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Interactive comment on "High resolution neodymium characterization along the Mediterranean margins and modeling of ε_{Nd} distribution in the Mediterranean basins" *by* M. Ayache et al.

Anonymous Referee #1

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General comments This timely study presents (1) the high resolution map of Mediterranean margin eNd distribution, (2) the Mediterranean seawater eNd distribution simulated by the high-resolution regional model that was optimised for the relaxation term of boundary exchange (BE) and (3) the impact of Eastern Mediterranean Transient (EMT) on seawater eNd values simulated by the calibrated model. The compilation of continental margin Nd isotopic compositions is highly appreciable and extremely useful for studying present and past Mediterranean seawater eNd variability.

My major concern is the Nd modelling parts that used only BE as a source term. The

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authors are aware that the simulated seawater eNd values are generally too radiogenic relative to measured seawater samples. They will integrate dust and river inputs as well as scavenging for their future modelling study. Under such condition, it is not clear the geochemical meaning of estimated Nd exchange time of three months. I would suggest that the authors add some more explanation for the following points.

1. Disagreement of LIW eNd values (eNd > -5) towards the western basin between the field data and the simulation. The advection of high eNd LIW (eNd > -5) towards the western basin has not been observed for the field data. I agree that seawater eNd data are still sparse to provide a robust diagnostic. But the authors ignored seawater Nd isotopic compositions reported by Henry et al. (1994) and Vance et al. (2004). The eNd value from site BAOR in the Strait of Sicily (eNd = -7.7±0.6; Henry et al., 1994) provides a constraint for eNd values of LIW entering the W Med Sea. Indeed, this value is consistent with other seawater Nd isotopic compositions from the intermediate water depths in the E Med Sea showing that high LIW values are confined in the easternmost part of the Levantine Sea (Fig. 5). Personally, I had never seen the LIW eNd values at sites close to the Strait of Sicily as high as -5 for the modern seawater and recent archives. I suggest that the authors consider all the existing Med seawater data to optimize the relaxation time (Figs. 4, 5 and 6) and add explanation about the possible reasons for the data-model decoupling for the LIW eNd values.

2. Diagnostic of simulation performance with vertical eNd profiles In relation to point 1, the comparison of vertical eNd profiles between the simulation and data would be carried out for site by site instead of the average profiles as shown in Figure 6. Seeing Figure 5d and 5e, one can have impression that simulated eNd is more stratified than the field data (for example Alboran Sea) but this feature does not appear in Figure 6. Since the number of sites providing seawater eNd profiles is limited, I suggest that the data-model comparison will be done for site by site along the longitude. This new Figure 6 will clarify the areas of data-model decoupling and will provide the elements of further discussion.

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3. Too radiogenic eNd values for the Aegean Sea and its impact on the simulated EMT. The direct measurement of seawater samples indicates that Aegean seawater eNd values do not exceed -5.9±0.2 (Tachikawa et al., 2004). The simulated values are higher than this limit. The EMT simulation result could be sensitive to the performance Aegean Sea eNd simulation. Considering the overestimation of Aegean eNd values and too weak formation of the Adriatic Deep Water formation, the simulated shift of seawater Nd isotopic signatures due to EMT could be overestimated. It is true that more negative eNd values of surface water in southern part of the E Med Sea will be obtained by Saharan dust contribution. In contrast, it is not obvious that the Aegean Sea water eNd will decrease by considering Nd sources other than the BE. Since the simulated eNd shift due to the EMT is relatively small, some comments about this point would be added.

Taking into account the above-mentioned points, I am not totally convinced by the BE alone can explain the major features of the Mediterranean seawater eNd distribution. Nonetheless, this work provides an important advance of understanding seawater eNd distribution in the Mediterranean Sea. Considering the compilation effort and the originality of modelling aspects, I strongly recommend accepting this work after moderate revision.

Minor or specific comments Page 2, line 9, delete “all stable”. Page 2, line 26. Define “IC”. Page 2 footnote about the eNd definition. The equation should be corrected: eNd=[(143Nd/144Nd)sample/(143Nd/144Nd)CHUR-1]x10ˆ4 Page 3, line 5. The eNd value of the Mediterranean outflow was estimated to be -9.4 (Henry et al., 1994; Tachikawa et al., 2004). Page 5, line 16. Acid concentrations are shown with wrong fonts. “HN03” should be “HNO3”. Page 6, line 9. Delete “Nd” after “eNd”. Page 9, lines 9-10. “Lacan et al., (2012)” should be replaced by “Spivack and Wasserburg, 1988”. Page 10, line 15. “underestimation” should be “overestimation”. Page 11, line 5. About the comparison of intermediate eNd values between the model and the data. It is not clear the referred values here correspond to which part of Table 2. Page 14, line 16.

“eps Nd” should be corrected.

Figure 1. Indicate the relationship between the geological province and colour code in the caption. Figure 4. The x-axis should be delta eNd (data-model) and the y-axis should be “Water depth (m)” not “profondeur”. There is no “dashed line” as indicated in the caption. It should be the black solid line. Figures 8 and 9. The colour code indicates eNd difference between specific year and 1987. Please indicate this information in the captions.

Appendix 2, 3 and 4. EXP5. The conditions of the relaxation time are different from Table 3. Please correct.

Reference Vance, D., Scrivner, A. E., Benecy, P., Staubwasser, M., and Henderson, G. M.: The use of foraminifera as a record of the past neodymium isotope composition of seawater, Paleoceanography, 19, doi:10.1029/2003PA000957, 2004.

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