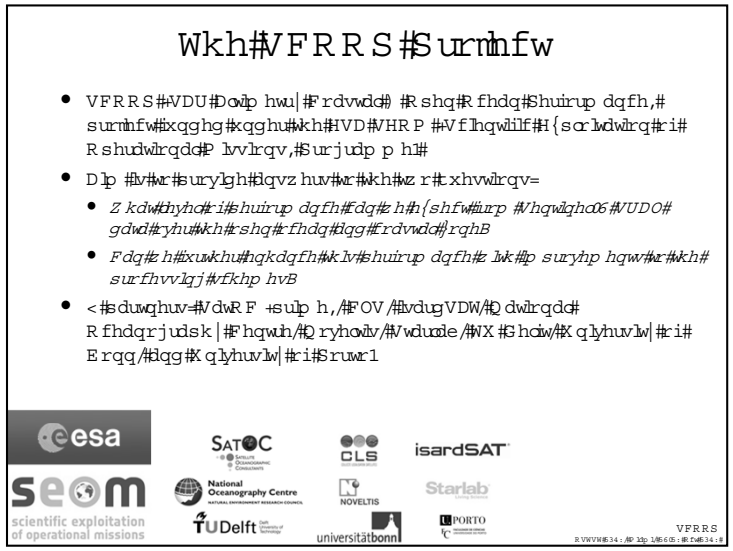
In this presentation I give an overview of the SCOOP: Sentinel-3 SRAL SAR Altimetry in the Coastal and Open Ocean project, and summarise the results.

It is an ESA project, supported under the Scientific Exploitation of Operational Missions Programmes

The project is led by SatOC (UK) and there were eight other partners in the project: CLS, isardSAT, National Oceanography Centre (UK), Noveltis, Starlab, The Technical University of Delft, the University of Bonn, and the University of Porto were funded by ESA.



SCOOP – SAR altimetry Coastal and Open Ocean Performance – is a project funded by ESA under the Scientific Exploitation of Operational Missions (SEOM) programme.

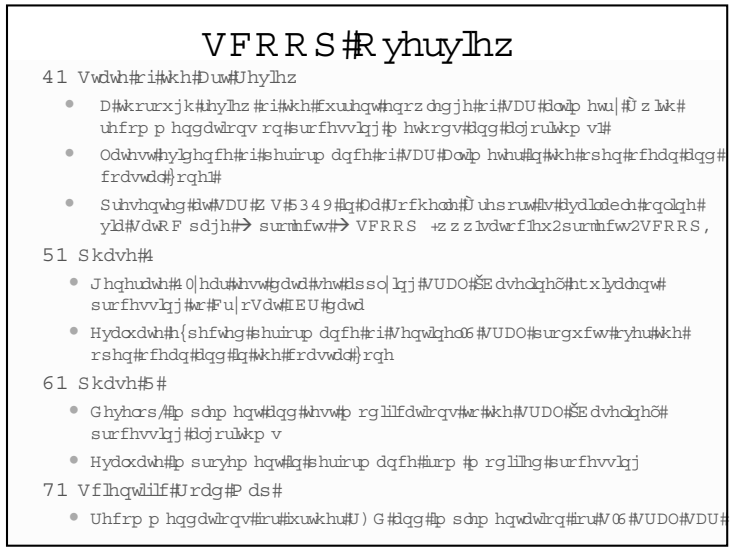
Essentially, it has been set up to answer the two questions:

- *What level of performance can we expect from Sentinel-3 SRAL data over the open ocean and coastal zone?*
- *Can we further enhance this performance by developing and implementing improved processing schemes?*

SCOOP started in October 2016 and is expected to end in July 2018. There are partner projects

looking at SRAL measurements over inland waters and ice.

9 partners in the project: SatOC (prime) from the UK , CLS (France), isardSAT (UK), National Oceanography Centre(UK), Noveltis (France), Starlab (UK), TU Delft (the Netherlands), University of Bonn (Germany), and University of Porto (Portugal).



