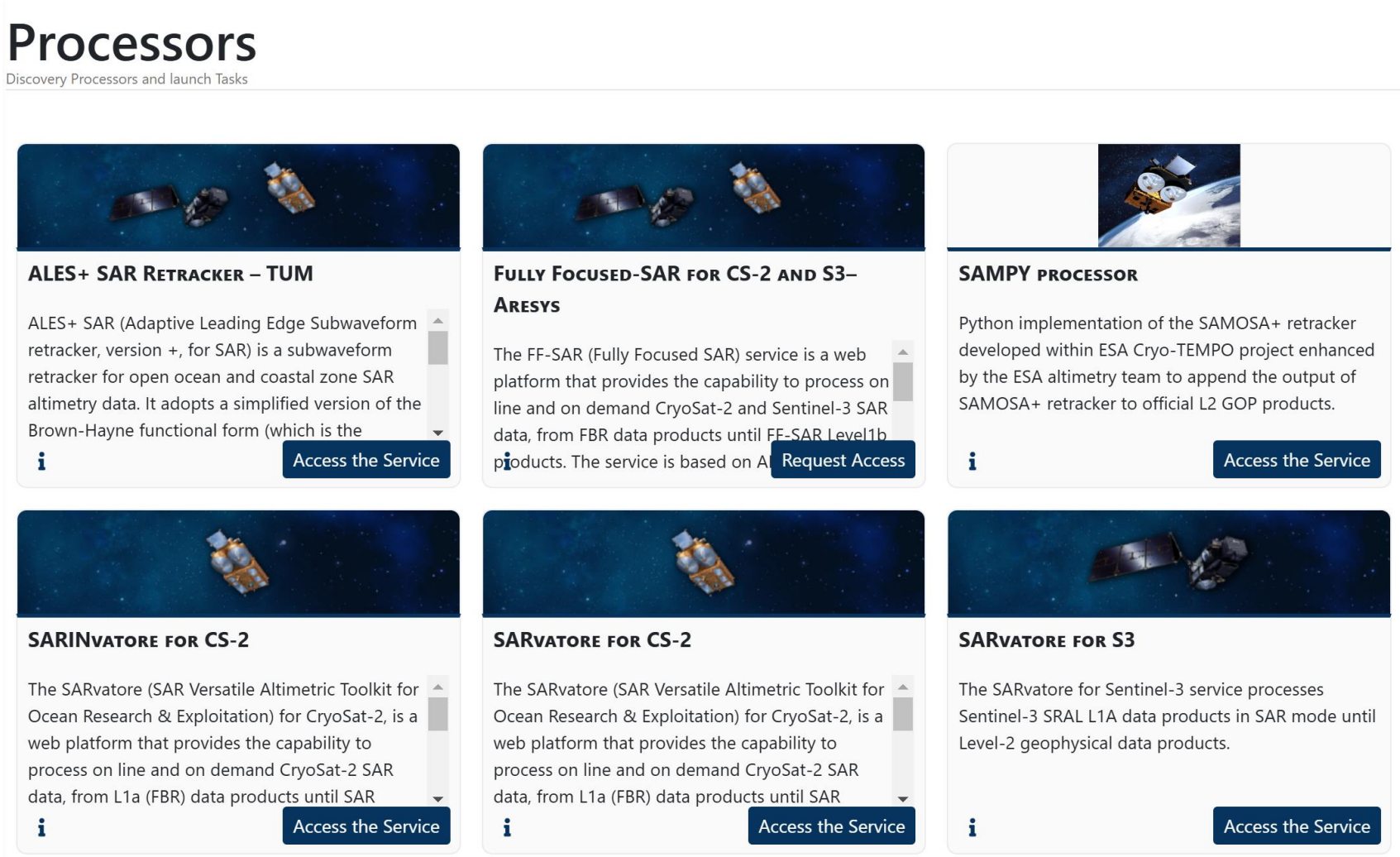
Localization of Space-Based Measurements through Correlation with In-Situ Measurements

