IEEE GEOSCIENCE and REMOTE SENSING Newsletter

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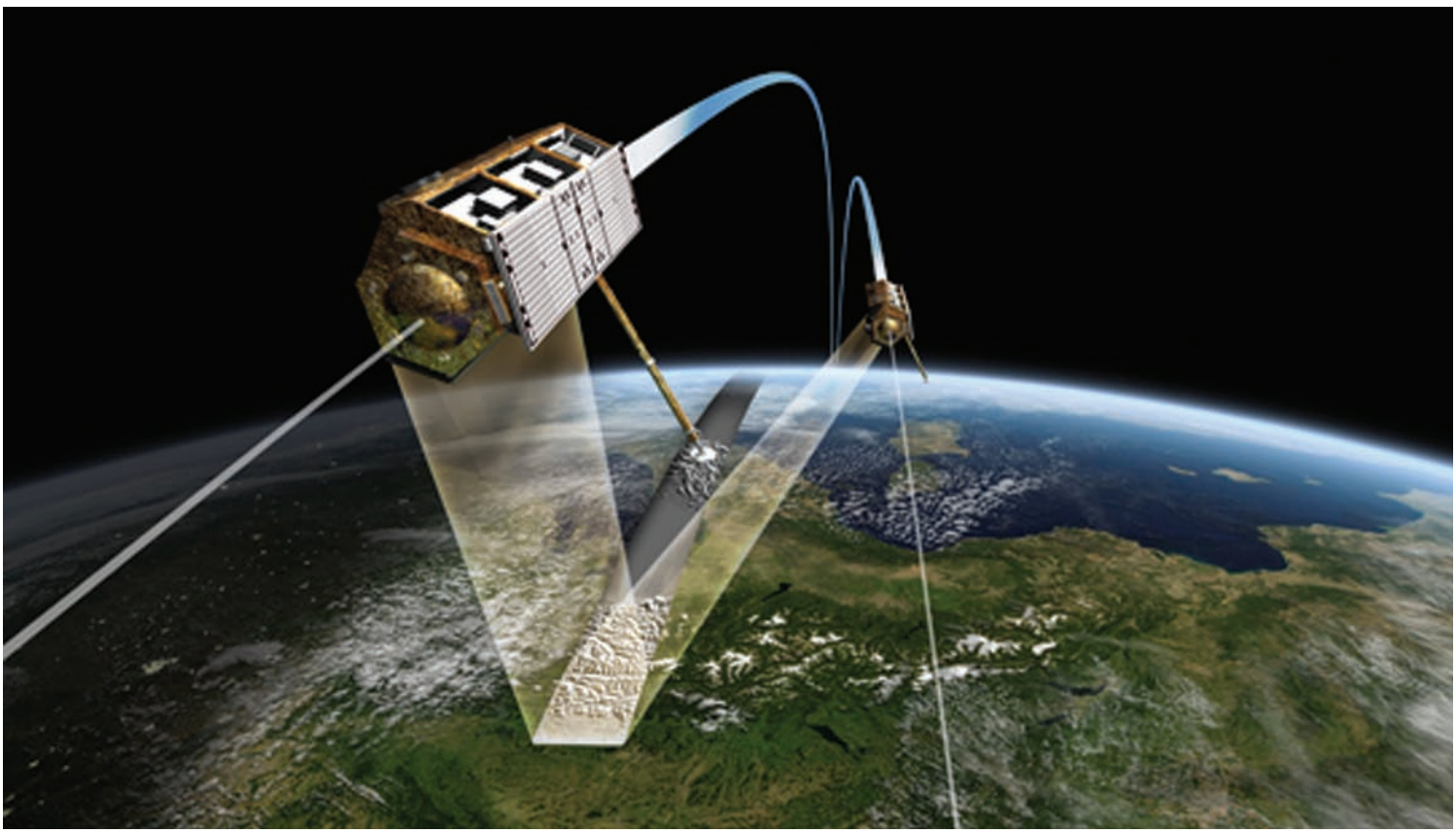

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GRS-S Newsletter Schedule

Month	June	Sept	Dec	March
Input	April 15	July 15	Oct 15	Jan 15

IEEE GRS-S AdCom, Officers and Committee Chairs – 2010 GRS-29 (Division IX)

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This last issue of 2010 of the IEEE Geoscience and Remote Sensing Newsletter is rich of contributions that are related to different activities developed both in the general field of remote sensing and in the specific framework of the GRS Society. We have a mix of technical articles and reports on very important and interesting topics related to our field.

Before providing an overview of the content of the December issue, I would like to remind you once again that there is the possibility to download the electronic version of the Newsletter as soon as it is published at http://www.grss-ieee.org/category/newsletter/. Soon the GRS-S members will have the possibility to register on the GRS-S website for subscribing a service that advizes by e-mail as soon as a new issue of the Newsletter is published on-line. This e-mail will also report the Table of Contents of the issue. The new service aims at a timely dissemination of the most updated news on remote sensing and GRS-S.

This issue contains three articles in the *Feature* section. The first one reports on a very special event held at Honolulu during the IGARSS conference, which is related to a special session organized to honor Kiyo Tomiyatsu for both his visionary activity in the remote sensing community and his outstanding service to the GRS Society. The article provides many details on the impressive career of Kyio that were described in the special session. This contribution is followed by a nice brief note of Kyio, which regards his vision in the formation and development of the GRS Society. The second main feature article presents an interview by Paul Racette to the President of the GRS Society Alberto Moreira. In this interview Alberto shares with our community his vision on remote sensing, on the last years developments of this technology, and on the promising and exciting future expected for this field. Finally, the third article is focused on the very important topic of the geospatial information standards under development and applied in geoscience. Standards are fundamental for a proper management of the geospatial

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President's Message

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What a dynamic and eventful time for the Geoscience and Remote Sensing Society! In the ten years since the beginning of the 21st century, we have experienced substantial changes in the activities, profile and benchmarks of our society: We have 41% more members (this makes us the IEEE Society with the largest membership increase during this period), an increase in the number of GRSS chapters from 13 to 35 (15 in North America, 10 in Europe, 2 in Africa, 2 in Latin America and 6 in the Asia-Pacific region), increase in IGARSS attendance by 80%, two new journals (GRSL and J-STARS), ca. 10 technically co-sponsored Specialty Symposia every year, increased collaboration with many international organizations and agencies (NASA, CSA, JAXA, ESA, GEOSS, AARSE, ISPRS, JB GIS, etc.), a quarterly industrial sector newsletter, a book series, a dedicated conference for GOLD (Graduate of the Last Decade) members every two years, a web-based educational program with tutorials and selected conference presentations, an on-line version of our Newsletter with free download, establishment of a task force on membership globalization (more than 50% of our members now live outside North America), two new Technical Committees (FARS – Frequency Allocations in Remote Sensing and ISIS – International Spaceborne Imaging Spectroscopy), a new GRSS logo, several new awards to recognize the outstanding scientific work and service of our members, and last but not least, a most fascinating age for remote sensing, indeed a golden age. GRSS is performing very well, and I foresee a great future for years to come.

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Cover Information: TanDEM-X and TerraSAR-X flying in close formation.

(Editor's Comments continued from page 3)

information and this contribution points out key issues related to the undergoing activities in this field.

In the *New Remote Sensing Missions* column, we have a contribution related to the recent launch of the TanDEM-X (**T**erraSAR-X **a**dd-o**n** for **D**igital **E**levation **M**easurements) satellite of the German Aerospace Center (DLR). TanDEM-X is a rebuilt (with some minor modifications) of TerraSAR-X. This new satellite can operate in close formation with TerraSAR-X creating a single-pass SAR interferometry system with adjustable baselines in across- and along-track directions. The article presents details on TanDEM-X, the current status of the mission, the science exploitation and other relevant information for understanding the technical specifications and the possible applications of this new satellite.

As in the previous issue, also in this one a large part of the *Report* section is devoted to the IGARSS 2010 and, in detail, to the article on the GRS-S Publication Awards presented at the IGARSS 2010 Banquet. The article reports on the winners of the IEEE GRS-S Transactions Prize Paper Award, the IEEE GRS-S Letters Prize Paper Award, the IEEE GRS-S Symposium Prize Paper Award, the IEEE GRS-S Interactive Session Prize Paper Award, the Student Prize Paper Awards, and the Chapter Excellence Award. Congratulations to all the award recipients! The *Report* section also presents a contribution related to the Global Navigation Satellite System (GNSS-R10) workshop, held at the Universitat Politècnica de Catalunya, Barcelona, Spain, in October 21st and 22nd, 2010.

The *Industrial Profile* column presents the ITT corporation, which is a leading company in the field of remote sensing. The article describes the field of activities of ITT, its organization, the key technologies that ITT offers to the remote sensing market and the main applications it addresses.

Finally, I would like to draw your attention on the different calls for nominations reported in this issue. It is very important that GRS-S members contribute to identify outstanding candidates for the different awards that are assigned by GRS-S and by our sister societies. I would emphasize the call for applications to be elevated to IEEE senior member. There are many scientists and professionals in our society who meet the eligibility criteria. I encourage them to apply and all IEEE GRS-S senior members to nominate eligible colleagues to achieve this valuable recognition.

Sincerely,
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GRS-S MEMBER HIGHLIGHTS

CALL FOR SENIOR MEMBERS: ELEVATE YOUR MEMBER GRADE OR NOMINATE A COLLEAGUE

The grade of Senior Member is the highest for which application may be made by the member and shall require experience reflecting professional maturity. IEEE Bylaw I-104.3 sets forth the criteria for elevation to Senior Member grade as follows:

- a candidate shall be an engineer, scientist, educator, technical executive or originator in IEEE-designated fields.
- candidates shall have been in professional practice for at least ten years.
- candidates shall have shown significant performance over a period of at least five of those years.

In addition, candidates for Senior Member grade must supply three references from current IEEE members holding the grade of Fellow, Senior Member, or Honorary Member. It should be noted that all of these references can contribute their reference online and the request is made automatically as part of the application process. The entire application process is done online.

More information about requirements for Senior Member Grade elevation can be found at IEEE website: http://www.ieee.org/membership_services/membership/senior/senior_requirements.html

An IEEE Member can be nominated for Senior Member Grade. Learn more about this procedure at IEEE website: http://ieee.org/membership_services/membership/senior/nominate.html

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You can also visit the GRS-S website: http://www.grss-ieee.org

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- Up to $25.00 gift certificate toward one new Society membership.
- A letter of commendation to your employer on the achievement of Senior Member grade (upon the request of the newly elected Senior Member).
- Announcement of elevation in Section/Society and/or local newsletters, newspapers and notices.
- Eligibility to hold executive IEEE volunteer positions.
- Can serve as Reference for Senior Member applicants.
- Invited to be on the panel to review Senior Member applications.
- Eligible for election to be an IEEE Fellow.

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If you are considering nominating a colleague from industry, government, or academia for elevation to IEEE Fellow grade, the opportunity to do so is now. This prestigious 46 year old group now numbers over 6000. These Fellows are the visionaries, the dreamers, the pioneers, and technology leaders in their field as well influential members in the international technology community.

IEEE Senior members or IEEE Life Senior members in good standing, who have completed five years of service in any grade of IEEE Membership and who have made an outstanding contribution to the electronic or electrical engineering profession may be nominated in one of four categories: application engineer/practitioner, educator, research engineer/scientist, or technical leader. The IEEE Fellow web site, http://www.ieee.org/fellows, has all the information you will need including the requirements for nominee eligibility as well as nomination instructions and all the necessary forms. The nomination period is presently open and will continue through 01 March 2011 for the Class of 2012.

You are strongly encouraged to read the information on "Before You Hit Submit" and then use the Online Application process which is quick and easy. Once you have started the application, it can be held in Draft status until you have completed the entire form and are ready to send the information to us. Once you have submitted the application, the electronic process will automatically send emails to your references and endorsers and provide the means for you to track their status. Also once you have submitted the nomination, no changes for whatever reason can be made which is why we encourage you to put the maximum number of references on the form and find out if they are willing to help you with the submission before sending the nomination.

The IEEE Fellow Staff is working to make your nomination process as trouble free as possible and they are ready to assist with all phases of the application process. Should you have any question during the completion process you can email fellows@ieee.org with any questions.

NOMINATIONS FOR IEEE AWARDS

The IEEE Awards Program provides peer recognition to individuals whose contributions to the art and science of electro- and information technologies worldwide have improved the quality of life.

The IEEE Geoscience & Remote Sensing Society members may be particularly interested in the following Technical Field Awards, whose nomination deadlines are 31 January 2011. The awards typically consist of a bronze medal, certificate and cash honorarium.

IEEE Electromagnetics Award for outstanding contributions to electromagnetics in theory, application or education

IEEE Photonics Award for outstanding achievement(s) in photonics.

IEEE Frederik Philips Award for outstanding accomplishments in the management of research and development resulting in effective innovation in the electrical and electronics industry.

IEEE Eric E. Sumner Award for outstanding contributions to communications technology.

IEEE Kiyo Tomiyasu Award for outstanding early to mid-career contributions to technologies holding the promise of innovative applications.

Awards presented by the IEEE Board of Directors fall into several categories: The Medal of Honor, Medals, Technical Field Awards, Corporate Recognitions, Service Awards, and Prize Papers. The IEEE also recognizes outstanding individuals through a special membership category: IEEE Honorary Member.

Nominations are initiated by members and the public, and then reviewed by a panel of peers. Their recommendations are submitted to the IEEE Awards Board prior to final approval by the IEEE Board of Directors.

For nomination guidelines and forms, visit http://www.ieee.org/awards. Questions? Contact IEEE Awards Activities, 445 Hoes Lane, Piscataway, NJ 08854 USA; tel.: +1 732 562 3844; fax: +1 732 981 9019; e-mail: awards@ieee.org.

COMPLETE LIST OF IEEE TECHNICAL FIELD AWARDS

IEEE Cledo Brunetti Award for outstanding contributions to nanotechnology and miniaturization in the electronics arts

- Award consists of a certificate and honorarium

IEEE Control Systems Award for outstanding contributions to control systems engineering, science, or technology

- Award consists of a bronze medal, certificate, and honorarium

IEEE Component Packaging Manufacturing Technology Award for meritorious contributions to, the advancement of components, electronic packaging or manufacturing technologies.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Marie Sklodowska-Curie Award for outstanding contributions to the field of nuclear and plasma sciences and engineering

- Award consists of a bronze medal, certificate, and honorarium

IEEE Electromagnetics Award for outstanding contributions to electromagnetics in theory, application or education

- Award consists of a bronze medal, certificate, and honorarium

IEEE James L. Flanagan Speech and Audio Processing Award for outstanding contribution to the advancement of speech and/or audio signal processing

- Award consists of a bronze medal, certificate, and honorarium

IEEE Andrew S. Grove Award for outstanding contributions to solid-state devices and technology

- Award consists of a bronze medal, certificate, and honorarium

IEEE Herman Halperin Electric Transmission and Distribution Award for outstanding contributions to electric transmission and distribution

- Award consists of a certificate and honorarium

IEEE Masaru Ibuka Consumer Electronics Award for outstanding contributions in the field of consumer electronics technology.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Internet Award for network architecture, mobility and/or end-use applications

- Award consists of a bronze medal, certificate, and honorarium

IEEE Reynold B. Johnson Information Storage Systems Award for outstanding contributions to information storage systems, with emphasis on computer storage systems.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Richard Harold Kaufmann Award for outstanding contributions in industrial systems engineering

- Award consists of a bronze medal, certificate, and honorarium

IEEE Joseph F. Keithley Award in Instrumentation and Measurement for outstanding contributions in electrical measurements

- Award consists of a bronze medal, certificate, and honorarium

IEEE Gustav Robert Kirchhoff Award for outstanding contributions to the fundamentals of any aspect of electronic circuits and systems that has a long-term significance or impact

- Award consists of a bronze medal, certificate, and honorarium

IEEE Leon K. Kirchmayer Award for Graduate Teaching for inspirational teaching of graduate students in the IEEE fields of interest.

- Award consists of a bronze medal, certificate and honorarium

IEEE Koji Kobayashi Computers and Communications Award for outstanding contributions to the integration of computers and communications.

- Award consists of bronze medal, certificate, and honorarium

IEEE William E. Newell Power Electronics Award for outstanding contribution(s) to the advancement of power electronics.

- Award consists of bronze medal, certificate, and honorarium

IEEE Daniel E. Noble Award for Emerging Technologies for outstanding contributions to emerging technologies recognized within recent years.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Donald O. Pederson Award in Solid-State Circuits for outstanding contributions to solid-state circuits.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Frederik Philips Award for outstanding accomplishments in the management of research and development resulting in effective innovation in the electrical and electronics industry.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Photonics Award for outstanding achievement(s) in photonics.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Emanuel R. Piore Award for outstanding contributions in the field of information processing in relation to computer science.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Judith A. Resnik Award for outstanding contributions to space engineering, within the fields of interest of the IEEE.

- Award consists of bronze medal, certificate, and honorarium

IEEE Robotics and Automation Award for contributions in the field of robotics and automation.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Frank Rosenblatt Award for outstanding contribution(s) to the advancement of the design, practice, techniques, or theory in biologically and linguistically motivated computational paradigms including but not limited to neural networks, connectionist systems, evolutionary computation, fuzzy systems, and hybrid intelligent systems in which these paradigms are contained.

- Award consists of a bronze medal, certificate, and honorarium

IEEE David Sarnoff Award for exceptional contributions to electronics.

- Award consists of bronze medal, certificate, and honorarium

IEEE Charles Proteus Steinmetz Award for exceptional contributions to the development and/or advancement of standards in electrical and electronics engineering.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Eric E. Sumner Award for outstanding contributions to communications technology.

- Award consists of bronze medal, certificate, and honorarium

IEEE Undergraduate Teaching Award for inspirational teaching of undergraduate students in the fields of interest of IEEE.

- Award consists of a bronze medal, certificate, and honorarium

IEEE Nikola Tesla Award for outstanding contributions to the generation and utilization of electric power.

- Award consists of a plaque and honorarium

IEEE Kiyo Tomiyasu Award for outstanding early to mid-career contributions to technologies holding the promise of innovative applications.

- Award consists of a bronze medal, certificate, and honorarium

FEATURE

SPECIAL SESSION HONORING THE ACHIEVEMENTS OF KIYO TOMIYASU AT IGARSS 2010 IN HONOLULU

Steven C. Reising, Colorado State University, US
Jón Atli Benediktsson, University of Iceland, Iceland

Introduction

Special sessions are organized for each year's IGARSS through an open proposal and selection process run by the IGARSS Technical Program Committee, led by each year's Technical Program Chair or Co-Chairs from the Local Organizing Committee. Over the years, some sessions stand out as *truly* special sessions. These include sessions to honor to a specific individual's career of outstanding contributions to geoscience and remote sensing as well as dedicated service to the IEEE and the profession. The "Special Session Honoring the Achievements of Kiyo Tomiyasu" at the 30th Anniversary IGARSS 2010 in Honolulu, Hawai'i, USA is one example of such a *truly* special session.

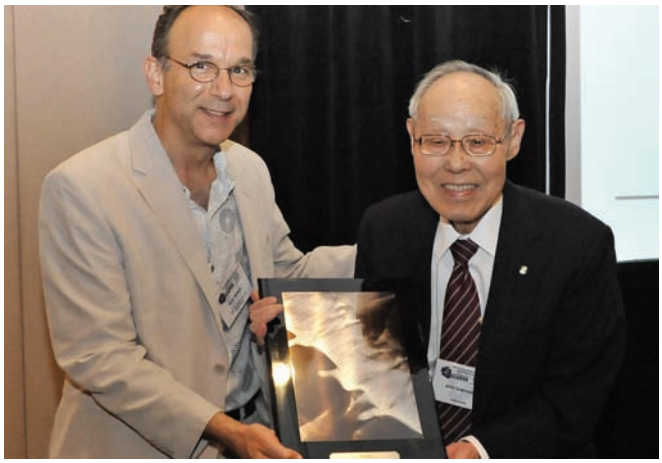
Kiyo Tomiyasu celebrated his 91st birthday on September 25, 2010. As an IEEE Life Fellow, his commitment and loyalty to IEEE spans 70 years, from when he joined the Institute of Radio Engineers, one of the predecessors of IEEE, in 1941 as a student until today. In May 2010, Dr. Tomiyasu was inducted into the IEEE Heritage Circle to honor his lifetime of giving to IEEE. His involvement with the IEEE Geoscience and Remote Sensing Society (GRSS) began in 1980, when GRSS was formed as a reorganization of the Group on Geoscience Electronics, in existence since 1963. Dr. Tomiyasu served as the first GRSS Awards Chair. He has been an Honorary Life Member of the GRSS and its Administrative Committee (AdCom) since 1999. He is currently an extremely active participant on the GRSS AdCom, attending nearly every meeting and working tirelessly in between, particularly on the Constitution, Bylaws, Operations Manual, and on policies for nominations and elections.

