Appendix A:

Biographical Information on Workshop Participants

Biographies of Participants to the Workshop on

Usable Science II: The Use and Misuse of El Niño (ENSO) Information in North America

31 October - 3 November 1994
Boulder, Colorado

Jean-Louis Bisson is in charge of the hydrological forecasting at Hydro-Québec. He has developed an inflow forecast system that is applied to all the watersheds that Hydro-Québec manages for is hydroelectric production. His interests include meteorological forecasting, statistical flood studies and determination of the Probable Maximum Flood. So far Probable Maximum Flood studies have been conducted for a few river systems in Québec.

He received his B.Sc. in Physics (1962) from the University Laval (Québec City) and his M. Sc. in Physics (Meteorology) from the University of Toronto (1965). He served as a meteorology forecaster with the Department of Transport of Canada until 1968 when he joined Hydro-Québec as a meteorology forecaster. In 1971 he became responsible for the meteorological and hydrological forecasting necessary to Hydro-Québec operational activities.

Russell D. Caid is Senior Director of Technical Services and R&D for Chiquita Brands, Inc., which encompasses Chiquita's worldwide banana growing activities. The main areas of responsibilities are disease and insect control and cultural practices in more than 40,000 hectares of bananas grown in Central and South America, Mexico, Windward Islands and the Philippines.

In 1954 and 1955 respectively, Russell Caid received a B.S. and M.S. in Entomology from Oklahoma State University at Stillwater. In 1957 he joined the United Fruit Company (now Chiquita Brands, Inc.). This assignment was in La Lima, Honduras as an assistant entomologist in their tropical research facility. Following this position, he assumed production responsibility for Chiriqui Land Company, Bocas Division, Panama in 1973. From 1977 through 1984, Mr. Caid was General Manager for Chiquita's operations in Costa Rica and Panama.

Stanley A. Changnon has been involved in weather-related research for 40 years. He directed the atmospheric research program involving 70 scientists and engineers at the Illinois State Water Survey for 20 years, and served as the Survey's Chief for six years. Today he is one of the Survey's Principal Scientists, a Professor of Geography at the University of Illinois, and the head of his own consulting firm which specializes in climate applications research. He conceived major national programs including METROMEX, a massive 10-year study of how large cities influence weather and change the local climate, and he planned the nation's regional climate centers program and developed the first center, the Midwestern Climate Center at the University of Illinois.

His research interests include investigations of climate change and climatic variability in space and time; studies of how weather and climate impacts agriculture, water resources and policy; investigations of both inadvertent and planned weather modification; investigations of flood and droughts; and studies of severe weather including thunderstorms, hail and tornadoes, and winter storms.

He has performed numerous projects for several state and federal agencies; received research grants totaling more than $20 million; served on numerous advisory groups including those of the National Academy of Science, NSF, EPA, and DOE; been a consultant to the weather insurance industry for 35 years; provided Congressional testimony on many issues; authored 600 papers and reports including five books; and received national awards for his research accomplishments from the American Meteorological Society, American Water Resources Association, American Agricultural Economics Association, and from the American Geophysical Union. He is a Fellow of the American Meteorological Society and the American Association for the Advancement of Science, and past president of the American Association of State Climatologists and of the Weather Modification Association.

Wayne E. Cook is the Executive Director of the Upper Colorado River Commission. The Commission is an interstate compact administration agency created by the Upper Colorado River Basin Compact of 1948 that participates in the development, utilization and conservation of the water of the Colorado River Basin. The Commission is vitally concerned with how forecasting and its accuracy impacts the operations of the Colorado River System reservoirs. The Commission is also interested in climate-related impacts on water users in the Basin and long-range implications of any climate change trends. Mr. Cook is currently involved in discussion among the seven Basin States and ten Colorado River Indian tribes regarding future long-range uses of the waters of the Colorado River as well as issues surrounding future operations of Glen Canyon Dam and the Grand Canyon.

He received his B.S. in Civil Engineering (1961) from Utah State University. He was employed by the United States Department of the Interior, Bureau of Reclamation, for 30 years. These years were spent entirely in the Colorado River Basin split equally between planning and operations. At retirement (1990) his responsibility included operations of the Colorado River reservoirs in the Upper Basin and Federal projects in the closed based (Wasatch Front) and Rio Grande and Pecos River basins in the United States. He had operational responsibility of Upper Basin reservoirs during the 1983-1986 floods on the Colorado River with direct involvement with stream flooding impacts throughout the Basin as well as spillway damages at Glen Canyon and Hoover Dams.

