

*The Cooperative Institute for Research
in Environmental Sciences (CIRES)*

**Annual Report
on NOAA Cooperative Agreement NA67RJ0153**

October, 2000

Susan K. Avery, Director
Paul D. Sperry, Executive Director
Prashant D. Sardeshmukh, Senior Research Scientist

University of Colorado at Boulder
National Oceanic and Atmospheric Administration
Boulder, CO

Overview

As the largest of eleven NOAA Cooperative or Joint Institutes, CIRES formalizes links between ten NOAA laboratories (most within the Boulder community) and eight departments plus three interdisciplinary academic programs at the Boulder campus of the University of Colorado. CIRES is also the largest of seven institutes within the University of Colorado system, employing over five hundred employees distributed between Fellows, research scientists, associate scientists, graduate students, undergraduate students, and administrative staff.

True to its name, CIRES scientists engage in cooperative research activities in a wide range of environmental sciences, with major foci in atmospheric and climate dynamics, cryospheric and polar processes, environmental chemistry and biology, and the solid earth sciences. In addition to these formal divisions, CIRES has five internal Centers further facilitating interdisciplinary research. These are the Climate Diagnostics Center, the Center for the study of Earth from Space, the National Snow and Ice Data Center, the Center for Limnology, and the Colorado Center for Chaos and Complexity. CIRES has also recently established a highly interdisciplinary *Western Water Assessment* program that will closely integrate with NOAA's existing assessment programs.

As in any other scientific discipline, advances in the environmental sciences result from improved observations, understanding, modeling and prediction. CIRES scientists have made important contributions on all of these fronts during the past year. It is not possible to do justice to all of these topics here but only to highlight some of the more interesting developments. The attached list of *Journal Publications* by CIRES scientists and should be helpful in assessing the full extent of these contributions. External recognition is also detailed in the attached list of *Awards* received by CIRES scientists.

The integral links between the NOAA labs and the University of Colorado through CIRES ensure an efficient 'transfer of science' and fulfill an important educational goal. CIRES is also continuing to develop its *K-12 Outreach Program* that has already been recognized as exemplary of its kind. Ongoing projects include professional development for K-12 teachers, classroom presentations for students, mentoring and partnership programs with teachers and students, and undergraduate course development for pre-service teachers at the University. The attached *Community Service and Outreach* supplement should give an idea of the breadth of these activities by CIRES personnel.

As we enter the 21st century, the development of environmental policies will increasingly rely upon science as an important input in the complex process of decision-making. CIRES takes seriously the role of science in its service to society, and in addition to broadening its educational function through its outreach programs, is moving toward facilitating meaningful interactions between ‘natural’ scientists and social scientists, political scientists, economists, lawyers, and others involved in decision-making.

Some notable CIRES contributions over the past year (July 1999 – June 2000) are summarized below, under the broad NOAA themes of

Health of the Atmosphere (and Biosphere)

Climate variability and Global Change

Integrated Assessments (including Water in the Interior West)

Polar Science (including Polar Stratospheric Ozone Depletion)

Earth Observing Systems

We stress again that this is not a comprehensive catalogue. Also, some of the contributions do not fit neatly under any single theme above and could be included under multiple themes,

Health of the Atmosphere (and Biosphere)

- Together with scientists at NASA, researchers at the Aeronomy Lab have shown that total chlorine is beginning to decrease at stratospheric altitudes above 30 km, responding to previously reported changes in surface concentrations of chlorofluorocarbons. The new study therefore represents the first direct evidence that the stratosphere is slowly starting to "heal". Global satellite measurements of hydrochloric acid (which accounts for over 80% of the total chlorine content near the stratopause) were used for this study. Thus, another step can be reported to the United Nations that policy actions taken are having their expected effects.
- Through global measurements of all the important chlorine bearing molecules, CIRES and CMDL scientists have established that troposphere total chlorine peaked in 1994 and is now slowly decaying. This indicates that stratospheric chlorine (and ozone depletion) should begin to decrease by the turn of the century.

- CIRES and CMDL scientists contributed to a paper in *Science* that described constraints on hemispheric mixing ratios of hydroxyl (OH), a cleanser of many atmospheric pollutants, from troposphere methyl chloroform measurements. Calculations showed that there exists 15 (± 10) % more OH south of the mixing barrier between the hemispheres, the Inter-Tropical Convergence Zone (ITCZ), than north of that zone.
- The Aeronomy Lab played a leading role in organizing a major field experiment in the Houston area in summer 2000 (the Texas Air Quality Study), the largest air quality field campaign ever conducted in Texas. The study took the first detailed look at how pollution is affected by the region's coastal meteorology and the unique mix of vegetation, refineries, and transportation sources of hydrocarbons. Colleagues in several NOAA laboratories participated (ARL, CMDL, ETL, FSL). Findings from the mission are critically needed by Texas air quality managers to design scientifically sound strategies that will enable the region to meet the National Ambient Air Quality Standards.
- Forest fires have long been recognized as an important influence on the quality of air on local and even regional scales. But new research at the Aeronomy Lab has shown that the effect can extend even thousands of miles away, crossing the entire North American continent. In 1995, lightning-induced forest fires in northwestern Canada were at times the largest source of summertime carbon monoxide pollution more than 2000 miles away in the eastern United States. This is a good example of enhanced scientific understanding potentially influencing decision-making in the air quality arena.

Climate Variability and Global Change

- Using both long-term observational data and atmospheric GCM simulations, CDC scientists made significant progress in determining the changes to the probability distributions of atmospheric variables during tropical ENSO events, with particular emphasis on the changes of second moments and extreme values. Their generation of very large ensembles of GCM integrations to determine these changes with statistical confidence was a significant and original step in this regard. This turned out to be particularly important, because the character of the anomalous variability differs sharply for the daily, fortnightly, monthly, and seasonal time scales. Perhaps most interesting of all, the results suggest that the seasonal mean climate may not necessarily be more predictable during El Niño than La Niña (as is commonly

thought), because, although the seasonal ENSO signal is larger during El Niño, the noise, that is the uncertainty of that signal, is also larger.

- CDC scientists, in collaboration with NCEP scientists, have investigated the predictability of droughts and floods over the United States through large sets of GCM simulations. In a recently completed study, their focus was on the central U.S. drought of summer 1988 and the floods of spring 1993, and the degree to which they may have been influenced by anomalous SST conditions in the eastern tropical Pacific. The conclusion was that the 1988 drought probably had little to do with the tropical SSTs, but the 1993 floods did.
- CDC scientists have successfully constructed a simple 37-component empirical-dynamical model that can predict wintertime northern hemisphere troposphere circulation anomalies at Week 2 with comparable skill to that of the million-component medium range forecast model in use at NCEP. This success has surprised many researchers and forecasters. One reason may be that the Week 2 extratropical predictability depends strongly on an accurate representation of tropical diabatic heating, which is known to be deficient in the NCEP model. The 37-component model does considerably better in this regard.
- CDC scientists, in collaboration with a CIRES Visiting Postdoctoral Fellow, have made novel use of high-resolution satellite radiance data to identify the distinctly different space and time scales of convective variability over the tropical continents and oceans. The results have important implications for the development of convective parameterization schemes in GCMs.
- CMDL scientists completed an evaluation of the daily, weekly, monthly, and annual variability of the climate-forcing properties of aerosols from 3 years of data at sites in the US and Canada. CMDL scientists also participated in determining the climate-forcing properties of aerosols from southern Asia, as observed over the Indian Ocean from aircraft and a ground site during the 3-month long international Indian Ocean Experiment (INDOEX).

Polar Science (Including Polar Stratospheric Ozone depletion)

- Atmospheric Chemistry Project researchers at the Aeronomy lab, and also CIRES scientists at CMDL, contributed to observing and characterizing substantial ozone loss at a single altitude in the wintertime *Northern* Hemisphere. They participated on the NASA SAGE-III Ozone Loss and Validation Experiment (SOLVE) mission with aircraft and balloon flights from Sweden in the 1999/2000 winter. A suite of ozone-related measurements were made, ranging from large, condensed-nitric-acid-containing particles to long-lived gases that serve as tracers of dynamical motions. These data have been used not only to observe large local ozone losses (greater than 55% at a single altitude) during the mission, but also to understand the effects of temperature on the effectiveness of ozone-depleting chemicals. As a result, the role of unusually cold Arctic winters in ozone depletion in the Northern Hemisphere has been clarified.
- CIRES scientists at the Aeronomy Lab have completed a study demonstrating the role of stratospheric particles as reservoirs of ozone-depleting chemicals. A photoionization laser mass spectrometer onboard the NASA WB-57 high-altitude research aircraft made in-flight chemical analyses of particles above and below the tropopause. These first-of-a-kind data revealed the vertical profiles of the halogen content – fluorine, chlorine, bromine, and iodine – in particles at these altitudes. The results demonstrated that, in calculating the budgets of ozone-depleting chemicals in the lower stratosphere, the halogens stored in the *particulate* form, as well as the traditional gas phase, must now be accounted for.
- A CIRES scientist in collaboration with NOAA scientists has determined that the ocean is still a net sink for atmospheric methyl bromide, albeit a smaller sink. A paper published in the *Journal of Geophysical Research* showed that low productivity regions of the Atlantic Ocean resulted in a smaller net oceanic sink and that temperature alone could not explain the saturation anomalies observed. A cruise was undertaken this past year to examine the fluxes of other important halogens, including methyl bromide.
- From balloon-borne ozone measurements at the South Pole, CIRES and CMDL scientists have identified several indicators which will allow the healing of the ozone layer in Antarctica to be detected as early as the year 2005 (the ozone hole itself is not expected to disappear until about the year 2050).
- A CIRES scientist in ETL played a major role in the processing and analysis of Atmospheric Surface

Flux Group data (ASFG: a collaborative effort between ETL, CIRES, the Naval Postgraduate School and the Cold Regions Research and Engineering Laboratory), collected during the Surface Heat Flux of the Arctic Ocean (SHEBA) field experiment in the Beaufort and Chukchi Seas from October 1997 to October 1998. This scientist also directed ETL's participation in the upcoming Swedish-led Arctic Ocean Expedition experiment in the summer of 2001 (AOE-2001). The overall goal of this expedition is to measure and understand the sources and transport mechanisms of aerosols in the high Arctic, and assess the indirect effects of aerosols on climate change in the Arctic.

- CIRES scientists at the National Snow and Ice Data Center (NSIDC) have created a new *State of the Cryosphere* website as an efficient means of delivering information to researchers and the public. The site provides a broad audience with a current and succinct overview of the response of various components of the cryosphere to climate change: how features such as seasonal snow cover, sea ice, mountain glaciers, and the related topic, sea level, are responding to warming.
- NSIDC scientists, with their Russian partners at the Arctic and Antarctic Research Institute in St. Petersburg and also at the University of Washington, have completed an atlas of arctic meteorology and climate information. The atlas contains previously unavailable Russian synoptic meteorology data, newly released historical western drifting station data, and gridded fields of monthly means for six parameters. Scientific applications foreseen for the Atlas data include examining new evidence for climatic change from 1950 through 1990.
- NSIDC has established itself as the primary public source for declassified and unclassified data from both US Navy and Royal Navy submarines. The archive now includes the Submarine Upward Looking Sonar Ice Draft Profile Data and Statistics data set. Trends in the polar ice thickness distribution have been the subject of increasing research interest, with possible connections to global warming.

Integrated Assessments

- CIRES and CMDL contributed data and analysis of the trends, distributions, and budgets of trace gases (CO₂, N₂O, CH₄, SF₆, CFCs, HCFCs, HFCs) to the Intergovernmental Panel on Climate Change (IPCC) Assessment for 2000.

- CIRES and Aeronomy Lab scientists quantified the radiative impact of two fluorinated compounds, settling a dispute. NF_3 is a major industrial gas used in the electronics industry. $\text{C}_4\text{F}_9\text{C}_2\text{H}_3$ is a potential replacement of ozone-depleting compounds that are now being used as solvents. However, the "greenhouse acceptability" of both was being raised. The atmospheric lifetimes of these species were estimated by laboratory measurement of the parameters needed to calculate their lifetime. Their global warming potentials were calculated using measured IR cross-sections and the calculated atmospheric lifetimes. It was shown that the reaction of $\text{O}(^1\text{D})$, a very reactive, but low-abundance species, is an important loss process for NF_3 . The lifetime of $\text{C}_4\text{F}_9\text{C}_2\text{H}_3$ was shown to be very short. The atmospheric impact of these two man-made compounds was thus shown to be small, thereby avoiding unfounded restrictions on industry
- Aeronomy Lab scientists contributed to a study of the radiative of climate by *troposphere* ozone. This study estimated the global distributions of troposphere ozone from the difference between observations of the total column and stratospheric ozone. With these global data, modeling studies placed a new and tighter constraint on the radiative forcing of climate by troposphere ozone. The results of this study are cited in the forthcoming IPCC 2000 assessment as raising the level of scientific understanding of troposphere ozone forcing from "low" to "medium", which is international recognition of a step forward.
- Large uncertainties exist in our understanding of the magnitude and mechanisms of carbon dioxide transfer between the air and sea, restricting our ability to model global change. To help settle this issue observationally, CIRES and ETL scientists participated in three distinct direct gas flux measurement campaigns over the Atlantic, Indian and tropical west Pacific oceans on board NOAA's *Ronald H. Brown* in the summers of 1998 (Gas Ex-98) and 1999 (Jasmine and Nauru 99) respectively. These cruises yielded the first direct covariance carbon dioxide flux measurements over the open ocean. The measurements were also unique in allowing the CO_2 flux to be estimated as a function of wind speed. The Gas Ex-98 measurements have been utilized to make improvements to bulk gas flux parameterizations and to estimate the global oceanic uptake of CO_2 .

Water in the Interior West

The NOAA-CIRES *Western Water Assessment* (WWA) is an innovative interdisciplinary program linking climate variability and water resources to societal needs. As such, the project is also helping to define and justify the development of NOAA's Climate Services initiative. The WWA is focused on the Interior West, a region around Colorado in which abundant montane precipitation sustains surface flows across semi-arid plains in which water is intensively managed. The program calls for integration of the knowledge of climate variability, hydrology, biology, economics, demography and environmental law in reaching informed decisions on local water management and water use policies.

During the past year, the program has been concerned with assessments of the regional hydroclimatic variability and predictability, water needs, and water quality, and their implications for water management. Progress has been made on all of these fronts.

- On the hydroclimatic variability and predictability front, the effect of ENSO on climate variability in the region has been clarified. ENSO-related *seasonal* predictability has been found to be statistically significant but modest, and depend strongly upon location and the time of year. On *subseasonal* time scales, however the feasibility of making improved predictions of runoff using dynamical forecast models has been demonstrated in a study of the Animas River Basin, a small mountain watershed in southwestern Colorado.
- The Interior West is experiencing unprecedented population growth and economic development, resulting in stress on both the quantity and quality of the available water. A pilot project study of the vulnerability of the South Platte River Basin to climate variability has yielded interesting insights. For example, with increasing urbanization, one might expect the regional vulnerability to decrease as the climate-sensitive sectors of agriculture and forestry decline in importance. This overlooks the fact, however, that in the absence of new water sources, increasing urbanization forces a more efficient use of the available water, and generates a tight "water market" (i.e. the volume of water transfers and their prices) that becomes increasingly vulnerable to even minor climate variations.
- WWA scientists in the Center for Limnology have completed an analysis of the connection between climate variability, runoff, and water quality in the South Platte, a river used extensively for irrigation and

municipal supply. The analysis shows that climate variability, which presently is not taken into account in the issue of wastewater discharge permits, has a potential to alter the available dilution of waste in ways that cannot be anticipated from the recent hydrologic record. This makes it likely that at present some wastewater discharge permits are too restrictive, and others are not restrictive enough.

