Gamma Remote Sensing AG
ANNUAL REPORT 2025

RESEARCH AND DEVELOPMENT

ESA – CCI+ Glaciers (2018-2026)

The main objectives of the CCI+ Glaciers 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. GAMMA's responsibilities are in the glacier flow monitoring, in historical surge detection over Svalbard and in the service and system engineering.

ESA – CCI+ Biomass (2018-2027)

The main objectives of the CCI+ Biomass Project (coordinated by Aberystwyth University, UK) in the frame of the Climate Change Initiative (CCI) are to provide EO based services for forest biomass monitoring. GAMMA has the technical lead, with responsibilities in the algorithm development, system engineering, system implementation and the generation of the global biomass products. In 2025, GAMMA has produced a new set of maps from ENVISAT ASAR and Sentinel-1 C-band and ALOS-1 PALSAR-1 and ALOS-2 PALSAR-2 L-band SAR data depicting the global distribution of forest biomass at hectare scale resolution for the years 2007, 2010, and for each year between 2015 and 2020.

ESA – CCI+ Permafrost (2018-2026)

The main objectives of the CCI+ Permafrost Project (coordinated by GAMMA, with T. Strozzi acting as project manager, and b.geos GmbH, with A. Bartsch acting as science leader) is to deliver a permafrost related climate data record which complies with the requirements of the climate user community. GAMMA's responsibilities are in the coordination of the work, mountain permafrost thematic products, overall system design engineering and the production of subsidence maps at Arctic permafrost sites.

ESA – CCI+ Snow (2018-2027)

The main objectives of the CCI+ Snow Project (coordinated by ENVEO, Austria) in the frame of the Climate Change Initiative (CCI) is to provide essential climate variables for snow based on EO data. GAMMA's responsibilities are in the system design engineering and the system implementation of the AVHRR Snow Cover Fraction processor.

ESA – CCIx Karakoram Anomaly (2024-2027)

The main objective of this Cross-ECV activity (coordinated by the University of Zürich, Switzerland) in the frame of the Climate Change Initiative (CCI) is to investigate a widely recognized cryospheric and climatic singularity, the so-called 'Karakoram Anomaly', expressed by air temperatures that do not increase, glaciers that do not retreat and glacier mass balances that were close to zero or even positive over the past 20 years. GAMMA's responsibility is in the coordination of the glacier flow monitoring

ESA – Wide-Band Scatterometer Development, CCN1 (2023-2026)

In CCN1 of the ESA – Wide-Band Scatterometer Development addresses the use of the antenna gain measurements done at the ESA antenna range facility at ESTEC, and the focusing of WBSCAT measurements in the azimuth direction.

ESA – SMOS Expert Support Laboratory for Level 2 - Soil Moisture (2020-2025)

The tasks of the SMOS ESL for soil moisture include the development, implementation and assessment of SMOS land-surface retrieval algorithms. Initially it was all about the soil moisture algorithm. For several years now, the group has also been increasingly concerned with SMOS applications to the Cryosphere and to vegetation. GAMMA contributed new algorithm ideas relevant for applications to the Cryosphere arising from 2-stream radiative transfer modeling that are now being further tested and that may be introduced at a later stage into the operational processor. Further, we support the increasingly important topic of vegetation observation with fundamental research into microwave radiation transfer in vegetation.

ESA Forest Carbon Monitoring, CCN2 (2024-2025)

The aim of this project under the lead of VTT is to develop a robust, reliable, and transparent approach for the monitoring of forest carbon. In the proposed monitoring approach, optical and SAR EO data play a central role. In the context of the EU Green Deal an increasing demand for related services is expected. GAMMA contributes with large-scale pre-processing of Sentinel-1 and a pan-European dataset of forest biomass at 20 m spatial resolution for 2017, 2020, 2021 and 2023.

