

Gamma Remote Sensing AG

ANNUAL REPORT 2011

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 2011 results over New Zealand and Japan were derived, including ScanSAR interferometric results.

FP7 – DORIS: GMES downstream service for ground deformations (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. In 2011 GAMMA processed data over several sites in Switzerland.

FP7 – PanGEO: Enabling Access to Geological Information in Support of GMES (2011-2014)

In this FP7 Space-Call Project coordinated by Fugro-NPA, UK, geological surveys and persistent scatterer specialists cooperate to provide free access to geohazard information for many of the largest European cities. GAMMA is involved in the PSI processing over cities in Bulgaria, Czech Republic, Denmark, Greece, Hungary, Poland, Rumania, and Slovenia.

FP7 - Cryoland: GMES Service Snow and Land Ice (2011-2014)

In this FP7 Space-Call Project coordinated by ENVEO, Austria, the GMES Service Snow and Land Ice is developed to provide geospatial products on snow cover, glaciers, and lake/river ice derived from Earth observation satellite data. GAMMA addresses the improvement and validation of products on glaciers, lake and river ice and the development of tools for the use of Sentinel-1 for the derivation of snow products.

FP7 – GIONET: Network for Earth Observation Research Training (2011-2015)

In this FP7 Marie-Curie Action coordinated by the University of Leicester, UK, GAMMA trains two PhD students. In 2011 the students were selected and started then in October their work, Jessica Papke on “Monitoring landslide displacements with terrestrial and spaceborne Radar Interferometry” and Penelope Kourkouli on “DINSAR/PSI hybrid methodologies”.

FP7 – GEOCARBON: Operational Global Carbon Observing System (2011-2014)

In this project coordinated by the Centro Euro-Mediterraneo per i Cambiamenti Climatici, Italy, GAMMA contributes with the intergration of existing forest biomass data products to a global biomass map.

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 2011 GAMMA was involved with PSI processing over Swiss landslides and a Polish abandoned mining site.

ESA - Dragon II Cooperation Programmes (2008-2012)

The Forest Dragon project is 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 (2007-2011) & NOSREX-I/II/III (2009-2012)

In 2011 GAMMA provided further technical assistance for the deployment and operation of the SNOWSCAT X- to Ku-band scatterometer used by the Finnish Meteorological Institute in the frame of the NOSREX projects.

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 - 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 the generation of pan-boreal growing stock maps.

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

Under this contract GAMMA conducted 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 were 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 - CCI - Landcover (2010-2012)

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

ESA Contract 4000104365, Assimilation of high-temporal resolution SAR data into land process models (2011-2013)

In preparation of Sentinel-1 GAMMA develops processing techniques and applications for multi-temporal SAR data with a high temporal resolution. The project started on 1. Nov. 2011.

JAXA Kyoto & Carbon (K&C) Initiative, 2nd and 3rd phase (2009-2011 and 2011-2013)

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 in cooperation with Friedrich-Schiller University Jena, Germany, the Swedish Agricultural University, Umeå, Sweden, and Max-Planck Institute for Biogeochemistry, Jena, Germany.

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 2011 for customers in, Switzerland, Europe, Asia, and North America using data of the ERS, ENVISAT, Radarsat, ALOS, TerraSAR-X, and Cosmo-Skymed satellites. SAR, InSAR and Interferometric Point Target Analysis (IPTA) were used to generate forest biomass maps, deformation maps, deformation histories, terrain heights, and path delay maps. In 2011 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 2011 we organized again training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA). Further courses will follow in 2012. For information on future courses it is referred to our homepage (<http://www.gamma-rs.ch>).

GAMMA SOFTWARE

In 2011 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 2011 tools were added to further enhance the support for interferometric time series analysis. A special effort was dedicated to tools permitting to increase the efficiency of the processing of large data stacks.

License sales activities were continued with new licenses sold in Europe, Asia, and North America. 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 2011 the use of the ELBARA and the SNOWSCAT instruments was further supported by GAMMA in the frame of ESA contracts. The main hardware development effort at GAMMA was invested on the second generation prototypes of the GAMMA Portable Radar Interferometer (GPRI). Measuring, testing and validating were continued. Many successful and interesting GPRI measurements were accomplished in 2011 and several GPRI were sold.

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 Berne, ETH Zürich, University of Oslo). In 2011 Othmar Frey, Christian Mätzler, Jessica Papke, and Penelope Kourkouli started to work for GAMMA, Furthermore, Ingo Völksch was temporarily employed to support the ELBARA users. GAMMA is engaged in the company TERRARSENSE Switzerland AG, directed by Dr. Andrew Kos, offering services in applied geology and covering a wide range of ground-motion measurements (including GPRI).

PUBLICATIONS

Articles in journals and books:

- Cartus O., M. Santoro, C. Schmullius, and Zngyuan Li, "Large area forest stem volume mapping in the boreal zone using synergy of ERS-1/2 tandem coherence and MODIS vegetation continuous fields," *Remote Sensing of Environment*, vol. 115, 3, pp. 931-943, 2011.
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- Strozzi, T., C. Werner, A. Wiesmann and U. Wegmüller, Topography Mapping with a Portable Real-Aperture Radar Interferometer, *Geoscience and Remote Sensing Letters*, doi: 10.1109/LGRS.2011.2166751, published on-line 2011.
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