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Interactive comment on "Ventilation of the Mediterranean Sea constrained by multiple transient tracer measurements" *by* T. Stöven and T. Tanhua

Anonymous Referee #2

Received and published: 27 December 2013

The present manuscript essentially deals with deriving mean ages for water masses of different sub-basins of the Mediterranean Sea. Respective results were derived from transient Tracer Time Distributions (TTD) applied to transient tracer data which were obtained during a cruise conducted in April 2011. The authors analyze two different constrained TTD-based approaches and discuss their applicability to data stemming from the eastern and western Mediterranean Sea.

General comments:

The paper is basically a descriptive analysis of different TTD-based approaches and respective outcomes. The results are certainly interesting and important for the scien-

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tific community, but I do find a major revision necessary. Section 6 presents the results where little effort is made to discuss these findings in the light of already published data. In my opinion, especially a comparison to the work by Schneider et al. (2013) is required who use the same data and a similar TTD-approach but only focus on the 1IG-TTD. In contrast to the present paper Schneider et al. used a fixed delta/gamma ratio = 1. The results presented in the present paper indicate that this approach is not applicable to all sub-basins of the MedSea. So, to what degree do the results of Schneider et al. still hold or need to be revised?

The paper would benefit from providing uncertainties with respect to the estimated mean ages. Several separate figures could be merged into single figures with 2-3 sub-plots. The manuscript contains many typos and misspellings and occasionally entirely corrupt sentences.

Detailed comments:

The "Introduction" mainly consists of detailed description of major circulation features. The motivation what the paper is all about is rather weak. Information to what extent contents differ from or build on the previous analyses of Schneider et al. (2013) is missing.

There is a lengthy technical description about how parts of the tracer data were obtained. For non-tracer-experts, however, it remains unclear what particular technical system is used for what particular tracer. Information on data precision is not given. Instead, the reader is referred to an unpublished manuscript of the first author, which I, personally, do not find acceptable. Details on the analysis of helium/tritium of this particular cruise and respective data precisions/uncertainties etc. are entirely missing. Also the title of Section 2 is misleading, since also sections 4-5 basically contain descriptions of applied methods.

Section 3.1: Is Eq. really required for the understanding of the remaining text ? If so, given parameters should be introduced.

Section 3.2: An earlier version of the TIF (Steinfeld, unpublished) was shown by Ste-infeldt (2004), who should be cited here as well. The benefit of using this instead of the one published by Roether et al. (2013) is not yet clear to me. Probably because of corrupt sentences it remains unclear what determines the correction factors. Since two regional TIFs are introduced I would expect more details on this topic.

Section 4: please introduce alpha in Eq. 9

Section 5: I would assume that this is not the first approach to constrain the 1IG- and 2IG-TTD models. One could expect a more thorough introduction concerning already established and different approaches considered here. Sections 5.1 and 5.2 do not point to respective publications.

Section 6.2.1: please explain in more detail for what reason certain data points were considered as non-constrainable; how many were affected ?

Tables:

Please introduce at least in the caption of Table 1 parameters like alpha and gamma_1 and gamma_2. What does "n.a." mean here? Please, think of highlighting depth ranges pointing to relevant water masses. What are the uncertainties of the given mean ages?

Figures:

Pressure should be reported in deciBar [dBar] and not in deciBel [dB].

Figure 1: The TIF shown in Fig.1 and referenced as published by Steinfeldt (et al. ??) looks very similar to the TIF shown by Schneider et al. (2013), where it is claimed to be published by Roether et al. (2013); reference pointing to Stoeven et al. (2013) is missing

Figure 2: limited content of information since symbols and station labels are difficult to be identified/distinguished in parts of the figure; legend introducing colored contours is

missing

Figure 4: a colorbar should be given; use subscripts to disinguish between gamma_1 and gamma_2

Figure 5: different longitudinal scales were chosen for a/b and c; (near-)bottom samples are not visible; colorbar should have label indicating displayed property and unit (same holds other figures showing section data)

Figures 9+10: could be merged into one figure; also see comments for Fig. 5

Figure 11: the chosen approach to indicate the sill is irritating:why is the sill shallower/deeper for different tracer concentrations?

Figures 12+13: could be merged into one figure; also see comments for Fig. 5

Figures 14+15: please name considered stations in figure caption.

Figures 16+17: could be merged into one figure; also see comments for Fig. 5

Figures 12/16/22/26: there appears to be mismatch between the different figures concerning the number and spatial distribution of sampling depths, which is possibly related to the "reduced sectional interpolation quality" due to "non-constrainable data points". It remains unclear to me what determines the latter. Adding the delta/gamma-ratio = 1 as e.g. a black contour would be useful

Figure 22: The displayed tracer age differences are either below or above 10 years. What is the maximum ?

Interactive comment on Ocean Sci. Discuss., 10, 1647, 2013.

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