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Sentinel-3 updated Waves from the new "G62" baseline

The Copernicus Sentinel-3 (S3) mission is operated by EUMETSAT, that is also responsible for providing altimetry products in the global ocean domain. This includes open ocean, coastal zone and polar ocean. EUMETSAT has studied, developed, and put into operations (Q1/2026) a major update for the S3 mission, the "G62" baseline.

This poster focuses on technical evolutions performed in the marine altimetry processing chain to improve the SAR wave data. Several key updates were performed to the SAR Significant Wave Height (SWH), including the implementation of the vertical wave motion correction, introduction of a spectral window at level-1 processing and update of the retracker to SAMOSA+ at level-2.

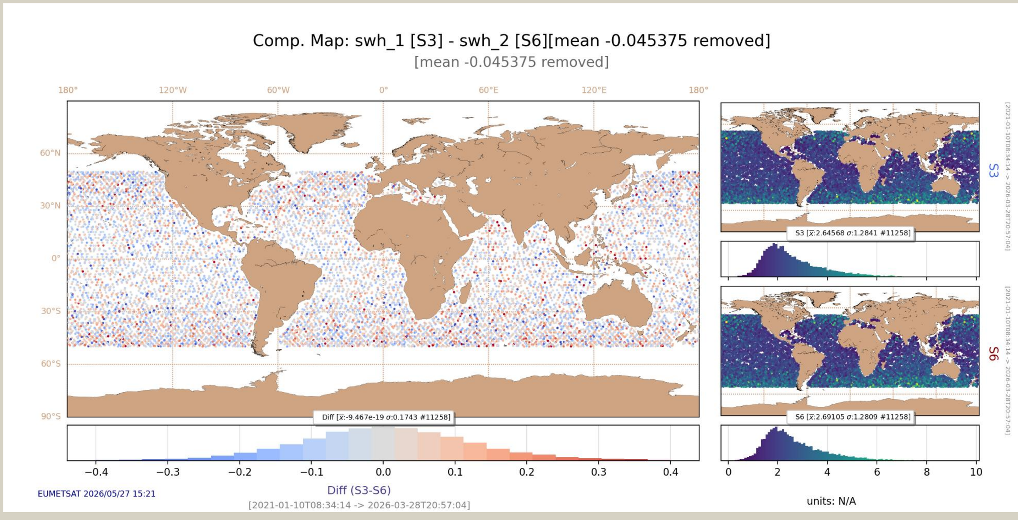
We introduce and validate the updated SWH, against other flyting instruments, such as altimetry reference missions (Jason-3 and Sentinel-6). Comparisons against in-situ buoys will also be presented. The comparison against CFOSAT's SWIM instrument data (nadir only) will be performed in future work.

As part of this processing baseline, a series of new altimeter derived wave parameters have been introduced, such as mean wave period; wave skewness; wave steepness; wave pseudo age and wave sigmaV. A small comparison is shown against MFWAM model, the SWH of the model is also compared against the altimeter.