Special Session

The Special Session in Honor of the Achievements of Kiyo Tomiyasu was held on Wednesday, July 28, 2010 in the Hilton Hawaiian Village, Honolulu, Hawai'i, USA, from 1:35 pm to 3:15 pm. At the start time, Session Co-Chair and VP for Technical Activities Steven C. Reising introduced the session by presenting brief highlights of Dr. Tomiyasu's biography, printed below as the last section of this article. Then Dr. Reising introduced the first presentation, entitled "Many Happy Returns: Reflections Inspired by Kiyo Tomiyasu," presented by Keith Raney of the Johns Hopkins Applied Physics Laboratory. Dr. Raney reviewed some of the highlights of Kiyo Tomiyasu's life, from his days as a Caltech undergraduate in electrical engineering (Tomiyasu said, "When I arrived as a freshman at Caltech, I was a scared rabbit…") to his M.S. at

Kiyo Tomiyasu grinning like a young lad after being greeted by the Hawaiian girls upon entering the Welcome Reception for IGARSS 2010 in the evening of Sunday, July 25.

Kiyo and Eiko Tomiyasu look on during the Special Session in his honor at IGARSS 2010 as Paul Rosen presents a slide with the IEEE Kiyo Tomiyasu Award.



Paul Rosen of the Jet Propulsion Laboratory (JPL) presenting to Kiyo Tomiyasu a plaque with a Mars Reconnaissance Orbiter Image and signed by JPL Director Charles Elachi.

Session Co-Chair Jón Atli Benediktsson congratulating Kiyo Tomiyasu and presenting him with a book entitled Mountains from Space *by authors from the German Aerospace Center (DLR) and signed by 36 GRSS colleagues to thank himfor all of his research contributions and volunteer service for geoscience and remote sensing.*

Columbia and his Ph.D. student days at Harvard, during which he met his wife Eiko Tomiyasu in 1946, and they married in 1947. Dr. Raney reviewed Kiyo Tomiyasu's myriad awards and honors, including his and Eiko's philanthropy and award initiation, featuring the Eiko and Kiyo Tomiyasu Endowed Professorship at Caltech and the IEEE Kiyo Tomiyasu Award for early career achievements.

In 1958, Townes and Schawlow invented the laser, it was realized by Maiman in 1960, and beginning just a year afterward, from 1961–67 Kiyo Tomiyasu led the GE Laser Group, publishing a seven-paper bibliography of laser and laser-device research in the *IEEE Journal on Quantum Electronics* from 1965–68. To date, Kiyo Tomiyasu holds 20 U.S. patents (1956–72) and has published 95 refereed papers (1948–2010) and one book [1]. His first patent (1958), entitled "Serrated Choke System for Electromagnetic Waveguide", is the invention that prevents potentially harmful microwave radiation from leaking through the seal of a microwave oven door, even when an object is lodged between the door and the inside wall of the oven [2]. He received the GE Steinmetz Award in 1977 "for his work in microwave sensors and devices, which has led to more effective satellite designs, and for his co-invention of the high-brightness disc laser." Dr. Raney, who worked for the Canada Center for Remote Sensing from 1976–94 and was responsible for the conceptual design of the RADARSAT synthetic aperture radar (SAR), credited Kiyo Tomiyasu's 1981 published paper on wide-swath SAR for providing the underlying insights that were key to the sucess of the Canadian Space Agency's RADARSAT [3]. Finally, Keith Raney thanked Kiyo Tomiyasu for his many contributions and commented on his character, saying in part, "… and you have always maintained perspective, while being energetic, original, gentle and generous."

Second, Prof. Reising introduced the presentation entitled "Communication Coding of Pulsed Radar Systems," given by Werner Wiesbeck of the University of Karlsruhe. In his presentation Prof. Wiesbeck demonstrated how the technologies and processing of radar and communication may be combined to produce an intelligent transportation system allowing driver assistance, congestion avoidance, dynamic route planning and other benefits. The implementation is partly based on using communication signal coding, e.g. orthogonal frequency division multiplexing, to create joint radar and communications systems. Prof. Wiesbeck showed that this has been verified through measurements from vehicles at 24 GHz. Digital beamforming is used for azimuth processing, and most importantly, one system can accomplish both radar and communications functionality.

Third, Prof. Reising introduced the presentation entitled "The Future of Spaceborne Synthetic Aperture Radar" by Gerhard Krieger and Alberto Moreira of the German Aerospace Center (DLR). Dr. Krieger gave the presentation, to which he added the subtitle, "A Tribute to the Pioneering Work of Kiyo Tomiyasu". First, he related the first civilian satellite using SAR, Seasat, to Kiyo Tomiyasu's 1978 tutorial paper in the *Proceedings of the IEEE* on SAR and its applications to imaging of the ocean surface [4]. Then he covered the history of

Shown after the special session, left to right, are GRSS President Alberto Moreira, Werner Wiesbeck, Gerhard Krieger, Paul Rosen, Kiyo Tomiyasu, Eiko Tomiyasu, Keith Raney, Martti Hallikainen, Steve Reising and Jón Atli Benediktsson.

civilian space-borne SAR from 1978 to present, focusing on the myriad applications, including earthquakes, volcanoes, glaciers and sea ice, ocean, land environment, subsidence, traffic, disasters and reconnaissance. He focused on the "many ingenious ideas of Kiyo Tomiyasu", including the implementation of bistatic radar using two satellites that Kiyo presented in an IEEE EASCON conference paper in 1978. This idea eventually led to DLR's TanDEM-X mission successfully launched in June 2010. Dr. Krieger cited specific sentences of Kiyo Tomiyasu's 1978 conference paper that showed how 3-D imaging of the Earth could be accomplished using formation flying of two SAR satellites. He then showed data from the brand-new TanDEM-X missionand discussed new, future techniques, including the potential for 4-D SAR imaging.

Session Co-Chair and GRSS Executive VP Jón Atli Benediktsson introduced the fourth presentation, "Kiyo Tomiyasu, Co-Seismic Slip and The Krafla Volcano: Reflections on InSAR and Earth Science" given by Paul Rosen of the NASA/Caltech Jet Propulsion Laboratory. Dr. Rosen covered the latest results of applying interferometric SAR for the benefit of earth science, especially to study the effects of earthquakes and volcanoes, relating to Kiyo Tomiyasu's recent interest in the potential for earthquakes to be scientifically predicted. It was also very timely to talk about one of the volcanoes in Iceland.

At the conclusion of his presentation, Dr. Rosen presented to Kiyo Tomiyasu a 11" × 17" plaque with a satellite view of Russell Crater Dunes on Mars, an 8-inch × 12-inch image from the Mars Reconnaissance Orbiter High Resolution Imaging Science Experiment, with the citation:

"Presented to KiyoTomiyasu. With greatest appreciation on your ninetieth birthday for a lifetime of innovation in remote sensing,"

NASA Jet Propulsion Laboratory, California Institute of Technology,
Signed: Charles Elachi, Director.

Finally, Prof. Benediktsson introduced the final presentation, "Uncle Kiyo: GRSS Mentor and Corporate Memory," presented by Martti Hallikainen of Aalto University, Helsinki, Finland. Prof. Hallikainen included a personal anecdote of his youngest daughter, Paula, meeting Kiyo Tomiyasu for the first time at the AdCom meeting in Helsinki, when she was six years old. She immediately began calling him "Uncle Kiyo", and that appellation has lasted until her adult years. Then, in a humorous tone, Martti Hallikainen provided the audience with many examples of e-mails that Kiyo Tomiyasu has sent over the past 11 years to various GRSS AdCom members. In these examples, Kiyo Tomiyasu was motivating AdCom members to apply the highest standards of practice and consistency with regard to our operations, titles of officers, nominations and elections. Prof. Hallikainen made it clear that Kiyo Tomiyasu still continues sending these e-mails and keeping track of GRSS records [5] in 2010, marking a remarkable 70 years of involvement in and a lifetime of service to the IEEE.

At the conclusion of the five presentations in the Special Session in Honor of the Achievements of Kiyo Tomiyasu, on behalf of the IEEE Geoscience and Remote Sensing Society, GRSS Executive VP Jón Atli Benediktsson presented Dr. Tomiyasu with a book entitled *Mountains from Space: Peaks and Ranges of the Seven Continents* by Stefan Dech, Reinhold Messner, Rudiger Glaser, Ralf-Peter Martin of the German Aerospace Center (DLR), published by Harry N. Abrams, Inc., 2005, 244 pages, with 148 cloud-free illustrations in full color, at image ranges of 15 miles from aircraft to 500 miles from satellites. The book

was personally signed by 36 colleagues and friends of Kiyo Tomiyasu who are also prominent members of the GRSS.

Brief Biography of Kiyo Tomiyasu

Kiyo Tomiyasu was born in Las Vegas, NV, on September 25, 1919. Dr. Tomiyasu received the B.S. degree in electrical engineering from the California Institute of Technology, Pasadena, CA, in 1940; the M.S. degree in communication engineering from Columbia University, New York, NY, in 1941; and the Ph.D. degree in engineering science and applied physics from Harvard University in 1948. In 1949, he joined the Sperry Gyroscope Company, Great Neck, NY, as a project engineer. In 1955 he joined the General Electric Microwave Laboratory, Palo Alto, CA, as a consulting engineer, and five years later he joined the General Electric Research and Development Center, Schenectady, NY, where he was involved with lasers and microwave projects. In 1969, he transferred to the General Electric Valley Forge Space Center, Philadelphia, PA. There he became involved with microwave remote sensing of the Earth using satellite-borne radiometers, scatterometers and synthetic aperture radars (SARs). During the late 1970s, he published seminal journal papers on wide-swath SAR that helped to form the basis of the Canadian Space Agency's successful RADARSAT. As a result of corporate mergers, he became an employee of Lockheed Martin Company. After 50 years with the heritage company, he retired in 2005. He and his wife, Eiko Tomiyasu, now reside in Pomona, CA.

Dr. Tomiyasu is a Life Fellow of IEEE, with over 60 years of membership. He was President of the IEEE Microwave Theory and Techniques Society (MTT-S) in 1960–61, and served on its Nomination Committee and Awards Committee. He was the Editor of MTT Transactions in 1958–59, and Guest Editor of the May 1978 Special Issue on High Power Microwaves. In 1973, he was elected as Honorary Life Member of MTT-S and of its Administrative Committee. He received the Microwave Career Award in 1980 and the MTT-S Distinguished Service Award in 1987.

Dr. Tomiyasu's involvement in the IEEE Geoscience and Remote Sensing Society (GRSS) began in 1980, when GRSS was established as a reorganization of the Group on Geoscience Electronics of the Institute of Radio Engineers, which had been in existence since 1961. Dr. Tomiyasu led the revitalization of GRSS awards in 1981 and became its first Awards Chairman. He has been an Honorary Life Member of the IEEE GRSS and its Administrative Committee since 1999. He received the IEEE Centennial Medal in 1984 and the Third Millenium Medal in 2000. He donated to and initiated the IEEE Kiyo Tomiyasu Award (which he continues to call the IEEE Mid-Career Award), an IEEE Technical Field Award that recognizes early-to-mid career contributions to technologies that show promise of innovative applications. In May 2009, at the IEEE International Microwave Symposium in Anaheim, CA, Dr. Tomiyasu was inducted into the IEEE Heritage Circle to honor a lifetime of giving to IEEE.

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[1] K. Tomiyasu, *The Laser Literature: An Annotated Guide*, Plenum Press, New York, 1968, 172 pp.

[2] K. Tomiyasu, "Minimizing Radiation Leakage from Microwave Ovens," *IEEE Microwave Magazine*, vol. 9, no. 1, pp. 76–78, Feb. 2008.

[3] K. Tomiyasu, "Conceptual Performance of a Satellite Borne, Wide Swath Synthetic Aperture Radar," *IEEE Trans. Geosci. Remote Sensing*, vol. GE-19, pp. 108–116. April 1981; Correction, p. 171, July 1981.

[4] K. Tomiyasu, "Tutorial Review of Synthetic Aperture Radar (SAR) with Applications to Imaging of the Ocean Surface," *Proc. IEEE*, vol. 66, pp. 563–583, May 1978.

[5] K. Tomiyasu, "History Page: GRSS KEY MEMBERS (1981–2009)," *IEEE Geoscience and Remote Sensing Society Newsletter*, Cumulative Issue #150, pp. 28–29, March 2009.

GRSS, AN OBEDIENT SOCIETY, WITHOUT BORDERS

Kiyo Tomiyasu
IEEE Life Fellow
Pomona, California

With great humility, I appreciate the exceptional and memorable session held at IGARSS 2010 in Honolulu to celebrate my 90th birthday. This occasion gave me an opportunity to recall the events that occurred since 1979 when Professors Keith Carver and Fawwaz Ulaby asked my advice on the formation of the Geoscience and Remote Sensing Society (GRSS), to replace the extant Geoscience Electronics Society. I did not expect nor anticipate at that time the phenomenal growth of interest and activities that ensued in the subsequent 31 years. While pondering this, I encountered a 1995 paper by Professor John Silber, President of Boston University, "Obedience to the Unenforceable" an address delivered at a commencement.

Professor Silber gives credit to Lord Moulton (1844–1921), a mathematician and British judge, who noted that conduct, can be bound on one end by laws that can be enforced, and at the other end, personal freedom. In conducting their activities GRSS professionals and scientists are in this unenforced range.

The numerous papers published in our Transactions, and numerous papers presented and posted at IGARSS, and talks presented at GRSS Chapter meetings, our willingness to share knowledge, and to teach and inform others of new analyses, concepts, and to pass on knowledge for the benefit of the GRS Society, are in this unenforced domain. The principles are addressed in the IEEE Code of Ethics.

In performing these activities, our contributions to GRSS and hence to IEEE, becomes open knowledge, that is, service and knowledge without borders.

AN INTERVIEW WITH ALBERTO MOREIRA, PRESIDENT OF GRS-S

Paul E. Racette, NASA/GSFC, US

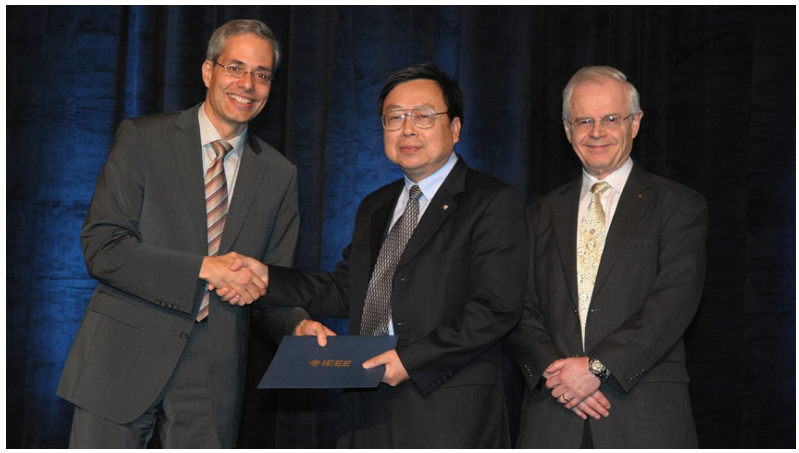
During the 2010 IGARSS in Honolulu, I had the pleasure to talk with Dr. Alberto Moreira, the Geoscience and Remote Sensing Society president, about his career, the GRS-S and his vision for Earth observations. What follows is an expanded version of the interview originally published on www.earthzine.org.

Dr. Alberto Moreira has a dynamic vision for remote sensing that is now, he says, in its golden age. And he sees that the rewards of maturity also bring responsibility. "This is a living Earth. We have a responsibility to leave the Earth at least in as good of condition as it is today."

Dr. Moreira is a pioneer in research and development of high-resolution radar signal processing, innovative synthetic aperture radar (SAR) system concepts and associated techniques like radar tomography, digital beam forming and advanced imaging modes. He received the B.S.E.E. and the M.S.E.E. degrees, in 1984 and 1986, respectively, from the *Aeronautical Technological Institute ITA*, Brazil and the Eng. Dr. degree (Honors) from the *Technical University of Munich*, Germany, 1993. In 2003, he received a full professorship from the *University of Karlsruhe*, Germany, in the field of Microwave Remote Sensing. As its chief scientist and engineer, Prof. Moreira managed from 1996 to 2001 the SAR Technology Department of the Microwaves and Radar Institute at the *German Aerospace Center* (DLR). Since 2001, he is the director of the *Microwaves and Radar Institute at DLR*. The Institute contributes to several scientific programs and space projects for actual and future air- and space-borne SAR missions. Prof. Moreira is the Principal Investigator for the *TanDEM-X* mission led by DLR.

His personal interests are dynamic, too. He is South American from Sao Jose dos Campos in Sao Paulo, Brazil. He went to Germany for his PhD and met his wife, also a Brazilian, in an art museum, an interest they share. His father is an architect, plays the violin and paints and his mother is a professional musician, from whom he learned to play the piano. He and his wife have two children, 12 and 14. His hobby, begun when he was 17, is gliding a tow airplane without a motor in which he has participated in world championships. "It's incredible the flight of gliders, a very nice experience. And this perhaps inspired me to work with space research.

Alberto Moreira, IEEE-GRSS President at the IGARSS 2010 Awards Banquet.



Alberto Moreira and IEEE President 2009 John Vig present Prof. Ya-Qiu Jin the 2010 IEEE GRS-S Education.

When you fly you are like a bird and can see the ground below, just like remote sensing."

Racette: How did you enter the field of remote sensing?

Alberto Moreira: My professor in Brazil told me if I wanted to make good research in my field I should go to either the United States, Europe, or somewhere else. I got a scholarship from the German government and with that I came to DLR, the German Aerospace Center, in '86, to earn a PhD in synthetic aperture radar. And this was a very challenging time for SAR because at that time, a few people had a deep understanding on how it works. Even the digital processing algorithms that could deliver a very focused image were not well understood. And my task at DLR was to develop a real-time algorithm for our airborne SAR. At that time we had workstations that were very slow. It took two days to process one SAR image, with some ten by ten kilometers. They had a request to have these in real-time. That was the topic of my PhD to develop an algorithm for real-time airborne SAR processing. At the end of my PhD, this was implemented in the airborne SAR. We had twenty-eight digital signal processors, dedicated computational units. We could have SAR images in real-time with three meters resolution, and these were used for more than ten years during innumerous airborne campaigns.

Racette: You're now the director of the *Microwaves and Radar Institute* at DLR.

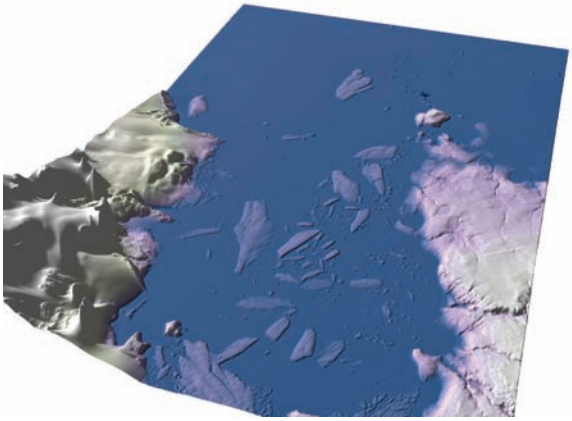
Alberto Moreira: This does not happen very often at DLR. I made a sort of career at DLR at the start as a PhD student. I was contracted as a researcher and then, after three years, I was a group leader responsible for ten people. In '96, I got the responsibility of a full department with some 35 people. Then in 2001, I was very proud to be selected as the director of the microwaves and radar institute. We are some 130 people. Our institute is shaping the future radar missions of the German space program. All the new radar missions in Germany are coming from our institute.

