

Localization of Space-Based Measurements through Correlation with In-Situ Measurements

Project Objectives

- Manila Bay is experiencing sea level rise at a rate nearly four times the global average, exacerbating the vulnerability on coastal communities.
- Satellite altimetry provides comprehensive sea level data with high spatial and temporal coverage, including but not limited to sea surface height (SSH), significant wave height (SWH), and sea surface temperature (SST). Using SAMOSA products, only the SSH and SWH were compared with in-situ measurements

Access of Data

- Ease of access to processors
- Choose processors and parameters
- Wait for processing to finish
 - For this project, it took less than an hour

Processors

Discovery Processors and launch Tasks



ALES+ SAR RETRACKER – TUM

ALES+ SAR (Adaptive Leading Edge Subwaveform retracker, version +, for SAR) is a subwaveform retracker for open ocean and coastal zone SAR altimetry data. It adopts a simplified version of the Brown-Hayne functional form (which is the



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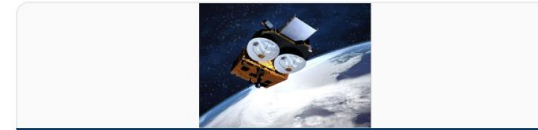


FULLY FOCUSED-SAR FOR CS-2 AND S3–ARESIS

The FF-SAR (Fully Focused SAR) service is a web platform that provides the capability to process on line and on demand CryoSat-2 and Sentinel-3 SAR data, from FBR data products until FF-SAR Level1b products. The service is based on A



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SAMPY PROCESSOR

Python implementation of the SAMOSA+ retracker developed within ESA Cryo-TEMPO project enhanced by the ESA altimetry team to append the output of SAMOSA+ retracker to official L2 GOP products.



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SARINvATORE FOR CS-2

The SARvatore (SAR Versatile Altimetric Toolkit for Ocean Research & Exploitation) for CryoSat-2, is a web platform that provides the capability to process on line and on demand CryoSat-2 SAR data, from L1a (FBR) data products until SAR



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SARvATORE FOR CS-2

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SARvATORE FOR S3

The SARvatore for Sentinel-3 service processes Sentinel-3 SRAL L1A data products in SAR mode until Level-2 geophysical data products.

