We thank the reviewer #1 for her/his constructive comments on the manuscript. We have carefully considered all questions and concerns raised. The structure of our reply is as follows; each comment from the anonymous reviewer is recalled in blue, and our reply in black.

The authors use a high-resolution dynamical model to simulate the distribution of radiocarbon in the Mediterranean Sea. While I feel the topic is relevant and the treatment new, I would like the author would better specify different aspects treated in the paper:

a) the role of the Atlantic Water: sensitivity experiments at Gibraltar should be discussed;

We have performed two simulations with different boundary conditions at Gibraltar (red and blue boxes and lines, see Fig.1, below); the first time series (red box) gives very low level of radiocarbon in the Mediterranean Sea (as represented in Fig.2, below). In the second simulation we used a larger box (blue in Fig.1), where results are more realistic compared to some data from the North Atlantic (Tisnérat-Laborde et al., 2013; Tisnerat-Laborde, personal communication). The radiocarbon simulation greatly improves when using the larger box as boundary conditions, hence this was used to simulate ^{14}C in the Mediterranean Sea.

This part has been clarified in the revised version of the manuscript.

[See changes p 7, line 18-25 in the revised manuscript.]

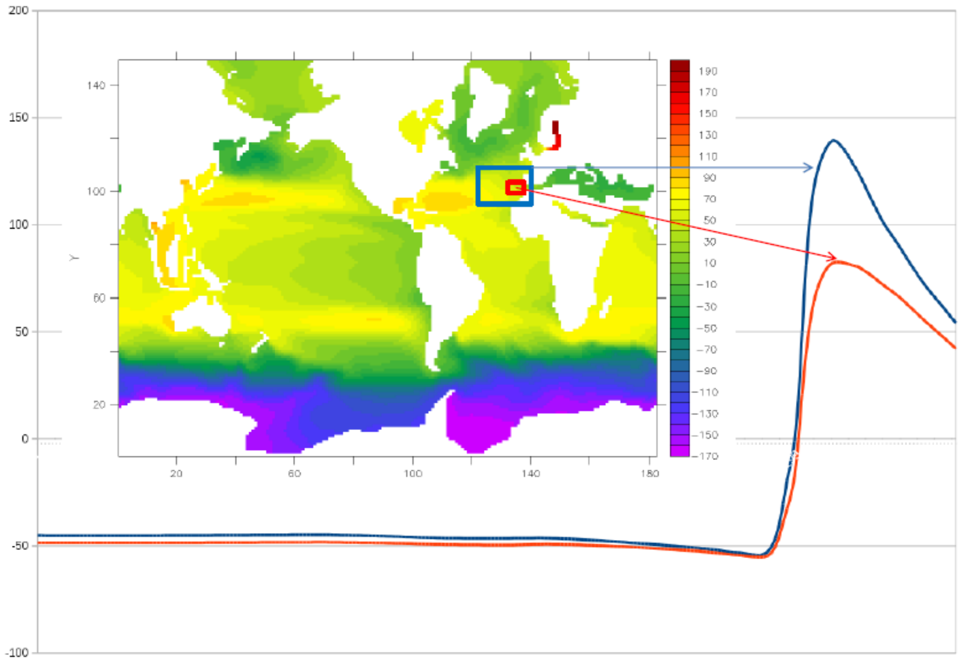

Fig. 1: The concentration of radiocarbon in the Atlantic inflow (NEMO global model, Mouchet et al. 2016).

