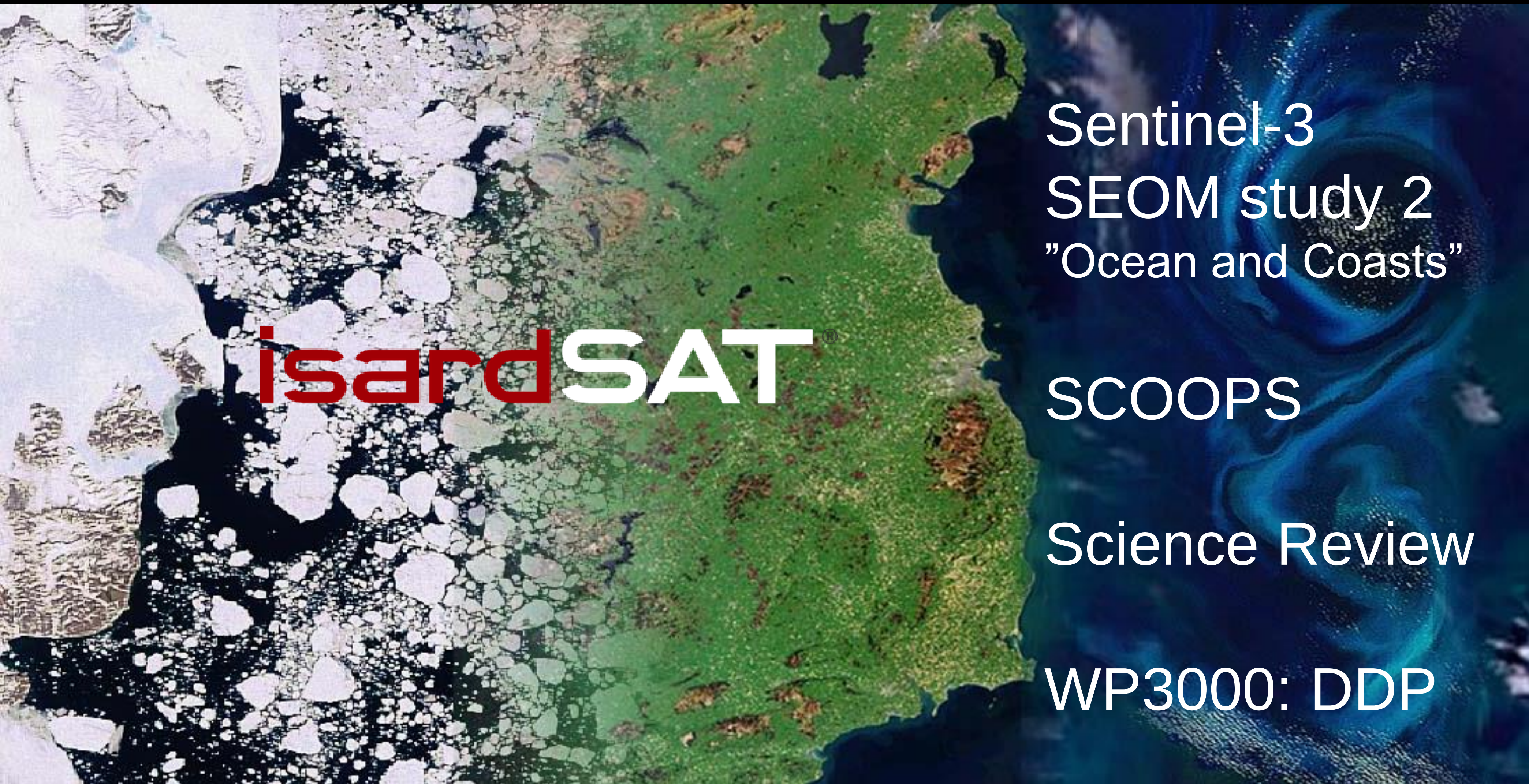


Sentinel-3
SEOM study 2
”Ocean and Coasts”

SCOOPS

Science Review

WP3000: DDP

Objectives of WP3000 – DDP development

- Implementing the initial processing scheme to produce L1B data from Cryosat-2 SAR C-FBR data, and generating the initial L1B test data sets for open ocean and coastal zone studies.
- Developing, testing and implementing modifications to the L1 processing.
- Implementing modifications to the processing scheme to produce L1B data, and generating L1B test data sets phase 2 of the open ocean and coastal zone.