Earth Observing Systems

- CIRES and NOAA scientists have collaborated on research related to the use of the Global Positioning System (GPS) bistatic signal reflections for remote sensing of sea state or wind speed, soil moisture and ice conditions. The work indicates that GPS reflectance mapping has great potential to provide information on the ocean near-surface wind conditions, presence and condition of sea and fresh-water ice, as well as the freeze/thaw state of frozen ground or soil moisture. GPS receiving systems are small and light weight, and particularly well suited to be deployed on aircraft and balloons. In addition, GPS reflectance operates at L-band and with bistatic geometry, characteristics that are not provided by existing passive microwave systems and satellite radar. Thus, the GPS observations could revolutionize remote sensing systems for monitoring ocean, ice and soil moisture conditions. This technique is novel and requires further modeling efforts and experimental verifications. It is state-of-the-art research that is relevant to NOAA's environmental monitoring mission.
- Methods to infer cloud microphysical properties, such as hydrometeor sizes and mass content using combined millimeter wave radar and infrared and microwave radiometry have been developed and refined. Thanks to the CIRES/NOAA leadership in this area, these methods are employed to measure cloud properties remotely from the ground in the various programs that seek to understand the impact of clouds on climate change, including DOE/ARM, NASA/FIRE, and NSF/SHEBA. The methods will also be applied from space in the CLOUDSAT project.
- CIRES and ETL continue collaborative work to develop and apply advanced radar-observing systems. A Memorandum of Agreement is in place to jointly use NOAA's Platteville Radar Observatory as a multi-sensor facility, both for atmospheric research and for new observing technique development.
- An airborne sampling system for routine, in-situ measurements of vertical profiles of aerosol radiative properties has been developed and deployed for remote aircraft operation by CIRES and CMDL

scientists. The instrument package does not require a technician in the field, and data are rapidly processed and displayed on the web semi-automatically at remote airports.

- In a joint effort, scientists at CIRES, ETL, and NCAR combined state-of-the-art, high-resolution Large-Eddy Simulation (LES) with clear-air electromagnetic scattering theory, resulting in the first synthesis of wind profiler signal time series on the basis of LES data. This new simulation technique will help engineers and scientists to optimize both design and employment of future wind profiler systems for atmospheric research and monitoring.
-

JOURNAL PUBLICATIONS BY CIRES SCIENTISTS

January 1999 - December 1999

1. **Abdalati, W., K. Steffen**, Accumulation and hoar effects on microwave emission on the Greenland ice sheet dry snow zones, **J. Glaciology**, **44**(14), 523-531, 1999.
2. **Alexander, M. A., C. Deser, and M. S. Timlin**, 1999: The re-emergence of SST anomalies in the North Pacific Ocean. **J. Climate**, **12**, 2419-2433.
3. **Atlas, D., C.W. Ulbrich, F.D. Marks, E. Amitai, C.R. Williams**, Systematic variation of drop size and radar rainfall relations, **J. Geophys. Res.**, **104**, 6155-6169, 1999.
4. **Angevine, W.M.**, Entrainment results including advection and case studies from the Flatland boundary layer experiments, **J. Geophys. Res.**, **104(D24)**: 30, 47-30,963, 1999.
5. **Araujo-Pradere, E.A., T.J. Fuller-Rowell, and M.V. Codrescu**, An empirical ionospheric storm-time correction model, **AGU Fall Meeting**, San Francisco: 1999.
6. **Arge, C.N., V.J. Pizzo**, Predicting the background solar wind and the geoeffectiveness of magnetic clouds, **Space Weather Week**: 1999.
7. **Arge, C.N., V.J. Pizzo**, A statistical comparison of solar wind speed and IMF polarity predictions at IAU using daily updated magnetic field observations from Mount Wilson and Wilcox Solar observatories, **AGU Fall meeting**, 1999.
8. **Armstrong, R.L., L. Cheshire, C. Haggerty, R. Hauser, M. Meshek**, All about glaciers, **AGU Fall Meeting**, San Francisco CA: 1999
9. **Armstrong, R.L.**, Satellite remote sensing of global snow cover – a brief history, **IUGG 22nd General Assem.**, Birmingham UK: 1999.
10. **Armstrong, R.L., T. Zhang, and M.J. Brodzik**, Variations of snowmelt on the Greenland and Antarctic ice sheets from 1978-1998 as derived from passive microwave satellite data, **EOS, Trans. AGU**, **80**(46): F-329, 1999.
11. **Armstrong, R.L., M.J. Brodzik**, A twenty year record of northern hemisphere snow fluctuations derived from passive microwave satellite data, **GEWEX 3rd Int'l Scient. Conf, on Global Energy and Water Cycle**, Beijing, China: 1999.
12. **Armstrong, R.L.**, A history of regional to global scale satellite remote sensing of snow and related activities at NSIDC, **Snow and Avalanche Study Establishment**, Manali India: 1999.
13. **Armstrong, R.L., M.J. Brodzik**, A twenty year record of global snow cover fluctuations derived from passive microwave remote sensing data, **5th Conf. On Polar Meteor. And Oceanogra.**, **AMS**, Dallas TX: 1999.

14. **Augustine, J.A., C.R. Cornwall, and G.B. Hodges**, 1999: An integrated surface radiation budget network for climate research. **10th Symposium on Global Change Studies**, Dallas, TX, Jan. 10-15, 1999. American Meteorological Society, Boston, MA, 500-503.
15. **Aurora, O.P., D.J. Cziczo, A.M. Morgan, J.P.D. Abbatt, R.F. Niedziela**, Uptake of nitric acid by sub-micron-sized ice particles, **Geophys. Res. Lett.**, **26(24)**: 3621-3624, 1999.
16. **Avery, S.K., J.L. Chang, D. Thorsen**, 1999, Narrow beam meteor radar results from Christmas Island, *National Radio Science Meeting*, Boulder, CO.
17. **Baker, B., A. Guenther, J. Greenberg, A. Goldstein, and R. Fall** (1999) Canopy fluxes of 2-methyl-3-buten-2-ol over a ponderosa pine forest by relaxed eddy accumulation: Field data and model comparison. **J. Geophys. Res.**, **104**, 261107-26114.
18. **Barone, S. B., M. A. Zondlo and Tolbert**, Investigation of the heterogeneous reactivity of HCl, HBr and HI on ice surfaces," **J. Phys. Chem.**, **103**, 9717-9730, 1999.
19. **Barry, R.G.**, Microclimate, **Encyclopedia of Environmental Science**, (eds.) **Alexander and Fairbridge, Kluwer Acad. Publ.**: **408**, 1999.
20. **Barry, R.G., T.Zhang, and D.A. Gilinchinsky, V. Sorokovikov, and S. Bykhovets**, 1999. Soil temperature variation and its relation to climatic conditions, International Conference on Monitoring of Cryosphere, Russian Academy of Sciences, **Consolidated Scientific Council on Earth Cryology**, Pushchino, pp. 89-90.
21. **Barsugli, J.J.** et al, The effects of the 1997-98 El Nino on individual large-scale weather events, **Bull. Amer. Met. Soc.**: 1999.
22. **Battin-Leclerc, Frédérique, In-Koo Kim, Ranajit K. Talukdar, A. R. Ravishankara, Robert Portmann, Rozeanne Steckler and Danielle Brown**, Rate coefficients for the reactions of OH and OD with HCl and DCl between 200 and 400 K, **J. Phys. Chem.**, **103**, 3237-3244, 1999.
23. **Belmonte, A., B.J. Rye, W.A. Brewer, and R.M. Hardesty**, "Coherent lidar returns in turbulent atmosphere from simulation of beam propagation," **Proceedings of 10th Biennial Coherent Laser Radar Conference**, Mt. Hood, Oregon, June 1999, pp. 78-81.
24. **Benjamin, S. G., D. Kim, T. Smirnova, and J. M. Brown**, 1999: Effects of GOES cloud-top assimilation into RUC mixed-phase clouds on short-range QPF. **XXII Scientific Assembly International Union of Geodesy and Geophysics (IUGG)**, 19-24 July, Birmingham, UK, B258.
25. **Benjamin, S.G., D. Kim, J.M. Brown, D. Devenyi**, Cloud analysis for the MAPS/RUC system, **24th Gen. Assem. EGS**: 1999.
26. **Berg, W., D.M. Anderson, and J.J. Bates**, Satellite observations of a pacific moisture surge associated with flooding in Las Vegas, **J. Geophys. Res.**: 1999.
27. **Berg, W., J.J. Bates, D.L. Jackson**, Analysis of upper-tropospheric water vapor brightness temperatures from SSM/T2, HIRS and GMS-5 VISSR, **J. Appl., Meteor.**, **38**: 580-595, 1999.

28. **Bergman, J.W.**, Shortwave radiative transfer through complex cloud distributions with the NCAR radiative transfer model, **10th Conf. on Atmos. Radiat., AMS** :378-380, 1999.
29. **Bergman, J.W.**, Seasonal variations of clouds in the east Pacific as simulated by the NCAR CSM, **NCAR Clim. Sys. Model Wksp.**, Breckenridge CO: 1999.
30. **Bhattacharyya, J., S. Gross, J. Lees, M. Hastings**, Recent earthquake sequences at Coso: evidence for conjugate faulting and stress loading near a geothermal field, **Bull. Seis. Soc. Amer.**, **89(3)**: 785-795, 1999.
31. **Bhattacharyya, J., A.F. Sheehan, K. Tiampo, and J.B. Rundle**, Using genetic algorithms to model broadband regional waveforms for crustal structure in the western United States, **Bull. Seis. Soc. Am.**, **89**, 202-214, 1999.
32. **Bodhaine, Barry A., Norman B. Wood, Ellsworth G. Dutton, and James R. Slusser**, 1999, On Rayleigh Optical Depth Calculations, **Journal of Atmospheric and Oceanic Technology**, **16**, 1854 - 1861.
33. **Bourgeois, J., C. Petroff, H. Yeh, V. Titov, C.E. Synolakis, B. Benson, J. Kuroiwa, J. Lander, E. Norabuena**, Geologic setting, field survey and modeling of the Chimbote, Northern Peru, tsunami of 21 February 1996, **Pure and Appl. Geophys.**, **154**: 513-540, 1999.
34. **Breon, F.-M., D.L. Jackson, and J.J. Bates**, 1999: Evidence of atmospheric contamination on the measurement of the spectral response of GMS-5 water vapor channel. **J. Atmos. Oceanic Technol.**, **16**, 1851-1853.
35. **Brewer, W.A., V. Wulfmeyer, R.M. Hardesty, and B.J. Rye**, "Boundary layer wind and water vapor measurements using the NOAA mini-MOPA Doppler lidar," Proceedings of 10th Biennial Coherent Laser Radar Conference, Mt. Hood, Oregon, June 1999, p. 76.
36. **Brock, C.A., J.C. Wilson, J.M. Reeves, R.A. Washenfelder, D.D. Parrish, T.B. Ryerson, J. Holloway, F.C. Fehsenfeld**, Particle formation and growth in the plumes of coal-fired power plants, **Fall AGU meeting**, San Francisco CA: 1999.
37. **Brown, Steven S., Ranajit K. Talukdar and A. R. Ravishankara**, Reconsideration of the rate constant for the reaction of hydroxyl radicals with nitric acid, **J. Phys. Chem.**, **103**, 3031-3037 1999.
38. **Burdge, J.R., D.L. MacTaggart, S.O. Farwell**, Realistic detection limits from confidence bands, **J. Chem. Educ.**, **76**: 434-439, 1999.
39. **Butler, J.H., D.B. King, and S.A. Yvon-Lewis**, 1999, Computation of the Air-Sea Exchange Coefficient from Halocarbon Disequilibria, *Eos*, transactions, **Am. Geophys. Union**, Spring Meeting, **80 (17)**, 46.
40. **Butler, J.H., D.B. King, S.A. Yvon-Lewis, J.M. Lobert, S.A. Montzka, and J.W. Elkins**, 1999, Seasonal and Temporal Variability in the Distribution of Methyl Bromide in the Surface Ocean, **IUGG XXII General Assembly**, A, 111.

41. **J. Butler, S. Montzka, D. King, D. Mondeel, G. Dutton, and J. Elkins**, 1999, Measurement of Atmospheric Halons and Methyl Bromide: Update, Climate Monitoring and Diagnostics Laboratory Annual Meeting, Boulder, CO, May 12-13.
42. **Capotondi, M.A.**, Thermohaline circulation variability in a climate system model (CSM), **European Sci. Foundation**, Torino Italy: 1999.
43. **Capotondi, M.A.**, Oceanic pathways of tropical-extratropical interactions and decadal variability, **4th CSM Wksp**, Breckenridge CO: 1999.
44. **Carrasco, J.F., J. Fernandez, J.B. Rundle, and V. Arana**, Methods for detecting volcanic unrest using a deformation model, **Bull. Vol.**, **60**, 534-544, 1999.
45. **Celaya, M., J. Wahr, and F. Bryan**, Climate driven polar motion, **J. Geophys. Res.**, **(104)**, 12813-12830.
46. **Chabrillat, S., A.F.H. Goetz, H.W. Olsen, L. Krosley, D.C. Noe**, Use of AVIRIS hyperspectral data to identify and map expansive clay soils in the Front Range urban corridor in Colorado, **Proceedings of the 30th Int'l Conf. of Appl. Geol. Rem. Sens.**, **II**: 390-397, 1999.
47. **Chabrillat, S., A.F.H.Goetz, H.W. Olsen, L. Krosley, D.C. Noe**, Effectiveness of field spectrometry and hyperspectral imagery for identification of swelling clays, **Int'l Symp. On Spec. Sens. Res. ISSSR 1999**, Las Vegas NV: 1999.
48. **Chang, J.L., S.K. Avery, R.A. Vincent**, New narrow-beam meteor radar results at Christmas Island: implications for diurnal wind estimation, **Radio Sci.**, **34(1)**: 179-197, 1999
49. **Chase, Thomas N., Roger A. Pielke, Timothy G.F. Kittel, Jill S. Baron, Thomas J. Stohlgren**. 1999. Potential impacts on Colorado Rocky Mountain weather due to land Use changes on the adjacent Great Plains. **Journal Geophysical Research**: **104**: 16673-16690.
50. **Clark, M.P., M.C. Serreze, D.A. Robinson**, Atmospheric controls on Eurasian snow extent, **Int'l J. Clim.**, **19**: 27-40, 1999.
51. **Clark, M.P., M.C. Serreze**, Snowfall responses over the USA to phase and amplitude variations in the tropospheric wavetrain, **IUGG Symp.**, Birmingham UK: 1999.
52. **Clark. M.P. and M.C. Serreze**, 1999: Snowfall responses over the U.S.A. to phase and amplitude variations in the tropospheric wave train, in: *Interactions Between the Cryosphere, Climate and Greenhouse Gases* (M. Tranter, R. Armstrong, E.C. Brun, G. Jones, M. Sharp and M. Williams, eds.), **IAHS Publication no. 256**, pp. 45-54.
53. **Codrescu, M.V., K. Beierle, T.J. Fuller-Rowell, S.E. Palo, and X. Zhang**, More TEC climatology derived from TOPEX/POSEIDON measurements. **Proceedings of the Ionospheric Effects Symposium**, J.M. Goodman Editor, 672-697, 1999
54. **Compo, G.P., G.N. Kiladis, P.J. Webster**, The relationship between east Asian pressure surges and the Madden-Julian oscillation, **COARE98**, Boulder CO: 172-174, 1999.

