

S3-IPF

# S3-TDS Generation for L2 SRAL/MWR IPF



[Reference]

CLS-DOS-NT-15-038

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## Lists of TBD:

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### Applicable documents

- AD 1 Plan d'assurance produit de CLS CLS-ED-NT-03-394
- AD 2 S3 level 2 TDS generation for SRAL/MWR IPF CAL-PR-15-0075

#### **Reference documents**

- RD 1 Manuel du processus Documentation CLS-DOC
- RD 2 Sentinel-3 Core Payload Data Ground Segment (PDGS) Instrument Processing facility (IPF) Implementation - Interface Control Document SRAL Level 1 and Level 2 S3IPF.ICD.008
- RD 3 Sentinel-3 Core Payload Data Ground Segment (PDGS) Instrument Processing facility (IPF) Implementation - Auxiliary Data Format Specification S3IPF.PDS.007
- RD 4 SALP Products Specifications: Volume 4 : Positioning and Orbitography External Products SALP-ST-M-EA-10882-CN
- RD 5 Cryosat Ground Segment Payload Data Segment PDS <-> SSALTO ICD CS-ID-ACS-GS-0123
- RD 6 GMES Sentinel-3 Pre-flight Validation of altimeter SAR processing: Preparation of the processing of L0 Cryosat-2 data with Sentinel-3 SRAL L1 Ground Prototype Processor CLS-DOS-NT-15-012
- RD 7 SentineI-3 PDGS <-> SALP ICD S3A-ID-M-00012-CN
- RD 8 Cryosat-2: Transponder Pass Tools File Transfer Document EOCFI-FTD-004
- RD 9 Sentinel-3 PDGS File Naming Convention GMES-S3GS-EOPG-TN-09-0009
- RD 10 Sentinel-3 Core Payload Data Ground Segment (PDGS) Instrument Processing facility (IPF) Implementation - Product Data Format Specification - SRAL/MWR S3IPF.PDS.003<u>rev 1.11</u>

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#### 1. Introduction

This document is a technical note describing the work performed in the framework of the AD 2 proposal, that is to say the generation of a Sentinel 3 Level 2 TDS within the Sentinel-3 Core Payload Data Ground Segment Instrument Processing Facility Implementation project.

The objective of the activity is to deliver realistic input data and corresponding auxiliary data files (ADF) necessary to support the development, configuration and the validation of the operational processors before the S-3A launch. The corresponding output data are also provided.

The document is composed of the following sections:

- Section 2 provides an overview of the input CS-2 data used,
- Section 3 describes the softwares used for the generation of the TDS,
- Section 0 provides details on the conditioning of the Auxiliary Data to be used in input of the L2 processing chain and the configuration used to process the data,
- Section 5 is dedicated to the validation of the L2 output products,
- Section 6 gives the architecture of the delivered data package.

[Reference] CLS-DOS-NT-15-038 V1.1 2015,Oct.09



#### 2. Input data

#### 2.1. Cryosat-2 data

Considering the operational requirements for SentineI-3 mission, it is necessary to have from launch the best available algorithms that have been fully validated with real data. SentineI-3 will be the first mission with 100 % SAR mode coverage over ocean, ice sheet and inland water. These three areas were operated in LRM mode in CryoSat-2 mission. Prior to SentineI-3 launch, it is then important to test and validate the processings to the only available SAR mode real data from CryoSat-2.

In CryoSat-2 and for preparation of Sentinel-3, additional areas have been operated in SAR mode: Ocean, ice sheets and inland water areas. This TDS generation considers the opportunity to process these SAR data from the L0 data and to make the L2 end products available to the users's community for a preliminary assessment. We present in this section the areas of study.

#### 2.1.1. SRAL SAR mode over ocean

Concerning the Ocean SAR data, the Agulhas stream has been acquired in this mode for many cycles, but has yet never been used for the validation of the S3 IPF chain. This ocean part is especially relevant to test the processing as it can offer sea states with high values of SWH. The elected period for the data is January 2013.

We present on the following figure the polygon extracted from the CS-2 geographical mask (data from January 2013, hence v3.4 of the mask):



Figure 1 - SAR Activation zone over the Agulhas Stream (ocean)

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### 2.1.2. SRAL SAR mode over ice sheet

During November-December 2014, CryoSat-2 has been operated in SAR mode over some areas in Antarctica, covering ice sheets margins and ice sheets interiors. This acquisition covers the period from November 17th until December 16th, and is geographically located over three areas shown on the following figure:



Figure 2 - SAR Activation zone over Antarctica (ice sheet)

Spirit zone (in green) has been activated from 17 until 30 November, Vostok Lake (in blue) has been activated between 24 and 30 November and Dome C (in red) has been activated between 1 and 7 December.

These areas over the Antarctic continent are relevant for the assessment of the processing over ice surfaces whether it concerns the algorithms dedicated to the ocean surfaces or to the ice surfaces (most of them are activated whatever the surface type).

## 2.1.3. SRAL SAR mode over inland water area

CryoSat-2 SAR mode has also been tested over the Amazon basin. The SAR area extent is presented below (data from November and December 2014, hence v3.6 of the mask):

[Reference] CLS-DOS-NT-15-038 V1.1 2015,Oct.09





Figure 3 - SAR Activation zone over inland water area

The period for the processed data is November 17<sup>th</sup> until December 16<sup>th</sup> 2014.

The growing interest for the processing over the hydrological areas to enable the monitoring of the large rivers can be deeper investigated through these data.

#### 2.2. SRAL/MWR SPS data

For the MWR data, we provide two datasets of simulated data coming from the Sentinel-3 System Performance Simulator:

- One orbit (6000 seconds) of Sentinel-3 MWR L1b data,
- A hundred of seconds of Sentinel-3 LRM SRAL + MWR coupled L1b data, along with the corresponding L2 output and the auxiliary files used for the production.

The start date of both simulations is April 15<sup>th</sup> 2013, 00h00.

[Reference]

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#### 3. Processing chains used

The generation of these TDS requires the succession of several processing chains that are described in the coming paragraphs.

#### 3.1. SRAL data

The generation of TDS in a S3-format with a CS-2 content implies to cope with the special features of each mission and the differences occurring in the files' format specification.

We can split up the whole processing into four main stages (represented by the red and green boxes in the Figure 4):

- The CS2/S3 conversion tool: this tool enables to transform CS-2 L0 SAR and ADF data into the format required by the S3 SRAL L1 processing chain.
- The S3 SRAL L1b processing: this step transforms the CS-2 L0 data (in S3 format) into CS-2 L1b data (in S3 format).
- The CS2/S3 ADF conversion step: this stage aims at providing to the S3 SRAL/MWR L2 processing chain all the necessary CS-2 auxiliary data in the correct format (S3 format).
- The S3 SRAL/MWR L2 processing: this final step transforms the CS2 L1b data (in S3 format) into CS-2 L2 data (in S3 format).



Figure 4 - Overview of the TDS generation

Within the framework of the present activity, the additional information can be provided:

- The CS2/S3 conversion used is the one developed and validated within the dedicated ESTEC/CNES contract.
- The S3 SRAL L1b processing chain used is the Ground Processing Prototype (version V3.1.0).
- The S3 SRAL/MWR L2 processing chain used is the IPF (version 05.02).

[Reference] CLS-DOS-NT-15-03	8 V1.1	2015,Oct.09
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#### 3.2. MWR data

The version of the MWR SPS/GPP used in the framework of this study is the V3.1. Regarding the SRAL/MWR coupled data, the SRAL SPS V3.1.0 was used, along with the GPP mentioned in the previous section.

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#### 4. Generation of the TDS

This section relates the actions carried out to be able to generate the TDS, and particularly the work performed for the preparation of the requested auxiliary files in input of the L2 processing chain. Moreover we mention some information about the IPF L2 configuration and the models used.

#### 4.1. Geographical selection of the data

For this TDS generation, as described in section 0, we focus on some specific geographical areas. Hence, it is necessary to extract from the amount of CS-2 global data only the piece of tracks that cross the requested areas. This preliminary step is described in this section.

#### 4.1.1. Polygons

Regarding the **Ocean data** over the Agulhas Stream, we used the following polygon (mentioned as latitude and longitude of the point), part of the v3.4 of the Cryosat-2 geographical mask (version in application in January 2013, date of acquisition of the data):

- Map point 1 : (-40.0, 20)
- Map point 2 : (-25, 30.0)
- Map point 3 : (-25, 40)
- Map point 4 : (-40.0, 40).

This polygon corresponds to the Figure 1.

As for the Ice Sheet data, the 3 polygons defined on Figure 2 are the followings:

- Dome C :
  - Map point 1 : (-76, 120.0)
  - Map point 2 : (-74, 120.0)
  - Map point 3 : ( -74, 126)
  - Map point 4 : (-76, 126)
  - Map point 5 : (-76, 120.0)
- Vostock :
  - Map point 1 : (-79, 110)
  - Map point 2 : (-79, 100)
  - Map point 3 : (-75, 100)
  - Map point 4 : (-75, 110)
  - Map point 5 : (-79, 110)
- Spirit :
  - Map point 1 : (-66, 137)
  - Map point 2 : (-66, 147)
  - Map point 3 : (-69.5, 143)
  - Map point 4 : (-67.5, 135)
  - Map point 5 : (-66, 137)

Finally, for what concerns the **inland waters data** over the Amazon basin (Figure 3), the polygon is extracted from the v3.6 release of the geographical mask (corresponding to the November-December 2014 period):

- Map point 1 : (3.0, -61)
- Map point 2 : (3.0, -47)
- Map point 3 : (-5, -35)
- Map point 4 : (-5, -61)
- Map point 5 : (3.0, -61).

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## 4.1.2. Selection

After the identification of these polygons, the ESA Cryosat-2 executable program *intersection\_lon\_lat* (available among the transponder pass tools described in RD 8) is used to retrieve the UTC time start and stop of each piece of tracks that crosses the areas of interest.

Then, knowing these time intervals, it is possible to filter the amount of global data and to select the input LO data to be used for the generation of the TDS.

### 4.1.3. Resulting tracks

The results of this geographical selection are presented in this section.

#### 4.1.3.1. Ocean tracks

In order to get significant piece of tracks to study, we apply a criteria of a minimum duration of 60 seconds over the output of the previous step. This results in 49 tracks, presented on Figure 5 and whose complete list is provided in Appendix B -.



Figure 5 - Ocean CS-2 SAR tracks over the Agulhas Stream

## 4.1.3.2. Ice sheet tracks

For the ice sheet data, we consider all the tracks coming from the localization tool without any duration criteria. This represents 3 tracks over Dome C, 7 tracks over Vostok and 28 tracks over





Spirit. These tracks are presented on Figure 6, Figure 7 and Figure 8 respectively and the complete list of the L0 products concerned is provided in Appendix B -.



Figure 6 - Ice Sheet CS-2 SAR tracks over Dome C large view (left) and zoom (right)



Figure 7 - Ice Sheet CS-2 SAR tracks over Vostok large view (left) and zoom (right)



Figure 8 - Ice Sheet CS-2 SAR tracks over Spirit large view (left) and zoom (right)

#### 4.1.3.3. Inland water tracks

Regarding the inland water tracks, we apply a duration criteria of 30 seconds, which leads to 59 tracks over this area and within the concerned period. The tracks to be used are presented on and the complete list of the L0 products is given in Appendix B -.

[Reference] CLS-DOS-NT-15-038 V1.1 2015,Oct.09





Figure 9 - Inland water CS-2 SAR tracks over Amazon basin

## 4.2. Preparation of the Auxiliary data files

The L2 processing chain is run in a Non-Time Critical processing stage. The complete list of the auxiliary files necessary for this processing can be found in the RD 2 document. The format of all the auxiliary files is described in RD 3.

Note that for all the files mentioned in the following sections, an operation of creation of the Manifest XML file and the product directory with the correct naming convention is necessary to be compliant with the Sentinel-3 format specification.

## 4.2.1. Precise Orbit Ephemeris (S3A\_SR\_\_\_POESAX)

We use Precise Orbit Files from the CS-2 mission ground segment (SALP provider), provided in a format compliant with the RD 4 / RD 5 documents. Regarding this format, it is needed to compress each file into a \*.TGZ file to be compliant with the S3 processing chains.

## 4.2.2. Platform (S3A\_SR\_2\_PCPPAX)

The CS-2 mission does not use any Platform data. To overcome this shortage, we use the roll and pitch information available in CLS database (computed from the Star Tracker files) and we set the field distance from the antenna to the center of gravity to 0.