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

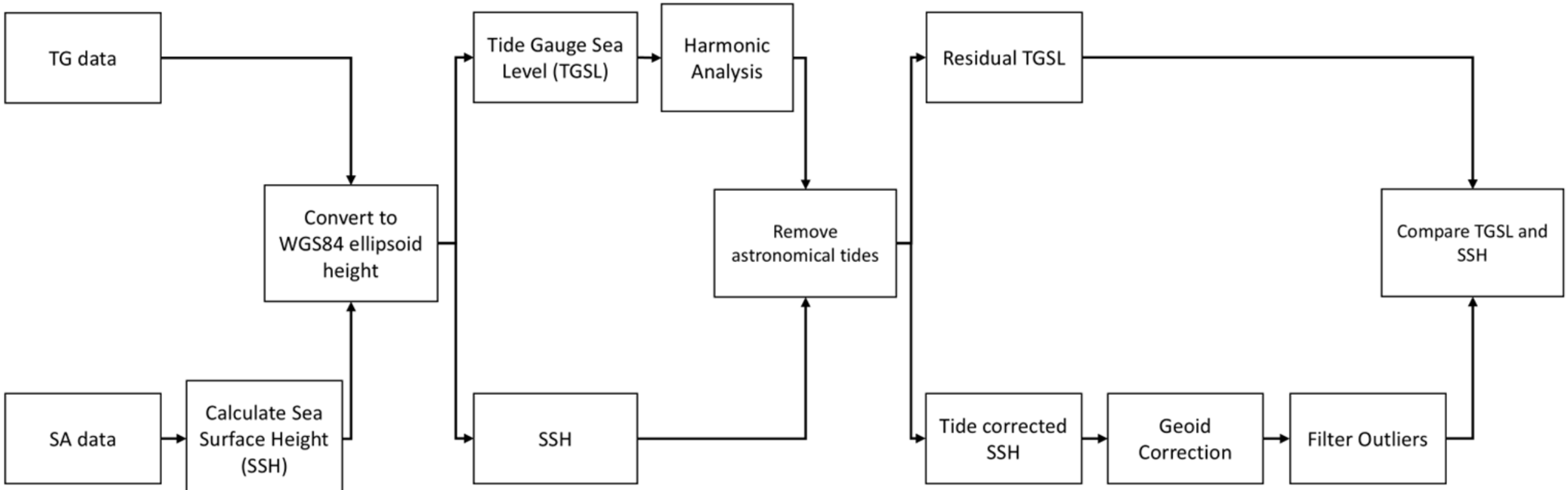
Access of Data

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



METHODOLOGY

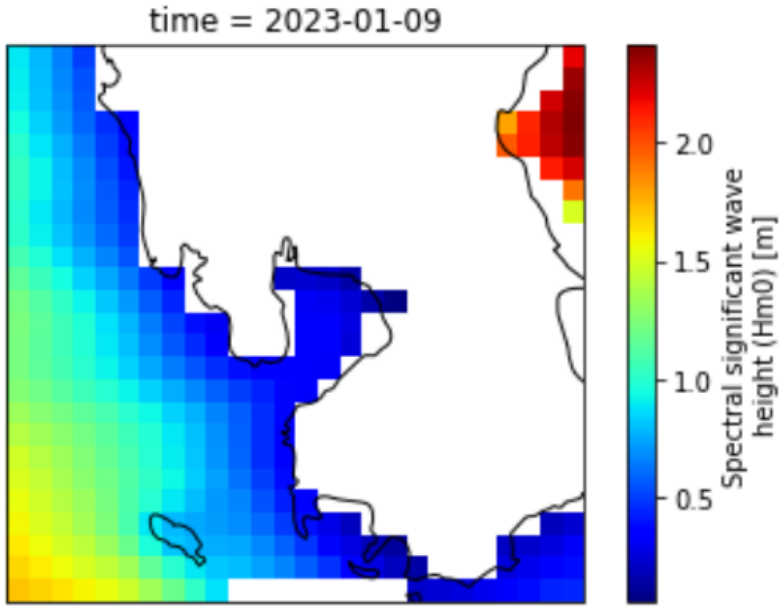
Sea Surface Height

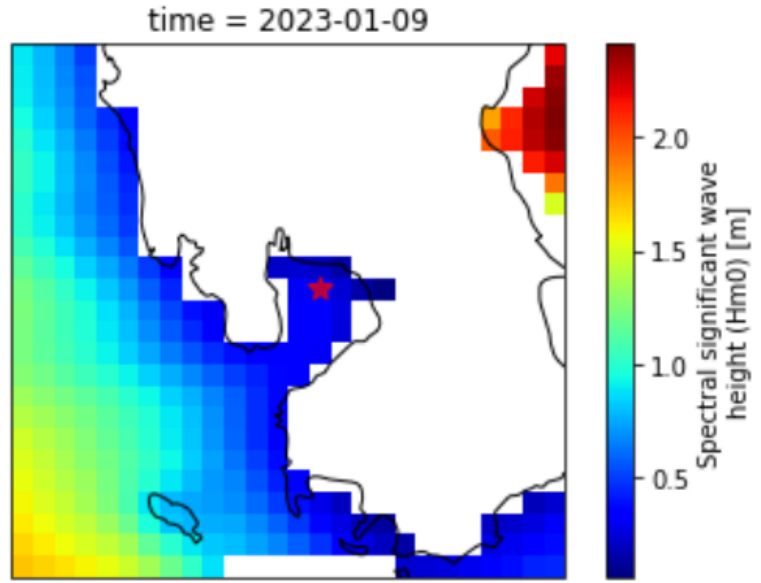


Significant Wave Height

Datasets

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





Global Ocean Waves Analysis and Forecast (CMEMS)

- Spatial resolution: 0.083° × 0.083°
- Temporal resolution: hourly
- Buoy 2 nearest grid sample (right photo)

Significant Wave Height

Triple Collocation

