Aviation Weather System Program Review and the Advanced Aviation Weather System Program Review and the Advanced Aviation Weather System Design Review. He also presented the ADAWS Version 1 System Architecture and Products in Taiper; aviation weather research activity talks, also in Taiper; and a talk on Aviation Weather Modernization Activities in Asia at the MDCRS Working Group in Boulder, Colorado.

Rita Roberts gave presentations at the 15th International Conference on Interactive Information and Processing Systems; the 29th International Conference on Radar Meteorology; and the Sterling, Virginia National Weather Service office.

Bob Sharman gave presentations on turbulence forecasting techniques, difficulties and approaches to the UCLA Department of Mechanical Engineering, to Northwest Airlines Meteorology Department, to Taiwan CAA, and at the Bit Conference on Aviation, Range and Aerospace Meteorology.

Non-Technical Educational Activities

Barbara Brown spoke to Wheatridge Middle School girls about scientific careers in February.

Bill Mahoney gave a talk about weather instruments and forecasting at the Fireside Elementary School.

Rita Roberts was a COMET mentor for one of the SOO's attending the COMAP class. She was also Science Fair judge at Sacret Heart School.

Workshops

Fei Chen gave a workshop on land-surface modeling and applications to mesoscale.

Tenny Lindholm gave an OCND Workshop.

Bill Mahoney gave workshops on: Meteorological data collection and reporting system (MDCRS) in the USA and possible expansion to Asis; windshear and windshear detection systems; and advanced aviation weather workstations in Taipei, Taiwan.

Tom Warner was the lead organizer for the UNAM-UCR-UCAR Tutorial on Regional Weather and Climate Modeling for Latin America held in Mexico City in August.

1999

ACD

ATD II. Most Significant Achievements During 1999

CGD The most significant achievements during 1999 were:

ESIG A. Meso-gamma Scale Prediction System Operational at Three Army Test Ranges

1400 g De crientist and engineers have developed an operational recognitaries, ascide manufaction forecasts system based on the MBR researcial mode of the M ммм

The detection of aircraft icing conditions (e.g., supercooled liquid water [SLW], freezing dizize) is a major goal of the FAA-funded aircraft icing work at RAP. Current remote sensing systems operationally deployed such as the National Weather Service WSR-880 radars are not able to detect supercooled liquid water in the form of cloud doptics, nor are they able to tell whether radar backcatter is due to snow or freezing dizize. In order to evaluate their potential, the Mount Washington king Sensors Project was conducted during the month of April in the vicinity of ML. Washington in lew Hampshire, a region with significant amounts of icing and freezing dizize. This was the first major field program ever conducted to test the ability of remote sensing devices to measure SLW and freezing dizize. The program was organized and managed by RAP and included participants from government agencies, universities, and other recent and the potentials.

C. Development and Implementation of Aviation Digital Data System (ADDS)

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D. Transfer of Weather Support to Deicing Decision Making (WSDDM) System to ARINC

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E. Buffalo Creek Flash Flood Prediction Studies Using Radar, TITAN, 4DVAR, and MM5 Mesoscale Model Coupled to a Runoff Model.

