Release Notes GAMMA Software, 20251201

Urs Wegmüller, Christophe Magnard, Charles Werner, Othmar Frey,
Philipp Bernhard, Andreas Wiesmann
Gamma Remote Sensing AG
Worbstrasse 225, CH-3073 Gümligen
http://www.gamma-rs.ch
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Introduction

This information is provided to users of the GAMMA software. It is also available online at https://www.gamma-rs.ch/uploads/media/GAMMA_Software_upgrade_information.pdf.

This release of the Gamma software includes new programs that provide new capability, additional features to existing programs, bug fixes and new/updated demo examples.

Gamma Software on Linux, macOS, and Windows

The Gamma software has been compiled and tested on Linux (different distributions), Apple macOS Sequoia (15.7.2) for both Intel and Apple Silicon processors, and Windows 10 and 11. Computationally intensive programs such as used in co-registration and resampling and geocoding have been parallelized using the OpenMP API built into the GCC compiler. Processing speed on Linux, macOS, and Windows systems is comparable.

Linux Distribution:

The Gamma software is developed on Ubuntu 22.04 LTS 64-bit Linux and is tested extensively with this distribution. The Gamma software is also available for Ubuntu 24.04 LTS.

Versions of the Software will also be uploaded for RHEL8 based on Rocky Linux 8, RHEL9 based on Rocky Linux 9, and RHEL10 based on Rocky Linux 10.

For installation instructions for the binary LINUX distributions see the HTML file INSTALL_linux.html (found in two places: the download directory of the distribution and the main directory of the distribution).

Apple MacOS Distribution:

The software in this version has been compiled using macOS Sequoia (15.7.2). You will need to install libraries such as GDAL using **Homebrew** (no longer MacPorts!). The build uses GCC 15 compiler. Versions are available for Apple Silicon and Intel x86_64 processors. This is the last time that a version for Intel is provided.

For installation instructions for the binary macOS distributions see the HTML file INSTALL_macOS.html (found in two places: the download directory of the distribution and the main directory of the distribution).

Windows Distribution:

The Windows version of the Gamma software is compiled with 64-bit support and multi-threaded. The build uses the MINGW64 GCC 15 compiler.

For installation instructions for the binary Windows distributions see the HTML file INSTALL_win64.html (found in two places: the download directory of the distribution and the main directory of the distribution).

The Gamma Software and its environment are now provided through two installers:

- Gamma Software Installer – Includes the Gamma Software. Its filename follows the pattern: GAMMA_SOFTWARE-YYYYMMDD_GEO_LAT.mingw64_msys2.exe
- Gamma Environment Installer – Provides shared libraries and support files for the Gamma Software, including MSYS2 (Linux-like environment), the current Gamma Local version, WinPython, 7-Zip, and Gnuplot. Its filename follows the pattern: GAMMA_ENV_YYYYMMDD.exe

Alternatively, the method previously used to install Gamma Software and Gamma Local is still available and is also documented in INSTALL_win64.html.

The Gamma Software binaries as well as the Gamma Software and environment installers are now signed using EV (Extended Validation) code signing.

The Gamma Plugin for ArcGIS is available in all Gamma Software distributions for Windows that include the *GEO* or *ISP/DIFF&GEO* modules. Full functionality requires access to the *LAT* module.

On both Windows 10 and 11, it is also possible to install the Windows Subsystem for Linux (WSL2) and run a Linux distribution of the Gamma software on that environment. Instructions for this setup are available in the HTML file INSTALL_wsl.html located in the main directory of the distribution. With Windows 10 reaching end-of-support in October 2025, the Windows distribution is now tested exclusively on Windows 11.

Documentation and Program List

The Gamma documentation browser is an HTML based system for viewing the web pages and pdf documents. The documentation browser includes for each module a Contents sidebar on the right side of the screen and a search functionality. The main Gamma documentation browser page *Gamma_documentation.html* is found in the main software directory.

