Analysis of STARLAB's SARM retracker performance on CryoSat-2 data

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INTRODUCTION

CryoSat-2 makes it possible for the first time to fully exploit the potentialities of Synthetic Aperture Radar (SAR) techniques applied to radar altimetry. Although CryoSat-2 mission is gathering a few SAR mode data over Ocean water bodies. This will allow a better understanding of the capabilities of this altimetric mode for oceanography. Work to this aim will also substantially benefit the Sentinel-3 mission, which likewise CryoSat-2 will have a SAR mode altimeter (SRAL) on board.

AIM

New retracking methods to account for the new shape of the SAR mode return echo are under definition. At STARLAB we have defined two analytical expressions for the SAR mode waveform over water bodies, with different level of approximation. The most complete form includes along-across track curvature effect, miss-pointing effects, radial velocity effects and allows for non-Gaussian Ocean surface statistics. This poster presents our latest findings in the cross-calibration and validation of our complete form applied to CryoSat-2 SAR mode data for the retrieval of Significant Wave Height (SWH) and Sea Level Anomaly (SLA). Some Parts of the work presented in this poster have been carried out under the ESA funded project SAMOSA (Development of SAR Altimetry Mode Studies and Applications over Ocean, Coastal zones and Inland waters)

METHODOLOGY

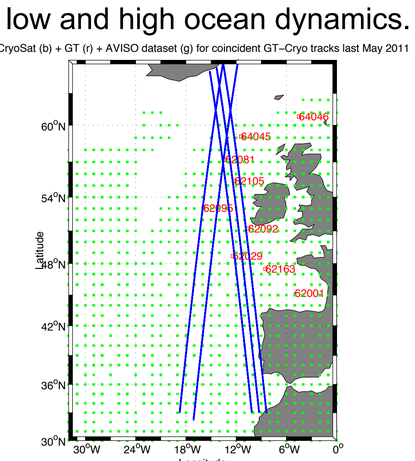
Starlab's Ocean Retracker

- Ocean retracking algorithm based on STARLAB's contributions to SAMOSA. This implies the derivation of a semi-analytical waveform model, which accounts for:
  - Elliptical antenna pattern
  - Mispointing error in elevation and azimuth
  - Errors in range cell migration correction
  - Surface Scattering pattern
  - Non-linear ocean wave statistics
  - Spherical Earth surface effects
- The Ocean retracking objective is to make the measured waveform coincide with a return power model according to weight Least Square estimators using the Levenberg-Marquardt method, which allows for the retrieval of:
  - Tau: the epoch → SLA
  - Sigma_c: the information relative to SWH
  - Pu: the amplitude which related to the backscatter coefficient
  - Pn: the thermal noise level (for removal)

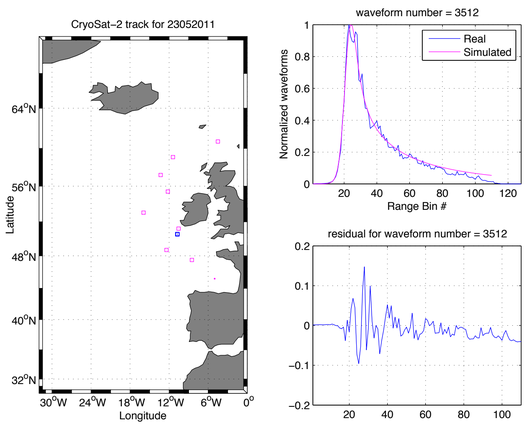
Data of Interest

- North-East Atlantic, May 2011
  - Why? Data availability and this region allows for low and high ocean dynamics.