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            Brandes, E.A., J. Vivekanandan and J.W. Wilson, 1999: A comparison of radar reflectivity estimates of
rainfall from collocated radars. J. Almos. Oceanic Technol., 16, 1264-1272.
 HAO
 MMM Carbone, R.E., T.D. Keenan, J. Hacker and J.W. Wilson, 1999: Tropical island convection in the 
absence of significant topography, Part I: Sea breeze and early convection. Submitted. Mon. Wea. Rev.
 Scb Chen, F. and K. Mitchell, 1999: Using GEWEX/ISLSCP forcing data to simulate global soil moisture
fields and hydrological cycle for 1987-1988. Journal of the Meteorological Society of Japan, 77, 1-16.
            Chen, F., 1999: Simulating the global climatology of the land surface energy balance by an off-line land surface model. Climate Dynamics. In review.
            Chen, F. and J. Dudhia, 1999: Coupling an advanced land-surface/hydrology model with the Penn State/NCAR
MMS modeling system. Part I: Model implementation and sensitivity. Mon. Wea. Rev.. In review.
            Chen, F., R. Pieke, Sr. and K. Mitchell, 1999: Development and application of land-surface models for 
m-voxcale atmospheric models: Problems and Promises. Observation and Modeling of the Land Surface Hydrological Processes. Editors V. Lakshmi, J. Alberston, and J. Schaake, American Geophysical Union. In review.
            Cherington, M.C., D.W. Breed, P.R. Yarnell and W.E. Smith, 1999: Lightning injuries during snowy conditions. British four of Sports Medicine, 32, 333,335
            Crook, N.A. and J.B. Klemp, 1999: Lifting at convergence lines. Submitted. J. Atmos. Sci.
            Keenan, T.D., S.A. Rutledge, R.E. Carbone, J.W. Wilson, M.W. Moncrieff, G. Holland, J.M. Hacker, K. Saito and
N.A. Crook, 1999: The maritime continent thunderstorm experiment (MCTEX): Overview and some results. Submitted. Bull. Amer. Meteor. Soc.
            Koren, V., J. Schaake, K. Mitchell, Q-Y. Duan and F. Chen, 1999: Snow-frozen ground parameterization in
the mesoscale Eta model. In Press. J. Geophys. Res.,
            Martner, B.E. and M.K. Politovich, 1999: A study of 5-day media forecasts in the Denver area. Submitted. Wea.
              Politovich, M.K., 1999: Wet and dry ice growth on airfoils. In Press. J. Aircraft.
            Rasmussen, R.M., J. Vivekanandan, J. Cole, B. Myers and C. Masters, 1999: The estimation of snowfall rate using
visibility. J. Appl. Meteor., 38(10), 1542-1563.
            Russell, R.W. and J.W. Wilson, 1999: Spatial dispersion of aerial plankton over east-central Florida: 
aeolian transport and coastline concentrations. Submitted. International Journal of Remote Sens
             Saxen, T.R. and S.A. Rutledge, 1999: Surface rainfall-cold cloud fractional coverage relationship in TOGA COARE
A function of vertical wind shear. In Press. Mon. Wea. Rev.
            Serafin, R.J. and J.W. Wilson, 1999: Operational weather radar in the U.S.: Progress and Opportunity.
Accepted. Bull Amer. Meteor. Soc.
            Serafin, R.J., J.W. Wilson, J. McCarthy and T.T. Fujita, 1999: Progress in understanding windshear and implications
on aviation. Storms. Accepted. Editor R. Pielke Sr. and R. Pielke Jr.
            Stensrud, D.J., J.-W. Bao and T.T. Warner, 1999: Using initial condition and model physics perturbations in short-range ensemble simulations of mesoscale convective systems. Accepted. Mon. Wes. Rev.
            Stoelinga, M.T. and T.T. Warner, 1999: Nonhydrostatic, mesobeta-scale model simulations of cloud ceiling and
visibility for an East Coast winter precipitation event. J. Appl. Meteor., 38, 385-404.
            Tucker, D.F. and N.A. Crook, 1999: The generation of a mesoscale convective system
from mountain convection. Mon. Wea. Rev., 127, 1259-1273.
            Vivekanandan, J., B. Martner, M.K. Politovich, and G. Zhang, 1999: Aircraft icing detection using dual-wavelength
radar observations. IEEE Trans. on Geoscience and Remote Sensing.
            Vivekanandan, J., B. Martner, M.K. Politovich and G. Zhang, 1999: Retrieval of atmospheric liquid and ice
characteristics using dual-wavelength radar observations. IEEE Transactions on Geoscience and Remote Sensing, 37, 2325-2334.
            Warner, T.T. and R.-S. Sheu, 1999: Multiscale local forcing of the Arabian Desert daytime boundary layer and implications for the dispersion of surface-released contaminants. Accepted. J. Appl. Meteor.
             Warner, T.T. and H.M. Hsu, 1999: Nested-model simulation of moist convection: The impact of coarse-grid
parameterized convection on fine-grid resolved convection through lateral-boundary-condition effects. Accepted. Mon. Wea. Rev.
            Warner, T.T., E.E. Brandes, J. Sun, D.N. Yates and C.K. Mueller, 1999: Prediction of a flash flood in complex terrain: Part 1 - A comparison of rainfall estimates from radar, and very-short-range rainfall simulations from a dynamic model and an automated-algorithmic system. Accepted. J. Appl. Meleor.
            Warner, T.T. and D.N. Yates, 1999: A Community Hydrometeorology Laboratory for fostering interdisciplinary
research by the atmospheric and hydrologic sciences. Submitted. Bull. Amer. Meteor. Soc.
             Warmer, T.T., D.N. Yates, E.E. Brandes, J. Sun, C.K. Mueller and G.H. Lesvesley, 1999- Prediction of a flash
flood in complex terrain: A comparison of flood discharge simulations using rainfall input from radar, a dynamic model, and an automated algorithmic system. Submitted. J. Hydrologic Engineering
            Weckwerth, T.M., T.W. Horst and J.W. Wilson, 1999: An observational study of the evolution of horizontal
convective rolls. Mon. Wea Rev. 127, 2160-2179.
            Weckwerth, T.M., V. Wulfmeyer, R.M. Wakimoto, R.M. Hardesty, J.W. Wilson and R.M. Banta, 1999:
NCAR/NOAA lower-tropospheric water vapor workshop, Accepted. Bull Amer. Meteor. Soc.
            Wilson, J.W., N.A. Crook, C.K. Mueller, J. Sun and M. Dixon, 1999: Nowcasting Thunderstorms
A Status Report. Bull. Amer. Meleor. Soc., 79, 2079-2099.
             Wilson, J.W., T.D. Keenan and R.E. Carbone, 1999: Tropical island convection in the absence of significant topography. Part II: evolution of mesoscale convective systems. Submitted. Mon. Wes. Rev.
            Wu, B., J. Verlinde and J. Sun, 1999: Dynamical and microphysical retrievals from Doppler radar
observations of a deep convective cloud. Submitted. J. Almos. Sci.
            Wurtele, M.G, A. Datta and R.D. Sharman, 1999: Unsteadiness and periodicty in gravity waves and lee waves
forced by a fixed rigid boundary. J. Almos. Sci., 56, 2269-2276.
            Wurtele, M.G, A. Datta and R.D. Sharman, The propagation of a gravity-inertia wave in a positively sheared
            Yates, D.N., T.T. Warner and G.H. Leavesley, 1999: Prediction of a flash flood in complex terrain: Part 2