55. **Curry, J. A., C. A. Clayson, W. B. Rossow, R. Reeder, Y. C. Zhang, P. J. Webster, G. Liu, and R. S. Sheu**, 1999: High-resolution satellite-derived dataset of the surface fluxes of heat, freshwater and momentum for the TOGIA COARE IOP. **Bull. Amer. Meteorol. Soc.**, **80**, 2059-2080.
56. **Curtis, A.J., M.C. Shirk, and R. Fall** (1999) Allylic or benzylic stabilization is essential for catalysis by bacterial benzyl alcohol clehydrogenases. **Biochem. Biophys. Res. Commun.**, **259**, 220-223.
57. **Cziczo, D.J., J.P.D. Abbatt**, Deliquescence, efflorescence, and supercooling of ammonium sulfate aerosols at low temperature, **J. Geophys. Res.**, **104(D11)**; 13,781-13,790, 1999.
58. **de Gouw, J.A., C.J. Howard, T.G. Custer, R. Fall**, Emissions of volatile organic compounds from cut grass and clover are enhanced during the drying process, **Geophys. Res. Lett.**, **26(7)**: 811-814, 1999.
59. **Dehant, V., P. Defraigne, and J. Wahr**, Tides for a Convective Earth, **J. Geophys. Res.**, **(104)**, 1035-1058.
60. **de Lima, A.R., J.S. S'a Martins, and T.J.P. Penna**, Monte Carlo simulation of magnetic systems in the Tsallis statistics, **Physica**, 553-566, June 1999.
61. **Del Negro, L. A., D. W. Fahey, R. S. Gao, S. G. Donnelly, E. R. Keim, J. A. Neuman, R. C. Cohen, K. K. Perkins, L. C. Koch, R. J. Salawitch, S. A. Lloyd, M. H. Proffitt, J. Margitan, R. M. Stimpfle, G. P. Bonne, P. B. Voss, P. O. Wennberg, C. T. McElroy, W. H. Swartz, T. L. Kusterer, D. E. Anderson, L. R. Lait, T. P. Bui**, Comparison of modeled and observed values of NO₂ and JNO₂ during the POLARIS mission, **J. Geophys. Res.**, **104**, 26,687-26,703, 1999.
62. **Delene, D.J., J.A. Ogren**, Variability of aerosol properties among surface monitoring stations, **Fall AGU**: 1999.
63. **Delene, D.J.**, Vertical profiles of cloud condensation nuclei above Laramie WY and Lauder NZ, **Clim. Monit. And Diagnos. Lab meeting**, Boulder CO: 1999.
64. **DeLuisi, J. J., J. A. Augustine, C. R. Cornwall, G. B. Hodges, and C. N. Long**, 1999a: Contrasting the SGP surface radiation budget with SURFRAD's six regional stations. Proceedings, **ARM Science Team Meeting**, March 22-26, 1999, San Antonio, TX, p 31.
65. **DeLuisi, J. J., J. A. Augustine, C. R. Cornwall, G. B. Hodges, C. N. Long, D. L. Wellman**, 1999b: NOAA's SURFRAD: Surface radiation measurements at six regional stations. **10th Conference on Atmospheric Radiation Measurements**, June-28-July 2, 1999, Madison, WI, 516-519.
66. **Desai, S., and Wahr, J.**, Monthly and fortnightly tidal variations of the earth's rotation rate predicted by a TOPEX/Poseidon empirical ocean tide model, **Geophys. Res. Lett.**, **(26)**, 1035-1038.

67. **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.
68. **Deser, C., J. E. Walsh, and M. S. Timlin**, 1999: Arctic sea ice variability in the context of recent wintertime atmospheric circulation trends. **J. Climate**, **13**, 617-633.
69. **Devenyi, D., S.G. Benjamin**, New developments in MAPS/RUC 3dvar analysis, **24th Gen. Assem. EGS**: 1999.
70. **Diaz, H.F., X.W. Quan, J.K. Eischeid, S.D. Woodruff, S.J. Lubker, T.P. Barnett**, 1999: Comparison of Decadal Trends in Surface Temperature in Different Data Sets. Climar 99, WMO Workshop on Advances in Marine Climatology, 8-15 September 1999, 240-244.
71. **Dickey, J.C., Bentley, C.R., Bilham, R., Carton, J.A., Eanes, R.J., Herring, T.A., Kaula, W.M., Lagerloef, G.S.E., Rojstaczer, S., Smith, W.H.F., van den Dool, H.M., Wahr, J.M., Zuber, M.T.**, Gravity and the Hydrosphere: A New Frontier, **Hydrological Sciences - Journal-des Sciences Hydrologiques**, (**44**), 407-415.
72. **Diner, D. J., G. P. Asner, R. Davies, J-P. Muller, A. W. Nolin, B. Pinty, C. B. Schaaf, and J. Stroeve** (1999) New directions in Earth observing: Scientific applications of multi-angle remote sensing, **Bull. Am. Meteorol. Soc.**, **80**:2209-2228.
73. **Divins, D.L.**, Development of a coastal relief model for the US continental margin, **Coastal Geotools '99**, Charleston SC: 1999.
74. **Downing, J.A., M. Mclain, R. Twilley, J.M. Melack, J. Elser, N.N. Rabalais, W.M. Lewis, Jr., R.E. Turner, J. Corredor, D. Soto, A. Yanez-Arancibia, R.W. Howarth**. 1999. The Impact of Accelerating Land-Use Change on the N-Cycle of Tropical Aquatic Ecosystems: Current Conditions and Projected Changes. **Biogeochemistry** **46**:109-148.
75. **Duane, G., P. J. Webster and J. Weiss**, 1999: Co-occurrence of northern and southern hemisphere blocks as partially synchronized chaos. **J. Atmos. Sci.**, **56**, 4183-4205.
76. **Dutton, G.D., M. Dicorleto, J. Elkins, M. Pender, T. Swanson, T. Thompson**, First year of station operation with the chromatograph for atmospheric trace species (CATS), **CMDL mtg.**, Boulder CO: 1999.
77. **Dvortsov, V.L., M.A. Geller, S. Solomon, S.M. Schauffler, E.L. Atlas, D.R. Blake**, Rethinking reactive halogen budget in the midlatitude lower stratosphere, **Geophys. Res. Lett.**, **26**: 1699-1702, 1999.
78. **Dvortsov, V.L., S. Solomon, M.A. Geller, S.M. Schauffler, E.L. Atlas, D.R. Blake**, On-line diagnostics of convective transport using short-lived halocarbons, **CSM Atmos. Model Wkp. Grp. Mtg.**, NCAR, Boulder CO: 1999
79. **Dvortsov, V.L., S. Solomon, R.W. Portmann, R.R. Garcia**, Midlatitude ozone depletion revisited: short-lived halocarbons and other issues, **J. Atmos. & Ocean. Tech.**, **16**: 309-322, 1999.

80. **Ecklund, W.L., C.R. Williams, P.E. Johnston, K.S. Gage**, A 3-GHz profiler for precipitating cloud studies, **J. Atmos. & Ocean. Tech.**, **16**: 309-322, 1999.
81. **Esipov, I.B., O.M. Johannessen, K.A. Naugol'nykh, E.C. Shang, Y.Y. Wang**, On the application of a Parametric radiator to monitoring the Fram Strait, **Acoustical Phys.**, **45(4)**: 448-454, 1999.
82. **Fahnestock, M. A., Scambos, T. A., Shuman, C. A., Arthern, R. J., Winebrenner, D. P. and Kwok, R.**, 1999. Snow 'mega-dune' fields on the East Antarctic plateau: extreme atmosphere-ice interaction. **Eos**, **80(46)**, p. F367.
83. **C. W. Fairall, P. Hacker, E. F. Bradley, S. Anderson, Y. du Penhoat, C. Eriksen, K. S. Gage, S. Kennan, M. LeMone, M. McPhaden, C. Ohlmann, D. Parsons, C. Paulson, R. Pinkel, S. Rutledge, A. Soloviev, R. Weller, E. Westwater, and E Zipser** (1999): "The Legacy of COARE for Technology and Ocean-Atmosphere Observing Capability", Proceedings of a conference on the **TOGA COUPLED OCEAN-ATMOSPHERE RESPONSE EXPERIMENT (COARE)**, Boulder, Colorado, 7-14 July 1998. **WCRP-107, WMO/TD-NO. 940**, 116-138.
84. **Fall, R.**, Biogenic emissions of volatile organic compounds from higher plants, **Chap. 2, Reactive Hydrocarbons in the Atmosphere**, 41-96, 1999.
85. **Fall, R., T. Karl, A. Hansel, A. Jordan, and W. Lindinger** (1999) Volatile organic compounds emitted after leaf wounding. On-line analysis by proton-transfer-reaction mass spectrometry. **J. Geophys. Res.**, **104**, 15963-15974.
86. **Fasullo, J.T., and P.J. Webster**, 1999: Warm pool sea surface temperature variability in relation to the surface energy balance, **J. Clim.**, **12**, 1293-1305.
87. **Ferguson, D.D., W. Klein and J.B. Rundle**, Spinodals, scaling, and ergodicity in a model earthquake fault with long range stress transfer, **Phys. Rev. E.**, **60**, 1359 – 1373, 1999.
88. **Fetterer, F., R. Barry, V. Radionov, P. Svyashchennikov, S. Priamikov, D.V. Westrum**, The environmental working group's arctic meteorology atlas on CD-ROM, **CLIMAR'99**: 1999
89. **Finkoglu, A. T., D. W. Reagor, K. O. Rasmussen, A. R. Bishop, N. Gronberch-Jensen, Q. X. Jia, Y. Fan, C. Kwon, and L. A. Ostrovsky**, 1999, Electrodynamical properties of coplanar waveguides made from high-temperature superconducting $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ electrodes on nonlinear dielectric SrTiO_3 substrates. **J. Appl. Phys.**, v. **86**, no. 3, 1558-1568.
90. **Folch, A.J. Fernandez, J.B. Rundle and J. Marti**, Ground deformation is a viscoelastic medium composed of a layer overlying a half-space: A comparison between point and extended sources, **Geophys. J. Int.**, **40**, 37-50, 1999.
91. **Frehlich, R., L. Cornman**, Coherent doppler lidar signal spectrum with wind turbulence, **Appl. Opt.**, **38(36)**: 7456-7466, 1999.

92. **Frehlich, R.**, Performance of maximum likelihood estimators of mean power and Doppler velocity with a priori knowledge of spectral width, **J. Atmos. And Ocean. Tech.**, **16**: 1702-1709, 1999.
93. **Frehlich, R.G.**, Maximum likelihood estimators for Doppler radar and lidar, **J. Atmos. Ocean. Tech.**, **16**: 1702-1709, 1999.
94. **Frehlich, R.G.**, Autonomous beam alignment for coherent Doppler lidar with multielement detectors, **Appl. Opt.**, **38**: 6927-6941, 1999.
95. **Frehlich, R.G.**, Doppler lidar velocity error for space-based platforms: definition and verification, **Lidar Working group on Space-based Wind Measurements**, Key West FL: 1999.
96. **Frei, A., D.A. Robinson**, Northern hemisphere snow extent: regional variability 1972-1994, **Int'l J. Clim.**, **19(14)**: 1535-1560, 1999.
97. **Frei, A., D.A. Robinson, M.G. Hughes**, North American snow extent, 1900-1994, **Int' J. Clim.**, **19(14)**: 1517-1534, 1999.
98. **Frost, G.J., G.B. Ellison, V. Vaida**, Organic peroxy radical photolysis in the near-infrared: effects on tropospheric chemistry, **J. Phys. Chem A.**, **103**: 10,169-10,178, 1999.
99. **Frost, G.L., M. Trainer, R.L. Mauldin III, F.L. Eisele, A.S.H. Prevot, S.J. Flocke, S. Madronich, G. Kok, R.D. Schillawski, D. Baumgardner, J. Bradshaw**, Photochemical modeling of OH levels during the aerosol characterization experiment, **J. Geophys. Res.**, **104**: 16,041-16,052, 1999.
100. **Fuller-Rowell, T.J. T. Matsuo, M.V. Codrescu, and F.A. Marcos**, Modeling thermospheric neutral density waves and holes in response to high-latitude forcing. **Adv. Space Res.**, **24**, 1447-1458, 1999.
101. **Fuller-Rowell, T.J., M.V. Codrescu, and P. Wilkinson**, Storm-time ionospheric correction maps. **Proceeding of the Ionospheric Effects Symposium**, Virginia, 42-49, 1999.
102. **Fuks, I.M., A.G. Voronovich**, Wave diffraction by a concave statistically rough surface, **Waves in Random Media**, **9(4)**: 501-520, 1999.
103. **I.M. Fuks, V.I. Tatarskii and D.E. Barrick**. Behaviour of scattering from a rough surface at small grazing angles. **Waves in Random Media**, **vol. 9**, pp 295-305, 1999.
104. **Fuks, I.M., and K. Naugolnykh**, Multi-frequency scintillation method for ocean flow measurement, **138 Meeting Acoust. Soc. Am., J. Acoust. Soc. Am.** **106**, No. 4, Pt.2, Oct. 1999, pp.2119-2120.
105. **Fuks, J., K.Naugolnykh and M. Charnotskii**, 1999: "Multi-frequency scintillation method for ocean flow measurement", **J. Am. Acoustical Soc.** **106** (4) 2119.
106. **Fuks, I.M.**, Remote Sensing of Layered Media with the GPS Signals, **XXVIth General Assembly of URSI** (Toronto, Ontario, Canada, August 13-21,1999) **Abstract FP.59**, p. 396.

107. **Gage, K.S., C.R. Williams, W.L. Ecklund, P.E. Johnston**, Development and application of Doppler radar profilers to ground validation of satellite precipitation measurements, **Adv. Space Res.**, **24(7)**: 931-934, 1999.
108. **Gage, K.S., C.R. Williams, W.L. Ecklund, P.E. Johnston**, Use of two profilers during MCTEX for unambiguous identification of Bragg scattering and Raleigh scattering, **J. Atmos. Sci.**, **56**: 3679, 1999.
109. **Gage, K.S., D.A. Carter, C.R. Williams, P.E. Johnston, W.L. Ecklund**, Use of Doppler radar profilers as a calibration tool in support of TRMM ground validation field campaigns, **29th Int'l Conf. Radar Meteor.**, Montreal Canada: 1999.
110. **Gao, R. S., D. W. Fahey, L. A. Del Negro, S. G. Donnelly, E. R. Keim, J. A. Neuman, E. Teverovskaia, P.O. Wennberg, T. F. Hanisco, E. J. Lanzendorf, M. H. Proffitt, J. J. Margitan, J. C. Wilson, J. W. Elkins, R. M. Stimpfle, R. C. Cohen, C. T. McElroy, T. P. Bui, R. J. Salawitch, S. S. Brown, A. R. Ravishankara, R. W. Portmann, M. K. W. Ko, D. K. Weisenstein, and P. A. Newman**, A comparison of observations and model simulations of NO_x/NO_y in the lower stratosphere, **Geophys. Res. Lett.**, **26**, 1153-1156, 1999.
111. **Gao, R. S., R. J. McLaughlin, M. E. Schein, J. A. Neuman, S. J. Ciciora, J. C. Holecek, and D.W. Fahey**, Computer-controlled Teflon flow control valve, **Rev. Sci. Instrum.**, **70**, 4732-4733, 1999.
112. **T.F. Gao and E.C. Shang**, (1999) "The matched-field processing (MFP) performance limited by the aperture of vertical array in shallow-water waveguide," in book of "*Theoretical and Computational Acoustics '97*", ED. Y.C. Teng, and E.C. Shang, World Scientific Publisher, Singapore, 1999.
113. **Gasiewski, A.J., M. Klein, I. Corbella, D. Serke, J.R. Piepmeier, and V. Leuskiy**, High-Resolution Polarimetric Microwave Imaging of Rainbands: CAMEX-3 & TEFLUN-B PSR/A Data," poster presentation, **Second TRMM Science Workshop**, University of Maryland, College Park, MD, October 24-26, 1999.
114. **Gerbig, C., J.C. Lin, B.C. Daube, S.C. Wofsy, P.S. Bakwin, D.F. Hurst, K.J. Davis, S. Schmitgen, and P.C. Novelli**, 1999, Development of a simple trajectory transport model to assess regional CO₂ fluxes from aircraft and tower measurements, **Eos Trans. AGU**, **80**, F56.
115. **Gilles, M.K., J. B. Burkholder, and A. R. Ravishankara**, *Rate Coefficients for the Reaction of OH with Cl₂, Br₂, and I₂, from 235 to 354 K*, **Int. J. Chem. Kin.**, **31**, 417-424, 1999..
116. **Goetz, A.F.H., P.J. McIntosh, L.R. Lestak**, Multi-year calibration of LANDSAT TM for studies of land-use and land-use change in the High Plains, **Proceedings of the 30th Int'l Conf. of Appl. Geol. Rem. Sens., II**: 183-190, 1999.

117. **Goetz, A.F.H., L.R. Lestak, E.L. Johnson, P.J. McIntosh and A.S. Warner**, “Land and Land-use Change in the Climate Sensitive High Plains”, Poster Session **National GeoData Forum Congressional Reception** at the National Geographic Society, Washington, D.C., June 7, 1999.
118. **Goetz, A.F.H., L.R. Lestak, E.L. Johnson, P.J. McIntosh and A.S. Warner**, , “Land and Land-use Change in the Climate Sensitive High Plains”, Version 2, Poster Session **ESRI User Conference**, San Diego, July 26-29, 1999.
119. **Gozani, J.**, Effect of the intermittent atmosphere on laser scintillation, **Opt. Lett.**, **24(16)**: 436-468, 1999.
120. **Gozani, J.**, Coherence and statistical optics – clarifying the concepts of wave propagation through intermittent media, **Opt. Lett.**, **24(16)**: 1085-1087, 1999.
121. **Gozani, J.**, The scintillation of laser propagating through the intermittent stratosphere, **URSI**, Orlando, FL: 126, 1999.
122. **Gozani, J.**, Does the coherence improve for wave propagation through intermittent media?, **URSI**, Orlando FL: 127, 1999.
123. Granier, C., J.F. Muller, G. Petron and G. Brasseur, : **A three-dimensional study of the global CO budget**, *Chemosphere*, **1255-1261**, 1999.
124. **Granier, C., G. Petron, J.F. Muller and G. Brasseur**, The impact of natural and anthropogenic hydrocarbons on the tropospheric budget of carbon monoxide, submitted for publication in **Atmos. Environment**, 1999.
125. **Granier, C., G.P. Brasseur, and D. Erickson**, : **Atmospheric Chemistry and Climate**, Chapter 15 of **Atmospheric Chemistry and Global Change**, a textbook edited by G. Brasseur et al., Oxford University Press, 1999.
126. **Granier, C.**, Impact of stratospheric change on tropospheric species, **SPARC Newsletter No 13**, July 1999.
127. **Greenberg, J.P., A. Guenther, P. Zimmerman, W. Baugh, C. Geron, K. Davis, D. Helmig, L.F. Kisslinger, C.**, Seismology, **Encyclop. Appl. Phys.**, **17**: 155-174, 1999
128. **Klinger**, Tethered balloon measurements of biogenic VOCs in the atmospheric boundary layer, **Atmos. Environ.**, **33**: 855-867, 1999.
129. **G. A. Grell, S. Emeis, and W. R. Stockwell**: Application of a fully coupled MM5-Chemistry Model: Simulation of a mountain-valley wind system. Preprints of **ninth PSU/NCAR mesoscale modeling system users workshop**, pg. 11-15, Boulder, Colorado.
130. **Guenther, A., S. Archer, J. Greenberg, P. Harley, D. Helmig, L. Klinger, L. Vierling, M. Wildermuth, P. Zimmerman, S. Zitzer**, Biogenic hydrocarbon emissions and landcover/climate change in a subtropical savanna, **Phys. Chem. Earth (B)**, **24(6)**: 659-667, 1999.

131. **Hadd, A. G., D. W. Lehmpuhl, L. R. Kuck and J. W. Birks**, Chemiluminescence Demonstration of Ester Hydrolysis Reactions, **Journal of Chemical Education**, **76**,1237-1240 (1999).
132. **Hall, D. K., S. Li, A. W. Nolin, J. C. Shi**, Pre-launch validation activities for the MODIS snow and sea ice algorithms, **The Earth Observer**, **11**, 31-35, 1999.
133. **Y. Han and E. R. Westwater**, (1999): Analysis of Tip Cal Methods for Ground-based Microwave Radiometric Sensing of Water Vapor and Clouds. Microwave radiometry and Remote Sensing of the Earth's surface and atmosphere. VSP Science Press, Zeist The Netherlands
134. **Haran, Terry, T. Zhang, and Ted Scambos**, 1999. Spatial and temporal variations of surface albedo and snowmelt in northern Alaska, Supplement to EOS, **Transactions, AGU, vol. 80, No. 46**, Nov. 16, 1999, p. F345.
135. **Hare, J.E., W.R. McGillis, C.W. Fairall, J.B. Edson**, Application of open-and closed- path CO₂/H₂O gas flux instrumentation in the open ocean, **AGU Spring meeting**, Boston MA: 1999.
136. **Hay, W.W., R.M. DeConto**, Comparison of modern and late cretaceous meridional energy transport and oceanology, **Geol Soc. Amer.**, **332**: 283-406, 1999.
137. **Hay, W.W., R.M. DeConto, C.N. Wold, K.M. Wilson, S. Voigt, M. Schulz, A.R. Wold, W-C. Dullo, A.B. Ronov, A.N. Balukhovsky, E. Söding**, Alternative global cretaceous paleogeography, **Geol. Soc. Amer.**, **332**: 1-47, 1999.
138. **Hazler, S., M. Pasyanos, W. R. Walter, and A. Sheehan**, Two-station phase velocity determination for structure in North Africa, Proceedings of the 20th annual Comprehensive Test Ban Treaty Monitoring Conference, Las Vegas, September 1999.
139. **Heinrichs, J., K. Steffen**, The winter C-band backscatter of land ice and fast sea ice near Lady Anne Strait, N.W.T., **Appl. Develop. and Res.**, RADARSAT Int'l, Canadian Space Agency: 1999.
140. **Helmig, D.**, Review: Air analysis by gas chromatography, **J. Chromatogr. A**, **843**: 129-146, 1999.
141. **Helmig, D.**, Eddy correlation measurements of atmospheric volatile organic compound emissions (fluxes), **Pittcon '99 Book of Abstracts, #1354**, 7-12 March, Orlando FL: 1999.
142. **Helmig, D., L.F. Klinger, A. Guenther, L. Vierling, C. Geron, P. Zimmerman**, Biogenic volatile organic compound emissions (BVOCs) I. identifications from three continental sites in the U.S., **Chemosphere**, **38(8)**: 2163-2187, 1999.
143. **Helmig, D., L.F. Klinger, A. Guenther, L. Vierling, C. Geron, P. Zimmerman**, Biogenic volatile organic compound emissions (BVOCs) II. Landscape flux potentials from three continental sites in the U.S., **Chemosphere**, **38(8)**: 2189-2204, 1999.
144. **Hendon, H. and T. Shinoda**, 1999: Assessment of Warm Pool Surface Fluxes from NCEP Reanalyses. **Proceedings of COARE 98**.

145. **Holland, W.R., M.A. Capotondi**, Variability of the ocean thermohaline circulation, *Modeling the Earth's Climate and Its Variability*, Elsevier: 1999.
146. **Huang, H.-P.**, 1999: Scale-dependent properties of optimal perturbations on a zonally varying barotropic flow, *J. Atmos. Sci.*, **56**, 1238-1247.
147. **Huaman, M., and B. Balsley**, " Differences in Near-Mesopause Summer Winds, Temperatures, and Water Vapor at Northern at southern latitudes as Possible Causal Factors for Inter-Hemispheric PMSE Differences", *Geophys. Res. Lett.*, **26**, pp 1529-1532, June 1, 1999.
148. **Huang, H.-P., and P. D. Sardeshmukh**, 1999: The annual and semisannual cycles of atmospheric angular momentum, Preprints, **12th Conference on Atmospheric and Oceanic Fluid Dynamics**, American Meteorological Society, Boston, MA, 263.
149. **Huey, L.G., T.B. Ryerson, R.W. Dissy, E. Leibrock, R. Jacobek, D.T. Sueper, J.S. Holloway, M.T. Trainer, D.D. Parrish, F.C. Fehsenfeld**, Measurement of nitric acid in power plant plumes, *AGU Fall mtg.*: 1999.
150. **Hurst, D.F., G.S. Dutton, P.A. Romashkin, P.R. Wamsley, F.L. Moore, J.W. Elkins, E.J. Hints, E.M. Weinstock, R.L. Herman, E.J. Moyer, D.C. Scott, R.D. May, C.R. Webster**, Closure of the total hydrogen budget of the northern extratropical lower stratosphere, *J. Geophys. Res.*, **104(D7)**: 8191-8200, 1999.
151. **Irisov, V.** Azimuthal Variations of the Sea Surface Brightness Temperature: Comparison of the Model Spectra Calculations with Aircraft Observations, *IGARSS Proceedings*, vol. 4, 28 June- 2 July 1999, Hamburg, Germany, pp.2306-2309.
152. **Isebrands, J.G., A.B. Guenther, P. Harley, D. Helmig, L. Klinger, L. Vierling, P. Zimmerman, C. Geron**, Volatile organic compound emission rates from mixed deciduous and coniferous forests in northern Wisconsin, USA, *Atmos. Environ.*, **33**: 2527-2536, 1999.
153. **Jeffries, M.O., T. Zhang, K. Frey, N. Kozlenko**, Estimating late-winter heat flow to the atmosphere from the lake-dominated Alaskan north slope, *J. Glaciol.*, **45(150)**: 315-324, 1999.
154. **Jeffries, M, O., T. Zhang, K. Krey, and N. Kozlenko**, 1999: Conductive heat flux through the snow cover on lakes and tundra in late winter on the Alaskan North Slope, *Journal of Glaciology*, **45(150)**, 315-324
155. **Jobson, B.T., S.A. McKeen, D.D. Parrish, F.C. Fehsenfeld, D.R. Blake, A.H. Goldstein, S.M. Schauffler, and J.W. Elkins**, Trace gas mixing ratio variability vs. lifetime in the troposphere and stratosphere – Observations, *J. Geophys. Res.*, vol. **104**, 16091-16114, 1999.
156. **Joly, A., K.A. Browning, P. Bessemoulin, J-P. Cammas, G. Caniaux, J-P. Chalon, S.A. Clough, R. Dirks, K.A. Emaunel, L. Eymard, R. Gall, T.D. Hewson, P.H. Hildebrand, D. Jorgensen, F. Lalaurette, R.H. Langland, Y. Lemaitre, P. Mascard, J.A. Moore, P.O.G. Persson, F. Roux, M.A. Shapiro, C. Synder, Z. Toth, R.M. Wakimoto**, Overview of the field

- phase of the fronts and Atlantic storm-track experiment (FASTEX) project, **Q.J.R. Meteor. Soc.**, **125**: 1-37, 1999.
157. **Jones, C. H., L. J. Sonder, and J. R. Unruh**, Reply to Comment on "Lithospheric gravitational potential energy and past orogenesis: Implications for conditions of initial Basin and Range and Laramide deformation", **Geology**, **27**, 475-476, 1999.
158. **Kaehn, A.J., J.G. Calvert, A.D. Clarke, D.J. Erickson, C. Granier, P. Mirabel, K.H. Stamnes, G.F. Carrier, D.H. Ehhalt, E.M. Greitzer, M. Oppenheimer, G.N. Slinn**, A review of NASA's subsonic assessment project, **Report of the Panel on Atmospheric Effects of Aviation**, National Research Council, National Academy Press, Washington, D.C., 1999.
159. **Kahl, J.D., N.A. Zaitseva, V. Khattatov, R.C. Schnell, D.M. Bacon, J. Bacon, V. Radionov and M.C. Serreze**, 1999: Radiosonde observations from the former Soviet Union "North Pole" series of drifting ice stations, 1954-90, **Bull. Amer. Meteor. Soc.**, **80**, 2019-2026.
160. **Karbiwnyk, C., J. Birks, D. Helmig**, Measurement of atmospheric non-methane volatile organic compounds using ambient CFC reference compounds, **Pittcon '99 Book of Abstracts**, #1338, 7-12 March, Orlando FL: 1999.
161. **Kamata, Y., Sokratov, S.A., Sato, A.**, 1999, "Growth of depth hoar under extremely low temperature", Cold Region Technology Conference 99, Kitami, Japan, 7-12.
162. **Kegley-Owen, C., M. K Gilles, James B. Burkholder, and A. R. Ravishankara**, 1999, *Rate Coefficient Measurements for the Reaction OH + ClO → Products*, **J. Chem. Phys. A**, **103**, 5040-5048.
163. **Khattatov, B.V., J.C. Gille, L.V. Lyjak, G.P. Brasseur, V.L. Dvortsov, A.E. Roche, J.W. Waters**, Assimilation of photochemically active species and a case analysis of UARS data, **J. Geophys. Res.**, **104**: 18,715-18,737, 1999.
164. **Kisslinger, C.**, Seismology, **Encyclop. Appl. Phys.**, **17**: 155-174, 1999.
165. **Kleeman, R. and A.M. Moore**, 1999: A new method for determining the reliability of dynamical ENSO predictions. **Mon. Wea. Rev.**, **127**, 694-705.
166. **Knesel KM, Davidson JP & Duffield WA** (1999) Evolution of silicic magma through assimilation and subsequent recharge: evidence from Sr isotopes in sanidine phenocrysts, Taylor Creek Rhyolite, NM. **Journal of Petrology** **40**, 773-786.
167. **Knesel KM & Davidson JP** (1999) Sr isotope systematics during melt generation by intrusion of basalt into continental crust. **Contributions to Mineralogy & Petrology** **136**, 285-295.
168. **Knesel KM, Duffield WA, & Priest, SS** (1999) Dynamics of crystallization in silicic magmas constrained by size distributions of phenocrysts, Supplement to Eos, **Transactions** **80**, 1106.

