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Modeling of the anthropogenic tritium transient, and its decay product Helium-3, in the Mediterranean Sea, using a high-resolution regional model.

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This numerical study provides, for the first time in the Mediterranean Sea, a simulation of the anthropogenic tritium invasion and its decay product helium-3. The simulation is starting in 1950 and go up to 2011. It thus covers a 60-year period spanning the entire tritium transient generated by the atmospheric nuclear-weapon tests performed in the 1950s and early 1960s. The tritium is known as a passive tracer, which allows a good representation/signature of the upper water stratification, as well as, the high mixing in convection areas and the spreading at intermediate/deep levels. The tracer simulation is done using a high resolution regional model NEMO-MED12 (Beuvier *et al*., JGR, 2012) with at surface prescribed tritium concentration according to the temporal evolution derived from observations (see Roether *et al*., OS, 2013).
Several measurement of tritium and helium-3 performed along large scale transects in the Mediterranean Sea during the last decades allow a comparison of the simulated results with numerous in situ sections from cruises of Meteor M5/6, M31/1, M44/4, M51/2, M84/3, and Poseidon 234. The results show that the parameterization used for the tritium boundary conditions generates realistic results. Besides we calculate the tracer-age distributions according to the relationship between tritium and its radioactive decay product helium-3. In the eastern basin, the tracer simulation results highlight the weak formation of Adriatic Deep Water (ADW) in the Adriatic Sea followed by a week contribution to the Eastern Mediterranean Deep Water (EMDW) in the Ionian sub-basin while it shows a good representation of the Eastern Mediterranean Transient (EMT) signal from the Aegean Sea followed by a great contribution to the EMDW. In the western basin, the particularly intense deep convection event of winter 2005 in the Gulf of Lions during the Western Mediterranean Transition (WMT) is well simulated. However the spreading of the recently ventilated deep water to the south is too weak as mentioned in Beuvier *et al*. (2012). Finally, at intermediate levels, the spreading of the Levantine Intermediate Water (LIW) from the eastern basin towards the western basin is relatively well simulated when the simulated tracer-age distribution is compared to observation-based estimates.

Keywords: Mediterranean Sea; Tritium; Helium-3; Tritium-helium ages; Regional Ocean Modeling.