Overview of the SCOOP project:

4 main phases:

State of the Art Review

Phase 1 - Evaluates expected performance of S-3 SRAL products, as produced by the baseline processing scheme

Phase 2 - Looks at possible improvements to the S-3 baseline processing, and assesses any improvements in performance

Scientific Road Map – Final stage. Summarises results, and provides recommendations for further developments, implementations and research, for S-3 SRAL and for SAR altimetry in general

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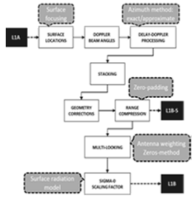

Image credits isardSAT

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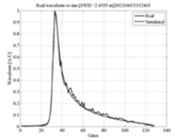
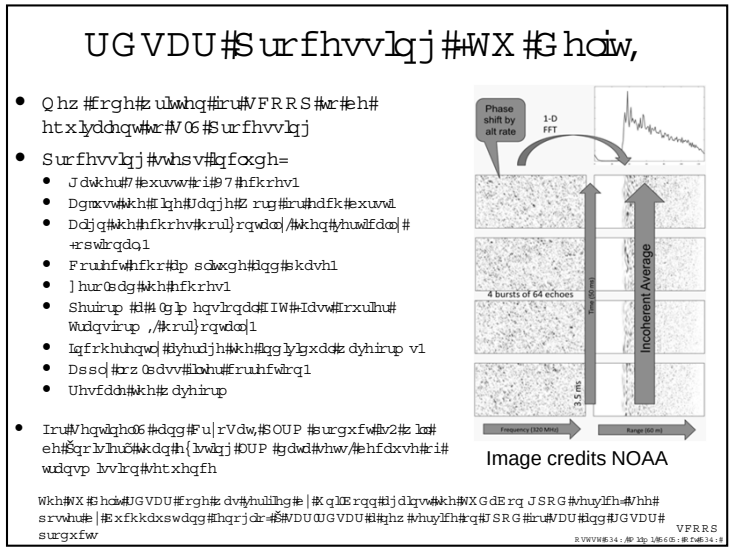


Image credits Starlab



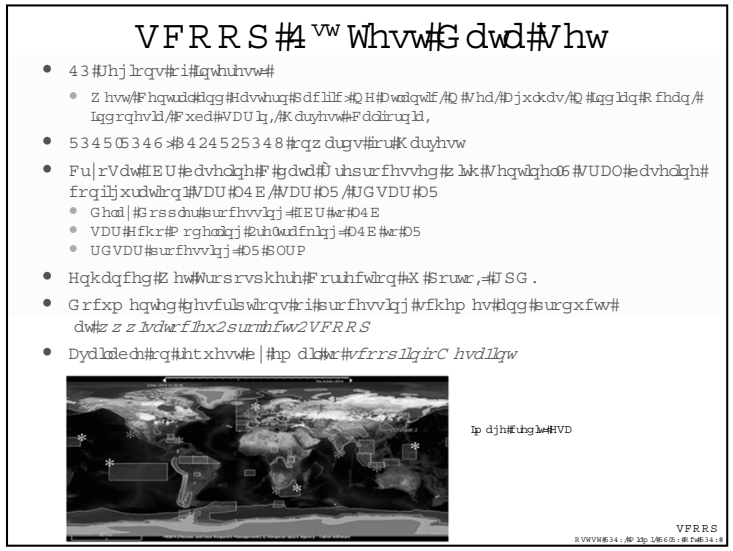
TU Delft are responsible for RDSAR processing in SCOOP.

RDSAR processing generates an “LRM like” product from SAR mode altimeter data. The purpose is to provide a product with continuity to previous altimeter missions.

However, for Sentinel-3 (and CryoSat) because of signal transmission pattern, it will be noisier than existing LRM data sets.

The main processing steps are listed on the left. On the right an illustration shows how the echoes are transformed by this processing into a single LRM like waveform.

For all Regions of interest in SCOOP we will provide L1B, L2 and RDSAR products. As already stated, the processing schemes will all be fully described.



For both Phase 1 and Phase2 we need a Test Data Set

We have identified 10 regions of interest : 5 open ocean and 7 coastal ocean (there is some overlap), from regions where CryoSat is operating in SAR mode.

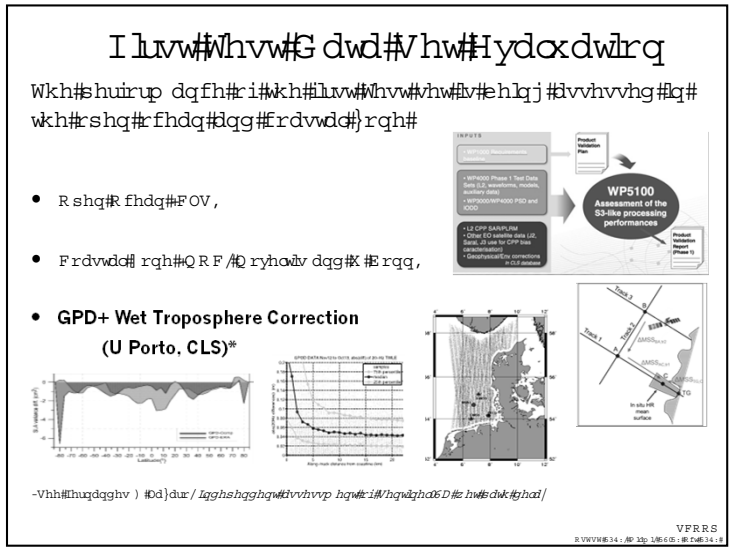
The stars on the map shows these areas: yellow for open ocean, orange for coastal zone.

