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Ocean Science Discussions

Interactive comment on "A new assessment of global mean sea level from altimeters highlights a reduction of global trend from 2005 to 2008" *by* M. Ablain et al.

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General comments

The main originality of this paper is an exhaustive description of the altimeter errors impacting the MSL. Studies about this subject have been already performed (Nerem et al., 2001; Fernandes et al, 2006). But reprocessed GDRs and updated geophysical corrections are now available, which justifies a new assessment. In addition, another important issue of the paper is the statistical approach to estimate the error with a

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confidence interval. Finally, this new assessment of the global budget error allows us to demonstrate that the recent sea level change (1 mm/yr since 2005) is not due to errors from altimetry measurements. In order to better demonstrate the new information presented in the paper are useful, we propose a new release of the paper to take into account all your remarks.

Specific comments

The authors should improve Section 5, which describes a result of tide gauge calibrations. If I understand the text correctly, a global land motion correction was made based on available the co-located GPS sites. Does this mean that no vertical land motion correction was made to the 70 tide gauges with no nearby GPS measurements? What was the maximum separation between a gauge and GPS site?

As only a few tide gauges can be corrected from "precise" vertical movement correction (the word "precise" means GPS are on most 10 km far from tide gauges, with no rift between both stations or locating on two different tectonic plates. From a geodetic point of view, GPS should have to be 1 km far from tide gauges but this would reduce colocated stations to a very small number and no global vertical land motion correction could be then computed), the global vertical movement correction is thus calculating from available colocated GPS data and applied on the whole tide gauges dataset. In practical, this global correction doesn't represent the true land motion at a given tide gauge, but as statistical monitoring are then deduced, it can be considered that this global vertical movement correction, in agreement with GIA models (Peltier, 2004), can be used to get a worldwide mean estimate of land motion.

In page 42, lines 3-4, I do not understand what is meant by "they are calibrated together in order to be used".

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Tide gauges are calibrated together to merged correctly all the time data series in order to estimate correctly the MSL evolution. Indeed, as tide gauges are not referenced to the same mean sea surface and .as the length of each time data series is not necessarily the same over all the altimetry period, tide gauges have to be calibrated together. This calibration step is not useful considering only time data series with the same length, but in this case the tide gauges number is dramatically reduced.

Was the inverted barometer applied to the altimetry data in order to compute the calibration?
Yes, altimeter SSH is corrected from the DAC correction (Dynamical Atmospheric Correction), derived from barometer inverse correction and MOG2D model (see Jason-1 GDR handbook for more details).

When the drifts are computed for each time series, are the gauges equally-weighted, or does the method effectively weight each altimeter-tide gauge residuals as Mitchum's method does?
After computing statistics, data time series differences are averaged in 2°x2° boxes. Then, they are balanced with regard to the latitude in order to take into account tide gauges spatial sampling. Note that comparison with equally weighted averages lead to similar results. This method is thus different from these of Mitchum's one. In our process, only homogeneous data time series are used since a quality control of tide gauge time series is computed upstream. This quality control checks time series with abnormal drift or jumps which can't be corrected (for example a jump corresponding to a mudslide with no GPS records). These are the reasons why results are quite similar with or without weighting each altimeter/tide gauge residual.

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How were the tides removed from the tide gauges?
High frequency tidal waves (diurnal and semi-diurnal tides) are filtering by a specific algorithm based on the Demerliac low-pass filter [Bessero, 1985]. Moreover, long-time tidal waves are filtering by a specific algorithm based on well-balanced tide tables [Cartwright and Eden, 1973].

What is the error on the vertical land motion correction? Leuliette et al. and Beckley et al have reported that the formal error on the trend fit to the 15-year mean sea level data is negligible. Is that case in this analysis?
Following the use of colocated GPS data in the assessment of the vertical land motion correction, the formal error on the trend is negligible for the 70 TG considered, which good space sampling lead to a global estimate of this vertical movement correction. But as this global correction is extended on the whole tide gauge dataset, a formal error of +/- 0.2 mm is then deduced. This formal error could be reduced by considering more colocated tide gauges or computing a global vertical land motion correction with the whole geodetic ground stations available.

page 34, line 27: Please describe how the spurious measurements were removed.
Spurious measurements are removed according to the editing procedure described on the GDR handbook (T/P, Jason-1). Basically, thresholds are applied over main instrumental parameters and geographical corrections.

page 35, lines 14-16: What is the estimated errors on the 3-year and 5-year trends?

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What rates are significant?
The formal adjustment error (not presented in the paper) ranging from 0.2 to 0.3 mm/yr using a 3 year window, whereas it is around 0.1 mm/yr with a 5 year window. These weak figures demonstrate the good linearity evolution of the MSL and thus the relevance of rates estimated over a short period.

page 35, lines 24-25: Please explain why you expected smaller rates for the 5-year window.
It's a mistake in the sentence, since the rates are indeed similar using a 3-year or a 5-year window. We wanted to speak about the rate variations. Then, we changed the sentence: "As expected, smaller rates are reported when using the 5-year window" by "As expected; smaller variations of rates are reported when using the 5-year window".

page 36, lines 11-15: The Jason-1 radiometer is prone to periodic offsets rather than drifts.
The Jason-1 radiometer is indeed prone to periodic offsets due to yaw maneuvers, but they are not homogenous over all the Jason-1 period. In addition the Jason-1 radiometer is also prone to jump at each radiometer stop. Finally, these radiometer anomalies contribute to a potential drift of the wet troposphere correction.

Technical corrections
page 32, line 19: Church and White 2006 is not in the bibliography.
page 32, line 22: Leuliette et al. 2004 is not in the bibliography.
page 34, line 3: Center should be Centre.
page 34, line 20: Gaspard should be Gaspar.

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page 35, line 11;page 35, line 26;page 36, line 1: The enya (&152;n) is missing from Nino
and Nina.
page 42, line 5: Capitalize "African".
page 42, line 12: Write out ULR.
All these correction have been taken into account.

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