GPOD TUDaBo SAR-RDSAR Software Prototype User Manual

Introduction

The G-POD Service G-POD (**G**rid-**P**rocessing **O**n **D**emand), **TUDaBo SAR-RDSAR** (**T**echnical **U**niversity **Da**rmstadt – University **Bo**nn **SAR-Re**duced **SAR**), is a web platform that provides the capability to process on line and on demand SAR mode Full Bit Rate (FBR or L1A) data to Level-1B and Level-2 geophysical data products.

The service is based on a **SAR-RDSAR** Processor Prototype that has been developed and tested by Christopher Buchhaupt and Luciana Fenoglio-Marc in TU Darmstadt and at the University of Bonn.

Available modes to generate L1B and L2 data are reduced SAR, unfocused SAR and LRMC, whereas several signal processing options and retrackers are available. The output data products are in standard NetCDF format and follow in large part the format and variable names of RADS products.

The G-POD graphic interface allows to select both geographical area of interest and time interval, depending of course on the availability of Cryosat-2 or Sentinel-3A SAR FBR data products in the service's catalogue. After the task submission, it is possible to follow, in real time, the status of the processed task.

More information about how to use the generic G-POD graphic interface can be found below on this G-POD wiki page.

The online SAR-RDSAR service is available [here](#).

List of option entries of the G-POD graphic interface

The users can customize and adapt the processing, according to their specific requirements, setting a list of configurable options grouped according to the processing level (L1B and L2). In the G-POD web interface, users can enter easily the processing options via a series of drop-down menu. A basic description of the options is given below, whereas the bold options are selected by default.

General Options:

Mission	**CryoSat-2**	Satellite mission which L1A data is going to be processed.
	Sentinel-3A	
Reference ellipsoid	**WGS84**	Reference ellipsoid used for the vertical datum.
	TOPEX	
	GRS80	

L1B Processing Options:

Option Name	Option Value	Option Description
Use RADS bias	**No**	Flag to determine if the RADS roll/pitch and range bias shall be used in the L1B processing. Alternatively the biases for roll/pitch and range are treated as in CryoSat-2 Baseline-C products. For Sentinel-3A no biases exists.
	Yes	
Process RDSAR	**Yes**	Flag to determine if RDSAR L1B data shall be processed.
	No	
Process unfocused SAR	**Yes**	Flag to determine if unfocused SAR L1B data shall be processed.
	No	
Process LRMC	**Yes**	Flag to determine if LRMC L1B data shall be processed.
	No	
Distribution of pulse/beam samples	**Exponential**	Stochastic distribution of the L1B data **before** the averaging, which is in state-of-the-art processing exponential. By selecting "Zero skewness Weibull" a transform is applied to achieve a sample power distribution close to normal.
	Zero skewness Weibull	
Use Hamming window	**No**	Flag to determine if a Hamming window shall be applied before each FFT.
	Yes	
Apply zero padding	**Yes**	Flag to determine if zero padding shall be applied before each FFT.
L1B sampling frequency	**20 Hz**	Sampling rate of L1B data. 20 Hz corresponds to a distance between samples of about 320 m, 40 Hz to about 160 m and 80 Hz to about 80 m.
	40 Hz	
	80 Hz	
Local surface approximation	Sphere	Surface representation used in the processing. "Sphere" assumes a globally constant curvature, "Ellipsoid" applies latitude dependent curvatures, "Slopes" includes geoid slopes and "Geoid" adds additionally the geoid curvatures.
	Ellipsoid	
	Slopes	
	Geoid	

L2 Processing Options:

Option Name	Option Value	Option Description
Retracked surface	**Water**	Flag to determine the surface which is going to be retracked. Water are locations which are flagged by the MODIS water-land mask as water and Ocean are water locations with a distance to coast bigger than 10km.
	Ocean	
	All	
	None	
Retracker RDSAR	**BMLE3**	Retracker used to generate RDSAR L2 data. BMLE3 is a state-of-the-art conventional altimetry retracker based on the Brown-Hayne model. SINC2 is a fast convolution based adaption of BMLE3, which does not use a PTR approximation. TALES is SINC2 using an ALES approach to lessen land contamination effects on L1B data.
	SINC2	
	TALES	
	NONE	
Retracker unfocused SAR	**SINCS**	Retracker used to generate unfocused SAR L2 data. SINCS is a fast convolution based SAR waveform retracker, which does not apply a PTR approximation. SINCS-OV is an adaption of SINCS including vertical wave orbital velocities by retracking the stack or L1B-S data.
	SINCS-OV	
	NONE	
Retracker LRMC	**SINCS**	Retracker used to generate LRMC L2 data. SINCS is a fast convolution based SAR waveform retracker, which does not apply a PTR approximation. SINCS-OV is an adaption of SINCS including vertical wave orbital velocities by retracking the stack data.
	SINCS-OV	
	NONE	