DDP Development overview

SCOOP Sentinel-3 L1 Delay-Doppler Processor (DDP) will be an **evolution** of isardSAT's existing DDPs:

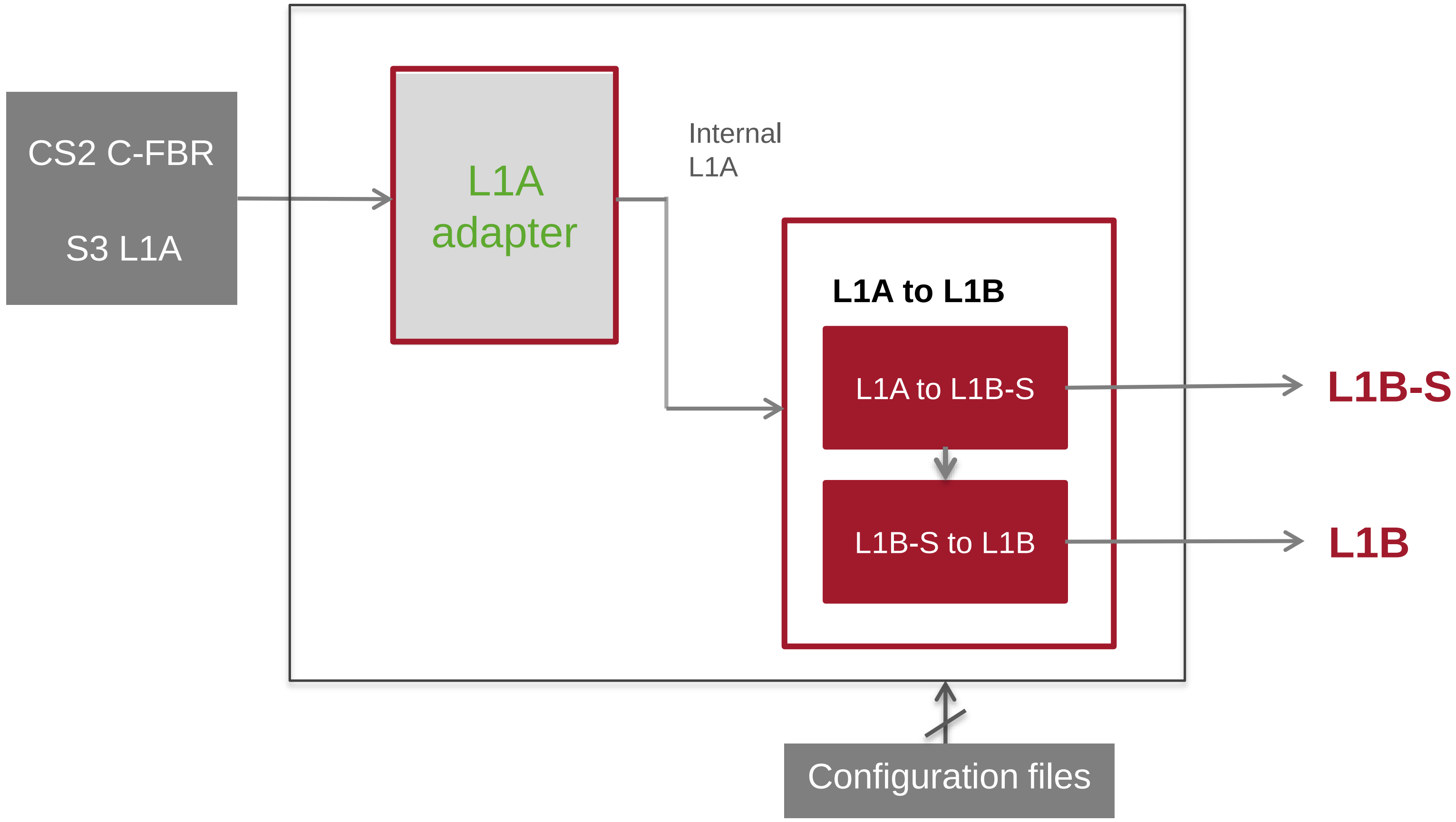
- **Sentinel-6/Jason-CS P4 GPP** (under ESTEC/ESA contract)
- CryoSat-2 DDP (developed in-house)
- Sentinel-3 L0/L1 GPP (developed for ESA through CLS)