Fonseca et al, 2019; Stofelen et al, 1998

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

α = bias

e = errors

β = linear calibration/scaling parameter

To compute the RMSE

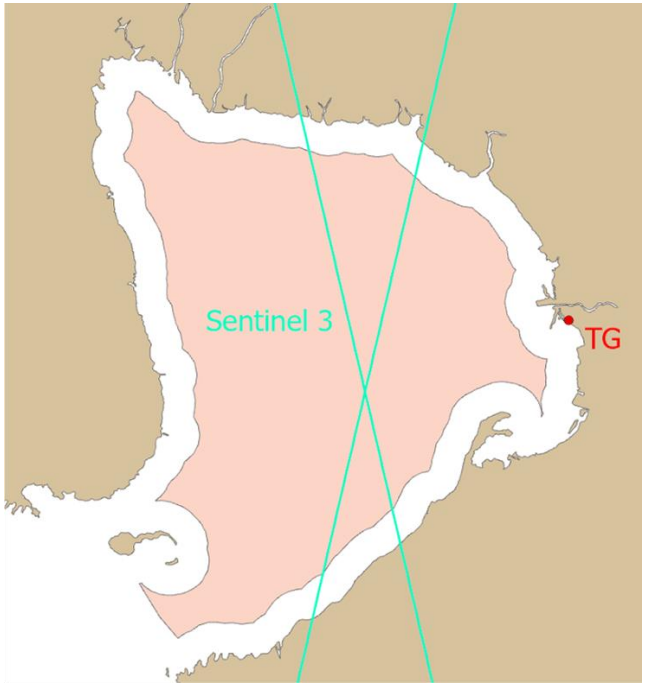
$$\langle e_{buoy}{}^2 \rangle = \langle (H_{buoy}{}' - H_{ASAR}{}')(H_{buoy}{}' - H_{ww3}{}') \rangle$$
$$\langle e_{ASAR}{}^2 \rangle = \langle (H_{ASAR}{}' - H_{buoy}{}')(H_{ASAR}{}' - H_{ww3}{}') \rangle$$
$$\langle e_{ww3}{}^2 \rangle = \langle (H_{ww3}{}' - H_{buoy}{}')(H_{ww3}{}' - H_{ASAR}{}')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