## 4.2.3. Characterization (S3A\_SR\_\_\_CHDNAX\_)

For the SRAL Instrumental Characterization database, we start out with the S3 file, modifying the parameters that are used in the SRAL L1 and L2 processing in accordance with the features of the CS-2 altimeter. These modifications have been validated in the framework of an ESTEC/CNES contract and are detailed in the RD 6 document.

## 4.2.4. Meteo 2D/3D (S3\_AX\_\_MA1\_AX and S3\_AX\_\_MA2\_AX)

The 2D and 3D files whose features are specified in RD 3 have been extracted from the ECMWF archive server. To ensure the match with the file format expected by the processing chain, the 2D

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parameters on one side and the 3D parameters on the other side need to be gathered by date in a same file (4 files per day for each type of parameter, 2D and 3D, at 00h, 06h, 12h and 18h).

## 4.2.5. Pole location (S3\_\_SR\_2\_POL\_AX)

We use the historical Pole Location file common to all the missions, in the format corresponding to the one mentioned in RD 3 document, and with a sensing stop more recent than the last CS-2 data processed in the framework of this study to ensure a full coverage.

#### 4.2.6. Iono GIM (S3A\_SR\_2\_RGI\_AX)

The lono GIM files of the CS-2 mission have the same format than for the S3 mission, with the exception that the CS-2 files are created in the Big Endian convention, while the S3 processing chain expects the Little Endian one. In this way, a swapping operation must be performed on each file (one file per day).

#### 4.2.7. Dynamic Sea-ice concentration

The dynamic corresponding files are not available and the climatology files intended as back-up solution in the processing are used.

#### 4.2.8. MOG2D (S3\_\_SR\_2\_PMO\_AX)

We use MOG2D files produced in a NetCDF format, and to be compliant with the format specified in the RD 3 document, it is needed to compress each file into a \*.TGZ file (4 files per day).

#### 4.2.9. Static Auxiliary files

The list of the static auxiliary files used is conform to the list provided in the RD 2 document for the NTC processing stage.

#### 4.2.10. Job Orders

For each TDS, it is needed to build a Job Order with the corresponding data files. In particular, the dynamic files (meteo, orbit, ...) are specific to each TDS and need to be picked correctly regarding the start and stop times of the track.

#### 4.3. SRAL/MWR L2 IPF configuration

#### 4.3.1. SAMOSA retracking configuration

Regarding the SAR Ocean retracking, we mention here the main parameters of the algorithm:

- Maximum number of iterations : 10
- Array of Levmar control parameters: [0.001, 1e-3, 1e-3, 1e-3, 1e-3]
- Range PTR Gaussian approximation coefficient : 0.513
- Azimuth PTR Gaussian approximation coefficient : 0.90206/(2\*sqrt(2.\*log(2)))
- The Platform information (roll, pitch) is taken from the platform auxiliary data
- The idealized beam angles (computed geometrically) are used for the multi-looking procedure.



## 4.3.2. List of the Models and static tables

This section gives the information related to the models or the tables used for the geophysical variables provided in the L2 products.

File type	Name	Description	
SR_2_IC01AX SR_2_IC02AX SR_2_IC03AX SR_2_IC04AX SR_2_IC05AX SR_2_IC06AX SR_2_IC07AX SR_2_IC08AX SR_2_IC09AX SR_2_IC09AX	Modeled instrumental correction	d instrumental correction Set to 0	
SR_2_EOT1AX SR_2_LT1_AX	Ocean and Load tides (solution 1)	GOT4.8	
SR_2_EOT2AX SR_2_LT2_AX	Ocean and Load tides (solution 2)	FES2004	
SR_2_LNEQAX	Long period ocean tide	FES2004	
SR_2_MSS1AX	Mean Sea Surface (solution 1)	CNES-CLS 11	
SR_2_MSS2AX	Mean Sea Surface (solution 2)	DTU10	
SR_2_GEO_AX	Geoid height	EGM 2008	
SR_2_ODLEAX	Bathymetry/topography	ACE2	
SR_2_WNDLAX SR_2_WNDSAX	Wind tables	Witter & Chelton	
SR_2_SIGLAX SR_2_SIGSAX	Expected Ku-band Sigma0 table	ENVISAT table	
SR_2_SET_AX	Solid earth tide	Cartwright and Edden tide	
SR_2_MDT_AX	Mean Dynamic Topography	CNES-CLS 09	
SR_2_SSBLAX SR_2_SSBSAX	SSB correction table	ENVISAT table	

Table 1: List of the models and tables used for the generation of the TDS

Is has to be noted here that for the SSB, wind and expected Sigma0 tables, the LRM and SAR tables used are the same in both modes (the LRM mode one). In fact, in the future these tables are to be computed for the SAR mode which is not completed for the moment.

## 4.3.3. Warning regarding the L2 output products

The TDS generated here are based on CS-2 data. As a consequence it concerns a non-nominal S3 behavior, since there is neither C-band nor MWR data. This specificity has an impact on the L2 parameters, and consequently a certain amount of variables can not be computed in the processing. Hence, they shall not be considered when analyzing the L2 products (whose full content is described in RD 10).





The exhaustive list of these variables not to be considered here is provided in Appendix C -.

Moreover, it has to be added that the L1b processing is performed using the S3 Ground Processing Prototype for which there is no requirement to handle the complete absence of one of the band (Ku or C). For that reason, the CS-2 data processed containing only Ku band data, the C-band fields have been filled with Ku dummy values to avoid any unexpected behavior of the processor: as a consequence the C-band fields and parameters may not be empty but the content shall not be considered and analyzed.

### 4.4. NRT/STC configuration

With respect to the NTC processing stage, a processing in NRT or STC configuration requires different dynamic auxiliary data, insofar as some data may be absent or optional and the level of computation precision may be lower than in NTC.

The Table 2 sums up the dynamic data that are required or not in input of each processing step:

Data	NRT	STC	NTC
Orbit	DORIS Navigator L0 (back-up)	Preliminary	Precise
	S3A_DO_0_NAV	S3A_SRMDO_AX	S3A_SRPOESAX
Dlatform	NRT	Preliminary	Precise
Platform	S3A_SR_2_NRPPAX	S3A_SR_2_PMPPAX	S3A_SR_2_PCPPAX
Meteo 2D/3D	Forecast	Analysis	Analysis
	S3AXMF1_AX	S3AXMA1_AX	S3AXMA1_AX
	S3AXMF2_AX	S3AXMA2_AX	S3AXMA2_AX
lono GIM	Predicted	Predicted	Restituted
	S3A_SR_2_PGI_AX	S3A_SR_2_PGI_AX	S3A_SR_2_RGI_AX
MOCOD	None	Preliminary	Precise
MOOZD	None	S3SR_2_RMO_AX	S3SR_2_PMO_AX

Table 2: Difference in the Dynamic data for the NRT/STC/NTC processings

The test of these configurations aims at checking that the processing takes place properly whatever the processing stage and enables to assess the data with the dynamic auxiliary data available in shorter-time delays.

The following facts are to be noted regarding these data used for NRT/STC runs:

- For the Platform file, since the CS-2 mission does not contain any platform file (see section 4.2.2) we keep the same file for the three processing steps.
- Regarding the orbit, the NRT computation is performed with the DORIS Navigator L0 and the STC computation with the MOE from SALP.

For this test, we choose to provide one track over ocean whose description is provided in section 5.2.1.3.

#### 4.5. MWR configuration

Regarding the MWR configuration, we use the SPS to simulate scenes as realistic as possible.

Thus, the scene used for the MWR TDS (both MWR L1b TDS and SRAL/MWR TDS) is a set of simulations with a global geographic coverage at a resolution of 0.5°. Such maps have been

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computed using ECMWF analyses and the UCL radiative transfert model. The brightness temperatures have been simulated at the frequencies of the Sentinel-3 MWR (23.8GHz and 36.5GHz). The Sigma0 in Ku and C band are additional outputs of the Radiative Transfer Model.

The radiometric sensitivity measured during on-ground testing of the MWR has been taken into account in the simulation.

The Sigma0 Ku and the two brightness temperatures are used in the Level2 processing for the retrieval of the wet tropospheric correction.

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09
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#### 5. Validation of the production

In this section, we endeavour to show that the outputs of the L2 processing are consistent with both the specification of the processing chain and the data presented in input of the chain.

#### 5.1. Validation strategy

For each type of data (ocean, ice sheet and inland water), three specific tracks have been selected to perform this verification of the results and to present the outcomes.

The abundance of the L2 parameters makes it difficult to show all of them in an exhaustive way. For that reason, we choose to present a subset of parameters considered as relevant for the concerned area. Thus for example, the environmental and geophysical parameters (such as tides, mean sea surface ...) are presented only once (in section 5.2.1.1) since they do not depend on the acquired signal and only on the time and/or location information.

Note that in the framework of this study, the absence of MWR data leads to no MWR wet tropospheric correction (set to NaN) and no bi-frequency ionospheric correction, and hence to NaN values in the ocean Sea Surface Height Anomaly field of the produced L2 products. To overcome this problem, we compute a simplified Sea Level Anomaly (presented in the following sections) as is: SLA = altitude - range\_ocean - mean\_sea\_surf\_sol1. On the continental parts, the mean sea surface parameter contains the mean geoid value.

The content of the Level 2 SRAL/MWR product is described in RD 10.

#### 5.2. Validation

#### 5.2.1. Ocean

#### 5.2.1.1. First validation track

5.2.1.1.1. Presentation of the area

The area is located here:



Figure 10 - First zone selection over ocean

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It was recorded the 4<sup>th</sup> of January 2013 at 13h47 and lasts 4 minutes and 12 seconds. The ground track is descending. This zone has been selected for its varying SWH. The SAR echoes seen from side-on and from top are presented below:



Figure 11 - SAR Ku waveforms (ocean 1<sup>st</sup> validation track) The waveforms have a typical ocean-shape. Here is an example:



Figure 12 - SAR Ku waveform example (ocean 1<sup>st</sup> validation track)

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Figure 13 - PLRM Ku waveforms (ocean 1<sup>st</sup> validation track)

On Figure 13, the PLRM waveforms are conform to the expected shape over ocean. Figure 14 is an example of an echo - seen individually - in PLRM Ku.



Figure 14 - PLRM Ku waveforms example (ocean 1<sup>st</sup> validation track)



#### 5.2.1.1.2. Check of the output data

#### 5.2.1.1.2.1. General parameters

The following parameters here are sampled at 20Hz on Ku band.





We can notice on this figure strong values of the orbital altitude rate (>30 m/s).



Figure 16 - 20 Hz Latitude and longitude (SAR Ku)



Figure 17 - 20 Hz Surface class and type (SAR Ku)



For both the surface type and classification parameters, the 0 value stands for open ocean, which is coherent with the overflown surface.



AGC is displayed both on SAR Ku and PLRM Ku mode:

Figure 18 - 20 Hz AGC SAR Ku (left) and 20 Hz AGC PLRM Ku (right)

5.2.1.1.2.2. Geophysical and environmental parameters

an tide height (solution 1) : 1 Ha eight (solution 2) : 1 Hz -0.22 -0.22 nb= 252 min= -0.372 max=-0.227 mean= -0.278 std=0.041 nb= 252 min= -0.375 max=-0.223 mean= -0.268 std=0.041 -0.24 -0.2 -0.26 -0.26 Ê Ê -0.28 0.2 5 5 Sol1 Sol2 -0.3 -0.30 tide ide cean cean -0.32 -0.3 -0.34 -0.34 8 CLS 2015 8 © CLS 2015 -0.3 -0.36 50 100 150 200 time\_01 (seconds since 2000-01-01 00:00:00.0) 2013-01-04 13:47:16.0.000000 -0.38 -0.38 150 200 nds since 2000-01-01 00:00:00.0) time\_01 (se 2013-01-04 13:47:16.0 0000

The following graphs are related to tides evolution and are 1 Hz sampled:

Figure 19 - 1 Hz Geocentric ocean tide height: solution 1 (GOT4.8, left) and solution 2 (FES2004, right)



Figure 20 - 1 Hz Load tide height: solution 1 (left) and solution 2 (right)



Figure 21 - 1 Hz Solid earth tide height



Figure 22 - 1 Hz Pole tide height



Figure 23 - 1 Hz Equilibrium (left) and Non equilibrium (right) long period tide heights



The following figures display the mean sea surface:

Figure 24 - 20 Hz Mean sea surface height and accuracy (solution 1) (SAR Ku)



Figure 25 - 20 Hz Mean sea surface height (solution 2) (SAR Ku)

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Figure 27 - 1 Hz Mean dynamic topography (left) and accuracy (right)



Figure 28 - 1 Hz Ocean depth/Land elevation

The negative values of this parameter (corresponding to bathymetry) are compliant with the position of the track over ocean.



