

# Foreword to the March 2003 EOS Aqua AMSR-E Arctic Sea Ice Field Campaign Special Issue

**M**UCH of our knowledge of the global sea ice cover, including its seasonal and regional variability, its long-term trends on decadal time scales, and its interaction with other components of the climate system, stems from sea ice data records derived from satellite passive microwave observations. One of the more recent satellite multichannel microwave radiometers launched is the Advanced Microwave Scanning Radiometer for the Earth Observing System (EOS) (AMSR-E), which was designed and built for the National Aeronautics and Space Administration (NASA) by Japan's National Space Development Agency (now part of the Japan Aerospace Exploration Agency). AMSR-E was launched on May 4, 2002, onboard the EOS Aqua spacecraft. AMSR-E has a long heritage, starting with NASA's Scanning Multichannel Microwave Radiometer from 1979 to 1987 and the Defense Meteorological Satellite Program series of Special Sensor Microwave Imagers since 1987, and promises to provide a more accurate measure of the Earth's sea ice cover and its variability because it has more channels and about double the spatial resolution than its predecessors.

Through the support of the NASA EOS Project and NASA's Cryospheric Sciences Program and with the participation of scientists from NASA, other government agencies, and universities, a coordinated Arctic field campaign to validate the AMSR-E sea ice products was completed in March 2003. The standard AMSR-E sea ice products include sea ice concentration, ice temperature, and snow depth on sea ice. The field campaign consisted of seven aircraft flights using the NASA P-3 covering portions of the Bering, Beaufort, and Chukchi seas. Each of the seven flights had a specific validation objective. The Bering and Chukchi Sea flights were particularly useful for providing independent assessments of the characteristics and concentrations of a variety of sea ice types. The flights made near Barrow, AK, and over a Navy ice camp in the Beaufort Sea were coordinated with extensive surface-based measurements of snow and ice physical properties, and data from these flights were used primarily for the validation of the sea ice temperature and snow depth on sea ice products. The aircraft flights were also coordinated with high-resolution Landsat-7 Enhanced Thematic Mapper Plus and RADARSAT imagery that were acquired, processed, and analyzed to validate the AMSR-E sea ice concentrations. All of the validation data sets collected are archived and are publicly available at the National Snow and Ice Data Center in Boulder, CO (<http://www.nsidc.org>).

Some of the papers in this Special Issue report on the results of the validation campaign, providing the research community with a first measure of the accuracy of the AMSR-E sea ice products. These results will form a baseline for future AMSR-E sea ice validation studies. Other papers also provide insight into the reasons for the particular validation results obtained, suggest potential algorithm improvements, and enhance our understanding of microwave remote sensing of sea ice by studying geophysical processes. TGARS is a natural venue in which to publish these results, as it is the same journal in which the Aqua mission was described including the AMSR-E sea ice algorithms (EOS Aqua issue, vol. 41, no. 2, Feb. 2003).

## ACKNOWLEDGMENT

The guest editors would like to thank the IEEE GRS AdCom for approving the proposal for this Special Issue and Prof. J. Benediktsson, Editor of TGARS, for his help and guidance in the preparation of this special section. We also thank A. Larkin, TGARS Publications Review Coordinator, for her assistance with the review process. Finally, we thank the authors and reviewers for their valuable contributions to this Special Issue.

DONALD J. CAVALIERI, *Guest Editor*  
Cryospheric Sciences Branch  
NASA Goddard Space Flight Center  
Greenbelt, MD 20771 USA  
e-mail: donald.j.cavalieri@nasa.gov

THORSTEN MARKUS, *Guest Editor*  
Instrumentation Sciences Branch  
NASA Goddard Space Flight Center  
Greenbelt, MD 20771 USA

R. KEITH RANEY, *Guest Editor*  
Applied Physics Laboratory  
Johns Hopkins University  
Laurel, MD 20723 USA

ALBIN J. GASIEWSKI, *Guest Editor*  
Department of Electrical and Computer Engineering  
University of Colorado  
Boulder, CO 80309 USA



**Donald J. Cavalieri** (M'05) received the B.S. degree in physics from the City College of New York, New York, in 1960, the M.A. degree in physics from Queens College, New York, in 1967, and the Ph.D. degree in meteorology and oceanography from New York University, New York, in 1974.

From 1974 to 1976, he was a National Research Council Postdoctoral Resident Research Associate with the NOAA Environmental Data Service, Boulder, CO, where he continued his doctoral research on stratospheric-ionospheric coupling. From 1976 to 1977, he was a Visiting Assistant Professor with the Department of Physics and Atmospheric Science, Drexel University, Philadelphia, PA, where he worked on stratospheric temperature retrievals from satellite infrared radiometers. In the fall of 1977, he was a Staff Scientist with Systems and Applied Sciences Corporation, Riverdale, MD, working on sea ice retrieval algorithms, in preparation for the launch of Nimbus-7 SMMR. In 1979, he joined the Laboratory for Atmospheres, NASA Goddard Space Flight Center, Greenbelt, MD, where he is currently a Senior Research Scientist in the

Cryospheric Sciences Branch of the Hydrospheric and Biospheric Sciences Laboratory. His current research interests include polar ocean processes and microwave remote sensing of the cryosphere.

