

Gamma Remote Sensing AG

ANNUAL REPORT 2005

RESEARCH AND DEVELOPMENT

SIBERIA-II : Multi-sensor concepts for greenhouse gas accounting of northern Eurasia (2002 – 2005)

The SIBERIA-II project in the frame of the EC Environment and Climate Programme, Framework 5, CEO, was concluded in 2005. GAMMA's part was supported by the Swiss Federal Office for Science and Education. The overall objective of SIBERIA-II was to demonstrate the viability of full carbon accounting (including greenhouse gases (GHGs): CO₂, CO, CH₄, N₂O, NO_x) on a regional basis using the environmental tools and systems available to us today and in the near future. The region under study was Northern Eurasia, covering an area of 200 million ha and representing a significant part of the Earth's boreal biome which plays a critical role in global climate. The tools and systems employed included a selected yet spectrally and temporally diverse set of multi-sensor Earth Observation instruments, detailed existing databases of field information and some of the worlds most advanced climate models to account for fluxes between land and atmosphere.

ESA GSTP - Development of SAR Inversion Algorithms for Land Applications (2003 – 2005)

In cooperation with DISP, University Tor Vergata, Rome, Italy, CNR-ISSIA, Bari, Italy, Université Catholique de Louvain (UCL), Belgium, and LHWM, University of Ghent, Belgium, new prototype retrieval algorithms using advanced SAR data for the combined retrieval of vegetation and soil parameters were developed. GAMMA acted as coordinator of this project.

ESTEC/17508/03/NL/LvH/bj – Flashing fields! A preliminary investigation (2003-2005)

In 2005 a small extension to the initial characterisation of the “flashing field” anomalies was conducted, investigating ascending - descending orbit pairs acquired within about 12 hours over the same area. The presence of strong directionalities in the scattering over a significant fraction of agricultural fields could be confirmed.

INTEGRAL (2004 – 2006)

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. A big disappointment in 2005 was the failure of the CRYOSAT launch.

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 and fundamental 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 (2003-2006)

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 participate to pre-commercial projects. Application cases covered include surface movement monitoring for hard coal mines (pre-mining, active mining, abandoned mines), lignite open cast mines (active mining, abandoned mines), salt mines (solution mining, abandoned caverns, caverns used for gas storage), and oil and gas fields.

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 shall be based on already operational crisis information and crisis communication systems. The project will focus on risks typical to mountainous areas e.g. avalanches, landslides, debris flows, floods, etc. Service Nodes will be laid out to support day-to-day monitoring and predictions of risk mitigation scenarios as well as operation during concrete crisis situations.

ESA – DUP – SLAM II (2003 – 2005)

The objective of the SLAM II project was to develop EO based services and products as landslide motion survey, landslide displacement monitoring, and landslide susceptibility mapping, that can help operational activities of those institutions that are in charge of hydrogeological risk management. The project was coordinated by Planetek, Italy. Partners involved include TRE, Italy, University of Florence, Italy, Spacebel, Belgium, GEOTEST, Switzerland, and GAMMA, Switzerland. Within Switzerland GAMMA and GEOTEST generated SAR interferometry based landslide products for FOWG and the cantons Bern, Freiburg, Valais, and Ticino.

ESA-ESRIN PSIC4 (2005)

GAMMA participated to the Persistent Scatterer Interferometry PSI Processing over a Validation Test Site (PSIC4) project, as part of which it conducted an IPTA processing over a predetermined test-site. The validation of the results by geological services is ongoing.

ESA – DUE – EPIDEMIO (2003 – 2005)

EPIDEMIO is an ESA Data User Element (DUE) project with the objective to demonstrate uses of EO data in the context of support actions to reduce epidemic diseases in Africa. The project is coordinated by Jena Optronics, Germany. GAMMA contributes height and water body maps generated from ENVISAT ASAR and MERIS data.

ESA – EOMD –HYDRO: Environmental Information Services for Hydropower Plant Management (2003-2006)

The objective of this EO Market Development activity is to achieve awareness and acceptance of newest earth observation technologies for hydro power plant management. The project is coordinated by Carlo Gavazzi Space, Italy, with partners from Italy, Canada, Norway, and Switzerland. The main products developed in this project are snow cover maps, water content of snow and land displacement. On-line services will be provided for the Alps, Canada and Scandinavian countries for water resource monitoring and security management.

