

## ***Interactive comment on “Improved sea level record over the satellite altimetry era (1993–2010) from the Climate Change Initiative Project” by M. Ablain et al.***

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The comments of reviewer#2 allowed us to improve the paper. Our answers are described below. The revised version of the manuscript taking into account these comments is in attachment.

### General comments

The manuscript is well organized and written, and the work of the CCI is important and comprehensive. My main concern with this manuscript is that it relies heavily on several reports from the CCI\_sl project. I understand that the process used to evaluate and select corrections was reviewed by an external panel, this external review

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process should probably be summarized in a sentence or two in section 2 or 3. For my evaluation of this paper, I am assuming that those reports are beyond the scope of this review.

=> This comment of reviewer#2 is relevant and very useful to better understand the process to select new corrections. We have added two sentences at the beginning of section 3.

1) On page 2032, I found these two sentences misleading: "During the 1st phase of the project, that lasted 3 years from 2011 to 2013, satellite altimetry data from 7 altimeter satellites have been reprocessed by the SL\_cci consortium. Improved satellite orbits have been computed using up-to-date force models and an improved reference frame realization." TOPEX and GFO are 2 of the 7 satellites, yet the orbits for these missions were not reprocessed in this phase and remain in different reference frames.

=> The sentence has been improved.

2) Page 2036, line 22: The GMSL error seems to be higher (on average) for Jason-2. Is there an explanation? Also, for Jason-1 and Jason-2 eras, the scatter in the error "reduction" appears to increase. Is there an explanation for this? Wouldn't expressing this figure as a reduction in variance be better?

=> The ECMWF reanalyses mainly improved the sea level calculation on the first decade because strong improvements have been performed in the atmospheric model and in the assimilation of external data. From 2005 onwards the reduction of the error is almost null and even slightly positive indicating a very low degradation of the reanalysis in comparison with the operational model. The reasons are: a) the model differences between the operational and reanalyses outputs are close; 2) the spatial resolution of the reanalyses grids (0.75 degrees) is degraded in comparison with the operational model (0.25 degrees). This impact is detailed in Legeais et al, 2014 for the wet troposphere correction.

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Concerning the second issue pointed out by reviewer#2, we preferred in the paper to present the results with an error reduction rather than a reduction in variance. But in fact, both metrics are directly linked and similar. Indeed, the variance reduction is obtained from crossover analyses estimating the homogeneity improvement of ascending and descending sea-level measurements using the new altimeter correction instead of the former one. So, the variance differences provide a performance indicator of the new correction to improve the sea level calculation (only for temporal scales < 10 days). In practice this "variance differences" indicator (or variance reduction whether it is an improvement) measures twice the variance of the error assuming the error is the same on the ascending and the descending tracks. Therefore, dividing this figure by  $\sqrt{2}$ , we directly provide an estimation of the error reduction of the sea level along altimeter tracks which is more explicit for users. In the paper we provide the average error reduction cycle by cycle.

3) Page 2046, section 5.4: The authors acknowledge that this section and none of the results in figure 11 include uncertainty estimates. Several estimates of uncertainties on the Argo, GRACE, and altimetry comparisons have been published since 2008-2009. This section should more clearly state that the uncertainties in these comparisons probably exceed the differences among the evaluated sea level products. Also, line 9 refers to "RL05" GRACE data. Does this mean only CSR RL05 fields? My guess is that using GFZ and JPL GRACE fields would show greater differences globally and regionally than the changes in the altimetry products.

=> The paragraph has been improved to take into account this comment.

Minor comments 1) Page 2033, line 25: The minus signs are missing from PDF version of the paper. => Anomaly not present in the files provided to the editor, but only on PDF file online.

2) Page 2034, line 8: "fulfil" should be "fulfill" => No modification because "fulfil" is in British English and "fulfill" in American English. Is it fair?

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3) Table 1, Typo in the year for Andersen et al. . => Anomaly not present in the files provided to the editor, but only on PDF file online.

Please also note the supplement to this comment:

<http://www.ocean-sci-discuss.net/11/C1071/2014/osd-11-C1071-2014-supplement.pdf>

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Interactive comment on Ocean Sci. Discuss., 11, 2029, 2014.

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