ESA – Modulate (2024-2025)

The main objectives of the ESA Project Monitoring landslides with multi-platform L-Band radar techniques (MODULATE), are to use satellite and terrestrial car-based L-band SAR Interferometry to map and monitor landslides. GAMMA coordinates this project and is supported by University of Milano Bicocca (UNIMIB), Scuola Universitaria Professionale della Svizzera Italiana (SUPSI), and Swiss Federal Institute for Forest, Snow and Landscape Research (WSL). Test sites are in southern Switzerland and northern Italy.

HORIZON 2020 NextGenCarbon (2025-2029)

NextGenCarbon, which is led by the Swedish University of Agricultural Sciences, aims to develop the next generation of global carbon models, harnessing the potential of combining EO, in situ data campaigns, novel demographic model structures and advanced assimilation techniques to create an unprecedentedly well-informed understanding of terrestrial carbon stocks and fluxes to inform multiple emerging policy frontiers. GAMMA is responsible for the creation of a time series of annual carbon stock maps in terrestrial vegetation using a combination of existing data products and novel satellite observations covering the last two decades and expanding into the next years.

ESA – CarbonEye (2025-2027)

Carbon Eye is a proposal lead by Gamma in response to Future EO-1 permanently open call. The aim is to harness the synergies between carbon markets and remote sensing technologies. GAMMA is responsible for the generation of carbon maps from a wide range of satellite remote sensing datasets that are then assessed by stakeholders in the context of MRV digital monitoring of baselines and project progress.

ESA – Living Planet Fellowship (2024-2026)

For two years, GAMMA hosts a Postdoctoral Fellow funded by ESA to work on biomass estimation with multi-decadal passive microwave observations and harmonization of biomass maps across various spatial scales. The work is in synergy with ESA's CCI Biomass + project.

GAMMA SOFTWARE

In 2025 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 land-use 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). Furthermore, a time domain back projection processor (TDBP) is available to process SAR data acquired along curvilinear sensor trajectories, such as GAMMA's car-borne L-band SAR measurements or SAR data acquired with a drone or airplane.

License sale activities were continued with new licenses sold in Europe, Asia, North America. User contacts indicate that the advanced algorithms and our competent support are important features of our software. This is also confirmed by an increasing number of running maintenance contracts. Many long-term users updated their license to the current version to be able to process data acquired by the newest SAR satellites (RCM, SAOCOM, Capella, StriX, UMBRA, LuTan-1, Superview Neo-2, HISEA-1/Gaojing-2, Fucheng-1, Hongtu, PALSAR-3, SWOT, NISAR, BIOMASS, Sentinel-1C). The software also supports processing of data acquired with the GAMMA GPRI, L-band SAR, and S-band SAR instruments.

We also look forward to further upcoming institutional and commercial SAR satellites.

GAMMA software is used to successfully run services on different cloud platforms To further explore the potential of SAR data processing in the cloud, we started a strategic partnership with Earth Big Data LLC/GmbH to collaborate on developing and delivering cutting-edge cloud-based solutions.

Further information related to the GAMMA Software is available online:

General information:
https://www.gamma-rs.ch/software
https://www.gamma-rs.ch/uploads/media/GAMMA_Software_information.pdf
Technical reports, conference and journal papers:
https://www.gamma-rs.ch/uploads/media/GAMMA_Software_references.pdf
Release notes / upgrade information:
https://www.gamma-rs.ch/uploads/media/GAMMA_Software_upgrade_information.pdf

Training courses

In 2025, in-situ and online training courses for SAR, SAR interferometry and Interferometric Point Target Analysis (IPTA) took place. To support new software users we also provided documented demo examples and supported the users over the internet. Courses will again be scheduled for 2026, for further information see our homepage http://www.gamma-rs.ch). We also trained users in the operation of GAMMA Instruments (GPRI, GAMMA L- and S-band SAR) and the related data processing.