ESA – TESI – Mining subsidence (2003 –2005)

Within the TerraSAR Service Infrastructure (TESI) project, coordinated by Infoterra-Germany, GAMMA was responsible for the mining subsidence service. A series of L-band SAR data over a coal mining area was used to demonstrate the potential of L-band DINSAR to overcome important limitations identified for C-band DINSAR, namely spatial gaps in the deformation information for vegetated areas and in the case of high deformation gradients as observed for underground hard coal mining. The product quality and the service utility were assessed by DSK, Germany.

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 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.

PRODUCTS AND SERVICES

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

A variety of mainly SAR based products were generated in 2005, using data of the ERS, ENVISAT, JERS, and Radarsat 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.

As part of a service contract GAMMA processed a series of Radarsat-1 scenes for JRC-Agrifish and made the related capability available for further processing at JRC through related software, training, and support.

Consulting

GAMMA's consulting activity included SAR and interferometric processing related aspects, application development support, and radar system engineering. In 2005 training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA) took place in Europe and Asia.

GAMMA SOFTWARE

In 2005 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).

Upgrades included improvements to the offset estimation programs, adaptations to permit generation of interferograms for pairs with slightly different carrier frequencies (ERS2-ASAR), ability to resample SLC images using a lookup-table (SLC_interp_lt, rdc_trans) taking into account scene topography, as well as additional functionality in the IPTA package, e.g. concerning the integration of ERS - ASAR series.

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

For the benefit of its software users GAMMA decided to better protect its intellectual property rights (IPR). Parts of the IPR used in the IPTA software were protected by pending patents.

LEGAL AFFAIRS

Politecnico di Milano (POLIMI) – Tele-Rilevamento Europa s.r.l. (T.R.E.) versus GAMMA:

In December 2003 we were informed by the Court of Trieste, Italy, that POLIMI and T.R.E. have asked the court to issue an immediate inhibition for GAMMA not to commercialize its IPTA software in Italy as it may infringe their Italian Patent 1.312.826 which protects a process to identify “permanent scatterers”. On 29. Dec. 2003 (!) the parties met at the court of Trieste. The judge did not follow the proposition of the complainants but suggested to have a competent technical expert answer questions on the validity of the POLIMI patent and a possible infringement or partial infringement of it by the GAMMA IPTA software.

A competent technical expert acceptable to both parties was selected, investigated the matter and reported to the judge. In an iterative manner the parties updated their positions and on 24. Nov. 2004 the judge of the court of Trieste made his verdict. All the complaints of POLIMI – T.R.E. were rejected. The IPTA software does not infringe Patent 1.312.826, nor is in interference with it.

In mid 2005, in accordance with the Judgement of the court of Trieste, POLIMI and TRE partially covered GAMMA’s process costs.

VARIA

GAMMA has ongoing or accepted projects selected through Announcements of Opportunity to conduct ERS, ENVISAT, JERS, ALOS, and TerraSAR-X research and development projects.

GAMMA employees are members of national (SED) and international (IEEE, RSPSoc, AGU) organizations, acted as peer reviewers (various journals), served on dissertation committees and were members of scientific committees (Multitemp’05 Conference, ESA Cat-1 project evaluation, Science reviewers to EC Framework Project and National R&D Projects).

NEW ADDRESS PER 15. FEB. 2005

On 15. Feb. GAMMA moved to its new offices in Gümligen:

Gamma	Remote	Sensing	AG
Worbstrasse			225
CH-3073			Gümligen
Switzerland			

Telephone and fax numbers, E-mail addresses and homepage address did not change.

10 YEARS GAMMA

In January 2005 Gamma Remote Sensing AG celebrated its 10th anniversary. With satisfaction and also some pride we look back on our achievements. GAMMA has become an established member of the “SAR community”. In our projects and services and through our GAMMA software license sales we interacted with several hundred (!) contacts at Universities, local to international public organizations, and industry reaching from single person companies to the huge space industry players. We supported individual students in their studies as well as space agencies in their planning of new missions.

