

# **Gamma Remote Sensing AG**

## **ANNUAL REPORT 2008**

### **RESEARCH AND DEVELOPMENT**

#### **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. In 2008, as part of a project extension the methodologies were adapted to ALOS PALSAR and TerraSAR-X to assess the potential of these sensors for the mining application.

#### **ESA – GMES – TERRAFIRMA-II (2005-2009)**

The focus of the ESA GMES project TERRAFIRMA-II (coordinated by NPA, UK) is on using SAR interferometric techniques to map surface motion of a large number of European Cities and landslides. GAMMA is involved with the SAR data processing for several European cities and Swiss landslides. In 2008 GAMMA provided surface motion information for Rybnik (PL) – Ostrava (CZ), Klosters-Conters (CH, landslide monitoring), Braunwald (CH, landslide monitoring), and Central Switzerland (CH, landslide survey).

#### **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).

#### **ESA - MOST Dragon I (2004-2008) and Dragon II (2008-2010) Cooperation Programmes**

The objective of the Forest DRAGON Project (Dragon I) is the development of algorithms for classification of SAR and InSAR data for forest mapping in China. The three objectives of the FOREST Ecosystem Observations of The Changing Earth Project (Dragon II) are 1) to further develop, improve and extent the products of the FOREST DRAGON 1 project, 2) to serve the observational priority of ESA's Living Planet Programme for the land surface and specifically ecosystem structure, and 3) to include new and innovative topics, i.e. exploration of synergistic EO data from radar, optical and hyper-spectral satellites and investigation of multi-temporal and multi-scale options. The Forest Dragon projects are coordinated by FSU Jena, Germany. 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)**

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 are mainly in the context of glacier flow monitoring.

### **ESA 21659/08/NL/LvH on Understanding Directionality in Surface Scattering by Imaging Radar (2008-2010)**

In this study GAMMA and its partners CNR – ISSIA Bari, Italy and Ludwig-Maximilians-Universität München, Germany try to improve the understanding of directional scattering effects taking place in the scattering of radar waves over natural surfaces, to assess how these effects affect the measurement of backscattering coefficient when standard calibration techniques are applied, and to investigate detection and correction techniques for these effects.

### **ESA ESTEC Contract 21206/07/NL/HE METAWAVE (2008-2010)**

The full title of this study coordinated by ARGOSS, NL is „Mitigation of Electromagnetic Transmission errors induced by Atmospheric Water Vapour Effects (METAWAVE)“. Its main motivation is to look for new methods which can be used to eliminate or reduce the effects of errors induced by the atmospheric path delay (mainly atmospheric water vapour) thereby improving the usability of spaceborne remote sensing for InSAR applications. Furthermore, the potential of InSAR techniques to contribute to the retrieval of atmospheric water vapor information is addressed.

### **ESA-DUE: GlobSnow (2008-2010)**

The ultimate aim of the GlobSnow project coordinated by the Finnish Meteorological Institute, Finland is the development of the knowledge and technical capacity necessary to implement a sustainable global snow monitoring service fulfilling the Global Climate Observation System (GCOS) implementation plan requirements. For this purpose the identification and specification of the user requirements, the standardization and homogenization of data sets and algorithms required to qualify for a relevant FCDR, and the demonstration and validation of the implemented service in collaboration with the user community are addressed within GlobSnow. GAMMA's main responsibility is the data processing system design and implementation.

### **ESA Novel Observation Study BIOMASAR (2008-2009)**

The objective of this study coordinated by Friedrich-Schiller-University Jena, Germany, is the validation of a novel biomass retrieval algorithm based on hyper-temporal Wide-Swath and Global Monitoring ENVISAT ASAR datasets.

### **JAXA Kyoto&Carbon (K&C) Initiative**

The objective of the ALOS K&C Initiative is to define, develop and validate thematic products derived primarily from ALOS PALSAR data that can be used to meet the information requirements relating to Conventions, Carbon Cycle Science and Conservation of the environment. GAMMA supported related activities on forest change detection of the Friedrich-Schiller University Jena, Germany, and the Swedish Agricultural University, Umeå, Sweden.

## **PRODUCTS AND SERVICES**

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

A variety of products were generated in 2008 for customers in, Europe, Asia, and North America using data of the ERS, ENVISAT, JERS, Radarsat, ALOS, TerraSAR-X, and Cosmo-Skymed satellites. The SAR interferometry and Interferometric Point Target Analysis (IPTA) were used to generate deformation maps, deformation histories, terrain heights, and path delay maps in a pre-operational manner.

In 2008 we successfully started to provide services using the GAMMA Portable Radar Interferometer (GPRI). Measurements over landslides, rock instabilities, glaciers, and infrastructure were acquired.

### **Consulting**

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

### **Training courses**

In 2008 we organized again training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA). Further courses, will follow in 2009. For information on future courses it is referred to our homepage (<http://www.gamma-rs.ch>).

## **GAMMA SOFTWARE**

In 2008 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).

In 2008 upgrades for Radarsat 2 and Cosmo-Skymed became available. Using TerraSAR-X data we could confirm that high-resolution SAR data are particularly well suited for IPTA, resulting in very high point densities. Furthermore, improvements to the functionality could be realized, e.g. to better support monitoring of non-uniform displacements.

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

GAMMA employees are members of national (SED) and international (IEEE, RSPSoc, AGU) organizations, acted as peer reviewers (various journals), were members of scientific committees (ESA Cat-1 project evaluation, CoreH2O Science Team, Tandem-X Science Team, various conferences), and engaged in University teaching (FSU Jena, Univ. Freiburg).

## PUBLICATIONS

### Articles in journals and books:

- Czarnogórska M., M. Graniczny, Z. Kowalski, and U. Wegmüller, "Dynamika zmian powierzchni terenu na Górnym Śląsku w okresie 10.07–25.08.2007 r. na podstawie danych interferometrycznych z satelity ALOS", *Przegląd Geologiczny*, vol. 56, nr 7, (ISSN 0033-2151), pp. 524-527, 2008.
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- Articles in conference proceedings:**
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- Eriksson, L.E.B., M. Santoro, and J.E.S. Fransson, "Temporal decorrelation for forested areas observed in spaceborne L-band SAR interferometry", *Proc. IGARSS'08*, Boston, 6-11 Jul. 2008.
- Fransson, J.E.S., M. Magnusson, H. Olsson, L.E.B. Eriksson, K. Folkesson, G. Sandberg, M. Santoro, and L.M.H. Ulander, "Detection of clear-cuts using ALOS PALSAR satellite images", *Proc. EUSAR 2008*, Friedrichshafen, 2-5 June, 2008.
- Lambiel C., R. Delaloye, T. Strozzi, R. Lugon and H. Raetz, "ERS InSAR for assessing rock glacier activity", *Proc. 9. Int. Conf. on Permafrost*, Fairbanks, USA, pp. 1019-1025, 29 June - 3 July, 2008.
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