

Gamma Remote Sensing AG

ANNUAL REPORT 2012

RESEARCH AND DEVELOPMENT

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 2012 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. In 2012 GAMMA completed the PSI processing over Varna, Bulgaria; Copenhagen, Denmark; Miskolc, Hungary; Cluj-Napoca and Bucarest, Rumania; and Maribor, 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 Kourkoulou 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. GAMMA was involved with PSI processing over Swiss landslides and a Polish abandoned mining site.

ESA Ku-Band Scatterometer Development & NOSREX-I/II/III (2007 - 2012)

In 2012 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 - Glaciers (2010-2013)

The main objectives of the Glaciers_CCI 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 in the glacier flow monitoring and in the service engineering.

ESA - DUE – GlobSnow 2 (2012-2014)

The objective of the GlobSnow-2 project coordinated by the Finnish Meteorological Institute, is further enhancement of the retrieval methodologies for Snow Extent and Snow Water Equivalent products and to re-process long term datasets utilizing the improved retrieval algorithms. 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 - DUE - Permafrost (2009-2012)

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 provides waterbodies information derived from multi-temporal SAR data and contributes multi-temporal SAR signatures to be used for urban mapping.

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. In 2012 the work focused on the processing methodologies and the processing of multi-temporal stacks over selected application sites.

ESA Support to Science Element, Contract 4000105184, SMOS+ Innovation Permafrost (2012-2013)

In this project coordinated by Finnish Meteorological Institute (FMI) the application of SMOS data for the characterization of the freeze/thaw cycle and the retrieval of permafrost information is addressed. GAMMA is involved through the ELBARA-II instrument operated in Sodankylä and focuses mainly on Radiative Transfer Modeling aspects.

ESA IAP - Monitoring Alpine Transportation Infrastructure using Space Techniques (2012-2013)

In cooperation with the Institute of Navigation of the Graz University of Technology, Austria (INAS), GAMMA develops integrated services for alpine railway and road operators. Slope stability / deformation information is provided using space-borne and terrestrial INSAR methods and GPS/GNSS.

ESA - Dragon 3 Cooperation Programmes (2012-2016)

Dragon 3 focuses on exploitation of ESA, Chinese, and third party mission EO data for geo-science and applications development in land, ocean and atmospheric applications in 50 joint Sino-European projects. GAMMA is involved in the Forest Dragon 3 and Himalayan Glacier Dynamics projects.

JAXA Kyoto & Carbon (K&C) Initiative, 3rd phase (2011-2014)

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, Swedish Agricultural University, Umeå, Sweden, and Max-Planck Institute for Biogeochemistry, Jena, Germany.

CH Spaceteq Project on Spaceborne SAR Tomography (2012-2014)

Under the Swiss Space-Technology Programme Project “GAMMA Software Module for Spaceborne SAR Tomography”, lead by the ETH Zurich, Institute of Environmental Engineering, Earth Observation and Remote Sensing, Spaceborne SAR Tomography methodologies are developed, tested, and integrated into a related GAMMA Software Module.

CH Spaceteq Project “Next Generation SAR Processing Tools” (2012-2014)

In cooperation with the GRID & Cloud Computing Group the Ecole d'ingénieurs et d'architectes, Fribourg, (EIA-FR) and the Signal Processing Laboratory of the Ecole Polytechnique Fédérale de Lausanne (EPFL), GAMMA addresses the acceleration of the GAMMA Software through parallel processing methods and preparations for Sentinel-1 data processing.

PRODUCTS AND SERVICES

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

A variety of products were generated in 2012 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 Persistent Scatterer Interferometry (PSI) were used to generate forest biomass maps, glacier lake maps, deformation maps, deformation histories, terrain heights, and glacier velocity maps. In 2012 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 2012 we organized again training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA). Further courses will follow in spring 2013 (for information see our homepage (<http://www.gamma-rs.ch>)).

GAMMA SOFTWARE

In 2012 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 2012 tools were added to process data of the JPL UAVSAR and the Indian RISAT-1 SAR.

License sales activities were continued with new licenses sold in Europe, Asia, Australia, North and South 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 2012 the use of the ELBARA and the SNOWSCAT instruments was further supported by GAMMA in the frame of ESA contracts. It is likely that a new ELBARA series will be built in 2013. There was again a significant interest in the GAMMA Portable Radar Interferometer (GPRI). Measuring, testing and validating were continued. Several GPRI instruments could be sold. Furthermore, a "car-SAR" test was conducted mounting the GPRI with a horn antenna on-top of a regular car to get a SAR image of the valley slopes to one side of a road.

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 and PhD supervision (FSU Jena, University of Berne, ETH Zürich, SLU Umeå). In 2012 Mike Schwank restarted to work at GAMMA and Andreas Wiesmann was on a sabbatical for several months. 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:

- Askne, J., Santoro, M., "Experiences in boreal forest stem volume estimation from multitemporal C-band InSAR," in *Recent Interferometry Applications in Topography and Astronomy*, Padron, I., Ed.: InTech, ISBN: 978-953-51-0404-9, 2012.
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- Strozzi, T., Wiesmann, A., Käab, A., Joshi, S., and Mool, P.: Glacial lake mapping with very high resolution satellite SAR data, *Nat. Hazards Earth Syst. Sci.*, 12, 2487-2498, doi:10.5194/nhess-12-2487-2012, 2012.
- Teatini P., L. Tosi and T. Strozzi, Comments on "Recent Subsidence of the Venice Lagoon from continuous GPS and interferometric synthetic aperture radar" by Y. Bock, S. Wdowinski, A. Ferretti, F. Novali and A. Fumagalli, *Geochemistry, Geophysics, Geosystems (G3)*, Volume 13, Number 1, doi:10.1029/2012GC004191, 31 July 2012.
- Teatini P., L. Tosi, T. Strozzi, L. Carbognin, G. Cecconi, R. Rosselli and S. Libardo, Resolving land subsidence within the Venice Lagoon by persistent scatterer SAR interferometry, *Physics and Chemistry of the Earth*, 40-41: 72-79, doi:10.1016/j.pce.2010.01.002, 2012.
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Articles in conference proceedings:

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- Wegmüller U., T. Strozzi, R. Delaloye and H. Raetzo, Landslide mapping in Switzerland with ENVISAT ASAR, *Procs. IGARSS'2012*, Munich, Germany, 22-27 July 2012.
- Werner C., A. Wiesmann, T. Strozzi, A. Kos, and U. Wegmüller, "The GPRI Multi-mode Differential Interferometric Radar for Ground-based Observations", *Procs. EUSAR'12*, Apr. 2012.