

VARIA

In 2006 Dr. Maurizio Santoro joined GAMMA. He has profound experience in the use of SAR for landuse classification and forest parameter retrieval. GAMMA has ongoing or accepted projects selected through Announcements of Opportunity to conduct ERS, ENVISAT, JERS, ALOS, Radarsat-2, and TerraSAR-X research and development projects.

GAMMA employees are members of national (SED) and international (IEEE, RSPSoc, AGU) organizations, acted as peer reviewers (various journals), and were members of scientific committees (ESA Cat-1 project evaluation, Science reviewers to EC Framework Project and National R&D Projects, CoreH2O Science Team, ESA-post-doc fellowship project).

PUBLICATIONS

Articles in journals and books:

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- Della Vecchia A., P. Ferrazzoli, L. Guerriero, X. Blaes, P. Defourny, L. Dente, G. Satalino, T. Strozzi, and U. Wegmüller, Influence of geometrical factors on crop backscattering at C-band, *IEEE Trans. Geosci. Remote Sensing*, Vol. 44, No. 4, pp. 778-790, 2006.
- Foster, J., B. Brooks, T. Cherubini, C. Shacat, S. Businger, and C. L. Werner (2006), Mitigating atmospheric noise for InSAR using a high resolution weather model, *Geophys. Res. Lett.*, 33, L16304, doi: 10.1029/2006GL026781.
- Santoro M., L. Eriksson, J. Askne, and C. Schmillius, Assessment of stand-wise stem volume retrieval in boreal forest from JERS-1 L-band SAR backscatter, *Int. J. Remote Sensing*, Vol. 27, Nos. 15-16, pp. 3425-3454, Aug. 2006 (doi 10.1080/01431160600646037).
- Strozzi T., U. Wegmüller, H.R. Keusen, K. Graf, and A. Wiesmann, Analysis of the terrain displacement along a funicular by SAR interferometry, *IEEE Geoscience and Remote Sensing Letters*, Vol. 3, No. 1, pp. 15-18, 2006.
- Wegmüller U., R. A. Cordey, C. Werner, P. J. Meadows, "Flashing fields" in nearly simultaneous ENVISAT and ERS-2 C-band SAR images, *IEEE Trans. Geosci. Remote Sensing*, Vol. 44, No. 4, pp. 801-805, 2006.
- Articles in conference proceedings:**
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- Eriksson L. E. B., J. Askne M. Santoro and A. Wiesmann, "Forest parameter estimation using JERS-1 repeat-pass interferometry: Stem volume retrieval in Siberia and Sweden", *Proc. IGARSS 2006*, Denver, Colorado, USA, 31- Jul. - 4. Aug. 2006.
- Federici P., A. Tamburini, G. Luzi, H. Rott, A. Schaffhauser, T. Strozzi, D. Ponce-de-León, O. Monserrat and G. Bernardini, "GALAHAD: an EU project for the remote monitoring of glaciers, avalanches and landslides", *Proceedings of the International Disaster Reduction Conference IDRC*, Davos, Switzerland, 27 August - 1 September 2006.
- Santoro M., O. Cartus, C. Schmillius, U. Wegmüller, C. Werner, A. Wiesmann, Yong Pang, Zengyuan Li, "On the generation of a forest biomass map for northeast China: SAR interferometric processing and development of classification algorithm", *Procs. FRINGE 2005 Workshop*, Frascati, Italy, 28. Nov. - 2 Dec., 2005.
- Santoro M., J. Askne, U. Wegmüller, and C. Werner, "ERS-ENVISAT Coherence Properties of Land Cover", *Proc. IGARSS 2006*, Denver, Colorado, USA, 31- Jul. - 4. Aug. 2006.
- Santoro, M. and J. Askne, "Accuracy assessment of stem volume retrieval from ERS-1/2 multitemporal coherence in Eurasian boreal forests", *Proc. Igarss'06*, Denver, 31 July - 4 August 2006.
- Santoro, M., A. Wiesmann, J. Askne, and C. Schmillius, "ERS and ENVISAT SAR coherence properties of boreal forests", *Proc. 26th EARSeL Annual Symposium*, Warsaw, 29 May - 2 June 2006.
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- Strozzi T., L. Re, G. Valenti, H. Raetz, K. Graf, U. Wegmüller, A. Wiesmann, and C. Werner, "SAR Interferometric Point Target Analysis of Slope Instabilities in the Community of Biasca, Switzerland", *Procs. FRINGE 2005 Workshop*, Frascati, Italy, 28. Nov. - 2 Dec., 2005 (<http://earth.esa.int/workshops/fringe2005>).
- Strozzi T., A. Wiesmann, A. Sharov, A. Kouraev, U. Wegmüller, and C. Werner, "Capabilities of L-band SAR data for arctic glacier motion estimation", *Proc. IGARSS 2006*, Denver, Colorado, USA, 31- Jul. - 4. Aug. 2006.
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- Wegmüller U., C. Werner, T. Strozzi, and A. Wiesmann, "Application of SAR interferometric techniques for surface deformation monitoring," *Procs. IAG - FIG Symposium Baden*, Austria, 22 - 24 May 2006.
- Wegmüller U., C. Werner, T. Strozzi, and A. Wiesmann, "Ionospheric electron concentration effects on SAR and INSAR", *Proc. IGARSS 2006*, Denver, Colorado, USA, 31- Jul. - 4. Aug. 2006.
- Wiesmann A., C. Werner, M. Santoro, U. Wegmüller, T. Strozzi, and A. Wiesmann, "ScanSAR Interferometry for land use applications and terrain deformation", *Proc. IGARSS 2006*, Denver, Colorado, USA, 31- Jul. - 4. Aug. 2006.
- Wiesmann A., U. Wegmüller, T. Strozzi, and C. Werner, "Landslide survey and monitoring with InSAR in the frame of ASSIST", *Procs. International Disaster Reduction Conference*, Davos, Switzerland, 27. Aug. - 1. Sep. 2006.