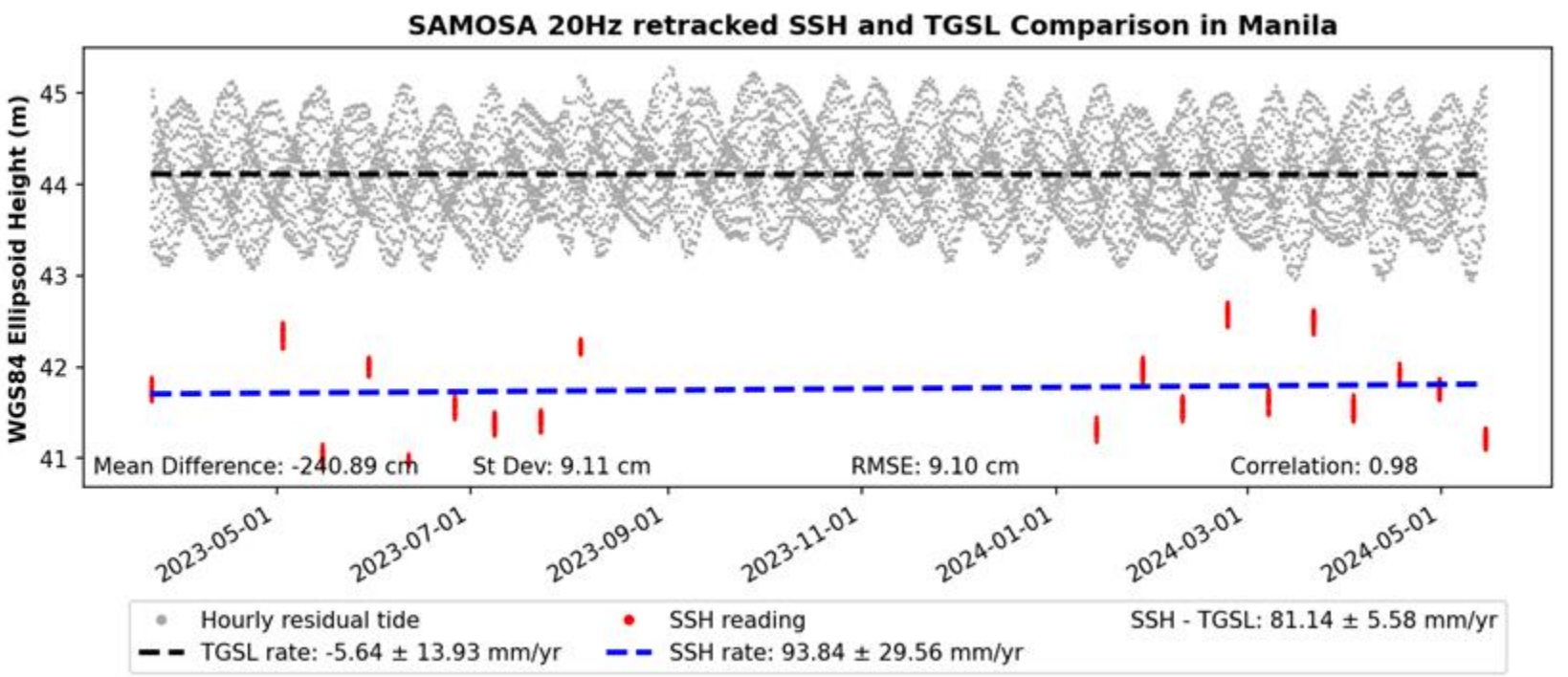
- Metrics.tcol_errors(x,y,z)