- A comparison of flood discharge simulations using rainfall input from radar, a dynamic model, and an automated algorithmic system. Accepted. J. Appl. Meteo.
            Xu, M., D.J. Stensrud, J.-W. Bao and T.T. Warner, 1999: Application of the adjoint technique to short range
ensemble forecasting of mesoscale convective systems. Submitted. Mon. Wea. Rev.
            Zhang, G., J. Vivekanandan and E. Brandes, 1999: A method for estimating rain fall rate and drop size distribution from polarimetric radar measurements. To be published.
            Bernstein, B.C., T.P. Ratvasky, D.R. Miller and F. McDonough, 1999: Freezing rain as an in-flight iring hazard. Preprints, 8th Conference on Aviation, Range and Aerospace Meteorology, Daliss, 10-15 January. Amer. Meteor. Soc., Boston, 38-42.
            Brandes, E. and M.K. Politovich, 1999: The potential for aircraft icing detection with radar. Report prepared for the 
Federal Avistion Administration, AUA-400, 14 pp.
            Breed, D.W., R.T. Bruintjes, V. Salazar and H. Ramirez Rodriguez, 1999: Microphysical characteristics of convective clouds in northern Mexico. Proc. Seventh WMO Scientific Conf. on Weather Modification, Chiang Mai, Thailand, WMO/TD No. 936, 57-59
            Brown, B.G., B.C. Bernstein, F. McDonough and T.A.O. Bernstein, 1999: Probability forecasts of in-flight icing conditions. Preprints, 8th Conference on Aviation, Range, and Aerospace Meleorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 433-437.
            Brown, B.G., T.L. Kane, R. Bullock and M.K. Politovich, 1999: Evidence of improvements in the quality of in-flight icing algorithms. Preprints, 8th Conference on Aviation, Range, and Aerospace Meteorology, Dallas, 10-15
            Bruintjes, R.T., D.W. Breed, G.B. Foote, M.J. Dixon, B.G. Brown, V. Salazar and H. Ramirez Rodriguez,
1999: Program for the Augmentation of Rainfall in Coahulla (PARC): Overview and design. Proc. Seventh WMO Scientific Conf. on Weather Modification, Chiang Mai, Thailand, WMO/TD No. 936, 53-56.
            Bruintjes, R.T., G.L. Kok, D.W. Breed and V. Salazar, 1999: Hygroscopic seeding: Theory
and practice. Proc. Seventh WMO Scientific Conf. on Weather Modification, Chiang Mai, Thailand, WMO/TD No. 936, 65-68.
            Carbone, R.E., T.D. Keenan, J. Hacker and J. Wilson, 1999: Tropical island convection in the absence of
significant topography. Preprints, 23rd Conf. on Hurricanes and Tropical Meleonology, Dallas, 10-15 January. Amer. Meteor. Soc. Boston, 530-533.
            Chen, F. and J. Dudhia, 1999: Land-surface model development for the MM5 V.3 system.
Proc. Workshop on land-surface modeling and applications to mesoscale models. Boulder, CO, 24-25 June. Amer. Meteor. Soc., Boston.
            Chen, F., T. Warner and K. Manning, 1999: Simulation of the 1996 Buffalo Creek
flash-flood event and its sensitivity to land-surface variability. Proc. Workshop on land-surface modeling and applications to mesoscale models. Boulder, CO, 24-25 June. Amer. Meteor. Soc., Boston
```

Chen, F., T. Warner, K. Manning and D. Yates, 1999: Using A high-resolution mesoscale coupled model to simulate the 1996 Buffalo Creek flash-flood event. Proc. 15th Conference on Hydrology. Long Beach, CA, January

Chen, F., D. Vates, M. LeMone, H. Nagai, S. Onkiey and R. Grossman, 1999: A multi-scale data set based on CASES-97 for studying land-surface heterogeneity and for validating land-surface models. Proc. 15th Conference on Hydrology. Long Beach, CA, January.

Davis, C., T. Warner, J. Bowers and E. Astling, 1999: Development and application of an operational, relocatable, mesogamma-scale weather analysis and forecasting system. Accepted. Tellus on Aviation, Range and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 433-437.

Dixon, M.J. and R. Rasmussen, 1999: Real-time short-term snowfall prediction for aviation using storm tracking and gauge-calibrated radar data. Preprints, 29th International Conference on Radar Meteorology, Monteal, 12-16 July. Amer. Meteor. Soc., Boston.

