Guest Editorial

THIS *Special Issue on Data Archiving and Distribution*, to our knowledge, is a first of its kind in the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING and represents the "coming of age" of this technical area. While the title of the issue is shortened to "Data Archiving and Distribution," the scope is considerably broader, covering data access, interoperability of data systems, and specialized services such as visualization. A few examples of this technical area's coming of age are as follows:

1) sessions at each of the IEEE International Geoscience and Remote Sensing Symposia from 2004 to 2008 that have dealt with data system issues such as archiving, distribution, access, special services, Web and grid services, and measurement-based systems, as they specifically apply to geosciences and remote sensing;
2) formation in 2005 of a new focus area in the American Geophysical Union (AGU) on Earth and Space Science Informatics and attraction of about ten complete oral sessions and tens of poster presentations on data- and information-system-related topics during AGU's annual meetings in autumn since 2005.

Contributing to the high interest in this area are a "data-rich" environment that has been benefiting Earth science researchers and applications' practitioners over the last decade, advances in the ever-expanding capabilities of the World Wide Web, and enabling technologies such as mass storage, high-speed computation, database management, data mining, information extraction, evolving standards, middleware for data access, and Web services to facilitate collaborative science.

The papers in this Special Issue are grouped into the following five general categories, with some overlap among them:

1) broad data system capabilities—development and evolution;
2) processing;
3) archiving and distribution;
4) search and access;
5) long-term preservation.

The papers are presented in this sequence. The first three papers address broad system capabilities. The first paper, by Kempler *et al.*, discusses the recent evolutionary changes that have been made at the Goddard Earth Science Data and Information Services Center (GES DISC) as a part of the overall evolution of NASA's Earth Observing System Data and Information System. The second paper, by Hueni *et al.*, presents a processing, archiving, and distribution system for hyperspectral sensor data from the Airborne Prism Experiment (APEX). While the system is described with a focus on the APEX instrument, the design is sufficiently generic to be adaptable to other sensor systems. The third paper, by Wolfmüller *et al.*, discusses workflow for processing and managing data from the Synthetic Aperture Radar on the German TerraSAR-X mission. The emphasis is on the features of the TerraSAR-X Payload Ground Segment that enables reuse in a multimission environment.

The next paper, by Tilmes *et al.*, covers various aspects of processing remotely sensed data. It describes a community-oriented measurement-based processing system that builds on the heritage of processing systems for NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) and Total Ozone Mapping System and Netherlands Agency for Aerospace Programs' (NIVR's) Ozone Measuring Instrument. This paper emphasizes reusability of system capabilities for future missions.

The focus of the next two papers is on data archiving and distribution. The first of these, by Moran *et al.*, presents preservation, archiving, and distribution of three interconnected long-term geospatial data sets at government and academic units in southeastern Arizona. The second paper, by Davies *et al.*, describes how the delivery of satellite-derived fire information has evolved over the last six years. The Fire Information for Resource Management System discussed here shows how remote sensing and geographic information system technologies have been integrated to deliver MODIS fire data to resource managers internationally.

The topics covered by the next set of five papers are related to search and access. The first of these, by Khalsa *et al.*, describes what the Group on Earth Observations (GEO) has proposed for achieving interoperability among its component systems and gives an overview of the Global Earth Observing System of Systems Interoperability Process Pilot Project (IP3). It addresses how the IP3 is helping to develop an advanced information infrastructure that supports the formation and operation of Earth system science communities based on cross-disciplinary information exchange. The second paper, by Lynnes *et al.*, describes a simple and fast free-text search interface called Mirador, which supports space–time queries for global remote-sensing data sets offered at the GES DISC. The main feature of this search interface is the quick response that enables a more iterative search strategy than with many other techniques. The next paper, by Demir *et al.*, presents a low-complexity method using a one-bit transform for displaying hyperspectral images. This method is well suited for hardware implementation. The next paper, by Berrick *et al.*, is about a Web-service-workflow-based system called Giovanni for data visualization and analysis. This system, implemented at the GES DISC, supports many types of single- and multiparameter visualizations and statistical analyses, and also provides users with capabilities for downloading images and data in multiple formats. The next paper, by Halem *et al.*, presents a service-oriented system for providing the scientific community with gridded radiance products from an online library of data from

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the Atmospheric Infrared Sensor and MODIS instruments. This Web-service-based system can provide instrument radiance data mapped on to standard as well as user-defined spatiotemporal grids.

The next paper, by Duerr *et al.*, is on long-term preservation of data products. While there are many aspects to the problem of long-term preservation, this paper focuses on the readability of data when support tools for particular data formats are no longer being maintained or as versions of data formatting systems change over time.

The final paper of this issue, a short paper by Du *et al.*, discusses atmospheric corrections and their impact on the data compression of multispectral and hyperspectral data. The observations made provide interesting indications for the remote-sensing community in efforts to standardize compression strategies for data archiving and distribution.

We hope that this Special Issue has sown the seed for a growing number of publications in this interesting area.

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Hampapuram Ramapriyan (M'03–SM'03) received the B.Sc. degree from University of Mysore, Bangalore, India, the B.E. and M.E. degrees in electrical engineering from the Indian Institute of Science, Bangalore, India, and the Ph.D. degree in electrical engineering from the University of Minnesota, Minneapolis.

