Foreword to Special Section on MISR

"Nothing tends so much to the advancement of knowledge as the application of a new instrument." So wrote the 19th century scientist and inventor Sir Humphrey Davy. Arguably, rigorous theoretical development and leaps of insight hold equally vital roles in the history of science. Yet, the invention of novel ways of making observations invariably leads us into new directions of research, provides heretofore unexplored methodologies for study, and, ultimately, can lead to new discoveries. It is with this expectation we draw together in this Special Section of the TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING a collection of early results from the Multi-Angle Imaging SpectroRadiometer (MISR), one of five instruments aboard NASA's Earth Observing System (EOS) Terra spacecraft.

Over two decades ago, widespread concerns about climate change and environmental degradation led to major efforts to coordinate scientific activities worldwide. The National Aeronautics and Space Administration (NASA), a key player in this arena, initiated the EOS program as part of an integrated measurement strategy. In 1988, NASA released an Announcement of Opportunity, soliciting instrument proposals. MISR, along with a large suite of other instruments, was selected for the EOS-A platform. Subsequent downsizing and reassessment of priorities led to reformulation of the mission as EOS-AM, which was renamed Terra prior to launch in December 1999.

MISR was conceived as a research instrument. Its innovative design has required solving a wide range of scientific and technical challenges. The use of an array of nine moderately high resolution cameras, calibrated radiometrically and geometrically to high accuracy, and which simultaneously observe from the vertical to very oblique viewing geometries, represents an unprecedented advance in the state-of-the-art of spaceborne remote sensing. The challenging development of automated ground data processing software that calibrates and coregisters the imagery and performs autonomous geophysical retrievals based on algorithms with little prior heritage similarly constitutes a significant step forward in the examination of earth's myriad assortment of clouds, aerosols, and surface types. MISR builds upon the strategy represented by center-to-limb observations that are traditionally used in planetary astronomy; theoretical reasoning exemplified in particle scattering and 1-D and 3-D radiative transfer equations; coarser resolution multiangular data from spaceborne instruments such as Earth Radiation Budget (ERB), Polarization and Directionality of Earth Reflectance (POLDER), and Along-Track Scanning Radiometer (ATSR); and field measurements from sensors such as the Portable Apparatus for Rapid Acquisition of Bidirectional Observation of the Land and Atmosphere (PARABOLA). MISR's airborne counterpart, AirMISR, has also proved to be an invaluable asset for pre- and postlaunch sensor calibration and algorithm validation efforts.

We are excited by the growing involvement of the Earth Science community in the use of MISR data, and look forward to increasing participation in the paradigm shift it represents. Much research lies ahead to take full advantage of MISR's potential and to explore its specific strengths and complementarity to other sensors. Publication of this Special Section represents a first step in this direction and marks a major milestone in the history of the MISR experiment. We would like to thank all of the authors and peer reviewers for their valuable contributions. We appreciate the assistance of Jessica Cedar, George Criscione, and Martin Morahan at IEEE, and owe special thanks to James Smith, TGARS Editor, for his forbearance and assistance during the process of assembling this collection of papers.

This achievement could not have been attained without the dedication of a diverse team of hardware and software engineers at the Jet Propulsion Laboratory and its subcontractors. The guidance and leadership of our colleagues on the international MISR science team, and the many research associates, post-docs, and students who work with them, has also been a vital component of this undertaking. The NASA Langley Atmospheric Sciences Data Center, where MISR data are routinely processed and archived, and the NASA Goddard Space Flight Center, which has the lead responsibility for the Terra mission, are gratefully acknowledged for their ongoing support.

The 20th century writer Zora Neale Hurston wrote: "There is no single face in nature, because every eye that looks upon it, sees it from its own angle." As our experience in using the data from the nine different eyes and angles of MISR evolves, and the scientific community delves in depth into this unique and rich data resource, we hope to illuminate the face of nature a bit more than otherwise would have been possible, and by so doing, open new avenues for understanding the changing environment and climate of our home planet.

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