Algorithm's Overview

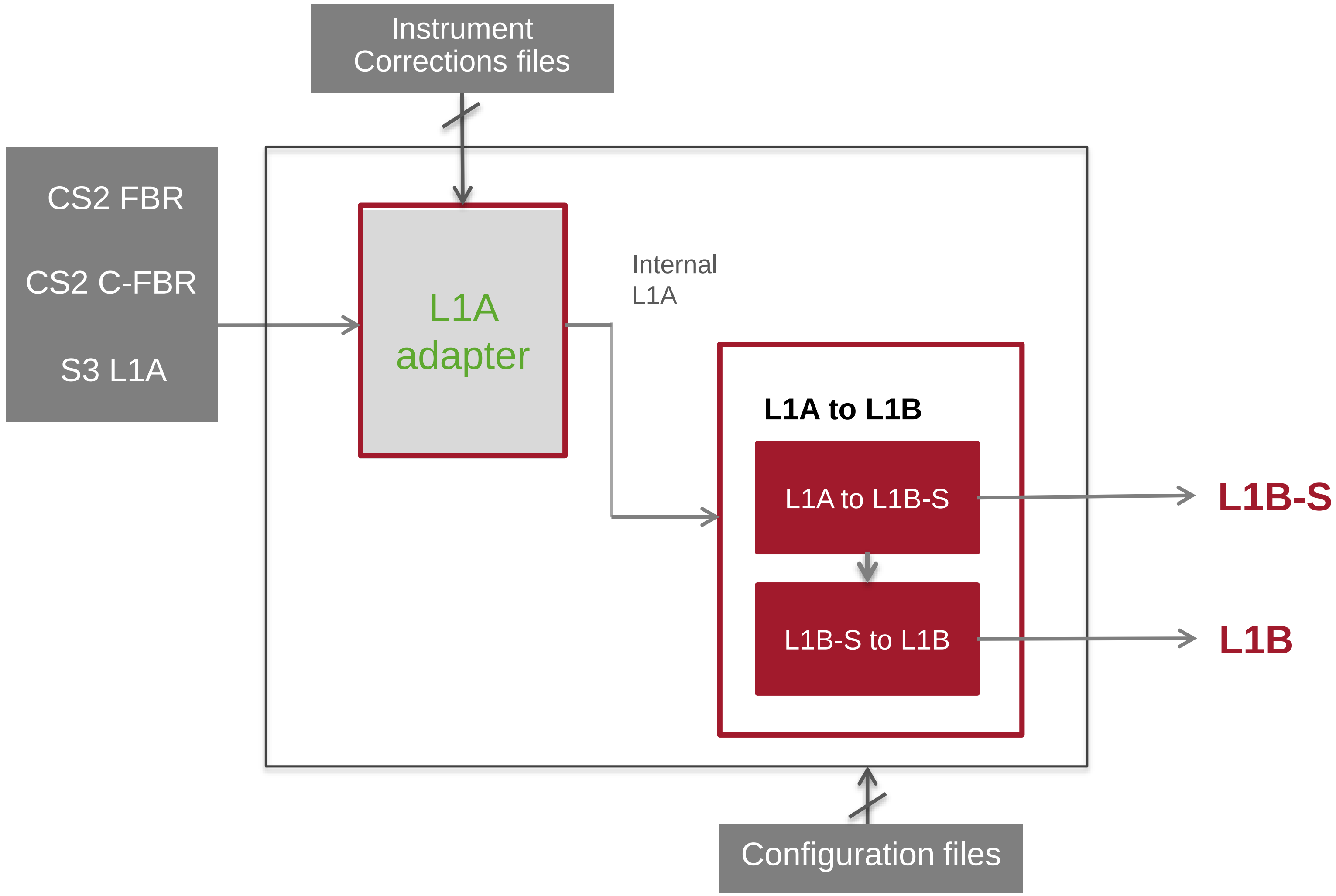
- The main processing stages of the Doppler-Delay processor (DDP) are:
  1. Surface locations, Final burst datation and Window delay
  2. Beam angles computation
  3. Azimuth processing (Delay-Doppler processing + Stacking)
  4. Geometry corrections
  5. Range compression
  6. Multi-looking
  7. Scaling factor computation (sigma-0 extraction)

- Details on the description and mathematical formulation of each of the processing stages in SCOOP ATBD (D1.3).

