THE RECENT STAGE (1998-99) OF THE EASTERN MEDITERRANEAN TRANSIENT

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Abstract
The shift of the formation site (1987-99) of the eastern Mediterranean deep and bottom waters from the Adriatic to the Aegean is the main element of the so called the "Eastern Mediterranean Transient". Observations indicate that the spreading of the older Aegean deep water that had been deposited as bottom water in the Cretan Passage (1991-95), has progressed further towards the East and the West. Moreover, the Aegean still functions as a source of deep water that outflows mainly from the eastern Cretan Straits, but it is no longer dense enough to reach the bottom of the adjacent basins, thus ventilating layers between 1500-2500 m.

Keywords: Deep waters, Hydrology, Eastern Mediterranean, Aegean Sea

Since the beginning of the 20th century up to the mid-80s, the deep conveyor belt of the Eastern Basin presented rather constant characteristics [1, 2]. Since 1987, abrupt changes in the thermohaline circulation and water properties basin-wide were initiated, namely the "Eastern Mediterranean Transient" (EMT). The Aegean Sea, the new and effective formation site of the deep and bottom waters [3, 4, 5], has provided the eastern Mediterranean with waters warmer (θ>13.3°C), more saline (S>38.7), richer in CFC-12 (>0.5 pmol/kg) and denser (σ_θ >29.2) than the previously existing deep and bottom water mass (EMDW) (σ_θ~29.18). Several hypotheses concerning possible causes of this unique thermohaline event have been reported [6], but there is still lack of a consistent and quantified theory of the EMT. We describe the present state of the EMT based on the collected hydrological and tracer data in the frame of E.U/ MTP-II/MATTER project (1997-99).

The most important structure in the deep and bottom layers of the eastern Mediterranean in 1995 was the dome-like shape of the young (O_2> 4.5 ml/l, CFC-12 >0.5 pmol/kg), relatively warm (θ > 13.6 °C), saline (S > 38.75 psu) and very dense (σ_θ >29.2) waters of Aegean origin, namely the Cretan Deep Water (CDW), that occupied a large area centered at the Cretan Passage [3]. The massive invasion of CDW caused an uplift of the 'old' EMDW in the water column and this water layer is recognisable in the temperature, salinity, dissolved oxygen and tracer minima (θ < 13.7 °C, S <38.8 psu, O_2< 4.3 ml/l and CFC-12<0.3 pmol/kg) at depths between 800-2500m in the Levantine Basin and 600-1500m in the Ionian Basin. Four years later the spreading of the Aegean water into the surrounding areas has progressed even further. The present structure indicates a change in the Aegean contribution resulting in the appearance of two dense-water cores; on top of the aforementioned Aegean dense waters (σ_θ >29.2) in the bottom layers (2500 m to bottom) there appear slightly less dense waters (σ_θ <29.2) within the 1500-2500m layer, along the Cretan Arc outside the Aegean Sea and in the eastern Ionian, while in the Levantine is totally absent. In particular, the most intense signal of this change is found in the Cretan Passage, to the south of Crete, where all the parameter distributions now show inversions. The old bottom Aegean dense waters have lost salt (ΔS~0.04 psu) and heat ($\Delta\theta$~0.11°C), probably mixed with other older EMDW of Adriatic origin, as the dome of the CDW water has been partly drained to fill the Levantine and Ionian Basins. Accordingly, the density decreased by less than 0.01. The fact that the near bottom CFC-concentrations in both basins did not increase substantially between 1995-1999 furthermore indicates that the subsequent advance of CDW at the bottom has been supplied from the earlier outflows but has not been refilled by similarly dense water output from the Aegean which should have led to increased CFC-12 concentrations. Secondly, the new observed Aegean core caused a significant increase in salinity (ΔS~0.11 psu) and temperature ($\Delta\theta$~0.3°C) resulting in an increase of density up to $\Delta\sigma_\theta$ ~0.02, along with increase in oxygen and CFC-12, within the 1500-2500dbar depth range, when compared with the properties of the waters occupied the same layers in 1995. The latter were the product of mixing of the old waters that were uplifted by the first very dense Aegean outflow [7] with the outflowing Aegean waters. It seems that this new Aegean outflow comes from the eastern Straits of the Cretan Arc and spreads westward towards the Ionian Sea. These more recently ventilated waters from the Aegean obviously did not obtain sufficiently high densities to reach the bottom but are settling at shallower depth between 1500-2000 dbar. However, the uplifted old waters occupy now a thinner layer 500-1000m above the aforementioned new Aegean layer, representing deep temperature, salinity, oxygen and CFC-12 minima in the vertical. Comparison of the hydrological parameters between November 1998 and June 1999 indicates weakening of the new Aegean signal in the layers 1500-2500 dbar. In particular, the temperature decreased up to 0.1°C, salinity up to 0.04 psu and the density up to 0.005.

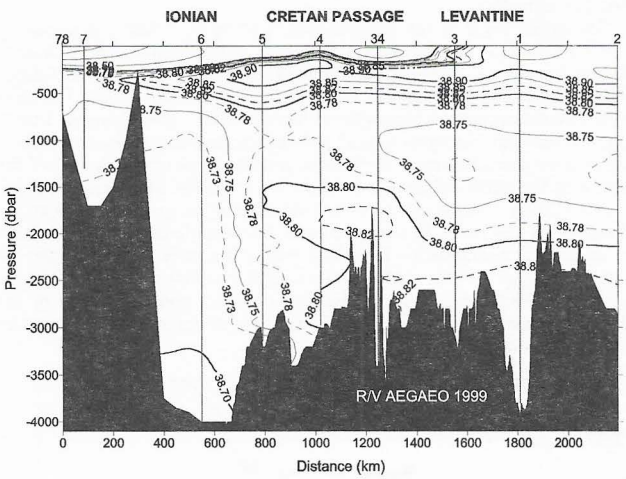

Figure 1. West-East Salinity transect in the Eastern Mediterranean

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