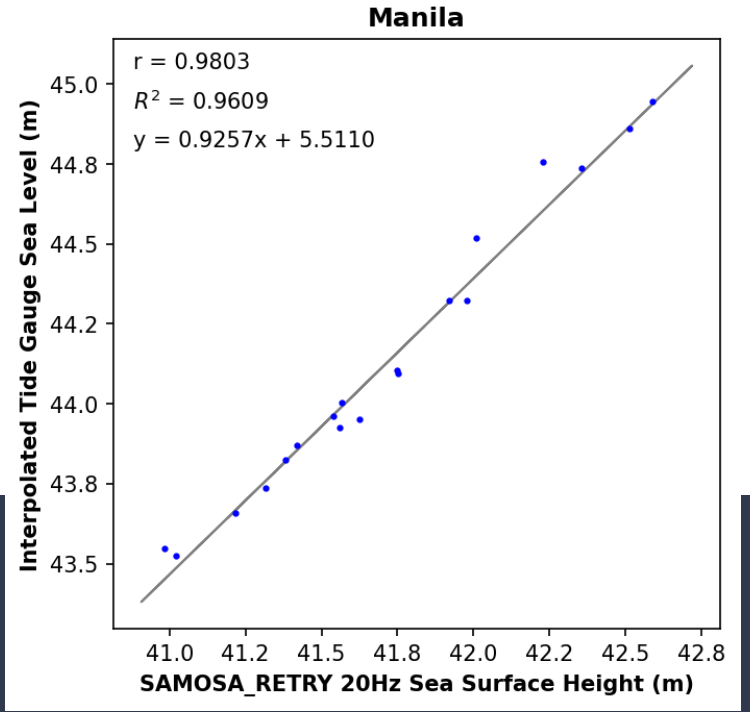
RESULTS

Sea Surface Height

Comparison of Hourly TGSL and Sentinel 3 SSH

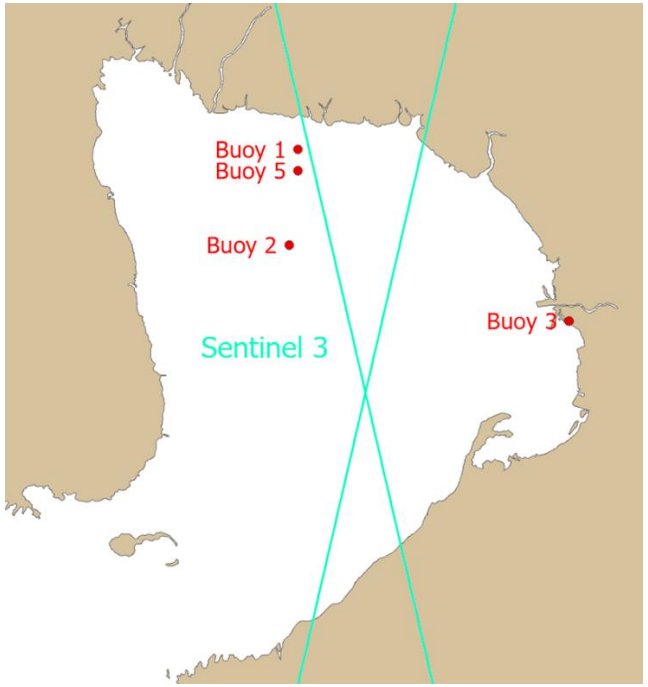






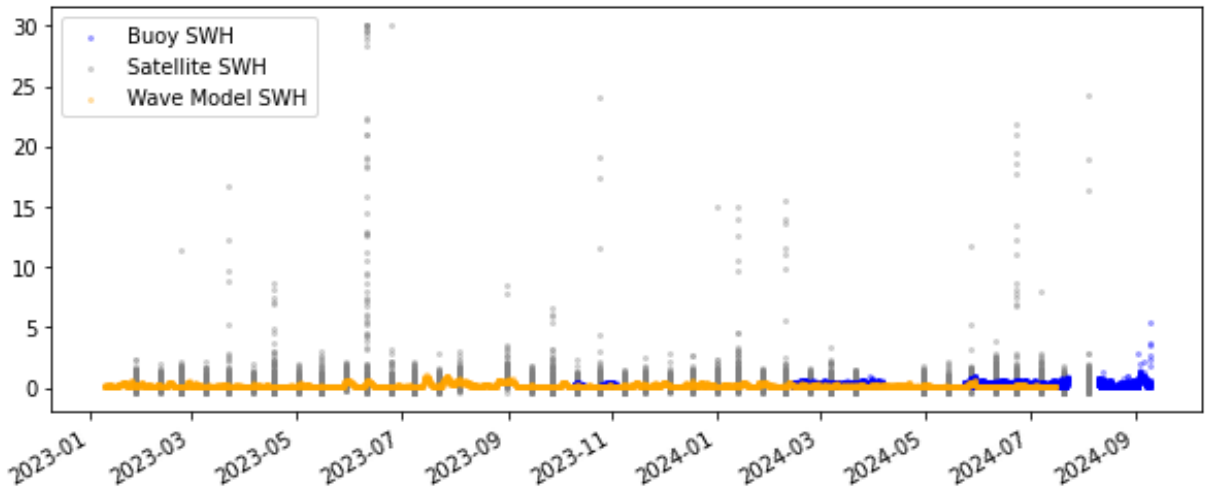
Significant Wave Height

