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Interactive comment on "A coastally improved global dataset of wet tropospheric corrections for satellite altimetry" *by* Clara Lazaro et al.

Anonymous Referee #2

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The paper presents a dataset of wet tropospheric correction applicable to altimetry and the methodology used to product it. The wet tropospheric correction is one of the correction applied to the altimeter range to compute the Sea Level Anomaly. The WTC is traditionnaly provided by on-board microwave radiometer, measuring in appropriate frequencies bands to correct for the excess path delay. The estimation of the WTC from the MWR measurements can be degraded by extreme rains events, ice surface, land contamination in coastal areas, instrument malfunctions. The author proposes a method named GPD+ that intend to improve the MWR-based WTC of operational processing, or propose a correction for mission without MWR on-board (Cryosat-2).

The method consists first in the filtering of the invalid WTC estimation from the operational product and second, by the estimation based on the objective analysis using

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Discussion paper

external data such as GNSS data, MWR Imaging data (providing water vapour), Numerical Weather Prevision model (ECMWF, ERA interim). The method is applied to almost all conventional missions.

The dataset used for the algorithm is rather well defined. The section about the GNSS dataset lack a discussion about the coverage of this network. Although the paper states otherwise, GNSS stations don't seem to be distributed globally over the globe. The section about the Imaging radiometer seems more dedicated to the filtering step of the method than to the description of the input dataset itself and the added value of this dataset. The NWP dataset is slighlty described, and lack a discussion of the difference between ERA Interim and ECMWF. The paper don't say if one mission can be covered by only one model or if two are needed, if there is a bias between the two models that shall be corrected. Also the paper stated that NWM data are provided as output from GPD+ for northernmost latitudes, but the method to adjust the model to measurements is not clearly defined (is it a simple bias computed over each cycle?).

The algorithm is well described and the workflow provides a clear overview of the processing. The method is assessed for Envisat only in this paper. The paper introduces Full Mission Reprocessing (FMR v3.0) but compare GPD+ dataset to the Composite Correction extracted from L2P products issued from an older reprocessing (FMR v2.1). According to the L2P product handbook available on AVISO, there is no composite correction in the L2P products, only MWR-derived correction. This point must clarified. In the validation section, both corrections (MWR-based and composite) are used for comparisons. it is difficult to follow which version of the Envisat MWR-based correction is used for the generation of the GPD+ and which one is compared to the GPD+.

The number of 30% of invalid WTC data over ocean for Envisat is stated but not justified. This number seems quite high. Moreover, the criteria to select valid SLA points is not discussed. The paper shall define the criteria of validity of the SLA. The L2P products provide a validity flag that could be used. The comparison of GPD+ with GNSS is more a validation of the method than a performance assessment. This section can

gain in clarity in the method used for this comparison. GNSS data are not independant of GPD+ data. Is the GNSS data cited in this section also used in the generation of the GPD+ dataset (data from another network for example)? In the first sections, one of the criteria for rejection of MWR-based correction is the distance to coast, but it is not clear if this criteria is used in this section. The fact that the method is not clear makes the figure 7 difficult to understand.

The paper provides a performance assessment (and not accuracy) of the section 3.2 using analyses of Sea Level Anomaly variances. In this section, the author compares the composite correction which is not part of the L2P products to the GPD+ correction. The method used is to select all valid SLA points, and for the points with the composite outside limits or invalid, the ERA interim WTC value is used. These points shall be discarded from the analysis as they do no represent a fair comparison with the MWR-based correction as the use of the model correction will degrade it. The previous sections have already shown that the GPD+ retrieve some invalid points. The color scales for figure 9 is not well chosen and is difficul to read. Figure 10a shows a strong peak, with not physical values, for latitude around 50°N that is not explained in the paper. For this diagnosis, it is not stated if data cover open-ocean only, or ocean and coastal areas. Moreover the figure shows a reduction of the SLA variance from 200km up to the cost but it is difficult to see the improvement close to the coast.

Although the paper title is “A coastally improved global dataset”, there is no real focus on coastal areas. It is not stated clearly in the paper but it seems that the dataset is based on 1Hz data where 20Hz data are more adequate for studies on coastal areas.

Minor comments

Row 118: “GNSS network of stations distributed globally along the coastlines”: GNSS stations don’t seems to be distributed globally over the globe. A map could be added to show the position of the GNSS stations used for the generation of the dataset.

Row 195: “values of 15km have been used for Jason-1/2/3”: 15km seems quite small

for this serie of MWR knowing that they measure at three frequencies, including a 18.7GHz with a large footprint. What is the reason for that?

Row 201: Talking about Envisat datat from latest reprocessing, the author states “30 % of the oceanic points have an invalid WTC value”: This seems quite a large number of invalid points when focusing on ocean surface only (with a valid SLA). From Figure 2, it does not look like one third of the points are invalid. How do you explain that number?

Row 209: the author states “Data from the reference missions”. For a non-specialist audience, the author should explain which are the reference missions.

Row 219: for the intercalibration processing, the difference at cross-over points with a time-lag of 180 minutes between reference missions and other altimetry missions are computed. Is that time span not too large for WTC ?

Row 229: “In addition, to reduce data discontinuities, ….” : from this sentence it seems that a bias is computed between the MWR and the NWM correction for each cycle. What is the rationale for a simple bias? How is computed that bias?

Row 274-275: “To prevent the loss of points when interpolating to 20 Hz points, in addition to ocean points, the closest land point is included, provided it is within a distance less than 50 km from the ocean.” Can you clarify the processing here? what is the closest land point?

Row 320: “”The GPD+ WTC is here compared to the ECMWF Reanalysis WTC (ERA Interim, GDR field mod_wet_tropo_cor_reanalysis_01) and with the WTC present in the AVISO CORSSH L2P products in July 2019 (AVISO, 2017). The latter dataset is usually called Composite Correction ”. You state here that you compare the GPD+ to Composite correction, but latter (line 334). But according to the L2P products handbok (https://www.aviso.altimetry.fr/fileadmin/documents/data/tools/hdbk_L2P_all_missions_except_S3.pdf), there is no composite correction in these products. And latter, the author says that he used the field ’rad_wet_tropo_cor_sst_gam_01’. This point shall be clarified

Row 330: “Anomalies in this field have been found, with the field out of limits in a set of points, most of them concentrated on certain passes,” : Do you mean that you found anomalies in the ERA interim product for WTC field?

Row 334: “The MWR-based correction used in the generation of these files” : Which files?

Row 342: The author found 30% of points with a rejected MWR-derived WTC. This figure seems quite large. It could be interesting to discuss that number and provides some insights of the repartition within the different causes. It seems this number is estimated over ocean. Does it include coastal regions? Which latitudes?

Row 362: “Only GPD+ estimates retrieved using observations are selected.” which observations? MWR? GNSS?

Row 370-376: Methodology difficult to understand

Row 381: “On the contrary”: -> Moreover, Additionaly . . .

Row 384: “Accuracy assessment” ==> Performance assessment

Row 420: “third party data”: what are those third-party data?

Figure 5: b) and c) look quite similar with land/ice contaminated pass. Outliers are not obvious in c).

Figure 7: why is there an increase in the number of points for the GNSS-GPD+ comparison but not for the GNSS-MWR one?

Figure 9: The green color cannot be seen on the color scale.

Figure 10: What is this peak around latitudes 50°N?

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