Comments on the manuscript

"**WAPOSAL: A Multi-Regional Wave Dataset from Satellite Altimetry for Significant Wave Height, Period Estimation, and Wave Power Density",**

submitted by S. Ponce de Leone et al to ESSD

General comments

This manuscript presents a new data set which contains in particular, an estimation of ocean wave power density in various coastal sites, at high spatial resolution. It is based on satellite radar altimeter measurements functioning in the "Synthetic Aperture Radar" (SAR) mode. The wave power density estimation relies on two variables classically provided by the satellite altimeter measurements (the normalized radar cross-section and the significant wave height H_S), which are estimated here using a processing specifically designed for SAR-altimeters and coastal regions (SAMOSA+ , see Dinardo et al, 2018), combined with an empirical function which relates these two variables to the zero-crossing wave period T_Z. This empirical function to estimate the zero-crossing period was already proposed and assessed by Gommenginger et al (2003), but the authors present here a new estimation of the relationship and a validation based on their satellite data set and buoy measurements.

The data set presented by Ponce de Leon et al. was obtained from two satellite data sets (Sentinel3A/B and Cryosat-2) and covers the Atlantic coasts of Europe, Madeira, the French Polynesian archipelagos, the Azores, the Canary Islands, the Mediterranean and Baltic Seas, and the coastal zone of French Guiana, over a period of 13 years (2011-2023).

This data set is new, and should interest users involved in the development of energy production from the waves. It is potentially an interesting downstream product from satellite observations. However, at the moment it lacks information on the possible biases on wave power density induced by the method developed by the authors.

As the data set also contains significant wave height and zero-crossing period with a high spatial resolution and in various coastal zones, it may also serve the validation of wave models specifically designed for these coastal zones and other oceanic and coastal applications.

The manuscript suffers however from a lack of details regarding i) the method to estimate the zero-crossing period and its validation, ii) sources of errors and error estimates concerning the wave power density , iii) the practical usefulness of the data set for wave energy applications, taking into account the time sampling at each site, which seems not very high.

After revision, I think that the manuscript could be published.

Specific comments

Section 2.2

- In Gommenginger, the empirical relationship between T_z and X is proposed based on dimensional arguments, which implicitly assume that the wave dispersion relationship is the one valid for deep water. Here, you apply it in coastal environment with various depths. So, justify why this approach may still be used even if applied in shallow water.

- Concerning the evaluation of the a and b coefficients of the T_z equation: please be more clear on how it was done: (a,b) values estimated for each buoy location ? or mixing all locations ? According to line 92 it seems that it is done for each location, but improve the clarity in the text earlier in the text. And explain in the manuscript why this has to be done for each location. I guess that doing so, the result of the fit (coefficients a,b) is adapted for each encountered condition of sea-state and bathymetry. But please, comment in the text. Also, do you mix all satellites data when you perform the regression or do you separate

the data sets between Cryosat, S3A, S3B? Please also comment in the manuscript and justify (if you mix all the satellites, did you check for potential H_s or σ_0 biases between the three satellites?)

- training and validation sets : please give more details about how data sets have been separated: all buoys used in both steps? Different time periods for training and validation? Random selection?

- about results of the regression: can you comment on the range of values obtained for (a,b) from the different sites? And also is the quality of the regression the same for all sites? More generally what is the quality of the fit when estimating (a,b)?

- Comparison of H_s and T_z between satellite and buoy measurements (Fig.2): The results seem really good but it would be useful to know whether all sites give equivalent quality or, regarding T_z, whether some of them (in particular those more exposed to swell) give results of less quality. This is an important information to provide to the future users of the data set.

- estimation of wave power density *P*: you provide an expression which relates the "energy period" T_e to the mean zero-crossing period T_z. However, it is known that the relation between T_e and T_z depends on the wave spectrum shape (see Cahill, and Lewis, 2014 – same paper as in you reference list). So, you must mention the underlying assumption on the wave spectrum shape associated with this relationship and estimate the possible bias on the wave power density due to other sea state conditions (or shape of wave spectrum). At least give a range of error in the estimate on *P*. Also, a statistical comparison of *P* from buoy and satellites using, for the buoys, T_e directly estimated from the buoy spectral measurements would give more confidence in the data wave power density set.

Section 4 (example of data application)

Line 158-160 and Figure 3: please mention what is the time period of averaging (annual mean or over all the data set period ?)

Lines 162-163 and figure 4: please mention what is the sampling time for this estimation of wave power density. Are the values plotted in Fig.4 averaged over a given time period? Or is it the minimum sampling time that is shown in Fig.4 ? If the sampling period is more than 1 or 2 days, discuss about the usefulness for wave energy applications with such long gaps.

In Fig.4- bottom panel, I suggest that you overlay the results from S-3 1/B and discuss on their agreement with the estimations from Cryosat.

Suggested technical corrections

- Everywhere: please number the equations

- Lines 74-76 = Suggestion to make the sentence and reference to Gommenginger more clear: " In (Gommenginger et al., 2003), it was **suggested**, **based on dimensional arguments**, that T_z is linearly related to **a variable named X, which is** a combination of significant wave height $\mathbf{H_s}$ and of the normalized radar cross section $\boldsymbol{\sigma_0}$, with $X = (H_s^2\ \sigma_0)^{0.25}$, and σ_0 expressed in natural units (non-dB)."

- Suggestion for Line 77: **Therefore, following Gommenginger et al, 2003, using collocated T_z in situ wave buoy data and altimeter H_s and σ_0 data, we have re-evaluated for each collocated data set the coefficients (a and b) of the following equation**:

$T_z = a\ X + b$

- Before line 80: add a sentence to explain that the method was validated by Gommenginger et al. 2003, using Topex altimeter measurements and a set of NBDC buoys and why it is necessary to establish again this relationship in your analysis.

- Line 93: suggestion; **Using the triplets** (σ_0, H_s from altimeters T_z from buoy), the regression coefficients a and b were determined **for each buoy location**

- Line 109: inconsistency between the reference given here and the reference in the list at the end of the manuscript. I think that the reference here is Cahill and Lewis, 2014, not Cahill, 2012.

- in the reference list: the doi and doi link for "Kasiulis et al, 2015" is not correct.

Data description and data availability

Following the link given in the manuscript, I checked that I could access to the ncdf files (sorted per country, satellite, date, and satellite tracks). But I did noy find the .zarr files mentioned in section 3 and in appendix A.

There is a small Inconsistency between the content of the manuscript and the general description found when following the link indicated in the abstract and at line 147 or 204 (https://doi.org/10.57780/ESA-1AB8CF3) . Indeed, in the landing page of https://doi.org/10.57780/ESA-1AB8CF3, the products that are mentioned are H_s and T_z but not the wave power. However, the product handbook is consistent with the current manuscript. (see screen copy below).

Parameter	- **Name:** wave-period - **Name:** wave-height

Open Science Catalog

Project	WAPOSAL
Status	completed
Region	severeal
Type	product
Missions	Sentinel-3, CryoSat-2
Variables	Wave Period, Wave Height