- DDP SW architecture (based on S6 L0/L1 GPP)

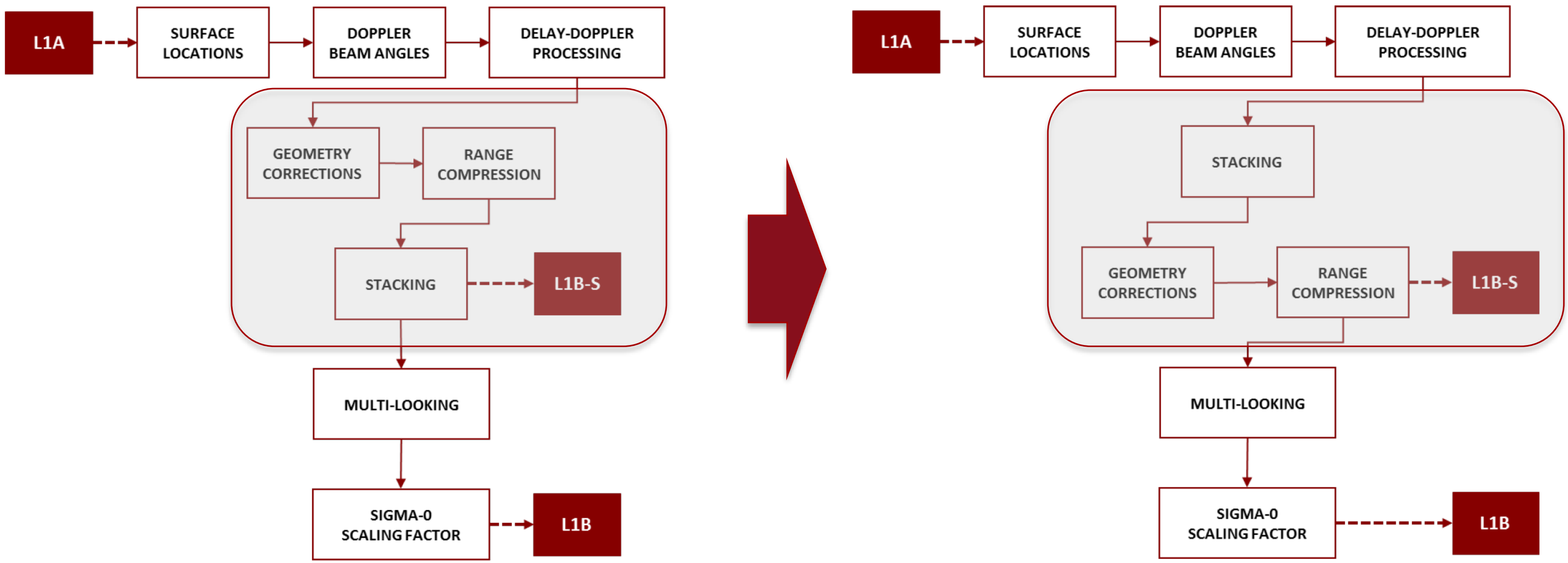


- DDP SW architecture (based on S6 L0/L1 GPP)



DDP Architecture

Change of architecture compared to previous alt. SAR L1b proc. (as for S6):



Will apply all corrections to surface-referenced echoes instead of satellite-referenced.

Helps validation & verification processes and incorporation of improvements in the stack. By itself shall not imply any improvement in performance.

Options on a DDP

GPP Processor Configuration			
Parameter	Type	Options	Applications
Burst azimuth windowing	Weighting	Deactivated /Boxcar, Hamming, Hanning	All
Surface focusing	Beam Pointing	Nominal / Surfaces forced by the user	Point Target, Inland waters
Azimuth processing method	Beam Pointing	Exact / Approximate	Point Target, Inland waters, Coastal
L1B-S and L1B range oversampling factor	Increase resolution	Deactivated / ZP = 2^n	Specular echoes
Stack masking	Cleaning	Deactivated / Defined by the user	Inland waters, Coastal
Antenna weighting	Weighting	Deactivated / Activated	All
Sigma-0 at stack level	Increase resolution	Deactivated / Activated	All
Multi-look zeros method	Weighting	Using / Not using zeros	All