Figure 29 - 1 Hz Model Dry (left) and Wet (right) tropospheric correction at zero altitude Both model dry and wet tropospheric corrections are consistent with the expected range of values over ocean.



Figure 30 - 1 Hz Model U/V wind speed

The relatively high values of model wind speed are compliant with this Agulhas stream area, place of potentially strong depressions.



Figure 31 - 1 Hz GIM ionospheric correction
[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09	24
	High frequency fluctuations of the sea surface topog min-0.026 mean-0.034 0.06 0.06 0.07 0.0	raphy : 1 Hz		

Figure 32 - 1 Hz HF fluctuations of sea surface (MOG2D)

# 5.2.1.1.2.3. Ocean Retracking outputs for SAR Ku (SAMOSA)

We present in this section the parameters inferred from the SAMOSA retracking for the SAR Ku data.



Figure 33 - 20 Hz (top left) and 1 Hz (top right) SWH, and 1 Hz standard deviation (bottom)

This first validation area presents SWH values ranging from 2 meters in the Northern part of the track to 8 meters in the Southern part. In the meantime, the 1-Hz corresponding standard deviation increases from 40 cm to 80 cm.



Figure 34 - 20 Hz (top left) and 1 Hz (top right) altimeter ocean range, and 1 Hz standard deviation (bottom)



The following figures present the simplified SLA mentioned above in 5.1.

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[Reference]

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The standard deviation of the simplified SLA is included between 6 cm for the area of lowest SWH and 12 cm for the area of highest SWH.



Figure 36 - 20Hz (top left) and 1 Hz (top right) corrected backscatter coefficient, and 1 Hz standard deviation (bottom)

We can notice on Figure 36 that the Sigma0 values are abnormally high compared to the values usually encountered over ocean (10-15dB). This is due to a high range of values for the scaling factor (L1b parameter) used for the computation of the L2 backscatter coefficient, as shown on Figure 37. This observation is applicable to all the Sigma0 values.

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Figure 37 - Sigma0 scaling factor



Figure 38 - 20 Hz mean quadratic error (SAR Ku ocean retracking)



Figure 39 - 20 Hz Number of iterations (SAR Ku ocean retracking)

Figure 38 and Figure 39 show a MQE parameter slightly increasing with the SWH values and a number of iterations constant over the dataset.

# 5.2.1.1.2.4. Ocean Retracking outputs for PLRM Ku (Ocean3, MLE4)

We present in this section the parameters inferred from the Ocean3 (MLE4) retracking for the PLRM Ku data.

<figure>

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Figure 40 - 20Hz (top left) and 1 Hz (top right) corrected SWH, and 1 Hz standard deviation (bottom)

The estimated values of the SWH are coherent with the values estimated from the SAR echoes (Figure 33). Moreover, the standard deviation is higher as in SAR, which is expected.

200 0-01-01 00:00:00.0)



Figure 41 - 20 Hz (top left) and 1 Hz (top right) altimeter ocean range, and 1 Hz standard deviation (bottom)





Figure 42 - 20 Hz (top left) and 1 Hz (top right) Sea Level anomaly and 1 Hz standard deviation (bottom)

The simplified Sea Level Anomaly computed from the PLRM ocean range is in the same range of values as for SAR and has a standard deviation between 10 cm and 15 cm. As expected, his is slightly higher than for the SAR data.



Figure 43 - 20Hz (top left) and 1 Hz (top right) corrected backscatter coefficient, and 1 Hz standard deviation (bottom)

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Figure 44 - 20 Hz Sigma0 scaling factor (PLRM Ku ocean retracking)



Figure 45 - 20 Hz Mean quadratic error (PLRM Ku ocean retracking)



Figure 46 - 20 Hz number of iterations (PLRM Ku ocean retracking)

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Figure 47 - 20 Hz square of off nadir angle (PLRM Ku ocean retracking)



Figure 48 - 1 Hz off nadir pitch and roll angles from platform data

We can check that the estimated off-nadir angle (square value) is coherent with the angles inferred from the platform data.



Figure 49 - 20 Hz Peakiness (PLRM Ku ocean retracking)

# 5.2.1.1.2.5. Retracking Ice-2 PLRM Ku

[Reference]

We present in this section the parameters inferred from the Ice-2 retracking for the PLRM Ku data.

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Figure 50 - 20 Hz range (PLRM Ku Ice-2 retracking)



Figure 51 - 20 Hz backscatter coefficient (PLRM Ku Ice-2 retracking)



Figure 52 - 20 Hz Width of the leading edge (PLRM Ku Ice-2 retracking)

The increase in the width of the leading edge observed on Figure 52 is coherent with the increase in the SWH estimated with the ocean retracker and presented on Figure 40.

[Reference] CLS-DOS-NT-15-038 V1.1 2015,Oct.09



Figure 53 - 20 Hz Slopes of the first and second part of the trailing edge (PLRM Ku Ice-2 retracking)

# 5.2.1.2. Second validation track

## 5.2.1.2.1. Presentation of the area

The area is located here:



Figure 54 - Second zone selection over ocean

It was recorded the 5<sup>th</sup> of January 2013 at 01h53 and lasts 4 minutes and 9 seconds. This zone is close to the previous one but with an ascending ground track.

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The waveforms are usual. Here is an example:



Figure 56 - SAR Ku waveform example (ocean 2<sup>nd</sup> validation track)

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Figure 57 - PLRM Ku waveforms (ocean 2<sup>nd</sup> validation track)



Figure 58 - PLRM Ku waveform example (ocean 2<sup>nd</sup> validation track)

## 5.2.1.2.2. Check of the output data

## 5.2.1.2.2.1. SAR Ku ocean retracking (SAMOSA)

We present in this section the parameters inferred from the SAMOSA retracking for the SAR Ku data.





Figure 59 - 20 Hz (top left) and 1 Hz (top right) SWH, and 1 Hz standard deviation (bottom)



Figure 60 - 20 Hz (top left) and 1 Hz (top right) altimeter ocean range, and 1 Hz standard deviation (bottom)



Figure 61 - 20 Hz (top left) and 1 Hz (top right) sea level anomaly, and 1 Hz standard deviation (bottom)



Figure 62 - 20 Hz (top left) and 1 Hz (top right) backscatter coefficient, and 1 Hz standard deviation (bottom)

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09	38
				000

## 5.2.1.2.2.2. PLRM Ku ocean retracking (Ocean3, MLE4)

We present in this section the parameters inferred from the Ocean3 (MLE4) retracking for the PLRM Ku data.



Figure 63 - 20 Hz (top left) and 1 Hz (top right) SWH, and 1 Hz standard deviation (bottom)



Figure 64 - 20 Hz (top left) and 1 Hz (top right) altimeter ocean range, and 1 Hz standard deviation (bottom)

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Figure 65 - 20 Hz (top left) and 1 Hz (top right) sea level anomaly, and 1 Hz standard deviation (bottom)



Figure 66 - 20 Hz (top left) and 1 Hz (top right) backscatter coefficient, and 1 Hz standard deviation (bottom)

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# 5.2.1.3. Third validation track

## 5.2.1.3.1. Presentation of the area

The area is located here:



Figure 67 - Third zone selection over ocean

It was recorded the 28<sup>th</sup> of January 2013 at 00h36 and lasts 3 minutes and 43 seconds. This zone has been selected for its high SWH mean.



Figure 68 - SAR Ku waveforms (ocean 3<sup>rd</sup> validation track)

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Figure 69 - SAR Ku waveform example (ocean 3<sup>rd</sup> validation track)



Figure 70 - PLRM Ku waveforms (ocean 3<sup>rd</sup> validation track)



Figure 71 - PLRM Ku waveform example (ocean 3<sup>rd</sup> validation track)



## 5.2.1.3.2. Check of the output data

## 5.2.1.3.2.1. SAR Ku ocean retracking (SAMOSA)

We present in this section the parameters inferred from the SAMOSA retracking for the SAR Ku data.



Figure 72 - 20 Hz (top left) and 1 Hz (top right) SWH, and 1 Hz standard deviation (bottom)

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Figure 73 - 20 Hz (top left) and 1 Hz (top right) altimeter ocean range, and 1 Hz standard deviation (bottom)



Figure 74 - 20 Hz (top left) and 1 Hz (top right) sea level anomaly, and 1 Hz standard deviation (bottom)



Figure 75 - 20 Hz (top left) and 1 Hz (top right) backscatter coefficient, and 1 Hz standard deviation (bottom)

2013-01-28-00-

150 ce 2000-01-01 00:00:00.0)

250

We can notice some outliers in the estimated parameters previously presented (especially SWH and range). This area is associated to the following waveforms:





Figure 76 - Waveforms causing outlier values on retracking parameters

We can observe on Figure 76 that the echoes in this small segment of track present a varying shape relatively to the SAR ocean one, and in particular we can notice the presence of a second peak on the trailing edge. This will necessarily impact the behaviour of the estimator, trying to fit this second peak.

#### 5.2.1.3.2.2. PLRM Ku ocean retracking (Ocean3, MLE4)

We present in this section the parameters inferred from the Ocean3 (MLE4) retracking for the PLRM Ku data.



Figure 77 - 20 Hz (top left) and 1 Hz (top right) SWH, and 1 Hz standard deviation (bottom)

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Figure 78 - 20 Hz (top left) and 1 Hz (top right) altimeter ocean range, and 1 Hz standard deviation (bottom)



Figure 79 - 20 Hz (top left) and 1 Hz (top right) sea level anomaly, and 1 Hz standard deviation (bottom)



Figure 80 - 20 Hz (top left) and 1 Hz (top right) backscatter coefficient, and 1 Hz standard deviation (bottom)

The same artefact as the one observed in SAR is present here for the PLRM estimations.

## 5.2.2. Ice sheet

## 5.2.2.1. First validation track

5.2.2.1.1. Presentation of the area

The area is located here, in the Vostok area:



Figure 81 - First zone selection over ice



This descending track was recorded the  $28^{th}$  of November 2014 at 22h14 and lasts 1 minute and 8 seconds.



Figure 82 - SAR Ku waveforms (ice 1<sup>st</sup> validation track)

Most of observed waveforms in this zone have this kind of shape:



Figure 83 - SAR Ku waveform example (ice 1st validation track)

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Figure 84 - PLRM Ku waveforms (ice 1<sup>st</sup> validation track)



Figure 85 - PLRM Ku waveform example (ice 1st validation track)

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09

### 5.2.2.1.2. Check of the output data





Figure 86 - 20 Hz Surface type (left) and surface classification (left)

For the surface type, the value is "2" which corresponds to "continental\_ice" and for the surface classification, the "4" value corresponds to "continental\_ice\_snow". This is compliant with the overflown area.



Figure 87 - 1 Hz Ocean depth / Land elevation



#### 5.2.2.1.2.2. Ice-1 retracking parameters (SAR Ku)



Figure 88 - 20 Hz altimeter range (SAR Ku ice-1 retracking)





5.2.2.1.2.3. Ice-2 retracking parameters (PLRM Ku)



Figure 90 - 20 Hz altimeter range (PLRM Ku ice-2 retracking)

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09



Figure 91 - 20 Hz backscatter coefficient (PLRM Ku ice-2 retracking)

5.2.2.1.2.4. Ice-sheet retracking parameters (SAR Ku)



Figure 92 - 20 Hz altimeter range (SAR Ku ice-sheet retracking)



Figure 93 - 20 Hz backscatter coefficient (SAR Ku ice-sheet retracking)

[Reference] CLS-DOS-NT-15-038

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5.2.2.1.2.5. Sea-ice retracking parameters (SAR Ku)



Figure 95 - 20 Hz altimeter range (SAR Ku sea-ice retracking)



Figure 96 - 20 Hz backscatter coefficient (SAR Ku sea-ice retracking)

[Reference] CLS-DOS-NT-15-038 V1.1 2015,Oct.09  $V_{1,1}$  2015,Oct.09  $V_{1,1}$  2015,Oct.09  $V_{1,2}$  2015,Oct.09  $V_{$ 



Figure 97 - 20 Hz Sea surface height (left) and sea surface height anomaly (right) (SAR Ku seaice retracking)



Figure 98 - 20 Hz interpolated sea surface height anomaly (SAR Ku sea-ice retracking)

5.2.2.1.2.6. Other parameters of interest



Figure 99 - 20 Hz Peakiness 2 (SAR Ku sea-ice retracking)

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[Reference]

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# 5.2.2.2. Second validation track

## 5.2.2.2.1. Presentation of the area

The area is located here in the Spirit area:



Figure 100 - Second zone selection over ice



Figure 101 - Zoom over selection as zone is in margin This ascending track was recorded the 28<sup>th</sup> of November 2014 at 20h33 and lasts 24 seconds.