Where the SAR coverage is available, we will generate a full year of test data.

Start with Cryosat FBR Baseline C data, produce three products with Sentinel-3 SRAL baseline

configuration: SAR L1B (multilooked SAR waveforms), SAR L2 (retrieved geophysical ocean parameters), RDSAR L2 (retrieved geophysical ocean parameters in a “pseudo” LRM product)

The processing schemes, and products, will be fully described in Project Documentation

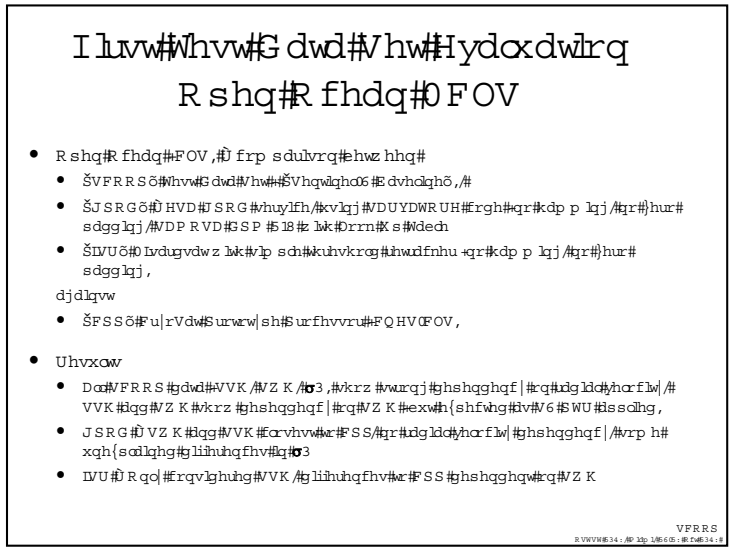


A full evaluation of the First Test Data Set will be made, to characterise its performance across a comprehensive set of metrics, to act as a baseline to measure any improvements resulting from modifications to the processing algorithms.

CLS will lead the evaluation over the open ocean, and NOC will lead the evaluation in the coastal zone, with contributions from Noveltis and U Bonn.

The University of Porto and CLS will provide an evaluation of the enhanced Wet Troposphere model that has been generated for Sentinel-3 by the University of Porto.

The figures show some examples of the assessment approaches



just a comment on slide 8:
it is said that SSH and SWH dependency on SWH is expected as S3 PTR applied. But in slide 4, it is said that LUT are applied to correct PTR approximation in the model.
There is for me a possible inconsistency between these two sentences.
Cheers
Thomas

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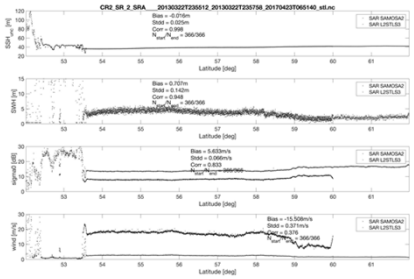

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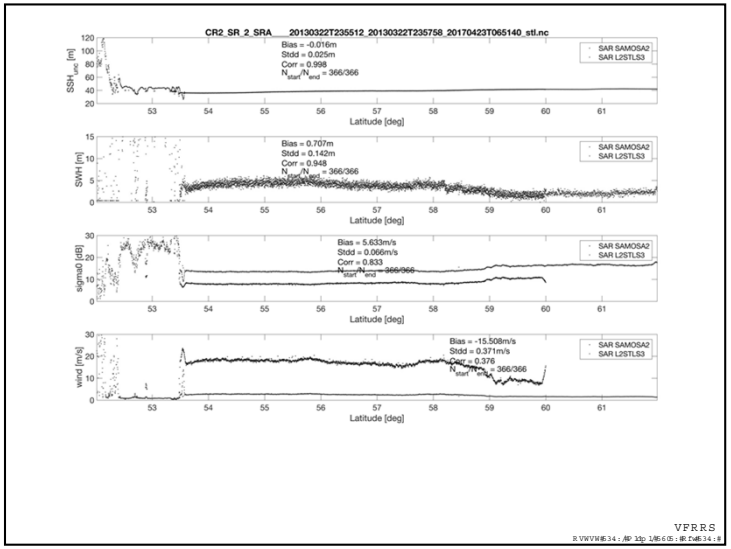

The s0 values between the products show an offset, there are known differences in the processing that will provide a constant bias.