POCCD: Configuration file

Name	Description	Value
Burst azimuth windowing	Type of window applied to each burst before performing the azimuth FFT	0 None 1 Boxcar 2 Hamming 3 Hanning (4 Other)
Surface focusing	Option to move the surface locations	0 No 1 Only one given surface 2 A given surface and the following ones 3 A set of surfaces (If 3 then we need the name of the file with the given surfaces)
Azimuth processing method	Value that forces the precision of the Delay-Doppler process	0 Automatic 1 Approximate method 2 Exact method
Antenna weighting	Flag to compensate for the antenna pattern	0 No 1 Yes
L1B-S and L1B range oversampling factor	Number of zero-padding applied to the waveforms during the range compression process	2, 4, …, 1024, …
Stack masking	Flag to apply a mask to the stack in order to delete undesired phenomena	0 No 1 Yes
Multi-looking method	Average through all the samples or just consider the non-0 samples	0 All samples 1 Only non-0 samples
Sigma-0 at stack	Compute different Sigma-0 values within the stack or not (then, the computation is only made on averaged stacks, i.e., one value per L1B waveform)	0 No 1 Yes

POCCD: Configuration parameters

Name	Description	Value
Noise start sample	Start sample index for computing the waveform's noise	12*zp (zero-padding)
Noise stop sample	End sample index for computing the waveform's noise	16*zp
Noise floor	Maximum noise power allowed for a beam.	-
Noise top	Threshold that flags a beam if its integrated power is above this value.	3* Noise floor
Number of input points for surface interpolation	-	10
Number of output points of surface interpolation	-	Input points * 20
Smoothing factor for surface interpolation	-	0
Roughness threshold	Threshold that determines if a surface is rough or not. This is used to decide the type of interpolation is applied to the surface	10 meters
Reference beam	When aligning a stack, the beam that is taken as a reference. This could be the central beam, the beam with the highest integrated power, etc. TBD	0 Central 1 Maximum integrated power (2 Others)
Sub-stack size	When computing stack characteristics, number of stack integrated power that are averaged in order to smooth the fittings that are performed.	5

POCCD: Characterisation parameters

INSTRUMENT PARAMETERS	
Ku band frequency	13.575 GHz
Rx bandwidth	320 MHz
Rx pulse width	44.8 μs
Chirp slope sign	negative
SAR pulse repetition frequency	18181.818 Hz
Number of pulses in a BURST	64
Burst repetition interval	0.011693825 s
PTR 3dB width	2.801e-9 s
ANTENNA PARAMETERS	
Antenna 3dB aperture used to compute the doppler model	2D elliptic sinc function: teta3dB_X = 1.095 deg teta3dB_Y = 1.22 deg
Antenna gain at boresight	42.6 dB

S3 like TDS

- In order to produce a Sentinel-3 like TDS we will create a POCCD file Sentinel-3 like (parameters adjusted to S3).
- We also need to know the Configuration parameters (and any, if any, parameter that might be hard coded).
- And the Characterisation data.

isardSAT deliveries

isardSAT has delivered:

- DX.X: Technical Note on science review or state of the art.
- DX.X: Requirement Baseline
- D1.3: Algorithm Theoretical Basis Document (ATBD) → draft now and updated @ T0 + 14
- DX.X: POCCD

Issues

- Because of the heritage of our DD processor, we do not implement in two phases.
- Data volume is huge! 4 Tbytes.
- Processing volume and time do not allow to reprocess all the data in different configurations (S3 and +) !
- Processing time based on S6 requirements:

	CAL1 (1)	CAL1 (2)	CAL2	Processing time
CASE 1*	Applied	Not applied	Not applied	1 times real-time
CASE 2**	Applied	Applied	Applied	0.5 times real-time

Note that this processing time is to be achieve by the operational S6 GPP in 2018.

- Note that ACDC is not part of SCOOP project.

isardSAT

Thank You!

Eduard.Makhoul@isardSAT.co.uk
Monica.Roca@isardSAT.co.uk

FBR (rough) data volume estimation

$$DV = N_{acq} \cdot \frac{T_{acq}}{T_{rc}} \cdot N_{brc} \cdot N_{pb} \cdot N_s \cdot 2 \cdot N_{bits}$$

Data Volume- Open ocean ROIs

ROI	Average volume per year (Gigabytes- GB)
CP40_002	**149,4**
CP40_003	**93**
SAR_Pico_00	**644,8**
AR2690_1	**37,16**
AN6524_1, AN6524_5 and AN6524_6	**257,4**
Agulhas (overlapping AR2677_1)	**167,65**
AR2690_2	**35,4**
Total	**1384,81**