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In this area of margins, the waveforms are far more peaky and disturbed than over the continental ice:



Figure 103 - SAR Ku waveform example (ice 2<sup>nd</sup> validation track)

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Figure 104 - PLRM Ku waveforms (ice 2<sup>nd</sup> validation track)



Figure 105 - PLRM Ku waveform example (ice 2<sup>nd</sup> validation track)



## 5.2.2.2.2. Check of the output data

## 5.2.2.2.2.1. General parameters



Figure 106 - 20 Hz Surface classification (SAR Ku)

Regarding the surface classification parameter, the "4" value corresponds to "continental\_ice\_snow". This is compliant with the overflown area. The "0" values (open ocean) corresponds to the very beginning of the margin zone.

The Ocean Depth and Land Elevation parameter on the following figure confirms the presence of ocean at the beginning of the track (negative values, i.e. bathymetry) before flying over the continent.



Figure 107 - 1 Hz Ocean depth/land elevation

## 5.2.2.2.2.2. Ice-1 retracking parameters (SAR Ku)



Figure 108 - 20 Hz altimeter range (SAR Ku ice-1 retracking)



Figure 109 - 20 Hz backscatter coefficient (SAR Ku ice-1 retracking)

5.2.2.2.3. Ice-2 retracking parameters (PLRM Ku)

The low number of estimated measurements can be explained by the disrupted waveforms.



Figure 110 - 20 Hz altimeter range (PLRM Ku ice-2 retracking)
### S3-TDS Generation for L2 SRAL/MWR IPF

			-,		
[Reference]	CLS-DOS-NT-15-038		V1.1	2015,Oct.09	60
	136 corrected 'ico   136 mb= 118.370   138 mb= 118.370   139 mb= 118.370   139 mb= 118.370   139 mb= 118.370   139 mb= 118.370   130 mb= 118.370   131 mb= 118.370   132 mb= 118.370   132 mb= 118.370   132 mb= 118.370   128 mb= 118.370   129 mb= 118.370   120 mb= 118.370   121 mb= 118.370   122 mb= 118.370   123 mb= 118.370   124 mb= 118.370   125 mb= 118.370   126 mb= 118.370   127 mb= 118.370   128 mb= 118.370   129 mb= 118.370   120 <t< td=""><td>e' backscatter coefficient : 20 Hz Pirm K</td><td>u band</td><td></td><td></td></t<>	e' backscatter coefficient : 20 Hz Pirm K	u band		
	Time reference: 2014-11-28 20:33:07.0.	450973			

Figure 111 - 20 Hz backscatter coefficient (PLRM Ku ice-2 retracking)

### 5.2.2.2.2.4. Ice-sheet retracking parameters (SAR Ku)

The low number of estimated measurements can be explained by the disrupted waveforms.



Figure 112 - 20 Hz altimeter range (SAR Ku ice-sheet retracking)



Figure 113 - 20 Hz backscatter coefficient (SAR Ku ice-sheet retracking)

[Reference]	CLS-DC	S-NT-15-038		V1.1	2015,Oct.09	61
		corrected li	re-sheet' altimeter elevation	- 20 Hz Ku band		
	200	nb= 439				
	150	min= -45.471 max=1700.318 mean= 1182.700 std=654.798				
	Ê					
	2 2 100					
	beet.2					
	ation_ice_s					
	elev					
		0			015	
					CLS 20	
	-50	,	10 15	20	25	
		time_20_	ku (seconds since 2000-01-0	1 00:00:00.0)		

Figure 114 - 20 Hz altimeter elevation (SAR Ku ice-sheet retracking)

5.2.2.2.5. Sea-ice retracking parameters (SAR Ku)

time\_20\_ku (seco Time reference: 2014-11-28 20:33:07.0.450973



Figure 115 - 20 Hz altimeter range (SAR Ku sea-ice retracking)



Figure 116 - 20 Hz backscatter coefficient (SAR Ku sea-ice retracking)

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Figure 117 - 20 Hz Sea ice surface height (SAR Ku sea-ice retracking)

# 5.2.2.3. Third validation track

5.2.2.3.1. Presentation of the area

The area is located here in the DomeC area:



Figure 118 - Third zone selection over ice

This descending track was recorded the 7<sup>th</sup> of December 2014 at 09h47 and lasts 33 seconds.

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Figure 119 - SAR Ku waveforms (ice 3<sup>rd</sup> validation track)

Here is an example of waveforms in this zone:



Figure 120 - SAR Ku waveform example (ice 3<sup>rd</sup> validation track)

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Figure 121 - PLRM Ku waveforms (ice 3<sup>rd</sup> validation track)



Figure 122 - PLRM Ku waveform example (ice 3<sup>rd</sup> validation track)



### 5.2.2.3.2. Check of the output data

### 5.2.2.3.2.1. General parameters



Figure 123 - 20 Hz surface classification (SAR Ku)

For the surface classification, the "4" value corresponds to "continental\_ice\_snow". This is compliant with the overflown area.





5.2.2.3.2.2. Ice-1 retracking parameters (SAR Ku)



Figure 125 - 20 Hz altimeter range (SAR Ku ice-1 retracking)

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09	
				1



Figure 126 - 20 Hz backscatter coefficient (SAR Ku ice-1 retracking)

5.2.2.3.2.3. Ice-2 retracking parameters (PLRM Ku)



Figure 127 - 20 Hz altimeter range (PLRM Ku ice-2 retracking)



Figure 128 - 20 Hz backscatter coefficient (PLRM Ku ice-2 retracking)





### 5.2.2.3.2.4. Ice-sheet retracking parameters (SAR Ku)



Figure 129 - 20 Hz altimeter range (SAR Ku ice-sheet retracking)



Figure 130 - 20 Hz backscatter coefficient (SAR Ku ice-sheet retracking)



Figure 131 - 20 Hz altimeter elevation (SAR Ku ice-sheet retracking)





### 5.2.2.3.2.5. Sea-ice retracking parameters (SAR Ku)



Figure 132 - 20 Hz altimeter range (SAR Ku sea-ice retracking)



Figure 133 - 20 Hz backscatter coefficient (SAR Ku sea-ice retracking)



Figure 134 - 20 Hz sea ice surface height (SAR Ku sea-ice retracking)

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# 5.2.3. Inland water

## 5.2.3.1. First validation track

### 5.2.3.1.1. Presentation of the area

The area is located here:



Figure 135 - First zone selection over inland water



Figure 136 - Zoom over track

It was recorded the 14<sup>th</sup> of December 2014 at 08h19 and lasts 2 minutes and 13 seconds.

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This area has been selected because of the sea/land transition. This surface shift can be seen clearly on the waveforms and on the computed outputs.





On the representation of the waveforms on Figure 137, the scale of the bottom figure has been modified to use the maximum echo amplitude value over ocean. It enables to see the ocean waveforms correctly, since the echoes over inland water are far more powerful. This allows seeing quickly the sea/land transition. The following samples are even clearer:



Figure 138 - SAR Ku Waveform over ocean

This waveform was recorded over ocean.

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Figure 139 - SAR Ku Waveform over land

This waveform was recorded over land.

We observe a high variation of the echoes depending on the surface.





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Figure 141 - PLRM Ku Waveform over ocean



Figure 142 - PLRM Ku Waveform over land

### 5.2.3.1.2. Check of the output data

5.2.3.1.2.1. General parameters



Figure 143 - 20 Hz surface class (SAR Ku)

The ocean-land transition is visible through the surface classification, going from "0" value (ocean) to "1" value (land) with some "2" (continental\_water) or "3" (aquatic\_vegetation) points.

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Figure 144 - 1 Hz Ocean depth / Land elevation

5.2.3.1.2.2. Ocean retracking in SAR Ku



Figure 145 - 20 Hz backscatter coefficient (SAR Ku ocean retracking)



Figure 146 - 20 Hz altimeter range (SAR Ku ocean retracking)

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09	74
	25 corrected 'ocean' significant wa	veheight : 20 Hz Ku band		
	man=0.438 max=20.005 mean=1.436 20 - std=1.726			
	15			
	5			
	0 20 40 60 time_20_ku (seconds since 20 Time reference: 2014-12-14 08:19:50.0.026852	80 100 120 140 000-01-01 00:00:00.0)		

Figure 147 - 20 Hz Significant waveheight (SAR Ku ocean retracking)

The SWH values over the first part correspond to the estimations over ocean and have a range of values expected for this parameter (below 5 meters). Regarding the second part of the track, over inland, it is far more disordered, corresponding to the peaky waveforms acquired.

5.2.3.1.2.3. Ocean retracking in PLRM Ku



Figure 148 - 20 Hz backscatter coefficient (PLRM Ku ocean retracking)



Figure 149 - 20 Hz altimeter range (PLRM Ku ocean retracking)

[Reference] CLS-DOS-NT-15-038

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Figure 150 - 20 Hz Significant waveheight (PLRM Ku ocean retracking)





Figure 151 - 20 Hz altimeter range (SAR Ku ice-1 retracking)



Figure 152 - 20 Hz backscatter coefficient (SAR Ku ice-1 retracking)

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# 5.2.3.1.2.5. Ice-2 retracking parameters (PLRM Ku)







Figure 154 - 20 Hz backscatter coefficient (PLRM Ku ice-2 retracking)

## 5.2.3.2. Second validation track

5.2.3.2.1. Presentation of the area

The area is located here:



Figure 155 - Second zone selection over inland water

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[Reference]

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Figure 156 - Zoom over Amazon cross

It was recorded the  $8^{\rm th}$  of December 2014 at 20h50 and lasts 133 seconds. This record highlights the Amazon zone.



Figure 157 - SAR Ku waveforms (inland water 2<sup>nd</sup> validation track)

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On the previous bottom figure, for a graphical purpose, the scale was arranged in order to catch the dynamic and the high variations (the maximum of the bottom figure is equal to 0.01% of the maximum of the top figure). Echoes are more various in this zone and present very disordered shapes:



Figure 158 - SAR Ku waveform example (inland water 2nd validation track)



Figure 159 - SAR Ku waveform example (inland water 2<sup>nd</sup> validation track)

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Figure 160 - PLRM Ku waveforms (inland water 2<sup>nd</sup> validation track)

On the previous bottom figure, for a graphical purpose, as for SAR the scale was modified to 0.01% of the maximum echo amplitude.



Figure 161 - PLRM Ku waveform example (inland water 2<sup>nd</sup> validation track)



### 5.2.3.2.2. Check of the output data

### 5.2.3.2.2.1. General parameters



Figure 162 - 20 Hz surface class (SAR Ku)

For this flight over Amazon basin, the surface classification mainly provides "1" value (land) with some "2" (continental\_water) or "3" (aquatic\_vegetation) points, which is in line with the earth view shown on Figure 156.



Figure 163 - 1 Hz Ocean depth/Land elevation



### 5.2.3.2.2.2. Ocean retracking in SAR Ku



Figure 164 - 20 Hz backscatter coefficient (SAR Ku ocean retracking)



Figure 165 - 20 Hz altimeter range (SAR Ku ocean retracking)



Figure 166 - 20 Hz Significant waveheight (SAR Ku ocean retracking)



### 5.2.3.2.2.3. Ocean retracking in PLRM Ku



Figure 167 - 20 Hz backscatter coefficient (PLRM Ku ocean retracking)



Figure 168 - 20 Hz altimeter range (PLRM Ku ocean retracking)



Figure 169 - 20 Hz Significant waveheight (PLRM Ku ocean retracking)



### 5.2.3.2.2.4. Ice-1 retracking parameters (SAR Ku)



Figure 170 - 20 Hz altimeter range (SAR Ku ice-1 retracking)



Figure 171 - 20 Hz backscatter coefficient range (SAR Ku ice-1 retracking)

5.2.3.2.2.5. Ice-2 retracking parameters (PLRM Ku)



Figure 172 - 20 Hz altimeter range (PLRM Ku ice-2 retracking)

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Figure 173 - 20 Hz backscatter coefficient (PLRM Ku ice-2 retracking)

# 5.2.3.3. Third validation track

### 5.2.3.3.1. Presentation of the area

The area is located here:



Figure 174 - Third zone selection over inland water

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[Reference]

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Figure 175 - Zoom over Amazon cross

It was recorded the 25<sup>th</sup> of November 2014 at 09h32 and lasts 132 seconds. This record highlights the Amazon zone, close to the previously selected record. However, this ground track is descending.



