

## ***Interactive comment on “Analyses of altimetry errors using Argo and GRACE data” by J.-F. Legeais et al.***

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We thank Reviewer 2 for his comments that will be accounted for to improve the manuscript. We respond below point by point to each comment.

First of all, please note that following the suggestions of referee #1, the structure of the manuscript will be slightly modified. However, the results and conclusions of the study will be unchanged.

In addition, we will ask the editor for a copy-editing of the manuscript by native English speaker in order to improve the typographical and grammar content. If it is not possible, we will do this before submitting the new version.

[1] In-situ DHA are computed using a synthetic climatology. This synthetic climatology

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has been computed following Guinehut et al. (2006): In-situ Dynamic heights (DH) are computed from Argo temperature and salinity vertical profiles with a 900 dbar reference level. These DH can be expressed as the sum of the mean field reference (that we want to estimate) and an anomaly ( $DH = \langle DH \rangle + DHA$ ). At this step, the in-situ DHA are considered to be equivalent to the altimeter Sea Level Anomalies (SLA) (in terms of anomaly). Thus, the mean dynamic height is computed as  $\langle DH \rangle = DH - SLA$  at each Argo profile. A global homogeneous field is then computed on a  $1^\circ$  horizontal grid using all DH/SLA pairs and through optimal interpolation." This will be included in section 2.2 of the revised manuscript. Ref: Guinehut, S., P.-Y. Le Traon and G. Larnicol, 2006 : What can we learn from Global Altimetry/Hydrography comparisons ?, Geophys. Res. Lett, 33, L10604, doi:10.1029/2005GL025551

[2] This will be changed in the revised manuscript.

[3] The caption of Figure 1 will be modified as required.

[4] The caption of Figure 2 will be modified as required.

[5] The sentence in section 4.3 will be reworded with: "At low frequencies (in blue), the SL\_cci product (triangle) is more in agreement with in-situ data than the SSALTO/DUACS product (circle). As the quality of climate products is rather addressed at these low frequencies (inter-annual and long-term evolution of the sea level), this highlights the better relevance of the SL\_cci products for climate studies."

[6] The correlations given in table 1 and 2 have been computed with a 95% confidence interval. This information will be added in the captions of tables 1 and 2.

[7] We state that the approach used for the collocation of altimeter (10-days box-averaged along-track SLA) and in-situ data leads to larger variability of the differences in regions of high ocean variability and that this could be reduced by computing maps of altimeter SLA by optimal interpolation (OI). We have compared the global statistics of the SLA-DHA differences obtained with grids of altimeter SLA from Jason-1 mission

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computed successively with the classical box-average method and with OI. The global correlation between altimeter and in-situ data over a seven-year period is significantly increased (+0.1) and the rms of the differences is reduced by 3.2 cm when using altimeter grids computed by OI. These significant improvements are directly associated with the SLA averaging technique: for each SLA map computed by OI, temporal correlation scales are used to weight the data whereas all data have the same weight when averaging over a 10-day window. We have not checked further the impact on the decrease of the error in areas of high ocean variability.

[8] In section 5.2, we mention that the estimation of the trend of SLA-DHA is little affected by removing areas of high ocean variability. And a few lines later, we illustrate with Fig. 6 that the global statistics between SLA and DHA are modified when removing these areas. As this may be confusing, the sentence will be modified with the following: "This indicates that contrary to the trend of the SLA-DHA differences which is less sensitive, the global statistics computed between altimetry and Argo data are significantly affected by the areas of large ocean variability."

[9] Labels and legends of both panels in Fig. 10 will be enlarged so that they can be better read.

[10] The sentence regarding the choice of the reference level of integration of Argo floats in the introduction of section 5.7 will be clarified. Thus, the first sentence of section 5.7.1 will be reworded accordingly as requested: "For a given reference level of integration of the vertical density profiles, only the floats reaching at least this level will be used to compute the associated DHA whereas shallower floats will not be included in the calculation."

[11] In section 5.7.3, it will be specified in the text that the in-situ DHA referenced to 900 dbar is represented by the black triangle in Fig. 15. The end of the sentence will be removed and replaced by "This reduced vertical sampling of the water column leads to a decrease of the DHA standard deviation by a 0.85 factor at global scale."

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