All this was possible thanks to Gamma’s competent, motivated, and hardworking staff who also owns the company. Work was often very interesting and included a wide variety of applications and geographic regions. Almost unaffected from economic turbulence (“new economy”, “reorganization of space industry”) and politics (“high national deficits”, “increasing unemployment”, “budget cuts”, “introduction of the EURO”, “development of the European Community”, “relation Switzerland - European Community”) GAMMA followed its strategy, paid salaries on time, and will be able to present for the tenth time a positive balance.

PUBLICATIONS

Articles in journals and books:

Catani F., P. Farina, S. Moretti, G. Nico and T. Strozzi, On the application of SAR interferometry to geomorphological studies: estimation of landform attributes and mass movements, *Geomorphology*, Vol. 66, Issues 1-4, pp. 119-131, 2005.

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Strozzi T., P. Farina, A. Corsini, C. Ambrosi, M. Thüring, J. Zilger, A. Wiesmann, U. Wegmüller and C. Werner, Survey and monitoring of landslide displacements by means of L-band satellite SAR interferometry, *Landslides*, doi: 10.1007/s10346-005-0003-2, 2005.

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Teatini P., L. Tosi, T. Strozzi, L. Carbognin, U. Wegmüller, and F. Rizzetto, Mapping regional land displacement in the Venice coastland by an integrated monitoring system, *Remote Sensing of Environment*, No. 98, pp. 403-413, 2005.

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Eriksson L., A. Wiesmann, and C. Schmullius, “Forest change detection with L-band interferometric synthetic aperture radar, *Proc. ForestSAT 2005*, Gothenburg, Sweden, 31. May – 3. Jun. 2005.

Eriksson L., J. Askne, M. Santoro, C. Schmullius, and A. Wiesmann, “Stem volume retrieval with space-borne L-band repeat-pass coherence”, *Proc. IGARSS 2005*, Seoul, Korea, 25-29 Jul. 2005.

Le Toan T., J. L’Hermitte, U. Wegmüller, and A. Wiesmann, ENVISAT ASAR data for forest observations in Siberia, *POLINSAR 2005 Int. Workshop*, Frascati, Italy, 17-21 Jan. 2005.

Santoro M., O. Cartus, C. Schmullius, P. Yong, U. Wegmüller, and A. Wiesmann, Status of processing of ERS-1/2 tandem data for Northeast China, *ESA-NRSCC Dragon Cooperation Prog.*, 2005 Santorini Symposium, Greece, http://earth.esa.int/dragon/participants/256/pres_Maurizio_Santoro_256.pdf, 29.6.–1.7. 2005.

Strozzi T., S. Schwab, U. Wegmüller, K. Graf, H. Raetz, P. Manunta and M. Paganini, Large scale survey of mountain permafrost displacement in alpine areas from satellite radar interferometry, 2nd. *European Conference on Permafrost EUCOP’05*, Potsdam 12-16 Jun. 2005.

Strozzi T., P. Teatini, L. Tosi, U. Wegmüller, and C. Werner, SAR Interferometric Point Target Analysis and application to the monitoring of land subsidence in the Venice Lagoon, *SISOLS’05*, Shanghai, P.R. China, October 23-28, 2005.

Wegmüller U., V. Spreckels, C. Werner, T. Strozzi, and A. Wiesmann, “Monitoring of mining induced surface deformation using L-band SAR interferometry”, *Proc. IGARSS 2005*, Seoul, Korea, 25-29 Jul. 2005.

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Wiesmann A., U. Wegmüller, T. Le Toan, M. Santoro, C. Werner, and T. Strozzi, “Use of ENVISAT ASAR wide-swath mode data over Siberia for large area land cover mapping, parameter retrieval, and change detection”, *Proc. IGARSS 2005*, Seoul, Korea, 25-29 Jul. 2005.

Tampellini L., L. Eikvil, E. Malnes, G. Ober, D. Power, T. Strozzi, F. Vescovi and P. Vincent, EO-HYDRO: Earth observation data for the hydropower plant management, *31st International Symposium on Remote Sensing of Environment*, Saint Petersburg, Russian Federation, June 20-24, 2005.