The program *gamma_doc* facilitates the access to the documentation related to a given module or program:

gamma_doc	Opens the main page of the Gamma documentation browser and shows the program list.
gamma_doc DIFF	Opens the DIFF&GEO documentation.
gamma_doc gc_map2	Opens the reference manual web page for *gc_map2*.

Further information related to the GAMMA Software is available online:

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

In case the program list is incomplete, run the python script program_list.py after successful installation of the Gamma Software in the main folder of the Gamma Software distribution:

```
./program_list.py Gamma_documentation_base.html Gamma_documentation_contents_sidebar.html -a
```

Python and Matlab wrappers

The Gamma Software is integrated into Python and Matlab through wrappers. Gamma Software program calls become Python / Matlab function calls where command line arguments can be used as function arguments, and system outputs can be stored in variables or written to log files. Binary

images, point lists and data, parameter files, tab files, can be easily read, inspected, and written using additional functions provided with the wrappers.

The *py_gamma* Python module permits a smooth usage of the Gamma Software within Python scripts, Jupyter Notebooks as well as within a Python Interactive Development Environment (IDE) such as Visual Studio Code, Spyder or PyCharm. Using *py_gamma*, function arguments can be entered either as positional arguments or as keyword arguments, with the Gamma command line parameter names becoming the keyword names.

In the same way, the Matlab (and Octave) wrapper, composed of *mat_gamma* and *par_file* classes, permits a smooth usage of the Gamma Software within an interactive use of Matlab as well as within Matlab scripts.

Gamma plugin for ArcGIS

The Gamma plugin for ArcGIS permits using some Gamma software functionalities (tools) from ArcGIS Pro (Windows only) using a convenient interface. The Gamma plugin allows to perform the following operations:

- Reading SAR data from various sensors / formats
- Detection, radiometric calibration and geocoding of SAR data
- Co-registration of SLC and MLI SAR images in slant range / azimuth geometry
- Adaptive interferometric coherence estimation
- Multi-temporal processing and filters
- Spatial filtering of 2D SAR images
- Change detection in SAR images
- Polarimetric decompositions

Using ArcGIS ModelBuilder, it is possible to generate dedicated processing chains using the Gamma tools as building blocks. It is also possible to use each Gamma tool as a Python function (ArcGIS Pro is required). Note that the LAT module is required to be able to use all the tools; without the LAT module, only a subset of the tools is available.

See also gamma-rs.ch/uploads/media/2024-1_Gamma_Plugin_for_ArcGIS_presentation.pdf.

Hardware Recommendations

Using multi-core processors (8 or more cores) will bring substantial improvement in processing speed due to parallelization of the code base. There should be at least 8 GB RAM available for each processor core with 16 GB per core recommended. Disk storage requirements for using the Gamma Software effectively depend on the amount of input data and data products that will be produced. Based on our experience we recommend considering at least 16 TB space, especially when working with stacks of Sentinel-1 or very high-resolution data (TerraSAR-X, Cosmo-Skymed) data. The current trend towards larger data products requires substantially increased storage capacities.

GAMMA Software Training Courses

A SAR/INSAR (MSP/ISP/DIFF&GEO/LAT) training at GAMMA (near Bern, Switzerland) is planned for 18. – 22. May 2026.

A PSI (IPTA) training at GAMMA (near Bern, Switzerland) is planned for 21. – 24. Apr. 2026. See also https://www.gamma-rs.ch/software/training.

Significant Changes in the Gamma Software Modules since the Mid 2025 Release

Update to license agreement conditions:

We modified Clause 2 of the license agreement:

Additional text for Clause 2 of the license agreement: Customer is strictly prohibited from entering, uploading, or otherwise transmitting the Software, Documentation and Demo Examples into any generative artificial intelligence (AI) tool, large language model (LLM), or similar third-party service not explicitly approved by GAMMA.

The modified version of the license agreement is valid from 1-Dec-2025. The users with an existing license are informed with the delivery of the end-of-2025 release (in the software delivery E-mail and here in the release notes.