Racette: Does that include the ESA, the ERS-1 and...

Alberto Moreira: We have made substantial contributions in the conceptual analysis, the performance estimation and calibration for all the ESA radar missions. For the *Sentinel-1* we have a contract from industry for defining the calibration algorithms of the mission. We have also had international programs with NASA. Since the eighties we have been collaborating with JPL in the scope of the *Shuttle Imaging Radar missions* SIR-C/X-SAR, and also *SRTM*. DLR has contributed with the X-band radar systems for these missions. SIR-C/X-SAR in '94 was a milestone in radar development because this was the first mission with three radars at three different frequencies. In 2000, with the SRTM [Shuttle Radar Topography Mission] we had one radar from JPL, a C-band radar, and the X-band radar from Germany, both for topographic mapping. That mission was also again a milestone in remote sensing because the topographic data from interferometric SAR measurements became a reference for the geocoding of remote sensing data and for several geoscience applications.

Racette: The *TerraSAR-X* is Germany's first radar satellite.

Alberto Moreira flies a German glider (ASW20, 15 m span) over the atlantic mountains in Brazil.



First Digital Elevation model of TanDEM-X produced just 25 days after launch. The picture shows the ice floes on the coast of October Revolution Island. Due to the very large interferometric baseline during the approximation phase of the satellites, the height accuracy is as good as 30 cm.

Alberto Moreira: That's a mission in a public-private partnership between DLR and the German industry. TerraSAR-X was launched in June 2007. Since then it is supplying high-resolution radar images for scientific and commercial applications. TerraSAR-X is the fruit of consistent development of German radar technology over many years and is an example of successful cooperation with the German space industry. Our institute is responsible for the system engineering, radar instrument operation and calibration and is involved in a number of scientific proposals for data evaluation.

Racette: How many free flying SARs have been launched?

Alberto Moreira: We have a tremendous development in the radar area. Ten years ago, we had two satellites in space: *RadarSat-1* was one and the *ERS-2*. These were single frequency, no polarization and so on. As of today we have fifteen spaceborne radars flying with different frequencies and polarizations and this has been a huge development. The great number of SARs in space is a prominent example of the golden age of remote sensing.

Racette: Fifteen SARs?

Alberto Moreira: All SARs! In addition to ERS-2 and Radarsat-1, that are still operating, we have three *CosmoSkymed* satellites, we have the *ENVISAT/ASAR* satellite, we have *ALOS/PALSAR*, we have the *TerraSAR-X, TanDEM-X, TECSAR* from Israel, five *SAR-Lupe* satellites, and *Radarsat-2*. So we have now indeed sixteen and a new era for SAR remote sensing!

Racette: So you are the Principal Investigator on the *TanDEM-X*.

Alberto Moreira: In 2001 we started with the realization of *TerraSAR-X* satellite in Germany. And then in 2003, the national call for the next Earth Observation mission after TerraSAR-X was issued in Germany. I had the vision at that time: our institute should submit a strong proposal for a first interferometric SAR mission with close formation flying because of the huge demand for digital elevation models with improved quality. In 2006, we were very happy that the German Space Agency selected our mission proposal, TanDEM-X, for implementation. That was a challenge: A lot of changes could not be done as we would like because *TerraSAR-X* was almost built and scheduled to be launched in 2007. We started indeed in 2004-05 doing the kind of minimal changes in *TerraSAR-X* in order to allow for a bistatic radar operation. *TerraSAR-X* was launched in 2007 and *TanDEM-X* now in June 2010.

Racette: So it just launched recently.

Alberto Moreira: Very recently, but our team at DLR is so strong: three days after the launch, we produced our first radar image! This is a world record, normally it takes a few weeks or even months to have the first image. And just last week, 25 days after the launch of TanDEM-X we were able to produce our first DEM [digital elevation map] with a height accuracy of about 30 cm. Still, with a big separation between the satellites, as they are flying three seconds behind the other, this is more or less 20 kilometers. They have been approaching very slowly and now they are just about 350 meters from each other!

Racette: What are the objectives of the TanDEM-X mission?

Alberto Moreira: The primary objective is to produce a new global digital elevation model with accuracy much better than what is currently available. Today what we have globally is about ten meters height accuracy. From SRTM we don't have the ice caps, we only have DEM data within ±60 degree latitude because the shuttle could not cross the poles. With TanDEM-X we will have global coverage of consistent quality with horizontal spacing of about 12 meters and a height accuracy of 2 meters. For local areas, we can achieve accuracy that is even better than one meter in the height. For example, last week our first DEM had an accuracy of about 30 centimeters. Because the separation is so big, the interferometer becomes very sensitive. But we cannot map the whole Earth, for example the Himalayas, the Alps, or Rocky Mountains with accuracy of a few ten centimeters. That's too sensitive: you lose control of the topography. In the first year, we'll map the Earth with accuracy of about four meters. Then we'll map it again the next year with much higher accuracy. The two products will deliver a high quality DEM with accuracy of about two meters.

Racette: Now, GEOSS is built around the nine societal benefit areas. What are the societal benefits of TanDEM-X?

Alberto Moreira: Basically, the global DEM, is the first goal of TanDEM-X. With this product we make contributions to the following 5 GEOSS benefit areas. One example is *hydrology*. Water flows according to the ground slope. If we use the present-day DEM's ten meters accuracy to simulate waterflow, then you can see how inaccurate water modeling can be. Other benefit areas are *disaster* (e.g. high resolution 3D maps

of affected areas), *climate* (topographic maps of the polar caps providing high-resolution information about the ice melting), *agriculture* (biomass estimation of crop fields by using the innovative technique of polarimetric SAR interferometry) and *ecosystems* (monitoring of forest areas, aforestation and deforestation). We are also planning to produce global maps on land use change since we are going to map the whole land masses twice.

Racette: How are you incorporating these radar data sets with GEOSS?

Alberto Moreira: We are working in one of the GEOSS working groups that is also working with the SRTM DEM and with the ASTER DEM. The TanDEM-X mission was only possible because of a public-private partnership with the industry. Our industry partners paid 30% of the cost of the spacecraft, and DLR the rest. We cannot open the whole DEM to the scientific community on a global basis because otherwise you don't have a commercial market for the industry. We plan to make available to GEOSS a DEM with reduced pixel resolution but with height accuracy much better than currently available. This is how we have established industry partnerships so that we can do business as well as research and contribute to GEOSS.

Racette: How do you see Earth Observation evolving?

Alberto Moreira: In the GRSS, we had a membership growth of 41%, this is the highest of all IEEE's 38 societies. This is, in part, because what we do is fascinating. We can measure things from space that no one 20 years ago could believe would be possible. We can measure the deformations of the land surface with millimeter accuracy. We can measure biomass from space, measure soil moisture and see how the ice caps are melting with incredible accuracy. We can see how sea level is increasing every year from space with millimeter accuracy… and so on. The research that is driven by the scientific community is allowing a number of new applications in the commercial markets, services like oil spill monitoring, environmental monitoring, ship monitoring in the northern areas during the winter, and services for precision farming.

Twenty years ago there was a claim that satellite measurements are not reliable. The problem was they did not have information diversity, they did not have good accuracy, the resolution was poor. Today, this has changed. With nearly every mission launched, we are surprised because it can do more than it was prescribed to do. We are in a golden age for remote sensing. Contributions of the GRSS can be seen in recently launched missions such as SMOS, the CryoSat, and TanDEM-X. These are all missions in which members of our Society have made a significant contribution from the conceptual design, calibration, implementation and information retrieval. The GRSS is a fascinating society and it has really been a pleasure for me from the beginning. I have been a member involved in the GRSS for about 20 years.

Racette: 1990 was my first IGARSS.

Alberto Moreira: Ok, well we were almost together.

Racette: IGARSS this week has been phenomenal. Congratulations to you and the organizers who have done a great job for arranging IGARSS's 30th anniversary. The society has had significant influence and impact on the development of remote sensing and the geosciences. What are some of the highlights of the society's contribution that you see?

Alberto Moreira: One nice example is the monitoring of earthquakes and volcanoes. This year at IGARSS we have had several sessions dedicated to remote sensing of volcanoes and earthquakes. What we are seeing today is incredible. We can observe the volcano's inflation and deflation over decades using satellites. In the early 1990's came the first results of applying interferometry to study volcanoes. This research field on interferometry is something that was born from the GRSS community that has led the field over the past two decades and still does today. Today, we can observe the inflation of the volcanoes with centimeter accuracy. Earthquake is a bit more challenging because the movement is much more sensitive. We need to detect movements with millimeters accuracy. This is but one of the many, many examples I could give.

Racette: The GRSS membership has broad diversity in terms of international participation. However women and minorities are still underrepresented in the society. What is the society doing to address underrepresentation?

Alberto Moreira: Well we are a very international society, with half our membership existing outside the US, and also our Administrative Committee is comprised of 18 people of whom more than half come from outside the US. Our international representation stems from the nature of our work – this is global and this is outstanding. We have a minority program, we have student programs and we support the participation of more women in our society. For example, yesterday we had a young professional luncheon and there were more or less 60 or 70 participants, all young, and at each table with ten people there was one senior member of the society and I had the pleasure to be at a table and with me there were 7 women and 2 men. This particular event is a good example of bringing students, women students, the future generation, into our Society and I think these efforts will very much improve our Society.

Racette: What do you see are the top technical challenges to address over the next decade?

Alberto Moreira: Well we need to separate the technical challenges into categories such as lidars, imaging optical sensors, radars, and also microwave radiometers. In all these measurement areas we need to move in the direction of data continuity. Whether we are mapping long-term processes or short term, the measurements will only become reliable if there are data available over long periods. Radars, for example, digital beam forming represents the future technology, allowing a much better performance, swath width and resolution than existing systems. Microwave radiometers are moving towards the concept of synthetic aperture. The optical, high resolution, and several hyperspectral sensors are just coming out with an incredible number of bands.

One most important part is that these technologies must become affordable – remote sensing must be affordable. The cost of the satellites must become cheaper. We have good examples from Europe over the last few years where the industry makes offers much below the cost cap set by the funding agency. This is a revolution and I hope that in this way we can afford these new technological developments. We need solutions where the next generation of technology has a heritage from the past. We need a road map for 20 years ahead, so we can plan the heritage from one technology to another without big jumps that are usually associated with high risks and costs. Then technology development becomes affordable.

Racette: ESA just recently hosted the *Living Planet Symposium*. Do you view the Earth as a living entity?

Alberto Moreira: The Earth is dynamic. Every minute, every second something is changing on the Earth. Human beings make the Earth much more dynamic. This is a challenge because Earth's processes are rather complicated and they interact with each other in ways we do not understand. One big challenge is to guarantee that we have sustainable development. The Earth is so fragile that if we don't care, future generations will have less chance for a better life than we have. And this we cannot afford. Sustainable development is an agreement between countries, every nation has a responsibility to make sure that they are taking care of the water resources. Every individual has this responsibility. This is a living Earth. We have a responsibility to leave the Earth in at least as good of condition as it is today.

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GEOSCIENCE DEPENDS ON GEOSPATIAL INFORMATION STANDARDS

Siri Jodha Khalsa, University of Colorado, US
George Percivall, Open Geospatial Consortium (OGC), US

Early in their studies, science and engineering students learn the importance of using a consistent set of units – typically the International System of Units (SI). The meter is the base SI unit of length and without an accepted definition and method for realization of the meter, science would be impossible. Standards bodies – for the meter this is the International Bureau of Weights and Measures (BIPM) – enable worldwide uniformity of measurements and their traceability to the SI.

Similar to standards for measurements, information standards are fundamental to the progress of science. Usage of internationally accepted standards allow scientists to reliably access and review data and information gathered by other scientists in order to advance the knowledge of our world.

Science advances in part by working with current standards to arrive at conclusions based on those accepted standards. Science also advances by reconsidering accepted standards, offering new axioms, and working towards a view of the world based on new standards. In either paradigm, the need for well defined and realized standards is vital to the progress of science.

Geospatial information standards provide the basis for communicating data, information and hypothesis about our world. In specifying earth location basic units of length such as the meter must be placed within a framework of accepted standards for coordinate reference systems (CRS). CRS standards from the International Organization for Standardization (ISO) and the Open Geospatial Consortium (OGC) allow us to unambiguously place data in a geospatial context. These standards are based on the mathematics of coordinate systems and the realization procedures of Geodesy.

Geospatial information not only involves coordinates, but also the attributes of the environment at the specified location. The attributes that are used to describe the environment require more interpretation than do spatial coordinates. Geospatial information standards address attributes in the categories of Observations, Features and Coverages. International standards for each of these types of attributes allows for differing perspectives of the world, mainly distinguished by the complexity of the abstract model associated with the perspective. Observations are closest to actual measurements. While traditional GIS systems, with a heritage in map-making, model the world in terms of geometric objects (points, lines, polygons, etc), with associated attributes, features, in contrast, are primarily typed by their conceptual significance within a specific application-domain. Features allow for a more involved semantic world-view as the basis for the attribute. Coverages return values for all locations in a spatio-temporal domain and

the domain is often discretised or sampled onto a grid. Again, clear definitions and methods for realizing these standards for geographic information are critical for clear communication and scientific progress.

Not only does geospatial information need to be defined based on internationally accepted standards, it must also be shared through mechanisms that enable unambiguous and automated transfer within the distributed information systems that underpin our scientific research infrastructure. Standards for discovery, access and processing of geospatial information have been defined and realized. Just as the Internet has made information dramatically more useable, standards for interoperability[1] of geospatial information and allow for better and more comprehensive science.

So how do international standards for geospatial information get developed and adopted in communities of practice? This is a complex process involving many scientists and engineers using the standards as well as the organizations that develop and maintain the standards. Two sessions at the IGARSS 2010 addressed the development and application of geospatial information standards specifically for the geosciences.

IGARSS 2010 Session: International Open Standards for Geosciences – Standards Development

Use of international open standards for geospatial information and services is increasing as the geoscience community participates in both the application and development of the standards. This first session included three papers describing some of the organizations currently working to develop and advance the adoption of international standards.

THE IEEE COMMITTEE ON EARTH OBSERVATIONS STANDARDS WORKING GROUP

Siri Jodha Khalsa; University of Colorado
Steven Browdy; OMS Tech, Inc.

The IEEE Committee on Earth Observations (ICEO) Standards Working Group (ISWG) is an international body working to further the use of international standards in the development of the Global Earth Observation System of Systems (GEOSS). It was formed by the ICEO in 2006 with a primary aim of helping to establish a process for reaching agreement on standards and other practices for achieving interoperability among components contributed to GEOSS.

The ISWG is exemplifying, within the GEOSS context, the use of international standards in carrying out its work, as well as advocating the use of standards within GEOSS communities of practice through the close cooperation between the ISWG and the GEOSS Standards and Interoperability Forum (SIF). Standards usage and interoperability within GEOSS continue to improve as GEOSS evolves through a series of Architecture Implementation Pilot programs, which include a growing number of participants every cycle. The ISWG, in support of the SIF, is reaching out to various GEOSS tasks that are developing domain taxonomies and ontologies, in order to help guide the evolution of semantic interoperability for the GEOSS. The ISWG also works closely with the IEEE Standards Association and its Standards Coordinating Committee 40 – Earth Observations to guide the development of new standards to help GEOSS realize its goals.

OPEN GEOSPATIAL CONSORTIUM (OGC) STANDARDS FOR THE GEOSCIENCES

George Percivall; Open Geospatial Consortium

Standards from the Open Geospatial Consortium (OGC) and other organizations are the basis for successfully deploying a seamless, distributed information infrastructure for the geosciences. This paper in the session described how OGC standards, deployment architectures and interoperability initiatives have been developed and apply to the geosciences. Many of the standards now adopted by the OGC consensus process are the result of innovative processes in the OGC Interoperability Program.

The OGC is an international not-for-profit voluntary industry consensus standards organization that provides a forum and proven processes for the collaborative development of free and publicly available interface specifications (open standards). OGC open standards have been implemented broadly in the marketplace and are helping to foster distributed and component technology solutions that geo-enable web, wireless, and location based services as well as broader government and business IT enterprises worldwide. OGC works closely with standards organizations and consortia in the technology community.

OGC standards were developed with requirements from the geosciences. Those OGC standards are now widely implemented providing interoperability for the geosciences.

GEOSS, INSPIRE AND GMES, AN ACTION IN SUPPORT (GIGAS)

Paul Smits, European Commission – Joint Research Centre

GIGAS (An Action in Support of GEOSS, INSPIRE and GMES) was a European Commission funded project to coordinate, align and institutionalize standards development and adoption across regional and international initiatives, namely GEOSS (mentioned above), INSPIRE, the Infrastructure for Spatial Information in the European Community, and GMES,

[1] ISO 2382-1. "The ability for a system or components of a system to provide information portability and interapplication, cooperative process control." Interoperability, in the context of OGC standards, is software components operating reciprocally (working with each other) to overcome tedious batch conversion tasks, import/export obstacles, and distributed resource access barriers imposed by heterogeneous processing environments and heterogeneous data.

the Global Monitoring for Environment and Security. The latter is a Joint initiative of the European Commission and European Space Agency and like INSPIRE is a legislative instrument. Three standardization organizations were also involved in the GIGAS project: OGC, ISO's Technical Committee on geographic information, TC 211, and the European Committee for Standardization (CEN) Technical committee on geographic information, CEN/TC 287. Interoperability through the adoption of standards is at the core of GEOSS, INSPIRE and GMES, which provide complementary approaches to similar goals and objectives. However, there are important differences in the related architectures and approaches to the promulgation and adoption of common standards. A goal of GIGAS was to characterize these differences and make targeted recommendations for each initiative, as well as for the participating standardization organizations, with the purpose of increasing harmonisation. GIGAS also provided a framework for Europe's contribution to the GEOSS Standards and Interoperability Forum.

IGARSS 2010 Session: International Open Standards for Geosciences – Standards Applications

This second session discussed some of the latest advances in implementing open standards for access, processing and presentation of sensor information to communities that include researchers, policy makers and general public. The five papers discussed current developments and the need for standards for types of observations including climate variables. Discussion by the session participants is resulting in additional feedback to standards bodies (OGC, ISO, etc.) to further advance the standards.

AIR QUALITY COMMUNITY EXPERIENCES AND PERSPECTIVES ON INTERNATIONAL INTEROPERABILITY STANDARDS

Stefan Falke; Northrop Grumman

Erin Robinson; Washington University in St. Louis

The air quality community includes a broad range of organizations across government, academia and industry addressing various components of the air quality system, including near real time monitoring of air pollution concentrations from surface, aerial and satellite sensors, forecasting of air quality conditions, and retrospective analysis of air quality. These activities have generated multiple projects and information systems that address different aspects of air quality science and management. The community has recognized the value of interoperability among these projects and systems and is collaborating in the use of international standards for data and information exchange in developing information networks across these systems. This paper described recent efforts and experiences in the use of web standards and anticipated next steps in the evolving air quality community information infrastructure.

In general, the air quality interoperability efforts have found success in using existing web standards to achieve a base level of interoperability but have enhanced their ability to share and use information across systems by extending the standards to meet community-specific requirements. As the community gains experience in how to implement and tailor the standards they will develop best practices that can be shared across the air quality community and more broadly to other interoperability communities for evaluation and potential integration with the formal standards development processes.

ONEGEOLOGY: A PRAGMATIC APPROACH TO INTERNATIONAL STANDARDS

Ian Jackson; British Geological Survey

OneGeology is a global venture to increase the accessibility of geological map data. Geological survey organizations from 113 countries are currently participating in OneGeology and to date 41 of those are serving geological data through a dedicated web map portal. The reason for the success of OneGeology since its inception in February 2006 lies in its four unifying goals: make existing geological map data web accessible; transfer know-how to the developing world; accelerate the progress of an emerging geoscience data interchange standard; use OneGeology to raise the public profile and understanding of geoscience.