Figure 176 - SAR Ku waveforms (inland water 3<sup>rd</sup> validation track)

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On the previous bottom figure, for a graphical purpose, the scale was modified to 0.01% of the maximum echo amplitude.



Figure 177 - SAR Ku waveform example (inland water 3<sup>rd</sup> validation track)





On the previous bottom figure, for a graphical purpose, the scale was modified to 0.01% of the maximum echo amplitude.

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Figure 179 - PLRM Ku waveform example (inland water 3<sup>rd</sup> validation track)

### 5.2.3.3.2. Check of the output data

5.2.3.3.2.1. General parameters







Figure 181 - 1 Hz Ocean depth / Land elevation



### 5.2.3.3.2.2. Ocean retracking in SAR Ku



Figure 182 - 20 Hz backscatter coefficient (SAR Ku ocean retracking)



Figure 183 - 20 Hz altimeter range (SAR Ku ocean retracking)



Figure 184 - 20 Hz Significant waveheight (SAR Ku ocean retracking)



### 5.2.3.3.2.3. Ocean retracking in PLRM Ku



Figure 185 - 20 Hz backscatter coefficient (PLRM Ku ocean retracking)



Figure 186 - 20 Hz altimeter range (PLRM Ku ocean retracking)



Figure 187 - 20 Hz Significant waveheight (PLRM Ku ocean retracking)



# 5.2.3.3.2.4. Ice-1 retracking parameters (SAR Ku)



Figure 188 - 20 Hz altimeter range (SAR Ku ice-1 retracking)



Figure 189 - 20 Hz backscatter coefficient range (SAR Ku ice-1 retracking)

5.2.3.3.2.5. Ice-2 retracking parameters (PLRM Ku)



Figure 190 - 20 Hz altimeter range (PLRM Ku ice-2 retracking)

[Reference]
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Figure 191 - 20 Hz backscatter coefficient (PLRM Ku ice-2 retracking)

# 5.2.4. NRT/STC

Level 2 products are also created for near real time (NRT) and slow time critical (STC).

In this section, we give a representation of a few parameters modified by the use of different dynamic data from the data used for NTC configuration. The files modified between the different processing stages are listed in 4.4. For these NRT and STC runs, we selected the third track over ocean that was recorded the 28<sup>th</sup> of January 2013 at 00h36 and lasts 3 minutes and 43 seconds (presented in section 5.2.1.3).

In section we present the differences to the NTC mode, rather than the parameters themselves.

## 5.2.4.1. NRT

In the case of NRT, the dynamic auxiliary files that are different from NTC are: orbit data (DORIS navigator L0 instead of precise), iono GIM (predicted instead of restituted) and meteo (forecast instead of analysis).



### 5.2.4.1.1. Orbit-related parameters

Figure 192 - 20 Hz Latitude (left) and Longitude (right) differences (NRT/NTC)

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The order of magnitude for the differences in the coordinates is the micro-degree, which corresponds to the field resolution and is then acceptable.



Figure 193 - 20 Hz Altitude and Orbital Altitude Rate differences (NRT/NTC)

The difference of altitude is around the centimetre which is expected given the difference of precision between both orbit data information. The orbital altitude rate difference is equal to 0 almost for all the measurements.

5.2.4.1.2. Iono GIM -related parameters



Figure 194 - 1 Hz Ionospheric correction differences (NRT/NTC)

The differences observed on the Iono GIM correction are millimetric.





Figure 195 - U (left) and V (right) components of the model wind vector differences (NRT/NTC)



Figure 196 - 1 Hz model dry (left) and wet (right) tropospheric correction zero altitude differences (NRT/NTC)

## 5.2.4.2. STC

In the case of NRT, the dynamic auxiliary files that are different from NTC are: orbit data (preliminary instead of precise), iono GIM (predicted instead of restituted) and MOG2D (preliminary instead of restituted). The iono GIM parameter was already shown for the NRT configuration.

#### S3-TDS Generation for L2 SRAL/MWR IPF

[Reference] CLS-DOS-NT-15-038 V1.1 2015,Oct.09



## 5.2.4.2.1. Orbit-related parameters





The order of magnitude for the differences in the coordinates is the micro-degree, which corresponds to the field resolution and is then acceptable.



Figure 198 - 20 Hz Altitude (left) and Orbital Altitude Rate (right) differences (STC/NTC) The differences observed for the altitude and orbital altitude rate are acceptable (beyond 5 mm).

### 5.2.4.2.2. MOG2D-related parameter



Figure 199 - 1 Hz HF fluctuations of the sea surface topography differences (STC/NTC) The differences observed for the dynamic atmospheric correction are acceptable (beyond 6 mm).

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09	

# 5.2.5. MWR

This test case is running using a couple LRM SRAL/MWR files in input. Thus, unlike the previous CS-2 TDS, the C-band data contains scientifically meaningful data. The TDS is being run in NTC mode. The track was recorded on the 15<sup>th</sup> of April 2013 and lasts 1 minute and 44 seconds.

## 5.2.5.1. Waveforms



Figure 200 - LRM Ku waveforms (SRAL/MWR SPS data)


Figure 201 - LRM Ku examples of waveforms (SRAL/MWR SPS data)

Sample

Samples



Figure 202 - LRM Ku examples of waveforms (SRAL/MWR SPS data)

It has to be noted that the choice of the scenario used here for the SRAL data has not a perfect scientific reality, which can be visible through the waveforms shown above. Indeed the transitions between areas of low and high SWH are not nominal (Figure 203).



The choice of the SRAL scene generation parameters (wind and waves) is not optimum regarding the coupling operation, and thus the imperfect signal behavior and associated estimations observed on Figure 200, Figure 201, Figure 202 and Figure 203 is not a matter of the functioning of the instrument simulator and ground processing prototype, but of configuration. Not that this scene parameterization can be re-examined to provide later on a new set of fully coherent SRAL data.

## 5.2.5.2. Ocean retracking parameters



Figure 203 - 20 Hz Significant waveheight (Ku band)







Figure 205 - 20 Hz backscatter coefficient (Ku Band)



# 5.2.5.3. Radiometer tropospheric corrections



Figure 206 - 1 Hz Radiometer wet tropospheric correction



Figure 207 - 1 Hz Radiometer wet tropospheric correction using SST and Gamma

# 5.2.5.4. Comparison to the input Radiometer scene

We check on the following figure the good match between the MWR scene with a given wet tropospheric correction and the MWR wet tropospheric correction inferred from the neural network performed in the L2 processing chain from the SRAL Sigma0.



Figure 208 - 20 Hz wet tropospheric correction from L2 (blue) and 20 Hz Hz wet tropospheric correction from L1B MWR (red) superposition

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09



# 6. Architecture of the delivery

The delivery repository contains the following folders:

Folder name	Role	Sections of the document referring to these TDS
Common	common sad/dad/configuration files	4.2
Hydro	CS-2 Inland water related TDS	2.1.3 / 3.1 / 4.1.3.3
Ice	CS-2 Ice related TDS	2.1.2 / 3.1 / 4.1.3.2
Ocean	CS-2 Ocean related TDS	2.1.1 / 3.1 / 4.1.3.1
NRT	CS-2 Near real time related TDS	3.1 / 4.4
STC	CS-2 Slow time critical related TDS	3.1 / 4.4
SRAL_MWR	SPS/GPP TDS with altimeter/radiometer coupling	2.2 /3.2 / 4.5
MWR	SPS/GPP MWR L1b TDS	2.2 / 3.2 / 4.5

Each TDS has the same organization:

Folder name	Role
Input	Input L1B folders
Common	Dynamic auxiliary data organized by role (pole, characterization)
Order	Job order associated to each input file
Output	Outputs of each IPF run
log	Log files of each runs

Note that the nomenclature of all the products delivered is conform to RD 9.

For example, ocean case contains the following directories:

ocean

+--- output

Ι	+ S3A_SR_2_WAT	20130103T015608_2	20130103T020017_2	20150917T084549_0	0248_124_217	_MAR_O_NT	SEN3
	+ S3A_SR_2_WAT	20130127T122928_2	20130127T123339_2	20150916T190116_(	0250_125_180	_MAR_O_NT	SEN3
Ι	+ S3A_SR_2_WAT	20130108T134222_2	20130108T134635_2	20150916T164635_0	0252_124_295	_MAR_O_NT	SEN3
	+ S3A_SR_2_WAT	20130127T012640_2	20130127T012930_2	20150916T185726_0	0169_125_174	_MAR_O_NT	SEN3
	+ S3A_SR_2_WAT	20130118T133006_2	20130118T133421_2	20150916T182159_0	0254_125_052	_MAR_O_NT	SEN3
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	+ S3A_SR_2_WAT	20130123T123729_2	20130123T123831_2	20150916T184046_0	0061_125_123	_MAR_O_NT	SEN3
I	+ S3A_SR_2_WAT	20130109T014844_2	20130109T015256_2	20150916T165109_(	0251_124_302	_MAR_O_NT	.SEN3
	+ S3A_SR_2_WAT	20130107T015112_2	20130107T015523_2	20150916T162537_0	0250_124_274	_MAR_O_NT	SEN3
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	+ S3A_SR_2_WAT	20130113T014349_2	20130113T014802_2	20150916T175631_(	0252_124_359	_MAR_O_NT	.SEN3
	+ S3A_SR_2_WAT	20130106T134449_2	20130106T134901_2	20150916T162109_(	0251_124_267	_MAR_O_NT	.SEN3
	+ S3A_SR_2_WAT	20130125T123300_2	20130125T123605_2	20150916T184942_0	0184_125_152	_MAR_O_NT	SEN3

[Reference]
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I		+ S3SR_2_PMO_AX_20130108T120000_20130108T120000_20150403T133700	NT	SEN3
I		+ S3_SR_2_PMO_AX_20130108T000000_20130108T000000_20150403T133700	NT	SEN3
I	I	+ S3_SR_2_PMO_AX_20130127T180000_20130127T180000_20150403T133700	NT	SEN3
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I	I	+ S3_SR_2_PMO_AX_20130118T180000_20130118T180000_20150403T133700	NT	SEN3
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I		+ S3_SR_2_PMO_AX_20130128T060000_20130128T060000_20150403T133700	NT	SEN3
Т	+-	orbit		
	I	+ S3A_SRPOESAX_20130110T215525_20130112T002325_20150403T133700	NT	SEN3
I	I	+ S3A_SRPOESAX_20130114T215525_20130116T002325_20150403T133700	NT	SEN3
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I		+ \$3A_\$RPOE\$AX_20130126T215525_20130128T002325_20150403T133700	NT	SEN3
	I	+ \$3A_\$RPOE\$AX_20130102T215525_20130104T002325_20150403T133700	NT	SEN3
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I	I	+ S3A_SRPOESAX_20130124T215525_20130126T002325_20150403T133700	NT	SEN3

[Reference]	CLS-DOS-NT-15-038	V1.1
	X_20130103T215525_20130105T002325_20150403T133700	

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Ì	Ī	+ S3A_SRPOESAX_20130107T215525_20130109T002325_20150403T133700	NT	SEN3
Ì	Ī	+ S3A_SRPOESAX_20130125T215525_20130127T002325_20150403T133700	NT	SEN3
Ì	Ī	+ S3A_SRPOESAX_20130119T215525_20130121T002325_20150403T133700	NT	SEN3
Ì	· I	+ S3A SR POESAX 20130123T215525 20130125T002325 20150403T133700	NT	.SEN3
Ì	· I	+ S3A_SRPOESAX_20130104T215525_20130106T002325_20150403T133700	NT	SEN3
Ì	· I	+ S3A SR POESAX 20130122T215525 20130124T002325 20150403T133700	NT	.SEN3
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ï	i	+ SAA_SR	NT	.SEN3
ï	Ì	+ S3A_SR	NT	SEN3
Ì	1	+ \$34 SR POESAX 20130120T215525 20130122T002325 20150403T133700	NT	SEN3
1	1	+ \$34 \$8 POF\$4X 201301127215525 20130114T002325 20150403T133700	NT	SEN3
	1	+ \$34 \$P POE\$4X 201301057215525 201301077002325 201504037133700	NT	SEN3
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1		+ 33A_3KF0L3KA_201301213323_201302011002323_201304031133700	NT	3LN3
			NT	SEN12
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		+ S3A_SR_2_RGI_AX_20130103T000000_20130103T235959_20150403T133700	NT	SEN3
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		+ S3A_SR_2_RGI_AX_20130115T000000_20130115T235959_20150403T133700	NT	SEN3