Updates to display and rasterfile generation programs (DISP):

In all display programs (dis*, dis2*, ras*), the image size and the data type (format) can now also be read from the associated parameter file of the image file (e.g. SLC_par, MLI_par, OFF_par, etc.). The width command-line parameter can be specified using a numeric value (as before), a parameter file path, or "-" for automatic detection of ".par" or ".dem_par" files. If no value or "-" is entered for the width command-line parameter, the program will check for a parameter file. For that, it adds ".par" to the image file name(s) and attempts to open them. If unsuccessful, it adds ".dem_par" to the image file name(s) and tries to open them. If unsuccessful, the program finally exits with an error message. When a parameter file is provided, the image size and the data type is automatically extracted from it. If a different data type is provided using the command-line option dtype, it takes priority.

Instead of

dispwr 250606.HH.mli 1460

it is possible to use

dispwr 250606.HH.mli 250606.HH.mli.par

or

dispwr 250606.HH.mli

Update to polarimetry tools (LAT)

The program ***yamaguchi*** was added to support the Yamaguchi polarimetric decompositions Yamaguchi 2005, "A Four-Component Decomposition of POLSAR Images Based on the Coherency Matrix" and Yamaguchi 2011, "Four-Component Scattering Power Decomposition With Rotation of Coherency Matrix".

The program ***freeman_durden*** was added (replacing the script *FD3C_DEC*) to calculate Freeman-Durden 3-component polarimetric decomposition from coherence matrix T elements. The actual implementation follows the algorithm described in J. Yin, and J. Yang, "Target Feature Extraction with Polarimetric Radar: A Remote Sensing Perspective," Electromagnetic Scattering, pp. 341-388, 2017, doi: 10.1142/9789813209954_0009.

For new sensors (NISAR) SLC products in map geometry are becoming available, in addition to the SLC products in slant-range geometry. To also support polarimetry starting from SLC data in map geometry the following polarimetry programs were updated:

- ***polcoh***
- ***polcovar***
- ***pauli***
- ***yamaguchi***
- ***freeman_durden***
- ***haalpha***
- ***diplane_helix***
- ***quad_pol_decomposition.py***
- ***quad2cp***
- ***stokes***
- ***wolf***
- ***stokes_qm***
- ***m_alpha, m_chi, m_delta***
- ***compact_pol_decomposition.py***

Furthermore, the program *arc_pol_decomposition.py* was updated to support the Yamaguchi and updated Freeman-Durden decompositions within the **ArcGIS Pro plugin**.

And finally, The HTML documentation for the polarimetric tools has been updated, expanded and improved. External links in the HTML documentation are now opened in a new browser tab.

BIOMASS P-band SAR support (ISP)

Working with BIOMASS P-band SAR SLC and DGM (detected, ground-range) data is supported with the new reader programs *par_BIOMASS_SLC* and *par_BIOMASS_MLI*. In the case of the detected ground-range image the data is directly transformed back into the better-defined slant-range geometry when reading the data.