169. **Knesel KM** (1999) Isotopic and petrologic constraints on the longevity of silicic magma bodies, Supplement to Eos, **Transactions 80**, 1178.
170. **Knowles, K., T. Zhang, and Roger G. Barry**, 1999. Some characteristics of permafrost and ground ice distribution in the Northern Hemisphere, Supplement to EOS, Transactions, **AGU**, vol. **80**, No. **46**, Nov. 16, 1999, p. F413.
171. **Krosley, L., H.W. Olsen, K. Nelson, S. Chabrilat, A.F.H. Goetz, D.C. Noe**, Mineralogy-swelling potential relationships for expansive shales along the Colorado Front Range Urban Corridor, **GSA**, Denver CO: 1999.
172. **Lantz, K.O., P. Disterhoft, J. J. DeLuisi, A. Thompson, E. Early, D. Bigelow, J. Slusser**, Methodology for Deriving Clear-sky Erythemal Calibration Factors for Yankee and Solar Light UV Broadband Radiometers of the U.S. Central UV Calibration Facility, **J. Atmos. Ocean. Tech.**, Vol. **16**, 1736-1752, 1999.
173. **Lehmpuhl, D. W., K. A. Ramirez-Aguilar, A. E. Michel, K. L. Rowlen and J. W. Birks**, "Physical and Chemical Characterization of Atmospheric Aerosols by Atomic Force Microscopy, **Analytical Chemistry**, **71**, 379-383 (1999).
174. **Leuliette, E.W. and J. Wahr**, Coupled pattern Analysis of Sea Surface Temperature in TOPEX/Poseidon Sea Surface Heights", **J. Phys. Oceanography**, **291**, 599-612.
175. **Lewis, W.M. Jr., J.M. Melack, W.H. McDowell, M. McClain, and J.E. Richey**. 1999. Nitrogen yields , from undisturbed watersheds in the Americas. **Biogeochemistry 46**: 149-162.
176. **Liebmann, B., G. N. Kiladis, J. A. Marengo, T. Ambrizzi, and J. D. Glick**, 1999: Submonthly Convective Variability over South America and the South Atlantic Convergence Zone. **J. Climate**, **12**, 1877-1891.
177. **Lynch, A.H., Chapin, F.S. III, Hinzman, L.D., Wu, W., Lilly, E., Vourlitis, G. and Kim, E.**, 1999: Surface Energy Balance on the Arctic Tundra: Measurements and Models. **J. Climate**, **12**, 2585- 2606.
178. **Lynch, A.H., G.B. Bonan, F.S. Chapin III and W. Wu**, 1999: The Impact of Tundra Ecosystems on the Surface Energy Budget and Climate of Alaska. *J. Geophys. Res.* Special issue of *J. Geophys. Research on New Developments and Applications with the NCAR Regional Climate Model*, **104**, 6647-6660.
179. **MacDonald, L.M., R.W. Sampson, D.M. Andeson**, Runoff and road erosion at the plot and road segment scales, St. John, U.S. Virgin Islands, **Earth Surface Processes and Landforms**: 1999.
180. **Malone, V.F., A.J. Chastain, J.T. Ohlsson, L.S. Poneleit, M. Nemecek-Marshall, R. Fall**, Characterization of a *Pseudomonas putida* allylic alcohol dehydrogenase induced by growth on 2-methyl-3-buten-2-ol, **Appl. and Environ. Microbiol.**, **65(6)**: 2622-2630, 1999.
181. **Marson I., Velicogna I.**, 'Flexural Isostasy in Italy'. 2nd Italian Forum of earth science, Bellaria (Rimini), 20-23 September 1999, p 555. [In Italian].

182. **Marshall, S., R.J. Oglesby, K.A. Maasch, G.T. Bates**, Improving climate model representations of snow hydrology, **Environ. Model. And Software**, **14**: 327-334, 1999.
183. **Maslanik, J.A. M.C. Serreze, and T. Agnew**, 1999. On the record reduction in western Arctic sea-ice cover in 1998. **Geophys.Res. Lett.** **26, 13** , 1905-1908
184. **Massman, W.J., and J.C. Weil**, 1999: An analytical one-dimensional second order closure model of turbulence statistics and the Lagrangian time scale within and above plant canopies of arbitrary structure. **Bound-Layer Meteor.**, **91**, 81--107.
185. **Matrosov, S.Y., R.A. Kropfli, R.F. Reinking, B.E. Martner**, Prospects for measuring rainfall using propagation differential phase in X- and S-K sub S-K radar bands, **J. Appl. Meteor.**, **38(6)**: 766-776, 1999.
186. **Matrosov, S.Y., B.E. Martner, R.A. Kropfli, and R.F. Reinking**, 1999: Estimation of rain parameters from differential phase and reflectivity measurements at X-band. Preprints 29th **Conference on Radar Meteorology, American Meteorological Society**, Boston, Mass., 311-313.
187. **Matrosov, S.Y.**, Retrievals of vertical profiles of ice cloud microphysics from radar and IR
188. Measurements using tuned regressions between reflectivity and cloud parameters, **J. Geophys. Res.**, **104(D14)**: 16,741-16,753, 1999.
189. **May, P.T., A.R. Jameson, T.D. Keenan, P.E. Johnston, W.L. Ecklund**, Combined wind profiler/polarimetric radar studies of the vertical motion and microphysical characteristics of sea breeze thunderstorms, **29th Int'l Conf. On Radar Meteor.**, Montreal Canada: 1999.
190. **McKeen, S., E.-Y. Hsie, T.B. Ryerson, L.G. Huey, J.S. Holloway, D.D. Parrish, M. Trainer, W. Angevine, G. Huebler, F. Fehsenfeld**, Scales of turbulence and plume spreading during SOS-99; July 12, a case study, **AGU Fall Mtg.**: 1999.
191. **McGuire, A.D., J.S. Clein-Curley, J.M. Melillo, D.W. Kicklighter, R.A. Meier, C.J. Vorosmarty and M.C. Serreze**, 1999: Modeling carbon responses of tundra ecosystems to historical and projected climate: Sensitivity of the pan-Arctic carbon storage to temporal and spatial variation in climate, **Global Change Biology**, **6**, 1-19.
192. **McTaggart, D.L., S.O. Farwell, J.R. Burdge, Z-T. Cai, T.J. Haakenson, W.L. Bamesberger**, A Continuous monitor-sulfur chemiluminescence detector (CM-SCD) system for the measurement of total gaseous sulfur species in air, **Atmos. Environ.**, **33**: 625-632, 1999.
193. **Montzka, S.A., J. H. Butler, J. W. Elkins, L. Lock, and D. Mondeel**, 1999, Seasonal and Inter-annual Variability of Methyl Bromide and Methyl Chloride from a Global Flask Sampling Network, **EOS, Transactions of the American Geophysical Union** **80 (46)**, F149.
194. **Montzka, S. A., J. H. Butler, J. W. Elkins, T. M. Thompson, A. D. Clarke**, and L. T. Lock, Present and future trends in the atmospheric burden of ozone-depleting halogens, **Nature**, **398**, 690-694, 1999.

195. **Moore, A.M., R. Kleeman**, Stochastic forcing of ENSO by the intraseasonal oscillation, **J. Clim.**, **12**: 1199-1220, 1999.
196. **Moore, F.L., J.W. Elkins, E.A. Ray, G.S. Dutton, D.F. Hurst, P.A. Romashkin, and D.W. Fahey**, 1999, Atmospheric transport and SF₆ loss derived from LACE observations, **Eos Trans. AGU**, **80**, S63.
197. **Moore, A. and R. Kleernan**, 1999: The non-normal nature of El Nino and intraseasonal variability. **J. Climate**, **12**, 2965-2982.
198. **Moore, A.M- and AT Mariano**, 1999: The dynamics of error growth and predictability in a model of the Gulf Stream. 1: Singular vector analysis. **J. Phys. Oceanogr.**, **29**, 158-176
199. **Muschinski, A., P. B. Chilson, S. Kern, J. Nielinger, G. Schmidt, and T. Prenosil**, 1999: First frequency-domain interferometry observations of large-scale vertical motion in the atmosphere. **J. Atmos. Sci.**, **56**, 1248-1258.
200. **Muschinski, A., P. P. Sullivan, D. B. Wuertz, R. J. Hill, 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**, 1437-1459.
201. **Naugolnykh, K., S. Egerev, I. Esipov, and K. Matveev**, 1999: "Nonlinear propagation of laser-generated acoustical pulses in a water and granulated medium", **J. Acoust. Soc. Am.** **106** (6) 3135-3141.
202. **K. Naugolnykh, E.C. Shang, and Y.Y. Wang**, (1999) "On the application of a parametric radiator to monitoring the Fran Strait," **Acoust. Phys.** **45**, (4) ,p.448-456..
203. **Naugolnykh,K., E.C. Shang, Y.Y. Wang**, Numerical simulation of the parametric array application for Ocean monitoring in the Fram Strait environment, **Theoret. and Comput. Acous.** '97, (eds.) **Teng, Shang, Pao, Schultz, Pierce, World Scientific Publ.:** 487-498, 1999..
204. **Neiman, P.J., F.M. Ralph, B.L. Weber, T. Uttal, L.B. Nance, and D.H. Levinson**, 1999: Observations of anomalous frontal propagation and frontally forced gravity waves along the steep eastern slope of the Rocky Mountains. Preprint, 8th Conference on Mesoscale Processes, 28 June-1July 1999, Boulder, CO. American Meteorological Society, 398-403.
205. **Neuman, J. A., L. G. Huey, T. B. Ryerson, and D. W. Fahey**, Study of inlet materials for sampling atmospheric nitric acid, **Environ. Sci. and Technol.**, **33**, 1133-1136, 1999.
206. **Nevison, C., V. K Gupta, and L. Klinger**, 1999: Self-sustained oscillations on Daisyworld, **Tellus**, **5** IB(4): 806-814.
207. **Newman, M., M. A. Alexander, C. R. Winkler, J. D. Scott, and J. J. Barsugli**, 1999: Linear inverse modeling of the coupled extratropical ocean-atmosphere system in the GFDL GCM. **Proceedings, 24th Annual Climate Diagnostics and Prediction Workshop**, Tucson, AZ.

208. **Niyogi, D.K., D.M. McKnight, and W.M. Lewis, Jr., 1999:** Influences of water and substrate quality for periphyton in a montane stream affected by acid mine drainage. **Limnology and Oceanography**, **44**, 804-809.
209. **Nolin, A. W. and J. C. Stroeve (1999)** Snow albedo determination and validation for MODIS and MISR. **Proc. of the 2nd International Workshop on Multiangular Measurements and Models**. Ispra, Italy, p. 41.
210. **Novelli, P.C., P.M. Lang, K.A. Masarie, D.F. Hurst, R.C. Myers, and J.W. Elkins, 1999,** Molecular hydrogen in the troposphere: Global distribution and budget, **Eos Trans. AGU**, **80**, **F82**.
211. **Odstrcil, D., V.J. Pizzo,** Three-dimensional propagation of coronal mass ejections (CMEs) in a structured solar wind flow 1. CME launched within the streamer belt, **J. Geophys. Res.**, **104(A1)**: 483-492, 1999.
212. **Ogren, J., P. Sheridan, A. Jefferson, E. Andrews,** Aerosol optical properties measured at the Kaashidhoo Climate Observatory during INDOEX, AGU, San Francisco: 1999.
213. **Ohno, Y., C.R. Williams, and K.S. Gage,** Simplified method for rain rate and Z-R relation estimation using UHF wind profiler, **29th Conference on Radar Meteorology**, 12-16 July 1999, Montreal, Quebec, Canada.
214. **Onasch, T. B., R. L. Siefert, S. Brooks, A. Prenni, B. Murray, M. A. Wilson and M. A. Tolbert,** "Infrared spectroscopic study of the deliquescence and efflorescence of ammonium sulfate aerosol as a function of temperature," **J. Geophys. Res.**, **104**, 21317-21326, 1999.
215. **Ostrovsky, L. A., and A. I. Potapov,** 1999. Modulated waves: Theory and applications. Johns Hopkins Univ. Press, Baltimore, MD (full edition published)
216. **Ostrovsky, L., J. Hare, A. Smirnov, R. Kropfli, K. Naugolnykh, E. Skirta, and T. Stanton,** 1999: "The action of swell onto the short surface waves: *in situ* and radar observations", Proceedings of the Air-Sea Interface Symposium, Sydney, Australia, 391-398.
217. **Pap, J., Anklin, M., Frohlich, C., Wehrli, Ch., Varadi, F., and Floyd, L.:** 1999, Adv. Space Res., Vol. 24, No. 2, p. 215.
218. **Pap, J. and Frohlich, C.:** 1999, Total Irradiance Variations, JASTP., 61, 15.
219. **Parrish, D.D., T.B. Ryerson, J.S. Holloway, M. Trainer, F.C. Fehsenfeld,** New Directions: does pollution increase or decrease tropospheric ozone in winter-spring?, **Atm. Environ.**, **33**: 5147-5149, 1999.
220. **Peckham, S. and V. K. Gupta,** 1999: A reformulation of Horton's laws for large river networks in terms of statistical self-similarity, **Water Resour. Res.**, **35(9)**, 2763-77.
221. **Peng, S., and J. S. Whitaker,** 1999: Mechanisms determining the atmospheric response to midlatitude SST anomalies. **J. Climate**, **12**, 1393-1408.