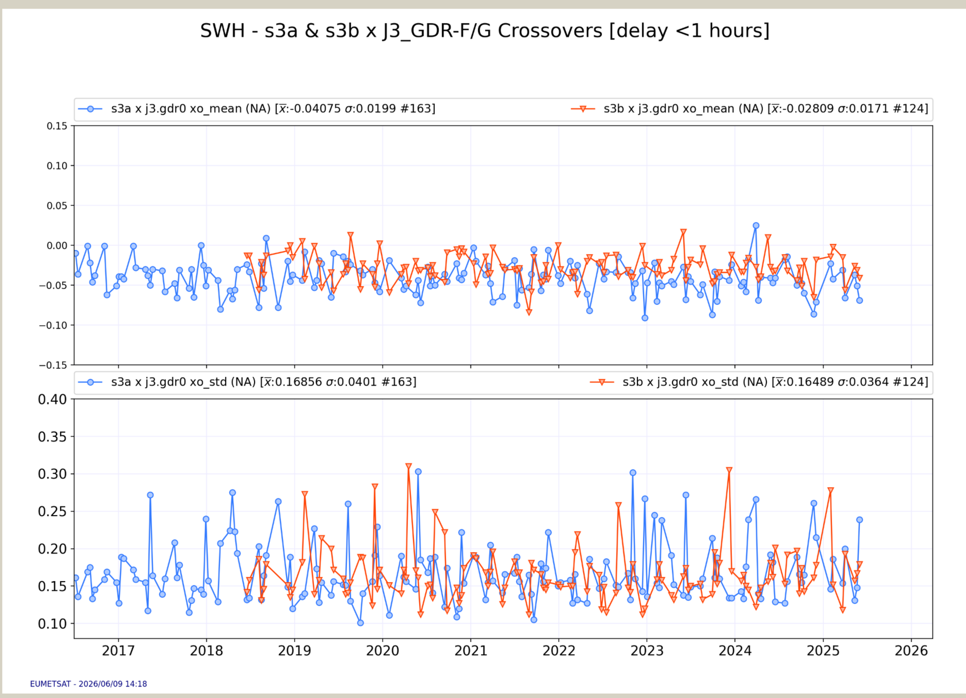
The analysis takes a long-term perspective, utilizing the fully reprocessed Sentinel-3 global ocean products, from start of the mission to the present, showing the excellent results of Sentinel-3 wave height and the stability over time.

Comparison against Reference Missions

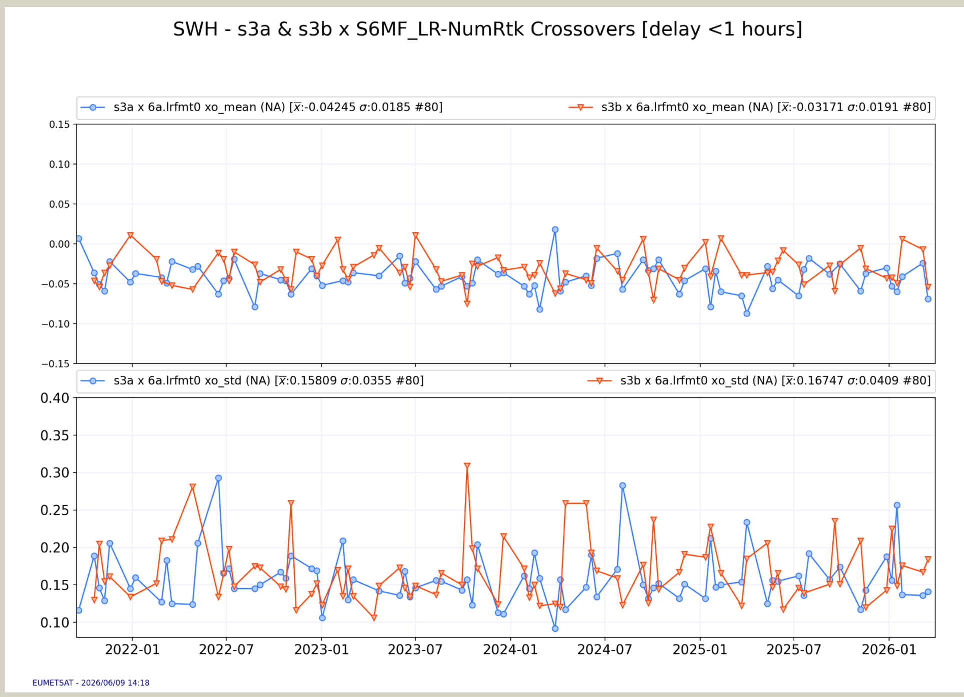
The images on this section were generated based on Crossover Analysis, using RADS. The mean values of the data were not adjusted, but clear outliners (outside the 3-sigma range for mean or standard deviation) were excluded. The data was selected over ocean without shallow bathymetry and with latitudes below 50 degrees to avoid a potential ice contamination. The distance to the coast is superior to 50 Km and SSHA, Wind Speed and SWH must be within nominal limits. The delay between the crossovers is up to 1 hour. For the timelines below the values are binned into 10-day aggregations. The top panel of each timeline shows the mean value of the differences and the bottom panel the standard deviation of such differences. The bottom left figure shows the crossover results of both Sentinel-3A (blue) and Sentinel-3B (red) against Jason-3 retrievals. Similarly the bottom right figure shows a comparison against Sentinel-6 MF, using LR mode and Numerical retracker.