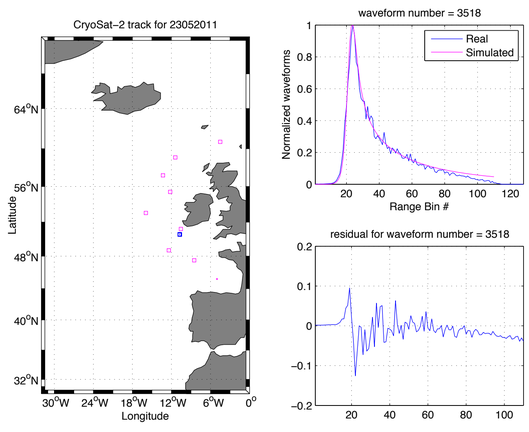
Figure 1: AoI.Number of tracks analyzed = 4, two descending (acquisition time 11pm), two ascending (acquisition time 10am)



- CryoSat-2 L1b and L2a:
  - L1b used for waveform fitting
  - L2a used for geophysical corrections
    - Missing SSB and High Frequency wind responses
      - SOLUTION for SSB →use of auxiliary data file from RA2 (SWH, wind from AVISO)
      - No solution for high wind responses
- AVISO merged maps MSLA and MSWH
- Ground truth data from buoys

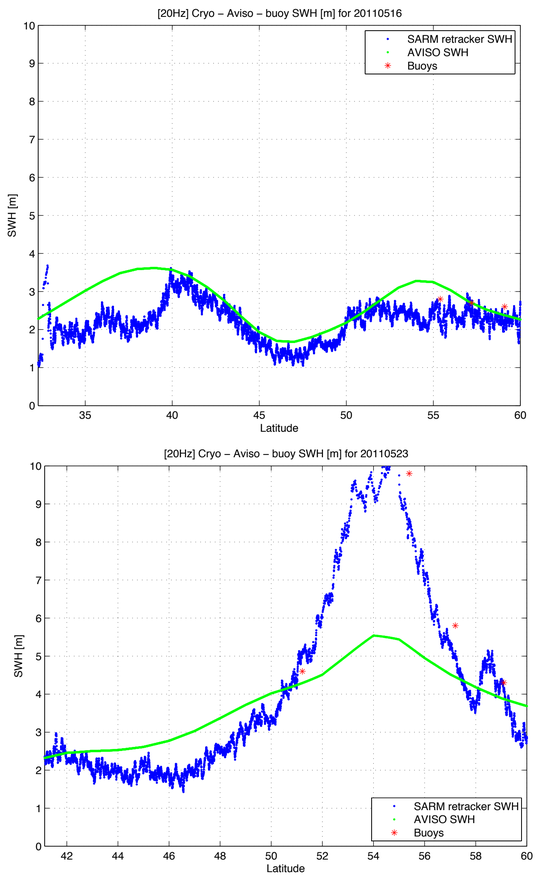


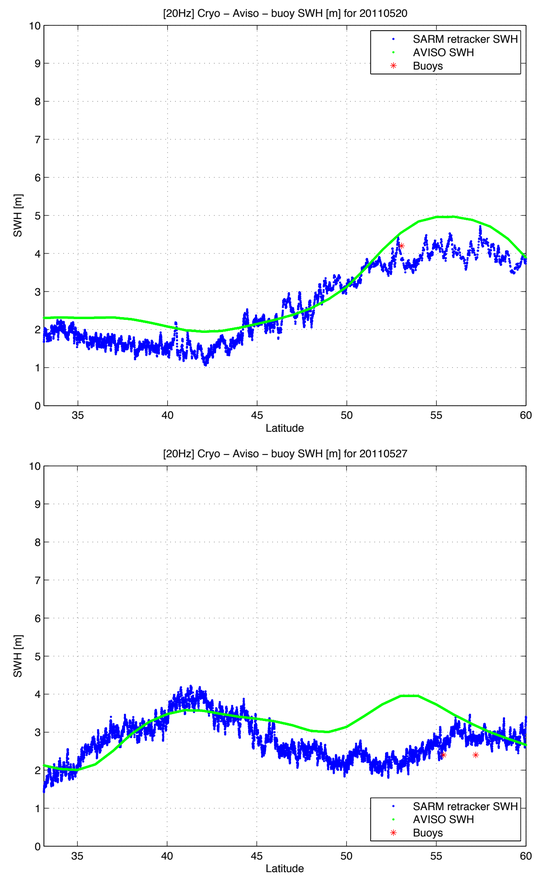
Figures 2,3: Examples of waveform fits by STARLAB's SARM retracker