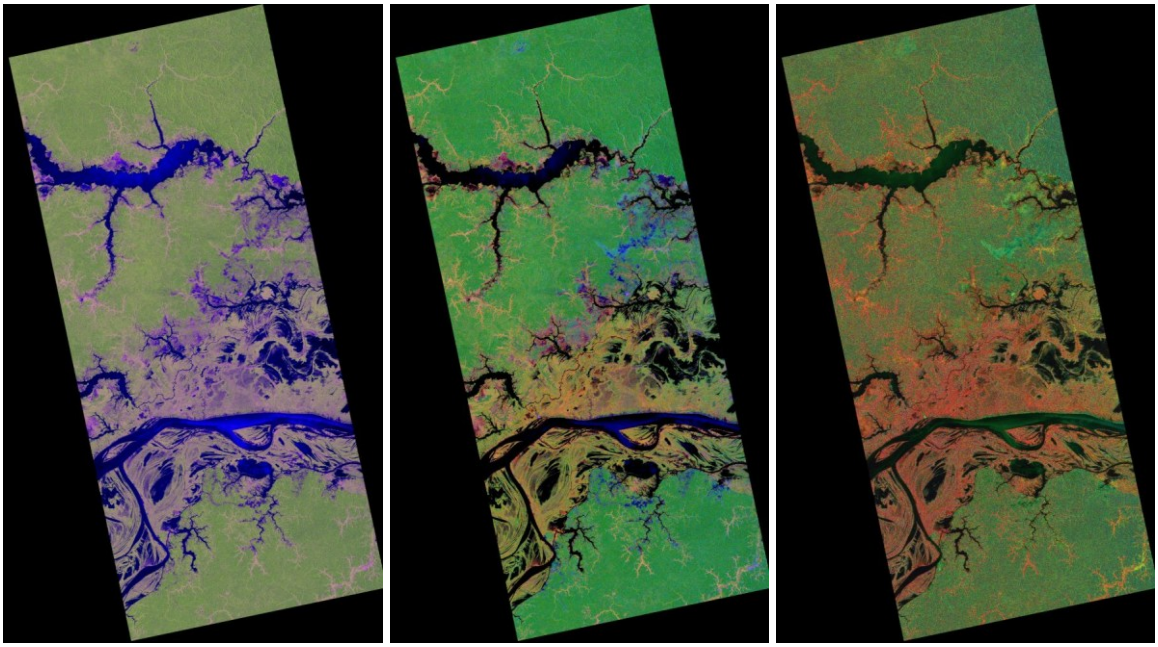
We were able to test actual BIOMASS data obtained through our related Cal/Val project. The commands used are documented in a new demonstration example. At present the input data cannot be provided with the demo, but BIOMASS data shall soon become freely available from ESA.

Early results obtained are shown in Figures 1 (based on a single quad-pol. acquisition) and 2 (based on an interferometric pair with a 3-day time difference and a short spatial baseline).

New and updated SAR data readers

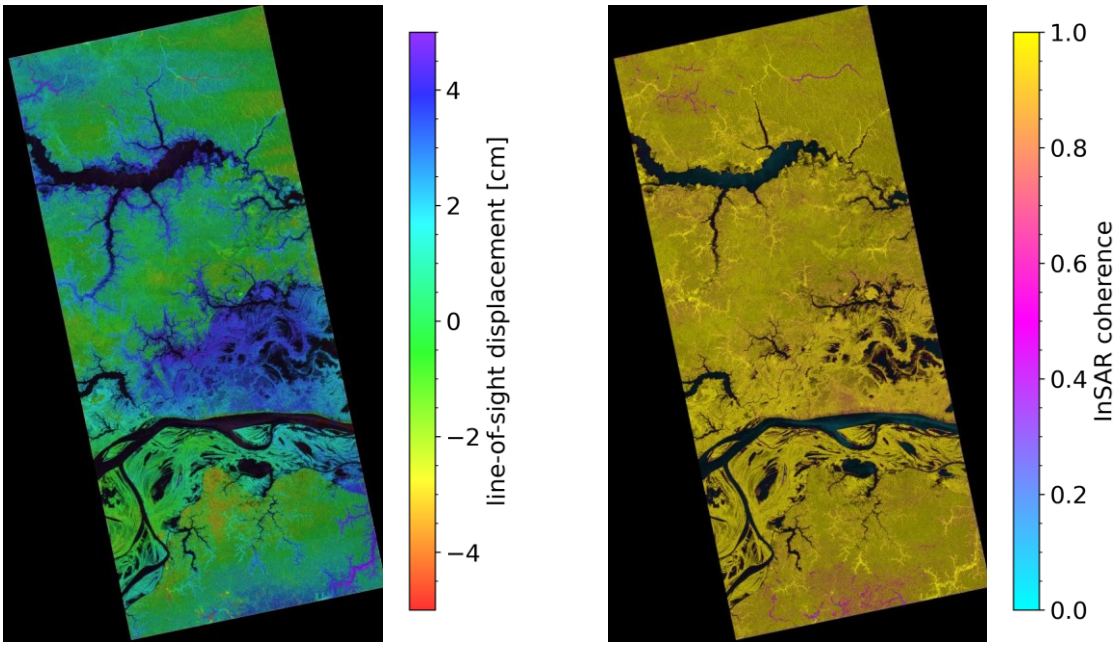
New / updated SAR data reader	**Short description**
par_BIOMASS_SLC ***par_BIOMASS_MLI***	For BIOMASS P-band acquisitions these programs support reading SLC data (SCS and STA products) and detected images in ground-range geometry (DGM products). In the case of the detected image the geometry is immediately changed from ground-range to slant-range (but optionally the ground-range image can also be generated).
par_ICEYE_SLC	Reading ICEYE SLC data acquired in squinted mode is now supported. The correct interpretation of the squinted mode data geometry was validated by determining an offset field between a squinted and a non-squinted acquisition over the same area.

