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.

Anonymous Referee #2

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Dear Referee,

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 manuscript addresses the effect on satellite altimetry estimates of the height of the sea surface resulting from the application of new geophysical corrections using reanalysis (ERA-interim) pressure values instead of the ECMWF-based operational corrections. I think that the issue is relevant and the manuscript is scientifically sound. I recommend publication after some revision, mostly minor and concerning mainly the clear presentation of the work rather than the content itself. In this line, some improvement on the use of the English language would also be beneficial.

I would suggest some restructuring of the presentation to improve the readability and clarity of the paper. For example, the DAC is only introduced in detail in page 5 (section3.1), and then it is explained that it comes from a barotropic model forced by pressure and wind, but in the introduction the issue with the ECMWF used in the barotropic model is already stated (pg 2, line 22). As another example, the grids of DAC and DT corrections are referred in section 2.2 (pg 4, line 12) without any hint on how those grids are derived from the pressure values until later in the paper. Although a reader familiar with satellite altimetry processing can follow the ideas, I think that the presentation could be improved to make the paper easier to understand for a wider oceanographic readership.

LC: The beginning of the paper has been a bit modified to propose a more logicapproach, 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

The acronyms should be fixed in the beginning and kept as simple as possible – for example, why use Dry_Tropo_ECMWF or DT_ECMWF (pg 7, line 25)?

LC: OK acronyms have homogenized in the all paper.

The comparison of Table 1 and Figure 1 can be confusing because of the differing start cycles used for the individual missions and the long-term series. It should be clear in the text whether the long term series correspond to spatially averaged observations (global MSL) or along-tracks time series resulting from the concatenation of observations from different missions.

LC: Figure 1 has been modified because the starting cycle of ERS-1 was wrong: it is cycle 15 as in table 1. The long-term series are either the along-track (fig 3, fig 5) or the crossovers (fig 7, fig 10) time series resulting from the concatenation of the cycles from different missions (TP-J1-J2 on one side and ERS1-ERS2-ENVISAT on the other side, cf figure 1). For global MSL estimations (table 2), mean grids of SLA are first computed for each cycle of each mission (every ~10 days as described on AVISO web site); then the global mean of each grid is computed for each cycle to estimate the MSL slope. The regional MSL slopes for each mission are then estimated using previous SLA grids for each cycle and each mission and a least-square method at each grid point.

⇨ Text has been clarified in section 2.3.

Specific comments:

Page 4, line 30: “is calculated from a cyclic way...” - perhaps rephrase (not clear)

LC: OK sentence has been rephrased => ‘The long-term monitoring of SSH is estimated thanks to the calculation of statistics for each altimeter cycle, all along the time span of each mission; …’

Page 5, line 3: “To go further to the coast...” - improve presentation, in the present formulation it appears that to go further to the coast SLA is considered instead of SSH, while what is meant is I think that to approach the coast along-track observations are considered instead of crossovers

LC: OK the sentence has bee rephrase to be clearer : ‘To pursue the analysis further to the coast, we consider along-track observations instead of crossovers…’

Page 8, line 5: section 0

LC: put explicit reference to DAC = section 3.1.1 (= section 2.3 in new organization proposed)

Page 10, line 28: SSH anomalies: : : SLA? (keep notation consistent)

LC: p11 line 5 => SLA

Page 12, line 9: c.f.

LC: OK changed

Page 13, line 21: …

LC: I don’t understand this comment.

Page 13,line 22: “misses a smaller spatial resolution”: : : is not clear, I suggest rephrase

LC: OK rephrased : “As Era-Interim … has a coarse spatial resolution compared to the operational database on recent years, …”

Figure 3: harmonize titles of upper and lower plots

LC: OK title have been harmonized.

Figure 10: the figure for TP/J1/J2 (left) seems to show a jump in SSH variance reduction at the end of 2013. Is it an artifact of the filter used, or a real feature?

LC: This is an artifact of the filter used.

Table 2: please add the corresponding uncertainties to the values presented in Table 2 (e.g 0.07 +- : : :). Is there a reason for the differences being 0 for J1 and highest for J2?

LC : The Least Square Root Error has been added in Table 2 (column 2); note that this theoretical adjustment error is underestimated as observations are not decorrelated in reality.

The differences observed between J2 and J1 are due to the different temporal series of the missions: J2 time series is shorter than for J1, which implies a higher estimation error for J2 (0.15 mm/yr instead of 0.07 mm/yr for J1) and thus likely stronger differences when using different corrections. The fact the mean impact of DAC_ERA is 0 for J1 is just that the value is < 0.01 so it was round off to 0. For DT_ERA the impact on J1 is -0.2 mm/yr and not 0.