Data Volume- Coastal zone ROIs

ROI	Average volume per year (Gigabytes- GB)
Flor_ST (overlapping AN2706_7)	**7**
CP4O_01	**146,6**
AmazonSAR	**26,8**
AN6524_1, AN6524_5 and AN6524_6	**194,1**
AN6524_4 (over North Sea)	**135,84**
Agulhas (overlapping AR2677_1)	**167,65**
ESurge_1	**50,2**
AN6531_4	**52,1**
Harvest	**19,6**
Total	**799,89**

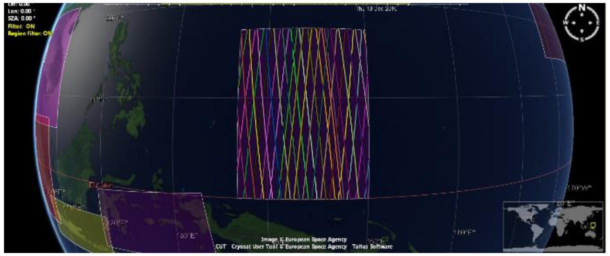
Total amount (2-years period):

2.7 Tbytes (Open Ocean) & **1.6 Tbytes (Coastal Zones)**

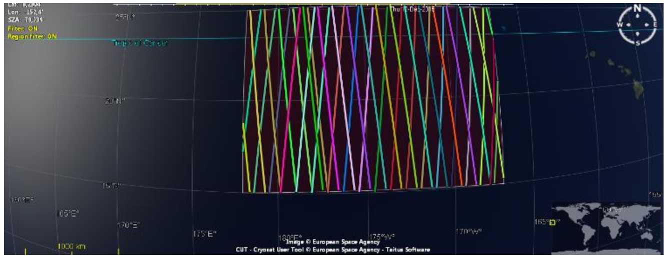
(*) Extrapolation of total volume amount from available data for April-October 2015 from CUT software