RESULTS

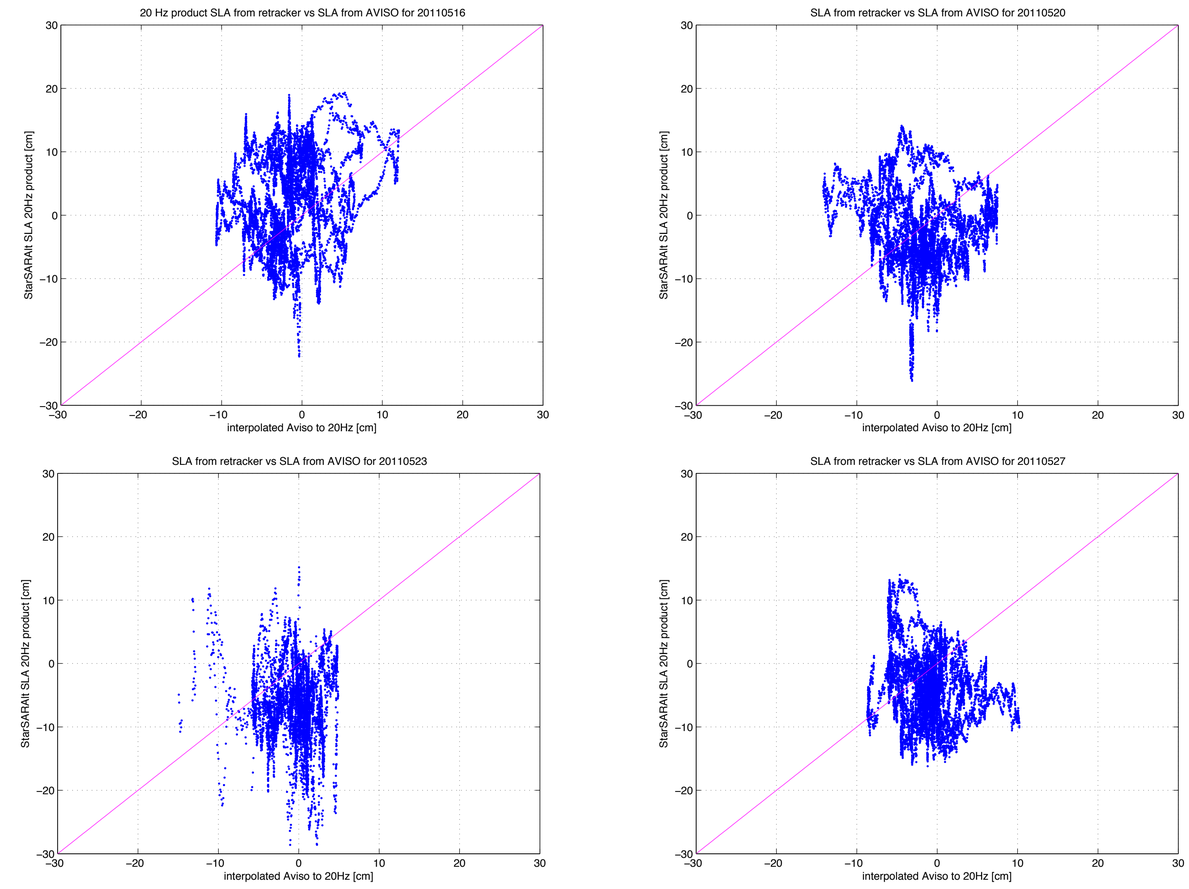
Significant Wave Height





Figures 4,5,6,7: Cross-calibration and validation of CryoSat-2 retracked SWH data with AVIOS MSWH and Buoy data. Retracking results compared to buoy data difference in the order of cms, except for on case with high Ocean dynamics.

Sea Level Anomaly



Figures 8,9,10,11: CryoSat SLA vs AVISO SLA. Results in SSB threshold

CONCLUSION

Retracker results have been successfully cross-calibrated and validated for SWH. Morevoer, the improved resolution of CryoSat allows for the better characterization of phenomena for high Ocean dynamics. Unfortunaltey, we have not succeeded validating our results for the case for SLA. The lack of SSB and High frequency wind response corrections in CryoSat-2 L2a do not allow for an accurate validation of our SLA results versus AVISO. Accounting for the data available, we have only been able to demonstrate that our retracker results for SLA stand in the SSB range +/- 20 cm. For further validation work we propose the addition of missing corrections in CryoSat L2a.

ACKNOWLEDGEMENTS

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