It is perhaps not readily apparent to most who have heard about OneGeology that one of the project's four key aims is to accelerate the development of standards. The project has taken a different, pragmatic, approach to doing this – instead of focusing on the development of the standards themselves it decided to be a vehicle for applying, communicating and disseminating standards, and perhaps just as importantly, illustrating graphically the benefits that standards bring when they are in place and also how the absence of standards impedes interoperability and completeness of information.

The simple goal of OneGeology is to unlock an existing science resource and make it shareable. To some it may seem that OneGeology is not very ambitious and, in a research sense, its achievements rather mundane. However, to draw that conclusion would be to fail to comprehend the scale of the technical, logistical, cultural and political challenges of a project that attempts deployment internationally and especially into the developing world. Perhaps also it would seriously underestimate the importance of sharing, applying and disseminating our science and taking a pragmatic approach to developing and promulgating the standards to do that.

OPEN STANDARDS IN THE INTEGRATED OCEAN OBSERVING SYSTEM (IOOS)

Jeff de La Beaujardière; National Oceanic and Atmospheric Administration

The Integrated Ocean Observing System (IOOS) is a US interagency project led by the National Oceanic and Atmospheric Administration. The goal is to provide sustained observational data and model outputs regarding the open ocean, coastal waters, and Great Lakes in the formats, rates, and scales required by scientists, managers, businesses, governments, and the public to support research and to inform decision-making. Starting in 2008, IOOS began implementation of a Data Integration Framework (DIF) to enable the evaluation of interoperability specifications, to demonstrate the feasibility and value of providing integrated ocean observations, and to provide the beginnings of initial operating capability for a nationwide IOOS data management capability. The initial scope of the DIF included three data assembly centers (DACs), four customers, and seven observed properties, and has since broadened further.

The Data Integration Framework project identified three general classes of scientific information to target first – *in situ* feature data, gridded coverage data, and images of data – and recommended a web service and an encoding convention to be used in each case. These recommendations were intended to standardize a small number of data access methods and thereby to enable a single client application to obtain data from multiple providers, and to harmonize the representation of data from different providers. These services can be established either instead of or in addition to prior arrangements between individual providers and customers.

UNITED STATES NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) USE OF INTERNATIONAL STANDARDS FOR UAVS

Donald Sullivan; National Aeronautics and Space Administration

The paper described the evolution and adoption of international standards in the operation of sensor packages carried on NASA Uninhabited Aerial Vehicles (UAVs). The author was the architect and chief software engineer for communication on each of these UAVs. While early UAVs utilized Line Of Sight (LOS) communication links for sensor command and control (C&C), the General Atomics Altus was the first with over the horizon (OTH) C&C. Inmarsat geosynchronous satellites provided the communication capability. Subsequently, the General Atomics Altair marked the introduction of OGC standards usage, the OGC Web Map Service (WMS) Interface Standard. The currently operational General Atomics Ikhana OTH C&C via geosynchronous satellites, but it marks a major deployment of numerous OGC services, including the OGC Sensor Planning Service (SPS), WMS, Web Coverage Service (WCS), and Web Notification Service (WNS) interface standards. Additionally, this was the first integration with the NASA EO1 satellite SPS, and the tasking by the Northrop Grumman/Washington University, Saint Louis OGC Web Processing Service (WPS) wrapper on a Smoke Plume/Fire Model.

The paper concluded with a discussion of the ongoing effort building a standards-based sensor web on the Northrop Grumman Global Hawk, connecting all 11 onboard instruments through a PostGIS database backend running a suite of services, primarily defined by OGC standards. The backend mirrors a similar database aboard the aircraft.

A DISTRIBUTED DATA SYSTEM FOR INTERDISCIPLINARY ECOSYSTEM SERVICES MODELING

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Chengquan Huang; University of Maryland
Zhiliang Zhu; U.S. Geological Survey

Currently, there is much interest in developing ecosystem models to forecast how ecosystem services may change under alternate land use and climate futures. The knowledge base for ecosystem services is broad, and is often derived from diverse scientific disciplines. Building the required interdisciplinary models is especially challenging, because the data needed for ecosystem simulations are from different disciplines. These data must be interoperable in order for them to be used together, and be accessible from remote locations for distributed models. Additional difficulties include inconsistent data structures, formats and metadata, and limitations on computing, storage, and connectivity. Existing geospatial databases, data sharing systems, metadata systems, and modeling systems cannot meet the needs of interdisciplinary ecosystem service simulations for several reasons. First, the shared data, metadata, and models within such systems are generally designed for use on standalone computers or within closed networks, not for extensive sharing and integration of resources for interdisciplinary ecosystem simulations. Further, the systems designed to share the resources are typically built using inconsistent data formats and model coupling methods. Hence, the resources are often not interoperable and are not directly accessible to support the collaborations needed to address interdisciplinary ecosystem studies.

This paper proposed an architecture for sharing and integrating resources for interdisciplinary ecosystem services studies. Data from various sources, including satellite images, field observation, and other data types, are collected and stored in databases. Although different databases may be used to house different datasets, geospatial data services and metadata services are established to provide a consistent data access interface. The data services are compliant with OGC standards, such as WMS, WCS, and Web Feature Service (WFS). Metadata generated through metadata services will be compliant with ISO 19115/ISO 19139 geospatial metadata standards.

A DISTRIBUTED LIDAR PROCESSING MODEL BASED ON OWS AND BPEL

Lingjun Kang; Fuzhou University
Qunyong Wu; Fuzhou University
Ying Yuan; Xiamen University of Technology

LIDAR (Light Detection and Ranging) has gained more and more popularity for its ability to construct detailed digital elevation models, build 3D surface features and extract topographic parameters. However, current LIDAR processing systems tend to be centralized for several reasons. First of all, shorter acquisition cycles and larger volume point cloud datasets require excellent computing and storage ability for efficient post-processing. Secondly, from a software engineering perspective, workflow-like processing requires processing step separation for better maintenance and reuse. Thirdly, a universal interface for LIDAR data is necessary for lowering public threshold of accessing LIDAR data. To tackle these problems, this paper proposed a distributed LIDAR processing model, which abstracts LIDAR processing procedure into sequential steps, and consequently realizes these steps with GRASS modules and encapsulates them with an OWS (OGC Web Service) standard interface, and, finally, chains OWS with the de facto workflow language BPEL.

The paper proposed a LiDAR Markup Language (LML), understood as GML-based geometry part plus LAS-based non-geometry part. OGC's GML (Geography Markup Language) is a meta-language for modeling geographic object. The point type in GML is utilized to model geometry portion of LiDAR cloud point. LAS is standard exchange format defined by ASPRS (American Society for Photogrammetry and Remote Sensing). Standard attributes defined in LAS will help to tackle semantic heterogeneity of current LiDAR data. Currently LAS is a binary format instead of an XML-based format, which is suitable for data exchange on the Internet. Standard attributes defined in LAS are used for the non-geometry portion of a LiDAR cloud point.

This paper demonstrated the feasibility of a distributed LiDAR process model, which when compared to the traditional model, provides advantages in three aspects. First of all, LiDAR data is serialized as LML and separated from the process node. This improves data interoperability and sharing. Secondly, each process module is encapsulated as service and deployed on a different machine. This improves both process module interoperability and computing resource utilization. Thirdly, LiDAR workflow benefits concurrent computing model supported in BPEL.

Conclusions

These two sessions at IGARSS described how standards for geospatial information are being developed and highlighted several areas where they are being applied.

Applying international standards is a combination of policy and practice. Many organizations now require the use of standards in funded research and development projects – this is the policy part. The organizations recognize that in order to realize the highest benefit and lowest life cycle cost from their investments, adherence to standards is the most cost effective approach. But policy alone is insufficient. Communities of practice must develop and use what become international standards. The examples provided in these IGARSS 2010 sessions show how several geoscience communities are using established geospatial information standards and advancing beyond the current standards and feeding their experiences back into the standards development process.

To adequately study and address the broad global issues that confront society interoperability of information in the geosciences is necessary. Seamless discovery and access of relevant information from data providers around the world is achieved through standards-based protocols and metadata. Too much of researchers' time has traditionally been spent on locating data and many times there are datasets that satisfactorily fit the need that go undiscovered. Access to geoscience data in a fashion similar to documents on the World Wide Web dramatically reduces the time spent finding and evaluating data. Accuracy and precision of scientific data and information are achieved only through agreements about the data itself and how it is stored.

Without accepted geospatial information standards and methods for realization of the standards, progress in the geosciences would be impossible. Internationally accepted standards allow scientists to reliably review data and information gathered by other scientists in order to advance the knowledge of our world.

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NEW REMOTE SENSING MISSIONS

TANDEM-X: CLOSE FORMATION ACHIEVED

Manfred Zink, TanDEM-X Ground Segment Project Manager,
German Aerospace Center (DLR), Germany

TanDEM-X (**T**erraSAR-X **a**dd-o**n** for **D**igital **E**levation **M**easurement) opens a new era in spaceborne radar remote sensing. A single-pass SAR interferometer with adjustable baselines in across- and in along-track directions is formed by adding a second (TDX), almost identical spacecraft to TerraSAR-X (TSX) and flying the two satellites in a closely controlled formation. With typical across-track baselines of 200–400 m a global Digital Elevation Model (DEM) with 2 m relative height accuracy at a 12 m posting will be generated.

TDX was launched on June 21st into the TSX orbit but at an along-track distance of 16000 km. After drifting to 20 km distance the monostatic commissioning phase of TDX was successfully performed in less than 3 months. On October 14th TDX was maneuvered into close formation (horizontal/vertical separation 360/400 m, mean along-track distance 0 m) with TSX. First DEMs in bistatic operation have been generated already indicating the improvements compared to SRTM.

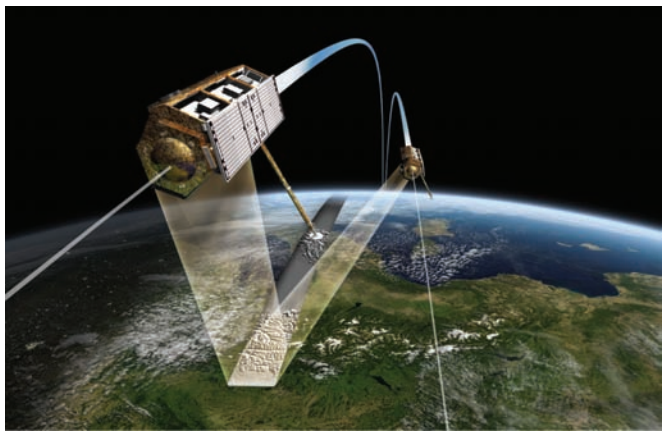


Figure 1. TDX and TSX flying in close formation.

TDX solid state mass memory capacity is 768Gbit which is doubled compared with TSX to support the collection of the enormous amount of DEM data.

The TanDEM-X Spacecraft

The TDX satellite is a rebuild of TSX with only minor modifications. This offers the possibility for a flexible share of operational functions for both the TerraSAR-X and TanDEM-X missions among the two satellites.

During the last phase of the TerraSAR-X spacecraft development, the SAR instrument design was extended to allow exchange of synchronization pulses to support coherent operation of both SAR instruments during bistatic operation. Six sync horns on each satellite provide a quasi-omnidirectional coverage. An additional propulsion system based on high-pressure nitrogen gas is accommodated on TDX. This cold gas system provides smaller impulses than the hydrazine system on both satellites (which is used for orbit maintenance) and supports formation flying by fine orbit control of the TDX satellite. The

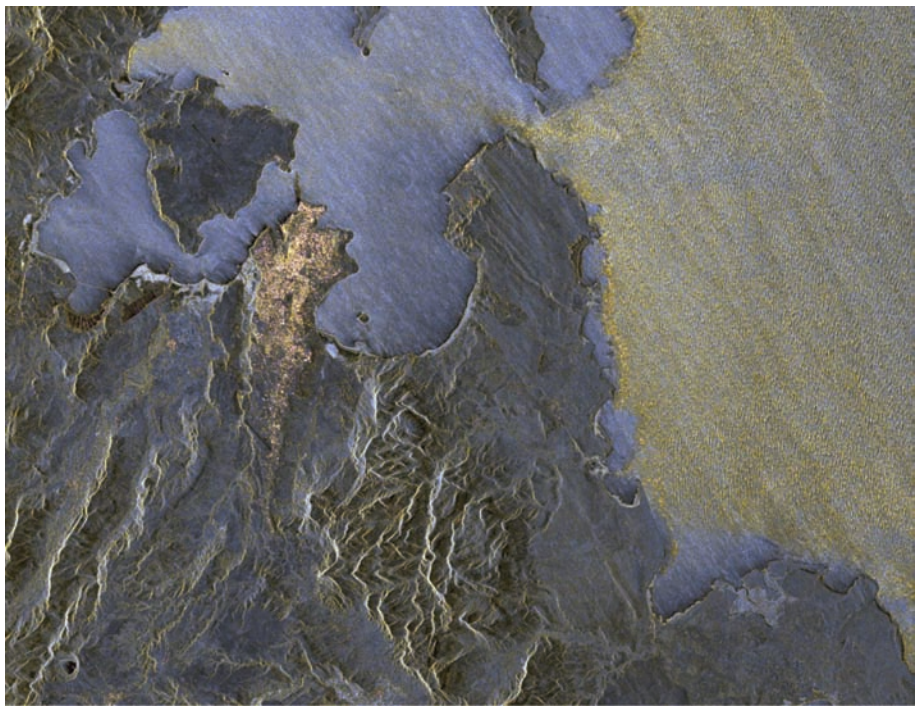


Figure 2. First SAR image acquired by TDX over the northern region of Madagascar only 3.5 days after launch.

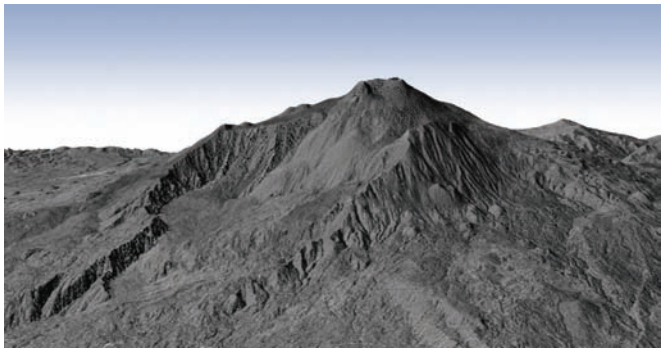


Figure 3. First bistatic DEM acquired by the TanDEM-X mission over Mount Etna on October 15th, 2010.

The TDX satellite is designed for a nominal lifetime of 5 years. Predictions for TSX based the current status of system resources indicate at least one extra year (until the end of 2013) of lifetime, providing the required 3 years of joint operation.

The Ground Segment

The missions TerraSAR-X and TanDEM-X jointly share the same space segment consisting of the TSX and TDX satellites orbiting in close formation and are operated using a common ground segment, that was originally developed for TerraSAR-X and that has been extended for the TanDEM-X mission. Specific new developments are described in the following.

The spatial baseline between the TSX and TDX is derived at mm accuracies from on-board GPS measurements taken by the two-frequency IGOR GPS receivers.

A key issue in operating both missions jointly is the different acquisition scenarios: whereas TerraSAR-X requests are typically single scenes for individual scientific and commercial customers, the global DEM requires a global mapping strategy. This strategy has also to account for the current formation flying geometry which, in turn, depends on the orbit parameters selected and for any given orbit configuration permits generating a digital elevation model only within a certain latitude range.

The two satellites will downlink their data to a global network of ground stations: Kiruna in Sweden, Inuvik in Canada, O'Higgins in the Antarctic, and Chetumal in Mexico. The global acquisitions for digital elevation model alone will absorb a data volume of more than 350 terabytes. After a brief quality check, the data will be recorded on tape and shipped to DLR in Oberpfaffenhofen for processing and archiving.

The entire processing chain is a new TanDEM-X specific development. However, it consists of individual modules which strongly benefit from the TerraSAR-X and the Shuttle Radar Topography Mission (SRTM) heritage. Major design drivers result from the acquisition strategy which requires the combination of several (global) coverages and application of multi-baseline processing techniques based on supporting intermediate products. Absolute height calibration will rely on globally distributed reference elevation data provided by the laser altimeter from the NASA ICESat mission.

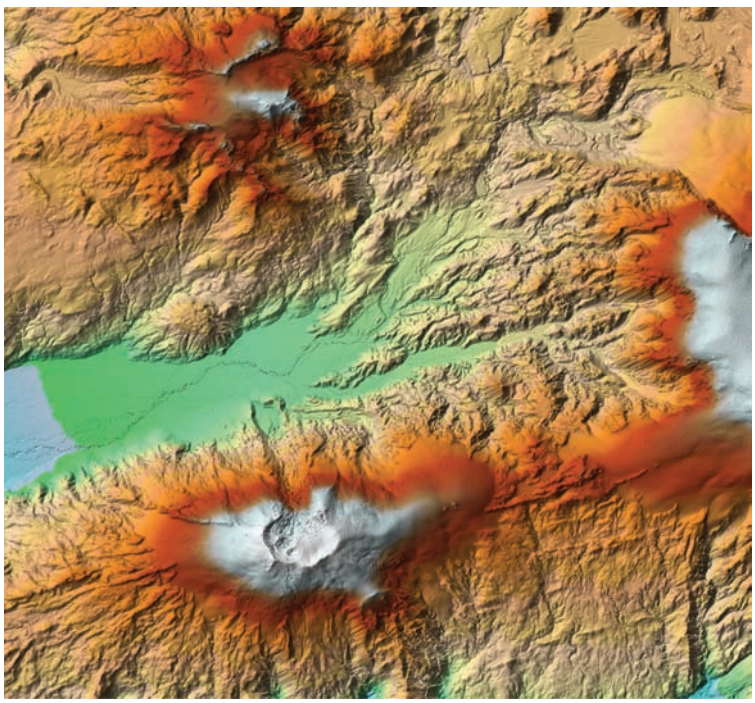


Figure 4. DEM of Eyjafjalla Vulcano in Iceland that has been active in spring 2010.

Close Formation Flight

An orbit configuration based on a helix geometry has been selected for safe formation flying. The helix like relative movement of the satellites along the orbit is achieved by combination of an out-of-plane (horizontal) orbital displacement imposed by different ascending nodes with a radial (vertical) separation imposed by the combination of different eccentricities and arguments of perigee. Since the satellite orbits never cross, the satellites can be arbitrarily shifted along their orbits. This enables a safe spacecraft operation without the necessity for autonomous control. Cross- and along-track baselines ranging from 200m to 10km and from 0 to several 100km, respectively, can be accurately adjusted depending on the measurement requirement.

Although the passive stability of the Helix orbit prevents collisions in principle, a number of mechanisms have been introduced in the satellite design to safeguard against collision and mutual illumination risks:

- In addition a safe mode based on the magnet torquers for attitude control was introduced on both satellites. Unlike the hydrazine propulsion system, employing the magnet torquers for attitude control will not lead to any orbit deviation. To complement this additional safety feature, the ground operating concept has been modified to ensure that the ground segment can respond swiftly enough to any problems on the space segment.
- To avoid mutual illumination, exclusion zones have been defined, orbit segments in which one of the two satellites is not allowed to transmit radar pulses. Moreover, the synchronization link between the two satellites can be used to check each other's operating status. If the sync signals received do not exceed predefined thresholds it is assumed the partner satellite has problems and the radar transmission will be immediately suppressed. Lastly TDX is equipped to receive telemetry data from TSX and to react on any non-nominal operating status.

Mission Status

In the first few weeks after launch the along-track distance was reduced from 16000 to 20 km and TDX was already maneuvered into a Helix orbit with 1.3 km horizontal separation. Thereby the movement due to the Earth's rotation during 3 seconds (corresponding to 20 km distance) was compensated and the same ground tracks as TSX were achieved to facilitate cross-calibration between the two SAR systems.

