Information

GAMMA Brochures

GAMMA REMOTE SENSING: Overview on R&D, Products and Services, and Software[1]

GAMMA SAR AND INTERFEROMETRY SOFTWARE: Presentation of Processing Software[1]

GEOPHYSICAL DISPLACEMENT MAPPING: Introduction to technique, products and services[1]

[1]may be downloaded from the GAMMA homepage

How to reach GAMMA

To obtain further information on GAMMA's research activities, products, and services, inquire about license agreement conditions, or request an offer, please contact us. Additional information may also be found at GAMMA's homepage.

GAMMA Remote Sensing Research and Consulting AG

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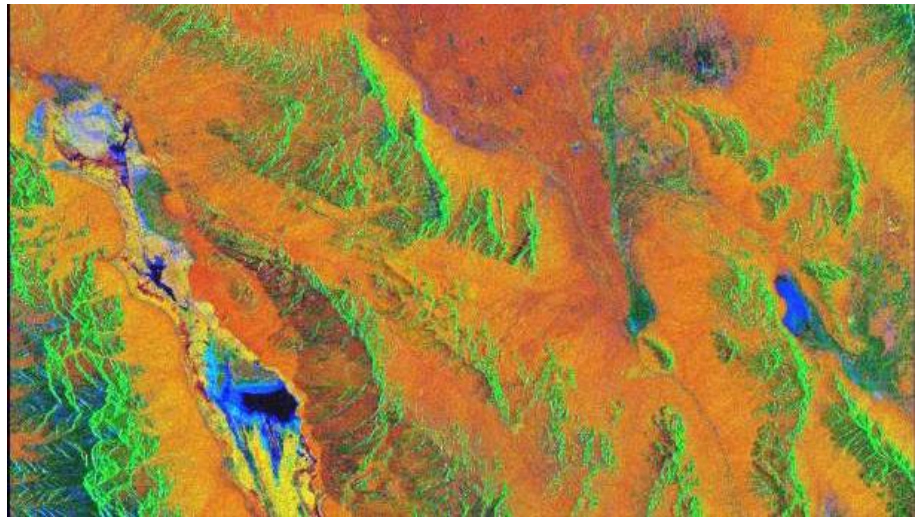
Research & Development	Microwave Remote Sensing Signal Processing Techniques and Application Development
Products & Services	Data Processing, Value Adding, Consulting, Interpretation and Application Support
Software	Software for SAR and Interferometric Processing, Geocoding, and Land Applications



Death Valley — SAR interferometric landuse characterization

(ERS-1 raw data courtesy of ESA, processing by GAMMA)

GAMMA Remote Sensing AG

Who is GAMMA ?

GAMMA Remote Sensing Research and Consulting AG (GAMMA) is a Swiss corporation (Aktiengesellschaft - AG) located near Bern, Switzerland. It was founded in January 1995 by Dr. Charles Werner and Dr. Urs Wegmüller.

Research and development, processing and adding value to remote sensing data, license sales for its commercial processing software, and EO-data distribution are GAMMA's primary business elements. GAMMA is both well integrated in the remote sensing research community, and offers commercial services and software licenses. This maintains GAMMA's technical competence and provides insight into customer requirements for information and tools.

The key personnel of GAMMA have extensive experience in scientific research, SAR and interferometric signal processing, active and passive microwave remote sensing techniques, theoretical and empirical modeling, and application development.

GAMMA's competence encompasses technical aspects such as SAR processing, interferometry, differential interferometry, geocoding, and mosaicing as well as fully integrated product generation from EO-data. Typical products are digital elevation models, geophysical displacement maps and landuse products (forest maps, hazard maps, etc.).

Projects

- European Forest Observation using Radar, EUFORA (EC Env. & Climate Program, supported by the Swiss BBW, 1996-1998)
- SAR imaging for boreal ecology and radar interferometry applications, SIBERIA (EC Env. & Climate Program, supported by the Swiss BBW, 1998-2000)
- Multi-sensor concepts for greenhouse gas accounting of northern Eurasia, SIBERIA-II (EC Env. & Climate Program, supported by the Swiss BBW, 2002-2005)
- ERS SAR interferometry for land applications (ESA-ESTEC contract, 1995-1997)
- Multi-sensor and interferometric retrieval techniques (ESA-ESTEC contract, as subcontractor of Joanneum Research, Graz, Austria, 2000-2002)
- Differential interferometric applications in urban areas (ESA-ESRIN DUP, 1997-2000)
- Geophysical Surface Deformation Mapping Service (ESA-ESRIN DUP, 2000-2001)
- VENEZIA: Subsidence monitoring service in the lagoon of Venice for regional administrative and water authorities (ESA-ESRIN DUP, 2001-2003)
- ALPS: Alpine landslides periodical survey (ESA-ESRIN DUP, 2001-2002)
- ERS, JERS, SRTM, ENVISAT, and ALOS Announcement of Opportunity projects
- Commercial services and consulting (SAR processing, INSAR, DINSAR, geocoding, mosaicing, coherence product, digital elevation models, subsidence maps, landuse maps, hazard maps)
- License sales and consulting for GAMMA MSP, ISP, DIFF&GEO, LAT software