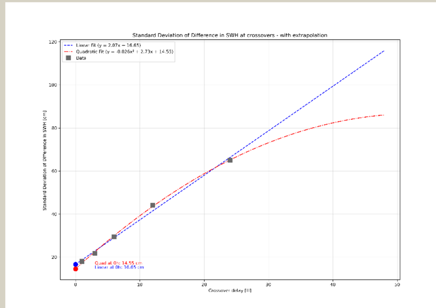
The same crossover points have been plotted geographically to verify the existence of any regional pattern, that was not identified. On the figure, S3A is compared against S6 MF LR/NR and the mean difference is removed from the comparison.



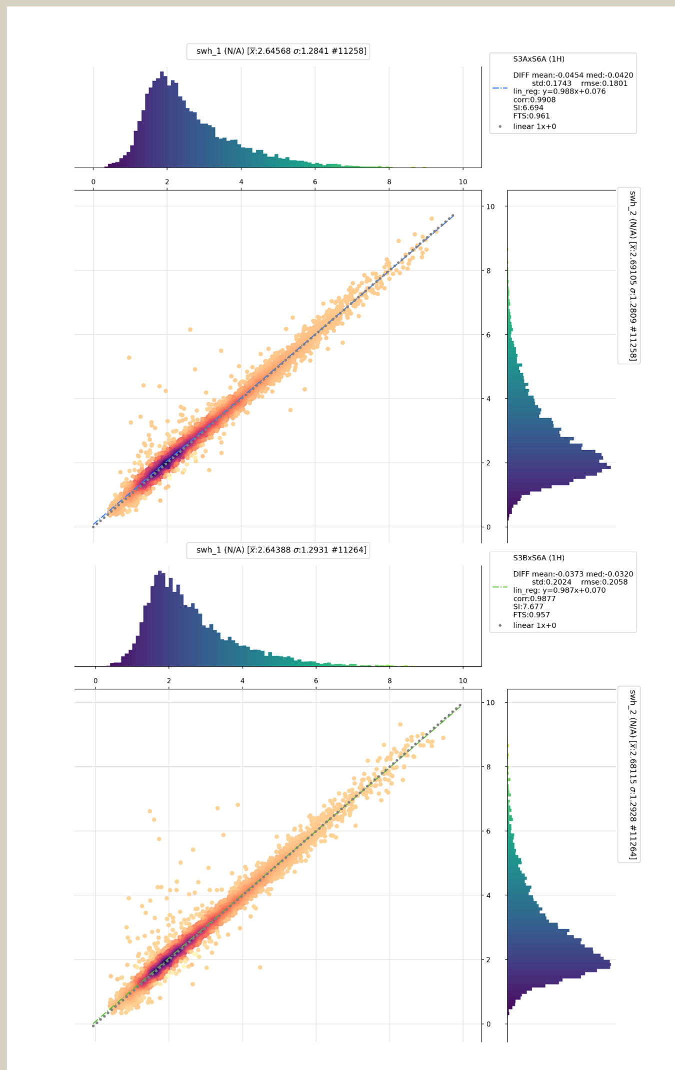
Timeline of crossovers for SWH against Jason-3. S3A in blue and S3B in red.



Timeline of crossovers for SWH against S6 MF LR/NR. S3A in blue and S3B in red.



