

## ***Interactive comment on “Mean dynamic topography of the black sea, computed from altimetry, drifters measurements and hydrology data” by A. A. Kubryakov and S. V. Stanichny***

**Anonymous Referee #1**

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The objective of the paper entitled “Mean dynamic topography of the black sea, computed from altimetry, drifters measurements and hydrology data”, is to produce for the Black Sea an estimate of the Mean Dynamic Topography making use of three different dataset: sea level anomalies from altimetry, in-situ surface velocity currents from drifting buoys and dynamic heights from hydrological profiles. Applying a method developed for the global ocean by (Rio and Hernandez, 2004), the authors have computed a Mean Dynamic Topography for the Black Sea, that was shown to be of higher quality than existing solutions based on modeling and climatological data.

General comment: The computation of the Mean Dynamic Topography for the Black

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Sea, where few solution exist, based mainly on ocean modeling or climatological data, is an important contribution to the optimal use of altimeter data in the area. The method used, a slightly modified approach of the (Rio and Hernandez, 2004) paper, is well described, the different processing steps and results are clear, and the resulting field appears effectively to be an improvement above the existing solution based on modeling and climatological data. I therefore consider that this paper should be published in Ocean Science Discussion after minor revisions. In addition to the corrections/demands for clarification listed below, I think that the paper really needs to be proof-read by an English native speaker. I have tried to correct some sentences in the “other comments” section below, but, being myself not an English native person, I have not tried to make an exhaustive correction of the paper.

Main points

It would be better to shortly describe in introduction what we know about the Black Sea MDT (you describe it in section 2.2.4, I think it would fit better in introduction) Page 703 Line 5: the time period average depends on the SLA production center. When using AVISO SLA, it corresponds to the 1993-1999 time period. Explain better why the Mean Dynamic Topography is computed/needed for the 1993-1999 time period: The Sea Level Anomalies used in this study are computed by SSALTO DUACS and they are referenced to a 1993-1999 mean profile. Therefore, to reconstruct the absolute dynamic topography, the mean dynamic topography for the same 1993-1999 time period is needed

Page 703 Line 24: add reference to Rio et al, 2011

Page 703 Lines 22-27: In the method by Rio et al, altimetric SLA are interpolated onto the drifters and hydrological profiles time and position. Why have you preferred stacking on the altimeter tracks? In effect, doing so, you reduce the number of in-situ measurements used for the calculation. On the other hand, you keep the full resolution of along-track altimetric data, that would be otherwise smoothed by the interpolation

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onto the in-situ measurements).

Page 704 Line 11 (Eq 3): You should insist on the fact that the time period of the obtained synthetic MDT  $H(r)$  depends on the time period to which the SLA used are referenced. Since you use SLA from AVISO (section 2.2.1) you get through equation 3 a MDT representative of the 1993-1999 time period.

Page 704 Lines 22-23: Explain better why in-situ measurements in the future may be used: In equation 3, the time period of the MDT is the time period to which the SLA used are referenced, whatever the time measurement of the in-situ data and the altimetry data. That is why any data may be used, also outside the period 1993-1999.

Page 705- section 2.2.1: you must say here that the SLA are computed relative the a 1993-1999 mean profile.

Page 709 Lines 1-12: In processing the dynamic heights, you neglect the steric effects occurring below 500m (the in-situ profiles extend down to 500m while you approximate the full steric effect of the Black Sea by a seasonal signal of 4 cm amplitude). Is the steric effect occurring below 500m negligible?

Page 709 – Results: Do you need to adjust (with a mean bias) the MDT computed from the drifters and the MDT computed from the dynamic heights before combining them? If yes: how do you proceed? If no: Are we sure that both MDT are compatible? The mean level of the MDT derived from drifters results from the minimization procedure of the  $C_i$ . The mean level of the MDT derived from the dynamic heights depends on the 500m reference depth and the computation of water balance  $W$ . How do you ensure compatibility of the both MDT mean level before combining them?

Page 709 Section 3.2.2: how many hydrological profiles are selected for computation?

Page 710: Lines 10 to 20 Description of the computed MDT: Authors mention a number of eddies by their names. Please give a geographical location (longitude, latitude) for each of them, as well as references to literature where their existence is mentioned.

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Page 711 Lines 13: Replace “Correlation is 0.78 and 0.73 with CMDT and SMDT” with “Correlation is 0.78 and 0.73 with SMDT and CMDT”. RMS differences are around 4cm in both cases. What part of the signal variance does it represent? Dispersion around mean slopes of Figure 7 seems quite important for both SMDT and CMDT.

Page 712: Why don't you consider only drifters in low wind conditions as you did for selecting drifters for the SMDT computation? You compute correlations on each single drifter trajectory. Do you always have long enough trajectories to get significant statistics? What is the correlation obtained for the whole trajectories dataset? What is the RMS difference expressed in percentage of the drifter variance.

Line 21: You find regression slopes greater than 1, which means that altimeter derived velocities are greater than drifter velocities, even though drifter velocities also include the Ekman component. I would have expected the contrary (at least the contrary is usually obtained in the global ocean). How do you explain this result? Comment on validation datasets used. You have chosen to take an important amount of data for validation (2002-2009 and 2001-2008), almost as long as the dataset used for computation (1993-2003). Have you tested the impact of using more data for MDT computation?

Other comments:

All through the text: Replace “methodic” by “method” Lack of pronoms (the)

Page 704 Lines 20 and Page 705 Line1: replace “receive” by “retrieve”

Page 705 Line 7: Replace “All standard correction was applied” by ‘All standard corrections were applied’.

Page 705 Line 10: Replace “Obtained SLA measurements have precision about 3–4 cm, temporal resolution 10-days and spatial 7 km.” by “ Obtained SLA measurements have a precision of about 3-4 cm, a 10 days temporal resolution and a 7 km spatial resolution.”

Page 705 Line 17: Replace “depth..” by “depth.”

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Page 705 Line 18: Replace "A temporal resolution" by "Temporal resolution"

Page 706 Line 2 Replace "to a depth 500m" by "to a depth of 500m"

Page 707 Line 13: Replace "project" by "projected"

Page 707 Line 16: Replace "consisted of" by "made of"

Figure 2: Contradiction between Track number (68) and text on page 707 (track number 84)

Figure 3: Contradiction between caption (track number 84) and plot title (track number 68)

Page 708 Line Replace "Let sea level for each cross point is for track number  $i$  is  $l_i$  and for track  $j$  is  $l_j$ , Respectively" by "Let sea level for each cross point be  $l_{ij}$  for track number  $i$  and  $j$  for track number  $j$  respectively."

Page 709 Line 1: Inappropriate reference to Figure

Page 709 Line 19: Replace "time period after 1992 year characterized" by "time period after 1993 is characterized"

Page 713: Lines 13-14 Replace "'Synthetic" method allow to improve mean dynamic topography in future when there will appear new in-situ measurements." By "The "synthetic" method allows to compute an improved MDT estimate each time new in-situ measurements are available."

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Interactive comment on Ocean Sci. Discuss., 8, 701, 2011.