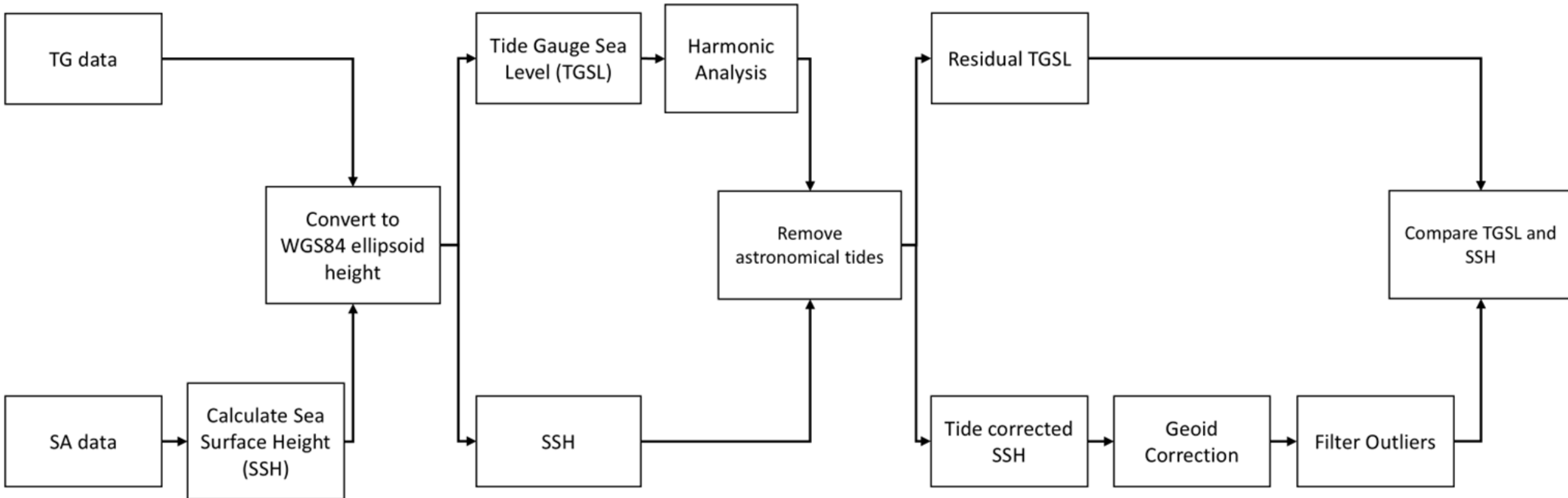


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METHODOLOGY

A large, solid dark blue shape that starts from the bottom left corner and extends diagonally upwards towards the right, covering the bottom half of the slide.

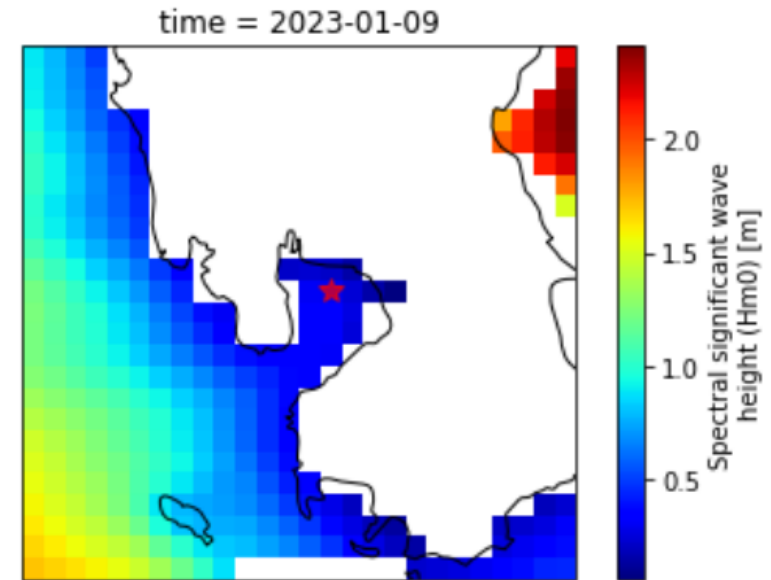
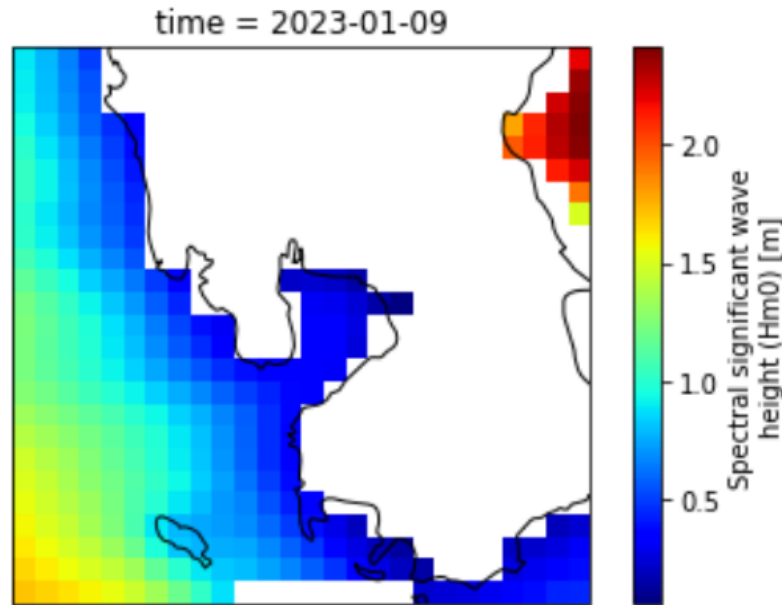
Sea Surface Height



Significant Wave Height

Datasets

- Satellite Altimetry SWH
- Buoy SWH
- Wave Model (CMEMS)



Global Ocean Waves Analysis and Forecast (CMEMS)