John D. Cox is a science writer at The Sacramento Bee, a general circulation daily newspaper of 280,000 daily and 350,000 Sunday circulation in California's capital. The Bee has a national reputation for its coverage of science and environmental issues, having won Pulitzer prizes in both areas in 1992. Cox is in his third year on the science beat, covering the whole range of science news with a special emphasis on those stories and those disciplines of particular interest to Northern Californians. His own special interests include

studies which relate to understanding the marine environment such as fisheries ecology, marine biology and oceanography.

Mr. Cox is a journalist of wide experience. He began his reporting career in 1963 at a small Northern California daily and a year later joined United Press International at the news agency's Pacific Division headquarters in San Francisco. Cox was with UPI for six years, serving in bureaus in Helena, Montana; Fresno, California; and finally, Sacramento, where he covered the California Legislature. He then moved to London, where he joined Reuters Ltd. as an editor of the agency's Western Hemisphere report. Cox has been with The Bee since 1979. He is a Senior Writer at the paper.

Margaret A. Davidson is Executive Director of the South Carolina Sea Grant Consortium, a public consortium of universities dedicated to coastal research and education programs. She has a M.S. in Resource Policy and a J.D. She is interested in various coastal resource issues and ways in which individuals and institutions affect resource policy. She serves on a number of state and federal level advisory committees and has recently returned from a residency in southern Thailand on a Fulbright Fellowship.

Henry F. Diaz is a research climatologist in the Climate Diagnostics Center of the Environmental Research Laboratories of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. Dr. Diaz has worked in NOAA throughout his 20-year professional career. He is a Fellow of the Cooperative Institute for Research in Environmental Sciences (CIRES) of the University of Colorado (Boulder), and Adjunct Associate Professor in the Department of Geography at CU-Boulder. He has published extensively in the scientific literature about the nature of climatic variability on regional to global spatial scales, and ranging from interannual climatic variability to century-scale fluctuations. He is also a recognized expert on the El Niño/Southern Oscillation (ENSO) phenomenon and has written several journal articles on teleconnection features of ENSO, as well as coedited a book titled *El Niño: Historical and Paleoclimatic Aspects of the Southern Oscillation*, published by Cambridge University Press (1992).

He received his B.S. degree in Meteorology (1971) from The Florida State University, his M.S. in Atmospheric Science (1974) from the University of Miami, and his Ph.D. in Geography (Climatology) (1985) from the University of Colorado at Boulder. He has worked for various units of the Environmental Research Laboratories in Boulder during the past 15 years in a variety of climate research and climate impacts issues, particularly, on the impact of climatic variation on water resources in the western United States.

Maxx Dilley is a Senior Visiting Scientist with the University of Wisconsin Disaster Management Center. He works at the U.S. Agency for International Development's Office of U.S. Foreign Disaster Assistance (OFDA) in Washington D.C. Current responsibilities include famine mitigation, early warning systems, vulnerability assessment and Geographic Information Systems.

He holds a B.A. from the University of Delaware and both M.S. and Ph.D degrees from Pennsylvania State University, all in Geography. He was an American Association for the Advancement of Science Fellow At OFDA for two years prior to accepting his present position. His research interests include climate, Mexican agriculture and climate change.

Paul R. Epstein is on the faculty of Harvard Medical School and holds a Masters Degree in Tropical Public Health from the Harvard School of Public Health (HSPH). Dr. Epstein has worked in medical, teaching and research capacities in Africa, Asia and Latin America, and has recently coordinated and co-edited an eight-part series on Climate Change and Human Health for *The Lancet* (23 October - 11 December 1993). Dr. Epstein is a member of the HSPH group on emerging diseases, is a contributing author for the IPCC Guidelines on the Methodology of Impact Assessments, and is a principal core author for the WHO/WMO/UNEP - IPCC panel on the health impacts of climate change.

E. Ray Garnett is a Research Analyst with the Weather and Crop Surveillance Department of the Canadian Wheat Board (CWB) in Winnipeg, Canada. He has had an interest in longer range weather and crop forecasting since the super El Niño event of 1982/83 and aspires to forecasting North American spring grain crops such as the Canadian spring wheat crop and U.S. corn crop well in advance of the growing season. His research relates to the study of large scale atmospheric and oceanic anomalies and their influence on the Indian monsoon and world grain yields and the development of methods for improving the early warning system for North American spring grains using teleconnective indices and lagged relationships. He is one of the principal coordinators of The Long-Range Weather and Crop Forecasting Working Group formed in Canada in 1993.

He received his B.A. in Political Science from the University of Winnipeg in 1969 and has been employed by the Canadian Wheat Board since 1970. He has worked in the Weather and Crop Surveillance Department of CWB since its inception in the early 1970s. He has a consistent track record in early identification and forecasts of drought in major growing regions of the world, in advance of or concurrent with other crop forecasters. In 1986 he took a six week sabbatical at the Purdue University Agronomy Department studying macro-climatic techniques of longer range weather and crop forecasting under Professor James E. Newman. He has written a number of papers in recent years and, as time permits, continues research and publication in longer range weather and crop forecasting.