222. **Penland, C., and L. Matrosova**, 1999: "Nonnormal El Nino Evolution in the Early 20th Century," **Proc. 24th Climate Diagnostics Workshop**, Tucson, AZ, 1-5 Nov., 1999. U. S. Dept. Commerce. Springfield, VA.
223. **Perovich, D., E. Andreas, J. Curry, H. Eiken, C. Fairall, T. Grenfell, P. Guest, J. Intrieri, D. Kadko, R. Lindsay, M. McPhee, J. Morison, R. Moritz, C. Paulson, S. Pegau, O. Persson, R. Pinkel, J. Richter-Menge, T. Stanton, H. Stern, M. Sturm, W. Tucker, and T. Uttal**, 1999: SHEBA: The surface heat budget of the Arctic Ocean. **EOS, Transactions, American Geophysical Union**, **80**, 481-486.
224. **Perovich, D.K., E.L. Andreas, J.A. Curry, H. Eiken, C.W. Fairall, T.C. Grenfell, P.S. Guest, J. Intrieri, D. Kadko, R.W. Lindsay, M.G. McPhee, J. Morison, R.E. Moritz, C.A. Paulson, W.S. Pegau, P.O.G. Persson, R. Pinkel, J.A. Richter-Menge, T. Stanton, H. Stern, M. Sturm, W.B. Tucker III, T. Uttal**, Year on ice gives climate insights, **EOS Trans.**, **80(41)**: 485-487, 1999. **Mon. Wea. Rev.**: 661-677, 1999.
225. **Pielke, R.A. Sr., R.L. Walko, L. Steyaert, P.L. Vidale, G.E. Liston, W.A. Lyons, T.N. Chase**, 1999. The influence of anthropogenic landscape changes on weather in South Florida. **Mon. Weather. Rev.**: **127**: 1663-1673.
226. **Pinto, J.P., J.A. Curry, A.H. Lynch, P.O.G. Persson**, Modeling clouds and radiation for the November 1997 period of SHEBA using a column climate model, **J. Geophys. Res.**, **104(D6)**: 6661-6678, 1999.
227. **Popp, P.J., Bishop, G.A., Stedman, D.H.**, Development of a High-Speed Ultraviolet Spectrometer for Remote Sensing of Mobile Source Nitric Oxide Emissions. **J. Air & Waste Manage. Assoc.** **49**, 1463-1468, 1999.
228. **Robert W. Portmann, Steven S. Brown, Tomasz Gierczak, Ranajit K. Talukdar, James B. Burkholder, and A. R. Ravishankara**, Role of nitrogen oxides in the stratosphere: A reevaluation based on laboratory studies, **Geophys. Res. Lett.**, **26**, 2387-2390, 1999
229. **Quan, X.W., H.F. Diaz, S.D. Woodruff, S.J. Lubker, J. K. Eischeid**, 1999: Comparison of Ship-Observed Sea Surface Temperature with Measurements From Drifting Buoys and Expendable Bathythermographs: 1980-95. **Climar 99, WMO Workshop on Advances in Marine Climatology, 8-15 September 1999**, 319-323
230. **Racette, P.E, E.R. Westwater, Y. Han, A.J. Gasiewski, E. Kim, M. Klein, K. Widener, B. Zak**, Millimeter wave radiometric arctic winter experiment, **Proc. 9th ARM Science Team Meeting**, San Antonio, Texas, March 22-26, 1999.
231. **Rajopadhyaya, D.K., S.K. Avery, P.T. May, R.C. Cifelli**, Comparison of precipitation estimation Using single- and dual-frequency wind profilers: simulations and experimental results, **J. Atmos. & Ocean. Tech.**, **16**: 165-173, 1999.
232. **Ralph, F. M., D. Kingsmill, P. Neiman, P. O. G. Persson, A. White, and W. D. Neff**, 1999: Comparison of VAD wind profiles from NEXRAD with data from the CALJET coastal wind

- profiler network. Proceedings, 29th International Conference on Radar Meteorology, 12–16 July, 1999, Montreal, Quebec, Canada, AMS, Boston, 888–891.
233. **Ralph, F. M., P. J. Neiman, P. O. G. Persson, J.-W. Bao, J. Schmidt, A. White, and D. Jorgensen**, 1999: Blocking by coastal mountains in land-falling Pacific winter storms. **Proceedings, Third Conference on Coastal Atmospheric and Oceanic Prediction and Processes**, 3–5 Nov., 1999, New Orleans, LA, AMS, Boston, 368–373. (Figures supplied to AMS appeared on front and back covers of proceedings volume.)
234. **Ramirez-Aguilar, K. A., D. W. Lehmpuhl, A. E. Michel, J. W. Birks and K. L. Rowlen**, Atomic Force Microscopy for the Analysis of Environmental Particles, **Ultramicroscopy**, *77*, 187-194 (1999).
235. **Ray, E.A., F.L. Moore, J.W. Elkins, G.S. Dutton, D.W. Fahey, H. Vomel, S.J. Oltmans, K.H. Rosenlof**, Transport into the northern hemisphere lowermost stratosphere revealed by in situ tracer measurements, **J. Geophys. Res.**, *104(D21)*: 26,565-26,580, 1999.
236. **Reid, G.**, Solar variability and its implications for the human environment, **J. Atmos. Solar-Terres. Phys.**, *61*: 3-14, 1999.
237. **Reinking, R.F., S.Y. Matrosov, B.E. Martner, B.W. Orr, R.A. Kropfli, and B.W. Bartram**, 1999: Slant linear polarization applied to detection of supercooled drizzle. Preprints 29th Conference on Radar meteorology, American Meteorological Society, Boston, Mass., 285-288.
238. **Rex, M., R. J. Salawitch, G. C. Toon, B. Sen, J. J. Margitan, G. B. Osterman, J. F. Blavier, R. S. Gao, S. Donnelly, E. Keim, J. Neuman, D. W. Fahey, C. R. Webster, D. C. Scott, R. L. Herman, R. P. May, E. J. Moyer, M. R. Gunson, F. W. Irion, A. Y. Chang, C. P. Rinsland, and T. P. Bui**, Subsidence, mixing and denitrification of Arctic polar vortex air measured during POLARIS, **J. Geophys. Res.**, *104*, 26611, 1999.
239. **Robertson, D.S.**. Algorithmic information theory, free will, and the Turing test, **Complexity**, *4(3)*: 25-34, 1999.
240. **Robinson, J.A., W. G. Scott, K. L. Rowlen and J. W. Birks**, Derivatization of Thymine and Thymine Photodimers with 4-bromomethyl-7-methoxycoumarin for Fluorescence Detection in High-Performance Liquid Chromatography, **Journal of Chromatography B**, *731*, 179-186 (1999).
241. **Robinson, J.K., M. J. Bollinger and J.W. Birks**, Luminol/H₂O₂ Chemiluminescence Detector for the Analysis of Nitric Oxide in Exhaled Breath, **Analytical Chemistry** *71*, 5131-5136 (1999).
242. **Romashkin, P.A., D.F. Hurst, J.W. Elkins, G.S. Dutton, F.L. Moore, P.R. Wamsley**, Effect of the tropospheric trend on the stratospheric tracer-tracer correlations: methyl chloroform, **J. Geophys. Res.**, *104(D21)*: 26,643-26,652, 1999.
243. **Ross, M. N., R. R. Friedl, D. E. Anderson, G. Ash, M. R. Berman, B. Gandrud, W. T. Rawlins, E. C. Richard, and A. F. Tuck**, 1999: ACCENT Mission Studies Effects of Aircraft and Rocket Combustion Emissions in the Upper Troposphere and Lower Stratosphere, **EOS Transactions of the AGU**, Vol 80, No. 38.

244. **Rozenberg, A. D. M. J. Ritter, W. K. Melville, C. C. Gottschall, and A. V. Smirnov**, 1999, Free and Bound Capillary Waves as Microwave Scatterers: Laboratory Studies, **IEEE Transactions on Geoscience and Remote Sensing**, vol. 37, n2, 1052-1065.
245. **Rundle, J.B., W. Klein, and S. Gross**, Physical basis for statistical patterns in complex earthquake populations: Models, predictions, and test, **PAGEOPH**, 155, 575-607, 1999.
246. **Rye, B. J.**, "Estimation of return signal spectral width in incoherent backscatter heterodyne lidar," **Proceedings of 10th Biennial Coherent Laser Radar Conference**, Mt. Hood, Oregon, June 1999, pp. 195-197.
247. **Ryerson, T.B., M. Trainer, R.W. Dissly, F. Flocke, J.S. Holloway, L.G. Huey, D.D. Parrish, D.T. Dueper, A.J. Weinheimer, F.C. Fehsenfeld**, Oxidation rates in power plant plumes, **AGU Fall mtg.:** 1999.
248. **Sardeshmukh, P.D., G.P. Compo, C. Penland** Changes in probability associated with El Nino, **8th Conf. Clim. Varia.**, Denver, CO: 16-19, 1999.
249. **Sardeshmukh, P. D., M. Newman, and C. R. Winkler**, 1999: Dynamically consistent estimates of diabatic heating. **Proceedings, 24th Annual Climate Diagnostics and Prediction Workshop**, Tucson, AZ.
250. **Scambos, T. A., Kvaran, G., and Fahnestock, M. A.**, 1999. Improving AVHRR resolution through data cumulation for mapping polar ice sheets. **Remote Sensing of Environment**, 69, 59-66.
251. **Scambos, T. A., and Fricker, H. A.**, 1999. Mapping basal processes of ice shelves using satellite measurements. **EOS 80(46)**, F330-F331.
252. **Scharfen, G., R. Bauer**, Antarctic data management support at the NSIDC, **West Antarctic Ice Sheet Initiative 6th Annual Wksp.**, Sterling VA: 1999.
253. **Scharfen, G., R. Barry, V. Troisi, S. Khalsa, R. Weaver, B. Raup**, "The Glacier Land Ice Measurements from Space (GLIMS) World Data Archive: An Information Management System for GLIMS," **Eos Transactions AGU Volume 80**, Number 46, November 16, 1999, p F329.
254. **Schlosser, C. A., A. Slater, A. Robock, A. J. Pitman, K. Ya. Vinnikov, A. Henderson-Sellers, N. A. Speranskaya, K. Mitchell, A. Boone, H. Braden, P. Cox, P. DeRosney, C. E. Desborough, Y.-J. Dal, Q. Duan, J. Entin, P. Etchevers, N. Gedney, Y. M. Gusev, F. Habets, J. Kim, E. Kowalczyk, O. Nasonova, J. Noilhan, J. Polcher, A. Shmakin, T. Smirnova, D. Verseghy, P. Wetzel, Y. Xue, and Z.-L. Yang**, 1999. Simulations of a boreal grassland hydrology at Valdai, Russia: PILPS Phase 2(d), **Mon. Weather Rev.**, Vol. 128, No. 2, 301-321.
255. **Schwarz, J.P., D.S. Robertson, T.M. Niebauer, J.E. Faller**, A new determination of the Newtonian constant of gravity using the free fall method, **Meas. Sci. Technol.**, 10: 478-486, 1999.

256. **Scott, J.D., M.A. Alexander**, Net shortwave fluxes over the ocean, **J. Phys. Oceanogra.**, **29**: 3167-3174, 1999.
257. **Schweiger, A., C.Fowler, J. Key, J. Maslanik, J. Francis, R. Armstrong, M.J. Brodzik, T. Scambos, T. Haran, M. Ortmeyer, S. Khalsa, D. Rothrock, R. Weaver**, P-cube: a multisensor data set for polar climate research, **5th Conf. on Polar Meteor. and Oceanogra.**, AMS, Dallas TX: 136-141, 1999.
258. **Scott, J.D., M.A. Alexander**, Net shortwave fluxes over the ocean, **J. Phys. Oceanogra.**, **29**: 3167-3174, 1999.
259. **Sen, B., G.B. Osterman, R.J. Salawitch, G.C. Toon, J.J. Margitan, J.-F. Blavier, A.Y. Chang, R.D. May, C.R. Webster, R.M. Stimpfle, G.P. Bonne, P.B. Voss, K.K. Perkins, J.G. Anderson, R.C. Cohen, J.W. Elkins, G.S. Dutton, D.F. Hurst, P.A. Romashkin, E.L. Atlas, S.M. Schauffler, and M. Loewenstein**, 1999, The budget and partitioning of stratospheric chlorine during the 1997 Arctic summer, **J.Geophys. Res.**, **104**, 26653-26665.
260. **Senff, C. J., R. J. Alvarez II, R. M. Hardesty, T. B. Ryerson, M. T. Trainer**, 1999: Investigation of Power Plant Plumes With Airborne Lidar During SOS99. **Proceedings of AGU Fall Meeting**, San Francisco, California, USA, 13-17 December 1999, 135-136
261. **Serreze, M.C. and C.M. Hurst**, 1999: Representation of mean Arctic precipitation from NCEP/NCAR and ERA reanalyses, **J. Climate**, **13**, 182-201.
262. **Serreze, M.C., M.P. Clark, R.L. Armstrong, D.A. McGinnis, R.S. Pulwarty**, Characteristics of the western United States snowpack from snowpack telemetry (SNOTEL) data, **Water Resour. Res.**, **35(7)**: 2145-2160, 1999.
263. **Serke, D.J., A.J. Gasiewski, M. Klein, V. Leuski, A. Francavilla, J. Piepmeier, I. Corbella**, Processing and initial comparison of PSR data from CAMEX-3 to SSM/I and TMI data, **AGU, 1999 Fall meeting**.
264. **P.E. Racette, E.R. Westwater, Y. Han, A.J. Gasiewski, E. Kim, M. Klein, K. Widener, B. Zak**, Millimeter wave radiometric arctic winter experiment, **Proc. 9th ARM Science Team Meeting**, San Antonio, Texas, March 22-26, 1999.
265. **Shang, E.C., Y.Y. Wang**, Subarctic frontal effects on long-range acoustic propagation in the North Pacific ocean, **J. Acoust. Soc. Am.**, **105(3)**: 1592-1595, 1999.
266. **Shang, E.C., Y.Y. Wang**, The frontal effects on long-range acoustic propagation in the north Pacific ocean, **Theoret. and Comput. Acous. '97**, (eds.) **Teng, Shang, Pao, Schultz, Pierce**, **World Scientific Publ.**: 475-486, 1999.
267. **Shang, E.C., Y.Y. Wang**, Subarctic frontal effects on long-range acoustic propagation in the North Pacific ocean, **J. Acoust. Soc. Am.**, **105(3)**: 1592-1595, 1999.
268. **E.C. Shang, A.G..Voronovich and Y.Y. Wang**, (1999) "Progress in the modal phase tomography (MPT) and modal-horizontal refraction tomography (MHRT) for ocean

