Innovative coherent processing approach for measuring ocean surface parameters

T. Moreau¹, J. Aublanc¹, P. Rieu¹, M. Raynal¹, N. Tran¹, P. Thibaut¹, F. Piriz¹, F. Boy², N. Picot², F. Borde³, C. Mavrocordatos³ 1 CLS, 2 CNES, 3 ESA



Context



- Alternative SAR-mode data processings were studied aiming at reducing swell waves sensitivity
- Low-Resolution with Range Migration Correction (LR-RMC) processing originally designed by Thales Alenia Space was studied in the frame of a ESA/CNES contract
- Preliminary evaluation of LR-RMC mode showed major improvement over open ocean with however biases occurring for high alongtrack surface slopes [Boy et al., OSTST 2017]
- A correction is made in (S3PP) LR-RMC processing for removing slope-induced errors

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Sensitivity to High Local Surface Slopes (before correction)



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Methodology for correcting slope-induced errors

- Add an along-track surface slope information to the slant-range correction to better align beams within the DDM
- Three approaches were developed/tested to estimate the local alongtrack surface slope for each 20-Hz measurement:
 - Using Sentinel-3A mean profile data (provided by DUACS)

The surface slope is calculated using the two nearest points on the profile

- Using MSS CNES CLS 2015 gridded model (~1.8km of resolution)

A spline interpolation is performed to get MSS heights (evenly spaced) along the sat ground track (at +/-3 km from nadir). The surface slope is then determined by linear regression on the computed MSS heights.

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Estimating the along-track slope directly on DDM

The surface slope is calculated by linear regression on epochs of the central beams

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- The three methods are consistent each other correcting effectively slope-induced errors
- The use of MSS grid is preferred as it offers an operational solution applicable to any missions operating in SAR mode

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- LR-RMC data analysis done before/after MSS slope correction
 - Using gridded MSS CNES CLS 2015 model



- LR-RMC data analysis done before/after MSS slope correction
 - Using gridded MSS CNES CLS 2015 model
 - No more MSS slope effects observable





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SLA Power Spectral Density Analysis



- No observable MSS slope effects [see talk Faugère, Errors]
- But also:
 - Large noise reduction on HF content
 - No swell-induced effects (red noise) at sub-mesoscales [see talk Labroue, Errors]
 - Despite its large footprint, no observable short wavelength correlated errors (bump)
 - Same behavior on large scales as for SARM

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Conclusions

- LR-RMC is a new coherent processing offering major improvement over open ocean
 - no bias at large scales
 - higher noise performances than SARM
 - removing short wavelengths correlated errors seen in LRM and SARM
- Now corrected for local along-track surface slope effects
- Fully validated through level-2 diagnostics
- Complementary assessment regionally [see talk Faugère, Errors]
- A good complementary operational solution to the current SAR-mode processing for ocean application

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Thanks for your attention

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Slope-induced errors in SWH are corrected for low to high MSS slopes

- PLRM is not corrected for the POCA making the comparison less meaningful
- The observed bias after correction (red) is very close to theoretical expectations (black)

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