CP40: Improved Estimation of the Thermal Noise in the SAMOSA Retracker

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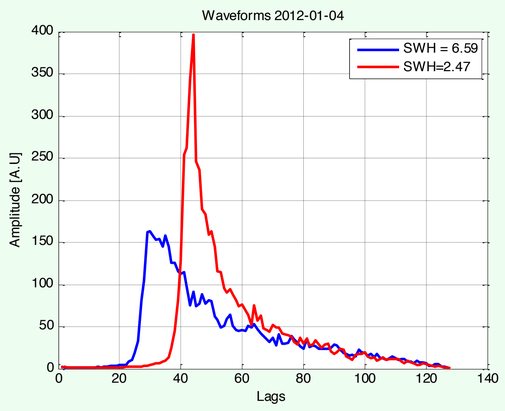
Introduction

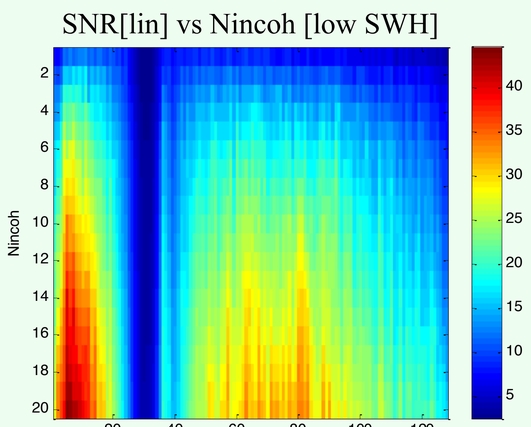
- Estimation of the thermal noise is a key parameter in the retracking of the SAR waveforms → affects directly the estimation of the SWH.
- Originally the noise level was obtained as the average value of the first SAR waveforms lags (typically lags 11-21).
- However, this approach does not consider the impact that the SWH can have on the leading edge and amplitude.
- Thus, it could not represent the true noise.

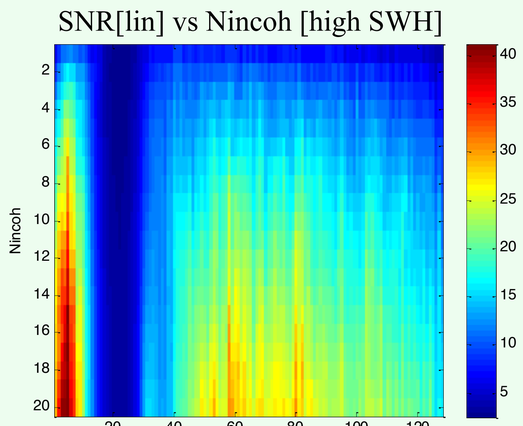


- In the framework of the CP40 project, an empirical model was proposed for the computation of the thermal noise [1].
- This work extends the work done in [1], and provides an optimized version of the SAMOSA retracker.

Optimisation of the Noise Floor Calculation

- An approach based on the uncorrelated characteristics of the thermal noise has been used to define the noise floor
  - SNR increases proportionally with N_{incoh} in the lags where the signal is uncorrelated.
  - Leading edge position tends to be shifted to the left side as SWH increases.
  - Noise floor is narrower at higher SWHs.

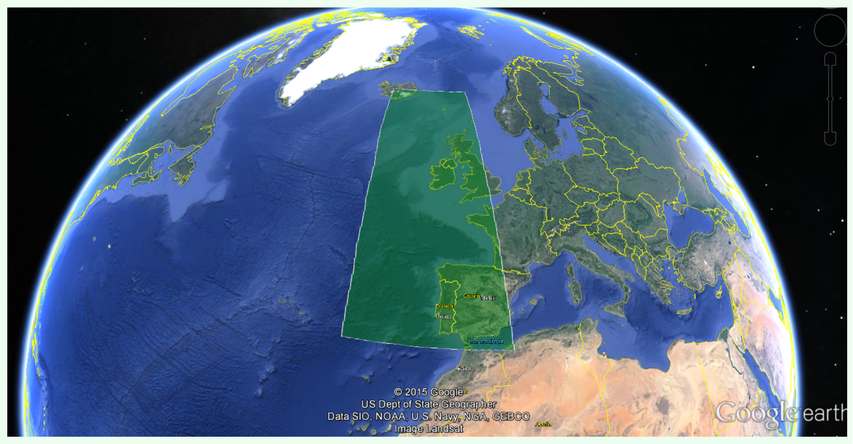




- Therefore:
  - **Optimum position, and optimum width (number of lags) of the noise region shall be considered!!!**

