

The scientific community lost a giant of a scientist, teacher, and administrator with Ed Epstein's death in October 2008. His contributions to science, education, and management are so many that it will not be possible to describe them all in this space allotted. Perhaps his most profound scientific achievement was his *Tellus* paper titled "Stochastic Dynamic Prediction," written when he was on a sabbatical at the University of Stockholm in

EDWARD S. EPSTEIN

1931–2008

1968–69. To this day, that subject remains a substantial and deep challenge. His concept was so visionary that human and computer resources have not yet been able to capitalize fully on it.

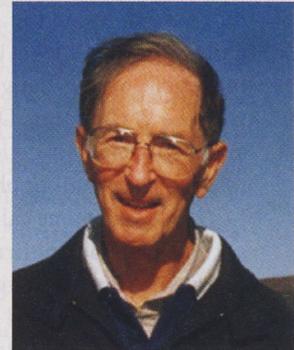
Edward S. Epstein was born in 1931. After illustrious academic achievements at the Bronx High School of Science and middle school, at the age of 15 he applied to Harvard, the University of Chicago, and the University of California. Even at that age, he was accepted at all three schools, and with a full scholarship he entered Harvard at the age of 16. After graduating from Harvard in 1951 with a major in astronomy, he attended Columbia University, majoring in statistics, and earned an MBA.

Like many of that day who became meteorologists, Ed was assisted in his career choice by the U.S. government, which offered him the options of being drafted, entering Officer's Candidate School and becoming a naval supply officer, or attending Penn State as an air force officer and studying meteorology; it was probably not a hard choice for Ed. He was awarded an M.S. degree from Penn State in 1954. After attending the Officer's Basic Military Course at Lackland Air Force Base in Texas in 1954, he was singled out to work at the Air Force Cambridge Research Center rather than being assigned forecasting duties at an air base. He was sent to Flagstaff, Arizona, to determine the vertical distribution of atmospheric ozone. This published work, "A New Method for Determining the Vertical Distribution of Ozone from a Ground Station," established his reputation as a research scientist. It also led to his being invited by Penn State to pursue a doctorate in meteorology, which he was awarded in 1960.

Ed joined the faculty of the University of Michigan as an instructor in 1959. During Ed's tenure there, the fledgling meteorology program that was in the Civil Engineering Department of the College of Engineer-

ing grew to become the Department of Atmospheric, Oceanic, and Space Sciences, with Ed eventually becoming the department chair in 1971. This successful transition went through several phases, with Ed critically involved in each. He progressed from instructor to full professor in 10 years, all the while playing a critical role in establishing a department and becoming department chair only 12 years after he moved to Michigan. While undertaking these service and administrative tasks enthusiastically and productively, his research activities flourished. In his very important 1969 *Journal of Applied Meteorology* paper, "The Role of Initial Uncertainties in Predictions," Ed studied the ensemble of forecasts made from a set of predictive equations with slightly differing initial conditions. While not the first to study this problem and use the term "ensemble" in regard to weather prediction, Ed—along with Tom Gleeson and Chuck Leith—was instrumental in setting the course for the many ensemble systems operational today.

Ed made many contributions to the probability and statistics literature, sometimes with student coauthors who themselves then became leaders in their fields. These include "A Bayesian Approach to Decision Making in Applied Meteorology" in 1962. Although Bayes's work was known, this was the first formal treatment of Bayes's theorem in meteorology, about which Ed said, "Bayes's theorem forms the basis for the statistical estimation of the frequencies of various alternative weather events." As the title of this paper indicates, Ed was a great proponent of probability forecasts—a subject currently receiving renewed interest in our field—and much of his work pertained to that subject. He was quick to take on challenges he saw in the literature, and we remember well his sparring with Tom Gleeson on the role of uncertainties of initial conditions in weather forecasting and whether nature should be treated as a logical opponent in the theory of games. He gave a presentation at the First Statistical Meteorological Conference in 1968 titled "On the Correspondence between Theory and Practice in Probability Forecasts." An important



Edward S. Epstein

1969 paper, "A Scoring System for Probability Forecasts for Ranked Categories" in the *Journal of Applied Meteorology* is one of the cornerstones in evaluating probability forecasts of ordered variables.