Peter R. Gent is a Senior Scientist and head of the Oceanography Section at the National Center for Atmospheric Research (NCAR). He received his Ph.D. in Mathematics from the University of Bristol, England, in 1974. He joined the Oceanography Section at NCAR in 1976. His interests are geophysical fluid dynamics, ocean circulation dynamics and the influence of the oceans on climate. He has concentrated on equatorial ocean dynamics and is a scientific member of the TOGA Program on Prediction which is aimed at El Niño prediction.

Michael H. Glantz is a Senior Scientist and the Director of the Environmental and Societal Impacts Group, a program at the National Center for Atmospheric Research (NCAR). He is interested in how climate affects society and how society affects climate, especially how the interaction between climate anomalies and human activities affect quality of life issues. His research relates to African drought and desertification and food production problems and prospects; societal impacts of climate anomalies related to El Niño events, and the use of El Niño-related teleconnections to forecast these impacts; development of methods of forecasting possible societal responses to the regional impacts of climate change; and the use of climate-related information for economic development. He has also coordinated joint research in the Central Asian Republics of the former USSR.

He received his B.S. in Metallurgical Engineering (1961) and an M.A. in Political Science (1963) from the University of Pennsylvania. After some years in industry (Westinghouse, Ford), he returned to the University of Pennsylvania and received a Ph.D. in Political Science in 1970. He has taught at the University of Pennsylvania, Lafayette College, and Swarthmore College. In 1974 he joined NCAR as a postdoctoral fellow, and in 1983 he was the first social scientist to become a Senior Scientist at that institution. He has edited several books and is the author of numerous articles on issues related to climate, environment, and policy. His most recent publication is *Drought Follows the Plow: Cultivating Marginal Areas*, published by Cambridge University Press in 1994.

William M. Gray is a Professor at the Department of Atmospheric Science, Colorado State University (CSU). Professor Gray has worked in the observational and theoretical aspects of tropical meteorological research for more than 35 years, much of this effort going to investigations of meso-scale tropical weather phenomena. He has specialized in the global aspects of tropical cyclones for his entire professional career. He studied under Professor Herbert Riehl who arranged his early reconnaissance flights into hurricanes in 1958. He has been involved with studies of broad-scale cumulus interactions and has extensively studied the processes associated with tropical cyclone structure, development, and movement. Numerous satellite-based studies of tropical weather systems have also been accomplished. Current areas of research include: tropical cyclone structure, movement and intensity change; seasonal prediction; meso-scale tropical weather systems; diurnal variability of tropospheric vertical motions; and ENSO variability.

He received his B.A. degree at George Washington University (1952), a M.S. degree in Meteorology at the University of Chicago (1959), and a Ph.D. degree at the University of Chicago, Department of Geophysical Sciences (1964). His dissertation was titled *On the Scales of Motion and Internal Stress Characteristics of the Hurricane*. He has recently become a Fellow of the American Meteorological Society. He was awarded the 1992 CSU "Jack E. Cermak" Graduate School Award for Outstanding Adviser; was co-recipient of the 1993 AMS Banner I. Miller Award; and received the 1994 AMS Jule L. Charney Award. He has been advisor to 38 successful MS (theses) graduates and 16 successful Ph.D. graduates in Atmospheric Science – 8 of whom have received student or other AMS awards.

Carl E. Hunt is a consulting economist doing business at 2542 Pine Street, Boulder, Colorado. Mr. Hunt received a Ph.D. in Economics from the University of Colorado at Boulder with a major field in industrial organization and public utility regulation.

Mr. Hunt has been involved in economic forecasting and the use of economic models to measure the impact of economic and non-economic phenomenon on state and local economies. He helped establish the Center for Economic Forecasting and Simulation at the University of Colorado and for ten years was responsible for forecasting the demand for electricity and natural gas for the State of Colorado. Mr. Hunt also was responsible for estimating the economic impact of the Mt. St. Helens volcanic eruptions on the Washington State economy. His work also includes environmental issues relating to the building of electric power plants and the production of electric power. He has been involved in developing incentives to encourage electric utilities to engage in demand side management activities and in developing methods to measure the effectiveness of demand side management activities.

Mr. Hunt has prepared and supervised a number of studies relating to economics and forecasting. He has published numerous articles and monographs relating to economics and public utility regulation.

George N. Kiladis obtained a B.S. degree in Physics from the University of Massachusetts in 1978, and a Ph.D. in Climatology from the University of Colorado in 1985. He has been working as a research scientist at the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado for the past 7 years. Primary research interests involve studying the large scale atmospheric circulation associated with tropical rainfall. This work encompasses a large range in time scales, from the interannual time scale associated with ENSO down to the within-season time scale associated with individual disturbances which evolve over a few days. Dr. Kiladis has authored or co-authored over twenty-five papers and four book chapters in the scientific literature in the past 10 years.

