

2014-2021, 8 YEARS WITHOUT BOTTOM-REACHING DEEP WATER FORMATION IN THE WESTERN MEDITERRANEAN. PROBABLY, THE LONGEST KNOWN PERIOD.

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Abstract: Deep Water Formation (DWF) appeared almost regularly every year, during central winter months, in an area located offshore the Gulf of Lions in the NW Mediterranean Sea. Since the early 1960s, the processes involved in the DWF have been monitored, more or less intensively by regular hydrographic surveys or by moored instruments. It is worth noting the international efforts carried out in late 60s-early 70s by the so-called MEDOC Group to obtain a quite precise description of the whole process. Although the intensity of the DWF, as well as the amount of the newly formed Western Mediterranean Deep Water (WMDW), have shown high interannual variability, those years when the DWF was absent were exceptional, *e.g.* 1990, and those not reaching the bottom were scarce, *e.g.* 1997. Typically, they were years with almost no cold northerly winds during winter. By contrast, in some years the amount of newly formed WMDW was exceptional, *e.g.* 1987, and in some cases, an extra amount of this water came from dense shelf cascading, *e.g.* 1999. Moreover, in some years, the so-called variable Bottom Water, a slightly warm and salty layer, appeared near the bottom. It was a layer not thicker than 300 m, attributed to a large area affected by DWF which caused an extra amount of Levantine Intermediate Water (LIW) involved in the process, *e.g.* 1973. Other concomitant conditions that contributed to the DWF variability across the years was the presence of a blocking anticyclone in the Balearic Sea, that would play a role in intensifying the exposure of surface water to the northerlies, *e.g.* 1999. In winter 2005, all the factors contributing to an intense DWF process acted simultaneously, resulting in a new structure within the WMDW. The amount of newly formed WMDW, with higher density, θ and S, was so extraordinary that affected the entire western Mediterranean basin, and it was identified as the Western Mediterranean Transition (WMT). The remnants of the WMDW previous to the WMT have been uplifted as to being available for a relevant contribution to the Mediterranean Outflow Water (MOW) through the Gibraltar sill. After the WMT, the MOW showed both lower θ and S than previously recorded up to around 2015, indicating that the old WMDW has been almost completely lost by leakage and diffusion. After the 2005 episode, the WMDW has evolved, changing its θ S shape and increasing both θ and S

at the bottom, but still maintaining a deep layer with higher stratification than before 2005. In a previous work, we attributed the long period (2014-2018) without DWF to a combination of mild winters, the absence of the old WMDW, and the deep stratification. Such a process would be similar to the recovery of the Eastern Mediterranean Transient. In the present communication we incorporate 3 new years of data to the series, discuss the current situation and try to identify the requirements for a successful bottom-reaching DWF.

Key words: Deep Water Formation, Mediterranean, Western Mediterranean Transition, Recent years.

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