An extrapolation was performed to estimate the intrinsic random noise of the of the crossover comparison by analysing the error across varying crossover time delays. Based on the zero-delay intercept, we estimate this baseline noise to be approximately 15–16 cm

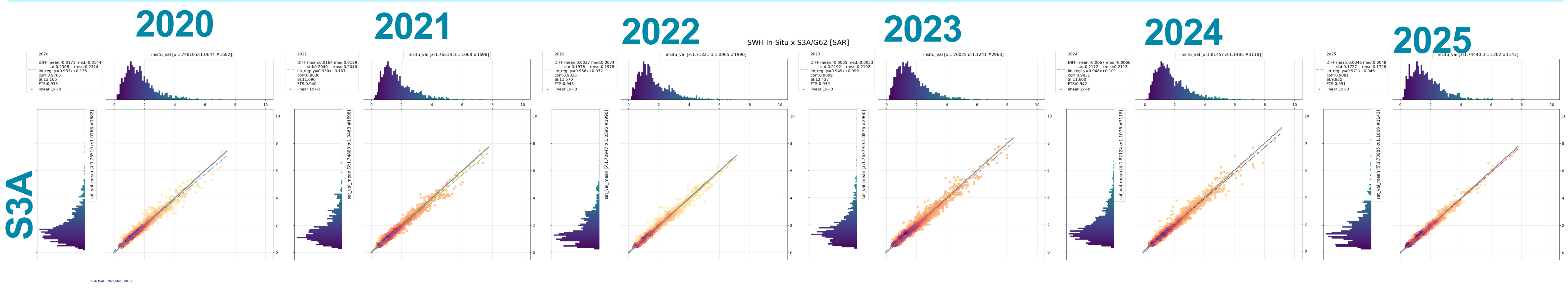


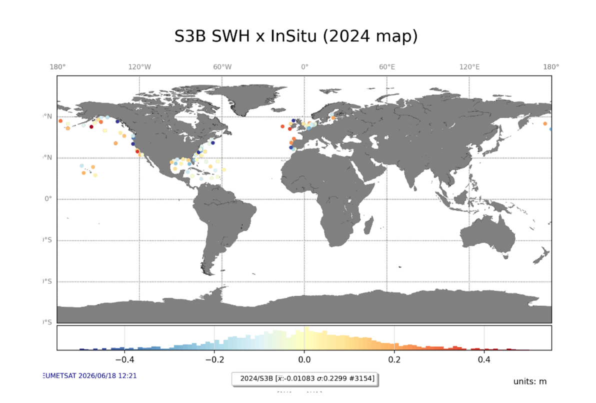
The above scatter plot shows the comparison of all individual crossover measurements for S3A versus S6 (top) and S3B versus S6 (bottom). No SWH dependency is visible. But there is a mean bias when comparing to the reference mission, with S3 underestimating SWH. This will be further investigated.

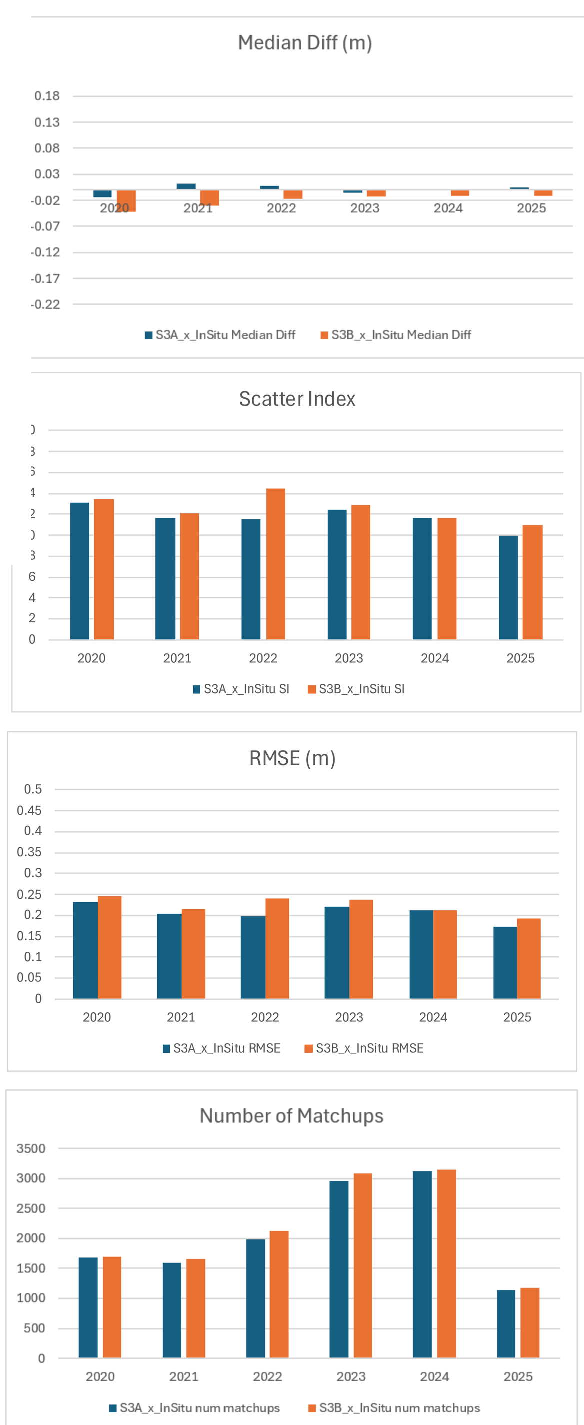
The short crossover time delay, which reduces the number of crossovers points, is necessary to capture fast evolving conditions but results in a noisier result, when comparing to standard SSHA crossovers of several days. Nevertheless, there is a very good coherence and stability in the comparison and no visible drift is observed.