He is the Assistant Project Manager of the Earth Science Data and Information System Project at NASA's Goddard Space Flight Center, Greenbelt, MD. He has over 35 years of managerial and technical experience in science data system development, image processing, remote sensing, parallel processing, algorithm development, science data processing, archiving, and distribution. The ESDIS Project develops and operates one of the largest civilian science data systems in the world—the Earth Observing System Data and Information System (EOSDIS) in support of NASA's Science Mission Directorate. The ESDIS Project has been instrumental in establishing, as a part of EOSDIS, a set of Distributed Active Archive Centers (DAACs) around the U.S. that manage NASA's Earth science data and provide convenient access to trillions of bytes of data in various scientific disciplines such as land processes, oceanography, hydrology, atmospheric sciences, cryospheric studies, etc. The project has also developed systems that facilitate "one-stop shopping" access to international data centers. His responsibilities in the project have ranged from supervising a group of technical professionals in the design and implementation of EOSDIS and managing the early development and operation of the DAACs to providing a customer focus by interfacing with the scientific customer community to understand their requirements and assuring that the system development accommodates their requirements. He has recently been involved in the study of the evolution of EOSDIS for the future decade and the implementation of its initial steps. In addition, he has supported the Intelligent Systems Project (ISP) within the Computing, Information, and Communications Technology Program, managed by NASA's Ames Research Center. Within the ISP, he was the Deputy Manager for Intelligent Data Understanding (IDU), one of the three technical areas. This was a basic research program in computer sciences with significant participation by the university community to advance the state of the art for solving problems relevant to NASA's future missions. He led a team to study concepts for "Intelligent Archives in the Context of Knowledge Building Systems" in support of ISP/IDU and implemented a testbed to illustrate some of the concepts developed by the study.

Dr. Ramapriyan has been the Cochair of the Technical Committee of the GRSS on Data Archiving and Distribution since 2005. He is a member of the American Geophysical Union (AGU). He was on the Program Committee and was session chair in the Earth Observing Systems Conference in the annual SPIE Symposia during 1996–2005.

Liping Di (M'01–SM'06) received the Ph.D. degree in remote sensing/GIS (geography) from the University of Nebraska, Lincoln, in 1991.

He is a Professor with the Department of Geography and Geoinformation Science and the Director of the Center for Spatial Information Science and Systems (CSISS), George Mason University, Fairfax, VA. He has engaged in geoinformatics and remote-sensing research for more than 25 years and has published over 100 refereed publications. He has served as the Principal Investigator (PI) for more than $20-million research grants and as co-PI for more than $8-million research grants/contracts awarded by the U.S. federal agencies and international organizations. His current research activities mainly include remote-sensing standards and the Web-based geospatial information and knowledge systems. He is well known for the development of standards for Earth observation and remote sensing.

Dr. Di was one of the core members of the NASA EOSDIS data standards team. He led the development of two U.S. Federal Geographic Data Committee remote-sensing standards and is leading the development of ISO 19130. He is also one of the major contributors to OGC Web Service specifications. He is a leading figure in the development of Web-based advanced distributed geospatial systems and tools. He has led the development of several influential Web-based geospatial data and information systems for satellite-based Earth observations, such as the Data and Information Access Link, the NASA Web GIS Software Suite, and GeoBrain. He has been actively involved in the activities of a number of professional societies and international organizations, such as IEEE GRS, ISPRS, CEOS, ISO TC 211, OGC, INCITS/L1, and GEO. He served as the Cochair of the Data Archiving and Distribution Technical Committee (DAD TC) of IEEE GRS from 2002 to 2005 and has been the Chair of DAD TC since 2005.

Lorenzo Bruzzone (S'95–M'98–SM'03) received the Laurea (M.S.) degree in electronic engineering (*summa cum laude*) and the Ph.D. degree in telecommunications from the University of Genoa, Genoa, Italy, in 1993 and 1998, respectively.

From 1998 to 2000, he was a Postdoctoral Researcher with the University of Genoa. Since 2000, he has been with the University of Trento, Trento, Italy, where he his currently a Full Professor of telecommunications. He teaches remote sensing, pattern recognition, and electrical communications. He is the Head of the Remote Sensing Laboratory, Department of Information and Communication Technology, University of Trento. He conducts and supervises research on these topics within the frameworks of several national and international projects. He is an Evaluator of project proposals for many different governments (including the European Commission) and scientific organizations. He is the author (or coauthor) of 60 scientific publications in refereed international journals, more than 120 papers in conference proceedings, and seven book chapters. He is a Referee for many international journals and has served on the scientific committees of several international conferences. His current research interests include remote-sensing image processing and recognition (analysis of multitemporal data, feature extraction and selection, classification, regression and estimation, data fusion, and machine learning).

Dr. Bruzzone is a member of the Managing Committee of the Italian Inter-University Consortium on Telecommunications and a member of the Scientific Committee of the India–Italy Center for Advanced Research. He is also a member of the International Association for Pattern Recognition and of the Italian Association for Remote Sensing (AIT). He ranked first place in the Student Prize Paper Competition of the 1998 IEEE International Geoscience and Remote Sensing Symposium (Seattle, July 1998). He was a recipient of the Recognition of IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING Best Reviewers in 1999 and was a Guest Editor of a Special Issue of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING on the subject of the analysis of multitemporal remote-sensing images (November 2003). He was the General Chair and Cochair of the First and Second IEEE International Workshop on the Analysis of Multi-temporal Remote Sensing Images (MultiTemp) and is currently a member of the Permanent Steering Committee of this series of workshops. Since 2003, he has been the Chair of the SPIE Conference on Image and Signal Processing for Remote Sensing. From 2004 to 2006, he was an Associated Editor for the IEEE GEOSCIENCE AND REMOTE SENSING LETTERS and is currently an Associate Editor for the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING.