

## ***Interactive comment on “C-GLORSv5: an improved multi-purpose global ocean eddy-permitting physical reanalysis” by Andrea Storto and Simona Masina***

**Anonymous Referee #1**

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This article generates an updated version of a previous Global reanalysis data. Part of the derived products has been made available in NetCDF format at doi:10.1594/PANGAEA.857995. The method used in generating the data has a number of improvements in comparing with the one used in the old version.

As a global ocean reanalysis dataset, they can be useful in many areas. Methods and materials are mostly described in sufficient detail to support the data.

It is observed that there exist similar global reanalysis datasets, e.g., in marine.copernicus.eu, ECCO or US HYCOM etc. Many components of the method description have also been published by the authors in other papers. However, these products haven't been inter-compared with the V5 data, either qualitatively or quanti-

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tatively. This makes it difficult to evaluate the “state-of-the-art” and “uniqueness” of the data.

The new data (V5) have been validated and compared with the old data (V4), which shows improvements in simulating variability of the sea ice and AMOC. However some features of the products have been degraded. Overall T/S validation in Fig.5 shows that only water temperature in upper 80m in V5 has smaller RSME than V4, T/S in other layers for V5 are worse than V4. The global SST comparison also show significant signals in several areas of degradation (Fig. 6). These results have not been analyzed in the paper for details.

The comparison of C-GLORSv5 with C-GLORSv4 and observations has partly followed the common standards, e.g., SST, upper layer heat content, AMOC transport index etc. but not so comprehensive in terms of validation. In CMEMS, validation matrix and specific QUID reports are made for each dataset.

The length of the article is appropriate. Overall structure of the article is well defined and structured and readable. However, presentation can be further improved, including in figures, acronyms, symbols. Please refer to detailed comments.

Detailed comments Acronyms: There are many acronyms not given their full name when first time shown, eg EN3, EN4, MDT, SLA, SSH, DMSP, RMSE, PIOMAS, OAFlux, ISCCP etc.

P1, L10: “a state-of-the-art ocean reanalysis”

Reviewer: as the article does not perform any cross-validation with other reanalysis products from different systems, it is very hard to say it is a “a state-of-the-art ocean reanalysis”.

P1, L18-19: “the new reanalysis outperforms the previous version, especially in representing the variability of global heat content and associated steric sea level, the upper ocean temperature and the thermohaline circulation.”

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Reviewer: the presentation can be more precise: “the thermohaline circulation” is AMOC, the “upper ocean temperature” is “slightly improvements in upper 80m but worse below for water temperature, and salinity is consistently worse in the upper 500m”

P1, L23: “a ocean” -> an ocean

P3, L29: “OcenVar” -> OceanVar

P4, L4: describe what is  $x$  and  $x_b$

P4, L10-15: VV and Vv shall make the same.

P6, L28: in the equation (5),  $\delta\bar{Z}_{ij}$  has been used in equation (4), but are different parameters.

P6, L32: “cost” -> coast

P8, L20-21: the analysis on Fig.5 results should more precise and detailed, notifying that temperature is only slightly better in upper 80m but not 100m, maybe it's good to give a quantitative value of how much the temperature and salinity are better or worse in different levels.

P8, L28: while there is a 3.2% decrease of RMSE for global SST, there exist significant degrade in Gulf Stream, Kuroshio extension and circum-Antarctic ocean. It should also be mentioned is the accuracy of the NOAA SST, ie. about 0.6C.

P9, L9-10: “C-GLORV5 data start in 1980 unlike C-GLORSv4 (1982)” should be changed to “C-GLORV5 data start in 1980 unlike C-GLORSv4 in 1982”

P9, L10-15: it is suggested to use longer period for comparison the trend, e.g. 1982-2013 where NODC, V4 and V5 all have data. Use 2003-2011 for trend inter-comparison may be affected by the statistical significance due to very small number of samples.

P9, L18-25: Figure 8 is not convincing to show that V5 has a better heat content trend

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than V4. Fig. 8c has 4 areas with large differences from V4, i.e., N. Atlantic including Gulf Stream, Kuroshio extension, South China Sea and circum-Antarctic ocean. Considering results from Fig.5 and Fig. 6, I would not conclude that these areas with significant differences are improved. The evaluation should reflect both significant signals of strength and weakness.

P9, L28: “RAPID-MOC” -> should this be RAPID-MOCHA?

P10, L5: 26N -> 26°N

P10, L21: “by a realistic” -> by a more realistic

P11, L3-4: “Based on this assessment, C-GLORSv5 proves a reliable tool for investigating the ocean and sea-ice interannual variability in polar regions.”

Reviewer: I am not sure if this statement holds. In terms of ice volume, V5 has more reasonable results than V4. But it is hard to justify that V5 is a reliable tool for investigating the ocean and sea ice interannual variability in polar regions. Even PIOMAS is just another model. Regarding to real interannual variability in ice volume, one cannot say much due to lack of data.

P11, L7-9: it would be good to have a reference here.

P12, L10-12: the summary here on V5's quality on T/S should be more precise, and reflect results from Fig. 5 and Fig.6.

P22, Fig. 3: title of vertical axis is missing

P23, Fig. 4: the legend “180d”: is this wrong? In the text it says 3 months, i.e., 90days.

P25, Fig. 6: the Caption should be rewritten

P26, Fig. 7: the correlation coefficients can be removed, as they are not explained and used in the text. Showing correlation generates a couple of issues: i) have the trends been removed before calculating the correlation? ii) the number of samples used and

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significant level of correlation

P28, Fig. 9 lower panel: the legends need to be corrected, "Sv"->PW .

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