The subsequent monostatic commissioning phase was dedicated to calibration and performance verification and revealed calibration accuracies and overall performance of the TDX SAR system and its products as good as for TSX. Comprehensive testing of the various safety measures has been performed in parallel to check-out activities on the new ground segment elements. In a Formation Flight Review early October "green light" was given for entering the close formation, which was achieved on October 14th. Bistatic DEMs are being acquired since then (see Figs. 3 and 4). With TDX delivering identical single SAR product quality as TSX, the TerraSAR-X Mission is running operationally on both satellites since October 25th. That means that user orders for high resolution SAR data will be acquired by either TSX or TDX whereby the selection is performed by the mission planning depending on the available resources and by considering criteria like the exclusion zones.

The bistatic commissioning phase of the TanDEM-X mission is running in parallel and is currently planned to be finalized in December. Global DEM acquisitions will start after an extensive test and verification program in the coming weeks has been successfully completed.

Scientific Exploitation

Beyond the generation of a global TanDEM-X DEM as the primary mission goal, local DEMs of even higher accuracy level (posting of 6 m and relative vertical accuracy of 0.8 m) and applications based on Along-Track Interferometry (ATI) like measurements of ocean currents are important secondary mission objectives. Along-track interferometry will also allow for innovative applications to be explored and can be performed by the so-called dual-receive antenna mode on each of the two satellites and/or by adjusting the along-track distance between TSX and TDX to the desired value. Combining both modes will provide a highly capable along-track interferometer with four phase centers. The different ATI modes will e.g. be used for improved detection, localization and ambiguity resolution in ground moving target indication and traffic monitoring applications. Furthermore TanDEM-X supports the demonstration and application of new SAR techniques, with focus on multistatic SAR, polarimetric SAR interferometry, digital beam forming and super resolution.

TanDEM-X has an ambitious time schedule to reach the main mission goal. After the commissioning phase, the first two years are dedicated to the global DEM acquisitions, followed by six months of additional acquisitions to cover difficult terrain. The baseline geometry in these first years is optimized for DEM performance. If the baselines are suitable, a limited number of scientific acquisitions can be included already during this phase. After the DEM acquisitions even larger baselines can be adjusted for higher accuracy DEMs on local scales and for the exploration and demonstration of scientific experiments.

The science proposal submission for data requests is available over the TanDEM-X Science Service: http://tandemx-science.dlr.de/. More information about the TanDEM-X mission is available under http://www.dlr.de/hr/tdmx.

Acknowledgement

This article has been prepared with contributions by DLRs TanDEM-X Team comprising more than 100 colleagues from the Microwaves and Radar Institute, the German Remote Sensing Data Center, the German Space Operations Center, and the Remote Sensing Technology Institute.

TanDEM-X is being implemented as a public-private partnership between the German Aerospace Center (DLR) and Astrium GmbH, with funding from the German Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie, BMWi). DLR has developed the mission concept and the ground segment and is responsible for planning and managing the mission, controlling the two satellites, generating the digital elevation model and coordinating the scientific exploitation of TanDEM-X products. Astrium built the satellites and is sharing the costs of development and operation. As with TerraSAR-X, Infoterra, a subsidiary of Astrium, is responsible for the commercial exploitation of TanDEM-X data.

REPORTS

GRS-S PUBLICATIONS AWARDS PRESENTED AT IGARSS 2010 BANQUET

Publications Awards Committee: Martti Hallikainen (Chair), Roger Lang, Klaus Seidel, Tat Soon Yeo, Tony Freeman

The IEEE Geoscience and Remote Sensing Society's 2010 Publications Awards were presented at the IGARSS Awards Banquet on Thursday, July 29 in Bishop Museum, Honolulu, Hawaii, USA. Bishop Museum was founded in 1889 by Charles Reed Bishop in honor of his late wife, Princess Bernice Pauahi Bishop, the last descendant of the royal Kamehameha family. The Museum was established to house the extensive collection of Hawaiian artifacts and royal family heirlooms of the Princess, and has expanded to include millions of artifacts, documents and photographs about Hawaii and other Pacific island cultures. Today, Bishop Museum is the largest museum in the state and the premier natural and cultural history institution in the Pacific. The Awards Banquet was hosted by IGARSS'10 General Co-Chairs Karen St. Germain and Paul Smits together with TPC Co-Chairs Paolo Gamba and David Kunkee.

Figure 1. Bishop Museum was the venue for the Awards Banquet.

Figure 2. IGARSS'10 main organizers (from left) General Co-Chairs Karen St. Germain and Paul Smits with Technical Program Committee Co-Chairs David Kunkee and Paolo Gamba.

The following awards were presented by GRS-S President Alberto Moreira and GRS-S Awards Co-Chair Martti Hallikainen during the dinner:

- Transactions Prize Paper Award
- Letters Prize Paper Award
- Symposium Prize Paper Award
- Symposium Interactive Prize Paper Award
- Three Student Prize Paper Awards
- Chapter Excellence Award.

IEEE GRS-S Transactions Prize Paper Award

The GRS-S established the **Transactions Prize Paper Award** to recognize authors who have published an exceptional paper in IEEE Transactions on Geoscience and Remote Sensing during the past calendar year. When selecting the paper, other factors considered are originality and clarity of the paper. Prize: Certificate and $3000, equally divided between the authors.

The *2009 Transactions Prize Paper Award* was presented to **Simon Yueh, Steve Dinardo, Ahmed Akgiray, Richard West, Don Cline, and Kelly Elder** with the citation**:**

For a very significant contribution to the field of endeavor of the IEEE GRS Society in the paper entitled **"Airborne Ku-Band Polarimetric Radar Remote Sensing of Terrestrial Snow Cover,"** coauthored by *Simon Yueh, Steve Dinardo, Ahmed Akgiray, Richard West, Don Cline, and Kelly Elder***,** and published in IEEE Transactions on Geoscience and Remote Sensing, Vol. 47, No. 10, pp. 3347–3364, October 2009.

Simon H. Yueh received the Ph.D. degree in Electrical Engineering in January 1991 from the Massachusetts Institute of Technology. He was a postdoctoral research associate at the Massachusetts Institute of Technology from February to August 1991. In September 1991, he joined the Radar Science and Engineering Section at the Jet Propulsion Laboratory (JPL). He was the supervisor of radar system engineering and algorithm development group from 2002–2007. He

became the deputy manager of Climate, Oceans and Solid Earth section in July 2007, and was promoted to the section manager in March 2009. He is also serving as the instrument scientist for the National Aeronautics and Space Administration (NASA) Aquarius mission for global sea surface salinity observations. He has been the Principal/Co-Investigator of numerous research projects, including the polarimetric wind radiometer research; airborne scatterometer project for hurricane wind measurements; Passive/Active L-band Sensor (PALS) project; NASA Instrument Incubator Project for a mission concept using a large mesh-deployable antenna for soil moisture and ocean salinity sensing; the airborne polarimetric radar (POLSCAT) for ocean wind velocity measurements; the POLSCAT/Cold Land Processes Experiments (CLPX-1 and -2) in 2002–2004 and 2006–2008; the Advanced Component Technology lightweight dual-frequency antenna feed project; the Aquarius PALS High Wind Campaign in 2009; the POLSCAT-CLPX3 experiment in 2009–2010. He is leading the development of Snow and Cold Land Processes mission concept at JPL. He has authored four book chapters and published more than 150 publications and presentations. He received the 2002 IEEE GRSS Transaction Prize Paper award, the 2000 Best Paper Award in the IEEE International Geoscience and Remote Symposium 2000, and the 1995 IEEE GRSS Transaction Prize Paper award for a paper on polarimetric radiometry. He received the JPL Lew Allen Award in 1998 and Ed Stone Award in 2003. He is an associate editor of IEEE Transactions on Geoscience and Remote Sensing and is the Fellow of IEEE.

Steve J. Dinardo received the B.S.E.E degree from California State University, Los Angeles in 1983. In 1978, he joined NASA Jet Propulsion Laboratory (JPL). Pasadena, CA. At JPL he has been involved in various projects, including very long base interferometry (VLBI), mobile VLBI, orbiting VLBI, GPS receiver development and international GPS service. From, 1995 through 1997, he was responsible for the deployment of the JPL aircraft polarimetric wind radiometers (WINDRAD) on NASA's DC-8 and P-3. He successfully coordinated the Hurricane Ocean Wind Experiment, sponsored by NASA and NPOESS, resulting in the first airborne Ku- Band scatterometer and multifrequecy polarimetric radiometers flights over hurricanes. He has also been responsible for development and deployment of JPL's aircraft rain radar and a 94-GHz cloud profiling radar on NASA's DC-8. He built the JPL Ku-band polarimetric scatterometer (POLSCAT), deployed on the NCAR C-130, for the first successful demonstration of polarimetric wind scatterometer technique. He has been responsible for the deployment of POLSCAT and WINDRAD on the DC-8 to support the NASA Cold Land Process Experiment in 2002–2003. He is currently involved in the development of low noise microwave radiometers and radar systems for aircraft and spacecraft for remote sensing of soil moisture and ocean salinity and GeoStar Geosynchronous microwave sounding instrument. Mr. Dinardo is a Senior Engineer at JPL, and a member of the IEEE.

Ahmed Akgiray received the B.S. degree with honors in Electrical Engineering at Cornell University in 2005, and M.S. degree in Electrical Engineering at University of Illinois at Urbana-Champaign, in 2007, with a thesis entitled "Calibration of Jicamarca Radar Using *F*-region Incoherent Scatter For Measurements of *D*-region Backscatter RCS."

He, then, joined the Jet Propulsion Laboratory where he has worked from May 2007 to present. His responsibilities included radar/radiometer data processing and hardware engineer for the landing radar of the Mars Science Laboratory (due to be launched in 2011). He is currently working on Soil Moisture Active and Passive (SMAP) satellite RF hardware development in addition to lead test engineer role on a subassembly of MSL landing radar.

Richard West received the Ph.D. degree in Electrical Engineering in 1994 from the University of Washington, Seattle. His Ph.D. thesis applied dense medium scattering theory to the analysis of passive microwave measurements of Antarctic snow. In 1995, he started working in the Radar Science and Engineering section at the Jet Propulsion Laboratory, California Institute of Technology, Pasadena. He has worked on the development of algorithms for the processing and calibration of data from the NASA Scatterometer, and from SeaWinds on QuikScat. In 1999, he began working with the radar instrument on the Cassini Mission to Saturn, and became the deputy task manager in 2002. From 2002 through 2004, he coordinated a small team that developed software for radar sequence generation and for data processing. During the Cassini Prime Mission from 2004 through 2010, he worked on all aspects of instrument operations including planning the science observations in coordination with the science team, designing the radar command sequences, and processing/calibrating the data received. In 2009

Figure 3. Simon Yueh and Steve Dinardo received the Transactions Prize Paper Award from GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

he started working on radar backscatter processing for the Soil Moisture Active/Passive (SMAP) project. His research interests include electromagnetic scattering theory, the applications of active and passive microwave data to problems in remote sensing and planetary science, and the development of new techniques/technology to enable more capable remote sensing missions.

Donald W. Cline is Chief of the Hydrology Laboratory for NOAA's National Weather Service (NWS). He received the B.A., M.A., and Ph.D. degrees in Geography from the University of Colorado in 1989, 1992, and 1995. He was formerly the Director of the NWS National Operational Hydrologic Remote Sensing Center. Prior to joining NOAA in 1998, he completed post-doctoral positions with the Department of Hydrology and Water Resources at the University of Arizona, the School for Environmental Science and Management at the University of California, Santa Barbara, and the Institute for Arctic and Alpine Research, University of Colorado. He has developed and taught courses in Surface Water Hydrology, Snow Hydrology, Geographic Information Systems, and Remote Sensing. His scientific and technical interests include hydrologic remote sensing, hydrological modeling, geospatial terrain analysis, and Cryospheric science. Dr. Cline is a member of the American Geophysical Union.

Kelly Elder recieved his BA from the University of Colorado, Boulder (1985), and his MA and PhD from the University of California, Santa Barbara (1988 and 1995). He is currently a Research Hydrologist with the Rocky Mountain Research Station, US Forest Service, in Fort Collins, Colorado. He is also the Scientist in Charge at the Fraser Experimental Forest, Fraser, CO. His research focuses on snow, forest hydrology, climate and avalanches.

IEEE GRS-S Letters Prize Paper Award

The GRS-S established the **Letters Prize Paper Award** to recognize the author(s) who has published in the IEEE Geoscience and Remote Sensing Letters during the calendar year an exceptional paper in terms of content and impact on the GRS Society. If a suitable paper cannot be identified from among those published during the calendar year, papers published in prior years and subsequently recognized as being meritorious may be considered. When selecting the paper, originality, impact, scientific value and clarity are factors considered. Prize: Certificate and $1500, equally divided between the authors.

The ***2009 Letters Prize Paper Award*** was presented to **David Lary, Lorraine Remer, Devon MacNeill, Bryan Roscoe, and Susan Paradise** with the citation:

For a very significant contribution to the field of endeavor of the IEEE GRS Society in the paper ***"Machine Learning and Bias Correction of MODIS Aerosol Optical Depth,"*** *authored by David Lary, Lorraine Remer, Devon MacNeill, Bryan Roscoe, and Susan Paradise*, and published in IEEE Geoscience and Remote Sensing Letters, Vol. 6, No. 4. pp. 694–698, October 2009.

David Lary is an atmospheric scientist interested in applying computational and information systems to facilitate discovery and decision support in Earth System Science. David Lary completed his education in the United Kingdom. He received a First Class Double Honors B.Sc. in Physics and Chemistry from King's College London (1987) with the Sambrooke Exhibition Prize in Natural Science, and a Ph.D. in Atmospheric Chemistry from the University of Cambridge, Department of Chemistry while at Churchill College (1991). His thesis described the first chemical scheme for the ECMWF numerical weather prediction model. He then held post-doctoral research assistant and associate positions at Cambridge University until receiving a Royal Society University Research Fellowship in 1996 (also at Cambridge). From 1998 to 2000 he held a joint position at Cambridge and the University of Tel-Aviv as a senior lecturer and Alon fellow. In 2001 he joined UMBC/GEST as the first distinguished Goddard fellow in earth science. Between 2001 and 2010 he was part of various branches at NASA/GSFC including the Global Modeling and Assimilation Office, the Atmospheric Chemistry and Dynamics Branch, the Software Integration and Visualization Office, and the Goddard Earth Sciences (GES) Data and Information Services Center (DISC) at NASA/GSFC. In 2010 he moved to the William B. Hanson Center for Space Sciences at the University of Texas at Dallas. His contributions have been recognized by his peers through: Invited contributions to the Royal Society, National Academies, and CDC, two dedicated EGU symposia sessions, four prestigious fellowships, five editorial commendations, six NASA awards, and eighty publications with over a thousand citations in the peer-reviewed literature.

Figure 4. George Komar received the Letters Prize Paper Award on behalf of David Lary, Lorraine Remer, Devon MacNeill, Bryan Roscoe, and Susan Paradise, from GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

Lorraine A. Remer came to the NASA/Goddard Space Flight Center in 1991, employed by Science Systems and Applications Inc. until 1998 when she became a civil servant. Currently she is a Senior Physical Scientist in the Climate and Radiation Branch of Goddard's Laboratory for Atmospheres. Dr. Remer leads the Decadal Survey Aerosol-Clouds-Ecosystem (ACE) Aerosol Subgroup of the Science Working Group, is a Member of the EOS-MODIS and CALIPSO science teams and was a member of the Global Aerosol Climatology Project science team. She was the lead author of the executive summary of the U.S. Climate Change Science Program (CCSP) report on aerosols and climate, and a contributing author to the United Nations interim and final reports on Hemispheric Transport of Air Pollution. She has been involved in field campaigns including the Smoke/Sulfate, Cloud And Radiation (SCAR) experiments, the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX), the Israeli Desert Transition Zone experiment, the Puerto Rico Dust Experiment (PRiDE), the Chesapeake Lighthouse Airborne Measurements for Satellites (CLAMS), the Intercontinental Chemical Transport Experiments (INTEX) including MILAGRO and the Arctic Research of the Composition of the Troposphere from Aircraft and Satellite (ARCTAS). During these deployments she served as a member of the forecasting team, lead platform scientist for the ER-2 and daily mission scientist.

Devon MacNeill is currently employed by Avid Radiopharmaceuticals in Philadelphia, PA. She interned with Dr. David Lary at the National Aeronautics and Space Administration, Goddard Space Flight Center through the DEVELOP Program from September 2008 through April 2009. The project focused on validating aerosol optical depth data (AOD) from the MODIS instrument, determining the factors affecting AOD data, and correction of bias with machine learning techniques. Devon graduated with a Bachelor of Science in Chemical Engineering from the University of Maryland in May of 2009.

Bryan Roscoe graduated with a Bachelors of Science in Computer Science and Math from Salisbury University in 2008. During the writing of this paper, he was working as a DEVELOP intern for Dr. David Lary at Goddard Space Flight Center. Bryan now works for Hawk Institute for Space Sciences. He currently supports NASA's EOSDIS project as a subcontracted Software Engineer.

Susan Paradise is a senior software engineer for the Multiangle Imaging SpectroRadiometer (MISR) project at the Jet Propulsion Laboratory. She leads the Aerosol/Surface software development and analysis team. She also led the development of the Aerosol Measurement and Processing System (AMAPS) code used for analysis and comparisons of spacecraft and ground aerosol data, such as MISR and AERONET. She has 25 years of experience in software development and analysis on remote sensing projects observing Earth's atmosphere.

IEEE GRS-S Symposium Prize Paper Award

The GRS-S established the **Symposium Prize Paper Award** to recognize the author(s) who presented at the IEEE International Geoscience and Remote Sensing Symposium (IGARSS) an exceptional paper in terms of content and impact on the GRS-S. In selecting the paper, other factors considered are originality, clarity and timeliness of the paper. The published versions of the papers in the Digest shall also be evaluated. Prize: Certificate and $1250, equally divided between the authors.

The ***2009 Symposium Prize Paper Award*** was presented to **Xiao Xiang Zhu, Nico Adam and Richard Bamler** with the citation:

For a very significant contribution to the field of endeavor of the IEEE GRS Society in the paper entitled **"Space-Borne High Resolution Tomographic Interferometry,"** coauthored by *Xiao Xiang Zhu, Nico Adam and Richard Bamler*, and presented at the 2009 International Geoscience and Remote Sensing Symposium, July 2009 in Cape Town, South Africa, IGARSS´09 Proceedings.

Xiao Xiang Zhu received the Bachelor degree in space engineering from the National University of Defense Technology (NUDT), Changsha, China, in 2006. She received the Master (M.sc.) degree in Earth Oriented Space Science and Technology (ESPACE) from Technische Universität München (TUM), München, Germany, in 2008. Since May 2008, she has been a Full-Time Scientific Collaborator with the Remote Sensing Technology, TUM, and pursues her Ph.D. degree on differential SAR tomography using TerraSAR-X data. Her work is part of the project team "Dynamic Earth" which was established in the International Graduate School of Science and Engineering (IGSSE), TUM, as a result of the German excellence initiative in 2007. In October/November

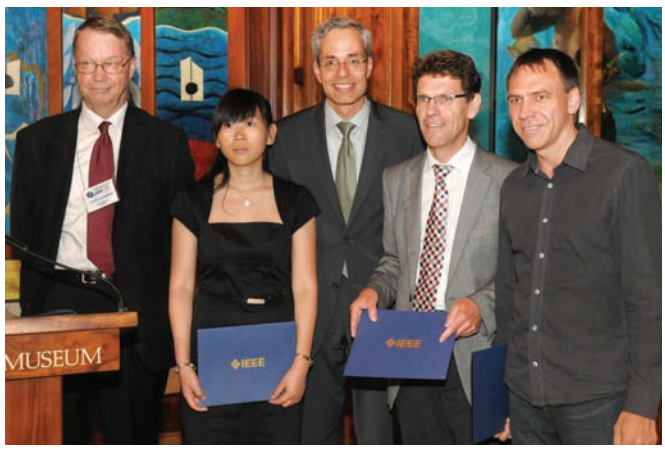


Figure 5. Recipients of the Symposium Prize Paper Award Xiao Xiang Zhu (second from left), Nico Adam (right), and Richard Bamler (second from right) with GRS-S President Alberto Moreira (in the middle) and Awards Co-Chair Martti Hallikainen (left).