Gordon A. McKay is a meteorologist retired from Canada's Atmospheric Environment Service. His interests are primarily in the application of climate information to environmental and socioeconomic concerns and in the underlying science. His career, in particular his activities within the Canadian Climate Program, has involved him with planners and decisionmakers on local to national scales as well as in bilateral and international studies of climate, climate applications, the consequences of climate variability and change, and climate prediction.

A weather forecaster in World War II and subsequently, in 1959, he was assigned to Canada's Prairie Farm Rehabilitation Administration to develop hydro- and agro-meteorological support programs. In 1966, he began organizing a national applied climatological research program, becoming Director of Environment Canada's Climate Applications Program in 1972. In the '70s he was an architect of the Canadian Climate

Program and retired in 1984 as the Director General of the Canadian Climate Centre. He remained active in consulting and World Meteorological Organization climate activities, having recently chaired the WMO CCI Working Group on Climate Change Detection. Over the period 1978-88, he organized and coordinated the 1988 World Conference on The Changing Atmosphere: Implication for Global Security. His consulting activities have included policy-related assessments of the implications of climate change for the Great Lakes and Beaufort Sea.

Kathleen A. Miller has been a member of the Environmental and Societal Impacts Group at the National Center for Atmospheric Research since 1985. Her research has focused on socioeconomic impacts of climatic variability and climate change with particular emphasis on the relationship between institutions, investment decisions and the management of climatic risks. Her published work includes papers on water resource institutions and climate, as well as papers examining economic aspects of climatic impacts on fisheries, agriculture and energy demand. She also has held an appointment as an adjunct faculty member in Economics at the University of Colorado.

Dr. Miller completed her doctorate in Economics at the University of Washington in 1985. Her dissertation, *The Right to Use vs. the Right to Sell: Water Rights in the Western United States*, examined the historical evolution of property institutions governing access to water in the arid western states and modelled the operation and effects of these institutions in the presence of both scarcity and intertemporal variability in water supplies.

Jean-François Mittaine is the Director of the Fishmeal Exporters Organization (FEO), a private organization composed of the world largest fishmeal exporters based in Chile, Peru, Scandinavia and South Africa. FEO provides various types of supply/demand analyses, relating reports of fishing, production and trade data originated by its members to the world market of proteins for animal use. On the supply side, FEO has shown growing interest in looking at the relationship between, on one hnnd, oceanographic conditions and development of the resource and, on the other, their impact on the world fishmeal market. This interest grew out of the development of the 1991-1993 El Niño which the organization followed closely in an attempt to identify relationships with the market forces. He is also associated to the CEOS research program.

He received a degree of «Ingénieur Agronome» from the National Institute of Agronomy in Paris (1970) and an M.S. in Food Science and Technology (1972) from Cornell University. After some years as Assistant Agricultural Attaché at the French Embassy in Washington (1972-1976), he joined the Continental Grain Company where he led the European planning and commodity research unit. In 1980, he became export manager of the second largest wheat flour firm in France. He also initiated and managed a major technical assistance program with Minoterie d'Haiti in Haiti and various other programs in Japan, China, and Yemen.

He has published various articles on commodity trading, including more recently a participation to a French yearbook of the world commodity markets (*Cyclope*). He is a member of I.I.F.E.T. and has co-authored two research papers presented at the last two meetings. He undertook a teaching assignment at C.N.A.M. in Paris for a graduate level seminar on World trade matters.

Claudia Nierenberg is the Program Manager for the Economics and Human Dimensions of Climate Fluctuations Program within NOAA's Office of Global Programs, and contributes to NOAA's international efforts to advance understanding of potential economic and social applications of climate forecasts. She has conducted research in the macro-economic effects of climate variability.

She received here B.A. from the University of Virginia and an M.A. in International Affairs from Columbia University. She came to NOAA in 1993 after four years at the National Science Foundation, most of which were spent working on NSF's international activities within the U.S. Global Change Research Program, and included a six-month assignment in the International Trade Office of the Department of Treasury. She is the co-author of *U.S. Economic Policy and Sustainable Growth in Latin America,* published by the Council on Foreign Relations.