- monitoring,” **Proceedings of The International Symposium on Ocean Acoustic Tomography and Acoustic Thermometry**, Tokyo Japan, JAMSTEC. May,1999.
269. **Shinoda, T., H. Hendon and J. Glick**, 1999: Intraseasonal surface fluxes in the tropical western Pacific and Indian Oceans from the NCEP reanalyses, **Mon. Weath. Rev.**, **127**, 678-693.
270. **Shinoda, T., and H. Hendon**, 1999: Modeling of Intraseasonal Variability in the western Pacific warm pool. **Proceedings of COARE 98**.
271. **Sievers, R.E., U. Karst, P.D. Milewski, S.P. Sellers, B.A. Miles, J.D. Schaefer, C.R. Stoldt, C.Y. Xu**, Formation of aqueous small droplet aerosols assisted by supercritical carbon dioxide, **Aeros. Sci. and Tech.**, **30**: 3-15, 1999.
272. **Skirta, E. A., E. M. Weber, J. M. Martin-Hayden, and L. A. Ostrovsky**, 1999. Time-frequency analysis of Lake Erie Surface elevations. In: Statistical Modeling (**Proc. of 14th intern. Workshop**), Ed. H. Friedl, A. Berghold, and G. Kauermann. Graz, Austria, 1999, pp. 674-678.
273. **Sloan, V.F., K. Steffen, J.F. Heinrichs**. 1999. Spatial and temporal observations of sea ice and polynyas in Arctic Canada using RADARSAT-1 and ERS-1 imagery: implications for modeling. **American Geophysical Union Abstracts**, Dec. 13-17, San Francisco.
274. **A.V. Smirnov**, 1999, Radar Observations of Ship-Induced Instabilities in the Ocean-Atmosphere System, **Oceanologica Acta**, **vol. 22**, n1, 45-50.
275. **Smirnova, T. G., J. M. Brown, and S. G. Benjamin**, 1999: Soil temperature and moisture evolution from MAPS/RUC2. **Workshop on land-surface modeling and applications to mesoscale models**, 24-25 June, Boulder, CO, 41-44.
276. **Smirnova, T. G., J. M. Brown, and S. G. Benjamin**, 1999: Sensitivity studies of MAPS/RUC land-surface scheme using PILPS 2(D) data. **XXII Scientific Assembly of the International Union of Geodesy and Geophysics (IUGG)**, 19-24 July, Birmingham, UK, A246.
277. **Smith, D.F., A.J. Gasiewski, M. Klein, J. W. Bao, H.W. Kroehl**, Full potential of satellite microwave data in numerical weather prediction models in all cloud conditions, **AGU, 1999 Fall meeting**
278. **Smith, C.A. and P. Sardeshmukh**, 1999, The Effect of ENSO on the Intraseasonal Variance of Surface Temperature in Winter., *International J. of Climatology*.
279. **Smith, Jeff, T. Zhang, and Richard L. Armstrong**, 1999. Detecting surface soil freeze/thaw status using passive microwave remote sensing data, Supplement to EOS, **Transactions, AGU**, **vol. 80**, No. 46, Nov. 16, 1999, p. F413.
280. **Smyth, S., S. Sandholm, B. Shumaker, W. Mitch, A. Kanvindi, J. Bradshaw, S. Liu, S. McKeen, G. Gregory, B. Anderson, R. Talbot, D. Blake, S. Rowland, E. Browell, M. Fenn, J. Merrill, S. Bachmeir, G. Sachse, and J. Collins**, Characterization of the chemical signatures of air masses observed during the PEM experiments over the western Pacific, **J. Geophys. Res.**, **vol. 104**, 16243-16254, 1999.

281. **Steffen, K., W. Abdalati, I. Sherjal**, Faceted crystal formation in the northeast Greenland low-accumulation region, **J. Glaciol.**, **45**: 63-68, 1999.
282. **Stephens, B. B., S. C. Wofsy, R. F. Keeling, P. P. Tans, and M. J. Potosnak**, The CO₂ Budget and Rectification Airborne Study: Strategies for measuring rectifiers and regional fluxes, Inverse Methods in Global Biogeochemical Cycles, **Geophysical Monograph 114**, AGU 1999.
283. **Stevermer, A.J., I. Petropavlovskikh, J.J. DeLuisi, J.M. Rosen, F. Congeduti**. A global stratospheric aerosol climatology: Effects on UV. Proceedings, 1999 AGU Fall Meeting, December 13-17, San Francisco, CA F210: A42B-13.
284. **Swayze, G.A., R.N. Clark, A.F.H. Goetz, T.G. Chrien and N.S. Gorelick**, "Spectral Identification of Surface Materials using Imaging Spectrometer Data: Evaluating the Effects of Detector Sampling, Bandpass, and Signal-to-Noise ratio using the USGS Tetracorder Algorithm, Part 1, **Journal of Geophysical Research**.
285. **Tatarskii, V.I., and V.V. Tatarskii**. Statistical non-Gaussian model of sea surface with anisotropic spectrum for wave scattering theory. **Part I - Abstract. Journal of Electromagnetic Waves and Applications, Vol. 13**, 899-900, 1999.
286. **Tatarskii, V.I., and V.V. Tatarskii**. Statistical non-Gaussian model of sea surface with anisotropic spectrum for wave scattering theory. **Part II - Abstract. Journal of Electromagnetic Waves and Applications, Vol. 13**, 901-902, 1999.
287. **Tatarskii, V.I., and V.V. Tatarskii**. Statistical non-Gaussian model of sea surface with anisotropic spectrum for wave scattering theory. **Part I. Chapter 12 (pages 259-291) in Progress in Electromagnetics Research, PIER 22**, J. A. Kong, Chief Editor, EMW Publishing, Cambridge, Massachusetts, USA, 1999.
288. **Tatarskii, V.I., and V.V. Tatarskii**. Statistical non-Gaussian model of sea surface with anisotropic spectrum for wave scattering theory. **Part II. Chapter 13 (pages 293-313) in Progress in Electromagnetics Research, PIER 22**, J. A. Kong, Chief Editor, EMW Publishing, Cambridge, Massachusetts, USA, 1999.
289. **Thomson, D., R. Winkler**, Software for the PALMS mass spectrometer, **Scient. Comput. & Instrum.:** 54-57, 1999.
290. **Timlin, M. S., M. A. Alexander, and C. Deser**, 1999: Re-emergence of SST anomalies in the North Atlantic Ocean. **Eighth Conference on Climate Variations**, Denver, Colorado, September 1999, 126-128.
291. **Tisdale, A. J. Prenni, L. T. Iraci, M. A. Tolbert and O. B. Toon**, Variation of the Infrared Spectra of Nitric Acid Hydrates with Formation Conditions: Impact on PSC Identification," **Geophys. Res. Lett.**, **26**, 707-710, 1999.
292. **Tokay, A., D.A. Short, C.R. Williams, W.L. Ecklund, and K.S. Gage**, Tropical rainfall associated with convective and stratiform clouds: Intercomparison of disdrometer and profiler measurements, **J. Applied Meteor.**, **38**, 302-320, 1999.

293. **Tomas, R., J. R. Holton, and Peter Webster**, 1999: On the theory of the location of convection in strong cross equatorial pressure gradient flows. **Q.J. Roy. Meteor. Soc.**, **125**, 1107-1127.
294. **Toon, G.C., J.-F. Blavier, B. Sen, J.J. Margitan, C.R. Webster, R.D. May, D. Fahey, R. Gao, L. Del Negro, M. Proffitt, J. Elkins, P.A. Romashkin, D.F. Hurst, S. Oltmans, E. Atlas, S. Schauffler, F. Flocke, T.P. Bui, R.M. Stimpfle, G.P. Bonne, P.B. Voss, and R.C. Cohen**, 1999, Comparison of MkIV balloon and ER-2 aircraft measurements of atmospheric trace gases, **J.Geophys. Res.**, **104**, 2679-2690.
295. **P. J. Webster**, 1999: Interdecadal changes in the ENSO-Monsoon System. **J. Clim.** **12**, 2679-2690.
296. **Yuri G. Trokhimovski, Vladimir G. Irisov, Ed R. Westwater, Len S. Fedor, and Vladimir Leuskiy**, 1999): Comparison of the sea surface brightness temperature measured during the Coastal Ocean Probing Experiment (COPE'95) from a blimp with model calculations. Microwave radiometry and Remote Sensing of the Earth's surface and atmosphere. VSP Science Press, Zeist The Netherlands
297. **Tuck, T.F., S. J. Hovde, M. H. Proffitt**, 1999: Persistence in Ozone Scaling under the Hurst Exponent as an Indicator of the Relative Rates of *Chemistry and Fluid Mechanical Mixing in the Stratosphere*. **J Phys Chem A**, **103**, 10445-10450.
298. **Tyndall, G., S. Liu, L. Benning, H. Berresheim, D. Ehhalt, F. Flocke, G. Frost, T. Jobson, D. Poppe, B. Ramacher**, Report on working group 3: data analysis, interpretation, modeling. **Proceedings of the workshop on volatile organic compounds in the troposphere**, Germany: 187-194, 1999.
299. **Tyus, H.M. W.C. Starnes, C.A. Karp, and J.F Saunders, III**. 1999. Effects of invasive tissue collection on rainbow trout, razorback sucker, and bonytail chub. **North American Journal of Fisheries Management** **19**:848-855.
300. **Tyus, H.M., and J.F. Saunders, III**. 1999. An evaluation of recovery needs for endangered fishes in the upper Colorado River, with recommendations for future recovery actions. **Final Report to the Colorado River Water Conservation District**. Contract # 1196-12-1591B. Center for Limnology, University of Colorado at Boulder.
301. **Van Zandt, T.E., C.R. Williams, W.L. Clark, W.L. Ecklund, and K.S. Gage**, Dual-radar techniques for measuring the turbulence energy dissipation rate, **29th Conference on Radar Meteorology**, 12-16 July 1999, Montreal, Quebec, Canada.
302. **Vavilova, V.V., W.M. Lewis, Jr.**, Temporal and altitudinal variations in the attached algae of mountain streams in Colorado, **Hydrobiol.**, **390**: 99-106, 1999.
303. **Vavilova V.V., Lewis W.M.** Spatial heterogeneity of attached algae and their coupling with suspended algae in mountain streams. **International Hydrological Symposium**, Fort Collins, 18-20 August, 1999.

304. **Vavilova V.V., Lewis W.M.** Diatom heterogeneity in two Central Colorado mountain streams. **15th North American Diatom Symposium**, Pingree Park, Colorado. September 22-25, 1999, p.22.
305. **Velicogna I., Wahr J.**, 'Are analyzed pressure fields good enough for geodetic applications?' **EOS Trans. AGU**, San Francisco, USA, 13-17 December 1999, **80(46)**, F255.
306. **Verplanck, P.L., G.L. Farmer, M. McCurry, S.A. Mertzman**, The chemical and isotopic differentiation of an epizonal magma body: Organ Needle Pluton, New Mexico, **Petrol.**, **40(4)**: 653-678, 1999.
307. **Vincent, P., J.S. Warren, D.F. Reid, T.L. Holcombe, D.L. Divins**, New bathymetry of Lake Huron, **42nd Conf. Great Lakes Res., Int'l Assoc. Great Lakes Res.**, **113**: 1999.
308. **Virden, W.T., J. S. Warren, T. L. Holcombe, D. F. Reid, and T. L. Berggren**, 1999, "Bathymetry of Lake Ontario," Boulder CO, NOAA National Geophysical Data Center, **World Data Center for Marine Geology and Geophysics** report no. MGG-15.
309. **Voigt, S., W.W. Hay, R. Hofling, R.M. DeConto**, Biogeographic distribution of late early to late cretaceous rudist-reefs in the Mediterranean as climate indicators, **Geol. Soc. Amer.**, **332**: 91-103, 1999.
310. **A.G. Voronovich and E.C. Shang**, (1999) "Horizontal-Refraction Modal Tomography of the Ocean with Mode Interaction," **IEEE-JOE**, **24**, N0.2, p.224-231. (Invited paper).
311. **Waite, M.E., S. Ge, H. Spetzler**, A new conceptual model for fluid flow in discrete fractures: an experimental and numerical study, **J. Geophys. Res.**, **104(B6)**: 13,049-13,059, 1999.
312. **Wagner, W.P., M. Nemecek-Marshall, and R. Fall** (1999) Three distinct phases of isoprene formation during the growth and sporulation of *Bacillus subtilis*. **J. Bacteriol.**, **181**, 4700-4703.
313. **Warshawsky, M. S., M. A. Zondlo and M. A. Tolbert**, Impact of Nitric Acid on Ice Evaporation Rates, **Geophys. Res. Lett.**, **26**, 823-826, 1999.
314. **Webster, P.J., A. Moore, J. Loschnigg and M. Leban**, 1999: Coupled ocean-atmosphere dynamics in the Indian Ocean during 1997 – 98, **Nature**, **40**, 23 September 1999, 356-360.
315. **Weil, J.C.**, 1999: Review of Air Quality: Third Edition. Thad Godish. 1997. In: **Bull. Amer. Meteor. Soc.**, **80**, 932--934
316. **Wessman, C.A., W. Cramer, R.J. Gurney, P.H. Martin, W. Mauser, R. Nemani, J.M. Paruelo, J. Penuelas, S.D. Prince, S.W. Running, and R.H. Waring**. 1999. Dahlem Group Report: Remote sensing perspectives and insights for study of complex landscape. In: Tenhunen, J.D. and P. Kabat (eds.). Integrating Hydrology, Ecosystem Dynamics, and Biochemistry in Complex Landscapes. **John Wiley and Sons Ltd., Chichester, UK. P.** 89-103.
317. **A.E. West, P.D. Brooks, M.C. Fisk, L.K. Smith, E.A. Holland, C.H. Jaeger III, Babcock, R. Lai, and S.K. Schmidt**. 1999. Landscape patterns of CH₄ fluxes in an alpine tundra ecosystem. **Biogeochemistry**. **45**: 243-264.

318. **Westwater, E.R., A.S. Vuazankin, K.P. Gaikovich, E.N. Kadygrov, D.Y. Moiseev,** Radiometric monitoring of atmospheric boundary layer temperature profiles, **Russian Meteor. Hydrol., (3):** 43-53, 1999.
319. **Westwater, E.R., Y. Han, V.G. Irisov, V. Leuskiy, E.N. Kadygrov, S.A. Viazankin,** Remote sensing of boundary layer temperature profiles by a scanning 5-MM microwave radiometer and RASS: comparison experiments, **J. Atmos. and Ocean. Tech., 16(7):** 805-818, 1999.
320. **Westwater, E.R., Y. Han, J.B. Snider, J.H. Churnside, J.A. Shaw, M.J. Falls, C.N. Long, T.P. Ackerman, K.S. Gage, W. Ecklund, A. Riddle,** Ground-based remote sensor observations during PROBE in the tropical western Pacific, **Bull. Amer. Meteor. Soc., 80(2):** 257-270, 1999.
321. **E. R. Westwater, A. S. Viazankin Y., K. Gaikovich, E. N. Kadygrov** (1999): Radiometric monitoring of the temperature of the planetary boundary layer of the atmosphere. Meteorology and Hydrology, N3, March 1999 (in English, Translated by E. R. Westwater)
322. **E. R. Westwater, Yong Han, and Fred Solheim** (1999): Resolution and accuracy of a multi-frequency scanning radiometer for temperature profiling. Microwave radiometry and Remote Sensing of the Earth's surface and atmosphere, VSP Science Press, Zeist The Netherlands
323. **Wheeler, M., G.N. Kiladis,** Convectively coupled equatorial waves: analysis of clouds and temperature in the wavenumber-frequency domain, **J. Atmos. Sci., 56:** 374-399, 1999.
324. **White, A. B., R. J. Lataitis, R. S. Lawrence,** 1999: Space and time filtering of remotely sensed velocity turbulence. **J. Atmos. and Oceanic Technol., 16,** 1967–1972.
325. **White, A. B., J. R. Jordan, F. M. Ralph, P. J. Neiman, and B. E. Martner,** 1999: Extending the dynamic range of an S-band radar for cloud and precipitation studies. **Proceedings, 29th International Conference on Radar Meteorology,** 12–16 July, 1999, Montreal, Quebec, Canada, AMS, Boston, 823–826.
326. **Wick, G. A., and A. T. Jessup,** 1999, Evaluation of Oceanic Cool Skin and Warm-Layer Models Using Recent Measurements of Improved Accuracy, **IEEE International Geoscience and Remote Sensing Symposium,** Hamburg, Germany.
327. **Wilfong, T.L., D.A. Merritt, R.J. Lataitis, B.L. Weber, D.B. Weurtz, and R.G. Strauch;** (1999), Optimal Generation of Radar Wind Profiler Spectra, **Journal of Atmospheric and Oceanic Technology, Vol.16,** 723-733.
328. **Williams, C.R., P.E. Johnston, W.L. Ecklund, K.S. Gage, D.A. Carter, R. Cifelli, A. Tokay, and Y. Ohno,** Comparison of rain drop size distributions deduced from profilers and surface disdrometers, **29th Conference on Radar Meteorology,** 12-16 July 1999, Montreal, Quebec, Canada.
329. **Winkler, C. R., M. Newman, and P. D. Sardeshmukh,** 1999: An empirical low-frequency forecast model incorporating diabatic heating. **Proceedings, 24th Annual Climate Diagnostics and Prediction Workshop,** Tucson, AZ.