2009, she was a guest scientist at the Italian National Research Council (CNR) – Institute for Electromagnetic Sensing of the Environment (IREA), Naples, Italy. In 2009, he ranked the third place at the student paper competition of the Joint Urban Remote Sensing Event, Shanghai, China. Her main research interests are signal processing field with applications to spaceborne SAR data, in particular SAR tomography and differential SAR tomography.

Nico Adam received the Diploma degree in electrical engineering and telecommunication science from the University of Rostock, Germany in 1995. He has been with the German Aerospace Center (DLR), Oberpfaffenhofen, since 1995, where he leads the SAR Interferometry team at DLR's Remote Sensing Technology Institute. His research interests include signal and image processing in the persistent scatterer interferometry framework and the development of algorithms and software for advanced remote sensing radar systems.

Richard Bamler received his diploma degree in electrical engineering, his doctor of engineering degree, and his "habilitation" in the field of signal and systems theory in 1980, 1986, and 1988, respectively, from the Technische Universität München (Germany).

He worked at that university during 1981 and 1989 on optical signal processing, holography, wave propagation, and tomography. He joined the German Aerospace Center (DLR), Oberpfaffenhofen, in 1989, where he is currently the Director of the Remote Sensing Technology Institute. Since then he and his team have been working on SAR signal processing algorithms (ERS, SIR-C/X-SAR, Radarsat, SRTM, ASAR, TerraSAR-X, TanDEM-X), SAR calibration and product validation, SAR interferometry, phase unwrapping, estimation theory and model based inversion methods for atmospheric sounding (GOME, SCIAMACHY, MIPAS, GOME-2) and oceanography.

Figure 6. Charles Werner received the Interactive Session Prize Paper Award on behalf of Mihai Tanase, Maurizio Santoro, Juan de la Riva, and Fernando Pérez-Cabello, from GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

In early 1994 Prof. Bamler was a visiting scientist at Jet Propulsion Laboratory (JPL) in preparation of the SIC-C/X-SAR missions, and in 1996 he was guest professor at the University of Innsbruck. Since 2003 he holds a full professorship in remote sensing technology at the Technische Universität München.

His current research interests are in algorithms for optimum information extraction from remote sensing data with emphasis on SAR, SAR interferometry, persistent scatterer interferometry, SAR tomography, and GMTI for security related applications. He and his team have developed and are currently developing the operational processor systems for the German missions TerraSAR-X, TanDEM-X, and EnMAP.

Richard Bamler is the author of more than 160 scientific publications, among them about 40 journal papers, a book on multidimensional linear systems theory, and several patents on SAR signal processing.

IEEE GRS-S Interactive Session Prize Paper Award

The GRS-S established the **Interactive Session Prize Paper Award** to recognize the author(s) who posted at the GRS-S Symposium (IGARSS) an exceptional paper in terms of content and impact on the GRS-S. In selecting the paper, other factors considered are originality, clarity and timeliness of the paper. The published versions of the papers in the Digest shall also be evaluated. Prize: Certificate and $1250, equally divided between the authors.

The ***2010 Interactive Session Prize Paper Award*** was presented to **Mihai Tanase, Maurizio Santoro, Juan de la Riva, and Fernando Pérez-Cabello** with the citation:

For a paper with exceptional merit and posted in the Interactive Session of the International Geoscience and Remote Sensing Symposium IGARSS'09 **"Backscatter Properties of Multitemporal TerraSAR-X Data and the Effects of Influencing Factors on Burn Severity Evaluation, in a Mediterranean Pine Forest,"** and coauthored by *Mihai Tanase, Maurizio Santoro, Juan de la Riva, and Fernando Pérez-Cabello*, and presented at the 2009 International Geoscience and Remote Sensing Symposium, July 2009 in Cape Town, South Africa, IGARSS´09 Proceedings.

Mihai A. Tanase received the engineering diploma in forestry from "Stefan cel Mare University", Suceava, Romania in 1999, the diploma in economy from Bucharest Academy of Economic Studies, Bucharest, Romania, in 2004 and the M.Sc. degree in Environmental Management from the International Centre for Advanced Mediterranean Agronomic Studies, Paris, France, in 2007. Currently he is with the Department of Geography at the University of Zaragoza, Zaragoza, Spain. He is PI for ERS and TerraSAR-X projects and participates in K&C Initiative as co-investigator. His research includes the use of remote

sensing for forest characterization. His current activity is focused on the use of SAR and interferometric SAR data for fire severity estimation and vegetation recovery monitoring after forest fires.

Maurizio Santoro (M'04) received the M.S. degree in aerospace engineering from the University "Federico II," Naples, Italy, in 1998, the Lic. Eng. degree from the Chalmers University of Technology, Göteborg, Sweden, in 2001, and the Ph.D. degree from Friedrich-Schiller-University, Jena, Germany, in 2003. From 2004 to 2005, he held a postdoctoral position at Friedrich-Schiller University. Since 2006, he has been a Project Scientist at GAMMA Remote Sensing AG, Gümligen, Switzerland. His main duties include SAR and interferometric SAR data processing, and applications of SAR interferometry for land cover mapping. He is involved as Principal and Co-Investigator in several international projects on the use of Earth observation data for land cover mapping and monitoring. His main research interests include characterization of land cover using SAR and interferometric SAR data, and retrieval techniques of forest biophysical parameters from SAR data.

Juan de la Riva received the PhD degree in Geography in the University of Zaragoza, Zaragoza, Spain, in 1994. He is currently a professor of Regional Geographic Analysis in the University of Zaragoza, Zaragoza, Spain. He coordinates the GIS and Remote Sensing Master Course. He focuses his research on the study of forested areas and the application of GIS and remote sensing techniques. He is member of the GEOFOREST research group and he has worked in different management studies in mountain areas, as well as in several research projects – FIRERISK, EROFUEGO, LIGNOSTRUM, RS-FIRE, PIR-FIRE – related to forest fires (post-fire environmental dynamic and risk modeling) and biomass estimation.

Fernando Pérez-Cabello received the PhD degree in Geography in the University of Zaragoza, Zaragoza, Spain, in 2001. He is currently a professor contracted doctor of Regional Geographic Analysis in the University of Zaragoza, Zaragoza, Spain. He focused his research on the analysis of the environmental dynamic of burned areas, by means of field data and remote sensing and GIS techniques. He is member of the GEOFOREST research group and he has worked at some national research projects – FIRERISK, EROFUEGO, LIGNOSTRUM, RS-FIRE, PIR-FIRE – concerning to the monitoring of burned areas, fire risk cartography and modeling of physical variables.

Student Prize Paper Awards

A total of three prizes were presented including two **GRS-S Student Prize Paper Awards** (third and second prize) and, for the third time, the **IEEE Mikio Takagi Student Prize** (first prize).

GRS-S Student Prize Paper Awards

The GRS-S **Student Prize Paper Award** was established to recognize the best student papers presented at the IEEE International Geoscience and Remote Sensing Symposium (IGARSS). It is believed that early recognition of an outstanding paper will encourage the student to strive for greater and continued contributions to the Geoscience and Remote Sensing profession. The award shall be considered annually.

Ten high-quality papers were preselected by the Student Prize Paper Awards Committee in cooperation with the Technical Program Committee. At IGARSS 2009 in Cape Town the students presented their papers in a special session on Tuesday morning and a jury, nominated by the GRS-S Awards Co-Chair, evaluated and ranked them for the awards.

The **Third Student Prize paper Award** was presented to **Amanda Mims** with the citation:

For the paper "**WindSat Retrieval of Ocean Surface Wind Speeds in Tropical Cyclones.**"

Her advisor is Christopher Ruf from the University of Michigan.

Amanda Mims received the B.S.E. degree in Earth systems science and engineering in 2009 and is currently pursuing the Ph.D. degree in atmospheric science, both from the University of Michigan, Ann Arbor. Her research interests include microwave remote sensing and retrieval algorithms to derive ocean wind vectors from passive instruments, particularly WindSat. Her focus is algorithms for atmospheric clearing under intense precipitation, using tropical cyclones as test cases. She is a student member of the Institute of Electrical and Electronics Engineers, the American Meteorological Society and the Geoscience and Remote Sensing Society.

The **Second Student Prize Paper Award** was presented to **Wei Di** with the citation:

For the paper **"Multi-view Adaptive Disagreement Based Active Learning for Hyperspectral Image Classification."**

Her advisor is Melba Crawford from Purdue University.

Figure 7. Recipient of the Student Prize Paper Award Amanda Mims with GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

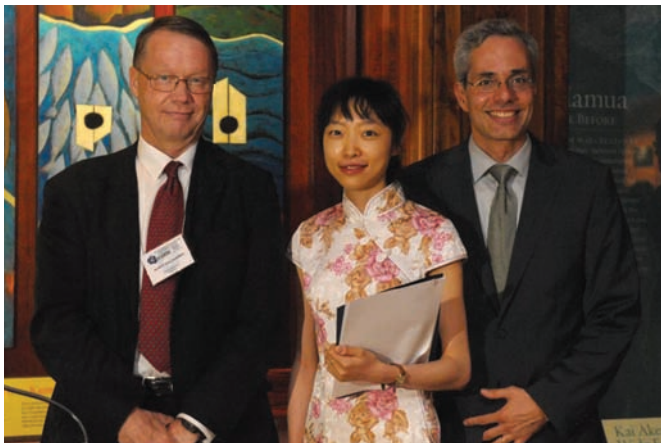


Figure 8. Recipient of the Student Prize Paper Award Wei Di with GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

Wei Di is a PhD student in Civil Engineering and Computational Science and Engineering (CS&E) in Purdue University, West Lafayette, Indiana, USA. She is advised by Professor Melba Crawford, and works in Laboratory for Applications of Remote Sensing in Purdue University. Her research interest is in machine learning and pattern recognition for hyperspectral data analysis, especially on active learning for hyperspectral image classification. She was awarded by the Lynn Fellowship from CS&E interdisciplinary program in Purdue University which aims to offer computational specializations for students across Science, Engineering, and Agriculture, etc. Before she joined Purdue University in 2008, she earned her B.S degree in Communication Engineering in 2005, and M.S. degree in Control Theory and Engineering in 2008 from Northwestern Polytechnical University, Xi'an, China, respectively.

2010 IEEE Mikio Takagi Student Prize

The **IEEE Mikio Takagi Student Prize** was established in 2006. It is to recognize a student who has presented an exceptional paper at the IEEE Geoscience and Remote Sensing Symposium (IGARSS).

The ***2010*** **IEEE Mikio Takagi Student Prize** was presented to **Brent Williams** with the citation:

For the paper ***"Scatterometer Image Reconstruction from Aperture-Filtered Samples."***

His advisor is David Long from Brigham Young University.

Brent A. Williams received the B.S. degree in electrical engineering from Brigham Young University, Provo, UT, in 2005. He recently finished his dissertation titled "Signal Processing Methods for Ultra High Resolution Scatterometry'' and will receive the Ph.D. degree in electrical engineering from Brigham Young University, Provo, UT, in August 2010. From 2005 through 2010 he has worked in the Microwave Earth Remote Sensing Laboratory exploring ultra high resolution ocean wind scatterometry and image reconstruction. He is currently at the Jet Propulsion Lab continuing research in scatterometry. Mr. Williams has several publications including 3 journal articles (2 currently in review) and 5 conference papers. He received the IEEE Geoscience and Remote Sensing Society Interactive Session Prize Paper Award for a paper submitted to IGARSS in 2006, and received the IEEE Geoscience and Remote Sensing Society Mikio Takagi Student Prize Award at IGARSS in 2007. Mr. Williams is a member of IEEE and Eta Kappa Nu.

Chapter Excellence Award

The GRS-S established the **Chapter Excellence Award** to recognize excellence in a GRS-S or Joint Local Chapter demonstrated by exemplary local GRS-S activities during the

Figure 9. The IEEE Mikio Takagi Student Prize recipient Brent Williams with GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

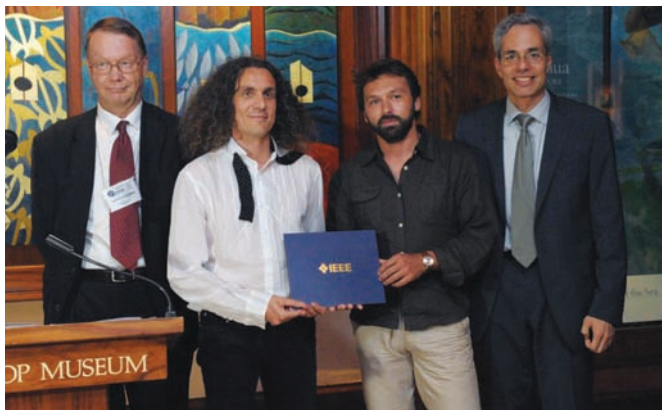


Figure 10. Grégoire Mercier (second from right) and Jocelyn Chanussot, (second from left), who received the Chapter Excellence Award for the French Chapter, with GRS-S President Alberto Moreira (right) and Awards Co-Chair Martti Hallikainen (left).

Figure 11. Kiyo Tomiyasu (right) with GRS-S President Alberto Moreira.

Figure 12. IGARSS'10 General Co-Chairs Karen St. Germain (left) and Paul Smits with IGARSS'11 General Chair Motoyuki Sato, Yoshio Yamaguchi, Ya-Qiu Jin, and Masanobu Shimada.

previous year. The award is considered annually and presented only when a deserving Chapter is identified. The selection criteria are quantity, quality, breadth and significance of activities and technical meetings during the previous calendar year, active participation of members in IGARSS and other GRS-S sponsored activities, and membership growth during the past three years. A Chapter that receives the GRS-S Chapter Excellence Award is not eligible to receive it again within the next three years. The Award consists of a Certificate and an honorarium of $1,000 to be used for Chapter activities.

The **2010 Chapter Excellence Award** was presented to **the French Chapter** with the citation:

For excellence as a GRS-S Chapter demonstrated by exemplary activities during 2009.

The award was received by Grégoire Mercier (present Chapter Chair) and Jocelyn Chanussot (previous Chapter Chair).

Congratulations to All 2010 Award Recipients

The GRS-S Awards Committee would like to thank the evaluators of IGARSS'10 technical sessions and the Editorial Boards of IEEE Transactions on Geoscience and Remote Sensing and IEEE Geoscience and Remote Sensing Letters, and the GRS-S Student Prize Paper Awards Committee for their valuable inputs to the awards process. We would also like to encourage all GRS-S members to actively participate in nominating the GRS-S Major Awards including the Distinguished Achievement Award, the Outstanding Service Award and the Education Award. As a new feature, GRS-S members can nominate papers also for journal awards. Please see instructions on the GRS-S Home Page.

Additional Highlights at the Awards Banquet

Kiyo Tomiyasu into IEEE Heritage Circle

Kiyo Tomiyasu (LF'85), who in 1941 joined the Institute of Radio Engineers, one of IEEE's predecessor societies, is being inducted into the IEEE Heritage Circle to honor his lifetime giving to IEEE. He was congratulated (a bit late) on the occasion of his 90th birthday.

Best Wishes for a Successful IGARSS 2011

The General Co-Chairs of IGARSS 2010, Karen St. Germain and Paul Smits, turned over the responsibility for the IEEE International Geoscience and Remote Sensing Symposium to IGARSS 2011 General Co-Chair Motoyuki Sato and his team, with best wishes for a successful symposium in Sendai, Japan, August 1–5, 2011.

We hope to see you in Sendai at IGARSS 2011!

Martti Hallikainen

REPORT ON THE GNSS-R10 WORKSHOP

Antonio Rius, GNSS-R '10 Co-chair, Institut d'Estudis Espacials de Catalunya / ICE-CSIC
Estel Cardellach, GNSS-R '10 Co-chair, Institut d'Estudis Espacials de Catalunya / ICE-CSIC
Adriano Camps, GNSS-R '10 Co-chair, Institut d'Estudis Espacials de Catalunya / CRAE-UPC
Manuel Martín-Neira, Conclusions Panel Co-chair, ESA/ESTEC
Valery Zavorotny, Conclusions Panel Co-chair, NOAA
Stephen T. Lowe, Conclusions Panel Co-chair, JPL

Introduction

In the past years, reflectometry of opportunity signals such as those from Global Navigation Satellite Systems (GNSS-R) has stood as a technique with a great potential for remote sensing applications. This article reports the last edition of the GNSS-R series of successful workshops that was held at the Universitat Politènica de Catalunya, Barcelona (Spain) during October 21st and 22nd, 2010.

The workshop was organized by the Institut d'Estudis Espacials de Catalunya, sections ICE (Space Sciences Institute) from the Spanish National Research Council (CSIC), and CRAE (Aerospace Research Center) from the Universitat Politècnica de catalunya (UPC).

The workshop logo (Figure 1) was inspired in famous catalan architect Gaudi's broken tiles.

The workshop was attended by 58 people from 14 different countries. It was run as a single session. A total of 29 oral presentations were included in the six plenary sessions on:

- Future and Planned Missions, chair: Salvatore D'Addio,
- Applications: Altimetry, chair: Stephen T. Lowe,
- Receivers and Systems, chair: Martin Unwin,
- Applications: Scatterometry, chair: James L. Garrison,
- Applications: Land, Cryosphere, Atmosphere, chair: Valery Zavorotny, and
- Simulators and Simulations, chair: Georg Beyerle.

In addition, 9 interactive presentations were included in a lively poster session on Thursday afternoon, which also included demos of software simulators (from Starlab and UPC), hardware exhibit (from ICE/CSIC and UPC), a stand from SPIRENT… while enjoying some food and beverages.

Seen from the last workshop, held at ESTEC on September 24th–25th, 2008, the GNSS-R community seems to be much more mature and consolidated. The main advances are summarized below:

- Ground-based and airborne field experiments (from aircrafts and zeppelin) over the ocean, land, dry snow, and ice were presented.
- New algorithms have been developed and tested for altimetry, ice monitoring, soil moisture, corrections to L-band microwave radiometry over the ocean to improve sea surface salinity retrievals, scatterometry, wind speed and direction…
- A number of satellite opportunities were announced aboard small satellites (e.g. PAU instrument aboard INTA's MicroSat-1) or aboard the ISS (International Space Station).
- The synergy with existing satellite radio-occultation systems has been further exploited.
- Receiver and simulator development has made very good progress, and flight-quality receivers are being built that are capable of processing the signals from the about 100 GNSS transmitters that will likely be in orbit soon.
- Novel applications of GNSS reflectometry are being attempted, such as soil moisture monitoring, vegetation height retrieval, surface's topography, ice sounding, and ship detection, or the deconvolution of the Delay-Doppler Map (DDM) so as to dramatically improve the spatial resolution of these techniques.

Figure 1. GNSS-R '10 logo [designed by E. Cardellach]. http://congress.cimne.com/gnss-r10/.

On Thursday evening, all participants were invited to enjoy the evening while having dinner in a typical restaurant at the famous *Las Ramblas* of Barcelona.

Figure 2. Dr. Zavorotny presenting the new results from his experiments.

N. RODRÍGUEZ]

Figure 3. Hardware and software exhibit during the poster session.

Workshop Conclusions

A conclusions session panel was chaired on Friday afternoon by Manuel Martín-Neira (ESA), Valery Zavorotny (NOAA), and Stephen Lowe (JPL) to summarize the main findings of the workshop, and the road map for the coming years.

The main conclusions of the two-day workshop, as reported by the session chairs, are summarized below:

The interferometric processing technique and its advantages for altimetry applications:

This technique was put forward by ESA in 1993, but only recently demonstrated in the laboratory and in an experiment from a bridge. In general, attendees backed the potential of this concept and recognized the results of its experimental demonstration. The advantage of the technique in terms of its superior altimetry accuracy over the use of clean replicas of open access codes is now well established. The advantage of enabling the use of restricted access signals was also acknowledged. The inter-satellite cross-talk, only studied at a preliminary level, was a subject identified for further analysis.