Software

GAMMA provides 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 is grouped modular packages:

- Modular SAR Processor (MSP)
- Interferometric SAR Processor (ISP)
- Differential Interferometry and Geocoding (DIFF&GEO)
- Land Application Tools (LAT)

The software is written in ANSI-C and has been installed on different UNIX workstations and on PC platforms with LINUX or NT operation systems. Documentation is provided in HTML language. Both binary and source code licenses are available. Attractive discounts are offered for University / Education users.

Each of the packages is very modular. The offered alternatives and parameters read from the command line allow optimization of the processing for the specific case. Shell scripts permit running and documentation of processing sequences in an operational and efficient way. Full frame SAR processing times for ERS and JERS on today's workstations and PCs are well below one hour, including processing parameter estimation, autofocus, radiometric calibration, and multi-looking. The software processes data of spaceborne and airborne SAR, including ENVISAT-ASAR, ERS-1/2, JERS, RADARSAT, and SIR-C. It fully supports the data formats provided by the agencies. Advanced, up-to-date algorithms are used. The main processing sequences are complemented by parameter estimation and quality control programs. A complete suite of display programs and utilities based on open source technology are added for convenient access to the input data, intermediate products, and final results.

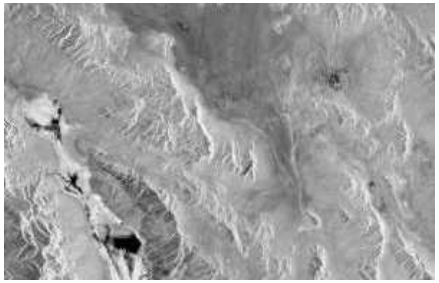
With its functionality, flexibility, robustness, efficiency, and competitive price, GAMMA software is an excellent solution for demanding processing jobs. This has been demonstrated by license sales to users at many leading institutes world-wide, since 1995. Another distinct advantage of the GAMMA software is the competent user support provided directly by the developers and experienced users of the software.

Recent software developments includes: full functionality on workstations (UNIX) and PCs (LINUX, NT), use of faster FFT routines to further reduce processing times, improved display tools using GTK with full portability to PCs (LINUX and NT). The functionality, flexibility, and accuracy of the offset estimation programs was further enhanced to allow coherence and feature tracking for monitoring of fast glacier motion and large seismic displacements.

More detailed information on the software may be found at GAMMA's homepage and in the Brochure *GAMMA SAR AND INTERFEROMETRY SOFTWARE.*

For current pricing information, advice on the software configuration for a specific application, to request a quote, or to place an order, please contact GAMMA at the address indicated on the last page of this brochure.

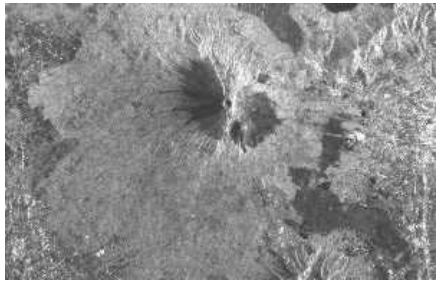
Examples



ERS-1 Death Valley

The GAMMA Modular SAR Processor (MSP) rapidly processes full frames to full resolution and includes programs for the assessment of data quality and processing parameters.

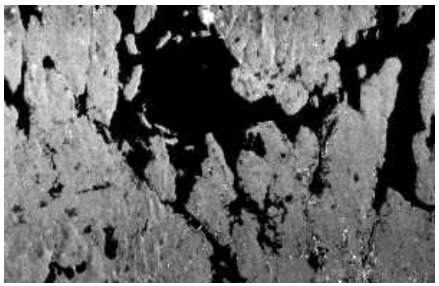
Raw data courtesy of ESA. Processing by GAMMA.



JERS Mt. Fuji

JERS SAR processing with the MSP supports a range dependent Doppler centroid, interference filtering, and radiometric calibration.

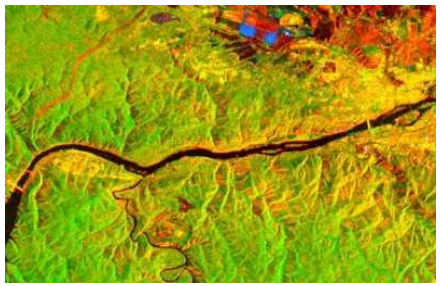
Raw data courtesy of NASDA. Processing by GAMMA.