Along with his former student, Allan Murphy, Ed added much to the science of weather forecast verification, and through their joint 1967 work, "A Note on Probability Forecasts and 'Hedging,'" also in the *Journal of Applied Meteorology*, introduced the term "proper" in connection with forecasts and scoring systems. New scoring systems that are proposed today are almost always subjected to this "properness" test, and the beat goes on to determine what score is proper and what is not.

Ed was wooed on two occasions to the United States government. From 1963 to 1964, he served in the Department of Commerce as scientific advisor to the assistant secretary for science and technology, where he focused on international meteorological programs. World Weather Watch was in its infancy and the Global Atmospheric Research Programme (GARP) was only a concept. In 1973, Ed was coaxed to join NOAA as an associate administrator for environmental monitoring and prediction. NOAA was in its first few years, balancing its science and services missions in fisheries regulation and conservation, geodesy, oceanography, meteorology, and hydrology. Ed was a strong advocate for founding those missions on sound science and reliable observations and for devoting necessary attention and resources to them.

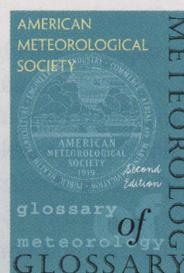
These were the early years of GARP and the World Weather Watch, and Ed was extremely supportive of the planning and execution of the GARP Atlantic Tropical Experiment (GATE) and the Global Weather Experiment, including the development of numerical models and global observing systems; several of the geostationary and polar orbiting satellites later became operational. It was also a time when national and international interests were turning more strongly to climate. He helped nurture the preparation of the legislation establishing the U.S. National Climate Program, and became its first director in 1978. In that role, he ensured that the fledgling Climate Analysis Center (CAC) in the National Weather Service would be given both research and operations missions, thus greatly enhancing its viability.

Ed had very wide-ranging interests, as his many publications indicate. He was a trustee of the University Corporation of Atmospheric Research and chairman of that organization's Budget and Program Committee. He was a member of the American Geophysical

Union, Royal Meteorological Society, and American Statistical Association, and served on committees of the National Science Foundation and the National Academy of Sciences/National Academy of Engineering. He was elected Fellow of the American Association for the Advancement of Science in 1978. He served as editor of the *Journal of Applied Meteorology* from 1971 until 1973 and associate editor of the *Journal of Geophysical Research* from 1964 to 1967. He was chair of the Meteorological Statistics Committee of the AMS from 1967 to 1969, and was an AMS councilor from 1974 to 1977. He coauthored papers in AMS journals with such far-ranging titles as "Application of Two-dimensional Spectral Analysis to the Quantification of Satellite Cloud Photographs," "Atomic Oxygen in the Polar Winter Mesosphere," and "Power-Spectrum Analysis of Atmospheric Ozone Parameters."

Ed's deep knowledge of climate science and observations—and his dedication to excellence—established sound direction for the future work of numerous organizations and programs. In 1981, he was named the chief of NOAA's Climate and Earth Sciences Laboratory. He got back into firsthand science, so to speak, in 1983 when he was appointed chief scientist of CAC. He followed his interest in both climate and Bayesian

THE GLOSSARY OF METEOROLOGY



The second edition of the *Glossary of Meteorology* is now available, with over 12,000 terms, including those from "new" disciplines, such as satellite meteorology and numerical weather prediction.

The CD-ROM version is compatible with Windows, Macintosh, and most UNIX platforms, and features hyperlinked cross-references.

Hardbound: \$85 List; \$60 AMS Members; \$35 AMS Student Members; **CD-ROM:** \$95 List; \$65 AMS Members; \$35 AMS Student Members

ISBN 1-878220-34-9, approx. 850 pp., hardbound.

To place an order, refer to the pricing chart above and submit your prepaid orders to: **Order Department, AMS, 45 Beacon Street, Boston, MA 02108-3693;** call 617-227-2426 ext. 686 to order by phone using Visa, Mastercard, or American Express; or send e-mail to amsorder@ametsoc.org. Please make checks payable to the **American Meteorological Society**.

methods only two years later with an AMS meteorological monograph titled *Statistical Inference and Prediction in Climatology: A Bayesian Approach*. He also published an extensive NOAA technical report in 1988, *A Precipitation Climatology of Five-Day Periods*.

