SPICE

Sentinel-3 Performance improvement for ICE sheets

POCCDv2.3

Scientific Exploitation of Operational Missions (SEOM)

Sentinel-3 SAR Altimetry

Study 4: Ice Sheets

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Change Log

Issue	Author	Affected Section	Reason	Status
v01	isardSAT	All	Document structure created.	Released to consortium 23/11/2015
v02	isardSAT	2	Updated DDP options	Released to consortium 25/11/2015
v03	isardSAT	P8	included reference Ray et al. 2015 **(**RD. 1**)**	Released to consortium 04/03/2016
v1	isardSAT	2	Updated information on retrackers	Released to consortium 02/11/2016
v2	isardSAT	1, 2	Updated information on L1 and L2 configurable options and L2 processing options.	Released to consortium 08/02/2018
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Distribution List

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Document Status:

Internal

Contents

Acronyms and Abbreviations

AD	Applicable Documents
ATBD	Algorithm Theoretical Basis Document
CLS	Collecte Localisation Satellites
DDP	Delay Doppler Processor
DEM	Digital Elevation Map
DPM	Detailed Processing Model
ESA	European Space Agency
FBR	Full Bit Rate
IODD	Input/Output Data Definition document
ITT	Invitation To Tender
KO	Kick Off meeting
LEGOS	Laboratoire d'Etudes en Géophysique et Océanographie Spatiales
LRM	Low Resolution Mode
pLRM	Pseudo-LRM
PSD	Product Specification Document
RB	Requirements Baseline document
RD	Reference Document
RDSAR	Reduced SAR (also known as Pseudo-LRM)
SAR	Synthetic Aperture Radar
SARin	Synthetic Aperture Radar interferometric
SEOM	Scientific Exploitation of Operational Missions
SoW	Statement Of Work
SPICE	Sentinel-3 Performance improvement for Ice sheets
SR	Science Review
TCOG	Threshold Center Of Gravity
TN	Technical Note

TPR	Threshold Peak Retracker
UL	University of Leeds

Applicable Documents

Reference	Document Name	Source
AD1	Scientific Exploitation of Operational Missions (SEOM). Sentinel-3 SAR Altimetry Statement of Work (SEOM S3-4SCI SAR Altimetry). Issue 1, 27/09/2014.	ESA
AD2	Special Conditions of Tender. Appendix 4 to AO/1-8080/14/I-BG.	ESA
AD3	ESA Contract Draft. SEOM-Ice Sheets. AO/1-8080/14/I-BG.	ESA
AD4	Letter of Invitation. AO/1-8080/14/I-BG.	ESA

Table 1. Applicable Documents distributed by ESA.

Reference	Document Name	Source
UL_ESA_SEOM_S3-4SCI_CL	Cover Letter	UL
UL_ESA_SEOM_S3-4SCI_TP	Technical Proposal (v3, 2015/01/05)	UL
UL_ESA_SEOM_S3-4SCI_MP	Management Proposal (v2, 2015/01/05)	UL
UL_ESA_SEOM_S3-4SCI_IP	Implementation Proposal (v3, 2015/01/05)	UL
UL_ESA_SEOM_S3-4SCI_FP	Financial Proposal (v2, 2015/01/05)	UL
UL_ESA_SEOM_S3-4SCI_CP	Contractual Proposal (v0.1, 2015/01/05)	UL

Table 2. Proposal documents.

Reference Documents

RD. 1 Ray, C., Martin-Puig, C., Clarizia, M. P., Ruffini, G., Dinardo, S., Gommenginger, C., & Benveniste, J. (2015). SAR altimeter backscattered waveform model. IEEE Transactions on Geoscience and Remote Sensing, 53(2), 911-919.

RD. 2 SPICE. Algorithm Theoretical Baseline Document (ATBD) – UL_ESA_SEOM_SPICE_ATBD, issue 1.1, 19th February 2018.

1 Introduction

1.1 Purpose and Scope

This document describes the Processing Options and Configuration Control Document (POCCD) for the Scientific Exploitation of Operational Missions (SEOM), Sentinel-3 Performance improvement for ICE sheets (SPICE) study.

The POCCD has been written by isardSAT Ltd and University of Leeds (UL). UL as the prime contractor is the contact point for all communications regarding this POCCD.

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2 L1 processing options

The processing options and configuration parameters will be contained in a JSON file. Each parameter of this file will have three fields:

- Name
- Description
- Value

The following table contains the processing options of the SAR Ku L1B chain:

Name	Description	Value
Burst azimuth windowing	Type of window applied to each burst before performing the azimuth FFT	- None - Boxcar - Hamming - Hanning
Surface focusing	Option to move the surface locations	0 Off 1 Only one given surface
Azimuth processing method	Value that forces the precision of the Delay-Doppler process	- Approximate method - Exact method
Stack masking	Flag to apply a mask to the stack in order to delete undesired phenomena	0 Off 1 On
L1B-S and L1B range oversampling factor	Number of zero-padding applied to the waveforms during the range compression process	Powers of 2, up to 2048
Multi-looking method	Average through all the samples or just consider the non-0 samples	0 All samples 1 Only non-0 samples
ROI filtering	Input records can be filtered out if they fall outside a given Region Of Interest	0 Off 1 On

Table 3. SAR Ku chain processing options

Apart from these processing options, there are many parameters within the SAR Ku chain that can or could be configurable.

Name	Description	Value
Doppler range correction	This flag activates/deactivates the Doppler correction in range	0 Off 1 On

Slant range correction	This flag activates/deactivates the slant range correction	0 Off 1 On
Mask look angles max	Maximum look angle allowed for a beam.	0.6 * pi /180
Mask look angles min	Minimum look angle allowed for a beam.	-0.6 * pi /180
Reference beam	When aligning a stack, the beam that is taken as a reference.	- Surface - Maximum power - Least difference - First beam - Shortest delay
Maximum stack size	Maximum number of beams that form a stack	240

Table 4 Configurable parameters within SAR Ku chain

The **pLRM chain** has only one configurable processing option and it is the L1B oversampling factor, also listed in Table 3. And regarding the configurable parameters, since it starts from the L1A SAR Ku stage, the pLRM chain is affected by some of the parameters listed in Table 4.

3 L2 and Retracker Options

Type	Description	Value
High/Low Resolution	Type of L2 input data	- Disabled - SAR - PLRM
Pre-retracking module	Waveform portion selection algorithm	- Not applied - DEM reference - Batch processing
Retracker	Type of retracker that is applied (see RD. 2)	- Disabled - TPR - TCOG

Table 5. L2 chain processing options

Apart from these processing options, there are a few parameters within the L2 chain that can be configurable, listed in the following table.

Name	Description	Value
Leading edge percentage	Power threshold used for leading edge detection	75 for SAR (TPR), 50 for pLRM (TCoG)
Minimum peak prominence	Minimum prominence for a peak to be detected.	3
Sliding window size	Number of samples around the current sample that are taken into account in the average, when smoothing the waveform	16
Peak left samples	Margin samples to the left when cutting the waveform	10
Peak right samples	Margin samples to the right when cutting the waveform	5
Parameter sliding window	Window size used to compute range, elevation and sigma-0 RMSE values.	5

Table 6 Configurable parameters within the L2 chain