par_HT1_SLC	The Hongtu-1 (HT1) reader program now also supports reading HT2 data. On Nov. 8, 2024 the 4 X-band radar satellites Hongtu-2 01-04 radar were launched. The reader program was updated to now also support reading HT2 SLC data. The reader could be tested using an interferometric pair with a 6-day time interval and a short spatial baseline.
par_NISAR_RSLC	We did not have access to actual NISAR data but based on feedback from members of the calibration team the version written based on the simulated data sets seems to work also for the actual data.



RGB of σ_{HH}, σ_{HV}, σ_{HH}/σ_{HV} Freeman-Durden decomp. HH–VV phase difference

Figure 1 BIOMASS quad-pol. P-band data over Amazonas on 20250606



Displacement 20250606-20250609 DInSAR coherence 20250606-20250609

Figure 2 BIOMASS P-band HH-pol. DInSAR over Amazonas on 20250606-20250609

Gamma Software Demo examples

The access to the Gamma Software Demo examples is limited to Gamma Software users with a valid license. The access information is provided with the software delivery. A list of the Demo examples is available here:

https://gamma-rs.ch/uploads/media/README_Gamma_Software_demo.html.

New / modified demo example:	**Contents**
Gamma_Polarimetry_demo	The polarimetry demo was updated to demonstrate the modified and added (Yamaguchi Decomposition) polarimetry tools.
BIOMASS_demo	A demo example for reading and processing BIOMASS data was added. At present no BIOMASS data is included with the demo (just the commands used and quicklooks of results generated (see also Figures 1-2 above). Actual data will be added after the commissioning phase when ESA starts to freely release BIOMASS data.
IPTA_demo_S1_Aletsch_from_orig	The Aletsch IPTA demo was updated to correspond to the latest version of the Gamma Software. It includes some improvements in the consistency of the estimated turbulent component of the atmospheric phase, as well as in the calculation of the equivalent single reference time series.

MSP

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ISP

par_S1_SLC: Can now read Sentinel-1 SLC data obtained using the Bursts Download API from the Copernicus Data Space.

read_S1_TOPS_SLC.py, S1_BURST_tab_from_zipfile.py: Now supports reading Sentinel-1 SLC data obtained using the Bursts Download API from the Copernicus Data Space.

