Review of "*The transient distributions of nuclear weapon-generated tritium and its decay product 3He in the Mediterranean Sea, 1952–2011, and their oceanographic potential*" by Roether et al.

The manuscript by Roether and coauthors presents an exhaustive description of available tritium and 3He measurements in the Mediterranean Sea, and links them to major features in the Mediterranean intermediate and deep water circulation. Tritium, produced in quantities largely above the natural level by nuclear tests in the late 50s and 60s, enters the ocean at the surface and decays (with a scale of ~18 years) as waters travel in the interior, thus providing an ideal clock for decadal water circulation. In conjunction with other tracers (e.g. CFCs, 14C), measurements of the type detailed in the manuscript can and shed light on important features of the basin's circulation, including dramatic events such as the East Mediterranean Transient (EMT).

The interpretation of tritium as an age tracer requires knowledge of the distribution of its daughter, 3He. This complicates the issue because 3He has additional sources besides bomb tritium decay, the most important of which are atmospheric and terrigenic primordial 3He. However, concurrent measurements of He and Ne provide a way for disentangling these components (also helped by the low injection of primordial 3He in the basin), allowing the use of tritium/3He data as tracers of water mass age.

The paper is organized around the presentation of a quite impressive tritium and 3He dataset, spanning the whole basin and approximately 5 decades. While many of the data were already published, the papers adds two new recent sections (2011) and discusses old, previously unpublished profiles. Overall, it is useful to have a comprehensive, long term and basin-wide view of the tritium/3He evolution all in one place. Major features of the tracer fields are extensively described in the manuscript, in relation with the circulation of major Mediterranean water masses. Particular attention is devoted to the tracers' transit through LIW and EMDW, especially in relation to the changes brought about by the EMT. The contribution of terrigenic He and 3He is quantified, and tritium-3He ages determined for the Eastern Mediterranean.

The data provides an independent constraint on intermediate and deep water circulation. The descriptive picture that emerges from the paper is consistent with previous findings, some of which were discussed by the Authors in previous work, and might provide the base for a future, more quantitative determination of water mass formation and circulation rates. The dataset as a whole should also represent an useful benchmark against which numerical models of the Mediterranean circulation could be tested.

The manuscript is well structured and written. While the central section is devoted to a rather detailed description of the tritium and 3He measurements, the discussion section provides a common thread that ties together the data presented.

The uncertainties in the measurements and in the derived quantities are adequately described and sound, the data is well presented and thoroughly discussed. I think the paper represents a useful contribution towards the understanding of Mediterranean circulation and variability, and I am supportive of publication in Ocean Sciences. I also encourage the Authors to make the dataset easily available to the general oceanographic community.

Minor and technical comments

(1) I wonder if the Authors have considered including a figure equivalent to Fig. 11 (especially the tritium-age panel) for the period following the EMT. Since most of the discussion is centered around the influence of the EMT, it would be interesting to see how this event is affecting the distribution of tritium/3He ages in the Eastern Mediterranean.

(2) I am not sure Fig. 3 adds much to the paper. The Authors could also clarify the choice of showing decay-corrected tritium in Fig. 2, and uncorrected tritium in Figs. 4-5.

(3) Somewhat, I would rather have the right panels of Figs. 5 and 9 to be part of Figs. 2 and 7 respectively (they nicely complete the picture of the tracer evolution in time). However, I understand if the Authors prefer to keep these sections together with their WMed counterparts, as they provide a nice synchronous zonal view of the entire Mediterranean.

(4) I am not sure the Mediterranean is completely unique with respect to the low contribution of terrigenic 3He (abstract, line 12; conclusion, l. 13). Tritium/3He ages have been accurately applied for example in the North Atlantic subtropical gyre (e.g. several paper by Bill Jenkins), where primordial 3He can be neglected.

(5) The figures form an essential part of the paper and are very informative. I feel in some case their legibility could be somewhat improved, for example increasing the size of some of the fonts used (e.g. in the contour labels in figs. 4,5,8,9; and especially figs. 10 where it's hard to read the station names), and using the same colorbar when possible (e.g. in the case of the 3He sections).

(6) Page 652, l. 27: remove the repetition of "similarly"

(7) In page 653 the Western Mediterranean Transition is introduced. Since the event is discussed a few times thereafter, it could be useful to describe its main features briefly in the introduction.

(8) Page 655, l. 3: is this conversion factor constant, or is it sensitive in any significant way to the δ^3He, ΔHe of the water mass?

(9) Section 4: is natural tritiugenic 3He a concern at all here?

(10) Page 656, the equation for the 3He components could be explicitly added (similar to the equation for He components in p. 656 l. 16)

(11) Pages 656, l. 17, and 657 l. 1: I think the Authors mean δ^3He_0 instead of δ^3He (also check the whole section)

(12) Page 657, l. 22, "must agree" with what? do the Authors mean that the values must stay constant?

(13) Page 658, l. 25, not sure what a "comforting environmental result" mean

(14) Table 2: what are the errors on these ratios? I ask just because I wonder about the significance of some of the minor trend reversals that are seen in few of the water masses

(15) Fig 1. I am not sure what the small panel (cumulative tritium curve) represents, or whether it is discussed in the text

(16) Right panels of Figs. 5 and 9: while the cruise shown in the figures should be the same, the little maps indicate somewhat different tracks, especially close to the Italian Peninsula