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Coherent account of the big transient in the Eastern Mediterranean deep waters, 1987-2001

W. Roether (1), B. Klein (2), B. B. Manca (3), A Theocharis (4), and S. Kioroglou (4)

(1) Univ. Bremen, Germany, (wroether@physik.uni-bremen.de / Phone +49-4746-72233), (2) Bundesamt für Seeschifffahrt und Hydrographie, Hamburg, Germany, (3) Istituto Nazinale di Oceanografia e di Geofisica Sperimentale, Trieste, Italy, (4) Hellenic Centre for Marine Research, Athens, Greece

We produce a detailed account of the evolving hydrography and the large-scale circulation of the deep waters that resulted from the unique influx of dense waters from the Aegean Sea in the 1990s (the Eastern Mediterranean Transient, EMT), using data from repeated hydrographic surveys in the Eastern Mediterranean (EMed) and the southern Aegean Sea. Aegean influx into the EMed deep waters averaged $\sim$2.5 10^6 m^3 s^{-1} between mid-1992 and late 1994. It peaked in 1993, when densities in the South Aegean were at their maximum, and when observations south and west of Crete found the common T-S inversion caused by the added Aegean waters to be lifted to 400 m depth, implying strong flow. The influx into the EMed deep waters totalled $\sim$ 3 10^{14} m^3, or about three times the volume of the entire Aegean Sea. Less than 5% of that were contributed prior to 1992 (being confined spatially to the south and west of Crete and to $\sim$1800 m in depth), and about 20% after 1994. In the spreading of these waters, bottom topography played a dominating role. The Aegean waters delivered via the principal exit route in Kasos Strait, east of Crete, flew westward along the Cretan slope, followed the Hellenic Trench up to $\sim$37˚N, and from there continued further west, predominantly moving cyclonically along the periphery of the Ionian Sea. After 1991, Aegean outflow furthermore crossed the East Mediterranean Ridge into the southwestern Levantine Sea from where it subsequently expanded into the southeastern Levantine. Levantine waters after 1994 consistently showed T-S inversions in roughly 1200 m depth, with amplitudes decreasing in time. The T-S distribution in the Ionian has been rather more diverse. The reasons are (i) additional input from the

Aegean via Antikithera Strait and from the Adriatic, both contributions being lower in densities and volume rates compared to the Kasos outflow, and (ii), gradual intrusion of the Aegean-derived waters, which was incomplete by 2001 although an Aegean signature was evident over the entire Ionian Sea by early 1995 already. It is expected that eventually the Adriatic Sea will return to be the dominant source of EMed deep and bottom waters, but our analysis shows that the competition between the two dense-water source areas is a precarious one. In any case, the EMed deep waters will remain transient for decades to come. Our results provide a basis for future modelling of the EMT and for other, more special investigations, such as on how the Aegean managed to generate the enormously high outflow rates at densities not observed previously.