Ed made the transition from high administration at NOAA headquarters to working scientist at CAC swiftly, gracefully, and enthusiastically. He soon became known to his junior colleagues as “Dr. Ed.” He treated his assistants as equals, wrote FORTRAN codes of startling economy and sophistication, applied them to projects of great practical value to CAC, and offered statistical advice and dryly humorous comments to all who asked. His combination of keenness and kindness are remembered affectionately by those who encountered him at CAC.

When the AMS started the *Journal of Climate* in 1988, Ed was associate editor and had a paper in the first issue titled “A Spectral Climatology.” He held the post of associate editor until 1994 and published three more papers in that journal. In another new AMS journal, *Weather and Forecasting*, he published with Murphy the paper “Skill Scores and Correlation Coefficients in Model Verification.” He was awarded an Outstanding Achievement Award by the International Meetings on Statistical Climatology in 1993.

Even before his later statistical work in the climate area, Ed contracted Parkinson’s disease in 1979. For

those who knew him, his masterful accommodation to that disease was a tremendous inspiration. Although it eventually became debilitating, he was still active until just a few years before his death on 14 October 2008, in Potomac, Maryland. He taught an AMS short course, “Bayesian Statistical Inference and Prediction for Climatologists and Meteorologists,” in 1985 and used as a text an AMS monograph he wrote that same year. He retired in 1993, and by January 1994 was a partner with Murphy in their company, Prediction and Evaluation Systems. Both Ed and Allan were Certified Consulting Meteorologists and Fellows of AMS. He was an avid bridge player, and he and his wife Alice were terrors at the table in the weather service bridge club, of which they were members for many years. After a game, one might be asked the next morning, “Did you win?” The answer more often than not would be, “No, Ed and Alice were there!”

Alice survives along with four children—Debra, Harry, Nancy, and Bill—and their spouses, and eight grandchildren. As was stated at his memorial service, he consciously did not let himself become a workaholic. This allowed him to spend time with his family, and it was evident that he was adored by them. Ed was a friend to many, and he is missed.

—FERD BAER, DON GILMAN, BOB GLAHN, DICK HALLGREN, AND DOUG SARGEANT

Earl E. Gossard, renowned atmospheric scientist and AMS Fellow, passed away on 27 January 2009 at his home in Fortuna, California at the age of 86. He was born on 8 January 1923 in Eureka, California, to Ralph Dawson Gossard and Winifred (Hill) Gossard.

Earl Gossard served in the U.S. Army Air Force from 1943 to 1946 as a first lieutenant and went on to attend Humboldt State University at Arcata, California. In 1948, he received his B.A. degree from the University of California at Los Angeles (UCLA). That year, he married Sophia (Marge) Poignand. Earl received his M.A. degree from the University of California at San Diego in 1951 and his Ph.D. in physical oceanography in 1956 from UCLA for research conducted at the Scripps Institution of Oceanography. While at Scripps he worked with Walter Munk on atmospheric gravity waves. His Ph.D. thesis was titled “Gravity Waves in the Lower Troposphere over Southern California.”

Concurrent with his studies, Earl began his professional career as a meteorologist at the Naval Electronics Laboratory (NEL) in San Diego, California, in 1951. He became head of the Radio Meteorology Section in 1955, and from 1961 to 1971 he was head of the Radio Physics Division at NEL (later the Naval Ocean Systems Center, NOSOC). In 1971 he joined NOAA’s Wave Propagation Laboratory (WPL) in Boulder, Colorado, as chief of the Geoacoustics Program. From 1973 to 1982 Earl served as the chief of the Meteorological Radar program at WPL. In 1982, he was appointed senior research associate at The Cooperative Institute for Research in Environmental Science (CIRES) at the University of Colorado in Boulder. In 1997, he retired from the university and worked as senior scientist with the Science and Technology Corporation until his retirement.

**EARL EVERETT
GOSSARD
1923–2009**