- Spatial resolution: $0.083^\circ \times 0.083^\circ$
- Temporal resolution: hourly
- Buoy 2 nearest grid sample (right photo)

Significant Wave Height

Triple Collocation

Fonseca et al, 2019; Stofelen et al, 1998

$$\begin{aligned}X &= \beta_x T + e_x + \alpha_x \\Y &= \beta_y T + e_y + \alpha_y \\Z &= \beta_z T + e_z + \alpha_{xz}\end{aligned}$$

α = bias

e = errors

β = linear calibration/scaling parameter

To compute the RMSE

$$\langle e_{buoy}^2 \rangle = \left\langle \left(H_{buoy}' - H_{ASAR}' \right) \left(H_{buoy}' - H_{ww3}' \right) \right\rangle$$

$$\langle e_{ASAR}^2 \rangle = \left\langle \left(H_{ASAR}' - H_{buoy}' \right) \left(H_{ASAR}' - H_{ww3}' \right) \right\rangle$$

$$\langle e_{ww3}^2 \rangle = \left\langle \left(H_{ww3}' - H_{buoy}' \right) \left(H_{ww3}' - H_{ASAR}' \right) \right\rangle.$$

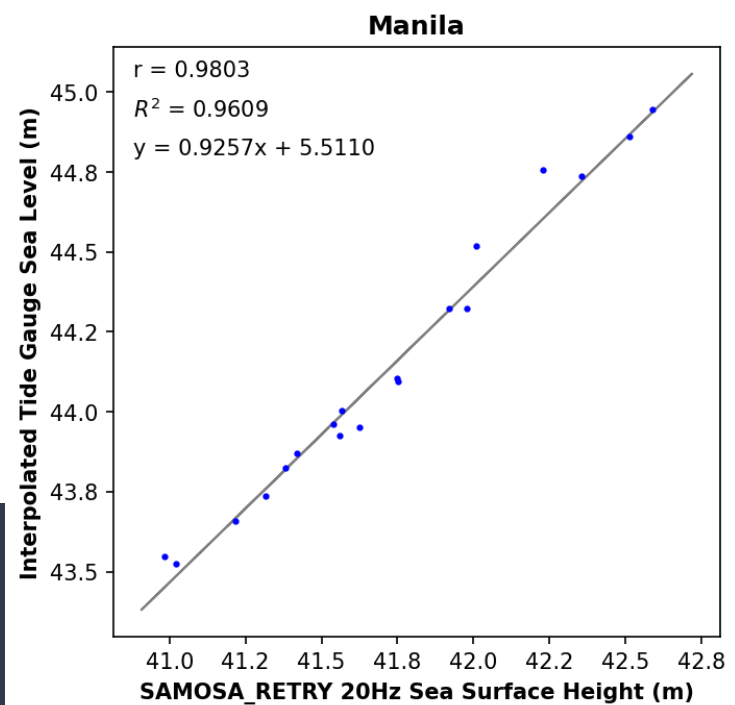
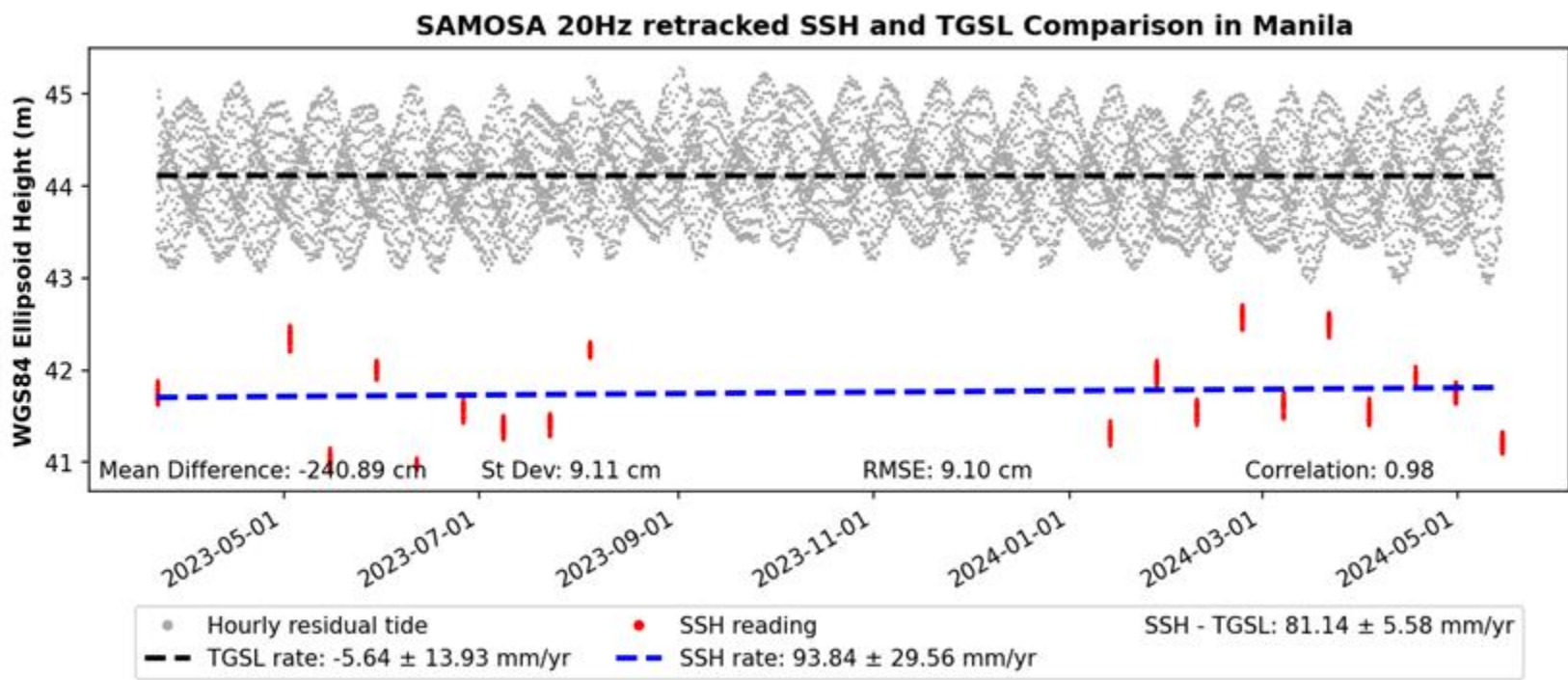
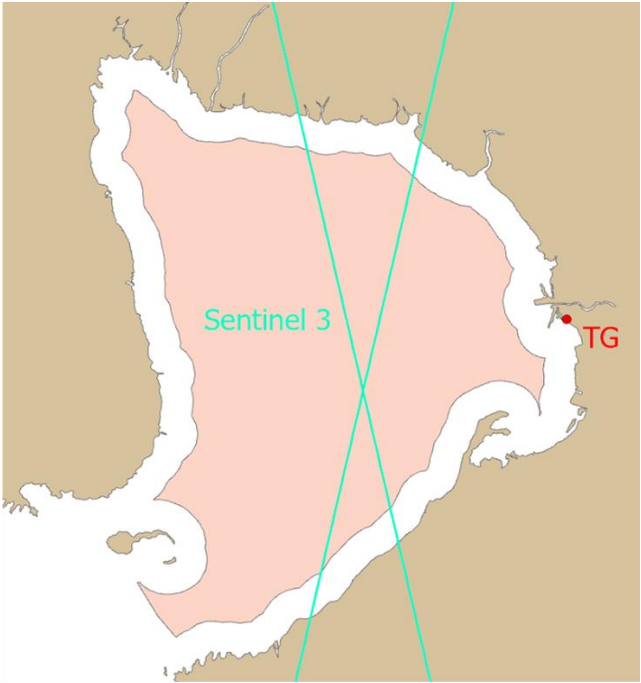
○ Metrics.tcol_errors(x,y,z)

RESULTS

A large, dark blue, diagonal shape that starts from the bottom left and extends towards the top right, covering the lower half of the slide.