Comparison against In-Situ

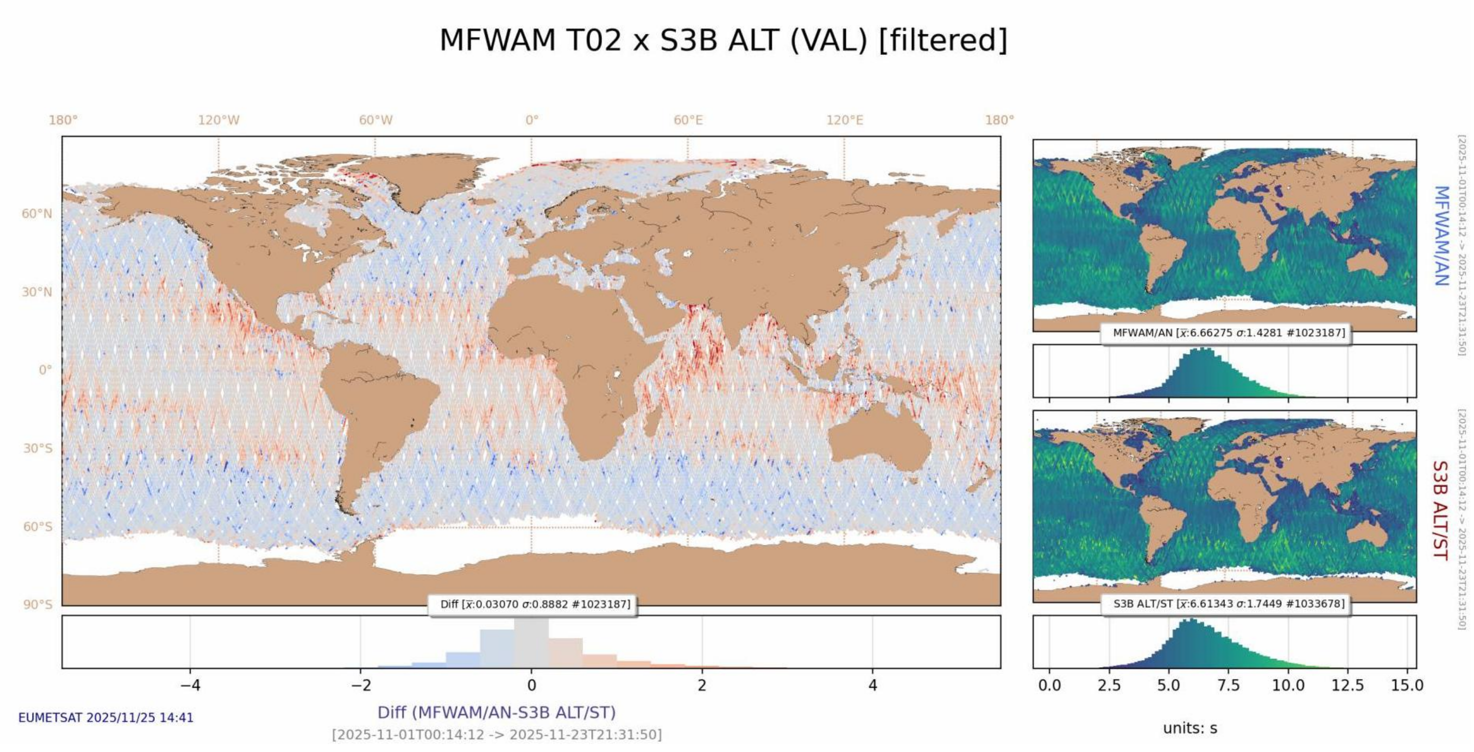
The following analysis was performed against in-situ SWH observations. These buoys are available on CMES in-Situ service, under the dataset INSITU_GLO_PHYBGCWAV_DISCRETE_MYNRT_013_030. The buoy data was filtered for valid quality, as per data QC flags, and matched against the satellite data, that was also filtered with the quality flags in the product. Only on the case of a time delay less than 10 minutes and 50 km are considered. Costal buoys (less than 50 Km from the coast) are rejected. Buoys with very few measurements per year are rejected also. A yearly comparison was done, shown in the scatter plots below (detailed scatter plots shown only for S3A SAR). The values yearly evolution is displayed on the right side, with Media Difference (top), Scatter Index, Root Mean Square Error (RMSE) and number of matchups (bottom), for both S3A (blue) and S3B (orange). The geographic location of the matchups was plotted (top right side) and it can be see that these are close to the continental platforms and lack a wide geographical distribution.