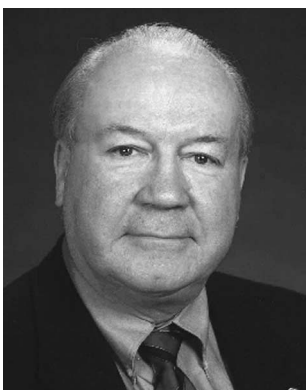
Dr. Cavalieri is a member of the American Geophysical Union and the American Meteorological Society.



**Thorsten Markus** (M'05) received the M.S. and Ph.D. degrees in physics from the University of Bremen, Bremen, Germany, in 1992 and 1995, respectively.

He is currently a Research Scientist with the NASA Goddard Space Flight Center (GSFC), Greenbelt, MD. From 1995 to 1996, he was a National Research Council Resident Research Associate with GSFC before joining NASA-UMBC Joint Center for Earth Systems Technology, where he worked until 2002. His research interests include satellite microwave remote sensing of primarily ice and the utilization of satellite data to study oceanic and atmospheric processes.

Dr. Markus is a member of the American Geophysical Union.



**R. Keith Raney** (S'61-M'62-SM'80-F'91-LF'02) received the B.S. degree (with honors) in physics from Harvard University, Cambridge, MA, in 1960, the M.S.E.E. degree from Purdue University, West Lafayette, IN, in 1962, and the Ph.D. degree in computer information and control engineering from the University of Michigan, Ann Arbor, in 1968.

He is a member of the Principal Professional Staff with the Space Department, Applied Physics Laboratory, The Johns Hopkins University, Baltimore, MD, and is the Assistant Supervisor of the Ocean Remote Sensing Group. He has contributed to the design of National Aeronautics and Space Administration's Magellan Venus mapping radar, the European Space Agency's ERS-1 SAR, and the Shuttle Imaging Radar SIR-C. He holds U.S. patents on an ice sounding radar suitable for a remote platform, the chirp scaling SAR processing algorithm, the Delay/Doppler radar altimeter, and has a patent pending on bistatic radar altimetry. While with the Canada Centre for Remote Sensing (1976-1994), he was responsible for the conceptual design of the SAR system, and he was Scientific Authority for the Canadian Seasat processor, the world's first

digital processor for satellite SAR data.

Dr. Raney was awarded the 1999 Gold Medal of the Canadian Remote Sensing Society, the 1998 IEEE Geoscience and Remote Sensing Society Transactions Prize Paper, and the Millennium Medal 2000 from the IEEE, among other awards. He is a member of the Science Advisory Group for the European Space Agency's CryoSat radar altimeter Earth Explorer mission and is a member of the Science Council for the NASA Institute for Advanced Concepts.



**Albin J. Gasiewski** (S'81–M'88–SM'95–F'02) received the B.S. and M.S. degrees in electrical engineering and the B.S. degree in mathematics from Case Western Reserve University, Cleveland, OH, in 1983 and the Ph.D. degree in electrical engineering and computer science from the Massachusetts Institute of Technology, Cambridge, in 1989.

He is a Professor of electrical and computer engineering with the University of Colorado at Boulder and the Director of the CU Center for Environmental Technology. From 1989 to 1997, he was a Faculty Member with the School of Electrical and Computer Engineering at the Georgia Institute of Technology, where he became an Associate Professor. From 1997 to 2005, he was with the U.S. National Oceanic and Atmospheric Administration's (NOAA) Environmental Technology Laboratory, Boulder, CO, where he was the Chief of the ETL's Microwave Systems Development Division. He has developed and taught courses on electromagnetics, remote sensing, instrumentation, and wave propagation theory. His technical interests include passive and active remote sensing, radiative transfer, antennas and microwave circuits, electronic

instrumentation, meteorology, and oceanography.

Prof. Gasiewski is the Past President (2004–2005) of the IEEE Geoscience and Remote Sensing Society. He is a member of the American Meteorological Society, the American Geophysical Union, the International Union of Radio Scientists (URSI), Tau Beta Pi, and Sigma Xi. He currently serves as Vice Chair of USNC/URSI Commission F. He served on the U.S. National Research Council's Committee on Radio Frequencies (CORF) from 1989–1995. He is the General Cochair of IGARSS 2006, to be held in Denver, CO.