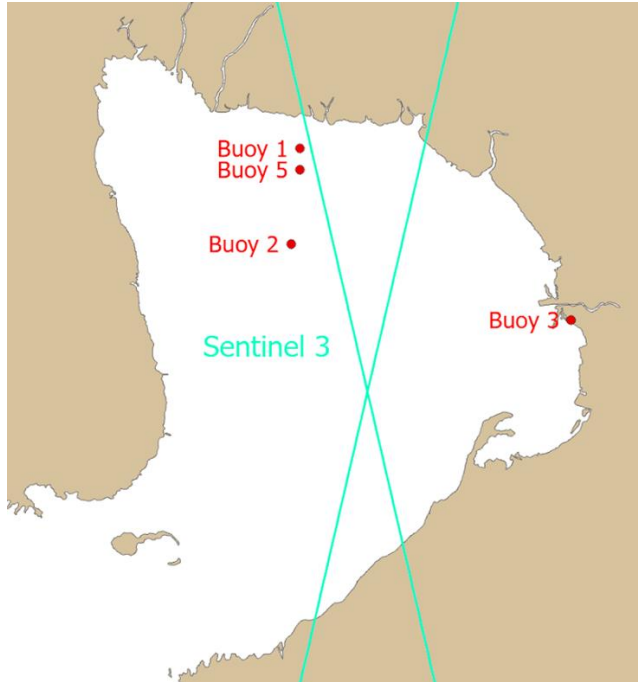
Sea Surface Height

Comparison of Hourly TGSL
and Sentinel 3 SSH



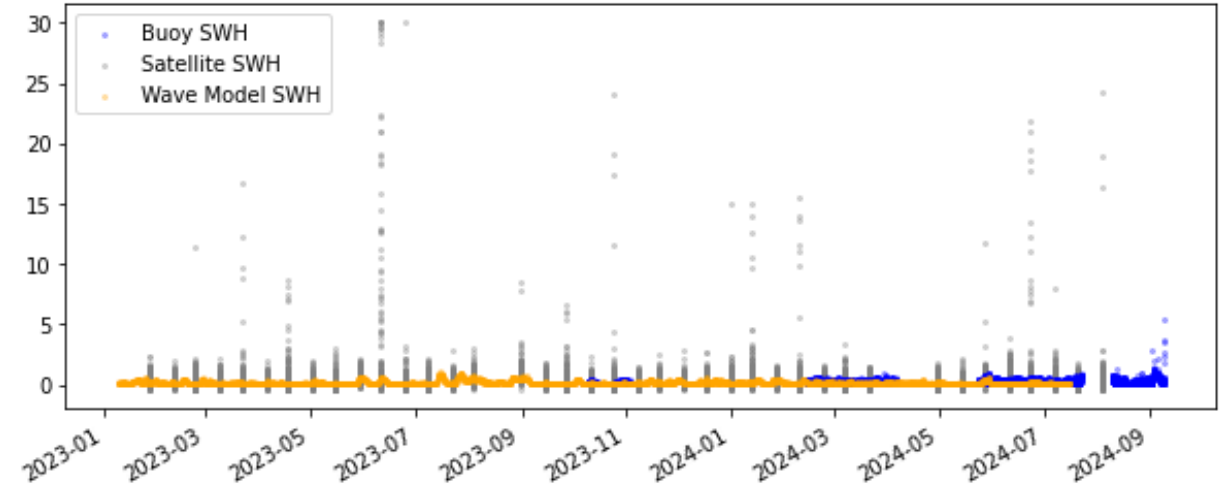
Significant Wave Height

Using Sentinel 3 SWH and model extracted using Buoy 5 coordinates

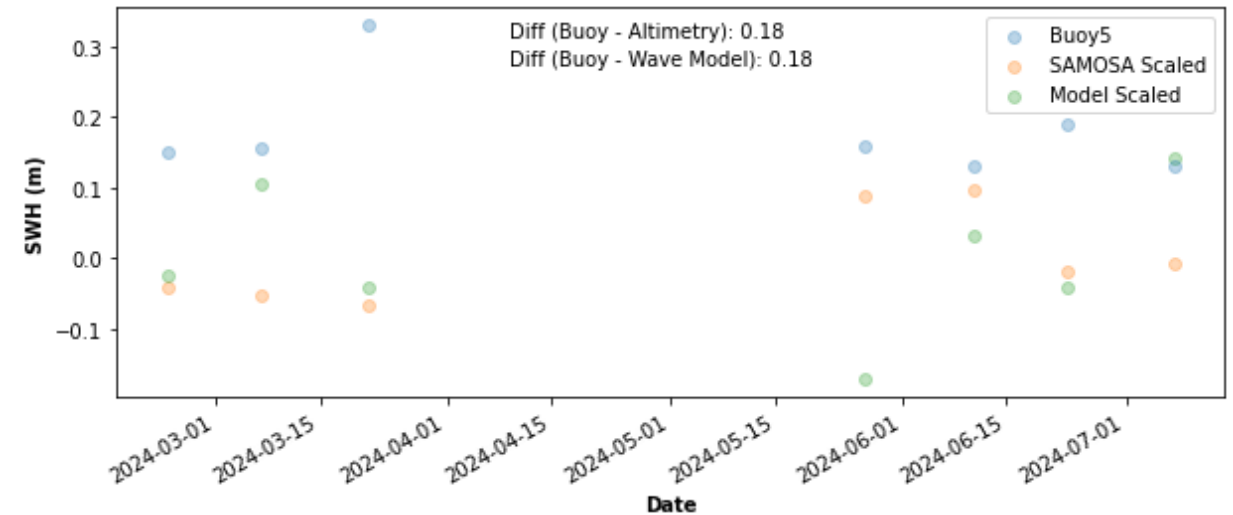


**Original values before averaging to hourly*

Original values