Further analysis is needed to account for the full offset.

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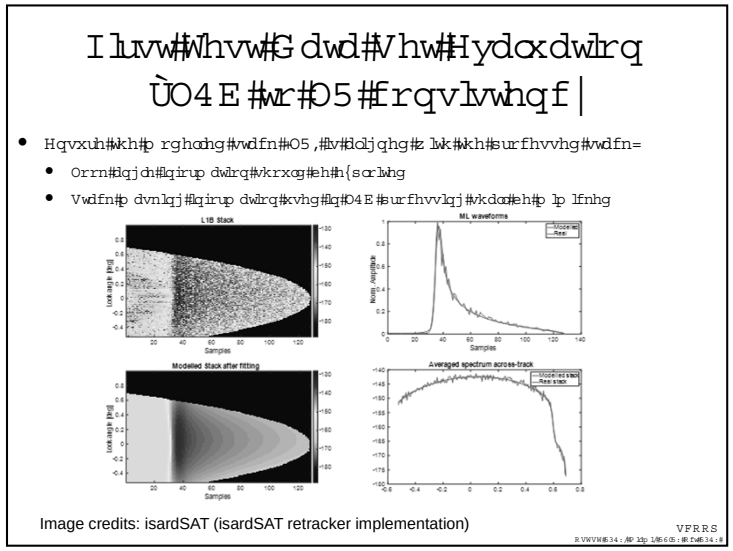
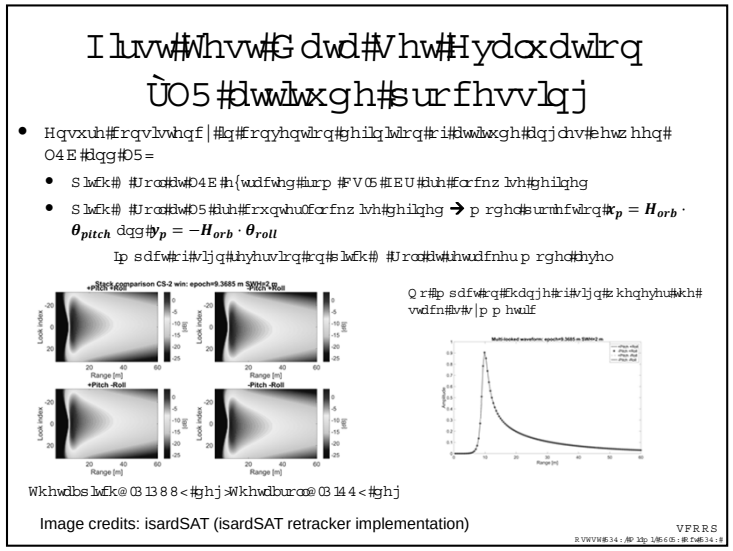


In order to ensure the performance on the geophysical retrievals (an avoid any unexpected dependencies), the theoretical-based analytical retracker included in the L2 shall be consistent with the L1B processing settings options.

So that the modelled stack in the L2 chain is aligned with the real stack: to do so we have to ensure first that the same Doppler looks used in building up the multilooked waveform are modelled in the L2 chain (so the stack is centred in a similar manner), and by exploiting the look angle information (start/stop angles included in the L1B data) this can be ensured as shown when comparing the real L1B-S stack and the modelled one.

As a second step, the mask over the stack shall be applied similarly: remove any potential beams + applying the artifically zeros created by wrapping during geometry correction/isardSAT approach the geom. Corrections (fine+coarse) are implemented through phase ramp compensation in the freq. Domain, differently from the fine [as phase ramp] and coarse [as hard shift] in Sentinel-3.