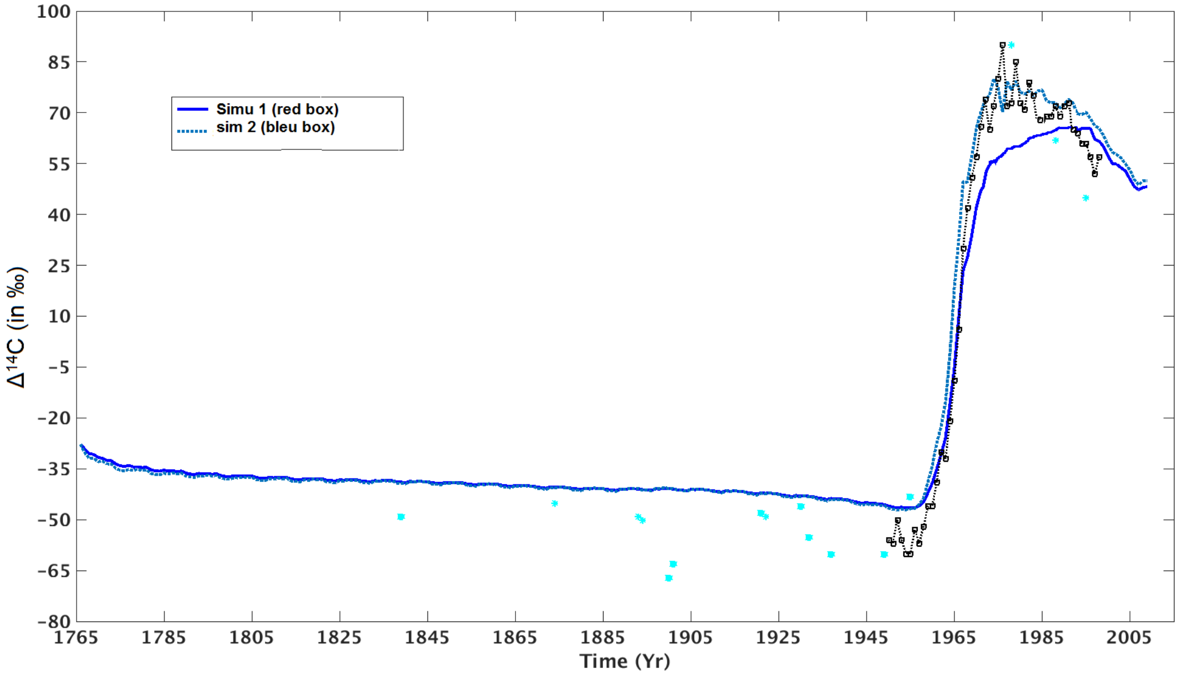

Fig.2: $\Delta^{14}C$ values (in ‰) in the Ligurian sub-basin from 1765 to 2008 for the surface water (0-10 m depth; blue), together with available in-situ observations (Tisnérat-Laborde et al., 2013) from coral (black dashed line). Simulated data obtained using the smaller box (Fig. 1) as boundary conditions.

b) the artificial modifications performed in order to simulate the EMT should be deeply discussed;

To improve dense-water fluxes through the Cretan Arc during the EMT (1992-1993) the ARPERA forcings were modified over the Aegean sub-basin (Beuvier et al., 2012a), by increasing mean values as done by Herrmann and Somot (2008) for the Gulf of Lions. More specifically, from November to March for the winters 1991-1992 and 1992-1993, daily surface heat loss was increased by 40 W m^{-2}, daily water loss by 1.5 mm and the daily wind stress modulus by 0.02 N m^{-2}. These changes accelerate the transfer of surface temperature and salinity perturbations into intermediate and deep layers of the Aegean subbasin, and improve the dense-water formation in the Aegean sub-basin during the EMT, with more intense mixing from winter convection.

The artificial modifications performed in order to simulate the EMT were fully discussed by Beuvier et al (2010), and in our previous work on anthropogenic tritium modelling (Ayache et al., 2015a). In this study we have used the same parametrization and method as in those previous work, therefore we do not think it is necessary to deeply discuss the details in the present manuscript.

[See changes, p 07 line 30-35 in the revised manuscript.]

c) how can convective penetration be increased in the simulations?

The convective penetration is more important in the classical area of deep convection in the Mediterranean Sea (i.e. Gulf of Lion, Adriatic and the Aegean sub-basins…) where the surface heat loss, water loss and the wind stress are more important on those areas.

In this work we have used a high resolution dynamical model (NEMO-MED12, Beuvier et al. 2012) based on the tagged version nemo v3.2 of the NEMO ocean general circulation model (Madec et al., 2008). This model was only forced by the atmospheric model AREPERA and we prescribe the initial and boundary conditions (as detailed in the manuscript section 2.1). Increasing the convective penetration could be obtained by changing air sea fluxes or in the Adriatic changing river runoff, but it is not the goal of this paper.

d) overall, a more critical discussion about limitations of the model simulations should be addressed.

We agree with the reviewer that limitations of the model simulations should be more critically discussed.

Previous passive tracer evaluations of NEMO-MED12 (e.g., Ayache et al., 2016; Ayache et al., 2015a; Palmiéri et al., 2015) have shown that the model satisfactorily simulates the main structures of the thermohaline circulation of the Mediterranean Sea, with mechanisms having a realistic timescale compared to observations.

However tritium/helium-3 simulations from Ayache et al. (2015) have highlighted the too-weak formation of Adriatic Deep Water (AdDW), followed by a weak contribution to the Eastern Mediterranean Deep Water (EMDW) in the Ionian sub-basin. In the western basin, the production of WMDW is correctly simulated, but the spreading of the recently ventilated deep water to the south of the basin is too weak. The consequences of these weaknesses in the model's skill in simulating some important aspects of the dynamics of the deep ventilation of the Mediterranean will have to be kept in mind when analyzing the model output.

We thank the reviewer for this suggestion. This part has been extended in the revised version.

[See changes p 12 line 34, in the revised manuscript.]