

Gamma Remote Sensing AG

ANNUAL REPORT 2010

RESEARCH AND DEVELOPMENT

FP7 - SAFER: Services and Applications for Emergency Response (2009-2011)

In this project coordinated by Infoterra France GAMMA supports INGV with land surface deformation information for earthquakes, volcanoes, and over a site in Romania. In 2010 results over Romania and the Etna and Merapi Volcanos were derived.

FP7 - DORIS (2010-2013)

In this FP7 Space-Call Project coordinated by CNR-IRPI, Perugia, Italy, GAMMA addresses the combined use of space-borne and ground-based radar interferometry in the context of ground deformation risk scenarios. The project started in late 2010.

ESA - GMES - TERRAFIRMA (2005-2009, 2010-2012)

The focus of the ESA GMES project TERRAFIRMA is on using SAR interferometric techniques to map surface motion of a large number of European Cities and landslides. In December 2009 the new coordinator Altamira and ESA signed the contract for Terrafirma III (2010-2012). In 2010 GAMMA was involved with PSI processing over Swiss landslides.

ESA - Dragon II Cooperation Programmes (2008-2012)

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 20716/07/NL/EL, Ku-Band Scatterometer Development (2007-2010) & NOSREX-I/II (2009-2011)

Under this contract GAMMA and its partners IAP, ENVEO, WSL-SLF developed a simple, well-calibrated, and transportable scatterometer at X- to Ku-band for enabling ground-based campaigns over snow-covered areas. In late 2009 and early 2010 we implemented a number of amendements requested by ESA in CCN1. During the winter 2009/2010 and again in 2010/2011 the SNOWSCAT instrument is used by the Finnish Meteorological Institute in the frame of the NOSREX projects, supported by GAMMA.

ESA - CCI - GlobGlacier (2010-2013)

The main objectives of the GlobGlacier Project (coordinated by University of Zürich, Switzerland) in the frame of the Climate Change Initiative (CCI) are to provide EO based services for glacier monitoring, as developed and demonstrated under the DUE GlobGlacier Project. GAMMA's responsibilities are mainly in the context of glacier flow monitoring.

ESA 21659/08/NL/LvH, 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 improved the understanding of directional scattering effects taking place in the scattering of radar waves over natural surfaces.

ESA 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. The project will be terminated in Jan. 2011.

ESA - DUE - GlobSnow (2008-2011)

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 Support to Science Element Study BIOMASAR (2008-2009,2010-2012)

In the first part of the BIOMASAR project (coordinated by Friedrich-Schiller-University Jena, Germany) a novel biomass retrieval algorithm based on hyper-temporal Wide-Swath and Global Monitoring ENVISAT ASAR datasets was developed and validated demonstrating high quality results. The objective of the second part of the project (coordinated by GAMMA) is now the generation of pan-boreal growing stock maps.

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 and biomass mapping of the Friedrich-Schiller University Jena, Germany, and the Swedish Agricultural University, Umeå, Sweden.

ESA - VAE - POLInSAR mapping services for forestry (2009/2010)

GAMMA supported Dendron in the ESA's Value Adding Element project on „POLInSAR mapping services for forestry“. GAMMA responsibilities concerned SAR, INSAR and polarimetric processing of Radarsat-2 and TerraSAR-X data.

ESA 22140/08/I-I-EC, GLOF: Glacier Lake Mapping (2008-2010)

In this DUE Innovators project GAMMA and the University of Oslo addressed the mapping of glacier lakes primarily using high resolution SAR data. Initially well known sites in the Alpes were used to develop and consolidate the methodology. The main application sites were then in the Himalayan and in Tajikistan.