Open Ocean ROIs

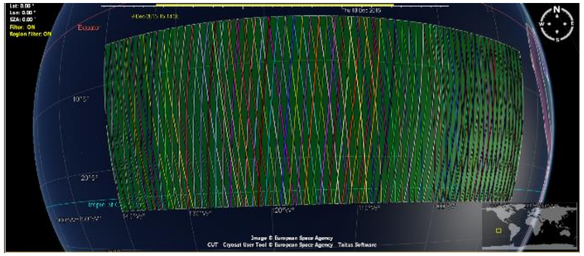
CP4O_002



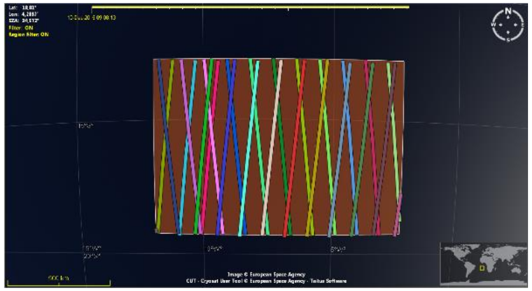
CP4O_003



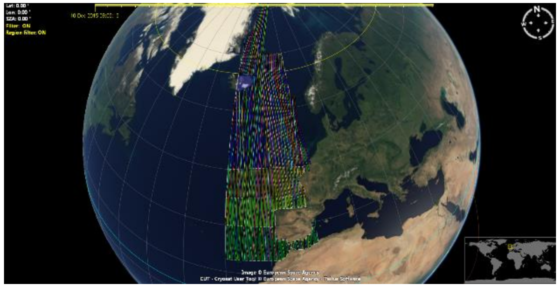
SAR_Pico_00



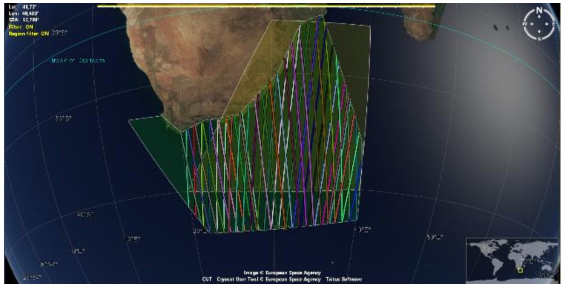
AR2690_1



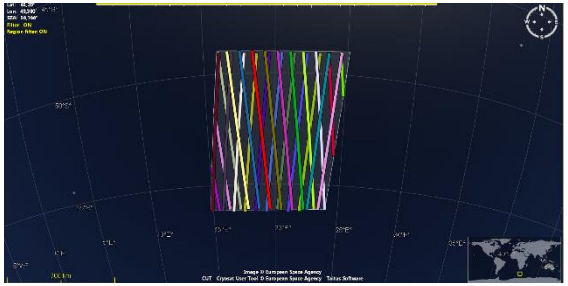
AN6524_1/5/6



AR2677_1

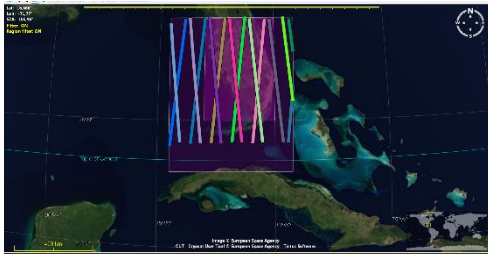


AR2690_2

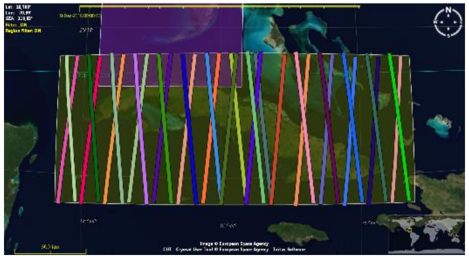


Open Ocean ROIs

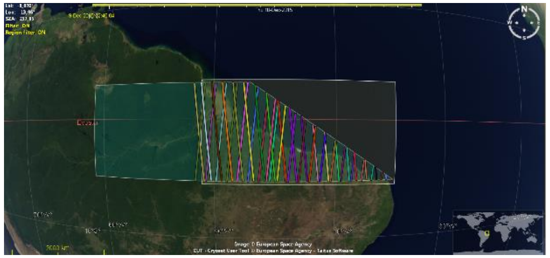
Flori_ST



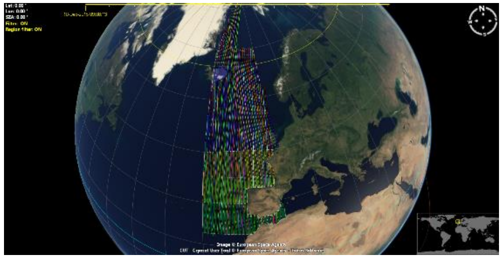
CP4O_01



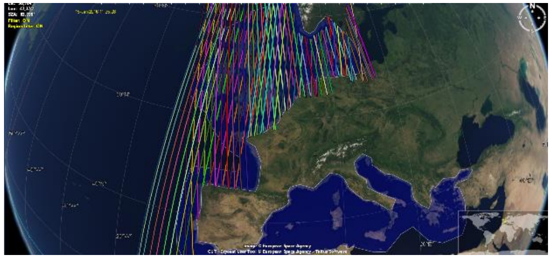
AmazoSAR



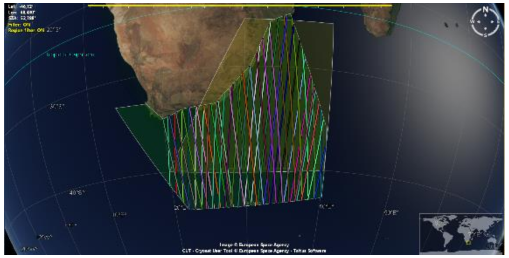
AN6524_1/5/6



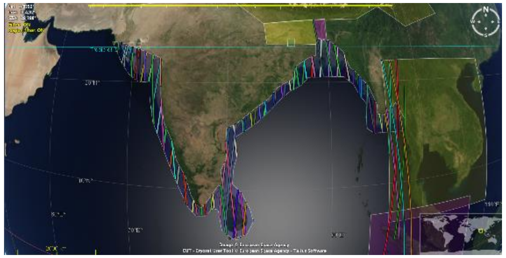
AN6524_1



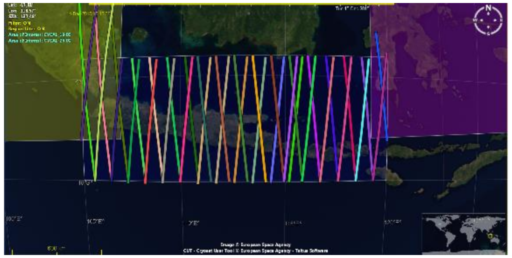
AR2677_1



ESurge_1



AN6531_4



Harvest