Author's response to Lee Lueng Fu's Comments on 'On the resolutions of ocean altimetry maps'

We would like to thank Lee Lueng Fu for taking time to read our manuscript and for providing comments. We provide below the referee comments in red and our answer to each point in green.

This paper presents a comprehensive study of the resolution of a popular product of ocean altimetry maps issued by the DUACS (AVISO) system. The study used a spectral coherence method to determine the spatial and temporal resolution of the maps, using independent altimetry data (for spatial resolution) and tide gauge data (for temporal resolution). A host of issues have been addressed: the dependence on the number of altimeters, the evolution of the system over the altimetry era, the comparison with previous studies, the sensitivity to the signal/noise ratio. This paper is highly recommended for users of the DUACS maps for any quantitative studies.

Some minor technical comments:

Lee Lueng Fu (**LLF**): P.1 lines 10-13: The sentence "These maps are ..." is awkward. Needs re-phrasing.

Author's Response (**AR**): we propose to re-phrase the sentence as: "These maps are generated using an optimal interpolation method applied to altimeter observations. They are provided on a global ¼°x ¼° (longitude x latitude) and daily grid resolution framework (1/8°x1/8° longitude x latitude grid for the regional products) through the Copernicus Marine Environment Monitoring Service (CMEMS)"

LLF: P.2, Line 30: What is the source for the independent 1 Hz along-track data? Although the answer is provided later, it should be made clear here.

AR: we add the source "Level 3 CMEMS" for the independent 1Hz along-track data

LLF: P.3, lines 25-30: Why does MSLA contain no noise? Is noise the same as random error? What is t in equations1-2? what is v(t)?

AR: We assumed that the MSLA contains no noise since it is resulting from the filtering of the along-track data through the DUACS mapping. We considered that the noise level in along-track SSH is much larger than in the mapped SSH. Here noise refer to instrumental noise. Following the comment made by referee #3, we have clarified this, and in the revised version of the manuscript, we redefined the effective resolution based on the spectral Noise-to-Signal ratio (PSD mapping error / PSD_along_track), which is more robust than the spectral coherence. This ratio (PSD mapping error / PSD_along_track) checks both the phase and the amplitude consistency between the two signals considered, whereas the spectral coherence focuses only on the phase consistency. We also illustrate that this change of definition has a weak impact on the results since the signal amplitude is globally optimal at the wavelength where the phase becomes incoherent. In response to reviewer #3, several test cases based on Observing System Simulation Experiment have been conducted and are freely available and interactively repeatable here: https://mybinder.org/v2/gh/mballaro/notebook.git/master (under the analysis_OSSE_NATL60 folder). They are also available at the end of the response to referee #3. These test cases show that the Magnitude squared coherence and Ratio PSD

error/PSD along-track are in good agreements, meaning the phase consistency is the dominant factor controlling the "quality" of the DUACS maps.

The 't' variable corresponds to the time.

LLF: P.4, equation (6): where is Gvv from equation (4)? P.5, lines 17-18: Provide reference on the larger correlation scales.

AR: We used similar notation as in Bendat et al. (2010). As for the previous question, we have updated the mathematical derivation in the new version of the manuscript. The reference (Pujol et al., 2016) on the DUACS-DT2014 reprocessing is added as reference for the larger correlation scales.

LLF: P.7, line 5: add "than" after"smaller".

AR: "Than" will be added after "smaller"

LLF: P.7, lines 26-27: Elaborate why up to four altimeters are required for near-real time products.

AR: We mention why up to four altimeters are required for near-real time products, referencing to the Pascual et al. (2006) paper. Up to four altimeters are required for near-real time products because only passed observation are available for the mapping. This reduced number of observations has an impact on the estimation of the sea surface height.

LLF: P.7, lines 29-30: This is an important point worth noting when the use of independent track for the study is first mentioned in the paper.

AR: We also add a sentence about this point in the methodology section. "It is worth noting, that we probably underestimate the resolution capability of the maps since we are estimating the spatial effective resolution of degraded maps to keep an independent dataset aside."

LLF: P.12, equation(9): either show a figure of SR(lambda) or describe its variation with lambda in words.

AR: We add a figure showing the SR(lambda), as well as for other spectral approach used to estimate the resolution (See Figure A5).