Interactive comment on "Major improvement of altimetry sea level estimations using pressure derived corrections based on ERA-interim atmospheric reanalysis" by L. Carrere et al.

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Dear L. Sun,

Thank you for your review and comments. My answers and suggestions for changes are noted in blue in the text below.
Best regards
Loren Carrere

General comments: The authors claimed a major progress with a diminution of the along-track SSH error of about 2-3 cm globally and even more than 3 cm at high latitudes and in shallow waters by using the new DAC_ERA correction. This is a notable progress for short-term and/or high frequent ocean dynamics, especially for the ocean mesoscale eddies. It could be accepted for publication after some major reversions.

Specific comments: The major progress is only mentioned in conclusion, but in the abstract. The abstract is vague in addressing their main improvements and contributions. The authors may want to summarize their results and make some more comprehensive conclusions.

LC: The abstract has been reformulated to show more clearly the results of the present paper. Conclusions have been slightly changed

There are too many abbreviations, which should be explained at the first time. The authors may also want to list them in a table. The authors must attempt to present their work in a logical fashion.

LC: OK all abbreviations have been homogenized and defined when first used in the first pages of the paper.
The beginning of the paper has been a bit modified to propose a more logic approach, clearer for the reader:
We propose to move the definition of DAC and DT in part 2, and change part 3 into 'differences of atmospheric pressure derived correction'.
New plan is thus, included moved sections noted en bold :

1- introduction

2- description of the datasets and methods

2.1- altimeter data

2.2- ERA-Interim dataset

2.3- DAC (= includes part 3.1 of initial version except the analysis of differences of DAC which is kept in section 3)

2.4- DT (= includes part 3.2 of initial version except the analysis of differences of DT which is kept in section 3)

2.5- method of comparison

3- **differences of atmospheric pressure derived corrections = includes the analysis of differences of DAC and DT (parts 3.1.2 and 3.2.2 of initial version)**

3.1- DAC

3.2- DT

Sections 4 to 6: organization unchanged

Pg 6,line 29 what are the “trends”, are they really become “more accurate”? The authors addressed long-term trends in section 5, where “results indicate that the impact on MSL trend is negligible at a global scale”.

LC: the impact of the non- homogeneity of the pressure forcing (particularly jumps in the time series) on the MSL trend estimation has been addressed in Ablain et al. 2009 (for inverse barometer and DT components). In the case of the DAC, this impact is indeed negligible for global MSL trend but it is significant at regional scale. This impact is explained by the fact that using the new DAC_ERA improves the high-frequencies and thus it diminishes a component of the estimation error.

Pg 7, section 3.1.2, The authors may want give the formula of DAC correction.

LC: OK the formula of DAC correction has been added in section 3.1-The dynamic atmospheric correction. The equations of the DAC, which are the shallow waters equations, are given in previous papers (Carrere and Lyard 2003; Carrere 2003).

Pg12, section 6, Can the authors make some comments on the feature progress on the short-term SLA products, given high resolution of ERA-based atmospheric reanalysis and altimeter missions?

LC: The main interest of ERA-interim is its constant resolution on the time series, the constant model version used and the more numerous assimilated datasets. Its slightly higher spatial resolution compared to the operational model on first years of altimetry, combined to other improvements mentioned above, help to have a better localization and a more realistic

amplitude of high/low pressure systems, which directly impacts the quality of the pressure derived corrections (DAC and DT).

If considering short-temporal scales, using DAC_ERA impacts large-scale features which characterize the high frequencies ocean response to atmospheric forcing: several thousands of km in deep ocean and a few hundreds km in shallow waters due to non-linearities (Vinogradova et al, 2007;Webb and de Cuevas, 2002). Using DT_ERA impacts large spatial scales as it is directly dependant from surface pressure.

Temporal and spatial scales impacted are similar from one altimeter mission to the other, as the DAC is defined by a unique temporal filtering as described in section 3.1; however as the time spans of the missions are different (length and period), and the cycles are also different implying different aliasing frequencies, the validation statistics can vary from one mission to the other.

Some examples are:

Pg 1, ERA-interim (Line 1, Line 12) or ERA-Interim (line 14) ?

LC: OK notation has been homogenized to ERA-Interim in the entire paper.

Pg 2, Line 24, what the “IB” is? I find the answer at Pg 5, line 31!

LC: IB is Inverse Barometer. Definition has been added on page 2.

Pg 3, Line 29 and Pg 5, line 6-7. The definition of SLA should be more consistent.

LC: OK correction has been made.

Pg 4, Line 29, the high-frequency part -> the high-frequency (noted HF)

LC: OK text has been corrected.

Pg 5, Line 13, mean sea level (MSL)-> MSL

LC: OK text has been changed.

Pg 5, Line 23, The high frequency (noted HF) -> The HF

LC: OK text has been changed.

Pg 5, line 25 TP (e.g. Pg 4, L17) or T/P (e.g. Pg 5, L25) ? Similar for “J1 and Jason-1”,”J2 and Jason-2”, “DAC-ECMWF” -> “DAC_ECMWF”

LC: OK notations have been homogenized in the entire paper.

Pg 9, line 10, 1996-1992 -> 1992-1996

LC: OK text has been changed

Pg 10, line 16, 5-2 cm2 -> 2-5 cm2

LC: OK text has been changed

Tables, The title of table should be above on the table.

LC: OK title put above the tables

Table 2, “ECMWF - DAC-ERA” should be “ECMWF – DAC_ERA”, and similar for “DT_ERA”.

LC: OK text has been changed.

Figure 2, where S1 and S2 respectively represents the diurnal and semi-diurnal atmospheric tides.

LC: OK text has been added in the legend of the figure.

Figure 3, “Left and right” should be “above and bellow”. “temporal” ->“Temporal”.

LC: OK text has been added in the legend of the figure

Figure 4, “statistics” ->“Statistics”.

LC: OK text has been added in the legend of the figure

Figure 5, “temporal” ->“Temporal”.

LC: OK text has been added in the legend of the figure

The references should be reedited. I find that the information (e.g., pages, paper id) in references is incomplete.

LC: OK references have been checked and completed.