Output Options:

Option Name	Option Value	Option Description
Dump waveforms	Yes	Flag to determine if the waveforms (L1B) shall be stored in the NetCDF output file.
	No	
Store Stack Data	Yes	Flag to determine if the stack data (L1B-S) shall be stored in the NetCDF output file.
	No	

Adopted Conventions

- The Reference Time for UTC is 01/01/1985 00:00:00

- The Curve Best-Fitting Scheme, used in the retracking stage, is a Levenberg-Marquardt Least-Squares Estimation Algorithm (LEVMAR-LSE).

- Static bias has been applied to the range, sigma nought and antenna mispointing measurements. The values of the static biases are reported in the output NetCDF data products.

- The orbital altitude has been corrected for a Time Tag Bias. The value of the applied time tag bias is reported in the output NetCDF data products.

- The measurements are posted both at a rate of 20 Hz/40 Hz/80 Hz and of 1 Hz.

- The sea state bias has not been applied to the sea level anomaly measurements.

- All the default geophysical path corrections are from the FBR products.

- No a priori data editing has been applied to the 20 Hz measurements.

- The misfit between a waveform model and waveform data has been computed as:

$$Misfit = \frac{100}{N} \sum_{k=1}^{N} r_k^2$$

where r_k are the differences between model's waveform power and data's waveform power, normalized for the waveform power's maximum value and N is the number of sampled considered during retracking.

Output Format

The L2 data products generated in output are in standard NetCDF format (RADS-convention)

The file naming convention for those files is: PSG_FBR_INPUT_FILENAME.nc

where:

FBR_INPUT_FILENAME is the filename of the SAR FBR data file given in input.

The NetCDF format is self-explanatory with all of the data field's meaning described in the attributes.

How to access the service
The service is open and free of charge.
In order to be granted the access to the service, you need to have an EO-SSO account (for EO-SSO registration, go here) and afterwards, you need to submit an e-mail to the G-POD team (write to eo-gpod@esa.int), requesting the activation of the **TUDaBo SAR-RDSAR** service for your EO-SSO user account.

Contact

For any question, bug-reports or support, please contact us at: altimetry.info@esa.int

For G-POD specific questions please contact: eo-gpod@esa.int

Acronyms

EO-SSO	Earth Observation Single Sign-On
EOP-SER	Earth Observation Programmes: Science, Exploitation, Research
FBR	Full Bit Rate
G-POD	Grid Processing On Demand
GRS	Geodetic Reference System
L1A	Level 1A
L1B	Level 1B
L1B-S	Level 1B-S
L2	Level 2
LRMC	Low resolution mode with range cell migration correction
RADS	Radar Altimeter Database System
RDSAR	Reduced SAR
SAR	Synthetic Aperture Radar
SINC	Signal model involving numerical convolutions
SINC2	SINC based conventional altimetry retracker
SINCS	SINC based SAR altimetry retracker
SINCS-OV	Extension of SINCS introducing orbital wave velocities
WGS	World Geodetic System

References

Buchhaupt C., Fenoglio-Marc L., Dinardo S., Scharroo R., Becker M (2018). A fast convolution based waveform modell for conventional and unfocused SAR altimetry, Advanced Space Research Special Issue CryoSat-2, https://doi.org/10.1016/j.asr.2017.11.039

Buchhaupt, C., (2019). Model Improvement for SAR Altimetry, PhD Thesis, University of Darmstadt, tuprints.ulb.tu-darmstadt.de/9015/, doi:

Fenoglio L. and Buchhaupt C. (2020). TUDaBo SAR-RDSAR for G-POD Altimetry Coastal and Open Ocean Performance -Algorithm Theoretical Basis Document (ATBD), ESA Reference number: EOEP-SEOM-EOPS-TN-17-046, Version 1.6, 30-01-2020