ISP_io, typedef_ISP.h: Update to support new parameters for correction of GPRI residual video phase (RVP) and for calibration: RF_freq_min, RF_freq_max, RF_chrip_rate, TX_chirp_time, ADC_sample_rate, TX_chrip_samp, CAL_loop_enable.

par_ICEYE_SLC: Reading ICEYE SLC data acquired in squinted mode is now supported.

par_BIOMASS_SLC: New program to generate SLC parameter and image files for BIOMASS SLC (SCS and STA) data products.

par_BIOMASS_MLI: New program to generate MLI parameter and image files for BIOMASS DGM data (detected image in ground-range geometry. When reading the data the geometry is transformed into slant-range geometry and the magnitude values are transformed to intensity values.

par_HT1_SLC: Updated to also support reading HT2 (Hongtu-2, PIESAT-2) SLC data.

par_EORC_PALSAR: Updated for the reading of PALSAR-3 SLC data. The slant range to the first pixel is now read from the header of the image file (before it was calculate based on the time-delay to the first pixel read from the header of the image file which is less accurate as it is rounded

to a full nano-second – which resulted in errors of several cm which affected the mosaicking of SLC sections).

SLC_intf: Added fc_flg command line parameter to turn off phase correction due to differences in the radar carrier frequency. By default the correction is performed.

ISP/html par_*.html: For most SAR data reader programs the related html documentation now specifies the output radiometric calibration. Furthermore, a comment has been added indicating if state vector filtering (using *ORB_filt_spline.py*) may be useful.

par_SV2_SLC: Updated to correctly read the azimuth line time and range pixel spacing for all "generation system versions" (processor version) of SV2 SLC data.

DIFF&GEO

dem_import, coord_trans, coord_trans_list: Support improved for global geoids not covering the entire Earth.

DIFF_lib.c: To avoid issues when processing data sets extending across the international date line the longitude is now wrapped to be no further than +/- 180 deg from the reference longitude in lat/lon conversion to Transverse Mercator, Oblique Mercator, Hotine Oblique Mercator, Polyconic, and Lambert Comformal Conic projections.

GEO_users_guide.pdf (in DIFF module and in the GEO module): The users guides have been significantly updated.

LAT

polcoh: New option for polarization orientation angle estimation and correction.

yamaguchi: New program to calculate 4-component polarimetric decomposition from coherence matrix T elements by Y. Yamaguchi. Two decompositions models are available, based on Yamaguchi et al., "A Four-Component Decomposition of POLSAR Images Based on the Coherency Matrix", IEEE TGRS, 2005 and Yamaguchi et al., "Four-Component Scattering Power Decomposition With Rotation of Coherency Matrix", IEEE TGRS, 2011.

quad_pol_decomposition.py: Addition of two versions of a 4-component polarimetric decomposition from coherence matrix T elements, based on Yamaguchi et al., "A Four-Component Decomposition of POLSAR Images Based on the Coherency Matrix", IEEE TGRS, 2005 and Yamaguchi et al., "Four-Component Scattering Power Decomposition With Rotation of Coherency Matrix", IEEE TGRS, 2011.

pauli: The Pauli decomposition can now also be performed on geocoded SLC images. A new [DEM_par] option has been added. When a DEM parameter file is provided using that option, the program assumes that the input SLC images are geocoded SLC images. It will read the image dimensions from the DEM parameter file.

polcoh: The calculation of the coherence matrix can now also be performed on geocoded SLC images. New [DEM1_par] and [DEM2_par] options have been added. When a DEM parameter file is provided using the [DEM1_par] option, the program assumes that the input SLC images are geocoded SLC images (i.e., geocoded Pauli components). The output DEM parameter file (option DEM2_par) describes the geometry of the multi-looked geocoded coherence matrix elements.

polcovar: The calculation of the covariance matrix can now also be performed on geocoded SLC images. New [DEM1_par] and [DEM2_par] options have been added. When a DEM parameter

file is provided using the [DEM1_par] option, the program assumes that the input SLC images are geocoded SLC images (i.e., geocoded HH, HV, VV components). The output DEM parameter file (option DEM2_par) describes the geometry of the multi-looked geocoded covariance matrix elements.

freeman_durden: New program to calculate Freeman-Durden 3-component polarimetric decomposition from coherence matrix T elements. This program replaces the script FD3C_DEC. The actual implementation follows the algorithm described in J. Yin, and J. Yang, "Target Feature Extraction with Polarimetric Radar: A Remote Sensing Perspective," Electromagnetic Scattering, pp. 341-388, 2017, doi: 10.1142/9789813209954_0009. The calculation of the Freeman-Durden decomposition can also be performed using geocoded coherence matrix elements.