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Ι	Ι	+	3d			
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Ì	Ī	Ì	+ S3AX_	MA2_AX_20130122T120000_20130122T120000_20150403T133700	SN	SEN3
Ì	Ì	Ì	+ S3 AX	MA2 AX 20130107T180000 20130107T180000 20150403T133700	SN	.SEN3
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	i		+ \$3 AX	MA2_AX_20130128T180000_20130128T180000_20150403T133700	SN	SEN3
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1	1	1	+ \$3 AY	MA2_AX_20130131T060000_20130121T060000_20150403T133700	SN	SEN3
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1	1	1	+ 35AA		3N	JEINJ
		1	+ 53_AX_	MA2_AX_201301061000000_201301061000000_201504031133700		SEN3
	1		+ S3AX_	MA2_AX_201301121180000_201301121180000_201504031133700	SN	SEN3
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			+ \$3AX_	MA2_AX_201301051180000_201301051180000_201504031133700	SN	SEN3
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I	I	I	+ S3AX_	MA2_AX_20130121T000000_20130121T000000_20150403T133700	SN	SEN3
I	I	I	+ S3AX_	MA2_AX_20130131T120000_20130131T120000_20150403T133700	SN	SEN3
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Ι	T	I	+ S3AX_	MA2_AX_20130114T000000_20130114T000000_20150403T133700	SN	.SEN3
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· I	, T	, T	+ S3_ AX		SN	.SEN3
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1	1	- I - J	+ \$3 AY	MA2_AX_20130105T060000_20130105T060000_20150403T133700	<u>5N</u>	SEN3
1	1	1	, <u>55_MA</u>	MA2_AX_20130103T180000_20130103T100000_20130403T133700		SENI3
		1	· 33MA_			JLINJ

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I	I	I	+ S3 AX	MA2 AX 20130119T060000 20130119T060000 20150403T133700	SN	.SEN3
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1	1	ı I	+ \$3 ΔX	MA2_AX_20130122T180000_20130122T180000_20150403T133700		SEN3
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1	1	1	+ 33 <u></u>	MA2_AX_201301071000000_201301071000000_201304031133700		SEN12
1	1	1	+ 33 <u>AA</u>		SN SN	SEN12
1	1	1	+ 33 <u></u>	MA2_AX_201301071120000_201301071120000_201304031133700		SEN12
1	1	1	+ 33 <u>AA</u>		SN SN	SEN12
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1	1	1	+ 33AA		SN	JEINJ
1	1	1	+ 33AA		SN	JEINJ
	1	1	+ 53AX	AA_201301081180000_201301081180000_201304031133700	SN	SEN3
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I	I	I	+ S3AX	_MA1_AX_20130103T000000_20130103T000000_20150403T133700	SN	SEN3
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I	Ι	I	+ S3AX	_MA1_AX_20130123T060000_20130123T060000_20150403T133700	SN	SEN3
	I	I	+ S3AX	_MA1_AX_20130125T180000_20130125T180000_20150403T133700	SN	SEN3
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	I		+ S3AX	_MA1_AX_20130119T060000_20130119T060000_20150403T133700	SN	SEN3
I		I	+ S3AX	_MA1_AX_20130109T060000_20130109T060000_20150403T133700	SN	SEN3
	I		+ S3AX	_MA1_AX_20130112T000000_20130112T000000_20150403T133700	SN	SEN3
I	Ι		+ S3AX	_MA1_AX_20130105T060000_20130105T060000_20150403T133700	SN	SEN3
I	Ι		+ S3AX	_MA1_AX_20130110T120000_20130110T120000_20150403T133700	SN	SEN3
I	I		+ S3AX	_MA1_AX_20130116T120000_20130116T120000_20150403T133700	SN	SEN3
I			+ S3AX	_MA1_AX_20130106T000000_20130106T000000_20150403T133700	SN	SEN3
Ι	Ι		+ S3AX	_MA1_AX_20130116T000000_20130116T0000000_20150403T133700	SN	SEN3
I	I		+ S3AX	_MA1_AX_20130105T180000_20130105T180000_20150403T133700	SN	SEN3
I	I		+ S3AX	_MA1_AX_20130119T000000_20130119T000000_20150403T133700	SN	SEN3
Ι	I	Ι	+ S3AX	_MA1_AX_20130112T180000_20130112T180000_20150403T133700	SN	SEN3
Ì	1	Ì	+ S3AX	_MA1_AX_20130107T060000_20130107T060000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130131T180000_20130131T180000_20150403T133700	SN	SEN3
Ì	Ì	Ì	+ S3AX_	_MA1_AX_20130127T120000_20130127T120000_20150403T133700	SN	SEN3
Ì	Ì	·	+ S3AX_	_MA1_AX_20130127T180000_20130127T180000_20150403T133700	SN	SEN3
·	·	·	+ S3 AX	MA1 AX 20130118T120000 20130118T120000 20150403T133700	SN	.SEN3
i	i	· I	+ S3 AX	MA1 AX 20130107T000000 20130107T000000 20150403T133700	SN	.SEN3
ï	Ì	, T	+ S3 AX	MA1 AX 20130110T000000 20130110T000000 20150403T133700	SN	.SEN3
i	i	· I	+ S3 AX	MA1 AX 20130103T120000 20130103T120000 20150403T133700	SN	.SEN3
·	·	·	+ S3 AX	MA1 AX 20130108T180000 20130108T180000 20150403T133700	SN	.SEN3
i I	Ì	, T	+ \$3 AX	MA1_AX_20130131T060000_20130131T060000_20150403T133700	SN	SEN3
Ì	Ì	' T	+ \$3 AX		SN	.SEN3
Ì	' 	' I	+ \$3 AX		SN	.SEN3
1	1	' I	+ \$3 AX	MA1_AX_20130104T120000_20130104T120000_20150403T133700	SN	SEN3
1		i I	+ \$3 AX	MA1_AX_20130114T060000_20130114T060000_20150403T133700	SN	SEN3
		i I	+ \$3 ΔX	MA1_AX_20130126T180000_20130126T180000_20150403T133700	SN SN	SEN3
1	1	ı I	+ \$3 AX	MA1_AX_20130108T1200000_20130108T1200000_20150403T133700	SN	SEN3
		i I	+ \$3 ΔX	MA1_AX_20130130T060000_20130130T060000_20150403T133700	SN SN	SEN3
1	1	ı I	+ \$3 AX	MA1_AX_20130129T180000_20130129T180000_20150403T133700	SN	SEN3
i I		i I	+ \$3 ΔX	MA1_AX_20130103T180000_20130103T180000_20150403T133700	SN SN	SEN3
1	1	1 1	+ \$3 AX	MA1_AX_20130127T000000_20130127T000000_20150403T133700	SN	SEN3
1	1	1	+ \$3AX	MA1_AX_201301271000000_201301271000000_201304031133700	SN	SEN3
1	1	1 1	+ \$3 AX	MA1_AX_20130124T120000_20130124T120000_201504031133700	SN	SEN3
1	1	1	+ \$3AX	MA1_AX_201301241120000_201301241120000_201304031133700	SN	SEN3
1	1	1 1	+ \$3 AX	MA1_AX_20130125T120000_20130125T120000_20150403T133700	SN	SEN3
1 1	1	ı I	+ S3 Δ¥	MA1_AX_20130102T120000_20130102T120000_20150403T133700	SN	SEN3
1	1	I I	+ \$2 AV	Mál áz 201301067120000 201301067120000 201504037132700		SENIS
1	1	1				SENI3
1	1	I I	+ 53AA			SENIS
1	1	1				SENI3
1	1	1	+ 53AA			SENIS
1	1	1	, 33AA			SENIS
1	1	1				SENIO
1	1	1	33HA			JLNJ

[Reference]	CLS-DOS-NT-15-038	V1.1	2015,Oct.09
+ \$3 ΔX	M&1 &X 20130107T180000 20130107T180000 20150403T133700		SN SEN3

I	I	Ι	+ S3AX	_MA1_AX_20130107T180000_20130107T180000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130111T000000_20130111T000000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130122T120000_20130122T120000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130121T000000_20130121T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130107T120000_20130107T120000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130109T120000_20130109T120000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130125T000000_20130125T000000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130114T120000_20130114T120000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130109T000000_20130109T000000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130124T180000_20130124T180000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130110T060000_20130110T060000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130125T060000_20130125T060000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130106T060000_20130106T060000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130121T060000_20130121T060000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130116T060000_20130116T060000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130113T060000_20130113T060000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130122T180000_20130122T180000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130120T120000_20130120T120000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130115T000000_20130115T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130131T000000_20130131T000000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130129T060000_20130129T060000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130128T120000_20130128T120000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130104T180000_20130104T180000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130104T000000_20130104T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130110T180000_20130110T180000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130114T000000_20130114T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130127T060000_20130127T060000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130130T120000_20130130T120000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130113T000000_20130113T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130128T000000_20130128T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	MA1_AX_20130106T180000_20130106T180000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130129T120000_20130129T120000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130131T120000_20130131T120000_20150403T133700	SN	.SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130105T000000_20130105T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130123T000000_20130123T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130111T060000_20130111T060000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130112T060000_20130112T060000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130117T000000_20130117T000000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130115T060000_20130115T060000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130105T120000_20130105T120000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130112T120000_20130112T120000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130116T180000_20130116T180000_20150403T133700	SN	SEN3
I	I	Ι	+ S3AX	_MA1_AX_20130114T180000_20130114T180000_20150403T133700	SN	SEN3
I	+	1	time			
I	I	+-	S3A_AXO	SF_AX_20000101T000000_20991231T235959_20130601T000000	ALS	EN3
+		inpu	ut			
I	+	\$	3A_SR_1_SRA_	20130130T131746_20130130T131939_20150403T133700	SEN3	5
	+	\$	S3A_SR_1_SRA_	20130103T144043_20130103T144217_20150403T133700	SEN3	1
	+	\$	S3A_SR_1_SRA_	20130114T023217_20130114T023245_20150403T133700	SEN3	1
	+	S	S3A_SR_1_SRA_	20130116T133233_20130116T133648_20150403T133700	SEN3	8
	+	\$	S3A_SR_1_SRA_	20130122T132537_20130122T132927_20150403T133700	SEN3	1
Т	+	S	3A_SR_1_SRA_	20130104T024427_20130104T024625_20150403T133700		5



