

Multiple equilibria and overturning variability of the Aegean-Adriatic Seas

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The Eastern Mediterranean Transient (EMT) –a transition and amplification of the Eastern Mediterranean Sea deep water source from the Adriatic Sea to the Aegean Sea –was observed in the mid-90' and stimulated intense research. We demonstrate, using an oceanic general circulation model, that the meridional overturning circulation of the Eastern Mediterranean has multiple equilibria states under present-day-like conditions, and that the water exchange between the Aegean and the Adriatic Seas can drastically affect these states. More specifically, we found two stable states and a hysteresis behaviour of deep water formation in the Adriatic Sea when changing the atmospheric (restoring) temperature over the Aegean Sea. In addition, the overturning circulation in both seas exhibits large decadal variability of the deep water formation. The Aegean-Adriatic relationship can be summarized as follows: warm and saline water of the Aegean can either flow in the sub-surface to the Adriatic, switching “on” deep water formation in the Adriatic by increasing its salinity, or the Aegean water can feed the deeper layer of the Ionian and Levantine basins, turning “off” the deep water formation in the Adriatic. The “off” steady state resembles some aspects of the EMT in which the Adriatic source of deep water was weakened when the Aegean source became active. Another noticeable finding of this work is the minor to none dense water outflow from both the Aegean and Adriatic Seas in some of the simulations. When none of the seas produce dense enough water, the Levantine basin deep layers are not ventilated and a sapropel-like period is enabled, as is evident in the Eastern Mediterranean sediments record.

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