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Gamma Remote Sensing AG
ANNUAL REPORT 2015

RESEARCH AND DEVELOPMENT

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 – APHORISM: Advanced Procedures for Volcanic and Seismic Monitoring (2014-2017)

In this project coordinated by INGV two new methods to combine different types of Earth Observation satellite data and ground data, one for volcano ash monitoring and one for earthquake damage mapping are developed. GAMMA is mainly involved with the earthquake damage mapping product and provides elements related to the use of SAR data, including the mapping of ground deformation and change detection for damage mapping.

FP7 – SEN3APP (2014-2017)

In this project coordinated by FMI processing lines and operational services combining Sentinel and in-situ data for the terrestrial cryosphere and boreal forest zone are being developed. GAMMA is mainly involved with the use of SAR data from Sentinel-1.

H2020 - COREGAL (2015-2017)

In this Project coordinated by DEIMOS, Portugal, the use of GNSS-Reflectometry is investigated to complement biomass estimation from spaceborne EO data at high spatial resolution. GAMMA provides biomass estimates from spaceborne SAR data and expertise on biomass estimation.

ESA - Ku-Band Scatterometer Development and ESA- NOSREX-I/II/III (2007 - 2016)

In 2015 the SNOWSCAT X- to Ku-band scatterometer acquired backscatter time series and tomographic measurements over a snow test site in Davos. After revising the instrument and rail motor the SNOWSCAT was installed for snow measurements during winter 2015/16 near Grimsel, Switzerland. The objective is to resolve layer structures in the snow pack.

ESA - CCI – Glaciers 2 (2014-2016)

The main objectives of the Glaciers-CCI Project 2 (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 and CCI Glacier. GAMMA's responsibilities are in the glacier flow monitoring and in the service engineering.

ESA - CCI - Landcover 2 (2014-2016)

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

ESA – WEOS: Waste Earth Observation Services (2013-2015)

Under the lead of ERA Maptec the WEOS team looks at the area of waste management with the aim to extend the uptake of the Earth Observation (EO) based geo-information services to a wider set of end-users. GAMMA is involved as SAR and INSAR specialist mainly to assess the possibilities in the mapping and monitoring of ship dismantling and land fill sites.

ESA – Snow Microstructure (2015)

GAMMA supports this project on "Microstructural origin of electromagnetic signatures in microwave remote sensing of snow", coordinated by Université Joseph Fourier Grenoble, with its experience in snow scattering and emission.

ESA – STSE Pathfinder Cryosphere (2013-2015)

In this project coordinated by the Finnish Meteorological Institute (FMI), the combined use of multi-frequency radiometry (L- to Ka-Band) and SAR imagery for enhanced monitoring of terrestrial cryosphere processes is investigated. GAMMA contributed with radiative transfer modeling for multi-layer configurations and with an analysis ENVISAT ASAR C-band data, investigating whether multi-temporal metrics could provide an additional source of information on processes of the boreal snow cover and soils.

ESA - Dragon 3 Cooperation Programme (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.

ESA – GLOFS: Glacier Lake Outburst Flood – Danger Monitoring (2014-2015)

In this project the involved user organizations are provided with demonstration services on glacial lake extent, detection, monitoring and modeling of slope instabilities and glaciers adjacent to the glacier lakes of concern. A service to map, monitor and forecast glacial lakes based on various sources of EO data (including optical and SAR high and very-high resolution data) together with in-situ data and models is set up and demonstrated. GAMMA coordinates the project and is supported by the University of Zürich, the University of Oslo, and ASIAQ, Greenland.

ESA – GlobBiomass (2014-2017)

In this project lead by the University of Jena the main goal is to develop and demonstrate an integrated and validated methodology using EO and in-situ data to improve regional and global biomass estimates. Where possible, very recent and near-future satellite data such as from the Sentinel-fleet will be implemented. GAMMA's role is to lead the System Development and Prototyping and the Global Biomass Estimation.

