Slowling down the overturning – Insights from conceptual modelling on a stably stratified Mediterranean Sea during the Messinian Salinity Crisis

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Although the Mediterranean is known for its equable climate, this does not apply on geological timescales. At the end of the Miocene, salinity of the Mediterranean Sea exceeded gypsum and halite saturation, leading to the youngest known salt giant to form in a relatively short time span. This event is called the Messinian Salinity Crisis. Insight into the exact circumstances leading to this extreme situation would increase our understanding of today’s system and how it would react to climatic changes. Some of the theories rely on a drastic change in circulation, leading to a stably stratified water column at high salinities. It is yet to be determined how realistic these ideas are.

Conceptual box models can help to find answers to this. In a previous study it was already shown that a decrease in the rate of deep water formation in the margins can lead to a stratified water column. Here we used a predefined value for the overturning. In contrast, in the present study, the circulation, including the exchange through the strait of Gibraltar, is dynamically driven by density differences. By modelling stratification for various assumptions regarding the efficiency of the strait of Gibraltar, evaporation and the connectivity of the margins, this set-up ables us to get in-depth insights regarding the system in general, and the influence of climate and bathymetry on the circulation, specifically.

This model brings us one step closer to an understanding of the circumstances of this extreme state of the Mediterranean Sea.