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Deep water mass characteristics and interannual variability in the North and Central Aegean Sea

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Abstract

The characteristics and interannual variability of the deep water masses in the North and Central Aegean Sea are being investigated through the data sets of the Hellenic Navy Hydrographic Service (HNHS) and the MEDATLAS 1997 project. In the period between 1987 and 1993, the densest deep water in the Mediterranean has been produced in the Aegean Sea (with σ_θ densities reaching up to 29.6 kg/m^3), contributing to what has been called the Eastern Mediterranean Transient. The examination of time series of mean integrated values of θ, S and σ_θ below the depth of 500 dbar reveals the significant deep water density increase after 1987 in all of the deep basins in the area. Data suggest that the density increase of 1987–1988 is mainly attributed to a temperature drop, while in 1993, an even more intense density increase is observed, characterized this time by an abrupt salinity increase. We assume that the increased salinity necessary to produce deep water masses with the observed characteristics was not locally produced but rather advected from the Levantine through the South Aegean. After 1993, no new deep water formation episodes have been observed. A series of Θ–S diagrams derived from HNHS CTD casts covering the period between 1993 and 2000, depict the different characteristics of the deep water masses in the area. As 1993 marks the end of the formation period, observed differences between basins in that year must be attributed to different deep water formation sites. Thereafter, the stagnating deep water in the North and Central Aegean basins has been slowly gaining buoyancy by losing salt and gaining heat. The rate at which this phenomenon takes place varies between different deep basins. It is suggested that these variations are linked to the different volumes of each basin as well as to the general circulation features of the Aegean Sea.

Keywords: Aegean Sea; Eastern Mediterranean Sea; Deep water formation; Deep water masses; Dense water; Salt advection

1. Introduction

The Aegean Sea is one of the four sub-basins of the Eastern Mediterranean (the other three being the Adriatic, the Ionian and the Levantine Seas). It lies

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to the northeast of the Eastern Mediterranean and is bounded to the north and west by the Greek mainland, to the east by the coast of Asia Minor and to the south by the island of Crete. The Aegean Sea communicates with the Eastern Mediterranean to the southwest through the western Cretan straits (namely the straits between Peloponnesos–Kithyra–Antikithyra–Crete) and to the southeast through the eastern Cretan straits (namely the Straits between Asia Minor–Rhodes–Karpathos–Kasos–Crete). The Aegean Sea is also connected with the Black Sea in the northeastern part, through the Dardanelles Straits (Fig. 1).

The total volume of the Aegean Sea is 8.1×10^{13} m^3, and it covers an area of 1.8×10^{11} m^2 having a mean depth of about 450 m. It is a rather shallow basin, but its bottom topography is quite irregular, with large plateaus next to steep deep basins. The Aegean is filled with dozens of islands and islets.

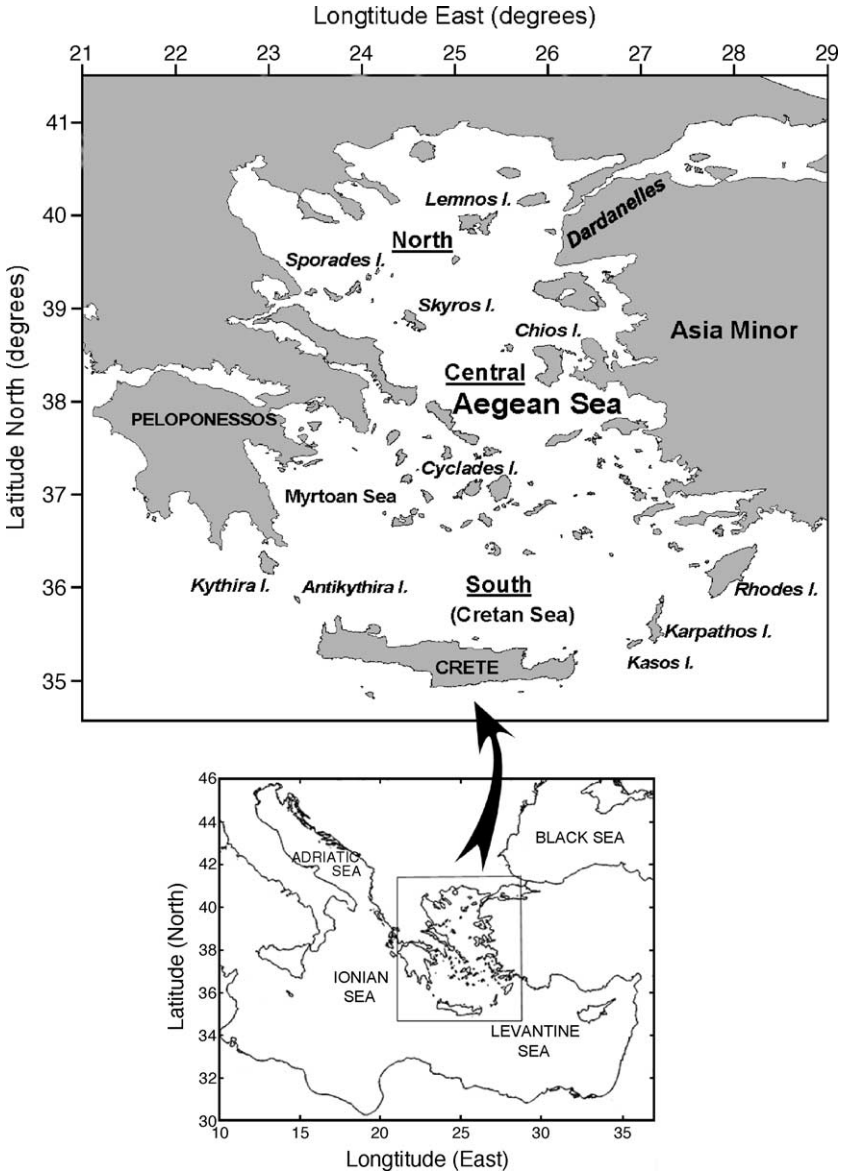

Fig. 1. The Aegean Sea and its position in the Eastern Mediterranean. Important geographical sites are being shown.