Paul Orbuch is Trade Counsel at the Western Governors' Association in Denver, where he focuses on international trade policy and its effects on sub-national environmental measures. He is also an Adjunct Professor at the University of Denver, University College, where he teaches a course on international environmental law and policy. Previously, Mr. Orbuch was a Staff Attorney with The Center for International Environmental Law (CIEL) and an Adjunct Professor of Law at American University's Washington College of Law where he taught courses on international institutions and on trade and the environment. He has also taught environmental law in Eastern Europe. He is co-editor of *Trade and the Environment: Law, Economic, and Politics* (Island Press) and is the co-author of "Integrating Labor and Environmental Concerns into the North American Free Trade Agreement: A Look Back and A Look Ahead," in volume 8 of the *American University Journal of International Law and Policy* and "Enforcement of Environmental Laws Under a Supplemental Agreement to the North American Free Trade Agreement," in volume V of the *Georgetown International Environmental Law Review.*

Prior to joining CIEL, Mr. Orbuch was a law associate with the Washington, D.C. law firm of Howrey & Simon in their international trade practice group and was a staff member on the President's Industry Policy Advisory Committee for Trade and Policy Matters. He is a 1988 graduate of the University of California, Hastings College of Law and 1985 graduate of the University of California Los Angeles.

Roger A. Pielke, Jr., is a Visiting Scientist at the Environmental and Societal Impacts Group at the National Center for Atmospheric Research. He is interested in how

society conducts scientific research and how society uses the information that results from research in the decision-making process. His current research is related to how the United States deals with mesoscale weather events, and particularly the role of weather forecasts for adaptation to and mitigation of the impacts of extreme events.

He received his B.A. in mathematics (1990), M.A. in Public Policy (1992), and Ph.D. in Political Science (1994) from the University of Colorado. His dissertation is titled "*Completing the Circle: Global Change Science and Usable Policy Information.*" He has worked at the House Science Committee in Washington, DC, and taught at the University of Colorado.

Thomas D. (Tom) Potter is Regional Director of the National Weather Service Western Region, based in Salt Lake City. He is interested both in the science of climate and weather and in the applications to society. Previously he was with the World Meteorological Organization in Geneva, Switzerland, as the Director of the World Climate Programme and the Director of the World Weather Watch working with 160 countries on their climate and weather service and a wide variety of applications. He also has served as Director of the NOAA National Climatic Center and the Environmental Data and Information Service.

Dr. Potter received a B.A. in Mathematics (1951), B.S. in Meteorology (1954), and an M.S. in Meteorology (1956) from the University of Washington in Seattle, and a Ph.D. in Atmospheric Sciences from Penn State University (1962). He is a graduate of the Harvard University Advanced Management Program. Potter is a Fellow of the American Meteorological Society and a member of Sigma Xi, the research honorary society. Recently he received a Presidential Award as a Meritorious Executive for sustained superior accomplishment in the management of programs of the U.S. Government and for noteworthy achievement of quality and efficiency in the public service.

Roger S. Pulwarty is a Research Associate at the Cooperative Institute for Research in the Environmental Sciences (CIRES), a joint institute between the University of Colorado, Boulder and the National Oceanic and Atmospheric Administration. He is interested in the role of climate and climatic information in policy and implementation processes related to natural resources management and development. His research has been on climate and hydro-climatic variability in the tropical Americas and on long-term variations of ENSO occurrence. He is presently involved in a National Weather Service project to assess socioeconomic aspects of atmospheric events. Initially the project will focus on assessing the role of climate forecasts in resources management in the Pacific Northwest and on cultural ecology approaches to mitigating hurricane-related hazards.

He received a B.S. (Hons) in Atmospheric Sciences (1986) from York University and, an M.A. (1990) and Ph.D. (1994) in Geography from the University of Colorado, Boulder. He has worked in the Mesoscale and Microscale Meteorology Division at NCAR, and has taught several undergraduate courses at the University of Colorado and short courses on statistical

analysis and climate, at the Ministerio del Ambiente in Caracas, Venezuela. He has published articles on the tropical Americas, ENSO variability, and climate and food supply.

Steven L. Rhodes is a political scientist with the Environmental and Societal Impacts Group, a program at the National Center for Atmospheric Research. His research interests include institutional responses to climate variability and climate change, climate change and environmental quality, and the use of climate- and weather-related information.

He received his B.A. in Political Science and International Relations (1972) from the University of California-Davis, and his M.A. (1975) and Ph.D. (1980) in Political Science/Public Administration from the University of Colorado. After teaching at Colorado State University and Colorado School of Mines, he received a postdoctoral fellowship at NCAR in 1982. From 1984 to 1989, Dr. Rhodes managed the environmental impact studies, the meteorological assessment, and the land acquisition program for the Denver International Airport project on behalf of the City and County of Denver, Colorado.

Jennifer Robinson is presently a research fellow working at the National Center for Geographical Information and Analysis. Her interest there is in the potential use of new spatial-analytic tools for getting some useful information out of the vast stream of date generated by global change research.