It was also noted that the price to pay for this technique is a bigger antenna and an associated higher instrument cost. This instrument will not be inexpensive, but it offers altimetry, potentially down to the 5-cm accuracy scientists request over a wide field of view, scatterometry, and other retrievals, a fact that should be considered in deciding on ESA's In-Orbit Demonstration mission. Moreover the cost of the instrument on a space mission is not especially critical. The fact that some applications, such as Tsunami warning and hurricane search, cannot be done with other concepts should also be considered.

An interesting proposal of applying this technique not only for reflectometry, but also for radio-occultation measurements was also suggested at the workshop.

A. CAMPS

Figure 4. From left to right Dr. Valery Zavorotny (NOAA), Dr. Manuel Martín-Neira (ESA), and Dr. Stephen Lowe (JPL) chairing the conclusions panel on Friday afternoon.

White paper on GNSS reflectometry:

Back in April 2006 a draft of a White Paper on GNSS Bistatic Ocean Altimetry was being prepared by some members of the GNSS-R community, but it was never finished. During this GNSS-R10 workshop it was thought that this was a good time to continue and to publish it. Steve Lowe (JPL) will take the initiative to send the draft to volunteers who want to add something. Timeline: by IGARSS 2011 in Sendai where there will be a session on GNSS-R.

Why is the GNSS-R community not involved in the ocean altimetry group?

At the same time of the GNSS-R10 workshop, a meeting of the ocean altimetry community was taking place in Lisbon, and so, the question above was posed. The meeting in Lisbon focused on the need for long-term stability of satellite tracks. There was a general consensus that the ocean altimetry community might be very interested in some realistic simulation

E. CARDELLACH

Figure 5. Group picture of the GNSS-R '10 attendees at UPC Campus Nord, with Salvà i Campillo sculpture in the back.

results of GNSS-R altimetry that could be then presented at that community in their meeting of next year, for example.

The use of continuously-operating GPS networks to retrieve soil moisture, snow depth, and vegetation:

Geodesists, geophysicists, and surveyors have installed over 10,000 high-quality (dual-frequency, carrier phase) GPS receivers around the world. The number of sites will inevitably grow. The operation and maintenance of these sites is supported by state and federal agencies, and the data are freely available on the Internet. Although geodetic receivers/antennas were designed to suppress reflected signals, it has been demonstrated that the signal-to-noise ratio data recorded by these receivers are sensitive to soil moisture, snow depth, and vegetation changes. These ground-based reflection data have a spatial footprint that is intermediate to satellites and in situ sensors. The GNSS-R community has an opportunity to take a leadership role in evaluating these geodetic GPS data for environmental sensing. The soil moisture data, in particular, are valuable for validation of SMOS and SMAP. The snow data are essential for management of water supply and flood control systems. Estimates of vegetation state are required for climate modeling and validation of satellite estimates of land surface conditions. We should talk to geodesists, who have the networks of sensors, and the hydrologists, who have the requirements.

Measurements with radiometers and GNSS-R on sea-surface roughness:

Several presentations and posters of the workshop were devoted to measurement of sea surface roughness with GNSS-R to be used for correcting the brightness temperature observed by L-band radiometers such as SMOS, Aquarius, or SMAP. This area was identified as of special scientific interest.

Following these discussions it was mentioned that Chris Buck (ESA) is trying to organize a session on GNSS-R during IGARSS-2011, Sendai (Japan), August 1st–5th, 2011.

Jim Garrison, from Purdue University, US proposed to use the Microrad approach for the following GNSS-R workshops, that is, to have dedicated workshops every 2 years alternating the venue between US and Europe, and he offered his University as venue for GNSS-R '12 workshop, and to include other signals of opportunity as well.

See you in Purdue in 2012!

INDUSTRIAL PROFILE

ITT CORPORATION

We Do Essential Things in Extraordinary Ways

ITT is a leader in next-generation remote sensing systems that integrate space, airborne, ground and warfighter sensors into broader, coordinated systems. ITT has two Divisions that design, develop, test, and manufacture mission critical remote sensing suites. They are the Electronic Systems Division, headquartered in Clifton, New Jersey, which specializes in RF/Microwave/Millimeter wave remote sensor suites both active and passive and the ITT Geospatial Systems Division, headquartered in Rochester, New York, which specializes in innovative night vision, remote sensing and navigation solutions that provide sight and situational awareness at the space, airborne, ground and soldier levels. Key applications include image intensification and thermal imaging; advanced power supplies; multi-spectral image systems; weather and climate monitoring; space science; intelligence, surveillance and reconnaissance; GPS-based positioning, navigation and timing systems; and image exploitation software.

ITT integrated solutions capture, compress, encrypt, transmit, combine, analyze and deliver data. With a fully, vertically integrated design and manufacturing hybrid facility, ITT not only designs but also produces the state-of-the-art equipment that enables new remote sensing techniques. Using ITT technologies, customers can move beyond mere image acquisition to image interchange and true knowledge sharing. Key applications include:

- **Climate and Environmental Monitoring** systems capture, process, visualize and analyze earth images, climate change and other environmental data. Commercial and government customers use this information to monitor and predict weather and climate change, and to conduct scientific research, all vital in forming national policy, protecting and saving lives and property, ensuring efficient and effective commerce and economic growth, and creating a more livable environment.
- **Positioning, Navigation & Timing – GPS**. With a 100% on-orbit mission success, ITT is a total GPS navigation systems supplier providing high-performance, reliable, cost-effective GPS payload, receiver and control solutions. ITT systems and components have been part of every U.S. GPS navigation system ever launched and provide military and commercial customers with exact location information.
- **Intelligence, Surveillance and Reconnaissance** systems provide intelligence and defense customers with the ability to collect images and related information that is critical to our national security.
- **High Resolution Commercial Imaging** systems provide commercial customers with high quality imagery information for a variety of applications from municipal planning and development to environmental monitoring.
- **Space Science Systems** from ITT provide scientists and researchers with imagery and data necessary to understand our earth and universe.
- **Precision Optics** solutions for various industries, including aerospace, astronomy, and microlithography. ITT's world-class facilities are capable of manufacturing and

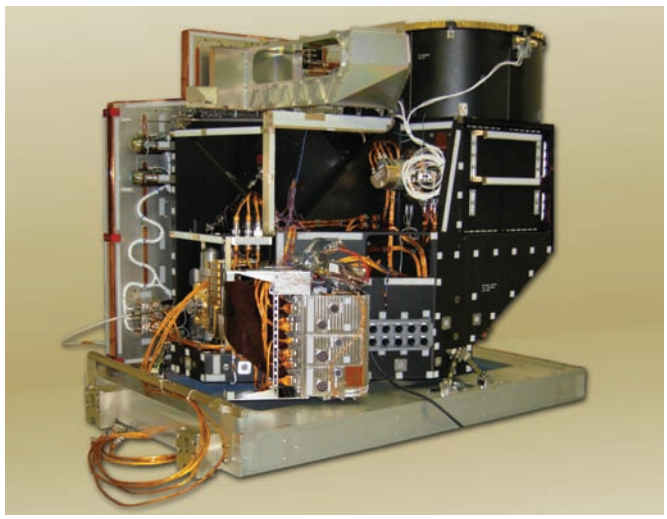
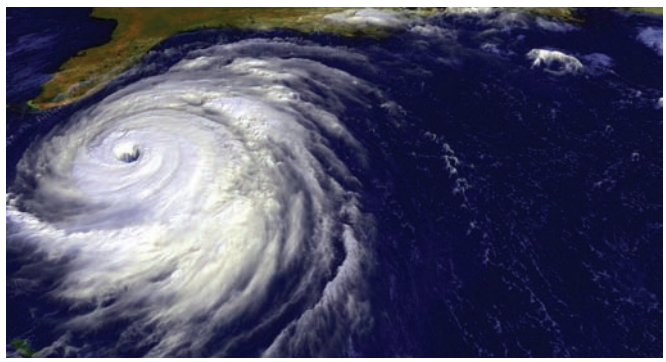
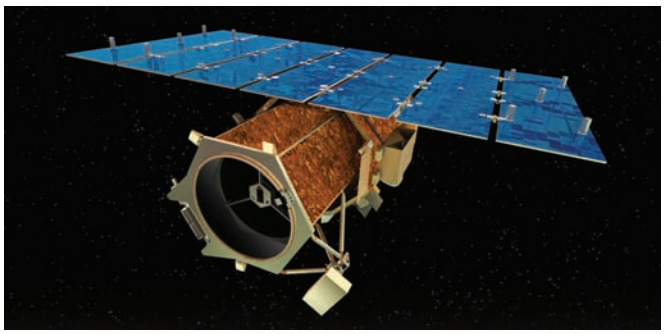


Figure 1. ITT Advanced Baseline Imager (ABI) that will fly on the next generation NOAA GOES missions.



NOAA

Figure 2. Hurricane Floyd, taken by ITT Imager.



GEOEYE

Figure 3. ITT designed and built the space borne imaging system for GeoEye-1.

NOAA

Figure 5. Hurricane Rita, taken by ITT Imager.

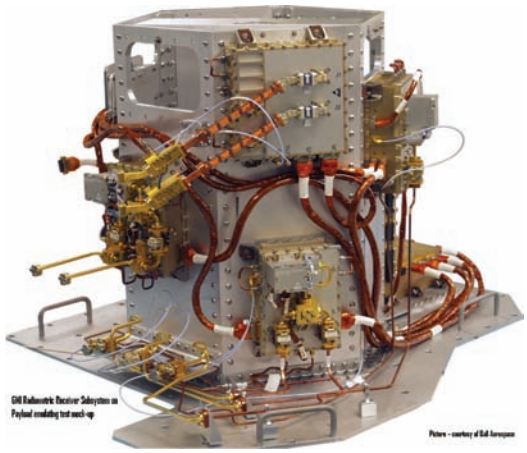


Figure 4. Global Precipitation Measurement Microwave Imager (GMI) Radiometric Receiver Subsystem on Payload emulating test mock-up.

SPACE IMAGING, INC.

Figure 6. Ikonos flies an advanced digital camera system designed and built by ITT.

delivering a full range of precision optics and optical systems including: mirrors, mounts and metering structures for ground, sea, air and space-based platforms and systems.

- **Imagery Information Solutions** provide productivity enhancements that help analysts generate, visualize, exploit and disseminate images and data. These solutions leverage and include leading software technologies, which provide data visualization, image processing and data analysis capabilities.

Capabilities

To help solve customers' most challenging problems, ITT employs comprehensive, leading edge capabilities, which span image and data collection through processing and dissemination.

Image and Data Collection

Image and data collection capabilities support systems used for a variety of applications, including meteorological; intelligence, surveillance and reconnaissance; GPS positioning, navigation & timing; high-resolution commercial imaging; and earth and space science:

- Radiometric Microwave/Millimeter Wave Imaging/ Sounding Receiver Subsystems
- Comprehensive Electro-optical (EO) Payloads (Imaging and Sounding)
- Infrared Interferometric Sensor Payloads
- Infrared Imaging
- Digital Radiometry
- Scatterometry
- Active and Passive Hyperspectral Sensor Payload Development for ground, air and space
- Payload Integration and Systems Engineering
- Active and Passive Control of Dynamic Environments
- Anti-jam Signal Generation
- Calibration
- Spaceborne, state-of -the-art sensitivity and phase noise RF Receiver Systems
- Navigation Waveform Generation
- High Precision, Ultra-lightweight Optically Stable Mirrors and Mounts
- Large Optics and Mirror Processing
- High performance composite structures

Image and Data Processing and Dissemination

Image and data processing and dissemination capabilities enable decision support solutions that help you quickly and

Figure 7. NPOESS Cross-track Infrared Sounder (CrIS) design and built by ITT that provides detailed atmospheric temperature and moisture observations for weather and climate applications.

accurately manage, exploit, analyze, visualize, interpret and disseminate images or data:

- Information Systems Engineering
- Image Simulations for Electro-optical, Multispectral, Hyperspectral, Infrared, Active and Motion Imaging
- Image Evaluations and System Performance Modeling
- Image Quality and Exploitation Algorithms
- Compression Analysis and Design
- Information Fusion and Visualization Tools
- Image System Analysis
- Digital Video Processing, Analysis and Design
- Synthetic Aperture Radar (SAR) Image Quality Support
- Multispectral/Hyperspectral/MASINT Processing, Analysis and Design.

Customers

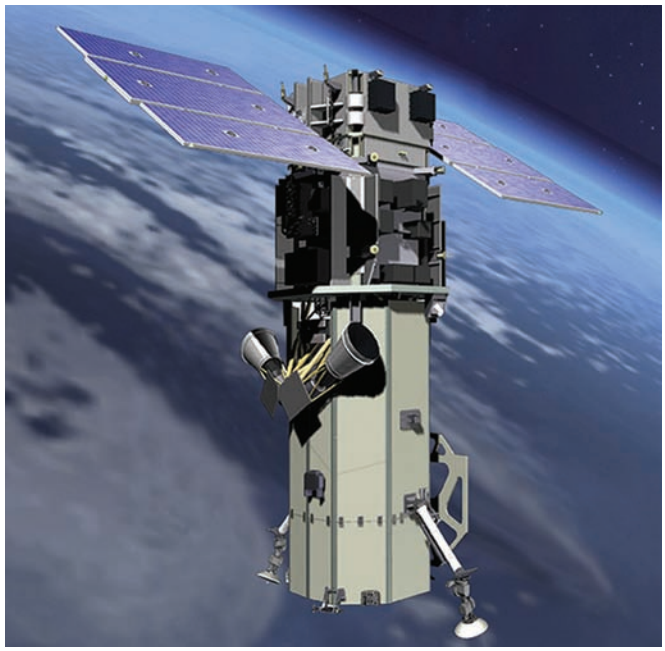
ITT serves commercial and government customers, domestically and internationally, in earth and space science, Department of Defense, intelligence, and commercial aerospace, with one of the widest ranges of capabilities in the remote sensing and navigation industry. A legacy of expertise and imagery leadership allows ITT to deliver against specific needs.

ITT is committed to the design, manufacture and delivery of premier quality products via a workforce dedicated to environment, safety and health excellence.

For additional Information, contact:

Mike Gregory
For RF/Microwave/Millimeter wave Remote Sensor Suites
1500 New Horizons Blvd.
N. Amityville, New York 11701
Phone: 631-630-5202
Sue Wirth

Figure 8. ITT designed and built a Total Power Water Vapor Radiometer for the Navy GFO mission.



DIGITALGLOBE

Figure 9. ITT designed and built the imaging payload for the commercial space imagery satellite – Worldview-2.

For Remote Sensing and GPS Payloads
1919 W Cook Rd
Fort Wayne, Indiana 46818
Phone: 260 451 6258

About ITT Corporation

ITT Corporation is a high-technology engineering and manufacturing company operating on all seven continents in three vital markets: water and fluids management, global defense and security, and motion and flow control. With a heritage of innovation, ITT partners with its customers to deliver extraordinary solutions that create more livable environments, provide protection and safety and connect our world. Headquartered in White Plains, N.Y., the company reported 2009 revenue of $10.9 billion. www.itt.com

(President's Message continued from page 3)

At the end of this year I will be finishing my term as President of GRSS. In the following I would like to recapitulate some of the highlights of this year.

1) We started 2010 with a number of important tasks for our Society, including the final preparations for IGARSS in Honolulu. IGARSS this year was a fantastic success and a most special event for our society: We commemorated the 30th anniversary of IGARSS. We had about 2000 participants, many young people, a great deal of networking among the participants, excellent plenary and technical oral sessions, very dynamic interactive poster sessions, several highlights like the Technical Committees and Chapters Luncheon, Young Professionals' Luncheon, Awards Banquet, and a most pleasant social program in a unique venue. This IGARSS has set a very high standard for future IGARSS conferences. With our membership promotion at the GRSS booth we awarded 123 free one-year GRSS memberships to conference participants. We received over 600 responses to a web-based survey that was sent to all IGARSS participants as well as to GRSS members. From this feedback we have prioritized a number of items to be implemented at future conferences. Thanks to all the participants of this survey that helped us with their inputs and suggestions to continuously improve future IGARSS conferences.
2) In the beginning of the year we implemented a new web site (www.grss-ieee.org) in order to provide more information and to continue improving services to our members and to the international remote sensing community. With this new web site we are achieving a much higher hit rate. A number of new features have been implemented on our web site, including a version for mobile phones, new features for educational services, live broadcast of selected oral presentations during conferences, Facebook and LinkedIn groups, a new distinguished speakers program and a calendar of events.
3) We had a successful review of our youngest journal, J-STARS (Journal of Selected Topics in Applied Earth Observations and Remote Sensing), that started at the beginning of 2007. (All IEEE journals are reviewed every 5 years.) J-STARS now exceeds the nominal page count of 400 per year and has became a well-established journal in the publication portfolio of GRSS, together with TGRS and GRSL. Prof. Ellsworth LeDrew, the founding editor of J-STARS, will be finishing his term at the end of 2010 and a new Editor-in-Chief, Prof. Jocelyn Chanussot, has been appointed for a 3-year term, 2011–2013. Ellsworth will further serve J-STARS for the next 3 years in the position of Deputy Editor-in-Chief. I would like to take this opportunity to congratulate both colleagues for their appointments and to wish them great success in the next 3 years.
4) During 2010 we had six new GRSS Chapters approved in the following locations: Brazil (Student Branch Chapter), South Africa (Joint Chapter), China (Nanjing Section), Australia (Joint Sections Chapter), Gambia, and Canada (Joint chapter reorganized with GRSS and OES). Other chapter initiatives are being undertaken in India, Alaska, Croatia, Indonesia, Mexico, Turkey and Brazil. The chapters provide an excellent opportunity to network with colleagues and experts in a local member community. If you are not yet involved in chapter activities, please check our web site for the GRSS Chapter point of contact nearest to your home city.
5) This year a new AdCom structure has been implemented, and the necessary changes have been made in the Constitution and Bylaws of GRSS. This was an important step for our Society in order to have our internal operations better reflect the focus of our activities. We have implemented a new portfolio with a Vice-President of Publications. Activities under this portfolio include the governance of our journals (TGRS, GRSL and J-STARS) and symposia publications, as well as of future publications. Prof. Wooil Moon has been appointed as Vice-President of Publications for 2010. In the same meeting we approved the increase in the number of issues per year for our Geoscience and Remote Sensing Letters (GRSL) journal from 4 to 6, starting in 2011.
6) In April we appointed a new editor for our Newsletter, Prof. Lorenzo Bruzzone. Lorenzo started very quickly in his new position and took the full responsibility for the June issue of the Newsletter. Already with his second issue, the September issue of the Newsletter achieved a record number of pages. A concept for transition into a magazine was presented by Lorenzo to the GRSS AdCom during its November meeting. The AdCom endorsed his concept, which foresees a transition into a magazine in the next 2–3 years.
7) In June we received final approval from the Technical Activities Board (TAB) of IEEE for our two new awards: GRSS GOLD Early Career Award and J-STARS Prize Paper Award. The first awards will be presented in 2011. GRSS has a total of 12 awards to recognize the outstanding achievements and volunteer service of our society members. For more information please refer to the web link http://www.grss-ieee.org/about/awards/.
8) During 2010 we have supported 10 conferences with technical co-sponsorship: International Conference on Geoinformatics, ASARS – Art, Science and Applications of Reflectance Spectroscopy Symposium, IPIN – International Conference on Indoor Position and Indoor Navigation, Whispers – Workshop on Hyperspectral Image and Signal Processing, SpaceWire conference, Atmospheric

Figure 1. Administrative Committee of the GRS Society during the July AdCom meeting. All volunteers!

Transmission Models Conference, PRRS – Pattern Recognition in Remote Sensing Workshop, Workshop on GNSS Reflectometry, URSI Commission F Microwave Signatures and ICMARS – International Conference on Microwaves, Antenna, Propagation & Remote Sensing. GRSS also provided technical co-sponsorship and support to the very successful IEEE GRSS GOLD (Graduate of the Last Decade) Conference held in Livorno, Italy during April 2010. In July during our AdCom meeting, Quebec City, Canada, was selected to host IGARSS 2014. The next three IGARSS conferences will be held in Sendai, Japan (August 1–5, 2011), Munich, Germany (July 22–27, 2012) and Melbourne, Australia (July 21–26, 2013).