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ī	+ \$3A_\$R_1_\$RA	20130105T143840 20130105T143949 20150403T133700	SEN3
T	+ S3A SR 1 SRA	20130107T143637 20130107T143721 20150403T133700	SEN3
i I	+ S3A_SR_1_SRA	20130126T004047_20130126T004231_20150403T133700	.SEN3
i I	+ S3A SR 1 SRA	20130127T012640 20130127T012930 20150403T133700	.SEN3
i I	+ S3A SR 1 SRA		.SEN3
i I	+ S3A SR 1 SRA	20130110T023708 20130110T023811 20150403T133700	.SEN3
Ì	+ S3A SR 1 SRA		.SEN3
i	+ S3A SR 1 SRA	20130126T132143 20130126T132433 20150403T133700	.SEN3
i	+ S3A_SR_1_SRA		
Ì	+ S3A_SR_1_SRA	20130114T133501_20130114T133915_20150403T133700	
Ì	+ S3A_SR_1_SRA	20130102T134943_20130102T135354_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130125T012906_20130125T013217_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130125T123300_20130125T123605_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130105T015340_20130105T015749_20150403T133700	
I	+ S3A_SR_1_SRA	20130103T015608_20130103T020017_20150403T133700	
I	+ S3A_SR_1_SRA	20130107T015112_20130107T015523_20150403T133700	SEN3
Ì	+ S3A_SR_1_SRA	20130128T131946_20130128T132206_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130123T123729_20130123T123831_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130109T014844_20130109T015256_20150403T133700	
I	+ S3A_SR_1_SRA	20130104T134716_20130104T135128_20150403T133700	
I	+ S3A_SR_1_SRA	20130112T133728_20130112T134141_20150403T133700	.SEN3
I	+ S3A_SR_1_SRA	20130113T014349_20130113T014802_20150403T133700	.SEN3
I	+ S3A_SR_1_SRA	20130131T122437_20130131T122849_20150403T133700	.SEN3
I	+ S3A_SR_1_SRA	20130109T143432_20130109T143453_20150403T133700	.SEN3
I	+ S3A_SR_1_SRA	20130106T134449_20130106T134901_20150403T133700	.SEN3
I	+ S3A_SR_1_SRA	20130108T134222_20130108T134635_20150403T133700	
I	+ S3A_SR_1_SRA	20130112T023442_20130112T023527_20150403T133700	.SEN3
I	+ S3A_SR_1_SRA	20130129T012414_20130129T012644_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130108T023935_20130108T024056_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130123T013133_20130123T013504_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130124T132341_20130124T132700_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130111T014617_20130111T015029_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130127T122928_20130127T123339_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130120T132738_20130120T133154_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130129T122703_20130129T123115_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130121T013400_20130121T013752_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130106T024201_20130106T024340_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130118T133006_20130118T133421_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130110T133955_20130110T134408_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130115T014122_20130115T014535_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130131T012147_20130131T012358_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130119T013627_20130119T014040_20150403T133700	SEN3
I	+ S3A_SR_1_SRA	20130117T013854_20130117T014309_20150403T133700	SEN3
+-	order		

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# Appendix A - List of acronyms

ТВС	To be confirmed
TBD	To be defined
AD	Applicable Document
RD	Reference Document
GPP	Ground Processing Prototype
IPF	Instrument Processing Facility
NRT	Near-Real Time
NTC	Non-Time Critical
PTR	Point Target Response
SPS	System Performance Simulator
SSB	Sea State Bias
STC	Short-Time Critical
TDS	Test Data Set

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# Appendix B - Geographical selection of the data

In this section, we provide the complete list of the input L0 CS-2 data used for the generation of the TDS along with their duration. Only the SAR files are provided.

1. Ocean (Agulhas stream)

CS2_L0 SAR input	Duration (hh :mm :ss)	File counter
CS_OPER_SIR1SAR_020130102T134943_20130102T135354_0001.DBL	00:04:11	1
CS_OPER_SIR1SAR_020130103T015608_20130103T020017_0001.DBL	00:04:09	2
CS_OPER_SIR1SAR_020130103T144043_20130103T144217_0001.DBL	00:01:34	3
CS_OPER_SIR1SAR_020130104T024427_20130104T024625_0001.DBL	00:01:58	4
CS_OPER_SIR1SAR_020130104T134716_20130104T135128_0001.DBL	00:04:12	5
CS_OPER_SIR1SAR_020130105T015340_20130105T015749_0001.DBL	00:04:09	6
CS_OPER_SIR1SAR_020130105T143840_20130105T143949_0001.DBL	00:01:09	7
CS_OPER_SIR1SAR_020130106T024201_20130106T024340_0001.DBL	00:01:39	8
CS_OPER_SIR1SAR_020130106T134449_20130106T134901_0001.DBL	00:04:12	9
CS_OPER_SIR1SAR_020130107T015112_20130107T015523_0001.DBL	00:04:11	10
CS_OPER_SIR1SAR_020130107T143637_20130107T143721_0001.DBL	00:00:44	11
CS_OPER_SIR1SAR_020130108T023935_20130108T024056_0001.DBL	00:01:21	12
CS_OPER_SIR1SAR_020130108T134222_20130108T134635_0001.DBL	00:04:13	13
CS_OPER_SIR1SAR_020130109T014844_20130109T015256_0001.DBL	00:04:12	14
CS_OPER_SIR1SAR_020130109T143432_20130109T143453_0001.DBL	00:00:21	15
CS_OPER_SIR1SAR_020130110T023708_20130110T023811_0001.DBL	00:01:03	16
CS_OPER_SIR1SAR_020130110T133955_20130110T134408_0001.DBL	00:04:13	17
CS_OPER_SIR1SAR_020130111T014617_20130111T015029_0001.DBL	00:04:12	18
CS_OPER_SIR1SAR_020130112T023442_20130112T023527_0001.DBL	00:00:45	19
CS_OPER_SIR1SAR_020130112T133728_20130112T134141_0001.DBL	00:04:13	20
CS_OPER_SIR1SAR_020130113T014349_20130113T014802_0001.DBL	00:04:13	21
CS_OPER_SIR1SAR_020130114T023217_20130114T023245_0001.DBL	00:00:28	22
CS_OPER_SIR1SAR_020130114T133501_20130114T133915_0001.DBL	00:04:14	23
CS_OPER_SIR1SAR_020130115T014122_20130115T014535_0001.DBL	00:04:13	24
CS_OPER_SIR1SAR_020130116T022951_20130116T023002_0001.DBL	00:00:11	25
CS_OPER_SIR1SAR_020130116T133233_20130116T133648_0001.DBL	00:04:15	26
CS_OPER_SIR1SAR_020130117T013854_20130117T014309_0001.DBL	00:04:15	27
CS_OPER_SIR1SAR_020130118T133006_20130118T133421_0001.DBL	00:04:15	28
CS_OPER_SIR1SAR_020130119T013627_20130119T014040_0001.DBL	00:04:13	29
CS_OPER_SIR1SAR_020130120T132738_20130120T133154_0001.DBL	00:04:16	30
CS_OPER_SIR1SAR_020130121T013400_20130121T013752_0001.DBL	00:03:52	31

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CS_OPER_SIR1SAR_020130122T132537_20130122T132927_0001.DBL	00:03:50	32
CS_OPER_SIR1SAR_020130123T013133_20130123T013504_0001.DBL	00:03:31	33
CS_OPER_SIR1SAR_020130123T123729_20130123T123831_0001.DBL	00:01:02	34
CS_OPER_SIR1SAR_020130124T132341_20130124T132700_0001.DBL	00:03:19	35
CS_OPER_SIR1SAR_020130125T012906_20130125T013217_0001.DBL	00:03:11	36
CS_OPER_SIR1SAR_020130125T123300_20130125T123605_0001.DBL	00:03:05	37
CS_OPER_SIR1SAR_020130126T004047_20130126T004231_0001.DBL	00:01:44	38
CS_OPER_SIR1SAR_020130126T132143_20130126T132433_0001.DBL	00:02:50	39
CS_OPER_SIR1SAR_020130127T012640_20130127T012930_0001.DBL	00:02:50	40
CS_OPER_SIR1SAR_020130127T122928_20130127T123339_0001.DBL	00:04:11	41
CS_OPER_SIR1SAR_020130128T003621_20130128T004004_0001.DBL	00:03:43	42
CS_OPER_SIR1SAR_020130128T131946_20130128T132206_0001.DBL	00:02:20	43
CS_OPER_SIR1SAR_020130129T012414_20130129T012644_0001.DBL	00:02:30	44
CS_OPER_SIR1SAR_020130129T122703_20130129T123115_0001.DBL	00:04:12	45
CS_OPER_SIR1SAR_020130130T003329_20130130T003736_0001.DBL	00:04:07	46
CS_OPER_SIR1SAR_020130130T131746_20130130T131939_0001.DBL	00:01:53	47
CS_OPER_SIR1SAR_020130131T012147_20130131T012358_0001.DBL	00:02:11	48
CS_OPER_SIR1SAR_020130131T122437_20130131T122849_0001.DBL	00:04:12	49

2. Ice Sheet

[Reference]

a. Dome C

CS2 L0 SAD input	Duration	File
C32_L0 SAK IIIput	(hh :mm :ss)	counter
CS_OPER_SIR1SAR_020141201T095513_20141201T095524_0001.DBL	00:00:11	1
CS_OPER_SIR1SAR_020141203T095223_20141203T095257_0001.DBL	00:00:34	2
CS_OPER_SIR1SAR_020141207T094729_20141207T094803_0001.DBL	00:00:34	3

b. Spirit

CS2_L0 SAR input	Duration (hh :mm :ss)	File counter
CS_OPER_SIR1SAR_020141118T092303_20141118T092355_0001.DBL	00:00:52	1
CS_OPER_SIR1SAR_020141118T092416_20141118T092509_0001.DBL	00:00:53	2
CS_OPER_SIR1SAR_020141118T204405_20141118T204457_0001.DBL	00:00:52	3
CS_OPER_SIR1SAR_020141118T204516_20141118T204603_0001.DBL	00:00:47	4
CS_OPER_SIR1SAR_020141120T092039_20141120T092128_0001.DBL	00:00:49	5
CS_OPER_SIR1SAR_020141120T092152_20141120T092243_0001.DBL	00:00:51	6
CS_OPER_SIR1SAR_020141120T204138_20141120T204228_0001.DBL	00:00:50	7
CS_OPER_SIR1SAR_020141120T204249_20141120T204332_0001.DBL	00:00:43	8

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CS_OPER_SIR1SAR_020141122T091816_20141122T091902_0001.DBL	00:00:46	9
CS_OPER_SIR1SAR_020141122T091927_20141122T092017_0001.DBL	00:00:50	10
CS_OPER_SIR1SAR_020141122T203910_20141122T203959_0001.DBL	00:00:49	11
CS_OPER_SIR1SAR_020141122T204022_20141122T204102_0001.DBL	00:00:40	12
CS_OPER_SIR1SAR_020141124T091553_20141124T091635_0001.DBL	00:00:42	13
CS_OPER_SIR1SAR_020141124T091702_20141124T091745_0001.DBL	00:00:43	14
CS_OPER_SIR1SAR_020141124T203642_20141124T203730_0001.DBL	00:00:48	15
CS_OPER_SIR1SAR_020141124T203755_20141124T203832_0001.DBL	00:00:37	16
CS_OPER_SIR1SAR_020141126T091330_20141126T091408_0001.DBL	00:00:38	17
CS_OPER_SIR1SAR_020141126T091438_20141126T091514_0001.DBL	00:00:36	18
CS_OPER_SIR1SAR_020141126T203414_20141126T203501_0001.DBL	00:00:47	19
CS_OPER_SIR1SAR_020141126T203528_20141126T203601_0001.DBL	00:00:33	20
CS_OPER_SIR1SAR_020141128T091108_20141128T091134_0001.DBL	00:00:26	21
CS_OPER_SIR1SAR_020141128T091213_20141128T091243_0001.DBL	00:00:30	22
CS_OPER_SIR1SAR_020141128T203147_20141128T203232_0001.DBL	00:00:45	23
CS_OPER_SIR1SAR_020141128T203307_20141128T203331_0001.DBL	00:00:24	24
CS_OPER_SIR1SAR_020141130T090845_20141130T090858_0001.DBL	00:00:13	25
CS_OPER_SIR1SAR_020141130T090945_20141130T091012_0001.DBL	00:00:27	26
CS_OPER_SIR1SAR_020141130T202925_20141130T203003_0001.DBL	00:00:38	27
CS_OPER_SIR1SAR_020141130T203055_20141130T203100_0001.DBL	00:00:05	28

c. Vostock

CS2_L0 SAR input	Duration (hh :mm :ss)	File counter
CS_OPER_SIR1SAR_020141124T221939_20141124T222046_0001.DBL	00:01:07	1
CS_OPER_SIR1SAR_020141125T114034_20141125T114141_0001.DBL	00:01:07	2
CS_OPER_SIR1SAR_020141126T221712_20141126T221819_0001.DBL	00:01:07	3
CS_OPER_SIR1SAR_020141127T113807_20141127T113914_0001.DBL	00:01:07	4
CS_OPER_SIR1SAR_020141128T221445_20141128T221553_0001.DBL	00:01:08	5
CS_OPER_SIR1SAR_020141129T113540_20141129T113647_0001.DBL	00:01:07	6
CS_OPER_SIR1SAR_020141130T221219_20141130T221326_0001.DBL	00:01:07	7

## 3. Inland water (Amazon basin)

CS2_L0 SAR input	Duration (hh :mm :ss)	File counter
CS_OPER_SIR1SAR_020141117T094228_20141117T094442_0001.DBL	00:02:14	1
CS_OPER_SIR1SAR_020141117T220608_20141117T220821_0001.DBL	00:02:13	2
CS_OPER_SIR1SAR_020141118T103052_20141118T103214_0001.DBL	00:01:22	3
CS_OPER_SIR1SAR_020141118T211518_20141118T211640_0001.DBL	00:01:22	4
CS_OPER_SIR1SAR_020141119T094002_20141119T094215_0001.DBL	00:02:13	5