yamaguchi: The calculation of the Yamaguchi decompositions can also be performed using geocoded coherence matrix elements.

haalpha: The calculation of the H/A/alpha (Entropy, Anisotropy, and alpha) decomposition can also be performed using geocoded Pauli components.

diplane_helix: The calculation of the Diplane and Helix components of the Krogager decomposition can also be performed using geocoded LL and RR circular components.

quad_pol_decomposition.py: Now uses the new version of the Freeman-Durden decomposition ("*freeman_durden*" program). The calculation of the decompositions can also be performed using geocoded SLC images.

quad2cp: Geocoded compact polarization data can now be synthesized from geocoded quad-pol data sets.

stokes: The calculation of the Stokes parameters matrix can now also be performed on geocoded SLC images. New [DEM1_par] and [DEM2_par] options have been added. When a DEM parameter file is provided using the [DEM1_par] option, the program assumes that the input SLC images are geocoded SLC images. The output DEM parameter file (option DEM2_par) describes the geometry of the multi-looked geocoded Stokes parameters.

stokes_qm: Geocoded quantitative measures can now be derived from geocoded Stokes parameters.

wolf: The calculation of the Wolf coherence matrix can now also be performed on geocoded SLC images. New [DEM1_par] and [DEM2_par] options have been added. When a DEM parameter file is provided using the [DEM1_par] option, the program assumes that the input SLC images are geocoded SLC images. The output DEM parameter file (option DEM2_par) describes the geometry of the multi-looked geocoded Wolf coherence matrix elements.

m_alpha, m_chi, m_delta: The calculation of the m-alpha, m-chi, and m-delta decompositions can now also be performed using geocoded Stokes parameters.

compact_pol_decomposition.py: The calculation of the compact-pol decompositions can now also be performed using geocoded SLC images.

haalpha: The names of the input Pauli components have been changed from <alpha>, <beta>, and <gamma> to <P_alpha>, <P_beta>, and <P_gamma>. These changes are for consistency and to avoid a conflict with the <alpha> output in "haalpha".

polcoh: The names of the input Pauli components have been changed from <SLC1>, <SLC2>, and <SLC3> to <P_alpha>, <P_beta>, and <P_gamma>. The names of the input parameter files have also been changed from <SLC1_par>, <SLC2_par>, and <SLC3_par> to <P_alpha_par>, <P_beta_par>, and <P_gamma_par>. These changes are for consistency.

LAT HTML documentation: The HTML documentation for the polarimetric tools has been expanded and improved, and external links in the HTML documentation are now opened in a new browser tab.

DISP

dis2SLC, dis2_dB, dis2_linear, dis2dt_pwr, dis2gbyte, dis2mph, dis2mph_pwr, dis2pwr, disSLC, dis_dB, dis_linear, discpx, disdt_pwr, disflag, disgbyte, dismph, dismph_fft, dismph_pwr, dispwr, disshd, ras24_float, ras3pwr, ras8_float, rasSLC, ras_dB, ras_linear, rascpx, rasdt_pwr, rasmph, rasmph_pwr, raspwr, rasshd, DIFF_io: Implemented the possibility to read width and dtype from parameter file for all display programs (dis* and ras*). Width parameters can be specified by direct numeric value, parameter file path, or "-" for automatic .par (.dem_par) file detection. When parameter files are used, dtype is automatically extracted from it. Command-line arguments have priority.

disshd, rasshd: Added the default value for col_post to 30 (used if it is not specified in the command line).

vismph_pwr.py, viscpx.py: Made the following 2 corrections:
1. Calculation of the intensity (power) of the complex data is now forced to be real.
2. Pressing "q" now correctly closes the image.

