

AN ESTIMATION OF WATER MASS FRACTIONS IN THE MIDDLE AND SOUTH ADRIATIC

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Abstract

The paper offers an estimation of water mass fractions in the Middle and South Adriatic by applying least-squares tracer analysis method on the temperature, salinity and dissolved oxygen data collected during six along-Adriatic cruises. Dense water formation is investigated too, confirming two major types of generation: (1) shelf-type occurring dominantly in the North and Middle Adriatic, and (2) deep-convection type occurring in the centre of the South Adriatic Pit.

Keywords: Adriatic Sea, hydrography.

Introduction

The Adriatic Sea has been recognized quite early as a source basin of dense water [1,2]. During strong and cold winter outbreaks shelf-type of generation appears on the North Adriatic shelf having depths lower than 100 m [3,4], whereas deep-convection type occurs in the deep circular South Adriatic Pit [5,6]. The Adriatic water masses thus generated flow toward the Otranto Strait and Ionian Sea where they contribute to the formation of the bottom or near-bottom waters [7].

Data and method

Temperature, salinity and dissolved oxygen data were collected along the central profile extending from the Jabuka Pit to the Otranto Strait during the cruises of February 1962, September/October 1974, April/May 1975, February 1976, July 1976 and January 1980. The data were analysed by applying the least-squares tracer analysis method [8], which uses concentration of several tracer variables to find the mixture of source water types that best describes the composition of a water sample. The analysis performed here resulted in fractions of 4 characteristic deep (dense) water types in the Adriatic: North Adriatic Dense Water – NADW, Middle Adriatic Deep Water – MADW, South Adriatic Deep Water – SADW and Modified Levantine Intermediate Water – MLIW.

Results

Figs. 1 and 2 show the fractions of SADW and MLIW in the Middle and South Adriatic. Primarily, the persistence of the South Adriatic gyre can be observed here. For example, MLIW entered the Adriatic in February 1962, passed near the Croatian coast and reached north-west parts of the South Adriatic Pit, whereas SADW had higher fraction values in the pit centre revealing the doming of isopycnals and upwelling that occurred there. The same feature can be traced also in the cruises of September/October 1974, April/May 1975 and July 1976, but the centre of the gyre has been positioned closer to the Palagruza Sill, as MLIW pushed the gyre northwestward.

During the strong episode of deep convection which occurred in February 1976 dense water reached down to 800 m, and therefrom expanded towards the Otranto Strait. In addition, shelf-type of dense water formation occurred in the North and Middle Adriatic during the

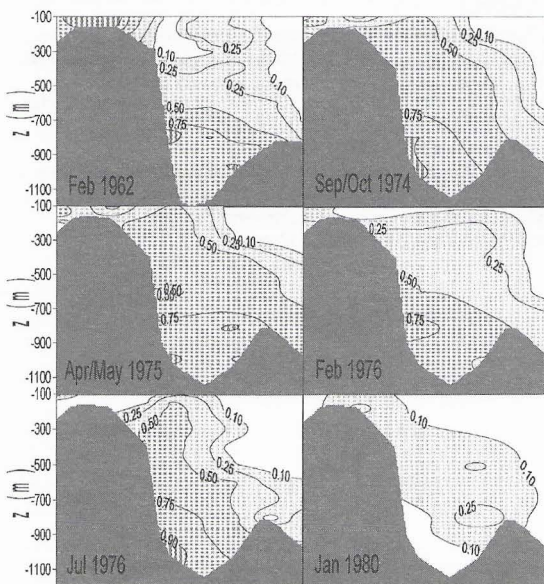


Figure 1: SADW fraction estimated for the central Adriatic section.

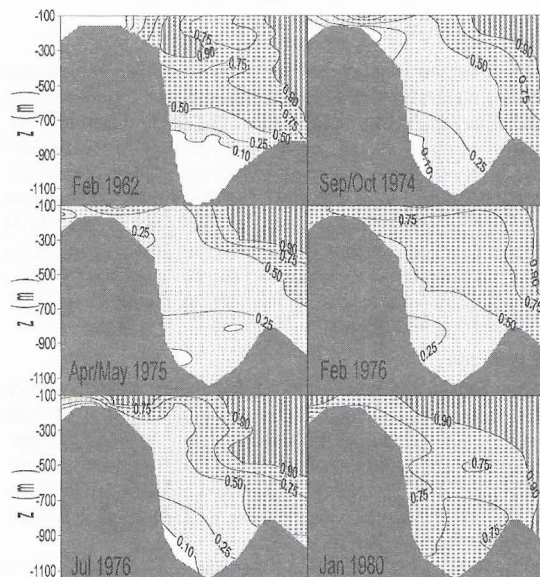


Figure 2: MLIW fraction estimated for the central Adriatic section.

same winter, as surface buoyancy losses were rather high in February whereas river discharges were low at the time. The North and Middle Adriatic water mass usually enters the South Adriatic as a subsurface vein on the Italian shelf, turbulently mixes and sinks in the area of Bari Canyon and fills the bottom of the South Adriatic Pit. Throughout productive years it can be also traced in the Otranto Strait, as observed during the July 1976 cruise with fractions higher than 10%. Simultaneously, SADW fractions were of even higher values (up to 35%), and both water masses contributed to the deep waters of the Ionian and Levantine basins. During the cruise of January 1980, which is known as ingress year, MLIW fraction dominated in the whole area, having value higher than 60% even at the bottom of the pit. The South Adriatic gyre was thus destructed and could not be detected in the density data.

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