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# Gamma Remote Sensing AG

## ANNUAL REPORT 2007

### 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, JERS and ALOS.

#### **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 are based on already operational crisis information and crisis communication systems with the focus on risks typical to mountainous areas e.g. avalanches, landslides, debris flows, floods, etc. Service Nodes are 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, lignite open cast mines, salt mines, and oil and gas fields. Currently the methodologies are being adapted to novel satellites (ALOS PALSAR, TerraSAR-X) and the potential of these sensors for the mining application is assessed.

### **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 2007 GAMMA provided surface motion information for the Rybnik (PL) –Ostrava (CZ), Grison (CH, landslide inventory), and Bernina (CH, landslide monitoring).

### **ESA – GMES – RESPOND-II (2006-2009)**

The focus of RESPOND -II (coordinated by Infoterra, UK) 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). In 2007 GAMMA provided a landslide survey product over the Khorog area in Tajikistan.

### **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.

### **ESA Contract 20716/07/NL/EL, Ku-Band Scatterometer Development (2007-2009).**

Under this contract GAMMA and its partners IAP, ENVEO, WSL-SLF develop a simple, well-calibrated, and transportable scatterometer at X- to Ku-band for enabling ground-based campaigns over snow-covered areas. Towards the end of the project an initial field campaign will be performed for demonstrating the functionality and performance of the "Snowscat".

### **ESA Contract 21013/07/NL/FF, ELBARA II L-Band Radiometer Systems for SMOS CAL/VAL Purposes (2007-2009).**

Under this contract GAMMA and its partners IAP and Metaplan build 3 L-band radiometers to be used for SMOS CAL/VAL Purposes. The ELBARA II radiometer design is a direct descendant of the ELBARA L-band radiometer system developed and implemented by IAP, with punctual modifications to improve the user friendliness. After completion the instruments will be deployed at test sites selected by the SMOS project authorities and ESA.

### **ESA – DUE - GlobGlacier (2007-2010)**

The main objectives of the GlobGlacier Project (coordinated by University of Zürich, Switzerland) are to define EO based services for glacier monitoring, demonstrate and implement services for a selected user group, validate the services, maintain a data base of the GlobGlacier products through the GLIMS database and thereby contribute to new scientific results in the domain of climate change detection, sea level contribution, climate and hydrological modeling. GAMMA's responsibilities in GlobGlacier are mainly in the context of glacier flow monitoring. The project was started in late 2007.

## **PRODUCTS AND SERVICES**

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

A variety of products were generated in 2007 for customers in, Germany, Italy, Hungary, United Kingdom, the Netherlands and Switzerland, using data of the ERS, ENVISAT, JERS, Radarsat, and ALOS 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**

In 2007 we organized again training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA). Further courses will follow in 2008. For information on future courses it is referred to our homepage.

## **GAMMA SOFTWARE**

In 2007 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).

A first upgrade concerning TerraSAR-X data should become available in December 2007. In 2008 upgrades for Radarsat 2 and Cosmo-SkyMed will follow.

License sales activities were continued with new licenses sold in Europe, Asia, North and South America, and Oceania. 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.

## **VARIA**

In 2007 Dr. Mike Schwank joined GAMMA for a part time job. As an expert in L-band radiometry and hydrological applications he is involved in the ELBARA II project.

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, various conferences).

## PUBLICATIONS

### Articles in journals and books:

- Benecke N., R. Kuchenbecker, S. Knospe, and U. Wegmüller, Überwachung bergbaubedingter Bodenbewegungen mit Radarinterferometrie – heute und morgen. *Geotechnik* 30, Nr. 1, pp. 35-41, 2007. VGE Verlag GmbH Essen, Germany, ISSN 0172-6145.
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- Strozzi T., A. Kouraev, A. Wiesmann, U. Wegmüller, A. Sharov and C. Werner, Estimation of Arctic glacier motion with satellite L-band SAR data, *Remote Sensing of Environment*, In Press, Corrected Proof, Available online 2 August 2007, doi:10.1016/j.rse.2007.06.007.
- Teatini, P., T. Strozzi, L. Tosi, U. Wegmüller, C. Werner, and L. Carbognin (2007), Assessing short- and long-time displacements in the Venice coastland by synthetic aperture radar interferometric point target analysis, *J. Geophys. Res.*, 112, F01012, doi:10.1029/2006JF000656.
- Articles in conference proceedings:**
- Askne J. and M. Santoro, “Boreal forest stem volume estimation from multitemporal C-Band InSAR observations”, *Procs. Envisat Symposium 2007*, 23-27 April 2007, Montreux, Switzerland (ESA SP-636, ISBN 92-9291-200-1).
- Cartus O., M. Santoro, C. Schmullius, P. Yong, L. Zengyuan, “Creation of large area forest biomass maps for NE China using ERS-1/2 Tandem coherence”, *Procs. Envisat Symposium 2007*, 23-27 April 2007, Montreux, Switzerland (ESA SP-636, ISBN 92-9291-200-1).
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- Delaloye R., T. Strozzi, C. Lambiel and E. Perruchoud, “Landslide-like development of rockglaciers detected with ERS-1/2 SAR interferometry”, *Proc. FRINGE 2007 Workshop*, Frascati, Italy, 26. – 30. Nov., 2007 (<http://earth.esa.int/workshops/fringe2007>).
- Della Vecchia A., P. Ferrazzoli, L. Guerriero T. Strozzi, U. Wegmüller, “A statistical and theoretical study about radar sensitivity to crop growth from S to X band”, *Proc. IGARSS 2007*, Barcelona, Spain, 23-27 Jul. 2007.
- Parcharidis I., M. Fomelis, P. Kourkoulis, U. Wegmüller, E. Lagios and V. Sakkas, “Continuous Risk Assessment of Structures in Areas of Ground Deformation Susceptibility by Persistent Scatterers InSAR: Preliminary Results of the Rio-Antirio Bridge (Greece) case”, *Proc. FRINGE 2007 Workshop*, Frascati, Italy, 26. – 30. Nov., 2007 (<http://earth.esa.int/workshops/fringe2007>).
- Raetzo H., U. Wegmüller, T. Strozzi, F. Marks, P. Farina, “Monitoring of Lumnez landslide with ERS and ENVISAT SAR data”, *Procs. Envisat Symposium 2007*, 23-27 April 2007, Montreux, Switzerland (ESA SP-636, ISBN 92-9291-200-1).
- Santoro M., C. Beer, A. Shvidenko, I. McCallum, U. Wegmüller, A. Wiesmann, C. Schmullius, “Comparison of forest biomass estimates in Siberia using spaceborne SAR, inventory-based information and the LPJ dynamic global vegetation model”, *Procs. Envisat Symposium 2007*, 23-27 April 2007, Montreux, Switzerland (ESA SP-636, ISBN 92-9291-200-1).
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- Stramondo S., U. Wegmüller, F. Bozzano, M. Saroli, F. Marra, M. Moro and F. R. Cinti, “IPTA Analysis and Geotechnical Investigation: Anomalous Subsidence in the city of Rome”, *Proc. FRINGE 2007 Workshop*, Frascati, Italy, 26. – 30. Nov., 2007 (<http://earth.esa.int/workshops/fringe2007>).
- Strozzi T., U. Wegmüller, C. Werner, A. Wiesmann and M. Santoro, “Potential of a C-band SAR mission with 12-day repeat cycle to derive ice surface velocity with interferometry and offset tracking”, *Proc. IGARSS 2007*, Barcelona, Spain, 23-27 Jul. 2007.
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