ESA 22526/09/I-LG, ERS-ENVISAT Tandem Cross-Interferometry Campaigns: Case Studies (2009-2011)

Under this contract GAMMA conducts research on ERS-ENVISAT Tandem (EET) Cross-Interferometry (CInSAR) for a variety of applications including DEM generation, ice motion, snow cover, desert and vegetation. For many of the proposed sites suited data pairs were acquired during the EET campaigns in winter 2007/08, 2008/09, and 2010. Results could already be presented in journals and at conferences.

ESA - DUE - Permafrost (2009-2011)

In this DUE Project coordinated by the TU Wien, GAMMA provides on one hand DEM and surface motion information over northern permafrost regions using SAR interferometry and on the other hand GAMMA is responsible for the data processing system design and implementation.

ESA - ECV - Landcover (2010-2012)

In this Project coordinated by UCL, Louvain, Belgium, GAMMA contributes waterbodies information derived from multi-temporal SAR data.

CH Spacetech Project (2010-2011)

Under this Swiss Space-Technology Programme Project enhancements to the GAMMA Portable Radar Interferometer (GPRI) shall be realized and tested in the field. The project started in Dec. 2010. GAMMA gets support in this development from ETH (Andrew Kos).

PRODUCTS AND SERVICES

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

A variety of products were generated in 2010 for customers in, Europe, Asia, North America and South America using data of the ERS, ENVISAT, Radarsat, ALOS, TerraSAR-X, and Cosmo-Skymed satellites. SAR interferometry and Interferometric Point Target Analysis (IPTA) were used to generate forest biomass maps, deformation maps, deformation histories, terrain heights, and path delay maps. In 2010 we also continued providing 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 2010 we organized again training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA). Further courses, will follow in 2011. For information on future courses it is referred to our homepage (<http://www.gamma-rs.ch>).

GAMMA SOFTWARE

In 2010 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 2010 further tools were added to the IPTA to further enhance the support for interferometric time series analysis. A full range of approaches using point scatterers or distributed multi-looked phases with single or multi-reference stack schemes is supported.

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.

GAMMA INSTRUMENT DEVELOPMENT

After its delivery the X- to Ku-band scatterometer SNOWSCAT, and the ELBARA radiometers are now intensively used in the field. In 2010 the main hardware development effort at GAMMA was invested on the second generation prototypes of the GAMMA Portable Radar Interferometer (GPRI). We look ahead to hopefully many successful and interesting measurements with the new GPRI in 2011.

VARIA

GAMMA employees are members of national (SIP, SED) and international (IEEE, RSPSoc, AGU) organizations, acted as peer reviewers (various journals, books), 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, University of Zaragoza, University of Oslo). In 2010 Rafael Caduff started to work part-time for GAMMA, mainly supporting GPRI Campaigns. In 2010 GAMMA engaged in the setting up of the TERRARSENSE Switzerland AG, a new company directed by Dr. Andrew Kos, offering services in applied geology and covering a wide range of ground-motion measurements (including GPRI). The paper by Tanase, M., Santoro, M., de la Riva, J., Perez-Cabello, F., "Backscatter properties of multi-temporal TERRASAR-X data and the effects of influencing factors on burn severity evaluation in a mediterranean pine forest," received the IGARSS'09 Interactive Session Prize Paper Award.

PUBLICATIONS

Articles in journals and books:

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- Wegmüller U., D. Walter, V. Spreckels, and C. Werner, "Nonuniform ground motion monitoring with TerraSAR-X persistent scatterer interferometry," *IEEE Trans. Geosci. Remote Sensing*, Vol. 48, 2, pp. 895-904, 2010.
- Articles in conference proceedings:**
- Bitelli G., F. Bonsignore, L. Carbognin, A. Ferretti, T. Strozzi, P. Teatini, L. Tosi and L. Vittuari, "Radar interferometry-based mapping of the present land subsidence along the low-lying northern Adriatic coast of Italy", *Procs EISOLS 2010*, Querétaro, Mexico, 17-22 Oct. in IAHS Publ. 339, Land subsidence, associated hazards and the role of natural resources development, 2010.
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