Robinson has a Ph.D. in Biogeography/Remote Sensing from the University of California at Santa Barbara (1987) and M.S. in Food and Agricultural Policy (1978). Her doctoral research related to fire as a component of the Earth system. In her varied career she has spent many years reviewing the usefulness and/or applicability of major scientific studies. This has included reviews of global models for the Global 2000 Presidential Commission, review of mathematical models in economic development planning done for the Rockefeller Brothers Fund, and a review of past climate impact analyses done for NCAR and Oak Ridge National Laboratory.

Maurice Roos is a water engineer, currently Chief Hydrologist in the California Department of Water Resources. He oversees work on flood forecasting, hydrology, water supply and snowmelt forecasting, staff meteorology and related subjects. He has done some experimental work attempting to use long-range weather forecasts for water year runoff forecasts. In addition, he has been involved in studies of the potential effects of global warming on water resources systems and he serves on an American Society of Civil Engineers' task committee on this subject.

He received a B.S. in Civil Engineering from San Jose State University in 1957 and has been employed by the Department of Water Resources since then. His career began with studies of channels, levees, proposed water transfer works and water quality problems in the Sacramento-San Joaquin River Delta. From 1965 through 1978, he served in the

Department's Division of Planning in various water planning studies, reservoir system operation studies, and helping evaluate water requirements and supplies and potential water system developments. He was one of the authors of several editions of *DWR Bulletin 160*, the Department's main water planning document. In 1979, he began his current assignment in the Division of Flood Management, primarily on flood and water supply forecasting. The job includes providing staff advice on drought, floods, global warming, and weather modification. During the past two years, he has had opportunity to share expertise in Israel, northern India, and Nigeria.

Richard J. Roth, Sr. is the Industry Affairs executive for CNA Insurance Companies, Chicago, Illinois. In this position he works with other insurance companies participating in organizations dedicated to the improvement of the industry and for public benefit. He is currently Chairman of the Hazards and Risks Assessment Committee of the Insurance Institute for Property Loss Reduction. The Institute's mission is to reduce deaths, injuries and loss of property resulting form natural hazards of all types in the United State, (hurricanes, earthquakes, tornadoes, floods, windstorm, hail, and freezing). Mr. Roth also represents CNA in working with the Natural Disaster Coalition, a consortium of insurance companies working for passage of legislation in Congress to provide pre-funding of catastrophic natural disaster, particularly hurricanes and earthquakes. He is on the Board of Natural Disaster (BOND) of the National Research Council. He is a property/casualty actuary, a Fellow of the Casualty Actuarial Society.

Mr. Roth received a B.S. Honors Degree in Economics from Northwestern University. He received meteorological training at the Massachusetts Institute of Technology while in the Air Force during World War II. He served as a Weather Officer from 1942 until 1946. He has been actively employed in the insurance business since that time, and during his career has served as chief actuary for the American International Group, Great American Insurance Companies, and CNA Insurance Companies. In 1980 he became the Industry Affairs executive for CNA.

Gary D. Sharp is Scientific Director of the Cooperative Institute for Research in the Integrated Ocean Sciences. He is interested in climate-driven upper ocean dynamics and their effects on marine ecosystems, particularly global pelagic fisheries. His background includes physiological ecology, genetics, and population ecology, with emphasis on the responses of tunas to short and long-term ocean dynamics.

In the late 1970s he was appointed to the UN Food and Agriculture Organization's Fisheries Department, as Fisheries Officer responsible for high seas fisheries issues, and fisheries oceanography, in general. He organized and convened, with his FAO colleague Jorge Csirke, the Expert Consultation to Examine Changes in Abundance and Species Composition of Neritic Fish Resources, which formed the technical basis for the 1983 World Conference on Fisheries, along with several other keystone workshops and Expert Consultations.

Among his identifiable contributions to real world fisheries issues was the analysis of Indian Ocean upper ocean climatology data sets, and identification and promotion of the western Indian Ocean high seas tuna fishery operating around and about the Seychelles. He has also worked with the longer term decadal and paleo-climatic research community toward a better general appreciation of the issues of long-term climate patterns, and ecological responses, within which ENSO and volcanic events act as frequent reminders that climate modeling is in its infancy. His recent ventures include development of graphical methods for portraying environmental time series. Dr. Sharp's major concerns with weather and climate related ocean dynamics lies with developing insights into biological responses at various relevant scales.

His degrees are in Zoology. (1967); and Biology (1968) from San Diego State University; and a Ph.D. in Marine Biology at UC San Diego, Scripps Institution of Oceanography. He and his wife, Kathleen T. Dorsey, operate the Center for Climate/Ocean Resources Study, a consulting service that provides expertise in climate related oceanographic and fisheries issues.