Dudhia, J. and F. Chen, 1999: Using a mesoscale model coupled to a land-surface model to simulate surface fluxes at high resolution. DOE ARM Science Team Meeting, San Antario, TX, 22-26 March

Holland, L.D. and M.K. Politovich, 1999: An inferred winter cloud climatology. Proc. 8th Conference on Aviation, Range and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 429-432.

Kane, T.L., B.G. Brown and R. Sharman, 1999: A preliminary climatology of upper level turbulence reports. Preprints, 8th Conf. on Aviation, Range and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 363-365.

Keeler, R.J., C. Kessinger, S. Ellis and J. VanAndel, 1999: Implementation of Nexrad AP clutter mitigation scheme, Preprints, 29th Conference on Radar Meteorology, Montreal, 12-16 July. Amer. Meteor. Soc., Boston, 580-581.

clutter mitigation scheme, Preprints, 29th Conference on Radar Meteorology, Montreal, 12-16 Ju

Keeler, R.J., C. Kessinger, J. VanAndel and S. Ellis, 1999: Implementation of NEXRAD AP clutter processing. Preprints, 15th Conference on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography and Hydrology, Dallas, 11-15 January, Amer. Meteor. Soc., Boston, 304-305.

Kessinger, C., S. Elis and J. VanAndel, 1999: An algorithm to detect anomalously-propagated ground clutter for the WSR-88D. Preprints, 15th Conference on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography and Hydrology, Dallas, 11-15 January. Amer. Meteor. Soc., Boston, 310-313. Kessinger, C., S. Ellis and J. VanAndel, 1999: Detection of anomalously-propagated ground clutter using fuzzy logic. Presented. The URSI Conference, Boulder, CO, 4-8 January. Kessinger, C., S. Ellis and J. VanAndel, 1999: A fuzzy logic AP clutter detection algorithm for the WSR-88D, Preprints, 29th Conference on Radar Meteorology, Montreal, 12-16 July, Amer. Meteor. Soc., Boston, 576-579. Kesinger, C., C. Frush and S. Elis, 1999. Preliminary experiments with AP dutter recognition using WSR-880 data collected with the ATDA time-series recorder. Preprints, 15th Conference on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography and Hydrology, Dalas, 11.15 Issues, Mem. Meteor. See Robots 114.15.1. Lindholm, T.A., 1999: Advances in providing weather information to the cockpit. Submitted. SAE Aerospace Safety Conference. Lindholm, T.A., 1999: Collaborative decision making and WEATHER. Air Traffic Technology International Journal, pp. 18-21. Mahoney, J.L., J.K., Henderson, B.G. Brown and C.S. Hartsough, 1999: Benefits of using FSL's Real-Time Verification System (RTVS) at the NWS/NCEP Aviation Weather Center. Preprints, 8th Conference on Aviation, Range, and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 95-99. McDonough, F. and B.C. Bernstein, 1999: Combining satellite, radar, and surface observations with model data to create a better aircraft king diagnosis. Preprints, 8th Conference on Aviation, Range and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 467-471. Miller, R.J., B.C. Bernstein and L. Koch, 1999: A climatology of freezing rain in the Columbia Basin. Preprints, 17th Conf. on Weather Analysis and Forecasting, Denver, 13-17 September. Amer. Meleor. Soc., Boston. Mueller, C.K. and J.W. Wilson, 1999: Preliminary efforts toward 1-2 hr national thunderstrorm initiation forecasts. Preprints, 29th International Conf. on Radar Meteorology, Montreal, 12-6 July. Amer. Meteor. Soc., Boston, 13-20. Politovich, M.K., 1999: How can we use and depict variability of clouds in icing forecasts. Proc. 8th
Conference on Aviation, Range and Aerospace Meteorology, Dallas, 10-15, January, Amer. Meteor. Soc., Boston, 443-446. Politovich, M.K., 1999: MWISP Science Plan. Available from FAA Aviation Weather Research Program, AUA-430., 52 pp. Roberts, R.D., D.W. Breed and P.C. Kennedy, 1999: Multi-parameter radar, aircraft, and satellite signatures associated with precipitation formation in Colorado convective clouds. Preprints, 29th Conf. on Radar Meteorology, Montreal, 12-16 July. Amer. Meteor. Soc., Boston. Roberts, R., T. Saxon, C.K. Mueller, C. Wilson, N.A. Crook, J. Sun and S. Henry, 1999:
Operational application and use of NCAR's published thunderstorm novacasting system. Preprints, 15th Conf. on Interactive Information Processing Systems. Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 158-161. Saxen, T.R., C.K. Mueller, T.C. Jameson and E. Hatfield, 1999: Determining key parameters for forecasting thunderstorms at White Sands Missile Range. Preprints, 29th Intl. Conf. on Radar Meteorology, Montreal, 12-16 July. Amer. Meteor. Soc., Boston, 9-12. Serafin, R.J. and J.W. Wilson, 1999: Operational weather radar in the U.S.: Progress and Opportunity, COST-75 Advanced Weather Radar Systems, International Seminar, Locarno, Switzerland, 35-61, ISBN 92-828-4907-4. Sharman, R., C. Tebaldi and B. Brown, 1999: An integrated approach to clear-air turbulence forecasting. Preprints, 8th Conf. on Aviation, Range and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 68-71. Sims, D., C. Fidalgo, C. Turner, M. Politovich and D. Johnson, 1999: Integrated icing diagnostic algorithm assessment at the Alvaition Weather Center. Proc. 8th Conference on Aviation. Range and Aerospace Meteorology. Dallas. 10-15 January. Amer. Meteor. Soc.. Boston. 53-57. Steiner, M., J.A. Smith, C. Kessinger and B.S. Ferrier, 1999: Comparison and assessment of radar data quality control algorithms, Preprints, 29th Conference on Radar Meleorology, Montreal, 12-16 July. Amer. Meleor. Soc., Boston, 582-585. Sun, J. and N.A. Crook 1999: Real-lime boundary layer wind and temperature analysis using WSR-88D observations. Preorints, 29th International Conf. on Radar Meteorology. Montreal, 12-16 July. Amer. Meteor. Soc., Boston, 44-47. Tilley, J.S., D. Wilkinson and M.K. Politovich, 1999: Application of mesoscale model data to algorithms for inflight icing over the Alaska region. Proc. 8th Conference on Avistion, Range and Aerospace Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc., Boston, 452-456. VanAndel, J., C. Kessinger and D. Ecoff, 1999: APCAT: An AP clutter analysis tool, Preprints, 29th Conference on Radar Meteorology, Montreal, 12:16 July, Amer. Meteor. Soc. Roston, 267:269 Vivekanandan, J., B. Martner, M.K. Politovich and G. Zhang, 1999: Aircraft icing detection using dual-wavelength radar observations. IEEE Trans. on Geoscience and Remote Sensing. Vivekanandan, J., G. Zhang and M.K. Politovich, 1999: Estimate of droplet size and liquid water content using dual-frequency radar measurements for aircraft icing detection. Proc. of 29th ICRM, Montreal, 12-16 July. Amer. Meteor. Soc., Boston, 872-875. Vivekanandan, J., G. Zhang and A.V. Ryzhkov, 1999: Estimation of canting angle distribution of raindrop spectra using radar measurement. International Radar Symposium. India. Dec. Warner, T.T., 1999: Land-surface physics and boundary-layer processes associated with desert microclimates: A review of observational and modeling studies. To be submitted. Meteorological Managraph, Amer. Meteor. Soc., Boston. Wilson, J.W., T.D. Keenan and R.E. Carbone, 1999: Tropical island convection in the absence of significant topography Part II: evolution of mesoscale convective systems. Preprints, 23rd Conf. on Hurricanes and Tropical Meteorology, Dallas, 10-15 January. Amer. Meteor. Soc. Boston, 534-537. Wilson, J.W., T.D. Keenan and R.E. Carbone, 1999: Tropical island convection in the absence of significant topography Part II: Evolution of mesoscale convective systems. Preprints, Eight Conference on Mesoscale Processes, Boulder CO, 24-25 June. Amer. Meteor. Soc. Boston Wilson, J.W. and R.D. Roberts, 1999: Evaluation of radar and other variables for the 0.2 for foreverse of the inferfections. Precrinis. 29th International Conf. on Radar Meteorology, Montreal, 12-16 July. Amer. Meteor. Soc., Boston, 5-8. Xu, M., J. Sun and N.A. Crook, 1999: Retrieval and forecasting of the boundary layer flow in the absence of the upper-level radar data. Preprints, 29th International Conf. on Radar Meteorology. Montreal, 12-16 July. Amer. Meteor. Soc., Boston, 40-42. Zhang, G. and J. Vivekanandan, 1999: Microwave radiation from mixed phase cloud for ground-based radiometer remote sensing. Proc. of IGARSS'99, Hamburg, Germany, June 28-July 2. Zhang, G., J. Wiekanandan and M.K. Politovich, 1999: Scattering effects on microwave passive remote sensing of cloud parameters. Proc. 8th Conference on Aviation. Range and Aerospace Meteorology. Dallas. 10-15 January. Amer. Meteor. Soc., Boston, 497-501.

