The evolving deep waters of the Western Mediterranean: post-WMT observations

Recent hydrographic shifts in the Western Mediterranean have revealed a notable decline in the signature of the Western Mediterranean Transition (WMT). Analysis of observations from 2011 to 2022 along the east-west GO-SHIP line MED01 and the north-south Med-SHIP lines (Schroeder et al., 2015, 2024) have shown a significant uplifting of the 29.11 kg m^{-3} isopycnal, which traditionally demarcated old and new deep waters since the WMT's onset in 2005 (Schroeder et al., 2016). This isopycnal, previously located at greater depths, now lies at the interface between Intermediate Water (IW) and Western Mediterranean Deep Water (WMDW), signaling profound changes in the basin's density structure.

In the post-WMT era, the water column below 1000 meters has established a new equilibrium characterized by higher temperature, salinity, and density. The shape of the TS-diagram in 2022, which was once hook-shaped, has now evolved into a straight line. However, this new straight TS-diagram differs from the "classical" straight line observed prior to the WMT. This adjustment reflects a weakly stratified deep water column, where the entire water column below 1000 meters is aligning to a new equilibrium state.

The observed rise of the 29.11 kg m^{-3} isopycnal and the up- and rightward shift of the TS-curves signify a transition from one deep-water state to another. This shift has altered the slope of the TS diagram. The absence of significant open ocean convection in the Gulf of Lion since 2013 (Josey and Schroeder, 2023) and limited diffusive mixing along the pathway to Gibraltar have further influenced this new state.

These findings highlight a significant departure from the WMT conditions, emphasizing a continuous evolution in the Western Mediterranean's hydrographic characteristics. The need for ongoing monitoring is crucial to fully understand and anticipate the implications of these changes.