330. **Wolfe, J. D., Fowler, C., and Scambos, T.,** 1999. Applications of 5-km AVHRR Polar Pathfinder Data in Arctic and Antarctic regions. **Eos** **80(46)**, F552.
331. **Wolter, K., R.M. Dole, and C.A. Smith,** 1999: Short-term climate extremes over the continental U.S. and ENSO. **Part I: Seasonal temperatures. Journal of Climate**, **13**, 3255-3272.
332. **Wolter, K.,** 1999: Quality Control in Recent and Pending COADS Releases. Invited Speaker at **WMO Workshop on Advances in Marine Climatology**, Vancouver, Canada, September 1999, pp. 312-318.
333. **Woodman, R. F., B.Balsley, F. Aquino, L. Flores, E. Vazquez, M. Sarango, M. Huamn, and H. Soldi,** "First Observations of PMSE in Antarctica", **Jour. Geophys. Res.**, **104**, pp 22,577-22,590, October, 1999.
334. **Worthington, R.M.** (1999), Alignment of mountain wave patterns above Wales: A VHF radar study during 1990-1998. **Journal of Geophysical Research** **104**, 9199-9212.
335. **Worthington, R.M., Palmer, R.D., Fukao, S.,** (1999a) An investigation of tilted aspect-sensitive scatterers in the lower atmosphere using the MU and Aberystwyth VHF radars. **Radio Science** **34**, 413-426.
336. **Worthington, R.M., Palmer, R.D., Fukao, S.** (1999b), Complete maps of the aspect sensitivity of VHF atmospheric radar echoes. **Annales Geophysicae** **17**, 1116-1119.
337. **Xu, L., Resing, K.; Babbitt, P. C.; Lawson, S. L. and Copley, S. D.** "Evidence that pcpA Encodes Dichlorohydroquinone Dioxygenase, the Ring-Cleavage Enzyme Required for Degradation of Pentachlorophenol in Sphingomonas, chlorophenolica", **Biochemistry**, **38**, 7659-7669. 1999.
338. **Zhang, T., R. G. Barry, K. Knowles, J. A. Heginbottom, J. Brown,** 1999. Statistics and characteristics of permafrost and ground ice distribution in the Northern Hemisphere, **Polar Geog.**, **23**, 147-169.
339. **Zhang, R., R.L. Armstrong, J. Smith,** Detecting seasonally frozen soils over snow-free land surface using satellite passive microwave remote sensing data, **5th Conf. on Polar Meteor. and Oceanogra.**, AMS, Dallas TX: 355-357, 1999.
340. **Zhang, T. and R. L. Armstrong,** 1999. Passive microwave remote sensing of frozen soils, in **Proceedings of the Third International Scientific Conference on the Global Energy and Water Cycle**, 16-19 June, 1999, Beijing, China, Preprint Volume, Supplementary Collection, p. 19-21.
341. **Zhang, T. and M. Jeffries,** 1999. Modelling Lake Ice Growth and Talik Formation within the Thaw Lake-Permafrost System in Alaska North of the Brooks Range, presented at the **INTERNATIONAL SYMPOSIUM ON THE VERIFICATION OF CRYOSPHERIC MODELS: BRINGING DATA AND MODELLING SCIENTISTS TOGETHER**, Zürich, Switzerland, 16-20 August 1999.

342. **Zhang, T. and M. O. Jeffries**, 1999. Thermal and hydrological regime of lakes in a tundra environment along the Alaskan Arctic coastal regions, Supplement to **EOS, Transactions, AGU**, vol. **80**, No. 46, Nov. 16, 1999, p. F412.
343. **Zhang, T. and R. L. Armstrong**, 1999. Passive microwave remote sensing of frozen soils, **International Union of Geodesy and Geophysics, (IUGG) 22nd General Assembly**, 26-30 July 1999, Birmingham, England, p. B.124.
344. **Zhao, Y.**, Signal-induced fluorescence in photomultipliers in differential absorption lidar systems, **Appl. Opt.**, **38(21)**: 4639-4648, 1999.
345. **Zilitinkevich, S. S., Grachev, A. A., and Fairall, C. W.**, 'The scalar roughness of the sea surface'. **24th EGS General Assembly**, The Hague, The Netherlands, 19-23 April 1999.
346. **Zilitinkevich, S. S., Grachev, A. A., and Fairall, C. W.**,: 'Scaling reasoning and new data on the heat and mass transfer over stormy sea'. **Plinius Conference on Mediterranean Storms**, Maratea, Italy, 14-16 October 1999.

Honors and Awards - 1999

EVERY, Susan K.

University of Colorado Robert L. Stearns Award, 1999

BARRY, Roger G.

Fellow, American Geophysical Union, 1999

BILHAM, Roger

Graduate School, Faculty Fellowship, 1999

CHESHIRE, Laura K.

Received NASA award for On-Line Communication Competition, *Distinguished Technical Communication and Best of Show*

CIRES Member's Council Award - 1999

DICHTL, Rudolph J.

Received the Antarctica Service Medal from the National Science Foundation and Department of the Navy for Service in Antarctica

FALL, Ray

Graduate School, Faculty Fellowship, 1999

FREHLICH, Rod

Elected Fellow of the Optical Society of America

FROST, Gregory J.

Awarded "Outstanding Paper, 1999" from NOAA Office of Oceanic and Atmosphere Research

FULLER-ROWELL, Tim

Received the *Director's Award* from the Space Environment Center

HARRIS, Katherine A.

Awarded the *Max Eaton Prize* from the American Meteorological Society

JING, Xiangbao

Received a Meritorious Work award from the National Weather Service

KINDEL, Bruce

CIRES Member's Council Award - 1999

LEWIS, William

President elect American Society of Limnology and Oceanography

MOORE, Fred L.

Received NASA Group Achievement award for POLARIS campaigns

OSTROVSKY, Lev A.

Received the *Orson Andersen Distinguished Fellowship* at the Institute of Geophys. And Planetary Phys., Los Alamos National Laboratory

RUNDLE, John B.

Distinguished Visiting Scientist at Jet Propulsion Laboratory

SCOTT, Michon

Received award of *Distinguished Technical Communication and Best of Show* for NASA's Earth Observatory On-Line Communication Competition

SIEVERS, Robert

University of Tulsa, Tulsa, OK. Honored as a Distinguished Alumnus, 1999

SPETZLER, Hartmut

Alexander von Humboldt Foundation, reinvitation for 3 months

TATARSKII, Valerian I.

Elected to Fellow, Institute of Physics, OK

THOMSON, David

Received "Outstanding Paper Award" from NOAA Office of Atmospheric Research 1999 competition

TOLBERT, Margaret

Awarded Outstanding Paper Award for Spring AGU 1999, with student Paula Hudson

VARANI, Annette

Awarded *Distinguished Technical Communication and Best of Show* for NASA's Earth Observatory

WALLOCH, Lynn

Awarded Certificate of Appreciation, NOAA/OAR/ERL Joint Institute Program

WEBSTER, Peter

National Science Foundation Special Creativity Award, 1999

Community Service and Outreach - 1999

ANDERSON, David M.

Science Fair judge, Boulder Valley School District
Technical advisor for the James Creek Watershed Initiative, Jamestown CO

ANDREWS, Elisabeth

Science Fair judge, Boulder Valley School District

ARAJO-PRADERE, Eduardo A.

Did the translation, voice over, and coordination with the video production of the Spanish version of the *SEC* video, "Eyes on the Sun", the Spanish translation of the **NOAA's Space Weather Scale**

ARGE, Charles N.

Science Fair judge, Boulder Valley School District

BATES, Gary T.

Volunteer at the Boulder Energy Conversation Center

BERGMAN, John W.

Science Fair judge, Burlington Elementary School, Longmont,
and Martin park Elementary School, Boulder
Mathematics e-mentor for 4th grade, Nederland Elementary School

BOYD, Lance

Conducted Project LEARN teacher technology training for K-12 science teachers, Craig CO
Serve as Liaison to Science from CU outreach programs, targeting more than 10,000 students
and 1,000 teachers across metro Denver, Ft. Collins, and Greeley

CESHIRE, Laura K.

Volunteer for American Institute for Graphic Arts events

CHURCH, Lee I.

Volunteer for city of Aurora's Morning Star Alzheimer's Daycare Program

CLARK, Martyn P.

Guest speaker at Central High School, St. Paul MN, on climatology

COMPO, Gilbert P.

Science Fair judge, Burlington Elementary School, Longmont; Summitt Middle
School, Boulder; and Coal Creek Elementary School, Louisville

CORNWALL, Christopher R.

Volunteer facilitator, Boulder County Health Dept. - OASOS Program (Out and
Supporting Our Selves)

COSTA, David M.

Volunteer firefighter and medic, Boulder Rural Fire Department
Volunteer camera operator, Boulder city Channel 8

DAVID, Donald E.

Board of Trustees of Shepherd's School, Inc.

DECLERK, Karen
Food Bank volunteer, Boulder County AIDS Project (BCAP)
Member of Boulder Area Human Resources Association
CIRES Colorado Combined Campaign Coordinator

DELENE, David
Science Fair advisor, Fairview High School

DELOACH, Valerie
Volunteer at the Colorado Therapeutic Riding Center

DICHTL, Rudolph J.
Volunteer at the Boulder Public Library

ENNIS, Christine
Serve on the NOAA Practical Hands-on Application to Science Education (PHASE) summer program

FETTERER, Florence
Volunteer for Colorado's Big Brothers/Big Sisters program

FREHLICH, Rod
Board member, Boulder Village Arts Coalition

FROST, Gregory J.
Board member, Commerce Children's Center,
Dept. of Commerce Boulder campus

GEORGE, Joanne L.
Treasurer for Calico and Boots, traditional
American dance demonstrations

GREEN, Linda J.
Present training sessions to U.S. West employees
Training consultant/advisor for Rocky Mountain Chapter of the Alzheimer's Association
Charter member, International Association for Healing Touch
Ordained ministerial counselor and facilitator

HARE, Jeffrey E.
Volunteer instructor at Eldora Special Recreations Program
Volunteer for State College Area High School - Wyoming 2000 Expedition (environmental field trip)

HARRIS, Katherine A.
Science Fair judge, Boulder Valley Schools
Mathematics e-mentor, Eagle Crest Elementary School, Longmont

HARTTEN, Leslie M.
Mathematics e-mentor, Pioneer Elementary School, Lafayette
Science advisor, New Vista High School, Boulder

HOBSON, Vinita
Colorado Ocean Science Bowl Rules Judge

THRASHER-HYBL, Tracy

Denver Rescue Mission volunteer
University Lutheran Chapel volunteer

JOHNSON, Eric L.

Presented educational seminar on remote sensing to the Morgan County Colorado farm cooperative
Presented remote sensing basics course to numerous primary and secondary school teachers
from throughout Colorado

KING, Daniel

Science Fair judge, Burlington Elementary School, Longmont
Judge for 2000 National Ocean Science Bowl

LAURSEN, Sandra

Science Fair judge, Boulder Valley Regional Fair

LYNCH, Amanda H.

Planning and preparation of Earthworks Workshop for school teachers
of earth science

MAPES, Brian

Court-appointed Special Advocate, Big Brothers

MASLANIK, James

Boulder office of Nature Conservancy volunteer

MCKEEN, Stuart A.

Member, Denver Regional Air Quality Council
Assistant coach, Boulder baseball leagues

MCKIE, Julie

Ocean Sciences Bowl volunteer
Denver Museum of Natural History Education collections volunteer

MCLEAN, Bradley

Journey Guide at Colorado Ocean Journey
Coach, local high school track and field events

MILLER, Tim

CIRES co-rep, Colorado Combined Campaign

NISHIYAMA, Randall

Member of CU's Museum fund raising committee

O'LOUGHLIN, Karen F.

Volunteer to help clear public hiking trails
Volunteer at Grace Lutheran Church, making food for funerals and receptions

OSTROVSKY, Lev A.

Science Fair judge, Ocean Bowl competition

PARKS, Bradley
Science Fair judge, Nederland Elementary
Boy Scout troop leader

RICHARD, Gretchen
Rules judge, National Ocean Sciences Bowl

RUNDLE, Marie
Science Fair judge, Boulder Valley Schools
E-mentor programs
Participant in "Read Across America" Day

SA'MARTINS, Jorge S.
Science Fair judge, National Ocean Sciences Bowl
E-mentor programs, Pioneer Elementary

SAUNDERS, James F. III
Coach for Boulder High School teams, National Ocean Sciences Bowl
Active in low brass section, Boulder High Wind Ensemble

SCOTT, Donna
E-mentor, Ryan Elementary, Lafayette
Science Fair judge, Ryan Elementary
CIRES Members Council

SCOTT, Michon
Volunteer at Denver Museum of Natural History, Earth and Space Science section

SCHUBERT, Robert
University Staff Council softball league committee

SERREZE, Mark C.
Serve as Science Fair judge, Martin Park Elementary

SHERMAN, David M.
Science Fair judge
E-mentoring, St. Vrain School District

SIEVERS, Robert E.
Conducted 3 exhibitions of sculptures within Colorado

SLOAN, Valerie
Participant in Earthworks 1999

SMITH, Lesley
Technical Advisory Panel, National Ocean Science Bowl
Scientific advisor for an Interactive Earth travelling science exhibit

SPETZLER, Hartmut
Visited high school science departments in rural areas to learn how science teaching can be improved and how universities can better adjust to the incoming students

STEVERMER, Amy J.

Volunteer, Ocean Sciences Bowl

STROEVE, Julienne

Contributed images and text for CIRES arctic exhibit, Ocean Journey Aquarium, Denver

SUEPER, Donna

Elementary and middle school Science Fair judge

VERPLANCK, Emily

Serve as Science Fair judge, Crest View Elementary, Boulder

WALLOCH, Lynn

Coordinator for Family-to-Family Program, Boulder County Department of Social Services,
for which CIRES was awarded Outstanding Community Donor

WEAVER, Alexandra

Collaborator on proposals to various agencies, submitted by St. Vrain School District

WICK, Gary

Moderator, National Ocean Sciences Bowl

ZHANG, Tingjun

Science Fair judge, Boulder Valley School District