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ATD RAP Staff, FY 98

con Director's Office ESIG

Barbara Middlebrook Caron Chambers Joanne Dunnebecke G. Brant Foote (director) Inger Galib Dara Houlston Rooe Lundeen Rooe Lundeen Rachard Santz Richard Wagnoer (deputy director) Lara Ziady

Applied Science Group

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Jampiled Com

Jampiled Com

Jampiled Com

Jampiled Com

Jampiled Group

Engineering

Operational Systems Group

Rachel Ame
Cella Chen
Cella Chen
Cella Chen
Cella Chen
Control Chen
Control Chen
Control Chen
Control

Systems Development Group

Systems Development Gr.

Dovid Alba

Robert Barron

Nathaniel Bongley

Gery Blackbarn

Thomas Carey

Jalien Chustang (shaden)

Jalien Chustang (shad

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ACD

Staff, Visitors and Collaborators

Steve Albersheim; Federal Aviation Administration (FAA) - Director's Office CGD

ESIG Al Astling Dugway; Proving Ground - TECOM Project

HAO David Atlas; NASA - Applied Science Group

MMM Ray Ban; The Weather Channel - Applied Science and Engineering Group

RAP Al Bedard; NOAA ETL - Juneau Project

SCD Rod Bogue; NASA - NASA Turbulence

Tom Bond; NASA - Icing Group

Nick Bornes; Aberdeen Test Center - TECOM Project

Roland Bowler; NASA - NASA Turbulence

Shirley Bradley; Aberdeen Test Center - TECOM Project

Bill Bresley; AlliedSignal - NASA Turbulence

Dr. Harold Brooks; National Severe Storms Laboratory - Applied Science Group

John Brown; NOAA/FSL - Turbulence Forecasting

Steve Bussalari; MIT/Lincoln Labs - FAA Program

Dr. Madkukas Chandra; DLR, Germany - Applied Science Group

Mr. Kuo-Cheng Chang; Taiwan Civil Aeronautical Administration (CAA) - AOAWS/Taiwan Project Michael Charles; AOPA Pilot Magazine - Aviation Weather

Stephen Chenault; Federal Aviation Administration (FAA) - Applied Science Group

Ivan Clark; NASA - Turbulence Group

Charles Clough; Aberdeen Test Center - TECOM Project

Ron Colantonio; NASA - Turbulence/AWIN/OCND

Ruben Contreras; Instituto Tecnologia Agropecuano #1 - Durango RainfallProgram

Tim Dagey; MIT/LL - Juneau Project

Jim Davis; Aberdeen Test Center - TECOM Project

Karel de Waal; South Africa Weather Bureau - Mexico Project

Bruce Donaldson; Weather Information Technology, Inc. (WITI) - DICAST Group

Dick Doviak; NSSL - NASA Turbulence

John Dow; Federal Aviation Administration (FAA) - Applied Science Group

Chris Dumont; Federal Aviation Administration (FAA) - Applied Science Group

Brian Duval; Federal Aviation Administrate(FAA) - Director's Office

Mike Edwards; Harris Corporation - Aviation Program

Ron Elliott; Oklahoma State University - Applied Science Group

Jack Enerngerger; NASA - NASA Turbulence

Jim Evans; MIT/Lincoln Labs - FAA Program

Warren Fellner: Federal Aviation Administration (FAA) - Director's Office

Dusan Frnic; NSSL - NASA Turbulence

Istvan Geresdi; Hungry - Applied Science Group Cecelia Girz; NOAA/FSL - Turbulence Forecasting

Randy Graham; National Weather Service SFO, Grand Rapids, Michigan - Applied Science Group Ruth Grasel: Federal Aviation Administration (FAA) - Applied Science Group

Dr. Michael Hadiimichael: Naval Research Laboratory - Applied Science Group

John Hallett; Desert Research Center - Applied Science Group

Scott Halvorson; Dugway Proving Ground - TECOM Project

Steven Harrah; NASA - NASA Turbulence

Jeff Hawkins; Naval Research Laboratory - OCND Program

Molly Hellmuth: University of Colorado at Boulder - Applied Science Group