ESA – SAOCOM-CS bi-static science for land applications (2014-2015)

In this study lead by DIET, La Sapienza Univ., the overarching objective activity is to consolidate the understanding of the L-band bi-static SAR signal (radiometry and phase) over land surfaces in the SAOCOM CS configuration. In particular, the study shall strengthen the scientific case for bi-static SAR acquisitions over land surfaces, consolidate potential applications and illustrate potential products.

ESA –SMOS Expert Support Laboratory for Level 2 - Soil Moisture (2014-2019)

The tasks of the SMOS ESL for soil moisture include the development, implementation and assessment of SMOS soil moisture retrieval algorithms. In 2015 GAMMA's contributed new algorithm ideas arising from 2-

flux radiative transfer modeling that are now being further tested and that may be introduced at a later stage into the operational processor.

ESA – Information content of multi-spectral SAR data (2015-2017)

In this project lead by GAMMA, the capability of improving retrievals and classifications using multi-spectral SAR data is investigated. GAMMA is responsible for the forest biomass and the water body phenology themes.

JAXA Kyoto &Carbon (K&C) Initiative, 3rd phase (2011-2014), 4th phase (2014- 2017)

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.

EO SERVICES, CONSULTING AND TRAINING

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

A variety of products were generated in 2015 for customers in, Switzerland, Europe, and North America using data of the ERS, ENVISAT, Radarsat, ALOS-1/2, TerraSAR-X, Cosmo-Skymed, RISAT, and Sentinel-1 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.

In 2015 we also continued providing services using the GAMMA Portable Radar Interferometer (GPRI).

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) with the acquisition and processing of the data. Furthermore, user specific adaptations of GAMMA hardware were developed and implemented.

Training courses

In 2015 we organized again training courses for SAR, SAR interferometry, and Interferometric Point Target Analysis (IPTA). Further courses will follow in spring 2015 (for information see our homepage (http://www.gamma-rs.ch). On several occasions we also trained users in the operation of GAMMA Instruments (GPRI, ELBARA) and the related data processing.

GAMMA SOFTWARE

In 2015 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 2015 a significant effort was spent on further improve PALSAR-2 (ScanSAR Interferometry) and Sentinel-1 TOPS mode data processing. Sentinel-1 TOPS mode InSAR (starting from SLC data) is fully supported and was operationally applied in several cases.

License sales activities were continued with new licenses sold in Europe, Asia, Africa, 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. Many long-term users updated their license to the current version to be able to process data acquired by the newest SAR satellites (Sentinel-1, ALOS-2). On several occasions the software was presented to potential customers.

GAMMA INSTRUMENT DEVELOPMENT

Terrestrial X- to Ku-band scatterometer (SNOWSCAT)

In 2015 the X- to Ku-band scatterometer SNOWSCAT was revised. In the meantime it was installed for snow multi-temporal backscatter and tomographic measurements during winter 2015/16 near Grimsel, Switzerland. The objective is to resolve layer structures in the snow pack.

GAMMA Portable Radar Interferometer (GPRI)

There was again a significant interest in the GAMMA Portable Radar Interferometer (GPRI). More than 20 instruments are now in operation by users in Europe, North America and Asia. The primary application is displacement monitoring over glaciers, rock glaciers, rocks, slopes, and infrastructure. Besides the standard instruments a second polarimetric GPRI was delivered to ETH, supporting bistatic – polarimetric – interferometric measurements. Existing customers promote the instruments with their high quality results.

GAMMA L-band radiometer (ELBARA)

GAMMA also finished building a new ELBARA L-band radiometer series and delivered first instruments to customers. There are two more ELBARA L-band radiometers close to completion, which are not yet sold.

VARIA

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

In 2015 Dr. Oliver Cartus joined the GAMMA team. He holds degrees in geography and a doctorate in natural science from the Friedrich-Schiller-University in Jena, Germany. From 2010 to 2015 he worked as a Post-Doc at the Woods Hole Research Center, Massachusetts, USA. His research interests focus on the use of remote sensing for the mapping of the Earth's land cover and the retrieval of forest biophysical parameters such as growing stock volume or aboveground biomass. He is also a long-term experienced user of the GAMMA Software.

In January 2015 GAMMA could celebrate its 20th anniversary.

PUBLICATIONS

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