GAMMA INSTRUMENTS

General GAMMA Instruments information: https:/www.gamma-rs.ch/instruments

GAMMA Portable Radar Interferometer (GPRI)

There was again a significant interest in the GAMMA Portable Radar Interferometer (GPRI). Meanwhile, more than 30 instruments are in operation by users in Europe, North America and Asia. The primary application is

displacement monitoring over glaciers, rock glaciers, rocks, slopes, and infrastructure. In 2025 the instrument has been redesigned and made more compact and lighter.

Further information and related technical reports, conference and journal papers are available online:
https://www.gamma-rs.ch/instruments/gpri-instrument-publications
https://www.gamma-rs.ch/instruments/gpri-application-publications

GAMMA SAR Systems (GLSAR, GSSAR)

The GAMMA Synthetic Aperture Radar (SAR) systems at L-band and S-band (GLSAR, GSSAR) have been successfully used for repeat-pass DInSAR-based mobile mapping of surface displacements with car-mounted and UAV-mounted system configurations. In 2025, GLSAR and GSSAR systems were delivered to customers and Gamma staff has supported UAV-based SAR measurement campaigns and training in North America and Asia. First manned airborne SAR acquisitions with a GSSAR system were conducted by a customer with support for deployment and data processing by Gamma staff. Further developments included an IQ-mode data acquisition mode with flexible swath (range gating) steering to also support SAR acquisitions from high-altitude long-endurance (HALE) platforms.

Further information and related technical reports, conference and journal papers are available online:
https://www.gamma-rs.ch/instruments/sar-system-publications

EO SERVICES AND CONSULTING

Ground-motion mapping and monitoring in Switzerland using terrestrial and satellite radar

Ground-motion mapping and monitoring services were provided to private and public Swiss customers using terrestrial radar measurements acquired with GAMMA's Portable Radar Interferometer (GPRI) operated at Ku-band, using car-borne SAR measurements with GAMMA's L-band SAR, and using satellite SAR data (Sentinel-1, ALOS-2 PALSAR-2, SAOCOM, TerraSAR-X, Radarsat-2).

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

A variety of products were generated in 2025 for customers in Switzerland, Europe, and North America using data of the ERS-1/2, ENVISAT, Radarsat, ALOS-1/2, TerraSAR-X, Cosmo-Skymed, Sentinel-1, ICEYE and SAOCOM satellites. SAR, InSAR, offset tracking and Persistent Scatterer Interferometry (PSI) were used to generate forest biomass maps, deformation maps, deformation histories, terrain heights, and glacier velocity maps. For Sentinel-1 near-real-time processing capability is applied for glacier velocity and ground stability mapping. In 2025 we also continued providing services using the GAMMA Portable Radar Interferometer (GPRI) and the GAMMA L-band SAR.

Online Services

Within the Forestry TEP, an online solution for commercial, research and public sector users to improve forest management, GAMMA provides a preprocessing service for Sentinel-1 (https://f-tep.com/services)

Consulting

GAMMA's consulting activity included SAR and interferometric processing related aspects, application development support, and radar system engineering. GAMMA also supported users of GAMMA Instruments (GPRI, ELBARA, GAMMA SAR, SnowScat, WBScat) with the acquisition and processing of the data. Furthermore, user specific adaptations of GAMMA microwave instruments were developed and implemented. GAMMA participated in an ISSI task-force to identify a strategy for development of a reference-quality model for snow and sea ice emission and backscattering (Sandells et al. 2025).

VARIA

After 30 years GAMMA received a new Chairman of the Board and CEO. The shareholders elected Dr. Andreas Wiesmann as Chairman of the Board and CEO. Former chairman Urs Wegmüller and former vice president Charles Werner remain on the board. New vice president is Dr. Maurizio Santoro.

Also in 2025 we were traveling to customers, and attending conferences.

GAMMA employees are members of national (SIP, SED, SGPF, FAN) and international (IEEE, RSPSoc, AGU, EARSEL, EGU) organizations, acted as peer reviewers (various journals, books), were members of scientific committees, engaged in University teaching and PhD supervision (FSU Jena, ETH Zürich).

PUBLICATIONS

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