Jim Henderson: Federal Aviation Administration (FAA) - Director's Office

Nobemi Hernandez: Universidad Nacional Autonoma de Mexico - Durango Rainfall Program

Chuck Herring; The Weather Channel - Applied Science and Engineering Group

Rick Heuwinkel; Federal Aviation Administration (FAA) - Director's Office

Gene Hill: Federal Aviation Administration (FAA) - Applied Science Group Farren Hiscutt: Electronic Data Systems - Mexico Proiec

Al Homans: ARINC - OCND Program

Daniel Horschel: Sandia National Laboratores - Applied Science Group

Mr. Ching-Huei Hsu (Jeff): CAA - Taiwan - AOAWS/Taiwan Project

Mr. Kuang-Yuan Huang (Kenny): CAA - Taiwan - AOAWS/Taiwan Project

Terry Huck: White Sands Missile Range - TECOM Project

Kathi Ishimaru: Federal Aviation Administration (FAA) - Applied Science Group Daniel Itenfisu; Oklahoma State University - Applied Science Group

Terry Jameson: White Sands Missile Range - TECOM Project Captain Jim Johnson: Delta Airlines - Turbulence Program

J.T. Johnson: National Severe Storms Laboratory - Applied Science Group

Chin-Ming: Jon CAA (ROC) - OCND Program

Alan Jones; FAA - Applied Science Group

Mike Jones; Naval Research Laboratory - Applied Science Group

Mr. Chun-Ming Jou; (SoSo) CAA - Taiwan - AOAWS/Taiwan Project

Rich Keen: AWDL - Tour

Bruce Kendall: NASA - NASA Turbulence

John Kiang; CAA Air Traffic Services Division - AOAWS/Taiwan Project Carolyn Kloth; AWC - OCND Program

Carl Knable; United Airlines - OCND Program

Dave Knerr; United Airlines - OCND Program

Gloria Kulesa: Federal Aviation Administration (FAA) - Director's Office Martin Lambert; University of Australia - Hydrology

Bill Langdon; United Airlines - OCND Program

Dr. Chin-Wan Lee; Air Navigation & Weather Services - CAA AOAWS/Taiwan Project

George Lee; CAA Air Navigation & Weather Services - AOAWS/Taiwan Project Phoenix Lee; Institute for Information Industry, Taiwan (III) - Taiwan Program

Dan Leger; Honeywell - OCND Program

Ken Leslie; AlliedSignal - Applied Science Group Mr. P.H. Liang (Stephen); CAA - Taiwan - AOAWS/Taiwan Project

Ms. Hue Chuan Lin: CAA - Taiwan - AOAWS/Taiwan Project

Jennifer Mahoney; NOAA/FSL - Verification Group

Brain Mapes: CDC - OCND Program

Dr. Hugo Martinez; Universidad Nacional de Cuyo - Director's Office and Applied Science Group

John McCarthy; Navy Research Laboratory (NRL) - Director's Office

Mark McHenry; DARPA - Advanced Sensors

Ian Miller; The Weather Channel - Applied Science and Engineering Group

Guillermo Montero; Universidad Nacional Autonoma de Mexico - Durango Rainfall Induction Program

Alfred Moosakhanian; Federal Aviation Administration (FAA) - Director's Office

Doug Moss; United Airlines - OCND Program

Brain Motta; Cooperative Institue for Research in Atmosphere (CIRA) - Applied Science Group

John Murphy; Weather Information Technology, Inc. (WITI) - DICAST Group

Robert Neece; NASA - OCND Program

Ron Olson; Federal Aviation Administration (FAA) - Director's Office

Jim Outlaw; Yuma Proving Ground - TECOM Project

Dave Pace; Federal Aviation Administration (FAA) - Director's Office

Guadalupe Paredes Universidad Nacional Autonoma de Mexico - Durango Rainfall Induction Program

Raul Perez; Universidad Nacional de Cuyo - Director's Office and Applied Science Group

Rod Potts; Bureau of Meteorology Research Centre, Melbourne, Australia - Applied Science Group

Greg Pratt; NOAA/FSL - ADDS Group

Dr. Chin-Piao Pu; Air Navigation & Weather Services - CAA AOAWS/Taiwan Project

Alfreado Puglesi; Universidad Nacional de Cuyo - Director's Office and Applied Science Group

Andy Reehorst: NASA - Applied Science Group

Jim Renick; TECH-NOLOGY Consulting - Director's Office

Pedro Restrepo; "Optimal Discussion, Inc." - Applied Science Group

Jim Riley; Federal Aviation Administration (FAA) - Applied Science Group

James Risby; Carnegie Mellon University - Applied Science Group

Roy Robertson; Collins - NASA Turbulence

Paul Robinson; Aerotech - NASA Turbulence

Dave Rodenhuis; Federal Aviation Administration (FAA) - Director's Office