Roger C. Stone is a Senior Scientist with the Agricultural Productions Systems Research Unit (APSRU) in Toowoomba, Australia. APSRU is a joint research unit funded by the Queensland Department of Primary Industries (QDPI) and the Commonwealth Scientific and Industrial Research Organization (CSIRO). The unit is mostly staffed by crop simulation modelers, crop physiologists and computer scientists. More recent additions are an economist and Roger Stone as a Climatologist/Meteorologist.

After a 17-year background in aviation-weather forecasting (with the national weather service in Australia), Dr. Stone switched his attention to climate analysis and the El Niño/Southern Oscillation phenomena. He is now interested in improving links between agricultural farming systems and climate systems. His research has focused on developing climate classification methods and climate forecast systems based on the Southern Oscillation Index, especially systems that can be easily liked to the developing science of crop and pasture simulation models.

He received his Ph.D. in climate analysis work from the University of Queensland, Australia, in 1992. His experience extends from practical day-to-day weather forecasting and lecturing in climate and meteorology subjects at the University of Queensland and the University of Southern Queensland to speaking at farmer field-days and workshops on El Niño and its impacts. In 1991 he joined APSRU to extend his knowledge of climate and weather systems to farming systems. He is the first climatologist to be employed by the Queensland State Government.

Norton D. Strommen served in the U.S. Navy before graduating from the University of Wisconsin with B.S. and M.S. degrees in Meteorology and a Ph.D. in Climatology from Michigan State University.

He worked as a consulting meteorologist before joining the National Weather Service in 1960. He has traveled in many areas of the world and served as a U.S. member to the World Meteorological Organizations' Commission for Agricultural Meteorology. Dr. Strommen joined the World Agricultural Outlook Board as Chief Meteorologist in 1980, to direct the conversion of the LACIE research results into an operational global crop monitoring and early warning program for USDA.

Dr. Strommen was elected a Fellow of the American Meteorological Society for his extensive contributions in meteorology and climatology. He received the Department of Commerce's gold Medal for leadership of NOAA's work in the Large Area Crop Inventory Experiment (LACIE), a joint NASA/NOAA/USDA research project. He also received the Department of Agriculture's award for Superior Service for his work on the Chernobyl Nuclear accident and the southeastern drought in 1986. He served on the President's 1988 Interagency Drought Policy Committee and was awarded the Department's Distinguished Service award in 1989. He was appointed as the United States representative to the North Atlantic Treaty Organization (NATO) , Science Panel on global Environmental Change in 1989. His article *Research and Exploration* published in *National Geographics* in 1992 highlights the role of climate variability and potential for climate change impacts on agriculture production.

Joseph J. Tribbia is a senior scientist at the National Center for Atmospheric Research and Head of its Global Dynamics Section in the Climate and Global Dynamics Division. He received a B.S. in Physics from the Illinois Institute of Technology in 1971, and a M.S. and Ph.D. in Atmospheric Science from the University of Michigan. He has been at NCAR since 1978 and his work has focused on the numerical simulation of the atmosphere and geophysically relevant flows. His research includes works on the application of dynamical systems theory in atmospheric dynamics, the problems of atmospheric data analysis and numerical weather prediction and most recently the simulation and prediction of El Niño/Southern Oscillation. He is a member of the American Meteorological Society and its committee on Atmospheric and Oceanic Waves and Stability and an Editor of its *Journal of the Atmospheric Sciences.*

Frank Y. Tsai is a senior technical advisor in the Hazard Identification and Risk Assessment Division of the Mitigation Directorate, Federal Emergency Management Agency (FEMA). He is interested in how climate can cause disaster, how climate affects the National Flood Insurance Program, and how we can mitigate climate-caused disasters. He has also coordinated research with the National Oceanic and Atmospheric Administration (NOAA) on hurricane climatology and extreme hurricanes in the 19th century.

He received his M.S. (1960) and Ph.D. (1968) degrees in Civil Engineering from the University of Minnesota. He has taught in the Engineering Sciences and Mechanics Department of Iowa State University. After some years in industry, in 1975 he joined the Federal Government. He has over thirty years experience in the field of hydraulics and hydrology with recent years in ocean and coastal engineering. He is responsible for the

development of many coastal methodologies including storm surge, wave height, and wave run-up used for flood hazard risk assessment analyses. He was a member of the Interagency Committee on Hydrology, Meteorology, and on Tsunamis and Flood Wave. He served as Technical Liaison or Project Officer for many panels and committees of the National Academy of Sciences studies for FEMA. He is the Chair of the American Society of Civil Engineering (ASCE) Tidal Hydraulics Committee and member of the Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR).