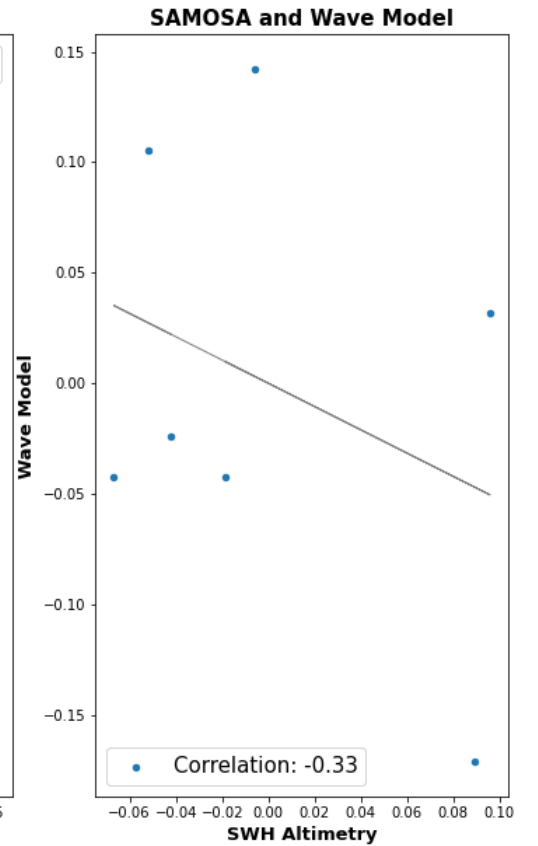
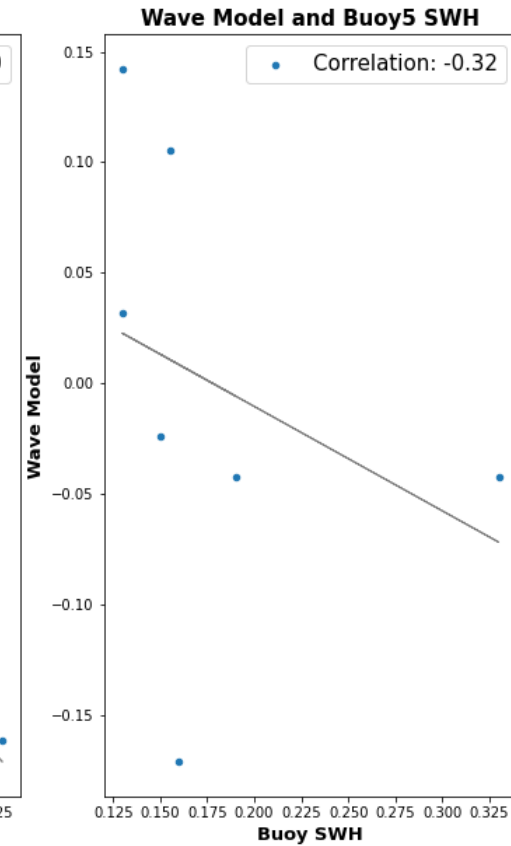
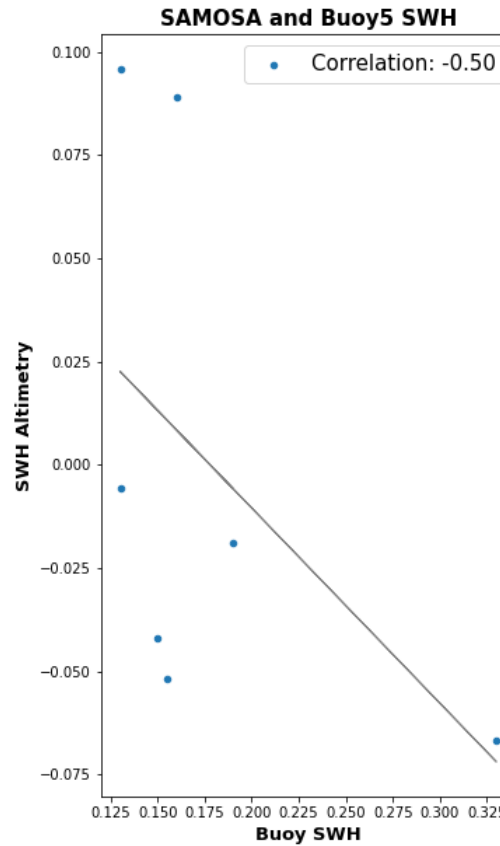
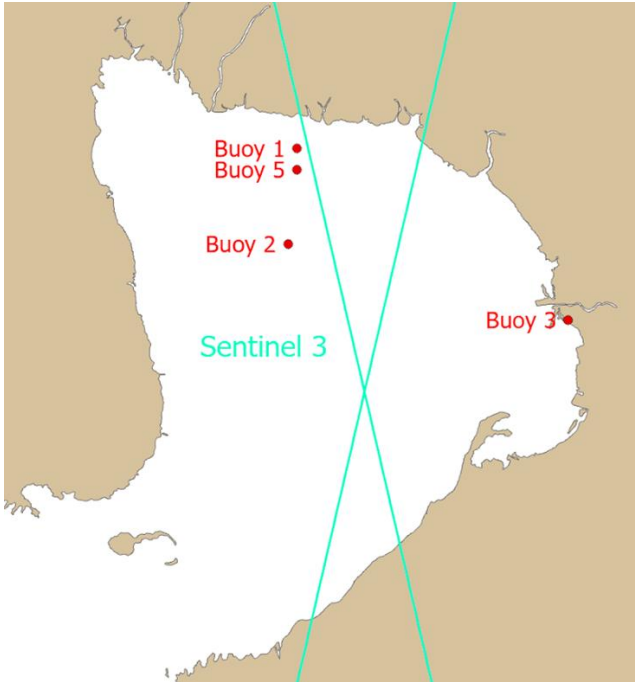


Scaled values



Significant Wave Height

Using Sentinel 3 SWH and model extracted using Buoy 5 coordinates



Significant Wave Height

Using SWH and model extracted using
Buoy 5 coordinates

	Sentinel 3	
	Scaling Parameter (β)	RMSE (m)
Buoy		0.1945169
Altimetry	2.38	0.0759509
Wave Model	-0.54	0.1066916

Conclusion

- Although the SSH from the SAMOSA retracked data are highly correlated with the tide gauge measurements, the mean difference between the two is 2.4 meters
- Low RMSEs were observed in collocating SWH data