9) This year GRSS has established a task force to enhance our globalization initiatives and to better prioritize the focus of our membership activities. Remote sensing is an emerging technology that is not yet well represented by the GRSS membership in several countries. We have several initiatives (workshops, chapters, tutorials, technical co-sponsorship for Specialty Symposia, travel fund support, etc.) to increase our activities and representation in Latin America, Africa and the Asia-Pacific region. Prof. Tony Milne is leading this task force and is the point of contact for Society members who would like to seek support for new activities in these regions.

10) GRSS has developed and promoted Community Remote Sensing over the last year to illustrate how the Internet, social networks, and other technologies will change the field of remote sensing by augmenting our traditional centralized satellite and aircraft data sources with citizen-supplied information and analysis. GRSS has promoted this new field by identifying and spotlighting projects from around the world that are contributing to the advancement of Community Remote Sensing. Dr. Bill Gail, Director of Corporate Relations for GRSS and member of the IGARSS 2010 core team, has initiated this idea and developed the IGARSS Community Remote Sensing Project, the so-called Geo-Wiki project, which is a global network of volunteers that would like to help improving the quality of land cover maps. More details and the results of this interesting project can be seen at http://igarss.geo-wiki.org/.

Our Society is performing very well and is considered as the premier society in remote sensing. I would like to recognize the outstanding work of innumerable volunteers that are contributing to GRSS. Our society operations are led by a team of 18 elected members with voting rights (AdCom) and is operated with the support and full engagement of many other members: ex-officio members (e.g. the Editors-in-Chief of our journals), committee chairs (e.g. technical committees), i.e. in total some 50 GRSS members. All are volunteers! You can see many of them in the picture above that was taken during our July AdCom meeting. Of course, we have many more volunteers in our society: We have over 1000 reviewers supporting the paper selection process of IGARSS, we have more than 50 scientists and engineers who participate in the IGARSS Technical Program Committee meeting every year, we have more than 400 members that support the review process of our journals, we have some 50 Associate Editors that are engaged in our journals and much more. The success of the activities of GRSS is the result of the hard work of its members and many other contributors in the international remote sensing community. One of the most important aspects of remote sensing is the nature of our work; we are performing research on issues related to environmental monitoring, sustainable development, climate change, understanding Earth's dynamic processes, etc. Considering this unique nature of our research field, the key role of our remote sensing community for its development, and the golden age that we have entered, Earth remote sensing is undoubtedly one of the most fascinating and most important research fields of all disciplines.

It has been a sincere pleasure and honor for me to serve the Geoscience and Remote Sensing Society during this year. I look forward to further supporting our unique community in the years to come. Finally, I would like to warmly commend to you our new President, Prof. Jon Benediktsson, who will take over duties on January 1, 2011.

Sincerely,

Alberto Moreira
President 2010
IEEE GRSS
alberto.moreira@dlr.de

CALL FOR PAPERS

IEEE Transactions on Geoscience and Remote Sensing Special Issue on ESA's Soil Moisture and Ocean Salinity Mission — Instrument Performance and First Results

Focus

The European Space Agency's (ESA) Soil Moisture and Ocean Salinity (SMOS) Mission was launched in November 2009 and has since provided soil moisture and ocean salinity data on a global scale. Soil moisture observations will further our knowledge about processes in the water and energy fluxes at the land surface whereas ocean salinity measurements will aid the characterisation of global ocean circulation and its seasonal and inter-annual variability. SMOS observations will also provide information on the characterisation of ice and snow covered surfaces and the sea ice effect on ocean-atmosphere heat fluxes and dynamics.

In support of the scientific requirements a novel technology was implemented: The payload of SMOS consists of the Microwave Imaging Radiometer using Aperture Synthesis (MIRAS) instrument, a 2-D interferometric radiometer operating at L-Band (1.4 GHz, 21 cm), measuring the brightness temperature emitted from the Earth at L-band over a range of incidence angles (0 to 55º) across a swath of approximately 1000 km. The main challenge for MIRAS has been to achieve the finest spatial resolution ever with a space-borne L-band radiometer over a wide swath. MIRAS is a truly novel instrument which synthesises a large aperture from a two-dimensional array of small passive microwave radiometers.

During the first year in orbit the focus has been on the calibration of the MIRAS instrument and the validation of the data, which will be the focus of this special issue. Hence we would like to invite contributions covering the following topics:

- Calibration and performance of the MIRAS instrument
- First results of calibration and validation and scientific studies using SMOS data, including results from in-situ and airborne campaigns, retrieval algorithm development and activities under ESA's Announcements of Opportunity for i) SMOS calibration and validation, and ii) scientific studies
- Contributions focussing on assimilating SMOS data into predictive models and developing new products based on SMOS data.

Submission Guidelines

Prospective authors should follow the regular guidelines of the IEEE Transactions on Geoscience and Remote Sensing (TGRS), as listed in the back cover of the Transactions. Authors should submit their manuscripts electronically to http://mc.manuscriptcentral.com/tgrs. Instructions for creating new accounts, if necessary, are available on the login screen. Please indicate in your submission that the paper is intended for the Special Issue by selecting "*ESA's SMOS Mission*" from the pull-down menu for manuscript type. Questions concerning the submission process should be addressed to tgrs-editor@ieee.org. For this Special Issue, authors are encouraged to contribute to the voluntary page charges.

Guest Editors of the SMOS Special Issue are

Susanne Mecklenburg
European Space Agency

Yann Kerr
Centre d'Etudes Spatiales de la BIOsphère (CESBIO), FRANCE

Jordi Font
Institut de Ciences del Mar (ICM), CSIC, SPAIN

Manuel Martín-Neira
European Space Agency, ESA-ESTEC

Inquires concerning the Special Issue should be directed to:
Susanne Mecklenburg
SMOS Mission Manager
European Space Agency
Tel: ++39 06 94180 695
susanne.mecklenburg@esa.int

Submission Deadline: March 31, 2011, with final publication in the May 2012 issue.

XXX URSI General Assembly and Scientific Symposium of International Union of Radio Science

URSI GASS 2011
ISTANBUL TURKEY

13-20 AUGUST 2011

Lütfi Kırdar Convention and Exhibition Centre
ISTANBUL / TURKEY

The XXX General Assembly and Scientific Symposium of the International Union of Radio Science (Union Radio Scientifique Internationale-URSI) will be held at Lütfi Kırdar Convention and Exhibition Centre in the beautiful historical center of Istanbul, Turkey on August 13-20, 2011.

The XXX General Assembly and Scientific Symposium will have a scientific program consisting of plenary lectures, public lectures, tutorials, posters, invited and contributed papers organized around the ten Commissions of URSI. In addition, there will be workshops, short courses, special programs for young scientists, student paper competition, programs for accompanying persons, and industrial exhibits. Over 1,500 scientists from more than fifty countries are expected to participate in the Assembly. The detailed program, link to electronic submission site, registration form and hotel information are available on the General Assembly Web site: www.ursigass2011.org

Information For All Authors - Submission Information

All contributions (four pages full paper and up to 100 words abstract) should be submitted electronically via the link provided on the General Assembly Web site. Please consult symposium website; www.ursigass2011.org for latest instructions, templates and sample formats.

Important Deadlines

Paper Submission	February 11, 2011
Notification of Acceptance	March 11, 2011
Early Registration	March 30, 2011

Topics of Interest

Commission A : Electromagnetic Metrology
Commission B : Fields and Waves
Commission C : Radiocommunication Systems and Signal Processing
Commission D : Electronics and Photonics
Commission E : Electromagnetic Environments and Interference
Commission F : Wave Propagation and Remote Sensing
Commission G : Ionospheric Radio and Propagation
Commission H : Waves in Plasmas
Commission J : Radio Astronomy
Commission K : Electromagnetics in Biology and Medicine

Student Paper Competition

A student must be first author of the paper. The student's advisor should attach a statement that his/her contribution is primarily advisory. For all other submission requirements and instructions can be found at the symposium website.

Short Courses and Workshops

Short Courses and Workshops will be organized on hot topics. Individuals interested in proposing short courses and workshops should contact conference organizers with their proposals.

Contact

For any questions related to the
XXX General Assembly;
E-mail: ursigass2011@ursigass2011.org

www.ursigass2011.org

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Sedef Kent, Turkey

Contact with URSI
Peter Van Daele, Belgium
W. Ross Stone, USA

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M. Taki, (*Vice-Chair*), Japan
Y. Ziya İder (*Local-Chair*), Turkey

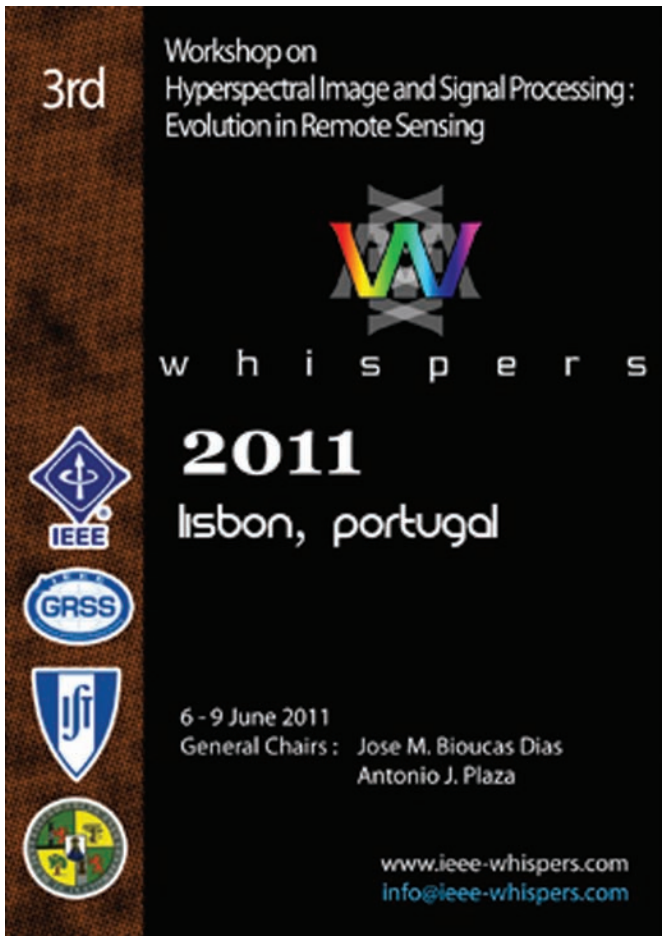
Geoinformatics 2011:
The 19th International Conference on Geoinformatics

June 24-26, 2011
Shanghai (China)

Organized by
The East China Normal University and The International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)

Sponsored by IEEE

Geoinformatics 2011 Co-Chairs:
East China Normal University and CPGIS
Abstract submission:
Before Jan. 30, 2011
Email: cpgis2011@cpgis.org
Register:
Before April 30, 2011
Registration fees:
Early bird on-line registration will open on Feb. 28, 2011 at http://cpgis.org Registration fee varies based on membership status and registration date.
Web Address:
www.geoinformatics2011.org



MultiTemp2011
6th International Workshop on the Analysis of Multi-Temporal Remote Sensing Images

July 12-14, 2011
Trento (Italy)

Chair:
Lorenzo Bruzzone, University of Trento
Extended Abstract Submission:
February 25, 2011
Registration Deadline:
June 15, 2011
Web Address: http://multitemp2011.org/

UNIVERSITY OF TRENTO - Italy

on the occasion of
100th Anniversary of Turkish Air Force

5th International Conference on Recent Advances in Space Technologies RAST2011

"The Future is in the Skies"
09-11 June 2011, Istanbul, TURKEY

Organized by
Turkish Air Force
Turkish Air Force Academy, Aeronautics and Space Technologies Institute

Important Dates:

Submission of summaries and special session proposals	**30 January 2011**
Notification of acceptance	**27 February 2011**
Camera-ready submission of full papers	**03 April 2011**

www.rast.org.tr

2nd International Conference on Space Technology

September 15-17, 2011
Royal Olympic Hotel, Athens, Greece

Greek Space Agency (GSA)

General Chair: Prof H Suess, DLR, Germany
Program Chair: Prof N Uzunoglu, MFOL,Greece
North America Liaison Chair:
Prof. Roger King, USA
Abstract submission (2 page) and industrial demos/exhibitions:
30 January 2011
Notification of acceptance:15 March 2011
Full paper deadline: 5 June 2011
The proceedings will be listed to IEEE Xplorer
Web address:
http://www.icspacetechnology.com/
More Information: Maria Petrou, petrou@iti.gr

ESA-EUSC-JRC 2011

Image Information Mining: Geospatial Intelligence from Earth Observation

March 30 - April 1, 2011
JRC - Institute for the Protection and Security of the Citizen, Ispra - Varese (Italy)

European Space Agency
European Union Satellite Centre
European Union Joint Research Centre

ESA-EUSC-JRC 2011Chair:
M. Datcu, DLR -German Aerospace Center

Short paper (4 pages, IGARSS format) submission:
Follow instructions on
http://earth.eo.esa.int/rtd/Events/2011_ESA-EUSC-JRC/index.html
https://www.easychair.org/account/signin.cgi?conf=esaeuscjrc2011

Register:
Within February 16, 2011
(online registration will be activated in early January 2011)

Registration fees:
Free of charge (up to available seats)

Web Address:
http://earth.eo.esa.int/rtd/Events/2011_ESA-EUSC-JRC/index.html

ISIDF2011:

The 2011 International Symposium on Image and Data Fusion

August 9-11, 2011
Tengchong, Yunnan Province, China

ISIDF2011 Chair:
Prof. Jixian Zhang (President of Chinese Academy of Surveying and Mapping; Chair of ISPRS WG VII/6)

Abstract submission:
Before February 28, 2011

Full paper submission:
Before June 30, 2011

Email: isidf2011@casm.ac.cn
Web Address:
http://isidf2011.casm.ac.cn

The 3rd International Conference

Microwaves, Radar and Remote Sensing Symposium

25-27 August 2011, Kiev, Ukraine

http://ieee.nau.edu.ua/index-22.html
Organized
by the IEEE Ukraine SP/AES Joint Chapter (Kiev)
and the National Aviation University, Kiev, Ukraine

Symposium Chair:
Prof. Felix Yanovsky, IEEE Fellow

Contribution Submission:
Camera-ready 4-page papers by April 20, 2011
e-mail to: yuliya-ans@yandex.ru; yanovsky@i.com.ua

Publications: Conference Proceedings book, CD, IEEE Xplore, and extended versions of the selected papers in the International Journal of Microwaves and Wireless Technologies (http://journals.cambridge.org/mrf)

UPCOMING CONFERENCES

See also http://www.techexpo.com/events or http://www.papersinvited.com

Name: International workshop on Multi-Platform/Multi-Sensor Remote Sensing and Mapping (IWMRSM)
Dates: January 10–12, 2011
Location: Xiamen, China
Contact: Prof. Ayman F. Habib
E-mail: habib@geomatics.ucalgary.ca
URL: http://www.mpmsrsm2011.org/

Name: Seventh conference on Image Information Mining
Dates: March 3–April 1, 2011
Location: Ispra, Italy
Contact: Dr. Roger King
E-mail: rking@cavs.msstate.edu
URL: http://earth.eo.esa.int/rtd/Events/2011_ESA-EUSC-JRC/index.html

Name: Joint Urban Remote Sensing Event
Dates: April 11–13, 2011
Location: Technische Universitaet Muenchen (TUM), Muenchen, Germany
URL: http://www.pf.bv.tum.de/jurse2011/

Name: Earth Observation for Global Changes (EOGC 2011)
Dates: April 13–15, 2011
Location: Technische Universitaet Muenchen (TUM), Muenchen, Germany
URL: http://www.eogc2011.tum.de

Name: 2011 IEEE Radar Conference (RadarCon '11)
Dates: May 23–27, 2011
Location: Kansas City, Missouri, USA
Contact: Dr. James Stiles
E-mail: jstiles@ittc.ku.edu
URL: http://www.ieeeradarcon11.org/

Name: 3rd Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing
Dates: June 8–10, 2011
Location: Lisbon, Portugal
E-mail: info@ieee-whispers.com
URL: http://ieee-whispers.com/

Name: 5th Recent Advances in Space Technologies (RAST2011)
Dates: June 9–11, 2011
Location: Istanbul, Turkey
Contact: Dr. Okyay Kaynak
E-mail: okyay.kaynak@boun.edu.tr
URL: http://www.rast.org.tr/

Name: Geoinformatics 2011
Dates: June 16–18, 2011
Location: Shanghai, China
Contact: Dr. Xinyue Ye
E-mail: xye@bgsu.edu
URL: www.geoinformatics2011.org

Name: 25th International Cartographic Conference
Dates: July 3–8, 2011
Location: Paris, France
URL: http://www.icc2011.fr/

Name: 6th International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (Multitemp2011)
Dates: July 12–14, 2011
Location: Trento, Italy
Contact: Prof. Lorenzo Bruzzone
E-mail: multitemp2011@disi.unitn.it
URL: http://multitemp2011.org/

Name: 2011 IEEE Geoscience and Remote Sensing Symposium (IGARSS2011)
Dates: August 1–6, 2011
Location: Sendai, China
URL: http://igarss11.org/

Name: The 2011 International Symposium on Image and Data Fusion (ISIDF2011)
Dates: August 9–11, 2011
Location: Tengchong, Yunnan Province, China
Contact: Dr. Yu Zeng
E-mail: zengyu@casm.ac.cn
URL: www.isidf2011.casm.ac.cn

Name: Pattern Recognition in Remote Sensing Workshop
Dates: August 10, 2011
Contact: Dr. Nicolas H. Younan
E-mail: younan@ece.msstate.edu
URL: http://www.iapr-tc7.org/prrs10

Name: XXX URSI General Assembly and Scientific Symposium of International Union of Radio Science (URSI GASS 2011)
Dates: August 13–20, 2011
Location: Istanbul, Turkey
E-mail: ursigass2011@ursigass2011.org
URL: http://www.ursigass2011.org/

(continued on page 48)

The Institute of Electrical and Electronic Engineers, Inc.
445 Hoes Lane, Piscataway, NJ 08854

(UPCOMING CONFERENCES continued from page 46)

Name: The 3rd International Microwaves, Radar and Remote Sensing Symposium (MRRS-2011)
Dates: August 25–27, 2011
Location: Kiev, Ukraine
Contact: Dr. Yuliya Averyanova
E-mail: yuliya-ans@yandex.ru
URL: http://ieee.nau.edu.ua/index-22.html

Name: Advanced RF Sensors and Remote Sensing Instruments Workshop
Dates: September 13–15, 2011
Location: Noordwijk, The Netherlands
Contact: Dr. Martin Suess
E-mail: Martin.Suess@esa.int
URL: http://conferences.esa.int/

Name: International Conference on Space Technology (ICST 2011)
Dates: September 15–17, 2011
Location: Athens, Greece
Contact: Dr. Maria Petrou
E-mail: Maria.petrou@imperial.ac.uk
URL: http://www.icspacetechnology.com/

Name: Asia-Pacific Conference on Synthetic Aperture Radar (APSAR2011)
Dates: September 26–27, 2011
Location: Seoul, Korea
Contact: Prof. Youngkil Kwag
E-mail: ykwag@kau.ac.kr
URL: http://www.kiees.or.kr/

Name: 14th International Conference On Ground Penetrating Radar (GPR2012)
Dates: June 7–9, 2012
Location: Shanghai, China
Contact: Dr. Xiongyao Xie
E-mail: xiexiongyao@tongji.edu.cn
URL: www.gpr2012.org

Name: 39th Scientific Assembly of the Committee on Space Research (COSPAR) and Associated Events (COSPAR 2012)
Dates: July 14–22, 2012
Location: Mysore, India
E-mail: cospar@cosparhq.cnes.fr
URL: http://www.cospar-assembly.org