Sushel Unninayar is the Director of Research for the GLOBE project and an advisor to the Consortium for the Applications of Climate Impacts Information (ACACIA) at the University Corporation for Atmospheric Research. He is interested in climate and global change, interannual to decadal variability and integrated assessments of multidisciplinary and multisectoral information to assist the policy and decision-making needed to develop prevention, mitigation or adaptation strategies to address the impacts of change. His research includes ENSO, man-induced and natural fluctuations (short-term and long-term physics) of the interactive Earth system, the detection of the greenhouse effect, global Earth system modeling, and the development of research protocol for the evaluation of climate impacts and response strategies utilizing climate models together with other inputs such as technological, social and policy projections.

He received his B. Technology (Honors) and AMIEE (London) in 1968, and an M.S. in Electrical Engineering in 1971 from the University of Hawaii. He worked for several years in the Cloud Physics Observatory in Hilo, Hawaii designing specialized instruments for in-cloud measurements. In 1977 he later obtained a Ph.D in meteorology from the University of Hawaii Institute of Geophysics. He was the Deputy Director for the GARP-MONEX international research field experiment and the initial phases of ALPEX. In 1981 he joined the World Meteorological Organization as a division head of the World Climate Program and launched several international projects dealing with ENSO, global climate system monitoring, and technology transfer (CLICOM--expert system computerization of climatology; over 130 countries). He has worked on projects with several international organizations and programs such as UNEP, UNDP, ICSU, IGBP, WCRP, IUCN, FAO etc. In 1988 he joined the National Science Foundation as a Program Director with the Global Change Research Program. Before joining UCAR in 1994 he also worked on NASA's Greenhouse Effect Detection Experiment (GEDEX) and Earth system modeling programs. He has published over 100 papers, articles, scientific reports, and monographs. His most recent publications are "A Framework Plan for GLOBE" (1994) and "Global Earth System Modeling in the Mission to Planet Earth Era--a NASA monograph" (1993).

Peter Usher is the coordinator of the Climate Unit of the United Nations Environment Programme. He is also manager of UNEP's Atmosphere Programme, which focuses on risks to the ozone layer; atmospheric pollution and its cross-boundary transport and climate variability and change. UNEP has its headquarters in Nairobi, Kenya, and Peter Usher has been with the Programme since 1977. Previously, he was employed in the East African

Meteorological Department as part of the British Technical Aid Programme, following the end of British Colonial involvement in East Africa.

He is a graduate of University College of Wales, Swansea and first went to Kenya in 1962, and apart from a short stay in the Arabian Gulf area has lived and worked in Kenya until the present.

Carol Whitman is currently the principal scientist for USDA's Global Change Program, representing the USDA to the interagency US Global Change Research Program. Her responsibilities include planning, analysis, coordination, and development of research and domestic policy for USDA's global climate change programs and the global change budget crosscut. She has also participated on the US delegation to the international panel related to the assessment of global climate change impacts and response strategies. Most recently she is serving as a Special Assistant to USDA's Under Secretary for Natural Resources and Environment and the Agricultural Council on Environmental Quality. Her portfolio includes the Committee on Environment and Natural Resources (R & D), the climate change mitigation and the U.S. Climate Change Action Plan, biodiversity, water quality, and pesticides.

Dr. Whitman graduated from Duke University in North Carolina with a B.A. in Botany. She received her M.S. in Ecology and Ph.D. in Plant Physiology from the University of California at Davis. After a postdoctoral fellowship with the Agricultural Research Service's Plant Stress Laboratory in Beltsville, MD, she worked as the Associate Coordinator for the USDA/USAID Dryland Agriculture Project. From 1990-91, she served as the ASA Congressional Science Fellow with now-Senator Byron Dorgan (DPND), managing legislative issues in agriculture, environment, water resources, and international development.

Stephen E. Zebiak is a Senior Research Scientist at the Lamont-Doherty Earth Observatory of Columbia University. His research focuses on the dynamics of climate on seasonal-to-decadal time scales; in particular, the interaction between climate and the oceans. He has collaborated on the development of a dynamical coupled ocean-atmosphere model to study, and more recently to predict, aspects of ENSO. He has coordinated the Experimental Prediction component of the International Research Institute for Climate Prediction Pilot Project, an activity designed to demonstrate the working principles of a multinational institute dedicated to climate predictions and their regional applications worldwide.

He received his B.S. in Applied Mathematics (1978) from the Massachusetts Institute of Technology, his M.S. in Applied Mathematics (1979) from Rensselaer Polytechnic Institute, and his Ph.D. in Meteorology (1984) from the Massachusetts Institute of Technology. Following his doctoral studies, he accepted a postdoctoral fellowship at the Lamont-Doherty Geological Observatory. He was appointed Associate Research Scientist in 1986, Research Scientist in 1990, and Senior Research Scientist in 1993. He is the author of several articles on ENSO and ENSO prediction appearing in a variety of scientific journals and science magazines.