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Overturning of the Mediterranean Thermohaline Circulation

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For more than five decades, the Mediterranean Sea has been identified as a region of so-called thermohaline circulation, namely of basin-scale overturning driven by surface heat and freshwater exchanges. The commonly accepted view is that of an interaction of zonal and meridional "conveyor belts" that sink at intermediate or deep convection sites. However, the connection between convection and sinking in the overturning circulation remains unclear. Here we use multi-decadal physical and biogeochemical simulations of the Mediterranean Sea and glider transport measurements to diagnose the location and physical drivers of this sinking. We find that most of the net sinking occurs within 50km of the boundary, away from open-sea convection sites. We also diagnose significant vertical biogeochemical fluxes near the boundary associated with this downwelling. We relate this sinking near the boundary to vorticity dynamic and the role of the Earth's rotation in suppressing net vertical motions in the open ocean. These findings corroborate previous idealized studies and conceptually replace the historical offshore "conveyor belts" by boundary "sinking rings". They challenge the respective roles of convection and sinking in shaping the oceanic overturning circulation and confirm the key role of boundary currents in ventilating the interior ocean.