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CS_OPER_SIR1SAR_020141119T220341_20141119T220554_0001.DBL	00:02:13	6
CS_OPER_SIR1SAR_020141120T211251_20141120T211424_0001.DBL	00:01:33	7
CS_OPER_SIR1SAR_020141121T093735_20141121T093948_0001.DBL	00:02:13	8
CS_OPER_SIR1SAR_020141121T220115_20141121T220328_0001.DBL	00:02:13	9
CS_OPER_SIR1SAR_020141122T084824_20141122T084857_0001.DBL	00:00:33	10
CS_OPER_SIR1SAR_020141122T211024_20141122T211207_0001.DBL	00:01:43	11
CS_OPER_SIR1SAR_020141123T093508_20141123T093722_0001.DBL	00:02:14	12
CS_OPER_SIR1SAR_020141123T215848_20141123T220101_0001.DBL	00:02:13	13
CS_OPER_SIR1SAR_020141124T084548_20141124T084631_0001.DBL	00:00:43	14
CS_OPER_SIR1SAR_020141124T210757_20141124T210950_0001.DBL	00:01:53	15
CS_OPER_SIR1SAR_020141125T093242_20141125T093455_0001.DBL	00:02:13	16
CS_OPER_SIR1SAR_020141125T215622_20141125T215834_0001.DBL	00:02:12	17
CS_OPER_SIR1SAR_020141126T084312_20141126T084404_0001.DBL	00:00:52	18
CS_OPER_SIR1SAR_020141126T210530_20141126T210734_0001.DBL	00:02:04	19
CS_OPER_SIR1SAR_020141127T093015_20141127T093228_0001.DBL	00:02:13	20
CS_OPER_SIR1SAR_020141127T215355_20141127T215607_0001.DBL	00:02:12	21
CS_OPER_SIR1SAR_020141128T084037_20141128T084138_0001.DBL	00:01:01	22
CS_OPER_SIR1SAR_020141128T210303_20141128T210306_0001.DBL	00:00:03	23
CS_OPER_SIR1SAR_020141128T210311_20141128T210428_0001.DBL	00:01:17	24
CS_OPER_SIR1SAR_020141128T210428_20141128T210516_0001.DBL	00:00:48	25
CS_OPER_SIR1SAR_020141129T092748_20141129T093001_0001.DBL	00:02:13	26
CS_OPER_SIR1SAR_020141129T215128_20141129T215340_0001.DBL	00:02:12	27
CS_OPER_SIR1SAR_020141130T083801_20141130T083911_0001.DBL	00:01:10	28
CS_OPER_SIR1SAR_020141130T210036_20141130T210250_0001.DBL	00:02:14	29
CS_OPER_SIR1SAR_020141201T092521_20141201T092734_0001.DBL	00:02:13	30
CS_OPER_SIR1SAR_020141201T214901_20141201T215113_0001.DBL	00:02:12	31
CS_OPER_SIR1SAR_020141202T083525_20141202T083644_0001.DBL	00:01:19	32
CS_OPER_SIR1SAR_020141202T205809_20141202T210023_0001.DBL	00:02:14	33
CS_OPER_SIR1SAR_020141203T092254_20141203T092507_0001.DBL	00:02:13	34
CS_OPER_SIR1SAR_020141204T083249_20141204T083417_0001.DBL	00:01:28	35
CS_OPER_SIR1SAR_020141204T205542_20141204T205756_0001.DBL	00:02:14	36
CS_OPER_SIR1SAR_020141205T092027_20141205T092240_0001.DBL	00:02:13	37
CS_OPER_SIR1SAR_020141206T083013_20141206T083151_0001.DBL	00:01:38	38
CS_OPER_SIR1SAR_020141206T205316_20141206T205529_0001.DBL	00:02:13	39
CS_OPER_SIR1SAR_020141207T091800_20141207T092013_0001.DBL	00:02:13	40
CS_OPER_SIR1SAR_020141207T200227_20141207T200300_0001.DBL	00:00:33	41
CS_OPER_SIR1SAR_020141208T082737_20141208T082923_0001.DBL	00:01:46	42

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CS_OPER_SIR1SAR_020141208T205049_20141208T205303_0001.DBL	00:02:14	43
CS_OPER_SIR1SAR_020141209T091533_20141209T091746_0001.DBL	00:02:13	44
CS_OPER_SIR1SAR_020141209T200000_20141209T200043_0001.DBL	00:00:43	45
CS_OPER_SIR1SAR_020141210T082501_20141210T082657_0001.DBL	00:01:56	46
CS_OPER_SIR1SAR_020141210T204822_20141210T205036_0001.DBL	00:02:14	47
CS_OPER_SIR1SAR_020141211T091306_20141211T091519_0001.DBL	00:02:13	48
CS_OPER_SIR1SAR_020141211T195733_20141211T195827_0001.DBL	00:00:54	49
CS_OPER_SIR1SAR_020141212T082225_20141212T082430_0001.DBL	00:02:05	50
CS_OPER_SIR1SAR_020141212T204555_20141212T204809_0001.DBL	00:02:14	51
CS_OPER_SIR1SAR_020141213T091040_20141213T091252_0001.DBL	00:02:12	52
CS_OPER_SIR1SAR_020141213T195506_20141213T195610_0001.DBL	00:01:04	53
CS_OPER_SIR1SAR_020141214T081950_20141214T082203_0001.DBL	00:02:13	54
CS_OPER_SIR1SAR_020141214T204329_20141214T204542_0001.DBL	00:02:13	55
CS_OPER_SIR1SAR_020141215T090812_20141215T091023_0001.DBL	00:02:11	56
CS_OPER_SIR1SAR_020141215T195239_20141215T195354_0001.DBL	00:01:15	57
CS_OPER_SIR1SAR_020141216T081722_20141216T081935_0001.DBL	00:02:13	58
CS_OPER_SIR1SAR_020141216T204102_20141216T204315_0001.DBL	00:02:13	59

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[Reference]



# Appendix C - List of the L2 variables not to be considered (no C-band, no MWR)

Name of the parameters	Reason for not considering the parameter
acq_stat_20_c	No C-band
agc_01_c	No C-band
agc_20_c	No C-band
agc_cor_20_c	No C-band
agc_numval_01_c	No C-band
agc_qual_20_c	No C-band
agc_rms_01_c	No C-band
alt_20_c	No C-band
amplitude_ocean_20_c	No C-band
atm_cor_sig0_01_c	No C-band
cl_gain_20_c	No C-band
dem_eeprom_20_c	No C-band
dist_coast_20_c	No C-band
dop_cor_20_c	No C-band
dop_cor_l1b_20_c	No C-band
dop_slope_cor_20_c	No C-band
epoch_ocean_20_c	No C-band
filtered_range_ocean_20_ku	No C-band
first_year_ice_class_01_ku	No MWR
first_year_ice_class_01_plrm_ku	No MWR
flag_man_plane_20_c	No C-band
flag_man_pres_20_c	No C-band
flag_man_thrust_20_c	No C-band
ice_sheet_snow_facies_flag_01_ku	No C-band, no MWR
ice_sheet_snow_facies_flag_01_plrm_ku	No C-band, no MWR
instr_op_mode_20_c	No C-band
interp_flag_mss_sol1_20_c	No C-band
interp_flag_mss_sol2_20_c	No C-band
int_path_cor_20_c	No C-band
iono_cor_alt_01_ku	No C-band
iono_cor_alt_01_plrm_ku	No C-band
iono_cor_alt_20_ku	No C-band
iono_cor_alt_20_plrm_ku	No C-band
isp_time_status_20_c	No C-band
lat_20_c	No C-band
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lat cor 20 c	No C-band
	No C-band
	No C band
	No C-band
	No C-band
mean_sea_sun_son_zo_c	No C-band
mean_sea_surf_sol1_acc_20_c	No C-band
mean_sea_surf_sol2_20_c	No C-band
mean_sea_surf_sol2_acc_20_c	No C-band
mode_id_20_c	No C-band
mod_instr_cor_range_01_c	No C-band
mod_instr_cor_sig0_01_c	No C-band
mod_instr_cor_swh_01_c	No C-band
mqe_ocean_20_c	No C-band
multi_year_ice_class_01_ku	No MWR
multi_year_ice_class_01_plrm_ku	No MWR
Nav_bul_coarse_time_20_c	No C-band
nav_bul_source_20_c	No C-band
Nav_bul_status_20_c	No C-band
net_instr_cor_range_20_c	No C-band
net_instr_cor_sig0_20_c	No C-band
net_instr_cor_swh_20_c	No C-band
number_of_iterations_20_c	No C-band
open_sea_ice_flag_01_ku	No MWR
open_sea_ice_flag_01_plrm_ku	No MWR
open_water_class_01_ku	No MWR
open_water_class_01_plrm_ku	No MWR
oper_instr_20_c	No C-band
orb_alt_rate_20_c	No C-band
Peakiness_1_20_c	No C-band
peakiness_2_20_c	No C-band
rad_liquid_water_01_ku	No MWR
rad_liquid_water_01_plrm_ku	No MWR
rad_surf_type_01	No MWR
rad_water_vapor_01_ku	No MWR
rad_water_vapor_01_plrm_ku	No MWR
rad_wet_tropo_cor_01_ku	No MWR
rad_wet_tropo_cor_01_plrm_ku	No MWR
rad_wet_tropo_cor_sst_gam_01_ku	No MWR
rad_wet_tropo_cor_sst_gam_01_plrm_ku	No MWR
rain_att_01_ku	No C-band, no MWR

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rain_att_01_plrm_ku	No C-band, no MWR
rain_flag_01_ku	No C-band, no MWR
rain_flag_01_plrm_ku	No C-band, no MWR
rain_rate_01	No MWR
range_ice_20_c	No C-band
range_ice_sheet_20_c	No C-band
range_ocean_01_c	No C-band
range_ocean_20_c	No C-band
range_ocean_numval_01_c	No C-band
range_ocean_qual_01_c	No C-band
range_ocean_qual_20_c	No C-band
range_ocean_rms_01_c	No C-band
range_ocog_20_c	No C-band
scale_factor_20_c	No C-band
sea_state_bias_01_c	No C-band
seq_count_20_c	No C-band
sig0_cal_20_c	No C-band
sig0_ice_20_c	No C-band
sig0_ice_sheet_20_c	No C-band
sig0_leading_edge_ice_20_c	No C-band
sig0_ocean_01_c	No C-band
sig0_ocean_20_c	No C-band
sig0_ocean_numval_01_c	No C-band
sig0_ocean_qual_01_c	No C-band
sig0_ocean_qual_20_c	No C-band
sig0_ocean_rms_01_c	No C-band
sig0_ocog_20_c	No C-band
sigmac_ocean_20_c	No C-band
slope_first_trailing_edge_ice_20_c	No C-band
slope_second_trailing_edge_ice_20_c	No C-band
ssha_01_ku	No C-band, no MWR
ssha_01_plrm_ku	No C-band, no MWR
ssha_20_ku	No C-band, no MWR
ssha_20_plrm_ku	No C-band, no MWR
surf_class_20_c	No C-band
surf_type_20_c	No C-band
swh_ocean_01_c	No C-band
swh_ocean_20_c	No C-band
swh_ocean_numval_01_c	No C-band
swh_ocean_qual_01_c	No C-band

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swh_ocean_qual_20_c	No C-band
swh_ocean_rms_01_c	No C-band
tb_238_01	No MWR
tb_238_quality_flag_01	No MWR
tb_238_std_01	No MWR
tb_365_01	No MWR
tb_365_quality_flag_01	No MWR
tb_365_std_01	No MWR
thermal_noise_ocean_20_c	No C-band
time_20_c	No C-band
total_electron_content_01	No C-band
tracker_range_20_c	No C-band
uso_cor_20_c	No C-band
UTC_day_20_c	No C-band
UTC_sec_20_c	No C-band
UTC_time_1hz_20_c	No C-band
waveform_20_c	No C-band
weighting_20_c	No C-band
wet_ice_class_01_ku	No C-band, no MWR
wet_ice_class_01_plrm_ku	No C-band, no MWR
width_leading_edge_ice_20_c	No C-band