Armando Rodriquez; Universidad Autonoma de Coahuila - Durango Rainfall Program

Dr. David Ross; Embry-Riddle Aeronautical University - Applied Science Group

Dave Sankey; Federal Aviation Administration (FAA) - Director's Office Ruben Santos; Universidad Nacional de Cuyo - Director's Office and Applied Science Group

Laurent Saussol; National School of Meteorology of France - Applied Science Group

Charlie Scanlon; NASA - OCND Program

Prof. Nelson Seaman; Penn State University - Applied Science Group

Lynn Sherretz; NOAA/FSL - ADDS Group

Jai Shin; NASA - Icing Group

Stephen Simmons; Weather Information Technology, Inc. (WITI) - DICAST Group

Tom Slatter; NOAA/FSL - Turbulence Forecasting

Ron Small; SimAuthor - NASA/FAA

Steve Smith: National Weather Service - Applied Science Grou

Dr. Zbignew Sorbjan; Marquette University - Applied Science Group

Dave Soreide; Boeing - NASA Turbulence

Bahns Stanley; The Weather Channel - Applied Science and Engineering Group

Paul Stough; NASA Langley - AWDL Tour

Ken Strzepek; University of Colorado at Boulder - Applied Science Group

Bob Stuever; NASA - Turbulence Grou

Paul Tag; Naval Research Laboratory - OCND Program

Deon Terblanche; South Africa Weather Bureau - Director's Office

Mr. Holine Tsai III; - Institute for Information Industry - Taiwan AOAWS/Taiwan Project

Ted Tsui; Navy Research Laboratory (NRL) - Director's Office

Sridhar Venkataramana; Oklahoma State University - Applied Science Group

Monica Villarreal; Instituto Tecnologia Agropecuano #1 - Durango Rainfall Program

Mr. T.A. Wang; Taiwan Civil Aeronautical Administration (CAA) - AOAWS/Taiwan Project

Dean Weingarten; Yuma Proving Ground - TECOM Project

Bill Weist; AlliedSignal - NASA Turbulence

Ken Williams; Alaska Air - Juneau Project

Wes Wilson; MIT/Lincoln Labs - FAA Program

Dave Witchey; United Airlines - NASA/FAA

Marily Wolfson; MIT/Lincoln Labs - FAA Program

Bob Wright; Federal Aviation Administration (FAA) - Director's Office

Jim Young: Redstone Technical Test Center - TECOM Project

Lucy Zheng; AlliedSignal NASA Turbulence

Once again in 1999, the stalf and violtors of ACD have been involved in a large number of experimental, observational, and theoretical projects. The major foci of the Division are the biogeochemical cycles, the oxidizing power of the atmosphere, the role of accrosiols, the relation between dynamics and chemistry in the middle atmosphere and the interaction between atmospheric chemistry and the climate system.

Perhaps the highest point of 1999 has been the launch in December of the MOPITT instrument on board the NASA/TERRA satellite MOPITT instrument on board the hASA/TERRA satellite MOPITT is project infliated at the University of Toronto with a strong participation of INCR scientibis. The instrument will measure curbon monoxide and methane in the troposphere, two chemical compounds that are released at the surface by biological and antirropogenic processes and that have a substantial impact on the oxidizing power of the atmosphere.

ACD staff has also contributed to several important field experiments sponsored by NASA and other agericies. Among them are the Pacific Expiritancy Experiment, and SOLVE.
Progress has able to been made in the development of regional models (MAND), and global models (MAND), and global models (MAND). And global models (MAND) and global models (MAND) and global models (MAND) and global models (MAND). The purpose of this arborne field experiment will be to understand the contribution of photochemical and plantage (arcsess) in the formation of the incorpospheric corner measured in progress of the contribution of photochemical and are 2000.

As I am stepping down from the position of ACD Director, I would to thank all my colleagues at NAR and in the broad atmospheric chemistry community for their support during the last 10 years ACD has been involved in exciting research during this gast decade and will continue to address important questions in the future.

Guy Brasseur Director