RADARSAT Bar Harbor

SAR processing of RADARSAT strip map data with the MSP resolves the Doppler ambiguity and applies secondary range migration to obtain accurate focus.

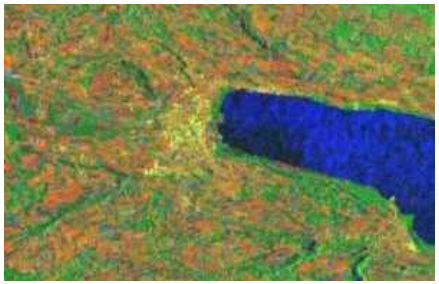
Raw data courtesy of RSI. Processing by GAMMA.



JERS mosaic SIBERIA

A 40 x 34 km^2 section of a large JERS mosaic over Siberia, including interferometric coverage as shown above.

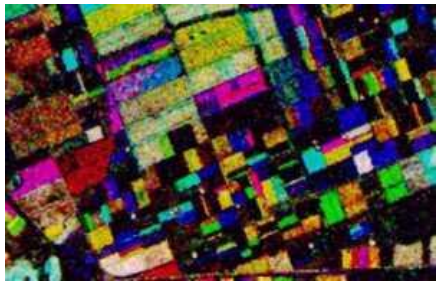
Raw data courtesy of DLR and NASDA, Processing by GAMMA.



SIR-C _ C-band VV Yverdon (CH)

SAR interferometric landuse characterization using repeat-pass SIR-C (CVV) data.

SLC Data courtesy of JPL/NASA. Processing by GAMMA.

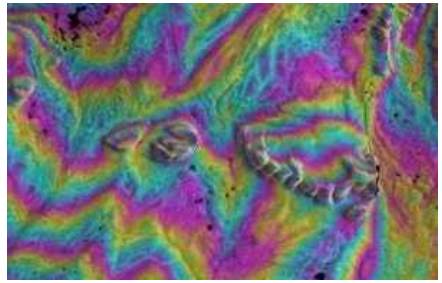


Multi-temporal ERS coherence

Farmland monitoring using multi-temporal SAR backscattering and, as shown, interferometric coherence.

SLC data courtesy of ESA. Processing by GAMMA.

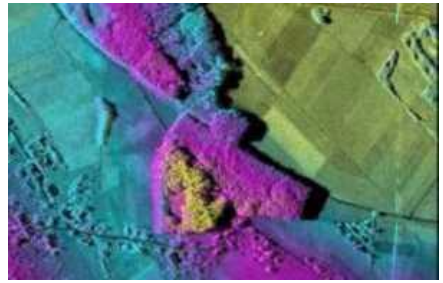
Examples



Digital Elevation Model Generation

Repeat-pass ERS SAR interferometry may be used for the generation of digital elevation maps, as demonstrated with this interferometric height map for Toolik Lake, Alaska.

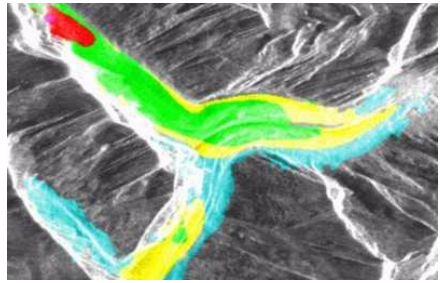
Raw data courtesy of ASF. Processing by GAMMA.



DOSAR near Solothurn (CH)

High resolution single-pass airborne interferometry: DOSAR interferometric height map over agriculture/forest site.

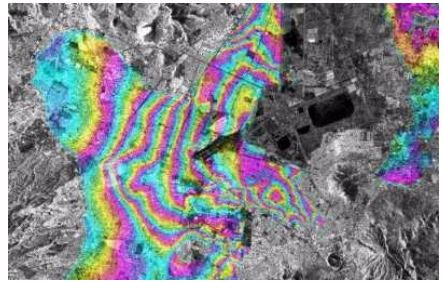
SAR data courtesy of Dornier GmbH and RSL Univ. Zürich. Processing by GAMMA.



Glacier velocity mapping

ERS differential interferometric displacement map for Aare-Glacier, Switzerland. Line-of-sight displacement in one day: cyan <1*cm*, yellow: 1-2*cm*, green 2-3*cm*, red 3-4*cm*.

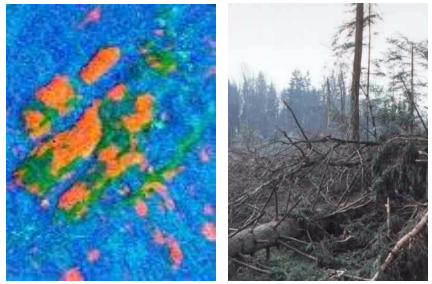
Raw data courtesy of ESA. Processing by GAMMA.