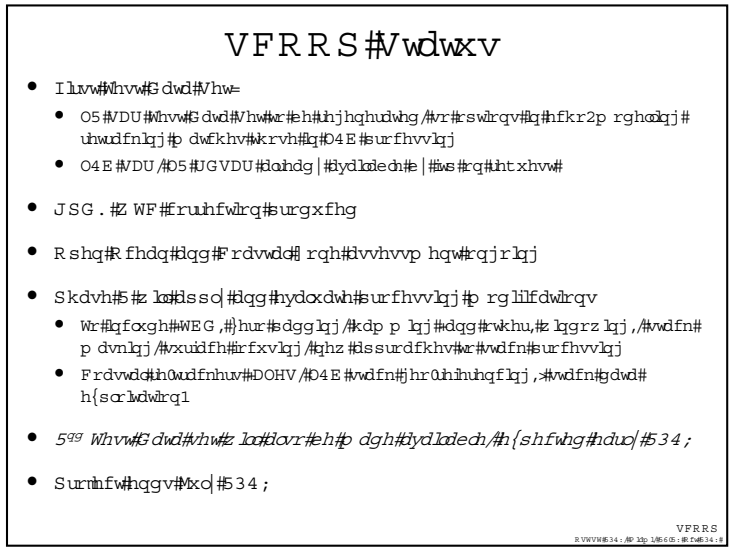
The corresponding waveform fitting in both across-track (conventional waveform) and along-track (called averaged across-track spectrum) are shown to indicate how well the modeling is performing whenever we corectly ingest + exploit the available information from L1B.



In a similar line, and to ensure consistency between L1B and L2, there has been some investigations on how the information of pitch and roll should be properly ingested in the retracker. As there are different conventions of definition in L1B (clockwise) and L2 (anti-clockwise), this may lead to some impact in the final processing (to be consistent the angles should be reverted at the input of the L2). So a dedicated small study has been carried out to understand how the change of signs impact the modelled stack.

The four figures show the modelled stacks for different combinations of signs in pitch (+ means no change of sign and – a reversion of it): then we can see from the model itself that changing the sign on roll no major impact is observed (even function), while the change of sign on pitch produces a symmetric displacement (letf/right) w.r.t. central look of the stack: if the masking of the stack is symmetric then when we generate the multilooked waveform no major impact is observed. In fact we have processed a whole year of data over Agulhas

region changing the signs and very correlated results are obtained in terms of SSH, SWH and sigma0 (precision and accuracy).



One small note to slide 13 (sorry for realising it only now). Where we mention ALES (which as you know is an algorithm designed for LRM retracking) that means two

things:

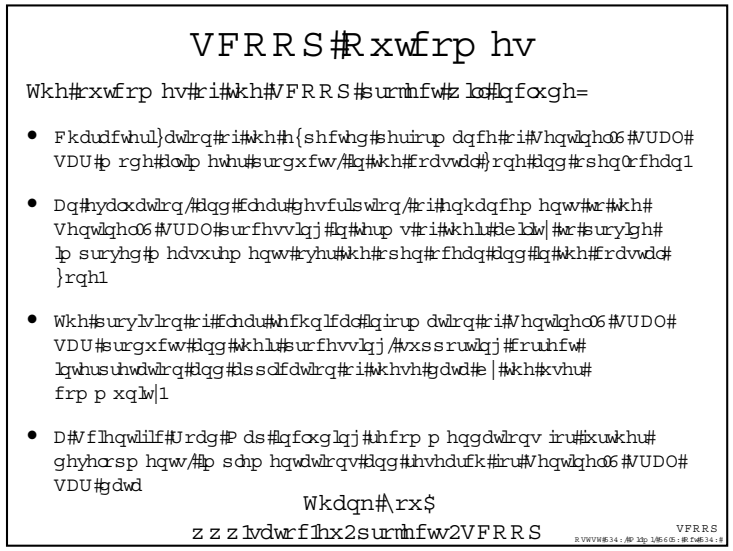
1) applying ALES to PLRM ; and

2) trying to extend the ALES approach (i.e.a sub-waveform whose width depends on SWH) to the SAR mode waveform. But for 2) the limited resources available will only allow as to make some proof-of-concept experiments.

We may not want to modify the slide (to avoid adding too much text), but I thought we should keep the above in mind

Cheers - and see several of you in Miami!

Paolo



Finally – we summarise the expected outcomes of the SCOOP project, which will include:

Characterization of the expected performance of Sentinel-3 SRAL SAR mode altimeter products, in the coastal zone and open-ocean.

An evaluation, and clear description of, enhancements to the Sentinel-3 SRAL processing in terms of their ability to provide improved measurements over the open ocean and in the coastal zone.

The provision of clear technical information of Sentinel-3 SRAL SAR products and their processing, supporting correct interpretation and application by the user community

A Scientific Road Map including recommendations for further developments, implementations and research for Sentinel-3 SRAL SAR data