disdem_par: Updated to guess parameter filename based on data filename if not provided on the command line

IPTA

def_mod_pt, multi_def_pt, multi_def_geo_pt, def_mod, multi_def, dis_ipta; In the case of a wrapped phase (FCOMPLEX data), the reliability of the initial coarse phase unwrapping step has been improved for models 0, 1, and 3.

data2pt, d2pt: Correction of a parallelization bug resulting in some wrong values being read for SCOMPLEX and DOUBLE data types.

multi_def_pt, multi_def_geo_pt, multi_def: Improved consistency in patch sorting when using different platforms.

mcf_pt: Improved unwrapping consistency when using multi-threading and when using different platforms.

TS_DISP

gamma_TS_viewer.py:

- if dates from attributes are not in chronological order, they are now sorted before plotting
- y-limits are now read from default config; if empty, they are set by the data limits
- user guide update
- Vector Layer Visualization: new save and delete buttons for scaling templates
- Time-series Visualization:
    - new "Add" and "Delete" buttons for Date Format in Configuration
    - new "Select All" button in Selection Tools

- Time Series Plot Viewer: Plotting Options can be saved, deleted and set as the default plot options

TDBP (Time-Domain Back-Projection)

The TDBP programs are available for Ubuntu 24.04/22.04 Linux and Windows 11 WSL2 with Ubuntu 24.04/22.04 Linux (and legacy 20.04 Ubuntu Linux and Windows 11 WSL2 versions).

The time-domain back-projection focusing program *az_proc_tdbp_gpu* employs parallelized TDBP imaging implemented in C/CUDA and therefore requires an Ubuntu Linux computer equipped with an NVIDIA GPU.

The TDBP module supports image focusing of SAR data from airborne platforms, UAVs, and mobile-mapping platforms such as cars, or trains, with high-quality 3-D geometry/motion compensation. Subsequent interferometric/tomographic processing and value-adding is supported. The TDBP module supports SAR image focusing of pulsed and FMCW SAR data with a generic sensor-agnostic data interface. In particular, SAR image focusing of FMCW SAR data acquired with our in-house Gamma SAR systems (https://www.gamma-rs.ch/instruments) is also supported. See also the Gamma L-band SAR demo examples and our publications on ground motion/slope stability retrieval plus other SAR imaging examples obtained with Gamma SAR systems mounted on a car or a UAV and processed with the TDBP module: https://www.gamma-rs.ch/instruments/sar-system-publications.

GIS

With the end-of-2023 distribution the additional module *GIS* has been included. All the users with a valid license and running maintenance for the *GEO* or a combination of modules that includes the *ISP/DIFF&GEO* obtain the module *GIS*. Notice that many of the programs of the *GIS* module require access to the *LAT*. Users without the *LAT* will not see the tools requiring *LAT* programs.

The *GIS* programs compose the "***Gamma Plugin for ArcGIS Pro***". This plugin supports running SAR data specific tools in the ArcGIS Pro environment (Windows only). The GIS module consists of several text files (README file, Change log file) and Python programs. The text files are in the main GIS directory, the Python programs and the related documentation (xml files that can be accessed within ArcGIS Pro) are located in the subdirectory scripts. The text file README_GIS is a listing of the contents of the GIS module.

arc_pol_decomposition.py: Addition of two versions of a 4-component polarimetric decomposition from coherence matrix T elements, based on Yamaguchi et al., "A Four-Component Decomposition of POLSAR Images Based on the Coherency Matrix", IEEE TGRS, 2005 and Yamaguchi et al., "Four-Component Scattering Power Decomposition With Rotation of Coherency Matrix", IEEE TGRS, 2011. New implementation of the Freeman-Durden decomposition.

arc_read_data.py: Support for BIOMASS SCS/STA/DGM data has been added. Support for HT2 has been added: the input source 'HT-1/Hongtu-1/PIESAT-1' has been modified to 'HT-1/HT-2/Hongtu/PIESAT.