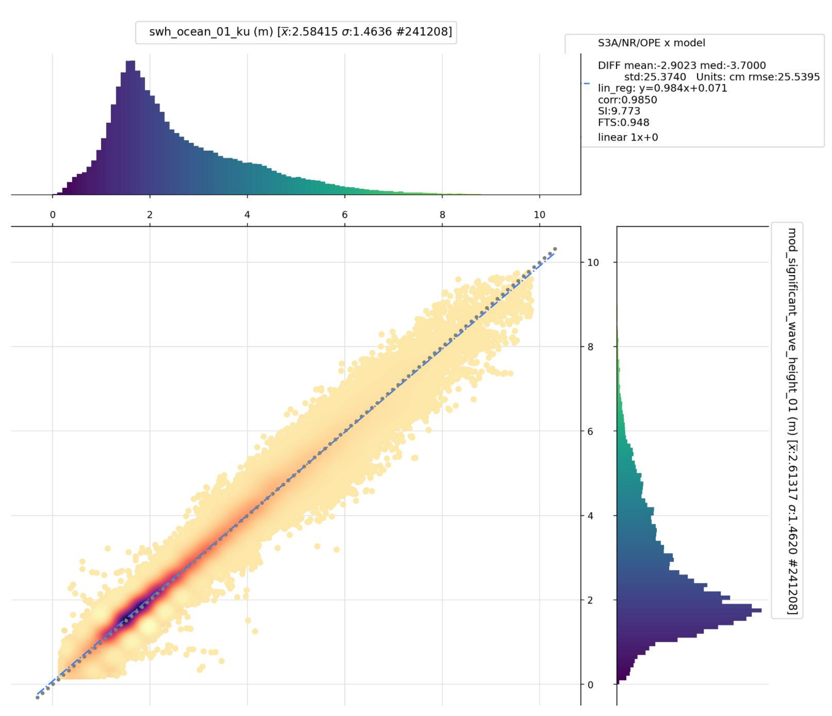






Comparison against Model





In the new processing baseline there are now several sea state properties derived from altimetry, including mean wave period (mean_wave_period_t02_alt_01_ku) that compare very well against the model data (left). On the right we have a scatter plot comparing MFWAM model data (pre-assimilation of S3 data) against the S3 SAR SWH data (in NRT), there is an excellent match.