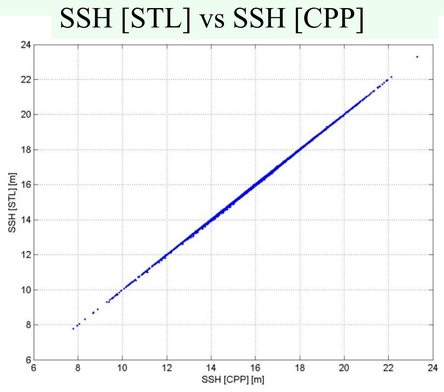
Test Data

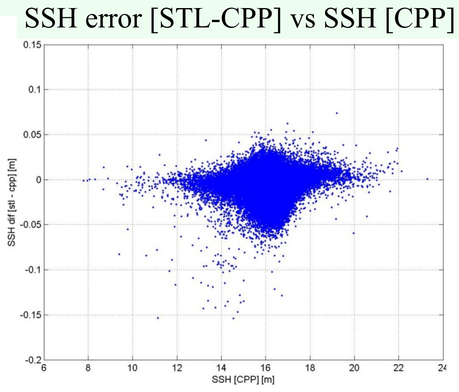
- Data from CryoSat-2 CNES-CPP L1b (v14) have been used as an input.
- Analysis focused on the area where in situ data (wave buoy) are available (30º- 65ºN and 20º- 0º W).

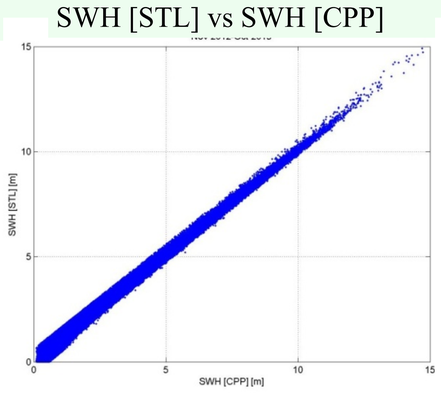


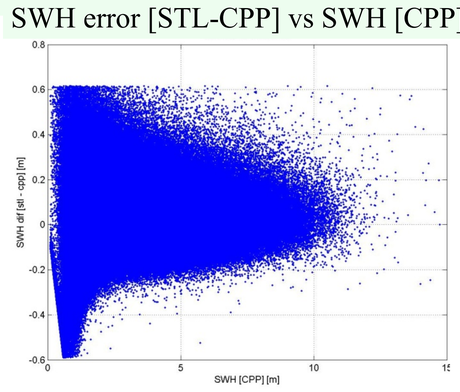
Error Analysis

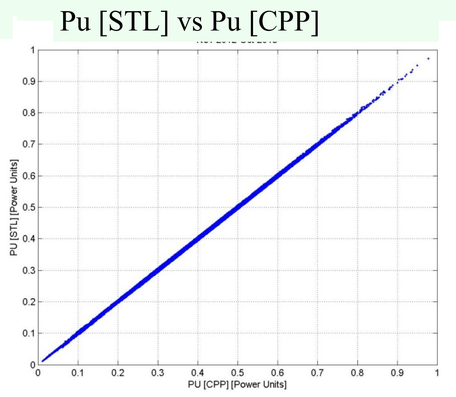
- SSH, SWH, and Pu comparison performed between the CNES-CPP and the updated SAMOSA retracker for different margins (i.e. 9, 14, 16, 18), and different window lengths (i.e. 1, 2, 3, and 4 lags).











Conclusions

- Parameters retrieved with the updated SAMOSA retracker show good agreement with those retrieved by the CPP retracker, (Correlation higher than 99%).

	SSH		SWH		Pu	
	Bias	Std	Bias	Std	Bias	Std
Error	$0.0039 \pm 5.52e\text{-}6\left(\sim \frac{0.0070}{\sqrt{1589461}}\right)$	0.0070	$-0.011 \pm 5.33e\text{-}7\left(\sim \frac{0.119}{\sqrt{1589461}}\right)$	0.119	$1.04e\text{-}4 \pm 5.22e\text{-}7\left(\sim \frac{6.59e-4}{\sqrt{1589461}}\right)$	6.59e-4

- Best results obtained using a margin of 14-16 lags and a window length of 2-3 lags.
- Consistent equivalence between the 20 Hz SAMOSA and CPP products.
  - Error bias of about 3 mm, with a std of 1 mm for SSH.
  - Error bias close to 1 cm for SWH and very low (0.0001) for the Pu.
  - Major discrepancies found at low SWH conditions.
- Validation against buoys performed in [2] confirms these results.

References

[1] Egido, A. et al., 2014: D4.1. Algorithm Theoretical and Validation Document - Open Ocean, CP40 WP4000 Technical Note.

[2] Passaro, M., and Cotton, D. et al 2015: D3.3. SAMOSA SAR retracker improvements-Assessment of Evaluation Data Set, CP40 WP3000 Technical Note.

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http://bit.ly/1XsN9T0