Gamma Remote Sensing AG

ANNUAL REPORT 2006

RESEARCH AND DEVELOPMENT

FP6 - INTEGRAL (2004 – 2007)

INTEGRAL is a STREP project in the EC Framework 6 Programme, coordinated by Joanneum Research, Austria. The general objective of the INTEGRAL initiative is to promote an advanced observation technology for the unsupervised detection, precise measurement and variational analysis of ice motion on large European glaciers based on the complementary use of radar interferometry and interferometric altimetry with SAR data from post-operational, operational and upcoming systems such as E-SAR, ERS, SRTM, ENVISAT, RADARSAT.

FP6 - ASSIST: Alpine Safety, Security & Informational Services and Technologies (2005-2007)

ASSIST is a STREP project in the EC Framework 6 Programme, coordinated by VCS, Germany. ASSIST aims at improving the capabilities of risk warning and risk management in the Alpine region by implementing an integrated pre-operational service based on existing precursor services and related infrastructure. The advanced services shall be based on already operational crisis information and crisis communication systems. The project will focus on risks typical to mountainous areas e.g. avalanches, landslides, debris flows, floods, etc. Service Nodes will be laid out to support day-to-day monitoring and predictions of risk mitigation scenarios as well as operation during concrete crisis situations. Gamma's focus within ASSIST is to provide SAR based information on landslides, snow cover, avalanches, and floods.

FP6 - GALAHAD: Advanced Remote Monitoring Techniques for Glaciers, Avalanches and Landslides Hazard Mitigation (2005-2008)

The FP6 Strep project GALAHAD, coordinated by Centro Elettrotecnico Sperimentale Italiano (CESI), addresses to landslides, avalanches and glaciers-related hazard mitigation, through the development of advanced monitoring techniques and the improvement of forecasting methods and tools. It aims at developing new functionalities of ground-based SAR interferometry and laser scanning techniques, enabling the improvement of reliability, precision and operative usefulness of the measurements and of the forecasting capacity of the interpretation tools.

ESA – EOMD – MINING: EO services development for the mining sector (2003-2008)

The objective of this EO Market Development activity is to achieve awareness and acceptance for EO-based integrated services for the mining, oil and gas sectors with DINSAR and IPTA based deformation information being a key element of these services. The project team consists of GAMMA (SAR specialist and project coordinator), DMT (Established market player offering geo-information services to mining sector and central node for the integrated service), MFB-Geoconsulting (optical EO, GIS, visualization specialist) and TU Clausthal (Prof. Busch acts as

science reviewer). Interested potential users of the service participated to pre-commercial projects. Application cases covered include surface movement monitoring for hard coal mines (pre-mining, active mining, abandoned mines), lignite open cast mines (active mining, abandoned mines), salt mines (solution mining, abandoned caverns, caverns used for gas storage), and oil and gas fields. The objective of a small extension of the project in 2007 and 2008 is to adapt the methodologies for novel satellites (ALOS PALSAR, TerraSAR-X) and to assess the potential of these sensors for the mining application.