Geophysical deformation mapping

ERS differential interferometric subsidence map for Mexico City. Each color cycle corresponds to a subsidence of 5*cm*/*year*.

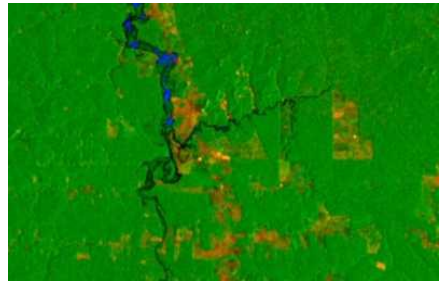
Raw data courtesy of ESA. Processing by GAMMA.



Hazard mapping

Forest damage (orange areas) caused by storm "Lothar" in Dec. 1999, as mapped with multi-temporal ERS SAR interferometry.

Raw data courtesy of ESA. Processing by GAMMA.



ERS Coherence Product

ERS Tandem coherence (red), backscattering (green), and backscatter change (blue) used to characterize deforestation area.

Raw data courtesy of ESA. Processing by GAMMA.

Products & Services

Data Processing Services

GAMMA has a high capacity for advanced SAR data processing. Steps as SAR processing, precision image registration, interferometric processing, radiometric calibration, and geocoding are fully operational and are offered to customers with attractive conditions. Advanced data processing such as large area mosaicing can also be offered, as well as support in data selection, determination of the processing strategy, and interpretation of the results. As part of the EC Project Siberia, GAMMA had the opportunity to demonstrate it's processing quality and capacity in the generation of a continental scale mosaic of JERS backscattering coefficients, coherence and texture values, based on more than 600 JERS scenes.

Standard Data Products

Coherence Product

The Coherence Product developed in cooperation with SPOTIMAGE includes multi-channel images of calibrated ERS backscattering coefficients, coherence, backscatter change, as calculated for an ERS Tandem pair, presented in DIMAP format with image data in GEO TIFF and auxiliary information and documentation in XML format (see also: SPOTIMAGE homepage).

Digital Elevation Models

Digital elevation models are derived from ERS or JERS data using SAR interferometry. The product quality depends on terrain type and surface cover. For well suited terrain a height accuracy on the order of 10*m* is feasible.

Surface Deformation Maps

Maps of millimeter to decimeter surface displacement can be retrieved with differential SAR interferometry. GAMMA does not only offer to conduct the necessary data processing, but provides support for strategy and data selection for a specific case. Thanks to the immense ERS archive with data since 1991 the chance that well suited historic data exist over a site is high. For further discussion and examples see also GAMMA Brochure "Geophysical Displacement Mapping".

Application Development Support and Consulting

GAMMA offers Application Development Support and Consulting. Its wide range of experience and interest in new ideas together with its technical competence and high level data processing tools ensure a competent and effective support.

Research & Development

GAMMA's declared goal is to maintain a high level of technical and scientific expertise. This is an essential prerequisite for development of new applications, consulting activities, and improving and maintaining the commercial software. To achieve this ambitious goal GAMMA is involved in research projects (ESA, EC, National Projects, etc.) and cooperates with competent partners at universities, public institutes and private companies.

Processing Techniques

Research and development on new processing techniques is essential to maintaining the advanced level of GAMMA's processing software. GAMMA's competence is primarily in the area of SAR and interferometric processing as well as all other aspects of SAR data processing such as geocoding, filtering, mosaicing, and classification. Pull factors driving GAMMA's R&D on processing techniques originate from demands of existing and new applications, the optimization of the techniques for new sensors, operational requirements, and quality control. New developments presented at conferences and in the literature and new hardware and software are relevant push factors to advance GAMMA's in-house technology. Recent examples include development of new methods for SAR geocoding, glacier velocity mapping, interferogram stacking, phase unwrapping using triangular irregular networks and minimum cost flow optimization techniques, and interferometric point target analysis.

Signature Interpretation, Modeling and Application Development

GAMMA has extensive experience in the measurement and interpretation of active and passive microwave signatures and the development of theoretical and empirical scattering and emission models for bare soil, vegetation covered surfaces, and snow. Together with the availability of advanced processing techniques and the good understanding of related effects on the extracted signatures this offers ideal conditions for the development and optimization of EO-data based applications. Recent developments include the differential interferometric applications geophysical displacement and glacier velocity mapping and GAMMA's involvement in the mapping of hazards using multi-temporal techniques, including interferometry.

Service Definition and Commercialization

As a private company GAMMA offers commercial products, services, and consulting. For this purpose GAMMA conducts R&D necessary to develop applications which were successfully demonstrated into products and services. The commercialization of products is done either by GAMMA or in cooperation with a larger distributor as it was done in the example of the ERS Tandem Coherence Product with SPOTIMAGE, France.