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Violent storms within the Sea: dense water formation episodes in the NW Mediterranean

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Abstract. Heat and water exchanges in the ocean occur almost exclusively at the surface. As water compressibility is very low, stratification of the fluid is expected and horizontal motion is predominant in the sea interior.

Among the few processes that may introduce a vertical component in the water motion are those that increase surface water density by freezing, cooling or evaporation. Those processes triggering convective motion are enhanced by cold surface air, dry wind and low solar radiation. Therefore, convective cells are more likely to occur when the temperature of the air at the sea surface is lower than sea surface temperature. Conversely, rain, river runoff, solar heating, calm and condensation at surface enhance stratification. Convective motion at sea has several scales ranging from few meters at the upper ocean, causing the surface mixed layer, to the entire water column, in what is known as deep convection. Only few places in the world ocean are suitable for deep convection, and only under particular weather conditions. In this paper, a brief review of the response to these particular conditions in the NW Mediterranean is presented in what is known as dense water formation. The violent sinking and spreading of water parcels that reach the deep sea floor in few hours is described. These are "hidden" mediterranean storms, occurring under the sea surface, "on the other side of the mirror".

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