

Interactive comment on “Evaluation of wet troposphere path delays from atmospheric reanalyses and radiometers and their impact on the altimeter sea level” by J.-F. Legeais et al.

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Please find below the point by point answer to the Referee Comment:

Page 1622: “Biases between the different radiometers have been removed”: In this study, we are not interested in the absolute biases between radiometer measurements but rather in their relative long term evolution. Thus, the biases between the different instruments have to be removed. Otherwise the estimations of the drift of the differences with models are affected and the long term behavior of the wet troposphere content cannot be discussed. For information, the observed biases are 0.13 cm (ERS2-ERS1), 0.58 cm (Envisat-ERS2), -0.80 cm (Jason1-TOPEX) and -0.07 cm (Jason2-Jason1).

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The measurements from the ‘verification phases’ are used to precisely estimate these biases. During these periods, the satellites follow each other in close succession and the same atmosphere is measured by the on-board radiometers. By convention, the first mission (TOPEX and ERS-1) is used as a reference, as performed for the altimeter sea level (see the MSL section of the AVISO website for the description of the method). A description of this method used to determine the biases will be added in the paper.

Terminology “SSH performances” used in section 3. A statement describing what it means will be added in the paper: “In this study, the term ‘SSH performances’ is used to assess in which extent altimeter sea levels are similar at the crossover points between ascending and descending tracks, which is thus only related with high frequency signals”.

Page 1625, line 12-15. The two last sentences will be rephrased: “However smaller differences do not necessarily constitute an improvement. Looking at the spatial variability of the MSL trend differences, a more homogeneous distribution will suggest an improved quality. This spatial variability is reduced the most with the ERA Interim reanalysis, especially for the first altimetry decade.”

Figure 7: we agree that in some regions, ERA-Interim has worse consistency with the radiometer than ECMWF operational for the period 2002-2012 (Jason-1), which is not suggested in the text. So page 1627, lines 7-12 will be replaced by: “Finally, the smallest differences and the most reduced spatial variability is detected with the ERA Interim reanalysis over the first decade (top left panel of Fig. 7), with differences in the radiometer of less than 5mm, mainly zonally distributed at low and midlatitudes (< 30°). The reanalysis provides slightly greater amplitude along the Equator and reduced at 10–30° latitude. After the year 2000, the results are similar to that obtained with the operational model but the consistency with the radiometer is slightly deteriorated with ERA interim in some regions.”

Page 1626, line 26 / page 1627, line 1 will be replaced by “The bottom panels of Fig. 7

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reveal significant differences of more than 1 centimeter between. . .”

Page 1628, line 25: the sentence will be replaced by: “. . . over the whole altimeter era. This has been done after interpolating the model’s grids on the satellite ground tracks in order to accurately compare both types of corrections through the estimation of the altimeter SSH. This also allows the separation of different wavelengths representative of climate scales.”

Minor suggestions and questions:

The term “SSH variance differences at crossovers” refers to the difference of variance of the SSH differences at crossovers. So we think that the term used is appropriate.

Page 1616, line 4: the following reference to the comparison of wet delays derived from GPS will be added in the text: Niell, A. E., A. J. Coster, F. S. Solheim, V. B. Mendes, P. C. Toor, R. B. Langley, C. A. Upham, 2001: Comparison of Measurements of Atmospheric Wet Delay by Radiosonde, Water Vapor Radiometer, GPS, and VLBI. *J. Atmos. Oceanic Technol.*, 18, 830–850.

Page 1616, line 23. The sentence will be replaced by the proposed correction: “to assess the long-term stability of the radiometer corrections”.

Page 1617, line 5: “should not be affected by jumps”: This will be replaced by the proposed correction: “have been more uniformly processed than the operational models, thereby eliminating jumps due to changes to the processing strategy.”

Page 1617, line 10: The sentence will be corrected: “the assessment of the modeled and instrumental WTC. . .”

Page 1617, line 24: The sentence will be corrected: “The NCEP/NCAR reanalysis. . .”

Page 1618, line 3: The sentence will be corrected: “model and 2.5. . .”

Page 1618, line 17: This should be “Merged GDR”. This will be corrected.

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Page 1618, line 24: This should be “neural algorithm”. This will be corrected.

Page 1619, line 4: This should be “effect of the spatio-temporal sampling by the altimeters.” This will be corrected.

Page 1619, line 8: We agree and this will be replaced by: “we are able to assess the quality of the WTC by evaluating the primary signals that are representative of climate scales.”

Page 1619, line 23: We agree and this will be replaced by: “the impact of the WTC at shorter periods. . .”

Page 1620, line 6: We agree and this will be replaced by: “additional editing of the crossover points is performed: using only data with latitudes lower than. . .”

Page 1620, line 21: We agree and this will be replaced by: “insignificant”

Page 1622, line 11-14: The sentence will be replaced by: “The quality assessment of the WTC at longer time scales will benefit from improved precision at shorter ones. Indeed, reduced high frequencies errors will decrease the formal error estimation of longer temporal signals such as annual cycle or trend.”

Page 1622, line 23: the sentence “which model is the most adapted” will be replaced by “which model is the most adapted for such a detection”

Page 1623, line 11: the sentence will be replaced by: “is slightly smaller with ERA Interim compared to the NCEP reanalysis”

Page 1625, line 9: the sentence will be replaced by: “MSL trends compared to those derived from the radiometer”

Page 1627, line 25: this will be modified: “Thus, very good knowledge. . .”

Page 1629, line 25: this will be modified: “since the expertise of each is of benefit to the other.”

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