ESA – EOMD –HYDRO: Environmental Information Services for Hydropower Plant Management (2003-2006)

The objective of this EO Market Development activity is to achieve awareness and acceptance of newest earth observation technologies for hydro power plant management. The project is coordinated by Carlo Gavazzi Space, Italy, with partners from Italy, Canada, Norway, and Switzerland. The main products developed in this project are snow cover maps, water content of snow and land displacement. On-line services will be provided for the Alps, Canada and Scandinavian countries for water resource monitoring and security management.

ESA – DUE – EPIDEMIO (2003 – 2006)

EPIDEMIO is an ESA Data User Element (DUE) project with the objective to demonstrate uses of EO data in the context of support actions to reduce epidemic diseases in Africa. The project is coordinated by Jena Optronics, Germany. GAMMA contributed height and water body maps generated from ENVISAT ASAR and MERIS data.

ESA – GMES – TERRAFIRMA-II (2005-2008)

In late 2005 the ESA GMES project TERRAFIRMA-II (coordinated by NPA, UK) was started. The focus of TERRAFIRMA-II is on using SAR interferometric techniques to map surface motion of a large number of European Cities and a number of landslides. GAMMA is involved with the SAR data processing for several European cities and Swiss landslides. In 2006 GAMMA provided surface motion information for the cities of Prague (CZ) and Larissa (GR), and for the Lumnez (CH) landslide.

ESA – GMES – RESPOND-II (2006-2009)

In late 2006 the ESA GMES project RESPOND-II (coordinated by Infoterra, UK) was started. The focus of RESPOND -II is on providing EO based services for the humanitarian sector. GAMMA's involvement is in the provision of thematic maps with a particular focus on generating SAR based information products in the context of natural hazards (e.g. landslides).

ESA - NRSCC Dragon Cooperation Programme (2004-2007)

GAMMA is a partner in the Forest DRAGON Project (coordinated by FSU Jena, Germany), as part of the Sino-European Dragon Cooperation Programme. The objective of the Forest DRAGON Project is the development of algorithms for classification of SAR and InSAR data for forest mapping in China. GAMMA provides technical support to European and Chinese partners on data processing and interpretation.

PRODUCTS AND SERVICES

Deformation Maps, DEMs , Landcover/Landuse and Change/Hazard Products

A variety of products were generated in 2006 for customers in France, Germany, Italy, Russia, and Switzerland, using data of the ERS, ENVISAT, JERS, and Radarsat satellites. The Interferometric Point Target Analysis (IPTA) software was used to generate linear deformation maps, non-linear deformation histories, point heights, path delay maps in a pre-operational manner.

Consulting

GAMMA's consulting activity included SAR and interferometric processing related aspects, application development support, and radar system engineering.

Training courses

GAMMA's consulting activity included SAR and interferometric processing related aspects, application development support, and radar system engineering. In 2006 an increasing number of training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA) took place. So far most courses were given to one individual customer. To react to an increasing interest GAMMA decided to start offering courses addressing topics of interest to a larger group of people. A first such course (planned for April 2007, just after the ESA ENVISAT Symposium in Montreux, Switzerland) will be announced in early January on GAMMA's Web-site. Further courses, also on topics as IPTA and GAMMA software training, will follow.

GAMMA SOFTWARE

In 2006 GAMMA continued to provide licenses for its user-friendly and high quality software to support the entire processing from SAR raw data to products such as digital elevation models, deformation, and landuse maps. The software consists of the Modular SAR Processor (MSP), Interferometric SAR Processor (ISP), Differential Interferometry and Geocoding (DIFF&GEO), Land Application Tools (LAT), and Interferometric Point Target Analysis (IPTA), complemented by the stand-alone module for Geocoding and image registration (GEO).

The most important upgrades in 2006 included support for ENVISAT ASAR ScanSAR SLC data, including ScanSAR interferometry, functionality to process ALOS PALSAR raw and SLC data from JAXA and ERSDAC, and a program to generate 2-pass differential interferograms directly from pairs of co-registered SLC images and the simulated interferogram derived from a DEM (improving terrain adaptive common band filtering in areas with small-scale DEM variations).

License sales activities were continued with new licenses sold in Europe, North and South America, and Asia. User contacts indicate that the advanced algorithms supported and our competent support are important features of our software. This is also confirmed by an increasing number of running maintenance contracts. On several occasions the software was presented to potential customers.