Using Sentinel 3 SWH and model extracted using Buoy 5 coordinates

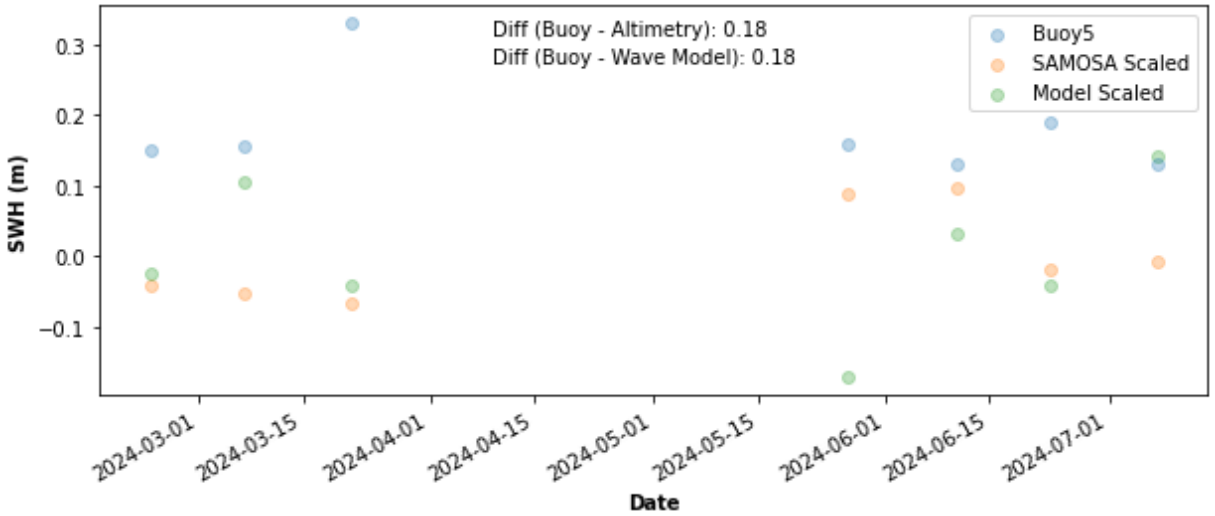


**Original values before averaging to hourly*

Original values

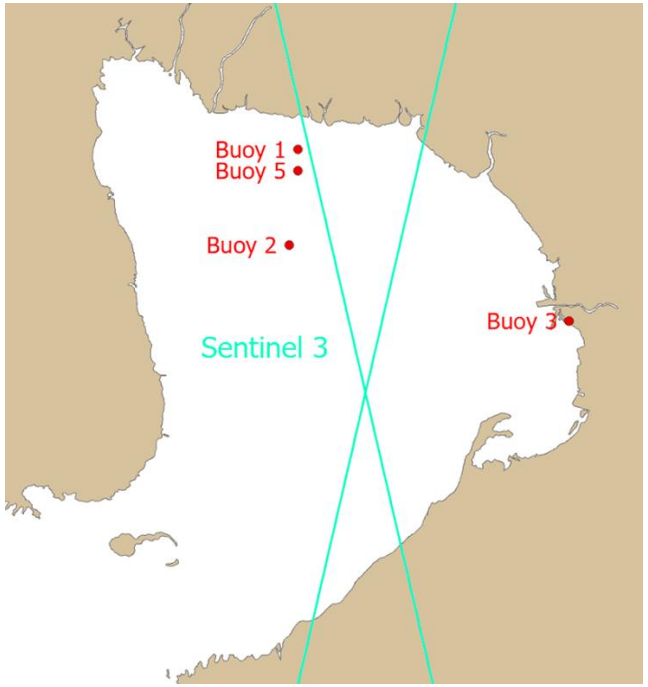


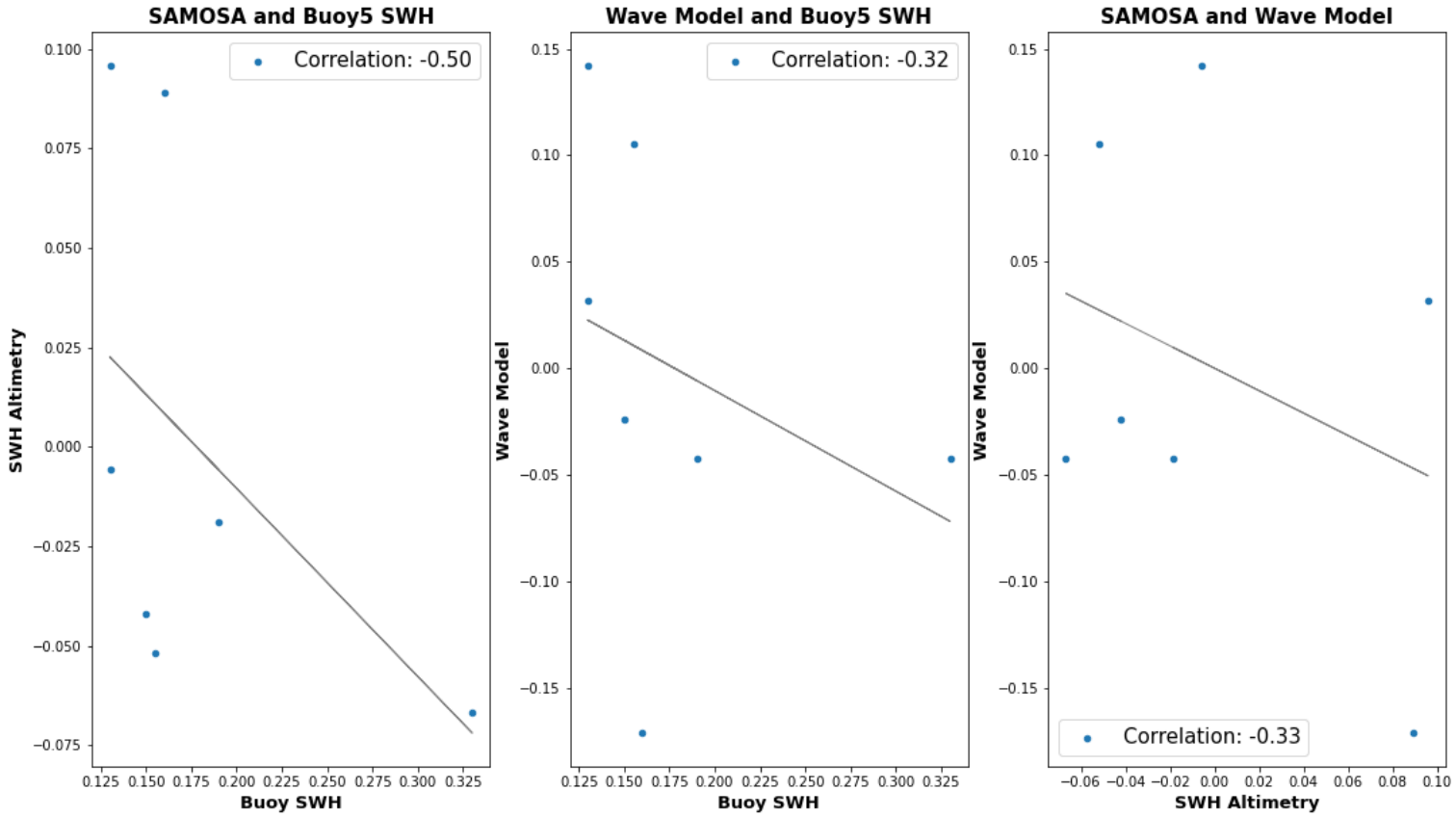
Scaled values



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 corelated with the tide gauge measurements, the mean difference between the two is 2.4 meters
- Low RMSEs were observed in collocating SWH data